$$
R R^{(N)}
$$

$$
8
$$

## PROFESSIONAL PAPERS.

NEW SERIES.

# LONDON: <br> GRORGE WOODFALL AND SON, 

ANUEL COURT, BKINNER STREET.

## PAPERS

ON SUBJECTS CONNECTED WITH

## THE DUTIES

## CORPS OF ROYAL ENGINEERS.

CONTRIBUTED by members of the royal and bast india COMPANY'S ENGINBERS,

AXD
EDITRD BY A COMMITTEE OF ROYAL ENGINEERS.

VOL. II. NEW SERIES.

LONDON:
JOHN WEALE, 59, HIGH HOLBORN.
1852.

$\qquad$
$\qquad$
$\qquad$

## NOTICE.

The Editors have to apologize to several Contributors for the noninsertion of their Papers, but the state of the funds at their command did not permit an extension of the volume.
G. G. LEWIS,

Major-General.
J. WiLliams,

Capt. R.E.
R. M. A., Woolwich, December 29, 1851.

## CONTENTS.

Paper PageI. On Quarrying Rock for Great Works, as practised at Holyhead inthe Years 1850 and 1851. By Major-General Sir John F. Bur-goyne, I.G.F., and Lieutenant Hutchinson, R.E.1
II. Description of a Military Chapel, built for part of the Garrison of Dublin. By Major-General G. G. Lewis, C.B., R.E. ..... 25
III. The Quebec and Halifax Railway. By Major Robinson, R.B. ..... 34
IV. Gunpowder Buildings. By Captain Yorke, R.E. ..... 91
V. Demolition of the Forts on the Canton River. By Lieut.Colonel Phillpotts, R.E. ..... 93
VI. Circular Instructions to the Commanding Engineer ..... 95
VII. Additions to the Barracks at Forton, to accommodate the Portsmouth Division of Royal Marines. By Captain James, R.E., F.R.S. ..... 101
VIII. By Major-General G. G. Lewis, C.B., R.E. De la Défense Na- tionale en Angleterre. Par le Baron P. B. Maurice, Capitaine du Génie de la Confédération Suisse, Ancien Elè̀ve de l'École Poly- technique, \&c., \&c. 1851. ..... 105
IX. Description of Concrete Blocks used in the Formation of the Break- water of the Harbour of Refuge, Alderney, Channel Islands, May, 1851. By Captain F. C. Hassard, R.E. ..... 129

## LIST OF PLATES.

No, of Sumaget of the Paper. No. of ..... Plates.
I. Holyhead Quarries ..... 31
II. Military Chapel, Dublin ..... 8
III. Halifax and Quebec Railway ..... 1
IV. Gunpowder Buildings ..... 1
V. Forts on Canton River ..... 2
VII. Forton Barracks ..... 6
VIII. De la Défense Nationale ..... 1
IX. Breakwater at Alderney ..... 1

## PROFESSIONAL PAPERS.

> PAPER I.
> On Quarbytsg Rock for Great Worrs, as practised at Holyzrad in the Years 1850 and 1851. By Major-General Sir Jonm F. Burgoyne, L.G.F., and Lieutenant Hurchanson, R.E.

The principal operation in the construction of the New Harbour of Holyhead consiated in throwing out a pier of atone 5000 feet in Jength, by a very large section in water, averaging 45 feet in depth.
Friensive quarry ground was obtained at a distance of 2930 yards from the harbome, and at an elevation of 00 feet above the sea; and a tram-road, at a moderate inclination, afforded every convenience for the carriage of the material.

The rock was a quartose selist, extremely hard, stratified in lines from N.E. to S.W., nearly vertical, or a little overhanging to the S.E., with oceasional cracks or joints in that and other directions.
The chief engineer of the work appointed by the Admiralty was James Rendell, Esq-; and the contractors, Messrs. Righy, of Loudon.

In the autumn of 1850 the contrictors, findiag it too difficult to supply the quantity of material demanded by the engineer, namely, an average of 2500 to 8000 tons per day, by the ordinary process of blasting, even on the largest scale, which was also found to be very costly, exceeding what ought to afford a reasonable profit on the contract price, in concert with the engineer, were desirons of trying the effect of bringing down the rock by much larger explosions, to be carried out by means of shafts and galleries and chambers, instead of holes bored; in short, by mines in contradistinction to blasts.

In order to arrive as early as possible at the best system, they made application to the Master-General and Board of Ordnance for the presence, for a short period, of an officer of mililary engineers, to co-operate and advise with their own officers ; and Captain George R. Hutchinson was selected for the duty. on aceount of much previous experience in effeeting large explosions with gurpowder,

In this sorvice he lost bis life; and as a most valuable officer, it is impossible to ullow the occasion to pase withont introducing a few worde in his praise.

Captain Hutchinson obtained his first commission as a Second Lieutenant on 29th May, 1839, and served successively at Chatham, Woolvich, the Mauritius, Devonport, Dover, Spithead, Brecon, and Gibraltar, to the entire satisfaction of his respective Commanding Olficers.

In April, 1842, he was among the officers employed under the present MajorGeneral Sir Charles Pasley, in the blowing-up of the Royal Geonge at Spithead,
a delicate and arduous nudertaking, in which he was conspicuous for his zeal and intelligence; and in December, 1842, and January, 1848, wbile etationed at Dover, he was allowed by the Maetee-Goneral to take the charge of blowing down a point of the bigh cliff near that place, under the chief direction of William Cabil!, Kaq, C.B, for the line of railway there constructing under that cogineer.

The operation was most suceessfully carried out, and the details, as described by Captain Hutchinson, will be found in the Professional Papers of the Corps of Royal Engineers, No. VI.

After kerving for a year and a half at Brecont, he was atationed at Gibraltar from 1845 to Septemher, 1850, where he again bad an opportunity of directing and witnessing a great deal of rock-hlasting.

It was impossible, therefore, to select an officer better qualified to assist the contractors at the Holyhead Works in their object.
In this duty he was zealously engaged from 24th October, 1850, until 24th February, 1851.

On that day lie attended to witness the explosion of a considerable mine, the line of least resistance being 34 feet, and charge 2600 ths of powder.

The mass of spectators were placed in a situation that might reasonably be eonsidered perfectly secure; he was among them, and if anything rather in the rear. The explosion took place; a shower of stones was thrown up to some distance arouni, from in unanticipated action of the mine, and he fell, struck down by one or more large masses, causing severe internal injury and comminuted fractures of the bones of his right thigh, knee, and leg. He died within eight hours of the accident, bearing himsetf, till he became unconscions, with the fortitude of a Christian and a soldier.

Thus fell, in the prime of lifo, a most valuable officer, under many of the circumstances, but without the élat, of being killed on actual service.

Captain Hhtchinson was most precise in the execution of all his duties: among his papers were found minute records of all the mining operations carried on during the period be was at Holyhead, made ap to the time of his death.

These papers were put into the hands of his brother, Lieutenant C. S. Hutchinson. Royal Engineers, who from them, added to his own researchea (having visited Holybead for the purpose), has drawn up the following report of those sperations.

> J. F. B.

## Report of Lieutenant C. S. Hurounson, Royal Engineer, to the Insprctor-General of Fobtifications, respecting the Mining Oprbations at Holybead Quarries.

Holyhead, August 1, 1851.
The accompanying rough plan and weetions of the ground occupied by and arailable for the quarries, will show their outline at the present date, and also what it was, before the explosion of any mines, in November last. The position (a nearly as 1 could ascertain it) of each mine that has been fired, numbering the same in the order of explosion, has been marked on the plan, as also the galIeriea and shafte at present in progress, or ready for firing.

It will be observed that the outine of the quarries now presents several highty favourable positions for mines, many long faces being opened towards the N.W. (along the strike of the strata, the dip being nearly vertical, or overhanging towardy the S.E., at an angle of from $80^{\circ}$ to $85^{\circ}$; and the great object now sought is eo to locate each mine that ite explosion may lend to preserve and leagthen these N.W. faces, against which it has been found from experience that powder acts with a far greater effeet than against any other,
The system now pursued and proposed for obtaining the greatest results at the emallent expense, is-

1st. To fix the poxition of the charge with reference to the natural fissures or joints which show themselves at irregular intervals both along the N.E. and N.W. faces of the rock (jointa of stratification or cleavage), so that it may be a little in advance of the reentering angle formed by buch fissures or joints; to place it also so that the line of least resistance may be across the strata, and to arrange its vertical position in order that it may be 2 or 3 feet under the level of the floor of the quarry; this latter with a view to breaking-up as much as poesible the bottom of the crater, whereby the great after expense of removing it by jumper-holes is cased.

Ind. To arrive at the position of the mine, in every practicable case, by eutering the face by a gallery commenced as near the floor of the quarry as circumstances admit of, by carrying in this gallery to about the required vertical position of the charge, by sinking a slaft to gain its actual position below the level of the floor of the quarry, and then to form the chamber at right angles

to the shaft. (The contractors' agent considers it preferible, where practicable to drive the gallery from (a) rather than (b), though the latter is a much eatier operation, as the effeet of the explosion generally, he thinks, tends to open first the joint $b \mathrm{c}$, and so, if the gallery is along it, to release the tamping, and give greater facility of exit to the explosive gas, whereas, in explosion, the joint $u c$ Is somewhat at first compressed; and if, therefore, the gallery has been formed along it, the resistance of the tamping would be increased.)

3rd. To load the mine with a charge varying according to cincumstances, which will be hereafter explained; to tarap it with rammed clay, ant to fire it by the voltaio battery.
The system is also now usually adopted of removing the earth and loose rock from the top of the quarry over a mine intended to be fircd, by siuking small shafte to the depth of about 20 feet, leading them with $\frac{1}{1}$ L. L. H. ${ }^{3}$ in feet for Tbe of porder, and firing them some days previous to the explosion of the mine. This is necesary, owiug to ite having been found that the earth, kee, where not removed, formed a conglomerate with much of the defbria of the mine, and rendered the removal of the stone a more difficult opention.
It will be seen, on reforence to the plam, that a number of galleries and shafte are now in progress. By commeneing new onés after each explosion, following the principles above stated in the choice of position and mode of execution, it is anticipated that a constant and ample supply of atone will be kept up, inereasing in quantity and decreasing in expense, as the height of face of the quarry beeomes greater.
With reference to the system that is now considered the best fur regulating and applying sharges, the particulars of the exeavation of galleries and sliafts, loading, tamping, and firing :
The system for regulating and applying charges bas beea slrearly explained.
The particulars of the excavations of shafts and galleries are as follows :-
Shefls. -The averuge dimensions of the shafts are about 6 feet by 4 feet. It sinking them, the first alyject sought is to find a natural joint or fissure, and to make it form one side of the shaff, since boles driven sideways up to a joint will produce a much greater effect in explosion of the clarges than if no such joint existed. It is therefore considerel no object to depart a few feet from the wishedfor horizontal position of a mine, to obtain the advantage of sinking along a joint, as the position can be regained by running a fow feet of gallery when the thaft has reached its required depth.

The side next the joiut is then first opened to its reguired breadth, and to about 18 inches in depth, by the explotion of charges lodged in Il-inch holes, driven down at $45^{3}$ to noect the joint, and when a side has been thas opened, a few vertient holes are uzed to open the shaft to its full size. The holes are from 1 foot 6 inches to 2 feet deep, and are charged with 4, 6 , or 8 oz of powder, acconding to the effect required to be prodnced, and the appearance of the rock. These holes are driven by handjumpers, by two men, one turning and one atriking, at the rate of from 5 to 6 feet lineal in the spell of 10 hours-a day's work. They are tamped with the soft stone and clay found in the joints of the rock, (the stone being first looken fine by the hammer), and the charges fired by Bickford's fuze. It may be assumed that 4 libe of powder are ordinarily consumed io removing 1 enbic yard of rock. The fragments of the explosion are generally broken up very small, and passed up the shaft in buckets. The rate of sinking the shafts necessarily varies much, depending on the degree of haviness, \&e, of the rock passed throngh. As am average, it may be assumed that two parties of two men each, relieving each other day and night (equal to two men working for twenty Hours), will cink about 1 foot in the twenty-four hours.

Galleries.-The dimensions of the galleries are from 3 feet to 4 feet wide, and from 5 feet to $\overline{5}$ feet if inches high. In commencing them, for the sume rusony as in the shafts, a natural joint of fisaure is always snught for, to form one side of the gallery. This side is generally opened to about 18 inchee in depth, by
boles driven horizontally, or with a slight inelination downward, and forming angles of $45^{\circ}$ with the joint, the bottom of the side being first opened ; the opening thus mado gives a face for the more effective removal of the other side, which is done by the explosion of snother series of holes. The holes are of the kame dimensions, und toaded with the same charges as in the shafts, and they are driven at about the same rate. The debris is wheeled out in barrows


The rate of driving the galleries varies very considerably with the nature of the rocks and direction of the strata. Under the most favourable circumstances, working with the strata, two parties of two men each, relieving each other day and night (working, that is 20 hours excluding meals), have driven 1 foot 8 inches per day; and in unfavourable cases with the strata, 1 foot 2 inches per day (of 20 hours). Against the strata, the rate per day of 20 hours has been $3 s$ low as 6 inches to 8 inches, and has seldom exceeded 1 foot 3 inches per day in the most favourable circumstances. The ventilation of the shafte and galleries is a point that receives but little attention. Common and water bellows are oceasionally used in the shafts, the air-ducts being formed with pitched canvas, and some shafts have attached to them a wooden framework on the principle of a windsail, which supplies a considerable quantity of air when any wind is blowing.

The excavations are principally performed by tark-work; the workmen provide their own powder, fuze, and candles, which induces economy in their expenditure. The supply and repair of tools, and any casing or gear required, are supplied by the contractor.
Loading. -The powder is brought in $50-\mathrm{lb}$. barrels (covered with sacks) to the mouth of the shaft, or gallery, on men's shoulders. They are there nuheaded with a wooden mallet, and emptied into canvas bags holding 100 lbs in the whaft mines, and 501 tb . in the gallery mines, and passed down or along the shatto
or galleries, at the case may be, no lighta being used. The powder-box (or boxes if one would be too lagge to be got into the chamber), made of 1 J -inch deal, ledged, having been previously firmly fixed in its position in the chamber, the powder is poured into it, the bonsting charge being placed about the centre, and the wires led up through the lid of the box, which is then nailed on with eopper naile. In wet weather the box would be made of $1 \frac{1}{2}$-inch deal, ploughed and tongued, and covered with painted eloth at the bottom; the lid wonld have a riae to the centre, and the whole would be coated with a composition of piteh and tallow.
If more than one box is used a communication is formed between them by passing through the adjacent sides of each a wooden tube entering a few inches into each box, and becoming filled with powder as the loading advances.
The loading occuples from one to three hours, according to the size and position of the charge.
Tamping.-The tamping now always used for the gallery mines is a red clay, of which great quantities are found in the immediate neighbourhood of the quarries. It is conveyed to the mouth of the gallery in waggons, and carried along it in bags, on men's shoulders, holding about 1 cwt. each. Next the charge, and for about 10 feet in front of it, it is rammed at about every 6 inches; for the next 10 feet at every 12 inches; and after this at every 18 inches. The rate varies, of course, with the nature of the excavation, but will average about 3 feet per hour for each operation, from sixteen to twenty men being constantly employed. This, of course, does not include the transport of the clay from the bank to the mouth of the gallery. The shafta are generally tamped with the earth, and loose stone, met with near their commencement, thrown in and rammed at irregular intervals. It is executed at an average rate of 10 feet per hour by from eighteen to twenty-two men.

Firing, -The mode of communicating ignition to the charge is almost universally by the galvanic battery. That used is of the form invented by Mr. Grove, consisting of eight cells, contained in a box measuring 1 foot 9 inches $\times 1$ foot, 3 inches $\times 1$ foot, the electric current being generated by alternate plates of platina foil and zinc immersed in nitric and dilute sulphuricacid. Communication is eatablished with the charge by means of two copper wires, No. 12 guage. From the battery to the mouth of the shaft or gallery they are covered with gatta percha. In the first straight branch of the shaft or gallery the wires (without gutta percha) are


## SCANTLING FOR WIRES

separated and secured in a piece of scantling with two grooves in it (in one groove Biekford's fuze is also placed, as a reserye, in case of accident to the wires) ; over the grooves is then mailed a slip of deal, and the scantling placed in meangle of the shaft or gallery. After the termination of the scantling the
vires are first separately bound round with old calico and eacking, and then bound logether, the foze with them, conducted up to the chamber and connected

with the bursting charge, the most secure and convenient form of which is shown in the sketch given above. The battery is usually placed in a rude hut on the top of, and from 200 to 300 feet from, the face of the quarries.

As to the "quantity and quality of powder used under different circumstances, and whether, if the powder is of a superior quality, the contractors have any means of testing it, or take it on credit from the manufacturers," by reference to the table accompanying this report, mines Nos, 43 and 30 , it will be seen that the charges have varied from $\frac{\mathrm{L} \mathrm{LR}^{3}}{8}$ in lbs, of powder, an a maximum to $\frac{\mathrm{L} \mathrm{LR}}{39}$ as a minimum. The first of these was, however, much in excess, and the latter fired for the purpose of overturning a mass of rock very much cracked and shaken, and very favourably situated for dislodgement. In the commencement of the mining operations the charges were used too low, and experience has shown the necessity of greatly increasing them, with a view principally to the more effectual breaking up of the bottom of the crater, to do which the charge has had to be lodged on a lower level, and consequently increased in magnitude, and enabled to overcome the additional resistance offered to it,

Considering the level of the charge as constant, the main element in estimating
its rize would appear to be whether it bas $t 0$ operate against a N.W. face, a N.E face, or a SE. face. Classifying the charges fired under these heade, we have them varying with the L.L.R. against the strata, and to operate against a N.W. face (when Iodged level with, or 2 to 3 feet ahove or below, the floor of the quarry), from $\frac{\mathrm{LLR}^{3}}{10}$ to $\frac{\mathrm{L} \mathrm{LR} \mathrm{R}^{\mathrm{a}}}{26}$, giving, out of seventeen fired, an average charge of $\frac{\text { L. . R }}{}{ }^{3}$, with a produce of material in tons varying from 43 to 0 per lb . of powder, or an average of $S_{1} \frac{1}{1}$ tons per Ib. In mines fired with the L.L.R., with the strata, and to operate against a N.B. face, with the charges on the same level as above, out of six fired the charges varied from $\frac{1}{}$ to $\frac{1}{h}$ L.L.H.R. ${ }^{3}$, with an average of $\frac{1}{1}$ L.L.R. ${ }^{3}$, and a produce of materials in tons varying from 3 to 0 per lb . of powder, and an average of $1 \frac{1}{2}$ ton per lb .

In these three mines (Nos. 31,43 , and 56 ), with the LLL.R. against the strata, and to operate against a S.E. face, Nos. 31 and 43 were more or less failures with charges of $\$ and $\%$ L.L.R. ${ }^{3}$. In No. 56, with a charge of $\frac{2}{}$ L.I. . R $^{3}$, the explosion was very violent, the probable produce about $2 \frac{3}{4}$ tons per lb . In all the mines but three, common merchant's blasting powder was used. In Nos 39,51 , and 52, a stronger powder, in the proportion of twenty to seventeen of the other, was employed, though the charges do not appear to have been reduced in consequence. The only means of testing the strength of the powder is by a small hand éprouvette, in which, however, the chamber and priminghole are so small that it is necessary to pulverize the powder before exploding it, thereby probably invalidating the accuracy of the tests. The respective strengths indicated by the eprouvette nearly agreed with those furnished by the powder merchants.


The prices of ingredients and rates for work performed are, as far as could be ascertained, as follows:-



With regard to "the great results obtained on the present system explanatory of the expenditure in time, labour, gunpowder, \&c., \&ec, to produce in the quarries any given amount of culic yards, or tons of material, in a fit state for the breakwater," the most correct data will be ohtained by taking the average of the guccessfol operations against a N.W. and N.E. face respectively. Against a N.W. face, supposing an average height of quarry of 100 feet, and the charge lodged near the level of the floor, 9100 tons of material in a fit state for the breakwater have been procured from gallery mines in the time necessary to form and load and tamp $47 \frac{1}{2}$ feet of gallery and 181 feet of shaft, consuming 64 working days, or nearly eleven weekn (the men working day and night); the expenditure of powder was 1830 lhs, or 5 tons per Ib . of powder, and the expense $\mathbf{t 1 2 5}$, or about $3 \frac{1}{\alpha}$. per ton, the above being an average of nine explosions. Against a N.E. face, taking the average of four successful explosions from gallery mines, with a height of face varying from 40 feet to 80 feet, and the charge lodged as before, 4600 tons of material in a fit state for the breakwater were dislodged in
the time taken to form, load, and tamp 54 feet of gallery and 17 feet of shaft, consuming 68 working days, or 11 J weeks (the men working day and night), with a charge of 2165 lbs . of powder, or 2$\}$ tons per lb ., and an expense of $£ 115118$, or $6 d$. per ton. Height of face necessarily constitutes a very main element in the yield of the mines, and this will be constantly improving as the face of the mountain is exposed to the S.W.

Shaft mines, with any large height of face, are far more expensive than gallery mines, and are now never used except in cases of emergency, or for the reason before described.

Some few details respecting the tools, \&c., used in the quarrying operations may be useful.

Various forms of jumper heads have been tried, and that found to answer best has been a chisel head, with the edge slightly curved. The sizes of the chisels vary with the depth of the holes to be sunk.

For a hole not exceeding 3 feet deep . . . chisel $1 \frac{1}{2}$ inch.

| $"$ | $"$ | 6 | $"$ | . | $\cdot$ | $\cdot$ | $"$ | 2 | $"$ |
| :--- | :--- | ---: | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| $"$ | $"$ | 10 | $"$ | $\cdot$ | $\cdot$ | $\cdot$ | $"$ | 3 | $"$ |
| $"$ | $"$ | 15 | $"$ | $\cdot$ | $\cdot$ | $\cdot$ | $"$ | 32 | $"$ |

In the rock of ordinary hardness about sixty drills are required to sink 4 feet.
Skilful smiths can sharpen about fifteen 8 -inch jumpers in the hour. The weight of hammer for drills are-

$1 \frac{1}{2}$-inch holes are driven 6 feet, by two men, in about 10 hours, or $\frac{6}{6}$ foot per hour; 8 -inch holes, 3 feet to 4 feet, in 10 hours, by three men, two striking and one turning, or $\frac{10}{10}$ foot to 10 foot per hour; $3 \frac{1}{2}$-inch holes, 2 feet 6 inches per 10 hours, or $\frac{1}{4}$ foot per hour, by three men the first 10 feet, and afterwards by four, two to turn and two to strike.

I inclose rough sketches of all the operations of which I was able to obtain the requisite information.

C. S. HUTCHINSON,<br>Lieut. R.E.

# Observations by Major-General Sir J. Burgoyne, on Lieutenant Hutohinson's Report on Holyhead Quarales, of August 1, 1851. 

The direction of the strata isnot quite elearly defined, It is stated "many long faces have been opened towards the N.W. along the strike of the strata, the dip being noarly vertical, or overbanging towards the 8.E., at an angle of from $80^{\sigma}$ to $85^{\circ /}{ }^{\circ 1}$ Is, then, the direetion of the line of strata N.E. and 8.W. of these faces towarde the N.W.? I can only perceive that of No, 9 Quarry.

It would appear to me that by cutting through from No. 7 and No. 8 Quarries, into and to the end of No. 9 Quarry, on a face of 107 feet, there would eventually be a face of 163 feet obtained, which would gradually increase to 340 feet, and all facing the most favourable point N.W.

In sinking the shafts by jumper holes 17 inch, and from 1 foot 6 inches to 2 feet deep, two men are employed, "one turning and one striking," Have they tried the churn jumpers worked by hand, and not hammered, and why do not they use them?

If the clay used for the tamping, and brought to the galleries for the purpose, in a moist or dry statel

Masom-Gen. Sir J. BURGOYNE.

## Explasations.

The general direction of the line of strata is N.E. and S. W., and the most fivouralle face for operating upon is therefore one facing the N.W. The "many long faces towards the N.W." allnded to, were, besides that in No. 9 Quarry, those varying from 50 to 100 feet in length, oceurring at intervals along the general line of the quarries.

I believe the contractors have some such intention, but unless they stop operations in No. 9 Quarry until Nos, 7 and 8 are carried into it, it will be a very long time before the advantage of a greatly increased leight of face is gained, as the face of No. 9 will be receding towards the S.E. very much faster than the faces of Nos, 7 and 8 can be carried in to the S.W.

Not having entered into this question when at Holyhead, I have written to the contractor's agent for informafion, and have not yet received his reply.

In a somewhat moist state, and is tough and adhesive.

[^0]DETAILS OF THE SEVERAL MINES THAT HAVE BEEN
From their Commencement up

|  | Date of explosion. |  | $\begin{aligned} & \text { Depth } \\ & \text { of shaft. } \end{aligned}$ | Length gallery. | $\begin{aligned} & \text { Vertical } \\ & \text { height from } \\ & \text { chan ber to } \\ & \text { top of rock } \\ & \text { to be rec- } \\ & \text { tnoved. } \end{aligned}$ | Level of <br> floor of <br> chamber <br> with refer- <br> ence to <br> door of <br> quarry. | Line of least resistance. | Description of powder used. | $\begin{gathered} \text { Charge } \\ \text { in } \\ \text { pounds. } \end{gathered}$ | Proportion of charge to the cube of the line of teast resistance. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 1 | $\begin{gathered} 1850 . \\ \text { Nov. } 1 \end{gathered}$ | 8 | $\begin{aligned} & \text { f. in. } \\ & 296 \end{aligned}$ | ft. in. | $\begin{aligned} & \text { fr. in. } \\ & 29 \end{aligned}$ | f. in. $70 \quad 6$ above | $\begin{array}{lr} \mathrm{f} . & \text { in. } \\ 24 & 0 \end{array}$ | Common merchant's powder. | 432 | $\frac{1}{31}$ |
| 2 | Nov. 18 | 3 | 410 | $\ldots$ | 410 | 540 above | $27 \quad 0$ | Do. | 600 | 312 |
| 3 | Nov. 30 | 1 | 486 | .... | $48 \quad 6$ | $\begin{gathered} 20 \\ \text { above } \end{gathered}$ | $36 \quad 0$ | D 0. | 1700 | $\frac{1}{4}$ |
| 4 | Dec. 7 | 5 | 640 | $\ldots$ | $64 \quad 0$ | 260 above | $80 \quad 0$ | D 0. | 1700 | ${ }^{1} \frac{1}{5}$ |
| 5 | Dec. 21 | 3 | 746 | 90 | $74 \quad 0$ | 170 above | 410 | Do. | 2800 | 25 |
| 6 | Dec. 21 | 6 | 680 | 180 | 780 | 150 above | $39 \quad 0$ | Do. | 2300 | $\frac{1}{20}$ |
| 7 | Dec. 21 | 4 | 50 | 340 | $100 \quad 0$ | $10 \quad 0$ above | 320 | Do. | 1400 | ${ }^{2}$ |
| 8 | $\begin{gathered} 1851 . \\ \mathrm{Jan.} .4 \end{gathered}$ | 5 | 620 | ... | $64 \quad 0$ | $36 \quad 0$ above | 310 | Do. | 1200 | ${ }_{2}$ |
| 9 | Jan. 11 | 6 | 800 | 76 | 80 | $10 \quad 0$ above | 310 | Do. | 1200 | $\frac{1}{25}$ |
| 10 | Jan. 16 | 9 | ...... | 470 | 400 | $\underset{\text { above }}{30}$ | 240 | Do. | 580 | $\frac{1}{26}$ |

## FIRED IN THE HOLYHEAD BREAKWATEE QUARRIES,

TO THE 31 कT OF JULX, 185.


|  | Date of $\begin{aligned} & \text { Daplosion. }\end{aligned}$ |  | $\begin{gathered} \text { Depth } \\ \text { of shaft. } \end{gathered}$ | $\begin{aligned} & \text { Length } \\ & \text { gallery. } \end{aligned}$ | Vertical beightfrom chamber to top of rock moved moved. | Level of hioor of chamber with refer floor of quarry. | $\begin{gathered} \text { Line } \\ \text { Leas } \\ \text { resista } \end{gathered}$ | of | Description of powder used. | $\begin{gathered} \text { Charge } \\ \text { ing } \\ \text { pounds. } \end{gathered}$ | Proportion of chargeto the cube of least resistance. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 11 | $\begin{array}{r} 1851 . \\ \text { Jan. } 17 \end{array}$ | 4 | $\begin{gathered} \mathrm{f} . \operatorname{in} . \\ 70 \end{gathered}$ | $\begin{aligned} & \mathrm{ft} . \mathrm{in} . \\ & 390 \end{aligned}$ | $\begin{array}{cc} \mathrm{ft} & \text { in. } \\ 92 & 0 \end{array}$ | ft. in. 80 above | $\begin{aligned} & \mathrm{fL} \\ & 32 \end{aligned}$ | $\begin{gathered} \text { in. } \\ 0 \end{gathered}$ | Common merchant's powder. | 1400 | 晾 |
| 12 | Jan. 18 | 7 | 110 | 440 | 850 | 50 above | 33 | 0 | Do. | 1400 | $\frac{1}{20}$ |
| 18 | Feb. 7 | 4 | 150 | 460 | $100 \quad 0$ | Level | 34 | 0 | Do. | 1800 | $\frac{1}{4}$ |
| 14 | Feb. 13 | 9 | ... | 460 | $40 \quad 0$ | Level | 25 | 0 | Do. | 1000 | $\frac{1}{16}$ |
| 15 | Feb, 18 | 3 | 750 | ... | 750 | $\begin{array}{cc} 17 & 0 \\ \text { above } \end{array}$ | 37 | 0 | Do. | 2500 | 25 |
| 16 | Feb. 20 | 8 | 670 | 220 | 730 | Level |  | 0 | Do. | 4000 | $\frac{1}{1}$ |
| 17 | Feb. 24 | 9 | 456 | 50 | $50 \quad 0$ | $\begin{gathered} 20 \\ \text { below } \end{gathered}$ |  | 0 | Do. | 2600 | Is |
| 17a | Feb. 25 | 9 | 566 | 50 | $60 \quad 0$ | $\begin{array}{ll} 4 & 0 \\ \text { above } \end{array}$ |  | 0 | Do. | 2000 | 18 |


| Nature of tamping. | Mode of effecting Imation. | Probable quantity of material procured, in tons. | Quantity of material ta erth pound of powder. in tons. | Total eapense of operution. | $\begin{gathered} \text { Cost of } \\ \text { each ton } \\ \text { of mat } \\ \text { terial. } \end{gathered}$ | Bemarks. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 6 ft. cement masoury, 6 ft . ruhble masoary in mortar, timber buttres, nammed clay and stose, timber buttres. | Toltaic battery. | Nil. | Nil. | E A. d. Not recorded | $\text { a. } d$ | This mine was as failure, the tamping having been blown out and no other effect proforsel: caused, protably, by Dlae of tamping not having been lon- enoueh with referenceto L. L. R. long enough wh th referenceto L.L.R. and also to the powder being injured by wet. L.L.R. against the strata. |
| Cement and raortar masoory, and rammel clay. | Do. | 4850 | 31 | $9010 \quad 0$ | $0 \quad 42$ | Explosion gentle. L.L.R. against the strata. Charge probably too small, as a large mass of rock was left standing in the centre of that intended to have been removed. It Was much shaken, anil removed by charging the rents, lce. |
| Rammed clay and timber buetresh | Do. | 8000 | 42 | 120180 | $\begin{array}{ll}0 & 31\end{array}$ | Exulosion gentle L.1.R. against the etrata. The charge was increased to $\frac{1}{1}$ L. L. R. ${ }^{3}$, owing to lta having been found, on remnanil of the debris from many of the mines, that the bottoms of the craters were left uninjured. By increasing the charge, and placing it on a lower level, it was hoped to remedy this. The cost includes only the second operation (this being the same mine as No. 11 , with new chamber). If to it he addict the cost of the fint failure, the expense would be increased to ${ }^{3} d$ per ton. |
| Ramined elay, | Do. | 4000 | 4 | $5200$ | $0 \quad 3$ | The position of this mine being very undavourable, the charge was largely ineressed. The explosion not yiolent, and debris well deposited for loading. L.L.R. with the strata. |
| Rammed earth and stove. | Do. | 2000 | 1. | 151180 | $16$ | L.L.I., with the strata. Effect bady rery little stone thrown down, prohably owing to the explosire gas meeting with an easy exit in some loose foints that occurred in the neighbourhood of the chamber, |
| Rammed elay, locise stanes, anal earth. <br> Gravel and sand. | Do. Do. | $10,000$ | 21 | $\begin{array}{lll} 190 & 5 & 4 \end{array}$ | $0 \quad 4 \frac{1}{2}$ | Kxperience having now clearly shown that the mines fired with the L..I.. R. with the strata, had been considerably undereharged, with the excep- tion of No. 14, where the height was small and rock soff, it was determined to increase the charge to id L.L.R. 3 . The effeet was exceltent. Explosion not violent, but debris aumirably disposed for loading, and bittom of crater completely broken up. [Captain Hutchinson's notes terminate here, and the records of the following mines have been obtained from the Contractor's apent.] |
| Do. | Do. | 20,000 | 41 | 287150 | 0824 | These two mines, to aet againat a $\mathrm{N}, \mathrm{W}$. Faec of 165 f . in length, were intended to have been fired simultaneously: lut by some aecident the wires of $17=$ becamee disconnected and 17 only exploded, and instead of acting on the whole mass in front of it, exerted its power on a small picce situated immedlately over the charge, and loolated from the large mass by into the air, and fell broken into fragments in a circle of upwards of mile rallus; one piece striking and R.E., who was standing at a distance of about 250 yands from the shaft. |


|  | Date of explosion. |  | $\begin{aligned} & \text { Depth } \\ & \text { of shaff. } \end{aligned}$ | $\begin{aligned} & \text { Length } \\ & \text { of } \\ & \text { gallery. } \end{aligned}$ | Vertical height from chamber to top of rock moved. | $\begin{array}{\|l} \text { Level of } \\ \text { floor of } \\ \text { ehamber } \\ \text { with refer- } \\ \text { ence to } \\ \text { floor of } \\ \text { quarry. } \end{array}$ | Line of least resistance. | Description of powder used. | $\begin{gathered} \text { of } \begin{array}{c} \text { Charge } \\ \text { inn } \\ \text { pounds. } \end{array} \end{gathered}$ | Proportion of chargeto the tine of least resist ance. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | f. in. | ft. in. | ft . in. | ft. in. | f . in. |  |  |  |
| 18 | 1851. <br> March 1 | 1 | 430 | 60 | 450 | $\begin{array}{ll} 2 & 0 \\ \text { above } \end{array}$ | $40 \quad 0$ | Common merchant's | 2500 | ${ }_{25}{ }^{2}$ |
| 19 | March 15 | 2 | 240 | 690 | $40 \quad 0$ | $\begin{array}{cc} 20 \\ \text { below } \end{array}$ | $\left.\begin{array}{ll} 30 & 0 \\ 26 & 0 \end{array}\right\}$ | Do. $\{$ | $\begin{aligned} & 2160 \\ & 1600 \end{aligned}$ | $\left.\begin{array}{l} \frac{1}{12} \\ \frac{1}{n} \end{array}\right\}$ |
| 20 | March 19 | 5 | 120 | 520 | 780 | $20$ below | 360 | Do. | 8000 | 16 |
| 21 | April 4 | 3 | 170 | 380 | $90 \quad 0$ | $\begin{aligned} & 20 \\ & \text { below } \end{aligned}$ | 410 | Do. | 3200 | $\frac{1}{21}$ |
| 22 | April 5 | 9 | 70 | 370 | 450 | Level | $27 \quad 0$ | Do. | 1400 | $\frac{1}{1}$ |
| 23 | April 5 | 10 | 300 | 40 | $30 \quad 0$ | $\underset{\text { below }}{2} 0$ | $24 \quad 0$ | Do. | 700 | \% 10 |
| 24 | April 15 | 8 | 816 | 120 | $81 \quad 6$ | $\begin{array}{ll} 6 & 0 \\ \text { below } \end{array}$ | 320 | Do. | 2500 | I |
| 25 | April 22 | 1 | 520 | 340 | 520 | $\begin{array}{cc} 5 & 0 \\ \text { above } \end{array}$ | $\left.\begin{array}{ll} 39 & 0 \\ 34 & 0 \end{array}\right\}$ | Do. $\{$ | 2200 2000 | $\frac{17}{20}$ \% $\}$ |


| Nature of tamping | Mode of otheting Igrition. | Prolable quantity of m+terat pricurad, is tons. | Quantitynf material to each pounit of pow der. in tons. | Total expense if muration. | Coat of each lim of mas- tenal. | Flemarks |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | e dr di. | 2. d. | The mass not blown down was much rent ; 17- was fired the next morning with food effict. The charge of 17 Was made so murh lareer than 17, oning to the greater mass on which It haul to act, as will be seen on reference to the drawing. L.L.K. against strata. |
| Loove earth and itune. | Foltaic battery, | 10,000 | 4 | $12110 \quad 0$ | 0 0 3 | L. L. IL. against strata. A portion of mass intended to have becn removed ubove and behind the charge teft standing, indicating too stwall a quantity of powder. |
| Rammed clay. | Do. | 4500 | 1) | $196 \quad 5 \quad 8$ | 0.10 | There two charges were fired simultanmously from cither end of a T gallery, to trake an opening in a face of rock, the L. L. F. f , being with the itrata; owing to which, and to the low level of the charges, they wete of the large amount expressed. The projected to some distance. No temelency to hlow the tampings the desired result was ellected. |
| Do. | D. | 9000 | 3 | $\begin{array}{lll} 133 & 5 & 9 \end{array}$ | $0 \cdot 3$ | L.L.R. against strata. Natural joints Interfered with the anticlpatel effect, and one opening near the gallery, a large portion of the tamping was blown outs part of the bittom of |
| Do. | Dos | 9190 | 2) | $13210 \quad 0$ | $\begin{array}{ll}0 & 3_{2}\end{array}$ | L.L.R. against thestrata. Charge in a favourable position. A natural point just in front of the charge again in. terfered with the production of the anticipated effect, and a portion of the tharning $\$ 18$ also blown: had which not vecurred, the rock would probably hivebeen better broken up. |
| Do. | Do. | 8000 | 24 | $6719 \quad 0$ | $0 \quad 51$ | L.L.R. arainst the strata. Explasion not viment stone very well broken for loading. Caure of large increase to charge is not explained; the position appearing similar to that of the last mine. Charge does not appear to have been in excess. |
| Looke stone ant earth rammed. | Do. | 2000 | 29 | 4800 | $0 \quad 5$ | L.L. R. ayainst strata. Explosion rather violent, indicating a somewhat exces of powder, as matght have been anticipated, from the pear- noss of the charge to the surfice, where the rock is genorally of less tenacity than at lower levels. |
| Dat | D\%. | 4000 | 1) | 170 | $0 \cdot 104$ | L.L.R. against the strata, Explotion not violent, but result minsatisfactory. owing to the occurrence of natural joints immediately in frout of the charge, to which the rock was blown out, leaving the whole of the shaft. tamping, AC., unlnjured. Cause of the large propirtion of the charge to L.L.R.² not explained; its low Pevel would appear the only reason. |
| Earth and clay rammed. | De | 12,500 | 3 | $211 \quad 9 \quad 18$ | $0 \quad 4$ | L. L. R. against strata. These mines were of in f . long: owing to which cause and to the comparatively high levd at which they were placed, thie propositions of L.L.R.3. Owing to the corupanative hardness of rock in max being tightily bound by a clay fault, its groportion was incressed aver that of theother. The result was enod, though the esal tis.chare etrake up the rock better than the other. |

VoL. II. N. S.

| 핳 | Date of explosion. |  | $\begin{gathered} \text { Depth } \\ \text { of shaft. } \end{gathered}$ | $\begin{aligned} & \text { Length } \\ & \text { of } \\ & \text { gallery. } \end{aligned}$ | Vertical height from chamber to top of rock to be re- moved. moved. | Level of floor of noor of with reference to quarry. | Line of least resistance. | Description of powder used. | $\begin{gathered} \text { Charge } \\ \text { in } \\ \text { inds. } \end{gathered}$ | Proportion of charge to the cube of the cube of the line of least resist- ance. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 26 | $\begin{aligned} & 1851 . \\ & \text { April } 29 \end{aligned}$ | 4 | $\begin{aligned} & \text { f. in. } \\ & 290 \end{aligned}$ | $\begin{gathered} \mathrm{f} . \mathrm{in} . \\ 60 \end{gathered}$ | $\begin{array}{lc} \text { f. in. } \\ 29 \quad 0 \end{array}$ | f. in. $80 \quad 0$ above | $\begin{array}{lr} \mathrm{ft} . & \text { in. } \\ 23 & 0 \end{array}$ | Common merchant's blasting | 800 | 1 1 |
| 27 | May 3 | 3 | 126 | 396 | $90 \quad 0$ | $\begin{array}{cc} 16 \\ \text { above } \end{array}$ | 350 | powder. Do. | 2200 | t |
| $\begin{aligned} & 28 \\ & 29 \\ & 30 \end{aligned}$ | $\text { May } 10$ | 9 |  | $36 \quad 0$ | $\begin{array}{cc}\cdots & \cdots \\ 50 & 0\end{array}$ | Level | … $\quad 38$ | Do. | 900 | \% |
| 31 | May 18 | 2 | 196 | 490 | 880 | $\begin{gathered} 26 \end{gathered}$ | $35 \quad 0$ | Do. | 2100 | \% |
| 32 | May 13 | 5 | 230 | 506 | 1180 | ${ }_{2}^{2} 0$ | $40 \quad 0$ | Do. | 2600 | \% |
| 33 | May 20 | Gul. <br> let. | 550 | 120 | 550 | $50$ above | $38 \quad 0$ | Do. | 2500 | 4 |
| $\begin{aligned} & 34 \\ & 35 \end{aligned}$ | May 21 | 2 | $\begin{aligned} & \text { Not re } \\ & 190 \end{aligned}$ | $\begin{gathered} \text { corded } \\ 510 \end{gathered}$ | $100 \quad 0$ | $\begin{gathered} 20 \\ \text { below } \end{gathered}$ | $\cdots$ | Do.. | 3000 | $\cdots{ }_{\text {, }}^{16}$ |
| 36 | May 28 | 7 | 180 | 510 | $90 \quad 0$ | $\begin{gathered} 300 \\ \text { below } \end{gathered}$ | 380 | Do. | 2100 | \% |
| \$7 | May 28 |  | Not re | corded | $\cdots$ | ... | $\ldots$ | Do. | 550 | Not |
| 38 | Nay 30 | 10 | Not re | corded | . |  | $\ldots$ | Do. $\{$ | $\begin{array}{r} 800 \\ 2100 \end{array}$ | $\} N o t$ |


| Nature of earipingt- | Mode of eftectiog Ifnition. | Probable quantity of materal procured, in tons. | Quantity of Inaterial to each pmund of powder. In tons. | Total expense of operation. | Cont of each ton of mat terial. | Remarks. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Loose stone and 6arth. | Foltaic battery. | 3000 | $3{ }^{3}$ | $\begin{array}{ccc} \mathbf{E} & 2 & d \\ 45 & 0 & 0 \end{array}$ | $\left.\begin{array}{cc} 2 . & d \\ 0 & 3 i \end{array} \right\rvert\,$ | L.L.R. agalnit the strata. Explosion violent; stanes thrown to a considerable distance. Charge in excess. |
| Rammed clay and gravel. | Do, | Nil. | Nil. | 9500 | Nil. | L. L.R. with strats. Tamping blown out, and the angles remnoved from the shaft and gallery, as shown in ketch. The chamber was badly situated, and the charge probably too small, the rock to be acted on being very tightly bound. |
|  | Bickford's fuze. | $3500$ | $4$ | Not re | corded | Small top shafts, which answered well. Details not recorded. <br> L.L.R. with the strata. This extremely small charge was used, on account of the mass to be removed being greatly cracked, and a bed joint occurring at the floor of the quarry ; the height of face also being small. It answered well. The wires had become injured fo tamping, and fuze was therefore used. |
| Rammed clay. | Voltaic battery, | Nil | $\cdots{ }^{\cdots} \cdot \cdots$ | Not re | corded | L.L.R. against the strata. Though against a S.E. instead of N, W. Face, the dyp of the atrata being thereby rendered less favourable for the dislodgment of the rock. The resule was, that the rock was much shattered in a N.E. and S. W, direction ; but not overturned. The tamping: was blown. Charge too small, |
| Do. | Da. | 10,000 | $3{ }_{7}$ | Not re | corded | section showina flanes of stanta. L. L. R. against the strata. Said to have worked well, and to have produced the anticipated result. |
| Earth and Loose stones rammed. | Fuse. | Not re | corded. | Not re | corded | Stated to have produced a very good effect, but no details are furnishel. Battery out of order. |
| Rammed clay. | Voltaic battery. | $\stackrel{+1}{12,000}$ | $\cdots{ }^{\cdots}$ | Not re | corded | Small top shaff, which answered well. I. L. R. against strata. Effect remarkably good. Stone well broken, and converiently deposited for loading. |
| Do, \& fine atone. | Do. | 0000 | 4) | Not re | corded | L.L. R. R. against strata. The face to be operated against being well ogen to the N.W., the only reason recorded for the gieat iliference between this charge and the lat, both having the same L.L.R.s. It Is described to have answered well. |
| recorded. | *.. ...* | +** | Not | recorded | $\cdots$ | A smail top shaft. |
|  | Dor | Not | recarded | ... ... | $\cdots$ | There is no sketch, and but a very imperfect recond of this operation. The two chargea were intended to have been fired simultaneously: but, owing to the weakness of iron and zinc plate battery, only one was Ig. nited (the small oneli and though |


|  | Date of explosion. |  | $\begin{aligned} & \text { Depth } \\ & \text { of shaff. } \end{aligned}$ | $\begin{aligned} & \text { Length } \\ & \text { gallery. } \end{aligned}$ | Vertical height from chamber to top of rock to be removed. | Level of thoor of chamber ence tothoor of <br> quarry. | $\begin{gathered} \text { Line of } \\ \text { reast } \\ \text { resistance. } \end{gathered}$ | Description of powder used. | $\begin{aligned} & \text { Charge } \\ & \text { in } \\ & \text { pounds. } \end{aligned}$ | Proportion of charge to the cube of least resistance. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | ft. in. | ft. in. | fr . in. | f. in. | f. in. |  |  |  |
| 39 | $\begin{array}{r} 1851 . \\ \text { June } 3 \end{array}$ | 4 | 230 | 890 | $90 \quad 0$ | Level | 260 | Stronger merchant's powder, as 20 to 17 of the other. | 1700 | $\frac{1}{15}$ |
| 40 | June 7 | 3 | 220 | 600 | $60 \quad 0$ | $\begin{gathered} 20 \\ \text { below } \end{gathered}$ | $36 \quad 0$ | Common merchant's blasting powder. | 2100 | \# |
| 41 | June 14 | 4 | Not re | corded | $\cdots$ | $\cdots$ | ... ... | Do. | 600 | Not |
| 42 | June 20 | 5 | 140 | 590 | 550 | 20 | 40 | Do. | 3500 | 18 |
| 43 | June 25 | 2 | 196 | 440 | 880 | $\begin{aligned} & \text { below } \\ & 2 \quad 0 \\ & \text { below } \end{aligned}$ | 180 | Do. | 1900 |  |
| 44 | June 30 | Not | record | ed | ... ... | ... ... | ... ... | Do. | 850 | Not |
| 45 | July 2 | 9 | Not re | corded | ... ... | ... ... | $\ldots$ | Do. | 2420 | Not |
| 46 | July 5 | Not | record | ed | ... ... | $\ldots$ | ... ... | Do. | 600 | Not |
| 47 | July 5 | 9 | Not re | corded | $\ldots$ | ... ... | ... ... | Do. | 2200 | Not |
| $\begin{aligned} & 48 \\ & 49 \\ & 50 \end{aligned}$ | July 7 <br> July 11 | $\begin{gathered} \text { Not } \\ 4 \end{gathered}$ | $\begin{aligned} & \text { record } \\ & 230 \end{aligned}$ | ed 400 | $\cdots{ }^{\cdots} \times 1$ | $\begin{array}{cc} \cdots & \cdots \\ 3 & 0 \\ \text { below } \end{array}$ | $\begin{array}{cc}\cdots & \cdots \\ 22 & 0\end{array}$ | $\cdots$ Do. | 1800 |  |
| 51 | July 12 | 9 | 486 | 550 | 50 | $\underset{\text { below }}{2} 6$ | $\begin{cases}33 & 0 \\ 33 & 0\end{cases}$ | Stronger powder. Mixed do, (commonand | 2300 2700 | is |
| 52 | July 12 | 9 | 570 | 480 | $57 \quad 0$ | $\underset{\text { below }}{2} 6$ | $38 \quad 0$ | stronger). <br> Stronger powder. | 3000 | $\frac{1}{16}$ |



|  | Date of explosion. |  | Depth of shaft. | $\begin{aligned} & \text { Length } \\ & \text { gatlery. } \end{aligned}$ | Vertical heightfrom chamber to top of rock to | Level of floor on chamber ence to quarry. | $\begin{gathered} \text { Line of } \\ \text { least } \\ \text { resistance. } \end{gathered}$ | Description of powder used. | $\begin{aligned} & \text { Charge } \\ & \text { in } \\ & \text { pounds. } \end{aligned}$ | Proportion of chargeto the tube of the line of teast resistance. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | f. in. | ft , in. | ft . in. | ft . in. | ft. in. |  |  |  |
| 58 | $\begin{array}{r} 1851 . \\ \text { July } 16 \end{array}$ | 3 | Not re | corded | ... ... | ... ... | ... ... | Common | 450 | Not |
| 54 | July 16 | 8 | 850 | 70 | Not | recorded | $\cdots$ | Do. | 1000 | Not |
| 55 | July 19 | 4 | 200 | 570 | $110 \quad 0$ | $\begin{array}{ll} 20 \\ \text { below } \end{array}$ | $86 \quad 0$ | D ${ }_{\text {. }}$ | 4200 | त |
| 56 | July 23 | 8 | 200 | 520 | 550 | $30$ below | 240 | Common merchant's | 2600 | 4 |
| 57 | July 24 | 6 | 800 | 70 | 80 |  | 320 | Do. | 3500 | b |
| 58 | August 2 | 4 | 840 | 180 | $90 \quad 0$ | $\begin{aligned} & 30 \\ & \text { below } \end{aligned}$ | 250 | Do. | 2000 | $!$ |


C. S. HUTCHINSON, Lieut. R.B.

[^1]
## Conclusion.

On theze opentions, as described by Lieut. Hutchinson, I would add the following few remarks :-

1. In considering the nature of the arrangements in working the quarriea at Holyhead, allowance must be made for the circumstances that regulated many of the proceedings, and prevented the course that would produce the best ultimate effects in the shortest time from being always adopted; these were chiefly the necessity for producing the absolute large quantity of material day by day, or at least week by week, without interruption, and, consequently, required explosions to be accelerated, or to be made in particular directions to meet that demand, rather than what would most speedily put the quarries in the best state for working ultimately with most economy.

This will account for what might otherwise appear not to be the most judicious order of proceeding. Consistent with this necessity, the most desirable end was still never lost sight of,
2. The amount of charges applied to these mines must not be taken as a guide in estimating the best proportion for producing the effect of merely bringing the rock down, for which $\frac{1}{2}$ in lbs. of powder of the cube of the line of least resistance in feet would be sufficient.

It was found by experience, that the work was more rapidly and more economieally performed by lodging the charge fall as low as the line of the floor or roadway of the quarry, by which the root of the rock down to that level was thoroughly broken up, although requiring a greatly increased charge, which was still further augmented to what would as much as possible break up the material at once into manageable masses; in short, the only limit to the amount of clarge for the most beneficial effect, would be the largest that would not scatter the material to a distance, nor reduce it to fragments too small for the pier work.

By this course, the work of excavating shafts and galleries, and boring holes, is reduced in the expense of consumption of powder, to a great saving of time and expense.
3. It is apprehended that, on the large scale of the works at Holyhead, and by the circumstances of the quarries gencrally, the material was produced in a state fit for removal, at least at half the expense which it had previonsly cost by the ordinary blasting, and to an amount per day that could hardly have been accomplished at all by that mode.

## EROLYEEEAD。

## JNS OF CROUND AVAILABLE FOR QUARRIES FOR ;TONE TO THE BREAKWATER NOW BEING CONSTRUCTED.

nirally property is shown by the dotted lines.
on the $29^{4}$. July 7857 is shewn thus ater
 mines in the order of thair explesions, as ars used fir rfannce in thenpurtice 2 progress arcompleted are mearked in black.



## PLAN \& SECTIONS OF CROUND AVAILABLE FOR QUARRIES FOR THE SUPPLY OF STONE TO THE BREAKWATER NOW BEING CONSTRUCTED.

The Berundary of the Atmiraly property is shown by the dotted limes.
The fice of the Quarries on the $29^{*}$ July 78517 is sham cturs A P P P The aro lines dotted thus


The Shafts if Galleries in progress arcompleted are martied in tladt.




Section on KLMNO through fishers, Gulld \& NO IC Quarmes.


## MINE N: 4. SHAFT NO 2. QUARRY NOS.

Firrd $7^{\text {th }}$ Dec: 1850 .
Sale $1 / \mathrm{Mch}-35$ fint



MINE NO IO. QUARRY N?9.

$$
\text { fired 16:the lant } 1851
$$

Siale thet-35fud.


Plan


Elantion on CDE.




RRY $N \div 9$.
i).

Level of Floor of Quaury


MINE NO 18. QUARRY N? I.
Firad fovMarch, 1851.
Sale $t$ tren- -25 feet:


Section on $A B$.

Nite The part shaded roporesents the mas: nomovet

MINE NO 19. QUARRY No2.

Final 15 至 1 Planch $185 \%$
suates then-35iad:






Clay Fiule
Plun


Section on A.B:

MINE NO 26. QUARRY NỌ.

Plan


Wite. Thepurt shaded nepreseruts the mass remned


## MINE N: 31. QUARRY NO2.

Firrd 13 th Mavi $185 \%$
Sials thoch - 55 Aid


Rick not romored but mendy munch ront if shatecred. Tarmying blown cul:
Mrading b. Shaft not stated to have bren inyurals.

Hoor of Qumy
Siction on $A B$.



MINE No 39. QUARRY No4.
Firred in Iune 1855.
Siede $1 / \mathrm{mox}$ - 25 fied



Section on $1 B$.

MINE N: 40. QUARRY No3.
Fired 7 th June 1851


Plan








MINES Nos 51 AND 52 QUARRY N: 9.
Fired $12^{\text {th }}$ July 1851.




MINE No 56. QUARRY No3.
Fired 23nd July 1851.
sfalle thot-25/iek


Sictien ond $B$.

 tailot the fitheis is rvmuend


## PAPER II.

## Drboription of a Mititary Chapel, built for part of the Garrison of Durlis, By Major-General G. G. Leiwis, O.B.B.E.

Ths drawings which accompany this paper will explain the design of a Military Clapel erected for a part of the Garrison of Dublin, 1846-7, and made moder my direction, by Mr. Cumming, Assistant Surreyor in the Royal Engincor Office of the Chiel Engineer in Ireland. The plan had two objects ; providing a Chapel for the Military Prisoners in the Prisou adjoining, and for two Regiments of Infantry and one of Cavalry, in the Royal Barracke, also near it. Tho huilding provided seats for 1608 persons, and the cost was about two pounds per sitting,
The architecture, externally, was taken from a church lately built in the west of England, and the peculiarity that recommended the deesign to me was, the position of the stairs, which are placed outside of the body of the brilding, and thus the noise of ascending and descending was in a great measure removed (see Plan No. 7).
The general arrangement of the sittings was in reference to the nature of the congregation, and consequent separation of rank and sexes (see Plan No. 1), which readers the construction of a military chapel necessarily different from ordinary Protestant churches divided into pews, and where, in fact, economy in epace is essential as well as of arrangement, The disposition of the whole was satisfactory; and I have a communication by me from the Garrison Chaplain, wherein he states that, as regards the liearing, every word is distinetly heard in every part; and the chapel is considered by several clergymen of the diocese as most comfortable and well appointed*.
The following specification will explain, with the Plans from 1 to 8 inclusive, the nature of the work, and the details. The walls of the chapel are built of rubble masoury and lime-stone, in regular courses, with granite ornaments, as shown in articles $9,11,12,15,17$, and 18 of the Specification. The roof is of fir, and the galleries, floors, \&c, of deal, supported by cast-iron columns; the sash frames are of cast iron; and the ceilings and roof are painted in imitation of oak.
This description of a military chapel, I believe, is the only one given in the Professional Volumes; and as the building answers every purpose proposed, it is conceived that the drawings may serve to assist the Corps in deeigns of a similar nature.

> G. G. L.

August, 1851.

> + See note at the end of this Paper.

## Spechioations for the Ereotion of a Military Chapel, Dublin.

OHAPEL-EXOAYATOR.

Foundations, dec.

Fining
Dlepanal of surniut earth, se.

Courrete.

Draina.

Foundations.

Superstructure.

Yentilation under flours.

Stepos.
Stunn Aressings,
se.

Chamfers.
Roofs of square
turrets.
Circular turret.

Blank hesels to
sloon and win-
stuws.

Templater under non cotamens.

1. The gronnd to be dug and thrown out to the required depthe, and to such additional depths as may be required for the foundations and other purposes.
2. The botfoms of the excavations to be well beaten down, as before described.
3. After the masonry of the footings has been built in, the remaining spaces of the trenches are to be filled and well rammed to the finished ground-line.
4. The superfluous earth and rubbish to be removed, spread, and levelled, as shall be directed, and such as may not be required in the formation of the ground, to be removed off the Ordnance premises.

## MASOS, BRTCKLAYER, ASD STONE-CUTLER.

5. Concrete, as before described, to be laid to the required lengths, breadths, and depths, as footings for the steps.
6. Two twelve-inch barrel-drains of brickwork in cement, to hee constructed for the discharge of the waste water from the premises into the main sewers.
7. The foundations, and dwarf and fender walls, to be of rubble masonry in mortar, as before described, and of the depths and the thicknesses shown in the drawings.
8. Killaloe rag ton slatez, bedded in cement, to be laid on the walls at the height of six inches over the ground-line.
9. The superstructure to be of rubble hammer-dressed masomry, with horizoutal beds, and vertical joints on the outer face.
10. Flues to be formed, as shown in the drawings, for the ventilation of the floors, and fitted with iron gratings.
11. All the doorsteps, stairs, and landings, to be of chizelled granite set in mortar, the stairs and landings laving nine-inch bearings on the walls.
12. The external arches, hood monldings, door and window jamhs, heads, sills, mullions and tracery, sercen-work to stairs, corbels under ends of girdens of flat rooft, ends of gallery-trusses, springing of principal roof, water-tables of buttresses, comices and blocks to eaves and gables, copings or verge courses, blockings to parapet copings, circular turret and eaves courses, to he of chiselled, sunk, moalded, and weathered granite, set in mortar and pointed in cement, as shown on the drawings.
13. The quoins of buttresses, and other external angles, not otherwise shown, to be cut to the vertical line.
14. All chamfers to bee sunk and finished as chiselled work,
15. The roofs of square turrets to be formed of four-inch granite flagging, chiselled on the face, rebated at the jointe, and rum with lead.
16. The lower part of the circular turret to be of masonry, as before described; for the face of the luilding, curved ou the face.
17. The hlank heads to doors and to the windows on either side of porch, to be formed of four-inch chiselled granite landings, sunk as shown on the soffitte, and the two blank windows over the eame in front to be similarly fitted.
18. Templates of granite two feet mquare and one foot thick to be fixed on fuotings of masonry in mortar, to receive the feet of the iron columne of the pulpit and gallery.
19. The floors of the porch. lower floors of turrets, side entrances, under trunsept stairs, and in the several doorwaya leading from the porches, turreta, and entrances into the chapel, to be laid with asplalte of Seysel on beds of eonerete not less than aix inches deep.
20. Wherever door-frames are provided, the stone door-steps are to be morficed to receive the iron tenons of the wooden frames.
21. Mortiees to be sunk for fixing two iron door-scraper at each uxternal doorway.
22. Proper sinkings to be made for fixing all the necessary iron work, hookg, hinges, pivots, dec, cramps, dowels, \&es, for fixing and securing the stone work.
23. Two shafte of nine-inch brickwork in cement, and twelve inches square, to be formed in connection with the sewers for the discharge of surface water, fitted with iron gratings eecured to chiselled perforated and rebated solid granite curbs six inches thick, bedded in cement.
24. The surface-drains to be formed all round, and to the distance of eight feet from the building, of four bricks on edge in mortar, pointed with cement, and laid with a sufficient fall to carry off the surface water to the before-mentioned shafts.
25. The intervals between the surface-drains and the building, and to the extent of one foot ontside the surface-drains, to be paved with assorted threesinch pebbles, laid as before described, and finished with granite street curb, five inches wide on the face, and not less than nine inches deep.
26. The remaining eqaces of the chapel yard to be covered with powder paving, three inches deep, and gravelled one inch thick.

CARPENTER AND JOLSER,
27. The roofs thronghont to be of fir, wrought, framed, and chamfered; tiebeams, twelve inches by six inches; queen-posts, ten inches and a quarter by six jnches, and seven inches by six inches in the waist; principal rafters, eight inches and a half by six inches; straining-beams, eight inches and a half by six incles; struts, three inches and a quarter by six inches; straining-sills, four inches and a quarter by six inches; struts above straining-beams, six inehes by six inches ; purlins, seven inches by four inches; pole-plates, four inchee and a half by four inches; wall-plate, eight inches and three-quarters by five inches; wall-pieces behind braces under tie-beams, eight inches by six inches; curved braces, eight inches by six inches; ditto, above straining-beams, six inches by six inches; tracery, four inches by three inches, with two curved pendents to each tie-beam.
28. Tie-beams, ten inches by four inches and a half; queen-posts, eight iuches by four inches and a half; struts, two inches by four inches and a half; ditto, alove the strining-beams, four inches by four inches and a half; principal rafters, five inches by four inches and a half; straining-heams, six inches and a half by four inches and a half; straining-silla, three inches by four inches and a haff; purlins, seven inches by four inches; pole-plates, four inches and a quarter by four inches; curved braces, six inclies by four and a half inches; tracery, three inches by three inches; wall-plates, six inches by four inches; and wallpieces behind braces ander tie-beams, six inches by four inches and a half, with two curved pendents to each lic-beam.
29. Purlios and bip-plates, seven inches by four inches; and struts, four inches

Chatiel rool.

Porsh roots

Flat ramis over officon ratrance anil vestry. Roof boarding.

Staircase foofs.

Bell-turret moof.

Centering.

Door-frames.

Lintels.

Flours.

Trusses, de., to galleries.
30. Pole-plates, four inches by four inches; and purline, eight inches by four inches.
31. Pole-plates, four inches by four inchics; and purlins, eeven inches by four inches.
32. Joists, eight inclies by two incher, one foot from centre to oentre; and wall-plates, four inches by three inches.
33. All the roofs to be covered, one-inch deal wrought one side, and shol, and rough where not seen from the interior of the chapel.
34. Two-inch deal wrought on the under side, shot and fillistered, and laid on fir girders, ten inches by six inches, wrought, chamfered, and fixed as shown on the drawings.
35. Fir pole-plate, five inches by four inches; collars, four inches by three inches ; ridge-post, six inclies by six inches; principal rafters, foor inches by three inches; intermediate mafters, four inches by two inches; and lraces, four inches by two fuches.
36. Proper centering to be provided, fixed, eased, removed, and refixed as may be required.
37. Fir door-frames to all doorways, kix inches by five inches, wrought, framed, rebated, and chamfered, the feet of them secured to the door steps, with castiron tenons, the head built into the masonry, and the jambs fastened by iron screw-bolts, let into the reveal.
38. Fir lintels, where required, of the respective widths of the work they may have to support, one inch thick for every foot in length, and having nine iuches bearing on the jambs
39. The joists of the body of the chapel, transepts, and chancel, officers' entrance and vestry, to be of fir, six inches by two inches, placed one foot from centre to centre on plates of fir, four inches by three inches.
40. The upper floor of bell-turret to have a fir curb, or wall-plate, six inches by six inches, with two wrought and chamfered fir girders, ten inches by six inches, and bearens, ten inches by six inches, for the sapport of the bell.
41. The lower floor or landing in turret at top of gallery atains to have wrought and chamfered girders, eleven inches by eight incbes, and wall-plates six inches by four inches.
42. The transept galleries to have fir lireast-summers, twelve inches by nine inches, wrought, framed, and chamfered, fixed on cast-iron columns.
43. The trusse日 for the support of the floors also of fir, wrought, framed, and chamfered; tie-beams, twelve inches by nine inches; principale, nine inches by nine inches; posts and struts, nine inches by nine inches; templates, six inches by aix inches; bindingjoistes, eight inches ly four inches; and bridgingjoists notehed on the eame, four inches by two inches, and fixed twelve inches from ventre to centre.
44. The children's gallery to have wrought, framed, and chamfered, fir breastsummer, twelve inches ly nine inches; Lie-beams, twelve inches by seven inches; principaly, seven inches by seven inches; posta and struts, seren inches by soren inches; templatex, six inches by six inches; binding-joists, eighteen inehes by four inches; and bridging.joists, four inches by two inches, and fixed twelve inches from centre to centre.
45. Band-gallery to have wrought and chamfered breast-summer, twelve inchex by nine inches ; tie-beams, twelve inches by four inches; principals, five inchen hy four inches; and posta, four inches by fourinches; templates, nix inches by

Nix incles; biading-joiste, eight inches by four inches; and bridgingrioiste, foor inchea by two inchea, placed twelve inches from eentre to centre. centre to centre, noteled and nailed to the under edgea of the gallery binding. joista.
47. The gallery fronta to be formed of wrought, framed, and chamfered fir sille, four inches by four inchea; top rails, four incher by four inches; mullionn with circular heads, three inches by three inches, all rebated to reeeive one-inch deal boarding, wrought both sides, ploughed and tongued. The joint between the breast-summers and sills to be covered by a moulding of eight-inch girth, and the top rail to be finished with a moulded capping seven inches by four inches, sunk to fit down upon the top rails
48. The upper floor of bell-turret to be laid with one-inch and a half deal flooring, wrought on the under side and laid with straight joints, with a trapdoor three feet square, as shown on the drawings.
49. The lower floors, or landinge in turrets at head of gallery stairs, to be laid with two-inch deal, wrought both rides, ploughed, and tongaed,
50. The floore of the body of the chapel, the transepts, officers' entrance, and vestry, to be laid with one-inch and a lialf deal, wrought, shot, rebated, filletted, and straight jointed, with tongued headings.
51. Steps at altar to be formed of one-inch and a half denh, wrought one gide and shot, with rounded nosings and fir bracketted; carriages four inches by three inches.
52. The flooring of the galleries in the transepts to be of one-inch and a balf deal, khot and fillistered, with rounded nosinga; the risens to be of one-inch deal, wrought one side and shot.
58. The flooring to be the same in all respects as for the trinsept-galleries.
54. Stairs to band-gallery to have one-ineh and a half deal steps and risers, wrought and mitred with rounded and retarned nosings; oneinels and a half deal wall-string, wrought and housed, for steps and risers; face-string of oneinch and a half deal, wrought, eut, and mitred, for steps and risens, framed to wrought and chamfered fir newels, three inches by three inches, with oak, wrought, snok, and moulded hand-rail, three inches by three inches, and oneinch and a quarter deal square balueters, dovetailed to the steps and housed into the hand-rails; four iron balusters to be provided and fixed, to match the wooden ones, and to secare the band-rails.
55. The atairs to be supported on fir carriages, six inches by three inches, three to each flight, fixed to fir-framed trimmers nine inches by three inches, and with one-inch and a half rough deal brackets.
fín. Joints of the quarter spaces and landings to lie of tir, four inches by two inches, twelve inches from centre to centre on plates four iuchee by two inches, laid with one-inch and a half deal, wrought and fillistered flooring; oneinch end a quarter deal skirting, nime inches wide, to be made good to the wall-etring, and plugged to the walls with oak plugs.
57. The akirting to the body of the chapel, transepts, chancel, officere entrance, and vestry, to be of one-inch and a quarter deal, nine inches wide, wrought and chamfered, fixed to deal fillets two inches by one inch, plugged to the walls with oak plugs.
58. The railing on the top step of the chancel to be formed of wrought,

## SPECIFICATIONS FOR THE ERECTION

famed, and chamfered sill, three inches by three inches; top rail three inches by three inches, mullions three inches by three inches, and capping five inches by three foches, to match the gallery fronts, having a portion in the centre, to the extent of five feet and a half, to open on hinges and hung folding.
Doors.
58. All the doors to be of two-inch and a half deal wrought, framed, braced, filled in with one-inch and a quarter deal aliceting, in widths not exceeding seven inches, wrought, rehated, and beaded, and bsek sheeted with the same diagonally; the doors to he hung folding, the external ones with wrought-iron hook-and-eye hinges, spanning the whole breadth of the doors, and the internal doors with three six-inch enst-iron butt hinges to each leaf.
60. The standing halves of the internal doors to be secured with ten-inch iron bright barrel-boltes, and those of the external doors with twelve-inch iron bright barrel-bolts.
61. The internal doors to have nine-inch iron rim drawback locke, with brisd slide-plates and knob-bandles on both sides.
62. The external doors to be fitted with strong ten-inch iron rim dead ehot locks and large-size home-made thumb-latches.
63. All the external doors to be rivetted through, as shall be direeted, with round-beaded wroughtiron bolts, and the hinges to be made of ornamental patterns, as will be directed.
Pulpit and rendlig deak.

Sents,

Nyanizing
64. The pulpit and reading desk to be of one-inch and a quarter right Dutch wainscot, wrought both sides, framed, moulded one side, and fitted with one-inch and a quarter doors, hung with brass hinges and brass pulpitlatches; one-inch and a quarter deal, wrought and rebated flooring on fir, framed bearers, three inches by two inches; one-inch wainscot bookboards and bearers, wrought both sides, and wrought, moulded and sink wainscot capping, to house down upon the framing; one-inch and a quarter wainscot seats, thirteen inches wide, on proper wrought, cut, and shaped brackets; one-inch wainseot steps and risens, with returned moulded nosings; one-inch and a quarter wainscot, wronght, beaded, sunk, and eut string hoards, and strong bracketted carriages, with wainscot monlded and snonk hand-rails, turned and mitred caps, turned and dovetailed wainscot balusters, four wrought and turned iron balusters to match, together with all the appurtenances, fittings, und iron work, to complete the whole in a perfect, substantial, and bandsome manner: together with the communion table, of right Dutch wainscot, with oneinch and a quarter top und vides, and tumed legs, as will be directed, at an expense not exceeding kixty pounds sterling.
65. The body of the chapel, transepts, and galleries, to be fitted with deal forms; the tops of an inch and a half deal, twelve inches wide, wrought both sides, and rounded at the ende, with wronght, ent, and shaped legs, twelve inches by one inch and a half; ledges, six inches by one inch and a half, and braces three inches by two inches. Those for the officers to have open backs of wrought and framed rails, and etandards four inches by one inch and a half.
66. All the timber in door-frames, lintels, wood-bricks, templates, wall-plates, joists, trimmers, trimming;joisto, ceilingjoists, roofing, gutter-boarding and slateboarding, gutterbearers, and flooring, to be Kyanized.

## 1RONYOUNDER AND SMITH.

67. Cast-iron plates, nine inches by six inches, half an inch thick, and closely perforated with holes half an inch in diameter, to be provided for the apertures in external walls, for ventilation, underneath the floor of the body of the chapel and transepte.
68. Wroughtiron cramps and dowels to be provided for securing the stone work where required, and run with lead.
69. Cast-iron tenons, one inch and a half square, with plates half an inch thick, to be provided and lixed to the feet of the door frames, let into the stone work, and run wilh lead.
70. Two east-iron door scrapers to be provided for each external doorway, let into the doorsteps, and run with lead.
71. Wroughtiron gratings with steeled eyex, let into the stone curbs, and run with lead, as before deacribed, to be provided and fixed over the shafts to sewers.

72, All the trusses of the roofs to be fitted with stirrups of wrought iron, two inches by balf an inch, one-inch square fron screw-bolts and nots, and iron wedges half an inch thick.
73. The trusses to be fitted with wrought-iron stirrups, as before deacribed, with one-inch square iron serew-bolts and nuts, and one-inch and a quarter round iron serew king-bolts and nuta,
74. The galleries to be supported on cast-iron columns, of an average bore of eight inches, and five-ighths of an inch thick, with caps and bases, as shown in the drawing, the feet to be let into stone plinths, and run with lead.
75. The gallery front framings to be secured with wrought-iron knees, two inches and a half wide and balf an inch thick, neatly fixed with one-inch square fron screw-bolts and nuts.
76. The framed inclosure of the altar to be secured similarly to that of the gallery fronts.
77. The hand-mils of gallery stains to be secured with four one-inch and a quarter wrought-iron square balusters to match the wooden ones, and firmly screwed to the string-boards, steps, and hand-rails.
78. Each of the door-frames to be fixed with not lese than eix three-quarter inch square iron screw-bolts and nuts, let into the stone reveale, and run with lead.
79. All the sashes to be of cast iron, one inch and three-eighths thick, to be built into grooves cut in the stone work.
80. A cast-iron column, to correspond with those for the galleries, to be provided and fixed to stone plinth below the floor, and run with lead, and to be fitted with wrought-iron plates, as shall be directed for securing it to the framework of the pulpit.
81. The stairs to be stiffened and secured with all necessary wroughtiron knees, as shall be directed, together with four turned wroughtiron balusters to match the woodens, and wrought-iron screw-bolts and nuts, \&e., as may be found necessary for the perfect completion and security of the work, together with an iron rack for raising the book-boards.
82. Five-inch semicircular cast-iron gatters, with fifteen stacks of three inchea bore, cast-iron rain water pipes, cistern heads, perforated cover and shoes complete, as before described, to be provided and fixed tas shall be directed.

## BELL-POUNDEIL.

88. One bell, of not less than four hundred weight, to be hung in the belfry, with all the nucessary iron work, axle, wheel, fackle, and rope complete.

Staircase, vestry, and officers' en+ trance roofs.

Gutters.

Sashes.

## pluybee

84. The apex of the belfry turret-roof to be covered with sheet lead, eight pounds to the superficial foot, and the floor of the belfry with sheet lead, seven pounds to the toot, furned up and trimmed to the eurb of the trap-door in the centre of the floor, and having flashings of lead, five pounds to the foot, and twelve inches wide, against the walls.
85. These roofs or flats to be covered with sheet lead, eight pounds to the foot, and flashings, five pounds to the foot, as before described; the llats to be laid with a proper fall to the heads of the rain-water pipes, into which the water is to le discharged by three-inch bore lead pipes, two feet and a half long, and weighing sixteen pounds to the foot, properly fitted and soldered to the lead flata.
86. At the intersections of the turrets with the main roofs, gutters are to be laid with sheet lead, seven pounds to the foot, and flashings, five pounds to the foot, as before described.
87. Flashings and step-flashings, not leas than twelve inches wide, of five pounds sheet lead, to be fixed to all the gables throughout, and wherever otherwise required at the junctions of the roofs with the walls.

## sLater.

89. The roofs over body of the chapel, the transepts, chancel, and porch, and conical roof of the bell-turret, to be covered with Killaloe queen ton slates, laid on boards, with iron nails, dipped in oil, or painted, and with three-inch lape; the ridges to be covered with English white ridge-stone, bedded in mortar, and pointed with cement.

## PLAStERER.

90. The ceilings of the officers' entrance, the vestry, and underneath the galleries, to be lathed, plastered, floated, and set with fine stuff, and finished with two coats of whiting and size.
91. All the walls of chapel, transepts, chancel, officers' entrance, vestry, porch, and turrets, with the several jambs, and arches of doorways, windows, and archways therein, to be rendered, floated, and set and finished with washed sand.

## PATNTER AND GLAZTER

92. All the wood and iron work exposed to view, and such as is usually painted, to have four coats common colours, in oil, including all stopping, knotting, cleaning, and rubbing down.
93. All the saches to be glazed with the best O glass.

## sotice,

The contractor is hereby particularly required to observe, that the foregoing terms of contract, general regulations, and specifications, are intended to embrace all and every description and kind of labour, materials, and workmanahip whatsoever, which may or shall be required for the due, full, and entire completion




## MILITARY




E LINE A. B. ON PLAN.
fiet te ane luche
20 is +o 50 Fiet


## ARY CHAPEL, DUBLIN.




RY CHAPEL, DUBLIN.


IDN ON THE LINE E. F. ON PLAN.
Soule if tert is eve tuche


## MILITAR CHAPEL, DUBLIN.



Srate, th Ficed to aut Iruch

## ILITARY CHAPEL, DUBLIN.



Slandiage o CO

MILITARY CHAPE



Eviantyify

MILITARY CHAPE


and finishing of the prison, chapel, governor's house, warder's lodges, and other out-offices, together with all the enclosure walls, entrances, gates, sewers, and every other appurtenance thereto belonging, notwithstanding any errors or omissions in the said terms of contract, general regulations, and specifications, without any extras or allowance for extra work which shall not have been executed by and with the consent, knowledge, and orders in writing, of the Commanding Royal Engineer of the Dublin District.
Combannding Royal Engineer's Office,
Dublin, 26 th A pril, 1845.

## Note to the Descbiption of a Military Chaprl.

(Copy.)
"18, Montpelier Hill, Jan. 29, 1849.
"My dear Sir,-In reply to your note of this day respecting the Garrison Church, I have very great pleasure in assuring you, that every day's experience confirms me in the opinion which I had long since formed, and have before expressed to Major Vicars-that, for its size, it is one of the easiest filled churches, by the voice, in this city. Since the pulpit and reading-desk have been removed to the centre, there has not been a single complaint in reference to hearing; and I feel confident that every word is distinctly heard, both from the desk and pulpit, in any part of the church, without any extraordinary effort on my part, and with less fatigue than I have suffered in churches less capacious. Several clergymen of this diocese, who have at times assisted me, concur in this opinion, and were distinctly heard in every quarter; they have assured me, that it is one of the most comfortable and best appointed churches that they have seen, and the pleasantest to speak in.
"GEORGE HARE,
" Chaplain to the Garrison.
"Major Lugard, Royal Engineers."

## PAPER III.

## The Quebec and Halifax Rallway. By Major Robisqua, R.E.

Towarns the elose of the year 1838, Lord Durham, Gorernor-General of Canads, received a despatel from Her Majesty's Government, acquainting him with their determination to establish a steam communication between Great Britain and Halifax, and instructing him to direet his attention to the formation of a road between that port and Quebec.
In his Report on the Affairs of British North America, made in 1889, Lord Durham recommended that this road should be a railroad.

This, however, was not the first suggestion for a milway to comnect Canada more elosely with the mother country ; for, in 1885, Captain, now Lieut.Colonel, Yule, of the Royal Eugineers, explored a line for a railroad from Quebec to St. Andrews, a port in the Bay of Fundy; but this line passing through the territory disputed between Great Britain and the United States, of which a great portion was finally ceded to the latter, it was never carried out.
The Cunard line of steamers between Liverpool and Halifax was established in 1840, and by them the communication between Eagland and the continent of North America has been uninterruptedly kept up ever since, in the most efficient and admirable manner, under a contract with the British Government.

Instead of the railway to complete the communieation onwards from Halifax to Quebee, it was at first proposed to construct a great military bigh road aeross the centre of New Brunswick, which was to branch off from the existing provincial mads near the bend of the Petitcodiac River, and join about the Riviere du Loup, the road leading from thence along the river st. Lawrence to Quebec.

In the year 1844 Captain Simmons, of the Royal Engineere, explored a line for this military high road.

But the rapid development of railroads in England and the United States of America, with the beneficial effects which everywhere attended their iutroduction, especially in the latter and neighbouring country, caused Lord Durham's suggestion of a raitway to be revived.

Two or three private Companies, having this olject in view, were projected in England during the general excitement which prevailed on the subject of railways in 1845 and 1846 , but sank of expired during the collapse which followed soun after.

In the British Provinces, however, the intense intereat which liad been excited in its favour continued unabated, and resolutions were paszed early in 1846, by each of the Houses of Legislature of the three provinees of Canada, New Brunswick, and Nora Seofia, iu support of the project, and soliciting the aid of Her Majesty's Government towards it, undertaking, at the same time, to pay the expensed of the preliminary surveys and explorations,
These refolutions, with the previous correspondenee and aulsequent communications which passed between the Governors of the Provinces and the Secretary of State for the Colonies, had the effect of induciDg Her Mrjesty's Government. to send out an exploratory and surveying expedition from this country.

Captain Pipon, of the Royal Engineere, who had just returned to Eugland from

America, where he had been engaged on the duties of the British Boundary Conmission appointed under the Treaty of Washington, was selected by the Inspector-Gencral of Fortifications to conduct it, Lieutensnt, now Captain, Henderson was appointed to assist him, and thirteen non-commissioned officers and privates of the Royal Sappers and Miners, all belonging to the Survey Companies, were sent out with flem.

The party left this country by one of the Cunard steamers in Jume, and arrived at Halifax on the 2nd July, 1846.

The instructions given to Captain Pipon for bia guidance being too long to repeat here, it will be sufficlent to give the following exiracts from a letter addressod to him subsequently by the UndenSecretary of State for the Colonies, which contain essentially their spirit :-
"1. Your instructions already authorize yon to employ all the means of the country of which you can avail yourself, to emable you to perform the service with celerity and efficiency.
"q. Although your instructions are very precize upon the point, Lard Grey thinke it right to remind yoi, that the firet and principal olgject of the inquiry on which you are engaged, is that of furniahing Her Majesty's Government with such general knowledge as may enable them to decide which is the best line to be adopted for a trink communication by railway through the British Provinces in North America, wifh reference to Imperial und Military, as well an to Provincial and Commercial Intereste, and that no detailed survey of the comitry should be atiempted, tutil the preliminary question as to the best line for a railroad through the country alall have been determined."

Captain Owen, of the Royal Navy, having suggested that the port of Whitehaven, near Canso, at the north-eastern extremity of Nova Scotia, should be the Atlantic termimus of the railway, in preference to Halifax, Captain Pipon was ordered to extend his explonations and inquiries to that harhour, and report upon the comparative advantages of that, or any other eastern port, for the terminus.

The operations being thus chiefly exploratory, a limited amount of instruments were purchased in England for the occasion ; viz :-
8 Mountain Barometers, by Gay Lussac, or Simms. Syphon construction.
45 -ineh Theodolites, by Simms.
4 Measuring Chains,
20 Pocket Compasses,
1 Podometer.
2 Rochon Telescopes; with some Thermometens.
Captain Pipon was, however, authorized to receive and make use of any of the instruments which were then in Ameriea belonging to the Foreign Office, and which were no longer required on the British Boundary Commission; and according to lits request, he received from Major Robinson, who watr retuming homa from Wazhington rid Halifux, in August:-

2 Monntain Barometers ly Símms.
6 Freuch Barometers Syphou construction-
2 Box Chronometers.
A. Poeket Chronometers.

110 inch Sextant.
2 Prismatic Compaases (Sehmalealider'se with a few mare Themonmelers and Mahogany Pocket Compasser, for the use of the Ssppers.

To these were added, early in the following year, also borrowed from the Foreign Office :-

16 -inch Theodolite.
15 -lieh "
1 Schmalealder's Compass.
1 81-feet Pentograph.
1 3-feet Beam Compass,
2 4-feet Steel Straight-edges.
2 Cases of Drawing Instruments.
8 Books of Logarithms; with some minor articles for the use of the drawing room.

It may be mentioned here, that aneroids were not at that time known, or some would have been certainly recommended to be taken, and fewer barometers.

In the course of the expedition full half of these were broken, and to repair them it was necessary to send them to England, causing much inconvenience and delay.

The pedometer was useless in the woods
The rochon telescopes were of the greatest service, in rivers or places where chains could not possibly be used.

Tents, blankets, and all other articles of camp equipage, felling axes, \&c., were purchased in the country, as required.

Canoes were either purchased or hired, as was found necessary or convenient.

The whole country to be explored, through New Brunswick, and that part of Lower Canada north of the Restigouche River, and extending from it to the banks of the 8 t . Lawrence, is covered with a dense primeval forest, consisting, for the most part, of pine trees, whose sharp-pointed branches, when they are prostrated by age or the violence of winds, form a regular abattis, and, with a thick mudergrowth of shrubs and bushes, they render these woods almost impervious. Parties exploring, as soon as they leave the rivers or beaten tracks, have to ent their own way before them.

The difficulties of exploring, in such a country, are very great. The hilla being as much covered with the forest as the lower portions, it is aot easy to obtain views of the surrounding country, and generally it is only to be done by elimbing.

Some of the Sappers became clever at this, and, ascisted by creepers (a contrivance of iron spikes) buckled to the feet, could elimb well.

In Nova Scotia the same difficulties were not experienced, there being many good country roads, of which advantage was taken whenever possible; and the woods are not so impenetrable as in New Brunswick.
In the latter province there are two good ligh roads, one on the east side, and another on the weat, which lead to the banks of the St. Lawrence; but north of the one which comects Fredericton with Boistown and Chatham, on the Miramichi River, there are no cross roads by which the interior of the country ean be reached.

The rivers and streams afford the ouly means of aceces, and when these are left, the exploring party must ent out its own patb.

The plan of proceeding was generally as follows -
From the beat information that could be obtained, either from persons
acquninted with the country or derived from former explorations, certain linea were selected for trial and examination.

Three or four partiea were formed, each consisting of generally one ciril surveyor (engaged in the country), two Rappers as assistant-surveyors, and a party of ten to twelve labourers, who were lired for the season. These were chosen from the lumber-men of the country-men acenstomed to the woods,-aud their duty was to carry the camp equipage and provintons, cut out and form carrying paths, \&c. They were also generally foand to be good canoemen.

Euch party was given a particular line to explore. The Sappers carried either two or Claree barometers with them, as could be apared, the same number of detached thermometers, one b-inch theodolite, and a measuring chain, poeketcompasses, \&o At the lines were cut out, they were measured, and the angles taken for direction, and also for elevation or depreasion. The barometers were regieterod at the aummith of ridges and bottoms of valleys, the time of registry being earefolly noted.

Somewhere, at the most convenient spot in the neighbourhood of the exploring parties, a sapper was sationed with is standari barometer, who did not move from his poat antil ordered to do no, whose duty it wae to register bis barometer and thornometers every hour during the day.

By a comparison of his registry afterwards with that of the party in the woods, the mems were obtained of making a barometrical section of the line, in addition to that given by the theodolite. Halifax, Truro, Whitehaven, Chatham, Camphellown, points close to the sea, were thus selected for standard barometer stations. The Grand Falls, whose height above the sea was well known, was uleo one. The formula ared for the reduction of the oliservations was Bailey's and the tables given in Simm's Treatise on Mathematical Instruments.

One great ilifficulty, and which formed a heary item in the expenses, was to keep the parties supplied with provisions, for the quantity which could be carried on the backs of the labouress, in addition to their ordimary burdens of tents, blankets, axes, camp-kettles, \&c., was not sufficient to last them many days. A bout 70 lbs , weight, including everything, was considered a fair load for a man to carry on hia day's marels

It was therefore necersary to entablish at different pointe depots of provisions. Supplies were porchased at. Fredericton, and sent op the river St. Johu to the Grand Falls and Madwaaka, and then carried up in canoes to the bead of Green River, where they were deposited in a loghat built by the boatmen, and left in charge of a triatworthy labourer.

Much in the same way, a depot, was formed on the Tobique River, where the lines cross it; another up the Restigouche River.

Somerimes the provisions were sent up the rivers in canoes, or in large flatbottomed boate, drawn by horees, and accompanied the parties, as op the Metapedia Fiver, 8 e.

Biecuit, salt pork, and salt beef, with tea and brown sugar, formed the staple artieles of dict.

No npirits or beer were permitted to be taken. Three meals per day, the fare at each beiug the same, and not restricted as to guantity. Tea was the great lixury at every meal, and it was surprising to witness the refreshing and strengthcaing effeet it had upon the men alter liard work.

To supply is party exploring somth-enat of Troir Pistoles, on the Et. Lawrenee,
provisiona had to be sent from Quebee to that place, and thenee earried into the woods by latiourers hired for the purpose.

As the distance increased from the river side, the carrying party increased also, for they themselves had to be fed on the journey ont and lack.

At the last portage, the number carrying amounted to twenty.
The exploring party then, howerer, acquirud a surplus atock, with which to take a departure in search of the depott at the head of Green Biver.

Some idea of the impneticable mature of the forest may be formed from the fist, that at this time the men cutting eould unt elear out, for the othern to follow them, much more than three miles per day.

In these woods it is unsafe to wander in the least degree from the path cut or marked out. The danger of heing lost is very greal.

In the first season, Captain Henderson and three labourers, exploring in the difficult coantry about the Upsalquitch River, loet their bearings, and were oul for three whole days and nights without a morsel to eat,

When they found themselves faitly lost, they adopted the best alternative left them, which was to follow a rumning etream
By serambling during the day along its banks, or wading in its bed, and at night sleeping under the shelter of the most favourable tree, they at the eud of that time reached its confluence with a larger stream, where to their great relief they found a small quantity of provisions stored under a logshed, to secure them from the bears. It was a deposit, or câche, made by some lumhermen to rerve a future purpose. But for this providential circumstance they must have all perished from hunger and fatigue.

In the second season, one of the civil burveyors, Mr. Grant, of the Crown Land Office, New Brunswick, was lost for five days, being rescued in the last stage of starvation, his limbs paralyzed and extremities frost-bitten. An interesting account of this most providential escape was published in Chambers' Ediuburgh Journal for June, 1848, No. 231, But the most unfortunate catastrophe which occurred early on this expedition, was the melancholy fate of Captain Pipon, who was accidentally drowned, on the 25th October, 1846, only a few montha after his arrival in the country.

He was descending the Restigouche River, which falls into the Bay Chaleurs, in a canoe, with his boatman and a boy, whom he had engaged at a ectuler's house to act as a guide down the river.

On passing throngh a part called the Suction Rapids, the rickety canoe, owing to some inadvertent movement of the parties on board, upset.

Captain Pipon and the man reached the shore in safety, but the boy remained elinging to the bow of the canoe.
Moved by his cries for asxjetance, Captain Pipon planged again into the siream, and endeavoured to reach him, but in vain. Encumbered with heavy boots and pea-coat, and probably numbed ly the coll, he soon sank in the rapid current, and was carried down the stream. The body wat found in about two hours after. The boy was, very soon after the accident oecurred, drifted safely to shore on the canoe.

Captain Henderson, who was at the time some bundred milles ligher up the river, upon hearing of it, hastened to Campbelltown, and from thence had the body immediately conveyed to Fredericton, where it was interred with military honours in the publie remetery.

His and tate was universally regretted. The Legialature of New Brunawick roted su eum of money to defray the expense of a monament to be placed to his memory is the Cathedral at Fredericton.

A tablet to lis memory was also placed, by the joint subseriptions of thirty of bit personad friends in the Corps, and the members of the Bonndary Commission, with whom be had so lately served, in the parish church of his family; at St. Brelades, in the Jeland of Jersey.

At his death, Captain Henderson sueceeded to the command of the expedition. The winter having set in, the parties were withdrawn from the woods, and returued, part to Fredericton, part to Halifax, The labourens were paid off, and the Sappers employed making plans and sections of the lines explored.

Early in 1847 Major Robinson was sent out to succeed Captain Pipon, and rematned in charge of the expedition until the completion of its labours, and the retirn of the parties to England in October, 1848.
Bejorls of progress and proceedings were sent home from time to time.
The following papers comprise the final reports of the officers and civil surveyors ${ }^{+}$engaged.

The despateles, and docoments* which follow them, are given to show the proceedinga which took place thereon, by Her Majeaty's Goverament and the Colonies, and the present prospecte of the railway being carried out.

The unfavourable view which Her Majesty's Raitway Commissioners took of the line soon or ever becoming a remurerative one, was fatal to its immediate adoption by the British Govermment.

A better opinion of its merits has since prevailed; but in the meanwhile as rival project-that of the European and North Ameriean Railway-has sprung up, and met with considerable favour in the provinces of New Brunswick and Noya Scotia.

The object of this railway is to facilitate the communication between England and the United States, by making a railway from Halifax, or some other port in Nova Scotia, to rum to St. John's in New Brunswick, and thence on to meet a line from Bangor in Maine, to the boundary at Calaiss

By the time it is constructed, or long before, it is expected that the lines from New York to Bangor, and from Portland to Montreal, will be completed.

The Britidh Goverament, however, as will be seen by the despateh of the 10th March, 1851, have been induced to come forward and offer moat valuable aid and axaiatance to enable the three provinces interested to make the Halifax and Quebec line, ant to Montreal in addition.

The result of this offer remains to be sgen.
The provinces are not now so unanimous in favour of the project as they were two or three years ago, the American line laving many advocates who give it a preference.

> WM. ROBINSON,
> Captain Royal Eugineers, Brevet-Major.

Excter, July 4, 1851.

[^2]
## Papers relative to the Quebee and Halifax Railmay.

No, 1.

> (No. 209.")

No. 1.
Copy of a Desparco from Earl Geiry to Governor-General the Earl of Elars and Kisoarding.

$$
\text { Mx Lonn, } \quad \text { Downing Street, November 17, 1848. }
$$

1. The Commissioners sppointed by Her Majesty's Government to explore and survey the line of country offering the greatest advantages for the formation of a nuilway from Halifax, through New Brunswick to Quebec, having completed the duties with which they were charged, I lave now the honour to tranamit to your Lordaliy the final report of Major Robinzon, addressed to the Inspector:General of Forlifications.
August 31, 1848.
2. I have perused this able document with the intereat and attention it so well merits, and I have to convey to you the assurance of Her Majesty's Government. that we fully appreciate the importance of the proposed undertaking, and enterfain no donbt of the great advantages which would result, not only to the provinces interested in the work, but to the empire at large, from the construction of such a railway; but great as these advantages would be, it is inpossible not to be sensible that the obstacles to be overcome, in providing for so large an expenditure as would be thus incurred, would be of a very formidable kind.

Before, therefore, Her Majesty's Government proceed to consider the question as to whether any steps should be taken to carry this plan into effect, it is necessary that we should be informed how the several provinces would be prepared to co-operate in its execution.
3. It is ohvious that the cost of the work would he too great, as compared to the return, to be anticipated from the probable traffic, to give reasonable hope of its being undertaken by any Company as a private speculation. The question, therefore, arises, whether it would be expedient that in some form public assistance chould be given towaris the accomplishment of an otject in which the public is so much interested.
4. The answer to this question must, in a great measure, depend upon the degree of importance which the provinces attach to the opening of this line of communication, and upon the amount of exertion they would be prepared to make for the purpose. 1 am , therefore, anxious that the subject should be brought under the early consideration of the respective Legislatures, and that I should be placed in possession of their views with respect to it as soon as may be practicable.
5. In forming a judgment, as to whether public assistance ought to be given towards the execution of the work, it will be necessary to take into consideration the different ways in which this might be done. Varions modes of proceeding have been proposed: one is, that of endeavouring to form a Company, by guarantecing to them a certain minimum interest on the capital, to be invested in the undertaking.

This plau would, no doubt, poasers some advantages; but on the other hand it

[^3]would he attended with the diandvantage of depriving the public of the proper control over a great natiomal work, and also of having a tendency to encourage inattention to economy, both in the construction and subsequent working of tho Iine. This last oljeetion has been met, by proposing that any company formed to construct the fine chouid receive ansistance, not in the form of a guarantee of any given rate of intereat, but of a fixed payment either of capital towarda the execution of the work, or of an annual sum of money in addition to the receipta derived from tnaffic when the line is completed.
6. Another plaw which has been suggested is, that the required capital should be raised by loan by the Goyernment, and contracts entered into for the formation of the line, whiels, when finished, coold be worked either by the Government, or by any Company formed for that porpore, and to which Company the working of the line might be leased, under kuch conditions and for ancl a period as migtit be decmed advisable. The oljections to this proposal are those usually raised againet the nudertaking of anch a work by a Government, white on the other band it would be attended with these adrantages: lirst, that probably the capital required would then be raised ou betfer terwit than could atherwise be expected; and secomilly, that the Government would have a more complete control over a great national line of commonication.
7. I am not able at present to pronounce any opinion in favour of one or other of these plans, or even in favour of the reeasure being attempted at all; but I merely throw out these different suggestions for the consideration of your Lordship, and of the Executive Council and Legistatuve of Camada.
S. It will forther be very material to consider what return is to be expected for the outlay, and from what source the means of affording any pecuniary assistance, to be given by the respective provinces, cau best be provided. Upon this part of the aubject 1 bave to remark that, in eatimating the prohable retura which the railway would yield, it appears to me highly neecssary to wiverh, not ouly to the direct return from the traffic, but to the indirect return from the increased value given to the lands through which it will pass. That the opening of the line would, in the districts it traversed, greatly enhance the value of the lands which are still lying waste, and also, though in an inferior degree, the value of those already settled, there can be no reasonable doubt, though I do not possess the means of judging whether the amount of that increased value has been correctly estimated by Major Rohinson is his report. Hence it seema to follow, Hat this increased value ought to be made available towards the exceution of the work, and I would suggest, for the consideration of the Colonial Authorities, whether it might not be advisable that Acts shouid be passed, vesting in the hands of the Commissionera to be appointed for that purpose, all the hitherto umgranted lands lying within a certain distance of the line, is order that these lands might be sold or otherwise appropriated for the promotion of the undertaking.
9. It might aleo, 1 think, be very reazomably enacted, that lands Iving within a given distance of the fine should be suljected, on its being completed and opened, to some moderate charge in the nature of a rate, in consideration of the benefit the proprietons receive from its The practive is general both in this country and in Ameriea of rating for the highways the property which ia benefited by them, and I can see no reason why this rule should not be extended to railways, Shonld this suggention be adopted, it would, 1 think, be expedient to give the owners of lands subjected to this charge the option of redeeming it

VOL. II. N. $s$.
upon easy terms, and of paying in land where they might have a difficulty in doing so in money.

I understand from Major Robinson, that the owners of land in one portion of Nova Scotia have already offered to contribute liberally to this object.
10. In addition to the value which the different Legislatures woild be prepared to contribute in land, or by the imposition of a lueal charge upon lands lenefited by the line, it would be necessary also for them to consider respectively what amount they would be willing to grant from the general revenue of the provinces towards the payment either of the interest of a loan to be raised for the execution of the work, or towards the sum which might be required to make good the engagements entered into with any Company that might undertake it.
11. The whole subject is one of the very bighest importance, on which I shall be anxious to learn the conclusions to which the Colonial Authorities may come, after mature consideration, and after such communication with each other as may be necessary.
The Right Hon. Earl of Elgin and Kincardine,
\&e., \&e.
\& have, \&e.,
(Signed) GREY.

## Enclosure in No. 1.

> Report on the Proposed Trunk Lane of Rathway from an Eastern Pobt in Nova Scotla, through New Bbunswick, to Quebeg.

Halifax, Nova Scotia, August 31, 1848.
Three principal lines or routes for a trunk line of railway present themselves for consideration; and, by combining portions of two of these lines together, a fourth and fifth route may be formed.

1st. Commencing at Halifax and crossing the province of Nova Scotia to a port in the Bay of Fundy, from thence by a steamer to St. John, in New Bruns wick, and then by Fredericton, along the St, John River to the Grand Falls.

From the Grand Falls, by the best practicable route across to the mouth of the Rivière du Loup, on the St, Lawrence, and by the right bank of the St. Lavrrence to Quebec.

The distance by this route would be as fallows :-

| Halifax to Windsor |
| :--- |
| Windsor to Annapolis |
| Annapolis to entrance Bay of Fundy : |
| Across Bay of Fundy to St. John (by sea) |
| St. John to Frederieton. |
| Fredericton to Woodstock |
| Woodstock to the Grand Falls |
| The Grand Falls to the mouth of the Rivierre du Loup . |
| Riviere du Loup to Quebeo . |
| Total distance, Halifax by the 8t, John River to Quebec |

This line may be termed a mixed ronte, by railway and steam-boat.
2nd. Commencing at Halifax and running to Truro, at the bead of the Bay of Fundy, thence over the Cumberland Mountains to Amherst, then along the coast
from Bay Verte to Shediac, thence by a north-westerly course, crossing the rivers Richibucto and Miramichi above the flow of the tide, so as not to interfere with the navigation.

Then by the valley of the north-western Miramichi to Bathurst, on the Bay Chaleurs, along the coast of this bay to the Restigouche River, and by it, and the valley of the river Metapedia, to the St. Lawrence, and by the right bank of the St. Lawrence to Quebeer

The distance by this route would be as follows:-
Halifax to Truro and Bay Verte .
Truro to Amherst and
Bay Verte to Shediac
Shediac to Miramichi River :
Miramichi River to Bathurst.
Bathurst to the Eel River, near Dalhousic
Dalhousie to the mouth of the Metapedia River .
Metapedia River to the mouth of the Naget River, near the
St. Lawrence .
Along the St. Lawrence from this point to Quehee
Total distance by this route .

This, for the sake of reference, may be called the Halifax and Eastern or Bay Chaleurs route through New Brunswick to Quebec.

3rd. Commencing at the harbour of Whitehaven, near Canso; at the northeastern extremity of Nova Scotia, thence along the Atlantic coast to Country Harbour and valley of the river St. Mary, thence by or near to Pictou, and along the northern shore to Bay Verte,
From Bay Verte to or near to the bend of Petitcodiac, thence across to Boistown, and northerly to the Restigouche River, crossing it several miles to the east of the Grand Falls.
From thence by the most direct and practical conrse to the Trois Pistoles River and along the right bank of the St. Lawrence to Quebec.

The distance by this route would be nearly as follows :-

| Whitehaven to Country Harbour . |
| :--- |
| Country Harbour to St. Mary's Valley and Pictou . |
| Pictou and along the coast to Bay Verte |
| Bay Verte to bend of Petitcodiac . |
| Petitcodiac to Boistown. |
| Boistown to the crossing of the Restigouche River |
| Restigouche River to Trois Pistoles, by the Kedgwick and |
| Rimouski Valleyz |
| Along the St. Lawrence to Quebec. |
| Total distance from Whiteliaven, by Boiatown, to Quebec |

This may be termed the direct route.
4th. Combining the Halifax route through Nova Seotia, and the direct routs thyough the centre of New Brunswick.

The distanees will be protably as under :-


5th. Combining the Whitehaven route through Nova Scotia with the Eastern or Bay Chaleurs route through New Brunswick to Quebec, the distances will be as under:-
From Whitehaven, by Pictou and the North Mles.
Coast, to Bay Verte, as in route No. 3 .

| From Bay Verte to the Bay Chaleurs, and mouth |
| :--- |
| of the Metapedia, as in route No. 2 |


| In Nova Scotia. |
| :--- |
| Mouth of the Metapedia River to the mouth of |
| the Naget |


| Along the St. Lawrence to Quebec . |
| :--- |

In New Branswick.

Total distance from Whitehaven to Quebee by this route . . . . . . . 692

Thus the distances will be as under:-

| By the mixed route, Halifax to Annapolis, by the St. John to |  |
| :---: | :---: |
| Quebee, the distance will be | 600 |
| 2nd. By the Halifax and Eastern or Bay Chaleurs route to Quebec | 635 |
| 3rd. By the direct route, Whitehaven, Boistown, and Quebec | 852 |
| 4th. By the Halifax, Truro, Amherst, and Boistown, to Quebee | 595 |
| . By the Whitehaven, Bay Verte, and Bay Chaleurs, to Quebee | 692 |

The first line fails in the most eseential object contemplated by the proposed railway, viz., a free and uninterrupted communication at all times and seasons of the year from the port of arrival on the Atlantic terminus in Nova Scotia to Quebec.

The intervention of the Bay of Fundy is fatal to this route.
In summer the transshipment of passengers and goods to and fro would be attended with the greatest inconvenience, loss of time, and additional expense; whilst in winter it would be even still more inconvenient, and liable to be interrupted by storms and the floating masses of ice which then occur in the bay.

In the case of the conveyance of troops, transport of artillery and munitions of war, the crossing the bay would at any time be most objectionable; and if suddenly required in critical times, might be attended with the worst consequences.

Commercially, too, it would destroy the fair prospect of the proposed line from Quebec to Hulifix competing successfully with the route by the Galf of the St . Lawrence, and with rival lines in the neighbouring States.

But there are atso other serions objections to be offered against it.
Pasaing through New Brunswick, and on the right bank of the St. John River, as it must necesearily do, to the Grand Falle, it would for a considerable diatance, both before and after the reawing that point, run along and close to the frontier of the United States.

In case of war, therefore, or in times of internal commotion, when border quarrele or border sympathies are excited, this line, when most needed, would be the most sure to fail, for no metsures could be taken which would at all times effectually guard it from an open enemy, and from treacherous attacks.

The passige across the Bay of Fundy, so close to the shores of Maine, would invite aggression, and require a large naval foree for its protection.

The engineering difficulties, as the line approsehes the Grand Falls from Wood. stock would not be easily overcome.
The space between the St, John River and the boundary line becomes gradually contraeted to a width of not more than two to three miles, and the country is broken and rough, whilst the banks of the St. John are rocky and precipitoun for tmany milea below the Falls

From the Grund Falls to the St. Lawrence, a distance of more than a hundred miles, the country ia so far known as to make it certain that there is very difficult and unfavourable ground to be encountered, which would require careful explorations and extensive ourveying.

This intervention of the Bay of Fundy, therefore, and the prosimity of this line, for a considerable distance, to the frontier of the United States, was so objectionable and fatal to this route, that the attention of the officers and the exploring parties was, after a slight examination of the country between Halifax and Annapolis, directed in search of other and more favoursble lines.

To onderstand the comparative advantages possessed by the other routes, as well as to be able to weigh the objections which may be raised against each, and afterwards determine from their relative merits which is the beat dircetion for the proposed line to take, it will be neceesary, previously, to give some description of the country throngh which the lines pass, the present amount and distribution of the population, and the engineering difficulties which were met with along the lines examined.
As it will be eeon in the emd, that only one of the lines, viz, the second, has been explored and carried out successfully from its terminus on the Atlantic quite through to Quebee, it magy be perhaps considered auperfluous to enter upon the disenssion of rival lines, but the object to be gained by so doing is to show that so much has been done and is known of the country as to render further exploratione for new lines unnecessary, because, if completed, they would not be likely to be recommended in preference to the one which will be proposed for adoption.

The distance from the Atlantic cosat of Nova Scotia to the bank of the St. Lawrence is about 360 miles in a strnight line. Iolersecting the country which must be traversed by any line of railway, and crossing its course at right angles, are five great obsiacles which bave to be eifher Burmounted or avoided.

1. The first is a broad rauge or belt of hich and broken land wbich rons along the Atlantic shores of Nova Scotia, from Cape Canso to Cape Sable. The breadth
varies fhom ahout 20 miles in its narrowest part, up to 50 or 60 miles in other places. Its arenage height may be about. 500 fest. The strata of which it is composed consist of granite, slate, and a variety of roeks, lard and difficult to cut through. The characteristic features of the surface are rugged and uneven, and therefore very unfiroumble for railsay operations. No ureful minerals of the metallie kind have been found is it, in quantities sufficient to work to advantage.

Valuable quarries of stone for building purposes are abundant, but these will be found everywhere nearly along the propored line,
This formation is estimated to cover nearly two-thirds of the surface of Nova Scotia. It is, generally speaking, unfarourable for agriculture; the timber on it is stinted in growih, and it is an object of some importance to pass through it, and leave it behind as soou as possible.

If a line be drawn from the head of the estuary of the Avon, near Windeor, to the Great Sbubenacadie Lake, and then aeross the Stewiacke River, along the upper parte of the streams in the county of Picton, to the Gut of Canso, all the portion lying to the pouth of this line belongs to this formation, and all to the north of it to the more favourable and bighly valuable formation of the earboniferous system.

The narrowest and shortest line by which this range or belt can be crossed oecurs at Halifax, and at the same time, owing to a favourable bresk in the chain, at the lowest point in altitude; the summit level through it not exceeding 90 feet.

The Halifax line (route No. 2) is clear of it in 20 miles. Before the aame can be done by the Whitehaven and direct line (route No, 3), it must follow the coast for upwards of 30 miles, as far as Country Harbour, and then a further course across it of another 30 miles; involving in this distance two, if not three tunnels, and must surmount a summit level of 400 feet.
2. The second great obstacle is the Bay of Fundy. This, as stated, is fatal to the first route. By the other routea it can be turned and avoided.
3. The third obstacle is the range of Cobequid Hills. These extend all along the north shore of the Bay of Minas, and very nearly across but not quite to theshore at the Straits of Northumberland. In hreadth, the range preserves nearly an uniform width of about 10 miles. In altitude, the hills average from 800 to 1000 feet. The lowest point, after a careful survey, was found to be, at the Folly Lake, 600 feet above the sea. This range can be avoided and passed by the Whitehaven and direct route, but must be surmounted and crossed over by the Halifax and Eastern line (route No. 2).

The prevailing rocks are granite, porphyry, and clay slate, in the upper portions; along the shore of the Bay of Minas and on the northern side, the formation is of the red sandstone and the coal measnres.
This range abounde with the most valuable minerals, of which a large mass of specular iron ore, of uneqoalled richness, occurs close to the line, and only requires facility of carriage for bringing coals to the spot, to be worked with profit.
A large portiou of this tract atill remains ungranted, and timber of excellent grow th, with abundance of the finest stone for building purposex, are to be met with, and, still belonging to the Crown, can be had for the expense of labour only.
4. The fourth obstacle is the broad and extensive range of the highlands which occupies nearly the whole apece in the centre of Now Brunswick from the Mira-
michi River north to the Restigouche. Some of these mountains rise to at altitude exceeding 2000 feet.

The Tobique River rans through them, forming a deep valley or trough, which must be crossed by the direct line, and increases greatly the difficulty of paxsing by them.

The lowest point of the ridge, overlooking the Tobique River, at which any line of railiway must pass, is 1216 feet above the sea. Then follows a descent to the river of 796 feet in 18 miles, and the gummit level on the opposite ridge or erest between the Tobique and Restigonche waterd is 920 feet above the sea, or a riee of 500 feet above the point of erossing at the Tobique water. These great summit levelk, which must be surmounted, form a serious objection to this route.

The Eastern line, by the coast, avoids this chain altogether. The greatest summit level along it will not be above 368 feet, while the distance by each from the province line at Bay Verte, to the Restigouche River (the northern limit of New Brunswiek), will be as nearly as poasible the same, there being only a difference of one mile in these two rontes through this province.

The rocks composing this chain of mountains are granite, various kinds of slates, grauwacke, limestone, sandstone, àc.
D. The fiffir and lat obistacle to be overcome, and which cannot be avoided by any of the routes, it the monntato range running along the whole course of the river $8 t$. Lawrence, in a very irregular line, but at an average distance from it of sbout 20 miles. It oceupies, with its spurs and branches, a large portion of the space between the St. Lawrence and the Restigouche River. The rockn and strata composing the range are of the same character and kind as the Tobique rabge. The toph of the mountains are as elevated in the one range as in the other:

The esploring partles fitited in finding a line through this range to join on to the direct line through New Brunswick, but succeeded in carrying on the Eastern or Bay Chaleurs route, owing to the fortunate intervention of the valloy of the Melapedia River.
The line which was tried and failed was across from the Trois Pistoles River, by the heads of Green River, and down the Prendy, or aome of the streams in that pari, rurning into the Restigouche River.
A fayourable line from the Trois Pistoles was ascertained along the Eagle Lakea and Torcadi River, as far as the Rimouski; and it is probsble that by ascendiug this river, and descending the Kedgwick River, this line (route No, 4) could be compleied.

But it is most improbable that it could compete in fayourable grades with the Metapedia-

It will be allowing it sufficient latitude to suppose it will be equal in engineering merite, and that, if accomplished, it will give the route No. 4 an apparent advantage of 40 miles in distance.

A very atriking characteristic in the geological formation of North America, and which has been noticed in the writings of persons who have described the country, is the tendeney of the rock strata to rum in parallel ridges in courets north-easterly and suoth-westerly.
On referring to the General Map, No. 1, and confining the attention more particalarly to that portion of commery eart and north of the St. Jobin liver,
through which any line must pask, thin general tendency eannot fail to be remarked.
The river St. Lawrence, the main Restigonche fiver and intermerfate chain of mountains, the Tobique Riyer and mountains, and all the etreams in New Brunsivick (the main trunk of St, Johm, and a branch of the Miramiehi excepted).
The Cobequid Range, the Bay of Fundy, and the high and roeky range along the Atlantic shore, have all this northeast and south-western tendency.
It will be evident, therefore, that any liue from the coant of Nova Seotia to the St. Lawrence has in general direction to follow, which is the most unfavoumble that could bave occurred for it, having to cross all these mountain ranges, streams, and valleys at right angles nearly to their courses

The lines explored for the direct route through New Branswick were obliged, on this account, to keep the elevated ground crossing the upper parts of the streame.

By so doing a line was found to the Restigouche, which may be considered just within the limits of practicability, but having very unfavourable summit levels to surmount.

And the peculiar formation of the strata and general course of the valleys and streams, renders it most improbable that any further explorations to improve this direct line through New Brunswick would be attended with mach success.

Very fortunately for the Eastern line, one of the branches of the north-western Miramichi presented itself as an exception to the general tendency, and enabled that line to reach the coast of the Bay Chaleurs.
The distance across in a direct line from the coast of Nova Scotia to the St, Lawrence has been stated at about 360 miles, forming the difficult and unfavourable portion of the line. When the St. Lawrence mountains are passed, then the tendency of the strata and courses north-easterly and south westerly becomes as favourable for the remaining 200 miles along that river as it was before adverse.
The general character of the ground between the St. Lawrence River and the mountains, is that of irregular terraces or broad valleys rising one above another ly steep short banks, having the appearznce as if the river had at some former periods higher levels for its waters.
The streams run along these valleys parallel with the course of the St. Lawrence until, meeting some obstruction, they turn suddenly off' and find their way over precipices and falls to the main river.

Having described such of the physical features of the country which form obstacles in the way of the lines ander consideration, it is proper next to describe those features and other resources which are advantages, and should be sought for by competing lines.

The geological syatems which prevail through the intermediate country to the mountain ranges, are the carhoniferous and new red sandetone,

They include large deposita of red marl, limestone, gypsum, freestone of excellent quality for building purposes, and extensive beds of coal. Indications of the latter are met with in abudance from the banks of Gay's River ( 20 miles from Halifax) up to the Restigouche River, and along the shored of the Bay Chaleurs.

Wherever these systems and minerals are found, a strong and productive soils favourable for agricultural puranits and settlement, is sure to accompany thens.

The surface of such if country, too, if generally low, or moderately undalating, and therefore the more of auch as diatrict that a line can be led flrough the better for it.
In Nova Scotia, this formation occupien its northern meetion, and amounts to nearly one-tbird of its whole area. It then extends all over the gouthern and enstern parts of New Brunswick.

In this respect, therefore, the ronte Nu. 2 has a decided adrantage.
The greatent and most valuable coal-field is that of Pictor.
It is eituated on the pouth eide of that harbour. The exact extent of the bed is not knokn, as it is froken by a great (geological) finil. It oceupieh, however, an area of many square miles

The coal is bituminons, of good quality, and the retns of most unusual thickness.
Mines in it are extennively worked, and large exports from them are made to the United Stales. Iron ore is ubsudank.

This is an advantage in favour of the Whitehaven and direet route.
The next great coal district is the Cumberland field, and it is second only in importance to fhat of Pietou.
It is nupposed to extend from the Macon River, west of Amherst, over to Tatmagouche, in the Straite of Northumberland.
Some mines in It liave been recently opened, and promise to be very productive.
The line No. 2 pasaes over this field for miles, and may be eonsidered, from that circumstance, as not being deprived altogether of an advantage possessed by the other route.
The great agricultural eapabilities of the eastern counties of New Brunswick have been described in the reports of Mr. Perley, the Govermment Emigration Agent, which were preeented to the New Brunswick Legidature in Pebruary, 1847, and ordered to be printed.
One most important oljeet to be altained by the consfruction of the railroad is the settlement of the public lands, and the encouragement of emigration from the mothervomutry,

As bearing very strongly upon this point, in the choice of the beat direetion for the line, I suljoin the following extract taken from Bouchette's Work on Canada, vol, i., page 381. It is a quotation made by him from "The Commissioners' Report of 1821,"
"The Bay of Gaspé, and particnlarly the Boy dea Chalonre, are susceptible of the most improved sgriculture. For the establishment of emigrante, no part in Canada offers such immediate resourees of livelihood as may be derived from the fisheries. It is a fact worthy of notice, that in the year 1816, when the fower parts of the province were afflicted with a famine from the deatruction of the barveat by front, no such inconvenience was experienced at Paepebiac, nor at any other place within the level tract above mentioned."

The tract alladed to here in not clearly defined by the quotation, but it is supposed to mean the whole district along the soath shore of the Bay Chaleurs.

This tends to show the effect produced by the vicinity of the ses, in moderating the temperature and saving the cropes from untimely frosts. In this respect, therefore, the line No. 2 has an important advantage over the one through the central and more elevated land of New Brunswick.

Vol. II. N. S.

As the interior is approached, and the distance from, as well as the elevation above, the sea increases, the dauger to crops from cold nights and early frosts also increases.

In the Madawaaka Settlement, and on the Upper St. John River, great failures of crops have occurred from this cauze, and wheat and potatoes are very liable to be destroyed.

From the Bend of Petitcodiac to the St. Lawrence, a distance of upwards of 300 miles, the direct tine would pass through a perfect wilderness, with not a single settler on the whole line, except a few at or near to Boistown.

Leaving engineering difficulties for the moment out of the question, the cost of construction wonld be materially increased by the extra difficulties attendant on the transport of necessary materials, and in supplying with food the labourers and others engaged on the line.

This disadvantage is not shared by the second route, which can be approached in oumerous places along the Gulf shore by means of hays and navigable rivers.

The direct line No. 4 will not have such advantages to present to settlers as the second. On the contrary, if adopted, it might be found necessary to ineur expenses for the establishment of small communities along the line, to repair and keep it open.

The facilities for external as well as internal communication, and other advantages arising from commerce and the fisheries, which will be developed by the Eastern line (and entirely wanting along the direct route), will, it is fully expected, make its vicinity eagerly sought for by settlers, and that it will, in the conrse of no very great length of time, lead to the extension of fhat long-continued village which now exists with but little exception from Quebee to Metis ( 200 miles), from the shores of the 8 t . Lawrence to the Atlantic Ocean.

It must be premised that a branch railway from the city of St. John is contemplated to pass up the Valley of the Kennebecasis, and connect with the main trunk at the Bay of Shediac.

The survey of this line, ordered by the Provincial Government, is in progress; and from the latest information received, the line promises most favourably.

The total population of New Brunswick has been estimated to amount, at the beginning of 1848, to 208,012, distributed in the proportions as under:-


Of these, the firat fonr, amonnting to 43,810 , are ou the line of the proposed route No. 2, and will he entirely thrown out by the adoption of the other.

Campbellton, Dalhousie, Bathurst, Chatham on the Miramichi, and Richibueto, seaports and shipping places of consequence on the Gulf shore, all of them susceptible of the greatest development, will be left isolated and cat off.

These porte are ice-hound during the winter months; and railway communisation will he to them of the greatest importance.

It will affeet most materially the interesis of the city of St. John, and the receipts opon their brauch railway.

It will affect also most sensibly the receipts of the main trunk line.
Along the south bank of the St. Lawrence, from Quebec to Metia, there are settled along it, in what can be only compared to one continued village for 200 miles, 75,000 inhabitantes.

Of these also a large population, probably 12,000 in number, residing between the Rimouski and Metis River, will be deprived of the benefit of the railway if the direct line be adopted.

To connterbalance the serious detriment which would thus be caused, this line would diminish the length of the branch line likely to be made to connect it with Fredericton, which is the geat of Government, and contains about 6000 isbabitants.

The population of Nova Scotia may be estimated to be about, viz :-


The population of Cape Breton is eatimated at 49,600 ,
Of the above, if the Whitehaven and direet route be adopted, the city of Halifax and county, amounting to 40,000 , will be excluded from the benefit of the line.

If the Halifax and Eastern line (route No. 2) be adopted, then the population of Sydney and Pictow, amounting to 53,500 , will be excluded.
To the population in the southern or remaining counties $(111,200)$, the Halifax ronte will be of easential benefit.

From the other route they would derive no advantage whatever.

It is now proposed to give an account of the explorations and their results
The dotted lines on the General Plan show where thesc were made, and the courses taken.
In the season of 1846, the Cumberland Hills were very earefully examined; sections with the theodolite were made, and harometrieal observations taken, to ascertain the lowest and tonet favourable point for crossing them.
The line which had been cut out and explored for the military road was followed from the Bend of Petiteodiac to Boistown.
From Bointown the general course was followed, and levelled as far as the Tobique River; hat the country was 80 unfavourable that new courses had to be constantly eought out.

A new line allugether was tried from the Tobique, as far us the Wagan Portage.
The results seduced from the ohservations and sections proved this line to be quite impracticable for a mailway,

Whilet this the was being tried, other parties explored from Neweastle on the Miramichi Iliver over to Crystal Brook on the Nipisiguit, the valleys of the Upsalquitch and ite tribotaries, and as far as the Restigouche Riven
The country at the upper waters of the Nipisiguit, and the whole of the Upealquitel valleys, were found to he rough, broken, and totally impracticable.
The result of this zoason's labour went to show, that the beat, if not the only, route that would be likely to le practicable, would lie by the aorth-west Miramichi to Bathurst, and then along the Bay Chateurs.

During the winter a suall reconnoitring party (on snow shoes) was sent op the Metapeliae Valley, as far as Metallis Brook, and they made their way across the country, from thence to the mouth of the Torcadi River on the Rimouaki.

Their report on this line was rather fayounable, and had there been any necessity for it, it would have been more filly explored the next seamon (1837).

As soon as this was sulficiently advanced to admit of the parties entering the woods, the explorations were resumed.

A grade line was carried over the Cumberland Hills, It was cut through the woods, from the foot on one aide to the foot of the slope on the other, a distance of 10 miles, and carefully levelled with a theodolite. This proved it to be quite prattieable.

The exploration of the Eastern line was again taken up.
It was commenced at the head of the tide, on the nouth-west of Miramichi, and was carried up the valley of the north-west Miramichi, over to, and down the Dpsalquitch River to Bathurst, and along the shores of the Bay Chaleurs to the Restigonche, up the Metapediac to the Metis, and along the taank of the St. Law. rence to the Rimouski and Trois Pistoles River.
The result of this exploration was so satisfactory that the party engaged upon it returned by the same route, surveyed it, and took the levels along it liack to the Miramichi River.
An exploratory line was then cut throngh the greater portion of the flat and generally level conntry between this river and the province line at Bay Verte.

An examination of the country was made from the Trois Pistoles River along the 8t. Lawrence to Quebec, which, with what had been done in Nora Scotia, during this and the former season, completed the whole of one good and fivourable line from Halifhx to Quebee.

The details are given in the accompanying Report, Appendix, No. 1; General Plan, No. 1; Model Map, No. 2; and Book, containing exploratory sheete, No. 16; containing plans and sections of the whole route, anil comprises the tine recommended to lee adopted.

Enwilling to abandon the direct route through the centre of New Brunswick, by which, if a line could be suceessfully carried out, the distance would be 80 materially shortened, an is spparent by the mileage given in route No -4 , it was determined to use every effort to decide either the pmeticability or impractieability of such a line, To this end large parties were employed the whole Reason.

One party explored, eut, and levelled a line the whole way between the Napadagan Lake and the Restigouche River, a distanee of 96 miles.

The line explored was a very great improvement upon the one of 1846 .
It is cousidered to lee eo far sutisfictory as to prove that a line for that distance can be found which would be within the limits of railway gradients.

The delails are given in the Assistant-Surveyor's Report, Appendix No. 2, with three exploratnry sheets, Nos. 17, 18, 19, containing plans and sections of the ground pasked over.
A large party wan ongaged in trying to find a line from Trois Pistoles liver on the St. Lawrenee, flirough the Highlands to the Restigouche River, for the purpose of connecting on to the New Brunswick party. The wiater overtook them whilet still embarrassed in the Highlands at the head waters of the Green Biver.
The dotued lines on the General Plan will shos their attempts.
A line was tried up the valley of the Aberequasb, bat it ended in a cut-desac. There was no way out of it.
A second line was carriod from Trois Pistoles over to Lac-des-Isles, Bagle Lake; and by the middle branch of the Tuladi River, the north-west bruch and head waters of the Green Biver were gained.
But this point was not reached, except by a narrow valley or ravine of four miles in length.
A theodolite nection was made of it, and it was found to involve a grade of at least one in forty-nine, and to attain that, heavy cuttings at one part, and embankments at another, would be nevessary.
There is no occasion at present to enter upon the discussion of whether thin should condemn a whole line; for having attained the Forks, at the head of the main Green River, no way was found out of it; and this explored line, like the firet-mentioned, must be considered to have ended in a cut-desuc also.

Further details are given in the report of Mr . Wilkinson, the surveyor enfrusted with the more immediate charge of this part of the line, in Appendix No. 3, with sketches attached to it.

It is just probable that a line might be found by way of the Kedgwick River and the Rimouski, as far as the mouth of the Torcadi River. From which, to the Trois Pistoles, there was ascertained to be no difficulty.

But as the adyantages in every way, except distance, are so much in favour of the bastern line, it would only be incurring delay, and perhaps useless expense, in further explorations of this part of the country.

In the Report (Appendix, No. 3) there is a third route suggested for examination and trial, viz, by one of the lower branches of the Green River and the Squattock Talies.

Whether sueceasful or not, it is liable to the olfeetion of approaching the frontier of the Loited Stales.
There rematins to be noticed the exploration for a line of railway from Whitehaven, on the eastern coast of Nopa Scoria, towarde Picton and Bay Verte.

This was rendered necessary in consequence of the suggestion made by Captain Owen, I.N., to make Whitehiven the Atlantic terninus of the mailway.

The detaile of this explorstion are given in the accompanying. Report, Appendix No. 4, and exploratory ehects, Nos, 20, 21, 22, and 24 .

Faginecriug lifficalties and expensive cuttings occur on this route.
From the commencement in the harbour of Whiteliaven, the line must pass along a barren and roeky coast for upwards of 30 miles to Country Harbour, before is ean turn off towarls the interior. And it cannot do this and get clear of
the seashore without the necessity of making a tunnel of about a mile in length through a ridge of whinstone,

Again, at the falls of the St. Mary River there will be required a tunuel of a quarter of a mile, and a viaduet across a valley of about 500 feet in length.

The summit level occurs between Lake Eden and Beaver Lake, and is 400 feet above the nea.

At Grant's Bridge, on the Fast River, for nearly three miles in length, there wonld necessarily be several expensive cutlings through rocks of sandstoue and limeatoue.

The length of this line from Whitehaven to Bay Verte is estimated at 181 miles. From Halifax to the same point is 124 ; leaving a difference of 57 miles.

If the direet route No. 3 conld be established, it would add 17 miles to the trank line.

But as it is not to be supposed that Halifax, the capital and great commercial city of the province, would in such a case allow itself to be excluded fromt the benefits of the proposed railway, then it would involve, in addition to this 17 miles of trunk railway, a branch line of probably 90 miles.

Or if the Eastern Bay Chaleurs line through New Brunswick be added on to it, as in route No. 5, then it will involve no less than 57 miles extra of trunk line, and the same necessity for the branch line of 90 miles mentioned.

To compensate for such disadvantages, it musi be shown that Whitehaven has the most paramount claims to be selected as the Atlantic terminus, in preference to Halifax.

The harbour of Whitehaven is 120 miles nearer to England, by sea, than Halifax; equivalent to, in ocean navigation by the steamers, to 10 hours.

This, it is readily conceded, is a very great advantage; and were there no draw. backs or other considerations in the way, it would be quite sufficient to give that port the preference.

It is a well-known fact, however, that there is a time and season in the year when the Cunard steamers cannot keep their direct couree to Halifax even, but are compelled by fields of ice to keep to the southward, and sometimes pass to the south of Sable Island.

During this lime, which occurs in the spring of the year, and may last for two or three months, there would be some risk in their making direct for the more northern port of Whitehaven. And if for these three months the steamers were obliged to make Halifax their port, then for that time the Whitehaven line would be uselens.

In respect to the adrantages which it is said to possess, of remaining open all the year round, it is not quite clear that it does so.

From inquiries made on the epot in the summer of 1847. Captain Henderson learned that the preceding winter the harbour had licen frozen over entirely, five to six incher thick, and that it was zometimes blockaded up and much incommoded by ice.

Subsequently, however, and during this winter, wheu the objects of the inquiries made there in the sammer became known, and the advantage of the milway spoken of, a statement, accompanied with affidavits, wan forwarded, with a view to counteract the effect of the information given to Captain Henderson and the parties exploring there.

They are given in the Appendix, No. 5, to this Repurt.

They tend to show that though the immediate entrance to the harhour may be, and genenally is, clear, yet that large quantities of floating ice find their way tlorough the Gut of Canso, and by Cape Breton, which pass off in a southerly direction, crossing the direet path of steamers and vessela from Europe.

The coasting vessels keeping in shore are not so liable to be molested by it.
The harbour is admitted to be a fine shect of water, but it does not, aud cannot, vie with Halifax, either in appearance or capacity.

Referring to Lientenant Shortland's Report, Appendix No. 5, who made a survey of it in obedtence to the directions of Captain Owen, R.N., it appears that. it is not free from the objection which is made against the port of Halifax, and is ite ouly drawback, viz., the prevalence of fogs

Lieutenant Shortland aaya, that "in foggy weather the harbour (Whitehaven) is difficult to approsch, especially to a stranger, as the somdings in shore are very irregular, and I have not been able to learn any good indications of its vicinity to be gathered from the lead, so as to render its approach by that means ceriain; and Torbay, ite immediate neighbour to the westward, is a dangerous place to get into.
" From the fishermen and small coasters I understand, the currents round the point are uncertain, and generally depend upon the wind, though the prevailing current is to the westward.
" I experienced this current in a boat when I visited the outer break; it was then setting to the westward, at the rate of one mile and a half per bour at least, I also perceived vessels in the offing setting rapidly in the same direction: the breeze was from the aastward, and light, though it had previously blown hard from the same point.
"We also on our paesage from Halifax to Canseau, during a fog, with the wind from the south-west, experienced an easterly current; but the land once made, the harbour is easily attained, especially by a steamer."

This calu scarcely be considered a favourable report of its advantages as a harbour intended for the great Atlantic terminus.

Accommodation and safety for a fleet of merchantmen could not be expected there, as is to be found at Halifax.

To make il a safe approach, Lieutenant Shortland continues thus:
" A judicious arrangement of fog-signals and lighthouses with buoys, on the principal dangers, and a good survey with the sea soundings well latd down would make the approach in the night, or during fogs, attended with small danger to a careful seaman."

One of the undoubted results of the railway will be to make Halifax, if it be made, ha it ought to be, the Atlantic terminus, the great emporium of trade for the British provinces and the Far West,
Whitehaven has not the capacity for this, and in winter it is evidently dangerous for sailing-vessels; and the selection of it as a terminus would be to exclude Halifix altogether; or to compel the formation of a branch railway of 90 milen in length, in addition to 57 miles of trunk railway.

It involves aleo the necessily of making expensive arrangements; lighthousen must be built, depots for the supply of the ateamers must be made, fortifications must be erected, and accommodation for a garrison providel. For the terminus of a great line of nilway wonld need protection in time of war-

At present there are only a few fisbermen's huts.
The probable eaving of 10 hours of lime in an oceau voyage, which variex even.
with the Cumand steamers, from if to 18 dayst, is not of such all-absorling magnituate as to entail, by the choice of the terminus, euch a fearfol amount of extra expense and inconcerience to a whole province.

At-a more advaneed period, perhaps, when the provinces lave attained all the prosperity they have a right to expect from this and other great works, which would follow as surely an effect follows caase, then it may be time to consider the propricty of making a banch to Whitehaven.

Its selection now as the terminus would most materially affect the receipta to be expected from the traffic.

Whitehaven, therefore, with ita longer and more expensive line of railway, fall of engineering difficulties, passing for miles through a district of comery, rocky, barren, and unfavourable for agriculture, henefitigy a comparatively small proporthon of the infiabitants, to the exclusion of the capital and the greatest amount of the province, or else involving the necessity of making a branch line of 80 nifea in length, is decidedly recommended to be rejected.
And the city and harbour of Halifax (one of the fuest in the world) is recommended to he selected as the Atlantic terminns for the proposed line of nihway.
That part of the direct route ( $\mathrm{Nos}, 3$ and 4), viz, the line from the Bend of Petitcodiac by Boistown to the Restigouche and the St. Lawrence, crossing the range of New Brunswiek monntains, having to surmount two nummit levels of 1216 and 920 feet, causing heavy grades, and increasing materially the cost of transport; passing through a totally unsettled and wilderness comtry; tavolving greater difficulties in the transport of the materials necessary for its construction, and in supplying food to the labourers engaged in its formation; excluding the towns and settlements on the Gulf shore, and so preventing the development of the vast resources of the country to be derived from the fisheries; and also inflicting a serions lons to the interests of the main line, and to the intended branch to the city of St, John, in New Brunswick, is, notwithstanding its one great advantage of diminiahed distance, recommended most strongly to be rejected.
And the route No. 2, from Halifax to Truro, at the head of the Bay of Fundy, passing over the Cobeqnid Hills, and on or near to Amherst and Bay Verte, crosesing from thence over to the rivers Richibucto and Miramichi above the flow of the tide, so as not to interfere with their navigation; then by the valley of the northwest Miramichi and Nipisiguit River to Bathurst; then along the shore of the Bay Chateors to the Restigonehe River; then by the valley of the Metapediac, over to, or near to. the river 8t, Lawrence; then by the route as shown in the General Plan, No. I, along the hanks of the St. Lawrence to Riviere du Loup, and from thence continued flirough either the necond or third conecasions along the river until it approaches Point Levi, is recommended as the best direction for the proposed trunk line of railway from un eastern port in Nova Scotia, fhrough New Brumswick, to Queliee.

It combines in the greatest degree the following important points:-
1et. The immediate prospect of direct, as well as the greatest amount of remumeration for the expenditure to be incurred ; the opening up of a large field for provineial improvements for the settlement of emigrants, and by affording the opportunity (in addition to internal) of external communication, by means of the Gulf of SL. Lawrence and the Bay Chaleurs, it will tend to develop in the highent degree the commerce and the fisheries of the province of New Brunswiek.
I In this preseat yesr (fssi) if would be mure correct to ay it to 13 itayf, sleamers of greater size and power having been inttoilueed.

2nd. Paering along the bewcoast for a great distance, and capahle of lieing approached at suyend poinls, by hayn or navigahle rivere, it pmesesses fhe greatest facilities for eonstruction, tending to reduce the expense, and by its more fivonrable gmades alao to the cost of working and sulusequent maintenance.

3rd. By passing over a less elevated country, and at the least distance from the zes, there will le less interruption to be apprehended from elimate, whilst the more favourable grades will increase the efficiency and rapidity of intercourse.

4th. Passiog at the greatest possible distance from the United States, it possesses, in the highest degree, the advantage to be derived from that cireumstance of the security from attack in the case of hostilities.

The beat general direction for the groposed tronk line of railway being admilled to be that of route No. 2, viz, the Halifax and Eastern or Bay Chaleurs route some additional remarks may be made upon its peeuliar advantages, as well as upon the few engineering difficultics which oceur, and in explanation of the plans and sections forwarded.

The details of the line are given in the Appendix, No. 1. The plans referred to are the General Plau, No. 1, the Model Map, No. 2 (which should be siretehed out on the floor to be properly viewed), and the hook containing 16 explonatory sheets of plans and sections, which relate exclusively to this line.

The city of Halifax is situated on the weatern side of the harbour, whilst the beat site for the termimus is on the opposite shore, at Dartmonth.

The distance to Quebee from the latter will be four miles shorter than from the fotmer; and one great advantage is, that its shore line is as yet comparatively free from wharves and commercial estahilhments, and an extensive tenainus can be formed there at less expense and inconvenience than on the Halifax side, where the Government dockyard and private establishments would interfere materially in the selection of a good site for it.

At Darmouth it is expected that vessels entering the harbour will be able to ouload at the railway premises, or probably into the railway cara, whilst an equally good terminus it to be had at Point Levi, opposite to Quebee: The same railway cars, loadeil from the ships in harbour at Halifax, will thus, after ruming an uninterrpted course for 655 miles, be delivered of their contents into the boats, if not into the bolds of vessels in the river 8 i , Lawrence. The same can, of course, be done from the river St. Lawrence to the vessels waiting in Halliax harbour.

Sueh an uninterrupted length of mitway, with such facilities at its termini, will le, it is believed, unequalled in the world.

In the transmission of goods and merchandise this will be a most favourable point in competing with rival lines. The Americau Railways, especially alous the Allantic States, are constantly interrupted, and passengers have to transfer themselves not ouly from cans to steam-boate, bat sometimea from one set of carriages to another set, in waiting for them on opposite banks of a river.

In Nova 8 cotin the passage of the Cobequid Hills cannot be effected without Leavy grades of 1 in 79 and 1 in 85 ; but as these oceur, the one ascending and the other immediately devcending, and only for 10 miles, the incouvenience can be easily got over by affording an assistant engine for the goods traine at that part. No engineering difficulties are expected to oceor from this up to the Eestigourle River.

It is necessary, however, to make some remark in reference to the sections
shown in the Book, Exploratory, iheet B and 7, comprising that part of New Brunswick lying between Shediac and the north-weet Miramichi.
The whole of this portion of the coantry is believed to be generally low and flat, with oecasional undulations. The section rum through it in the previous season of 1846, towards Boistown, confirmed this impression.

Its exploration and examination, therefore, was left to the last, and it was not antil the really formidable-looking obstacles had been explored, and suceessfully got over, that the attention of the parties was tumed to it,

As at this time the seasou was rapidly closing, the exploring parties were directed to cut straight lines through it, as the best means of obtaining the general altitudes and a knowledge of the country. No attempt was made to contour the hills. The sections, therefore, in these two sheets are not grades for fle railway, but of the ground passed over by the straight lines. With the exception of the immediate banks of the St. Lawrence, this is expected to prove one of the easiest portions of the line.

When the line reaches the month of Eel River, it caunot proceed direct on to Dalhousie, but must turn off up the valley of that river.

Two courses are afterwards open to it, one to turn off through a valley, by which it can soon gain the Restigouche, the other to proceed on to the head waters of the Eel River, and then turn down to that river. Which is the best of these two rontes can be better determined when the detailed surveys of the route are made.

The most formidable point of the line is next to be mentioned; this is the passage up the Metapediac Valley.

The bills on both sides are high and steep, and come down either on the one side or the other, pretty close to the river's bank, and involves the necessity (in order to avoid curves of very small radins) of changing frequently from one side to the other. The rock, too, is slaty and hard. From this canse, 20 miles of this valley will prove expensive, but the grades will be very easy.

About 14 bridges, of an average length of 120 to 150 yards, will be required up this valley. There is also a bridge of 2000 feet long, mentioned in the detailed report as necessary to eross the Miramichi River.

But bridging in this country is not the same formidable affisir that it is in England.

The rivens are nearly always zhatlow, and the materials, wood and stone, are close at hand.
The bridges in the United States, on the best lines, are built of wood on the truss-work principle, with stone piers and abutments.

On the Boston and Albany lines, and on many others in the New Rngland States, the bridge generally used and approyed of is known as "Howe's Patent Truss Bridge."
The eost of this kind of bridge, ns furnished by the parties who have purchaed the patent, is as follows:-

| Por spans of | Dollars. <br> 60 feet, single track, 11 p |  |  |  | 4 \& d. |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | 5 |  |  |
| \% | 100 | $\stackrel{\square}{\square}$ | 18 | " | 3 | 15 | 0 |  |
| $\cdots$ | 140 | " | 31 | " | 4 | 7 | 6 |  |
| - | 180 | " | 27 | , | 5 | 12 | 6 |  |
| $\cdots$ | 2111 | " | 30 | " | A | 5 | 0 |  |

The cost for double track woold he about 55 per cent ndditional,
The price includes the whole of the supentructure ready for the rails, but not the piers and abuuculs.

The bridge over the Connectient River, at Springfield, is huilt on this prineiple; it has seven spans of 180 feet each, and the sill of the bridge is 30 feet above low water. On other lines the same kind of bridge is used, lnt no ironwork is permitted (the unequal expansion and contraction of this metal is objected to), and the addition of an arch in introduced.

A bridge buitt on this prineiple on the Reading Railroad, 1800 feet long, cost 40,000 dollars, equivalent to 8380 L . Bterling.

Soon after pasaing the valley of the Metapediac, the great obstacle of the St, Lawrence chain of mountains is got over, and the line may range away towards tuebee; having however, oceasionally a river or ravine to crosk, whose passage requires consideration.

At the Trois Pistoles the stream, in the course of ages, has wom out at very awkward and deep maine. The bank on one side is generally steep and abrupt, whist that on the opposite is low, and sloping away back for a logg distance, before it again rearhos the leight of the table land.

The most favonrable site for crossing it occurs at alout 11 miles from the $8 t$. Lawrence, where the two banks hecome nearer to each other, and are more equal in beight.

At this point the breadth of the stream is 100 feet at bottom. The width between the banks at top 500 , and the depth is nearly 150 feet. The banks are rocky. Though formidable it is by no means impractieable,

On the New York and Erie Railway there is a bridge whose roadway is 170 feet alove the bottom of the ravine, which it crosses by one span of a75 feet. Its cost was 5200 l.

From Rivière du Loup to Quebee the railway might, but for the snow, be carried almost at a surface level.

Through the whole of New Branswick, for 234 miles, and through Lower Canada as far as Rivière du Loup, 167 miles, there will be found along the line abuodance of timber and stone (incloding limestone) of the best quality for building purposes. There will be fornd also, in New Brunswick more especially, aloundance of gravel for the superstructure.

In Nova Scotia the railway will have to pass, with but one little exception, through land which has been sold or granted away to individuals. The exception will be the other way in New Brunswick. It will be seen, on refereuce to the model mup, that it approaches the settlemeuts between Bay Verte and Shedinc, and skirts along the Bay Chaleurs.

In Canada, from the mouth of the Metapediae to the Trois Pistoles, it nums through still ungranted land. But for the last 110 miles between Rivière du Loup it runs through a densely-settled country.
Until the detailed surveys are made, and the precise location of the line marked on the ground, it will be impossible to state precisely the exact number of miles it will pass through Crown land.
If the following estimate be taken, it will not be much out:-


The following synopsis will show approximately the quantities of ungranted land in the counties through which the line passes:-

| In Nova Scotia. |  |  |
| :--- | :--- | :--- |
| Halifax County | Acres |  |
| Colchester | . | . |
| Cumberland. | . | . |

In New Brusswick.

| Westmoreland Con |  | 301,000 |
| :---: | :---: | :---: |
| Kent | - | 640,000 |
| Northumberland | . | 1,993,000 |
| Gloucester . | , | 704,000 |
| Restigouche | . | 1,109,000 |

In Canada.

| Bonaventure |  | - 2,000,000 |  |
| :---: | :---: | :---: | :---: |
| Rimouski | . . . | - $5,000,000$ |  |
| Kamouraska | . . . | 500,000 |  |
| LIslet | . . . | 600,000 |  |
| Bellechasse. | . - | - 500,000 |  |
|  | General total |  | 4,427,000 |

The land for the railway will have to be purchased in Nova Scotia for nearly its whole course, and in Canada for the 110 miles mentioned.
The latter, however, it is expected, will cost very little more than the expense which it would be necessary to incur in cleaning, getting out the stumps, and preparing the wild lands for the railroad.
No part of the line will ever be at any great distance from Crown lands; but it will be a question of detail for this part, as well as for the Nova Scotia section, whether it will be more advantageous to cut and convey from them the timber and materials required, or purchase them.

The direction of the proposed line being determined upon, the next points which present themselves for consideration are, the character of the road and method of construction.

In the first instance, it is considered that one line of rails will be sufficient; but in taking ground for the railways and stations, and wherever the line passes, regard should be paid always to the prospect of its being made at some future time a double track. And in the anticipation of a heary traffic, which there is a fair prospect of soon passing along it, and with a view to ultimate economy, as well as the saving of much inconvenience, it is recommended
that the road (being intended for the great tronk lime) shonld be constructed at once in a subetantial and permanent manner, with a good beavy rail, capable of bearing higb rates of apeed for passenger trains,

Oo all the prineipal lines of railway in the United States, the flat iron bar is every where heing diecarded, and the H, or T rail, generuilly of 56 lbs to the yard, is being subatituted for it.

On several of the lines, also, a double track is being made, and the worke constiveted are of a more permanent character than formerly.

Much lias heen natid in prase of the cheup method of making nailways io America, and the advantages to be derived from it in a new country,

As an example of this system, and its practieal resulto, the Etiea and Syracuse Railway may lie here quoted.

This road is 68 mites in length, and forms part of the Great Western tine, conuecting Albany, ou the Hudson River, with Buffalo, on Lake Erie-one of the priucipal linea in the comntry.

In its construction more than a usual amount of timber was uned. For a consilierable portion of its leagth (upwards of 19 miles) it passes through a deep swamp. Piles were driven into this to support a longecontinued Irestle-hridge, over which the railway track was carried upon longitudinal bearers.

For the other 38 miles the grading was made in the uanal manner, by excavations and embankments; but the superstructure was of wood.

Upon the grading in the direction of its length, a small trenel was excavated, and a silt of wood was firmly bedded in it. Where the sills abutted end to end, they were supported by a piece of wood of the same section laid beneath them. At right angles to, and upon the upper surfaces of the sills, were spiked crossties; and again, at right angles to the cross-ties, and immediately over the sills, were laid the longitudinal wood-bearers, to which the iron plates were firmly spiked. The centre of the rail and sill were in the same vertical plane.

Thus everything was done for economy, as much wood as possible being usen. This railway, for its construction and equipment, cost on an average only 86001 . per mile.

It was thought worthy, in 1843, to publish an account of it in London, and it forms the chief subject of a volume thas entitled, "Ensamples of Railway Making; which, although not of English Practice, are submitted to the Civil Engineer and the British and Irish Public."

The following Report is extructed from the Annual Statement of the Seerefary of State to the Absembly of the State of New York, dated 4th March, 1847:-
" The Syracuse and Utica Railroad has been opened for the transportation of phasengere for the last eight years.
"The Company, having determined to relay the road with an tron mil of the most improved form, have contracted for a considerable portion of the iron necessary, and are proceeding with the intention of laying a substantial structure, adequate to the proper performance of the business required.

> | "The present wood atructure bas cost the Company |
| :--- |
| "The irou now laid thereon is the flat bar, and will he uee- |
| less, and therefore will be sold. It is hoped that there |
| muy be derived from the sale of it |
| " Lenving the sum of |
| 17.075 |

which has heen expended for the cost of the wood struetare; which, in addition to a large annual amount for repairs, will be pructically worn out, sunk, and gone, when the new structure is laid and used, The new structure, it is mipposed, will cost about the same as the former, towards which, it is hoped, the old iron will pay as ahove, 80,000 dollars, leaving the sum of ahout 300,000 dollara to be raised by the Company on its credit.
"This will, when paid, relinbunc the capital of the Company for the equivalent amount which has been appropriated to the worn-out atructure. In addition to the cost of the new atructure, there will be required a considerable sum for netा engines, cars, \& es. The demund upon the Company for the traneportation of property at the elose of the canal, has entirely exceeded ita capacity to do this business. Property destined for sale in the eastern markets in large quantities, was stopped at most points upou the line of nilroad contigious to the canal. Being practically confined to the winter monthy in this branch of business, it cannot be expected that the Company could provide a supply of cars for thia sudden and extmordimary demand, when they must stand idte and go to waste during two-thinds of the year.
"When the road shall be relaid with the proposed iron rail, the public will require that the trains shall be run with incressed speed. In relation to this subject, it is deemed proper to refer to the following suggestions contained in the report of this Company made last year:-
" Very great embarrasament is experienced from the fact that cattle are ullowed to rum at large, and to impede and so often delay trains as at present. It is a serious matter, and unless more care shall be bestowed by the owners in restraining them, either at their own suggestion, or in pursuance of some proper law to be passed, it will be found very difficult to make good time upon this line. A part of our business must be always done in the uight, and it is then we experience the great hazard. The trains are frequently thrown off by them, and the danger to the persons in eharge, and to the passengers, is imminent. The owners always insist on pay for their animals destroyed, without reflecting upon the great damage that they cause to the property of the Company, and the more fearful injory that might ensue to passengers. If the ownere will not take care of them, it is impossible to keep them off: In Massachusetta much less difficulty in this respect is experienced; for there, it is believed, a penalty is inenrred by the owner of domestic mimals that go upon the railroad. Our business is conducted with all possible care in this respect, and the enginemen suitably feel the riak of life or limb (which to them is almost as importamt) that they incur from the growiug evil.
" A very proper law in this State has guarded the public and the Company against direct wanton injory to the trains by individuale. It is submitted, that negligence in allowing animals to run upon the railroads should be prevented by some suitable restraints,"

Some of the inconveniences arising from a cheap railway may be learnt from this report.

At this time the total amount spent upon its construction appears from the same report to have been $1,098,940$ dollars, equivaleot. to 4520 l, sterling per mile.

The new superstructure, it was aupposed, would coat about the same as fhe former, vis, 417,075 dollane, or about 1640 , steding adilitional, which will make the price of this railway, whon completed us intended, 5960 . per mile.

In other parte of the States, where these trente-bridge or Rkeleton railways fave been made, inktances have been known of the locomotive slipping down between the rails, wbich have warped outwards.

With a view therefore to ultimate economy, and to save inconvenience and interruption to the traffic when once established, it is most strongly recommended that the line, whenever commenced, shall be at once properly and efficiently made.

In determining the form of the road, it is necessary to bear in view that it will pass through a country everywhere liable to be obstructed by heavy falls of snow. It does not appear, lowever, from the results of inquiries made in the United States, that anything beyond inconvenience, and some additional expense in the cost of working the line, is to be apprehended from this cause.

The ruilway from Boston to Albany, which crosses the range of mountains between the Conneeticut and Hadson Rivers, attainfog apon them an elevation of upwards of 1400 feet above the sea, to which it ascends by a grade of about 80 feet per mile for 13 miles, traverses a country salyected to the same surt of winter as the Britiah North-American provinces.

The average depth of snow in the woods is from 8 to 4 feet, which is not muels less than it is in the woods of New Brunswiek and Canada.
In 1843, a year remarkable for the great number of snow-storms which oecurred, there were 63 falls of snow ; bat the traffic was not interrupted to any very serious extent, not more than two or three trips.

To keep the roads clear, two descriptions of anow-ploughs are used, one for the double track, and another for the single. In the former the ahare of the plough travels fromediately over the imer rail, throwing the snow outwards from the track. It is first used on one track, anid then runs lack upon the other.

In the aingle line the plonghare travels in the centre of the track, throwing the snow off at once upon hoth sideg.
For the double track the snow-plough weighs from 5 to 6 tous, and costs about 1256. For the single track it is somewhat lighter.

The plough requires generally, when rum withont a train, two engines of 20 tons each, of with a train, three engines.

When the fall of znow does not exceed a few inches, the small plough, alwnys fixed in front of the engine, consisting of an open frame-work projecting ahout 5 feet in front, and called a "comsecroper," is fonnd, when cased over, to be sufficient to elear the line. When the fall is deeper, the plough is used immediately after the snow has ceased to fall.
It ean be propelted by three 20 -ton engines through 3 teet of newly-fallen show at the rate of six miles an hour.

If the fall does not exceed two feet, it can travel at the rate of 15 miles an hour.
The drifts through which it is propelled are sometimes 15 feet deep, and from 200 to 306 feet long, and at others 8 or 10 feet deep, and from a quarter to half-a-mile in length.

The line of railway is marked in divisions of about cight miles, to each of which eight or ten men are allotted, who pasa along the line each day with small land-ploughs, picks, kes, clearing away the snow and ice which the frains collect and harden between the rails and the roadway.

It is found that the freczing of the anow or rain upon the mile doon not impede the heavy ergines, ae the wejght of the forwant wheele is sufficient to break it, and enable the driving wheele to bite,

Whenever, from local conecs, the snow is found to drift on the line of milway, snow feuees are erected, which are found very effectual. They are simple board fences, from 10 to 15 feet high, placed from 10 to 20 feet hack from the roadway.

In wet weather the rails become very slippery; but the diffically is overcome, and the wheels enabled to lite upon the steep gradients by the use of sand-boxes, which are fixed in front of the engine and immediately over the rails. These ean be opened at pleasure by the engine-driver, and the sand is used wherever necessary.

The means thus suecesefully adopted to overcome the obstacles arieing from ice and show are employed much in the same way upon all the railwaye which are exposed to them.

In the year 1847 the expense incurred under this head (removing fiee and snow) upon the western railroad in Massachusetts, was, accorling to the official return, 2763 dollars, equivalent to 5755 . sterling.

Upon many of the other lines expenses under the same head are returned, but very much smaller in amount.

In places where the rails are not raised above the general level of the country, much greater diffienlty is experienced in keeping the lines clear of snow than in parts where there are embankments.

From the foregoing it does not appear, therefore, that snow need be considered an insurmountable obstacle to the formation of a line of railway from Halifax to Quebec.

To obviate, as much as possible, the liability to interruption from this cause, it is recommended that in the construction of the line, it be adopted as a prineiple, that the top of the iron rail be kept as high as the average depth of anow in the country through which the line passes.

In Nova Scotia this will require probably an embankment of two feet high, gradually increasing as it proceeds northward to the St. Lawrence, and along the flat open country on its banks, to five or even six feet.

The whole of that part of British North America through which this line is intended to be rum, being as yet free from railways, the choice of gauge is clear and open.

Without eutering into and quoting the arguments which have been adduced in favour of the broad or narrow gauge of England, as it is more a question of detail than otherwise, it will be deemed sufficient for the present report to recommend an intermediate gauge. Prohably five feet six inehes will be the most suitable, as combining the greatest amount of practical utility with the least amount of increased expenditure.

With the olject of proceeding on to the consideration of expense of construction, the proposed trunk line wilt he aupposed to have a single track, with one-tenth additional forside lines and turn outa, to have a rail 65 Ibs , to the yand, supported upon longitudinal sleepers, with erose-ties, similar to the rail used upon the London and Croydon line; the wood to be prepared according to Payne's process, to have a gange of five feet six inchee, and as a prineiple, the top of the rails to be kept above the level of the surface of the ground, at a height equal to the average depth of the snow. For the best information as to the cost of making such a railway, reference must be made to the works of a similar chameter in the United States.

At about the close of the year 1847, there were in that country nearly 5800 miles of railway completed or in progress, The average cost for those having is
single lrack has been estimated at 22.000 dollars, equivalent to $4166 L$ aterling per mile. For the double track, 32,000 dollars, or 66661 , sterling per mile,

But the extreme differences which are to be observed in the cost of construction in the various States are so great, ranging from 1600 L . up to 24,000 . per mile, that no criterion can be established from averages obtained from such diveardant diata.

The State of Massachusetts affords the best materials for accurate infornation.
All the railroad corporations are by law obliged to make annital returus to the Legislatore, and rery valuable statistical information is thereby obtained upon nailway affairs.
From the officin reports for the year 1847, the following table (see next page) bas leen compiled.

This table comprises, with the exception of about 50 miles, upon which there occur some doubts an to what the account precisely einbraces, the whole of the railroads at present completed in the State of Massachusetts. The table shows $688 \frac{1}{2}$ miles of railway, including branches, which have cost in their construction and equipment $31,675,946$ dollars, or $6,599,1557$. sterling.

There are 146 miles of double trick. They have been taken at so much additional aingle track. A double track would not cost exactly twice that of a single one in ita construction: but as these lines were made originally only with single tracks, and have been added to from time to time as circumstances would admit, it must have tended to fincrease the cost, and in calculating the average expense per mile, it is considered the result will not be much is error. The cost per mile it appeark, then, has been 7950L, zterling.
There is no other State in the Uufon which presenta equally good data for making an spproximate estimate.

The climate und nature of the country beard also a strong resemblance to that through which the Hatifax and Quebec line will pass, and in this respect the analogy of the two cases is extremely favourable.
The New York and Erie railroad, 450 miles in length, now in course of construction, will, it is supposed from the latest information, cost 6250 L per mile, exclusive of equipment.
The estimate for fhe Huden River milroad from New York to Alhany, now in progress, in for the single track 7440 , sterling per mile.
The estimate for the Montreal and Portland line is about 5080f. aterling per mile.

For the Great Western railroad, in progress in Upper Canada, the estimate for that zection of the line which would most resemble the Halifax and Quebec road, is 56381 , per mile.
On referring to the table, it will be seen that all the lines have either the H or T rail, generally 56 lbs , to the yard.

The price of milroad iron in the Staten is very much greater than in England, or what it can be procured for in the British provinces. It pays a very bigh duty on importation into the states.

On some of the lines upwards of 151 . per ton for rails lave been paid. In England rails can now be bought for 86 , or 96 . per ton.

The advantage which the Halifax and Quebec line will possess over the lines in the tahle in the respect of iron alone may be estimated at $500 \%$, per mile.

VoL. II. N, 5 .

RAILROADS IN THE STATE OF MASSACHUSETTS.

| Name of road. | Length of road in miles. | Total cost of road and equipment. | Cost per mile. | Form of rail and libs. per yard. | $\begin{array}{\|c\|c\|} \hline \text { Miles of } \\ \text { single rail. } \end{array}$ | $\left\|\begin{array}{c}\text { Miles of } \\ \text { double rail. }\end{array}\right\|$ | Dividend for 1847. | $\left\|\begin{array}{c} \text { Cost per mile } \\ \text { of single } \\ \text { track, sterling. } \end{array}\right\|$ | Remarks. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Dollars. | Dollars. |  |  |  |  | £. |  |
| Boston and Lowell . | 26 | 1,956,719 | 75,258 | H $\left\{\begin{array}{rr}20 & 56 \\ 3 \frac{3}{4} & 63\end{array}\right\}$ | None | 26 | 8 | 7,830 |  |
| Boston and Maine | 73 | 3,021,172 | 41,385 | $\left\{\begin{array}{cc} \mathrm{H} 6 \mathrm{~m} .45 \mathrm{lbs} . \\ \text { rest } 45 & \text { to } 60 \end{array}\right\}$ | 68 | 5 | 9 | 8,069 |  |
| Boston and Providence | 48 | 2,545,715 | 53,014 | T 56 to 58 | $32 \frac{1}{4}$ | $15 \frac{3}{1}$ | $7 \frac{1}{2}$ | 8,316 |  |
| Boston and Worcester | $\left\{\begin{array}{l}44 \frac{1}{2} \\ 14\end{array}\right\}$ | 4,113,609 | 70,318 | T or H 60 to 64 | 14 | 441 | 8 | 7,583 | Including branches. |
| Connecticut River | $\left\{\begin{array}{c}36 \\ 2\end{array}\right\}$ | 1,167,156 | 30,714 | H 56 lbs . lbs. | 38 | None | 7 | 6;399 | Ditto. |
| Eastern. | $\left\{\begin{array}{l}38 \\ 20\end{array}\right\}$ | 2,937,206 | 50,641 | H and chair $\left\{\begin{array}{l}57 \\ 46\end{array}\right\}$ | 42 | 16 | 8 | 8,269 | Ditto. |
| Fall River . | 42 | 1,070,988 | 25,499 | H 52 to 56 | 42 | None | $\ldots$ | 5,312 |  |
| Fitchburgh . | $\left\{\begin{array}{c}49 \frac{1}{2} \\ 2\end{array}\right\}$ | 2,406,723 | 46,732 | T 56 lbs . | $46 \frac{1}{4}$ | $5 \frac{1}{3}$ | 10 | 8.835 | Ditto. |
| Lexington and W. Cambriage | $6 \frac{1}{2}$ | 221,309 | 34,047 | 56 lbs . | $6 \frac{1}{2}$ | None | $\ldots$ | 7,093 |  |
| Nashau and Lowell . | $14 \frac{1}{4}$ | 500,000 | 35,087 | T 56 lbs . | 11 | 13 | 10 | 3,822 |  |
| New Bedford and Taunton | $\left\{\begin{array}{c}20 \\ 1\end{array}\right\}$ | 483,882 | 23,042 | 56 lbs . | 21 | None | 8 | 4,800 | Ditto. |
| Norwich and Worcester | $\left\{\begin{array}{r}59 \\ 7\end{array}\right\}$ | 2,187,249 | 33,140 | T 56 lbs . | 643 | 13 | $\ldots$ | 6,725 | Ditto. |
| Old Colony . | $\left\{\begin{array}{r}37 \\ 7\end{array}\right\}$ | 1,636,632 | 37,196 | H 56 lbs . | 44 | None | 61 | 7,749 | Ditto. |
| Pittsfield and N. Adams . Western | $\begin{array}{r} 19 \\ 118 \end{array}$ | $\begin{array}{r} 446,353 \\ 6,982,233 \end{array}$ | $\begin{aligned} & 23,492 \\ & 59,171 \end{aligned}$ | H 56 lbs , $56 \frac{1}{2}$ to 70 | $\begin{aligned} & 19 \\ & 99 \end{aligned}$ | $\begin{gathered} \text { None } \\ 19 \end{gathered}$ | $\ldots$ | $\begin{array}{r} 4,894 \\ 10,617 \end{array}$ |  |
|  | $\begin{aligned} & 683 \frac{3}{4} \\ & 146 \frac{1}{4} \end{aligned}$ | 31,675,946 | $\ldots$ | $\ldots$ | $146 \frac{1}{2}$ | $\ldots$ | $\ldots$ | 7,950 | Average for single tract per mile. |
| Single track | 830 |  |  |  |  |  |  |  |  |

When these lines were constructed, also, the demand for labuor was extremely great, and wagea much higher than in the present day.

The average (of 79503.) derived from the table may therefore very fairly be reduced by eeveral hundred pounds.

The Halifas and Quebec line will have also many advantages which the Ameriean lines had not.

The land for the greater portion of the road will not have to be purchased, Timber and stone will be had nearly along the whole line for the labour of cutting and quarrying.
Judging, then, from the analogy afforded by similar, or nearly bimilar lives, in the neighbouring States-giving due weight to the considerations which have a teadency to modify the cost in the particular case of the Halifax and Quebec line, and forming the best estimate to be derived from the data obtained upon the explonatory survey, which under the circumstances of a perfectly new country, only recently explored, and still covered with a dense forest, is all that can in the first instance be done-it is considered that if the sum of 7000 , sterling per mile be assuned ae the probable cost of the proposed line, it will not be far from the correct amount.
The total distance from Halifix to Quebee will be about 685 milea.

$$
\begin{aligned}
& 685 \text { miles at } 70002 \text { per mile will be . . . } £ 4,445,000 \\
& \text { Add one-lenth for contingencica . . . } \\
& -\frac{444,500}{£ 4,889,500}
\end{aligned}
$$

Or, in round numbers, $5,000,000 \mathrm{l}$.
It is estimated, therefore, that the cost for construction and equipment of the proposed truok line, from Halifiax, through New Brunswick, to Quebec, will amount to $5,000,000$, sterling.

The question which presents itself next for consideration is a very important one, numely, the probable returns for such an expenditure.

The information to be afforded on this head ean only be derived in a very general why, from a consideration of the present population and reaourees of the three provinces.

The direct commamieation between the two termini, Halifax and Quehec, is of a very limited auture.

By land, it is coufined almost to the conveyance of the mails. Paszengers proceed generally ly way of the United States.

By sea, in 1847, the communication was by 17 vessele, which arrived at Queliec, having a tonnage of 1257 , and 18 departed from that port for Halifax whose tonnage amounted to 1386 tous.

This amount of intercourse does not at the first view appear encouraging to expected receipts; but when it is made to appear that this limited intercourse arises entirely from the want of good means of intercommunication, such us would be afforded by the propoeed railway, it becomes a strong argument in favour of making the line rather than againet it.

The communication of the provinces with each other is cramped and restricted beyond measure by the same want.

By nea the amount of intercourse may be judged of by the return given in Appendix No. 6, fornished by the Quebec Board of Trade.

The chief elements which enter into, and apon which depende, the sncceis of Fvery railway enterprise, are population, agriculture, and comineme.

At the extremities of the line, and for zome miles along the St- Fawrence, there is an abundant population. External commerce there is in an eminent degres In that of agriculture its deficiency is great at present, but as there are millions of acres of good productive land only waiting for the hands necessary to cultivate them, and the means of accers to which will be afforded by the railway, this very circumatance may be made to condnce to the advantage of the line, and pay a large portion of the expense of its conatruction.

The popalation of Halifax (the Ailantie terwinus) is estimated at 25,000 eouls. It is the capital of the province-the seat of government-and its commerce extensive. The value of ita importa and exports is estimated at $2,500,000$.

The city of Quebec, the other terminus, aceording to the census of 1844, contained (including the county, which is not given separately) 45,000 persons.

But this city derives additional importance from its being the one great ship. ping port and outlet for all Canada. By its port paspes the whole trade of that province. It may be regarded as the focus of commerve for a million and a hatf of souls. The value of the imports and exports together may he estimated at $5,500,0001$, sterling, giving employment to a very great amount of shipping.
This immense trade is of necessity crowded jnto six months, the navigation of the St. Lawrence being clozed for the remainder of the year.

In addition to these two great termini there are lying on each side of the line two most important tributaries, viz, the city of St. John and Prince Edward Island. The former with a population in city and county together of nearly 44,000 persons, with 3 commerce of the value of $1,800,000 \mathrm{~L}$. in exports and imports, giving employment also to a great amount of shipping. The latter with a population of 50,000 , engaged principally in agricultare and the fisherics. The exports and imports of this island are about 200,000 , annually.

Between the city of Quelee and the River Metis there are, setfled along the south bank of the St. Lawrence, 75,000 inhalitants all engaged in agriculture. These people are French Canadiaus, and almost every family has a small farm and homestead.

A striking peculiarity of thepe farms is their elongated shape, the length being generally 30 times that of the breadth ; oftentimes a greater disproportion exists. The houses and farm-fuildings are always built at one extremity, that which adjoins the road dividing one set of concessions from another. There are generally three or four lines of houses and roads running thas along the St. Lawrence.

The effect produced by this manner of pareclling out the land and building has beon to form what can only be compared to one long and continued village for 200 miles.

For the first 100 miles out of Quebec, as far mearly as the Rivière du Lonup, the proposed line of railway will run through the centre of this extended village, and with a train of moderate length, the last carriage will seareely have cleared the door of one house before the engine will le opposite another. For the second 100 miles it will leave these concessions and forms a little on one side, but still within reach. A more favoumble disposition of a popmiation (comprined of amall farmers) for contributing to the way traffic of a railroad could seawely have been devised.

In the country lying between the Reatigonche River and Halifax, the inhabitants who will be near to the railroad will amount to ahout 100,000 ; making the population, either upon or near to the line, including the two ternini, 250,000 persons. But if the total popuiation he takem within the srea, which will be to
nefited by and become contributors to the line, then it may be estimated at not tere than 400,000 souls.
In a report of the Directors, made upon the New York and Erie Railroad in 1843, when the question of proceeding with that line was sinder consideration, one of the data upon which its future receipts was caleulated was derived from population and relative distance. And using the data obtaiued from the working of one portion which had been completed and was in operation, it was calculated that 581.000 persons on a line of 425 miles in length, would return in net earnings to the railway $1,393,500$ dollars, or $2 \frac{1}{2}$ dollars nearly per head, equivalent to 106 . sterling. As the nailroad is not yet completed, the true result cannot yet be seen.
The net carnings of the railroads in Massachusetts for the year 1845 were $8,290,0 n 0$ dollars. The populatiun of that State, over whose area railways are everywhere extended, and the whole of which may therefore be considered as tributary to them, being at the time about 800,000 . This gives $2+$ dollars per head, equivalent to 11 e, or the same result nearly.
Applying the same ratio (of 108 . per head) to the 400,000 inhashtants who are within the area and likely to become tributaries to the Quebeo and Halifax Railway, it would give $200,000 \mathrm{l}$. as its probable revenue.
The great ntaple of trade of New Brunswick is its timber. For this all-abworbing parsait the inhabitants neglect agricultare, and inatead of raising their own supplies, they import proviaions in large quantities from Canada and the United States. In the year 1846, New Brunswick paid to the latter for provisions alone 216,000 . sterling, whilat, in return, the United States only took from them $11,000 \mathrm{l}$, in coals and fishi
Of Nora Scolia the great staples are timber and the producte of the finheries, The inhabitants import provisions aleo largely.

Canala is an exporting country, and eapable of supplying the demands of both.
In the winter of 1847.8 , the price of flonr at Halifax and St. Joha was at 405 . the barrel, and it was being imported from the chief porta in the United States, even from an far as New Orleans, in the Gulf of Mesico. At the same time, at Quebec the price of tlour was only 25s, per barrel. A very great difference, which, had the railroad been in existence, would not have occorred.

Another great nource of revenue likely to be developed by the railway in that of coals, to be derived from the Great Comberland Fiell.

Quebee and the upper country would, no douht, take large quantities for their own consumption. Halifax the same for itself, and alao for exportation to the Uniled States.

Considerable retorns would arise from the fisheries and from the prodnete of the forest lying contiguous to the line, which would find their way by it to the thipping ports.

The country through which the road will pass posserses, therefore, in fteelf, eluments which, when fully developed, cannot fail to realizo large receipts,

But there are, exclusive of these, other and highly important eonrece for productive revenue.

Halifax may beconsidered to be the nearest great Beaport to Europe.
Passengers travelling between England and the Canadas would adopt thia railway as the zhortent and heat line which they contd take. Emigrants would do the eame.

The mails, troops, munttions of war, commissariat supplien, and ail public atores, would aaturally pass by it , as the safest, speediest, and cheapoat means of conveyance.
If a straight line be drawu from Cape Clear, in Ireland, to New York, it will ent through or pass close to Halifax.
The latter is therefore on the direct route; and as the sea voyage across the Atlautic to New York may be shortened by three days nearly, in steamers, it is not improhable that on that account, when the branch railroad to St . John is completed, and other lines to connect ou with those in the United States, the whote or the greatest portion of the passenger traffic between the Old and New World would pass through Halifax, and over a great section of the proposed railroad.
But the great olject for the railway to attain, and which, if it should be able to aceomplish, its capability to pay the interest of the capital expended would be undoubted, is to supersede the long and dangerons paseage to Quebee by the Gulf of St. Lawrence.
To mike two voyages in a season vessels are obliged to leave England earlier, and eneounter the dangers of the ice in the Gulf, much sooner than it is safe or prudent for them to do.
The loss of life and property which has occurred from this cause, and returning late in the autumn, has been enormous. It carnot be ascertained, but probably it would have more than paid for the railway.
An opinion may, however, be formed of it from the rates of insurance, which in the spring and autumn are as high as 10 per cent.-a much bigher rate than to any other part of the world.

The navigation of the St. Lawrence is elosed for about six months of every year. During the whole of this period all the produce of the country is locked up, and necessarily lies unproductive on the hands of the holders.
The surplus agricultural produce of the year cannot be got ready to be sbipped in the season it is produced. In the winter of $\mathbf{1 8 1 6} \cdot \mathbf{7}$, it has been stated, on good authority, that 500,000 harrels of flour were detained in Montreal at the time when famine was raging in Ireland. As soon as the season opened, there was such a demand for shipping to carry provisions, that the prdinary course of the timber trade was deranged by it.

All this would have heen prevented had the railway been then in existence.
For six months in the year, then, the St. Lawrence would cease to be a competitor with the railway, and large quantities of prodnee would be certain to be forwarded liy it.

For the other six months of the year it would have aleo the following strong claims to preference:-rapidity of transport; the saving of heavy insurance; cheaper mate of freight from Halifax; vessels engaged in the Canadian trade could make three voyages to Halifax for two to Quebee,

The trade which is now crowded into six monthe, to the great inconvenience of every one concerned, rendering large stocks necessury to be kept on hand, would be diffused equally over the whole year.

It is most probsble that these advantages will be found so great that only the bulky and weighty articles of conmeree, such as the very heavy timber and a few other goods, will continue to be sent round by the Gulf of St. Lawrence.
If such should prove to be the caze, then the proposed railway would huve at suuch, or perhaps more, traftic than a single track could accommodate.

The cost of tmesportation, it is calculated, will not be too high on this line to
admit of the above results being realized; and in that case, more especially if the eapital can be raised at a moderate rate of interest, it is considered highly probable that it will, even in a commercial point of view, be a profitable undertaking.

From evidence given to the Gauge Commissioners in England, it appears that the cost of tranaport for goods on the undermentioned lines of railway was as follows:-

| Great Western | - 06 of a penny perton per mile. |  |  |
| :---: | :---: | :---: | :---: |
| Grand Junction | - 18 | , | " |
| Birmingham and Gloucester | - $\cdot 09$ | " | " |
| South Western | - 10 | " | " |
| London and Birmingham | - 12 | " | " |
|  | 5) 50 |  |  |
|  |  |  |  |

This is supposed to be gross weight, including carriages, \&c.
One-fifth of a penny per mile per ton will be a liberal allowance for the net reight.

From a very carefully-prepared document, extracted from a Report of the Commissioners appointed in 1846 by the Legislature of the State of New York, to locate certain portions of the New York and Erie Railroad, it appears that the cost of motive power on some of the principal railroads in the United States was 40 cents per train per mile, equivalent to $18.8 d$. sterling.

With the expected grades on the Halifax and Quebec line, it is calculated that an engine of good power, having the assistance of an extra engine for 25 miles of the distance, will couvey 100 tons of goods at a moderate speed of 8 to 10 miles an hour over the whole line.

The total cost per train would then be-

or 118 , per ton for the whole distance. Equal to 207 d per ton per mile, the same nearly as the average on the English railways.
At this rate the actual cost of carrying a barrel of flour from Quebec to Halifax will be only $18.1 d$; and if it be doubled, to pay interest on capital, then $28.2 d$. might be the price charged for ite conveyance*.
The freight of flour from Quebec to England may be taken at 58 . per barrel ; from Halifax, at 3 s .

[^4]The difference in freight would therefore pay its transit by railway, and the difference in the rates of insurance would be to the profit of the owner; and the voyage being shorter, there would be leas risk of its arrival in the market in a heated or deteriorated condition.
Provisions, and all other articles whose value is great in proportion to their bulk, would be as advantageously forwarded by this route.

It is fully expected, therefore, that the railway will be able to compete successfully with shipping in the St. Lawrence even during the summer season.

But there ia still another great and important source from which traffic may be expected, viz, from those vast and extensive regions in the Far West, round the Lakes Huron, Michigan, and Lake Superior.

By the completion of the canals along the River St. Lawrence, the produce of these lake countries now finds its way to the markets of Montreal and Quebee.

Large cargoes, consixting of upwards of 8000 barrels of flour, can now pass from their ports dowu to Quehee withont once breaking bulk.
Already produce which found its way to New York by the cireuitous route of the Mississippi and New Orleans has been diverted to the chamel of the St. Lawrence.

The extent to which this will take place it is not possible yet to calculate; but there is no doubt that large quantities of produce which formerly found its way to the Atlantic ports of New York and Boston will be diverted to the $8 t$. Lawrence.

Of the enormons exports of proviaions from the United States, the following will give some idea :-


The greatest portion, if not nearly all this immense produce, of which the above forms only a few items in the great account, was received at the Atlantic ports from the Far West. And it is for this most important and still incressing trade that Montreal and Quebee will now, by means of the St. Lawrence canals, have the most favourable chance of a successful competition with New York and Boston.
It has been calculated that the cost of transport for a barrel of flonr from the Lakes to New York was 5s. 1d. sterling; to Boston 6s.; exclusive of charge for translipment.

By the Quebee and Halifax line it is estimated, now that the canals are open, a barrel of flour may be delivered at Quebee for $2 \&$. sterling, and earried to Halifax for $28.2 \mathrm{~d} .-$ total, 4 s .2 d .

By the Montreal and Portland, 18 . $8 d$. has been estimated as the price per the railway, to which, if $2 s$. more be added as freight to Montreal, the price by that line will probably be ouly $8 \mathrm{~s}, 8 d$. sterling per barrel. The Montreal and Portland will have, therefore, an apparent advantage over the Quebec and Halifix line, arising from its much ahorter distance. But there are some drawbacka attending it, which may cause the preference to be given to the latter notwithstanding. The line paseen through the United States.

A transit duty of 21 percent. al valorem has to be levied upon all forelgu pro-
duce, and introdnces the inconvenience of custom-honsea and custom-house officers.

Portland is a forcign port, and is 400 miles by sea farther from England than Halifax.

It has been seen in a former part of this report, when speaking of the Utica and Syracause Railroad, how inadequate that line was to take all the fraffic which was required to he forwarded by it, at the time the Erie Canal is closed.

The growing poputation and prodnce of the Weatern Stated are so gigantic, that it is prolable there will be more than eufficient to employ fully both the Montreal and Portland and the Quelec and Halifix Railroads.

From the foregoing remarks it will appear, then, that although no very good or precise estimate of the returna for the expenditure of five millions sterling can be given, yet that there are very good general grounds opon which to form an oplnion that nttimately, if not at once, the line will, in a commercial point of view, le a very productive oue.

The Montreal and Portland, which will be the great competitor with that of the Quebec and Halifax line, is an enterprise of a purely commercial and local nature. As such, it is not likely shareholders will be contented unless they receive what they have every right to expect, a high rate of interest for the expenditure they have incurred and the risk they have encountered in the undertaking.

But with the Quebee and Halifax it is very different; the enterprize is of general intereat. It concerns the prosperity and the welfare of each of the three provinces, and the honour as well as the interests of the whole British Empire may le affeeted by it, It is the one great means by which alone the power of the mother country can be brought to bear on this side of the Atlantic, and restore the balance of power now fast turning to the side of the United States,

Every new line of mitway made in that comntry adds to their power, enabling them to concentrate their forces almost wherever they please, and by the lined, of which there are already some, and there will soon be more, reaching to their northern frontier, they can choose at their own time any point of attack on the longextended Cauadian frontier, and direct their whole strength against it.

The provinces, therefore, and the empire having euch interest in the formation of the Halifux and Quebec line, it should be undertaken by them in common, as a great public work for the public weal.

If so undertaken, the provinces, supported by the credit of the mother country, could raise capital at a rate of interest whieh could not be done by any Company of shareholders. And if to this advantage be added the disposal, for the exclasive benefit of the railway, of a portion of the wild lands along the line, and in the immediate country which it would be the means of opening to settlement and cultivation, then it is highly probable that it would be consiructed for three millions sterling.

In a former part of this report it has been estimated that there are in the counties through which this line will pass fourteen millions of acres of laod yet ungranted, and therefore remaining at the dispoal of the Provincial Goveruments

The ordinary price of an acre of wild or meleared land is about 28 . 6 d , to 38. per acee; but where public rouds are made through them the value immediately increases, and it will ont be considered an extravagant catimate lo suppone that

[^5]fhe land along it, or in the immediate vienity of the milway, will be worth 16 . per acre.

For the conatruction of the Great St. Lawrence Canal, by which Canada has now the prospect of reaping such immense advantages from the trule of the western country, the Imperial Government guaranteed the interest on a loan of two millions sterling and upwards, at 4 per cent. This loan was easily raised, and a large premium per cent, was received in uddition for it.
There can be little doubt that another loan of three millions sterling, at the same rate of 4 per cent, interest, could be raised upon the credit of the provincial revenues, if guaranteed by the mother country. With this amount of eapital, and two millions of acres to be reserved and sold from time to time, it is conceived the railway may be made.

Upon the strength of these two millims of acres, snd the loan as a basis, a large amount of notes might be issued in payment of the wages and salaries of the labourers and other persons employed on the works of the railway. They should be made receivable for taxes and Customs' duties. The amount anthorized to be issued might be limited to the extent of the acres, and as these were sold, an equal amount of the notes should be cancelled.

The issue of a number of notes which would pass current over the three provinces would be conferring a great benefit upon the community at large. The currency is not the same throughout, and persous who travel from one province to another are now put to inconvenience, and have often to pay a discount upon exchanging the notes of one colonial bank for those of another. Advantage might be taken of the measure to assimilate the currency of the colonies to each other, and make it "sterling," the same as in England.
By a little arrangement, ako, these notes might be made payable at the chief ports of emigration in the United Kingdom; and in that case a very great couvenience would be afforded to a large class of persons on both sides of the Atlantic.
To remit small sums now requires the intervention of bankers or agents. This has the effect, upon persons resident in the settlements (and no doubt also often in towns), of preventing their sending the assistance which they otherwise would do to friends at home. Many a small note would be put up and sent in a letter, which now is never thought of for want of the convenience.
In remituing sums from Halifax to Kngland the lanks do not like to give bills at less than 60 days' sight. These notes would, therefore, become a great public benefi, and there would be no fear of their being kept in circulation simost to any amount.

Upron the loan of three millions the interest at 4 per cent. would amount to 120,000\%. per annum.

Of this sum it may be fairly assumed that for the conveyance of the mails hetveen Halifax and Quebee, the Post Office department would be willing to pay annually an equal amount to what is now paid for the same service. This has not been officially obtained, but there are good gronnds for supposing that it is nearly 20,000 ,
In the case, then, that beyond this the mailway only paid its own working expenses, the sum of 100,000 , would have to be made good out of the revenues of the provinces.

The proportion of this, of of whatever oum might be deficient to pay the in-
terest on the loan, would have to he arranged; and it may, for the sake of illustration, be supposed to he as follows :-


For the proportion guaranteed by the provinces they would receive the benefits conferred by the railway in developing their resources, inereasing the value of all property, promoting the sale and settlonent of their wild lands, increased population, and increased revenue.

For the proportion guaranteed by the Imperial Government, all Government officers, civil or military, troops, munitions of war, supplies, se,, for publie service, and emigrants, should be transported over the line at the cost price.

New Brunswick and Noya Scotia, it is understood, are most willing to guarantee the interest to the extent of their means, and in a fair proportion.
Canada having done so much already for the communications aliove Montreal, it is fully expected will not be backward in perfecting those below Quebec.

In the extreme case supposed above, viz., of the railway yielding no returns beyond working expenses, it is not, coneeived that either one of the provinces or the empire would not receive an equivalent in some other form for its direct contribution to make good the interest.

An secount is at present being taken of the existing railway traffic between Halifax and Amherst, by the commissioner appointed by Nova Seotia to collect statisties for the railway. The same is being done for that portion of the line along the banks of the St. Lawrence.

There is some reason to believe that these two portions of the line will be found to have sufficient traffic to pay, over and above working expenses, the moderate interest upon capital of 4 per cent.

If such should prove to be correct, then the foregoing statement would be modified, and stand thus:- $\qquad$ Miles.
Total distance, Halifax to Quebec $\quad$. 635
Quebec to Riviere du Loup . . . . 110
Halffax to Amherst and Bay Verte
125
Leaving unproductive still . . . . 400 miles.
If the total line can be done for $3,000,000 \mathrm{l}$, then the proportion for the 400 miles would be $1,889,600 \mathrm{l}$, or $2,000,000 \mathrm{l}$. nearly.

The interest for which would amount to 80,000 .
Deducting $20,000 \mathrm{~d}$. for the conveyance of the mails, then the sum to be rosponsible for would be $60,000 \mathrm{~L}$, which, divided proportionally as before, would give for


Therefore, for the responsibility (perhaps for apotming it only) of $100,000 \%$., or as the case may prove, 60,000l, the Quehee and Halifax Railway may be made.

Bot to look to this great work ouly as a commercial speculation, and as yielding mere interest for the expenditure incurred, would be to take a very limited view of the objects it is capable of achieving.

In the United States they are well aware of the increased value which internal improvements and communications give to properly of every kind.

In those countries works have been undertakon for that olject alone, not for the mere return which the work-whether railway, road, or canal-would make of itecilf.

The indebtedness of the several States has been incurred almost entirely in making great internal improvements; and in the boldness and unhesitating way in which they have incurred debts and responsibilities, for the purpose of developing their resources, may be seen the secret of their unrivalled prosperity.

The State is in debt, but its citizens liave been enriched beyond all proportion.
Most unfavourable comparisons are made by travellers who visit the Britich provinces and the United States; and some have gone so far as to state, that travelling along where the boundary is a mere conventional line, they could at once tell whether they were in the States or not.

On the one side the State Governments become shareholders to a large amount io great public works, lead the way, and do not hesitate to incur debt, for making what has been termed "war upon the wilderness;" employment is given, and by the time the improvement is completed, property has been created, and the employed become proprietors.

On the other side the provincial Governments do not take the initiative in the same manner, and hence in the setflements, and in the provinees generally, may be seen this marked difference in the progress of people who are identically the same in every respect,

Until the British provinces boldly imitate the policy of the States in this reganl, and make "war upon their wilderness," their progress will continue to prosent the same unfavourable contrast,

The ereative or productive power of canals, railways, dec., may be traced in the history and progress of the State of New York.

The Erie Canal was commenced in 1817, and completed in 1825, at a coat of $7,148,789$ dollars, or $1,400,000 \mathrm{~L}$. sterling. In 1817 the value of real and personal property in the city of New York was, from official documents, estimated at $16,486,000 \mathrm{l}$ sterling. In 1825 it was estimated at $21,075,000 \%$, sterling. In 1820 the popolation of the State was $1,372,0002$., and in 1830 the population of the State was $1,918,000$ l.
The canal was found so inadequate to the traffic, that between the years 1825 and 1885 , a farther sum of $2,700,0002$, was to be expended in enlarging it :

Making the total cost to that date $4,100,000 \mathrm{~L}$ sterling.
It has been seen that in the city of New York-
In 1817 the olficial value of real and personal property was $16,436,000 \%$. 1895

Being an increase of $2 \ddot{4}$ times in sighteen years.

For the State of New York-
In 1817 the official value of real and personal property was $63,368,000$. 1885
" $110,120,000 \mathrm{~L}$.
Or an increase of nearly $47,000,000$, sterling in the value of property; attributed chiefly, if not entirely, to the formation of the canals.

In 1886 the amount conveyed to tide-water by the canal was 697,857 tons.
And on the 1st of July of that year there had accumulated in the hands of the Commissioners an amount sufficient to extinguish the whole of the outstanding debt incurred in its construetion.

The net receipts from all the State canals, after deducting the expenses of collection and superintendence, for the year 1847, was 449,270 l. Villages, towns, and cities have sprung up along its course.

The population of the State, which was-
In 1810 . $\quad$. $\quad$.
Was in $1845 \quad$ -
259,949
$2,604,495$

In 1846 the value of real and personal property was estimated at $128,500,000$.
It will be seen from the above, therefore, that in addition to the wealth created for individuals, the canals produce a large annual revenue to the State.
The following extracts from the financial affairs and statistics of some of the States may be quoted in illustration of this part of the subject:-
1847.

Massachuserts.


As security for the redemption of the scrip lent to railroads, the Commonwealth hold a mortgage on all the roads, and also 3000 shares in the Norwich and Worcester, and 1000 in the Andover and Haverhill.

## Pennsilufanta.

Public property, canals, and railreads, at original cost. $28,657,432$


## Nomth Cabolisa.

Debt of the State, on account of Railroad Companies .

## Dollars.

Orio.
Debt contracted for the sole purpose of the construction of
$1,110,000$
OHio.
Debt contracted for the sole purpose of the construction of
Poblie Works within the State :
Canals, 820 miles in length, cost
Net receipts in 1846, after paying repairs and expenses
In 1810 the population of this State was
In 1820
In 1840
Or tripled nearly in 20 years, during the progrens of her canale.

Michtann.
Debt on 30 th November, $1845 \ldots 4, \ldots 40$
Total length of railroads finished and belonging to the State, 222 miles.
This State was authorized to raise a loan of $5,000,000$ dollars for internal improvements.

For the same purpose, Congress granted to this State 500,000 acres of Iand.

$$
\begin{aligned}
& \text { In } 1840 \text { the population was . . . . . } 212,267 \\
& \text { In } 1845
\end{aligned}
$$

Or an increase of 50 per cent. nearly, in five years.
Indiana.

In Jauuary, 1847, the public deht was . . . | Dellars, |
| :---: |
| 14,394,940 |

By the terms of the Aet adjusting this debt, it is to be equally divided between the State and the Wabash and Erie Canal. Of this canal, which is to be 458 miles long, 374 miles are in Indiana; 174 of this portion are finished, and in operation. There remain 200 miles to be completed, upon which part about $1,200,000$ dollars have been expended by the State. It is estimated to cost the farther sum of $2,000,000$ dollars to complete the entire canal. To cover this amount, the State is to transfer to trustees 968,126 acres of land adjoining to or in the neighbourhood of the canal.
The population of this State, in 1811, was
1830, was
1840, was


Or an average of 5s. 7d, sterling per acre.
But to show the effect produced by a canal or railway passing through property, the following extract may be quoted from the Report of a Board of Directors of the New York and Erie Railroad Company in February, 1844:-
"The Board find that they have omitted one description of property, which has heretofore been considered of great value, but the right to most of which has been lost to the Company by failure to complete the road within a certain period; the most valuable of which consisted of 50,000 acres of wild land in Cattaraquas connty, near Lake Erie, and one-fourth part of the village of Dunkirk.
" An offer in writing was made in 1837 by responsible parties to take theee
donations, and pay further the sum of 400,000 dollars, provided certain portions of the railroad were completed within a specified time."

That is, ahout 8 dollars, or $38 e, 4 d$. sterling per acre.
In Michigan 461,000 acres were granted by Congress for the endowment of a miversity. These lands were selected, in sections from the most valuable of the State. The price of these was at one time 20 dollars, or $43.68,8 d$. sterling per acre, but became lower afterwards; 17,142 acres, the quantity sold up to 30 th November, 1845 , brought $24,9 \%$. per acre.

69,000 acres, devoted to schools, were sold for 16.78 . per acre.
Such, then, are some of the results of making "war upon the wilderness."
In New Brunswick there are, according to an official Report of the SurveyorGeneral, dated 15 th December, $1847,20,000,000$ acres, of which about $6,000,000$ are either granted or sold, and $3,000,000$ may be considered as barren or under water; leaving, therefore, at the disposal of the Goverument, $11,000,000$ of acrea of forest land fit for settlement.
Of the $6,000,000$ granted or sold, only 600,000 acres are estimated as being acbually under cultivation.

By a statistical table published by W. Spackman, London, there are-

| In England............. | Acres eultivated. | Acres uncultivated. | Acres unprolitable. | Total acres |
| :---: | :---: | :---: | :---: | :---: |
|  | $25,632,000$ | 8,454,000 | 8,256,400 | 32,842,000 |
| Wales | 8,117,000 | 530,000 | 1,105,000 | 4,752,000 |
| Scotland | 5,265,000 | 5,950,000 | 8,52S,980 | 19,788,000 |
| Ireland | 12,125,280 | 4,900,000 | 2,416,664 | 19,441,944 |
| In New Brunswick... | 600,000 | $16,400,000$ | 8,000,000 | 20,000,000 |
| Population of England |  | . . | . 14 | 5,508 |
| b | Wales . | + . | - . | 1,321 |
| " | Scotland | . . | - | 8,957 |
| " | Ireland | . $\cdot$ | - 8 | 5,982 |
|  | New Bruns | ck . | $\cdots \quad$. | 8,000 |

In Ireland there appears to be, from the ahove table, $17,000,000$ aercs of ground fit for cultivation, and it has a population of $8,000,000$ to support,

In New Brunswick there is an equal amount of ground to cultivate, and it has ouly a popnlation of 208,000 persons.

If the land yet oncleared and fit for cultivation be added, which remains in the northern section of Nova Scotia, and again between the boundary of New Brunswick and the River St. Lawrence to the east of Quebec, then there would be a quantity nearly equal to that of England itself, supporting a population of 400,000 souls ouly.

It is not too nuch, then, to say, that between the Bay of Findy and the St. Lawrence, in the country to be traversed by the proposed railway, there is abundant room for all the surptns population of the mother country.

Of the climate, soil, and capabilities of New Brunswick, it is imposeible to speak too highly,

There is not a country in the world more benutifuily wooded and watered.

An inepection of the map will show that there is Bearcely a seetion of it withnut its streams, from the runuing lrook up to the navigable river. Two thirds of ith boundary are washed by the sea; the remainder is embraced ly the large rivers the St. John and Restigouche,

For beauty and richness of scenery this latter river and its branches are not surpassed by anything in Great Britain.

Its lakes are namerous and most heautiful, is surface is undulating, hill and dale, varying up to mountain and valley. It is everywhere, except a few peaks of the highest mountains, covered with a dense foreat of the finest growth.

The country can everywhere be penctrated by its streams.
In some parts of the interior, for a portage of three or four miles, a canoe can float away either to the Bay Chaleury and the Gulf of St, Lawrence, of down to St. Joln's in the Bay of Fundy.

Its agricultaral capabilities, its climate, \&c., are described in Bouchett's works, in Martin's British Colonies, and other authors. The country is by them, and most deservedly 80 , highly praised.

There may be mentioned, however, two drawbacks to it, and only two.
The winter is long and severe; and in summer there is the plague of flies.
The latter yield and disappear as the forest is cleared; how for the former may be modified by it experience only can show.

For any great plan of emigration or colonization, there is not another British colony which presents such a favourable field for the trial as Now Bronswick.
To $17,000,000$ of productive acres there are only 208,000 inhatitants,
Of these $11,000,000$ are still public property.
On the surface is an abundant stock of the finest timber, which in the markets of England realize large sums annually, and afford an unlimited supply of fuel to the settlers.

If these should ever hecome exhausted, there are the coal-fields underneath.
The rivers, lakes, and sea-coasts abound with fish.
Along the Bay Chaleurs it is 80 abundant that the land smells of it; it is used as manure; and while the olfactory senses of the traveller are offended by it on the land, he sees out at sea immense shoals darkening the surface of the water.

For about the same expense, five emigrants could be landed in New Brunswick for one in the Antipodes, Being within a fortnight by steam from London, any great plan of colonization could be directed and controlled by the Home Government.

In case of distress or failure, it would be long previously foreseen; the remedy or assistance could be applied; or, if beyond these, there would be the upper country and the Far West always open, and ready to receive the colonists.

The present limited population being so generally engaged in the pursuit of the timber trade and in the fieheries, there is the richest opening for agriculturists.

New Brunswick annuslly pays to the United States upwarde of 200,0001 , for provikions and other articles which ahe can raise upon her own eoil.

Nova Scotia does very nearly the same thing.
Whilst within a few miles' reach of their own capitals, there is abundance of land for agricultural productions, these two provinces are depenilent for lagge supplies of food upon the United States,

Flour is imported from as far as New Orleans,
Wheat grown in the valley of the Misaisippi is shipped at St, Louik, and im-
ported into New Brunswick. It is ground into flour at the mille of St. Johu, and furnishes a large share of the bread eaten loy the labourers of that city.
There exists, therefore, a good market already on the spot for agricultural produce; and it would be a strange anomaly, indeed, if a country situated within three or fonr weeks' sall of the markets of England could uot compete with the growers of produce in the valley of the Missiaxippi and the countries round the great lakes in the Far West.
One thing, howeven is greatly to be deprecated; that is, iuy sudden or large emigration without previous preparation.

Before wheat or food of any kind can be grown, the foreat has to be removed; and that is a work of time and lard labour, dathg which those engaged in it must be fed from other sources.

With some litute previons detailed surveying, the proposed nilway can be commenced both at the Quebec and Halifax ends as soon as deeided upon, and earried on for miles, During which time the further detailed survey necessary for the remainder of the liae, and particularly the portion through the wilderness, might he made, and the line actually marked and cot throughont.

This line, when cut, would form a basis for laying out extensive blocks of land, and dividing them into allotments for settleps.

It will be unnecessary in thin Report to recapitulate all the good effects produced upon every country in which railways hare been eatablished; but some may be mentioned.

They have become necessury to the uge, and that country which has them not mnst fall behind in the onward mareh of improvement, and in the development of its reances; and the longer it in sniffered to do so, the greater and more unfayourable will be the contrast which it will present to the world.

Already in this respeet the British provinces of Nova Scotia and New Brunswick are fir belind their enterprising neighbous.
One of the immediate effects of making this nalway would be to place them in a position of equality. They ure now dependent upon them for food,

At the closing of the navigation of the St. Lawrence, if the United States were merely to prohibit the exports of provieions from their own harbours, the consequences would be aerious to these two provinces. Canada contd not then mupply them.
In Mas. 1847, when the exploratory parilies were being formed at Fredericton, and provisions were being forwarded to the woods for their use, there was a searcity of flour at St. John. It was said that sufficient for only two or three day's consumption remained in that city. The prices rose considerally, and the searcity was only averted by the arrival of some cargoea from the United Stutea intended for Rastporth

The railway, had it been established, would bave prevented such a state of thingo, aul may save it for the fature.
For the want of ench a communication, Nova Scotia now finds it easier and more advantageous, notwithstanding a heavy duty of 20 per cent. against her, to export ber great ataple of fieh to the States than to Canada; whereas, if the railway were made, it would pass on to the latter, where there would be an extensive market for it, and flour would be received in return.
Halifax would become the grand emporium of trade for the British provinces,

With the assintance of the electric telegraph, an order from Quebec coold be
VOL. II. N, S.
received in a few minutes, and the articles wanted could be sent off by the next truin.

As the vessels now arrive in fleeta in the spring, and again in the autumn, it is a matter of forethought and consideration to the merchant of Canada to know what he shall provide himself with.

To the intending emigrant it will afford him the choice of any month in the year to set out for his new country, and if, by means of friende previously settled, his place of abode has been chosen, he can time his arrival so as to have the shortest possible time to wait until bis own crops are ready to supply him with food.

Arriving now, as thousands annually do, in the spring, when the sced time is at hand, and the land uncleared, they lose the valuable opportunity of that years crop, and have to wait over, existing, perhaps, upon their little espital for nearly eighteen months, until the succeeding harvest comes to them. To all such emigrants nearly a year may be saved.
Surpriso has sometimes been expressed that out of so many who yearly land in the provinces, 80 many pass on and become settlers in the States.

To the poor man his labour is his capital, and he must transfer limself to the place where employment is to be found.

The proposed railway would be such a work as would engage thousands in its immediate construction; while the stimulus and new spirit it would infuse into the whole community, now cribbed and confined as it were to their own localinns, would give rise to branches and other works which would employ additional thousands.

It has been seen that the population of some of the Western States have doubled and even tripled themselves in the course of ten years.

The population of New Brunkwick is now only 208,000. Her revenue in 1847 was $106,000 \mathrm{~h}$. sterling, or 10 s. per head.
There is no apparent reason why, if the same facilities of employment and land for settlement were afforded, that her progress should not be also very great.

Every emigrant, induced to settle and remain in the country, may be calcnlated as producing $10 s$ annual revenue to the province.
If the formation of the railway increased the population of New Brunawick by $40,0 n 0$ persons only, then her proportion of the guaranteed interest would be covered from that cause alone.
The same might occur also to Nova Scotia and Lower Canuda.
It may be asked, what is to become of the labourens employed upon the railway during the winter? This is the season when lumbering or cutting of timber commences. They might engage in it also. But with the wages earned in the nummer they should be incited to purchase small lots of ground of about fify acres each.

The labours of the season over, or suspended upon the railway, they could moat advantageonaly employ themselves in clearing, logging, and improving their own lots. This they could do to such an extent, that in the spring the women and older children could boru the logs off and put in some sort of crops for food, auch as potatoes, Indian corn, ke.

Mechanics might cither do the same, if railway work could not be found for them, or find employment in the towns.
Ahother great effect of the railway would be to eninace almont immediately
the value of all real and persomal property. The effects produced by the Frie Canal in doubling and nearly tripling that of the city of New York has been stated.

Villages and towns would, no doubt, spring ap in its cousse the same an on the eanal. The railway would give them birth; agrieulture and external commeree would support and enrich them.
But if, by its means, the navigation of the Gulf of St. Lawrence is spared, what an amount of human suffering and loss of life will it not save.
The tosses from shipwreck have been great, but not equal to that arising from protracted royages and crowded emigrant ships.
In 1897, 89,738 persons emigrated to the British provinces, of whom 5293 persons perished at sea, and 10,000 are said to have died after their arrival.
This was a most unusual year, and it is to be hoped, by every friend of humsnity, that anything like it will never occur again.

No human means could have saved all this loss of life, but there is no doubt a less protracted voyage, and a more favourable time than the spring of the year in the St. Lawrence, wonld have grevented some of the fatal renults.

The railway established, the passage may be shortened, and the time of emigration may be selected at choice.
Troops are annnally moved to and from Camada. About the close of the navigation in 1843, a transport, having the lst Foyal Fegiment on board, was wreeked in the mouth of the St. Lawrence. The men got safely on shore, that there were no roads or means of getting away from the place. By the personal exertions of one of the officers, who raade bis way through the woods on snow-shoes to the nearest settlements, and thence to Quebec, information was given of the wreck, and a steamer sent down to take them off. But for this, the consequences must have been that the regiment would bave had to winter there in the best manner they could.

Embarking and disembarking at Halifax, all danger and inconvenience from the Culf navigation would be avoided. Time and expense would be eaved, and the season might lee dianeganded.

The mails to and from Canada could paes aver British territory exclusively, and they would be received at Quebec before the steamer reached Boston, and at Montreal about the same time as it arrived at that port.
In a political and military point of view, the proposed milway musb be regarded as becoming a work of necessity.

The increasing population and wealth of the United States, and the diffusion of xailways over their territory, expecially in the direction of the Canadian frontier, renders it absolutely necessary to counterhalanee, by some corresponding means, thoir otherwise preponderating power.

Their railway communications will enable them to select their own time and their own points of attack, and will impose upon the British the necessity of being prepared at all points to meet them,

It is most essential, therefore, that the mother country should be able to keep uf. Lier eommmications with the Canadas at all times and seasons. However powerful England may be at sen, no navy could save Chanda from a land force.

Ins conquest and annexation are freely spoken of in the United States, even on the floors of Congress.

Weakneas invites aggression, and as the railway would be a lever of power by which Great Britaio could bring her strength to bear in the contest, it is not jm-
probable that its construction wonld he the means of preventing a war at sume no distant period.
The expenses of one year's war would pay for a railway two or three times over.
The following extract from the Report of Lard Durlim, her Majenty's High Commissioner and Governor General of British North America in 1839, is so apposite and just, and bears so strongly apon the subject tunder consideration, that it is conceived no better conclusion can be made to this Report than to inzert it:-
"These interests are, indeed, of great magnitude; and on the sonrse which your Majesty and your Parliament may adopt with respect to the North American colonies, will depend the future deatinies, not only of the million and a half of your Majesty's-subjects who at present inhabit those provinces, but of that vast population which those ample and fertile territories ire fit and destined bereafter to support. No portion of the American continent possesees greater natural resources for the maintenance of large and flourishing communities, An almost boundless range of the richest soil still remains unsettled, and may be rendered available for the purposes of agricuiture. The wealth of inexhaustible forests of the best timber in America, and of extensive regions of the most valuable minerals, have as yet been scarcely touched. Along the whole line of sea-coast, around each island, and in every river, are to be found the greatest and richest fisheries in the world. The best fuel and the most abundant water-power are available for the coarser manufactures, for which an easy and certain market will be found. Trade with other continents is favoured by the possession of a large number of safe and spacious harbours; long, deep, and numerons rivers, and vast inland seas, supply the means of easy intercourse, and the structure of the country generally affords the uimost facility for every species of commmication by land. Unbounded materials of agricultural, commercial, and manufacturing industry ure there. It depends upon the present decision of the Imperial Legialature to determine for whose benefit they are to be rendered availabie. The country which has founded and maintained these colonies at a vast expense of blood and treasure, may justly expect its compensation in turning their unappropriated resources to the account of its own redundant population; they are the rightful patrimony of the English people-the ample appanage which God and Nature have set aside in the New World for those whose lot has assigned them but insufficient portions in the Old."

And if for great political objects it ever become necessary or advisable to mite all the British provinces under one Legislative Government, then there will be formed on this side of the Atlantic one powerfal British State, which, supported by the imperial power of the mother-country, may bid defiance to all the United States of America.

The means to the end, the first great step to its accomplishment; is the construction of the Halifax and Quebec Railway.
(Signed) WILLIAM ROBINSON.
Auguat 31, 1848.
Captain Royal Engineers, Brevet-Mtajor.
Majon General Bir Joln F. Burgoyne, K.C.B.,
Inspector-General of Fortifications,
Ees \&o. Ne.

## No. 1. <br> Copy of a Deseator from Earl Gegy to Governor-General the Earl of Euars and Kincarding.*


#### Abstract

My Lord, Downing Street, April 5, 1849. I have hitherto deferred answering your despatch of the 20 th of December last on the sulject of the proposed Halifax and Quebee Railway, because I was nnwilling to abandon the hope that in doing so I might be enabled to communieate to your Lordship the determination of Her Majenty'd Government to submit to Parliament some definite proposal with a view to the execution of this great national undertaking. I regret, however, to have now to inform your Lordship that, for the present at least, it has been found impracticable to overcome the difficulties which have stood in the way of every plan which lias hitherto been suggested for providing for the cost of a work of such magnitude as the proposed railway. While I entirely concor in your Lordalip's estimate of the extreme importance of that work to the empire at large, as well as to the North American provinces, and while I gladly acknowledge that the members of your Council have shown a disposition to do all that lies in them to promote its nccomplishment, and have sigggested a measure which has much to recommend it for effecting this object, still Her Majesty's Government have relactantly come to the conclusion that in the present circumstances of this country they would not be justified in applying to Parliament for the appropriation of so large a sum for this railway as it has been estimated that it would cost. You will exprens to the members of your Council my strong sense of the judgment and ability they have displayed in the consideration of this important subject, althongh the measure they have suggested has unfortunately been found open to objections which have proved insurmountable. It would be to me a subject of deep regret if I believed that the determination not to adopt this particular measure implied that all hope of hereafter carrying the projected railway into effect by other means must be given up, but I see no reason for coming to any such conclusion, nor will I despair that this great design may at no distant period be resumed with a_happier result,


$$
\mathrm{I} \mathrm{am}, d v_{0}
$$

GREY.
The Right Hon, the Earl of Elgin and Kineardine,


## Cofy of a Letter from B. Hawes, Esq., to J. Howe, Eeq.

Sir,
Downing Street, March 10, 1851.
I am directed by Earl Grey to inform you that he is at length ensibled to communicate to you the decision of Her Majesty's Government on the application for assistance towards the construction of the projected railway through Nova Scotia, contained in your letters of the 25 th of November and 16th of January last.
You are already aware, from the repeated conversations which you have had

+ A simitar deapatch wat addresed to the Licutenant-Governor of New Brunswick Nob IIf, Aprilts. 1840.
with Lord Grey, of the strong sense entertalned ty bls Lordship and his colleagues, of the extreme importance, not only to the colonied directly intereated, but to the empire at large, of providing for the construction of it railway by which a line of communication may be established on the British territory between the provinces of Nova Scotia, New Brunswick, and Canada, and that various plans which have been suggested for the aecomplishment of this object have undergone the most attentive consideration.
It appears from Sir John Harvey'g despatch of Augast 29, 1850, as well as from your letters and the verbal communications yon have made to Lord Grey, that the Provineial Govermment of Nova Scotia, fully relying on the concurrence of the Legislature, is desirous of undertaking the construction of that part of the projected line which would pass through that province, and proposes to obtain for that purpose a loan of $800,000 \mathrm{~L}$., whieh is the estimatel expense of the work. The assistance which Lord Grey nnderstands you to apply for on behalf of the province is, that the payment of the interest of a loan to this amoint should be guaranteed by the Imperial Parliament, the effect of which would be that the money might be mised on terms much more favourable than would be otherwine required by the lenders.
I am direeted to inform you that Her Majesty's Goverment are prepared to recommend to Parliament that this guarantee should be granted, or that the money required should be advanced from the British Treasury, on the conditions which I now proceed to state.
In the first place, as Her Majesty's Government are of opinion that they would not be justified in asking Parliament to allow the credit of this country to be pledged for any object not of great importance to the Britioh Empire as a whole (and they do not consider that the projected railway would answer this description, unless it should establish a line of communication between the three British provinces), it must be distinctly understood that the work is not to be commenced, nor is any part of the Ioan, for the interest on which the British Treasury is to be responsible, to be raised, until arrangements are made with the provinees of Canada and New Brunswick, by which the construction of a line of railway passing wholly through British territory from Halifax to Quebec or Montreal, shall be provided for to the satiafaction of Her Majesty's Giovernment.
In order that such arrangements may be made, Her Majesty's Government will undertake to recommend to Parliament that the like assistance shall be rendered to these provinces as to Nova Scotia, in oblaining loans for the construction of their respective portions of the work. If it should appear that by leaving it to each province to make that part of the line passing through its own territory, the proportion of the whole cost of the work which would fall upon any one province would exceed its proportion of the adrantage to be gained by it, then the question is to remain open for future consideration, whether some contribution should not be made by the other provinces towards that part of the line; bat it is to be clearly understood that the whole cost of the line is to be provided for by loans raised by the provinces in auch proportions as may be agreed upon, with the guarantee of the Iruperial Parliament.

The manner in which the profils to be derived from the milway when completed are to be divided between the provinces, will also remain for future consideration.

You will observe, that I lave stated that the line is to pass entirely through

Britiah terrltory; but Her Majeaty's Govermment do not require that the line ahall neccosarily be that recommended by Major Robiuson and Captain Hendereon.

If the opinion which is entertained by many persons well qualified to form a juigment is correct, that a shorter and better line may be found through New Brunswick, it will of course be preferred, and there will be sufficient time for determining this question while the carlier part of the line is in progress. It is also to be understood that Her Majesty's Government will by no means object to ite forming part of the plan which may be determined upon, that it should include a provision for estalisishing a communication between the projected railway and the railways of the United States, Any deviation from the line recommended by Major Robinson and Captain Henderson must, however, be subject to the approval of Her Majesty's Govermment.

It will further be required that fhe several Provincial Legislatares should pass laws making the loans which they are to raise a first charge upon the Provincial Hovenue, after any existing debts and payments on account of the Civil List settled on Her Majesty hy laws now in force; and also that permanent taxes ahalt be imposed (or taxes to continue in force till the debt shall be extinguished) sufficient to provide for the payment of the interests and sinking fund of the loans proposed to be raized after diacharging the above prior claims. It will further be necessary that the expenditure of the money raised under the guarantee of the Imperial Parliament shall take place under the superintendence of Commissoners appointed by Her Majesty's Government, and armed with sufficient power to secure the due application of the finds so raised to their intended Bbject. The Commissioners 30 appointed are not, however, to interfere with the arangements of the Provincial Governments, except for the above porpose,

The right of sending troops, stores, and mails, along the line, at reasonable rates, must likewise be secured.

If, on the part of the Govermment of Nova Scotia, yon should express your coneurrence in the above propozal, Lord Grey will immediately direct the GovernorGeneral of the British North American provinces to communicate with the Lieutenant-Governors of New Brunswick and Nova Scotia, who will also be directed to bring the aubject under the consideration of their respective Exeentive Councils, in order that if they should be prepared to join in carrying the undertaking intu offect on the terms proposed, the details of the arrangement between the provinees may be settled, and the sanction of the Legislatares obtained for the plan, so that it may, with as little delay as possible, be submitted for the approval of Parliament.

Before, however, the proposed measure can be so submitted to Parliament, it is proper to observe that there are some otdier questions affecting the pecuniary relatious letween the mother country and the colonies which will require to be considered; bat as these questions have little, if any, reference to Nova Scotiap it is not necessary that they should be further adverted to in this letter.
I am directed to add, that Lord Grey thinks it unnecessary that any measures should be taken by Her Majesty's Government to encourage the establishment of steam-vessels for the accommodation of emignants of the humbler class, which is one of the subjects to which you have called his attention.
If there should be a demand for such vessels, Lord Grey has no doubt that they will apeedily be aupplied by private enterprise; indeed, he has been informed that ships of large size intended for the conveyance of emigrante, and
furntehed with auxiliary atemm-power, are alreaty biliting both in this country and in America; and if by nndertaking the projected railway a demand for labour is created in the British provinces, and a large extent of fertile land is opened for the occupation of settlers, these circumstances cannot fail to lead to an extension and improvement of the means now afforded for the convegance of emigrants to these provinces.
Lastly, with reference to the suggestion contained in your letter, that convieta might be employed in the construction of the rilway, I am to inform you that, though Her Majesty's Govermment entertain no doubt that the expense of the work to the provinces might thus be greatly reduced, while at the same time, by judicious regulations, all risk of serious inconvenience might be guarded against, they would not be disposed to take any steps with a view to the adoption of this eugreation, unless on a distinct application from the Colonial Legielatures; but if such an application should be made. Her Majesty's Government would be prepared to make the necessary arrangements for the employment of a mioderate number of convicts on the work, without any charge for their custody and subsistence to the province which may have applied for them.
lam, ke .
Joseph Howe, Esq.
(Signed)

## B. HAWES.

## No. 3.

Copy of a Despater from Earl Grey to Governor-General the Earl of Elany and Kincardine.

## Mr Lord,

Downing Street, March 14, 1851.
From the correspondence which I have already had with your Lordship on the subject of the projected railway from Halifax to Quebee, you are well aware that, although Her Majesty's Government liave not hitherto been enabled to take any steps towards the execution of that work, it is an undertaking which they have long earnestly desired to see accomplished, as they believe it to be one calenlated very greatly to advunce the commercial and political interents both of the British provinces in North America and of the mother country. It is therefore with great satiefaction that I have now to acquaint your Lordehip that I have reason to hope that the time is at length come when this great national enterprise may be undertaken with advantage, if there still exista (as I am aure there does) as strong a desire to promote it on the part of the inhabitants of Canada and New Brunswick as they formerly expressed, and as the people of Nova Scotia bave again recently manifeated.
2. I enclose for your Lordship's information a copy of a deapatch addressed to me in the course of the last autumn by Sir John Harvey, introducing to me Mr. Howe, a member of the Government of Nova Scotia, and also copies of two lettera I have received from that gentleman, and of the answer which has, by my direction, been returned to him. Your Lordahip will perceive from these papers, that the proposal made by Mr. Howe, on behalf of the province of Nova Scotis, and to which Her Majesty's Government have thought it their duty so far to accede as to undertake on certain conditions to recommend it for the sanction of Parliament, is to the effect that the credit of this country should be employed to onable the provinces of Canada, New Brunswick, and Nova Scotia, to raise, upon advantageous terms, the funde necessary for the construction of the proposed
railway, juet as Camula han already been enablet, by similar asaistance, to contstruct the canala by which she laas lately completed the roat extensive and perfect nystom of iuland navigution which exista in the world. Although Her Majesty's Government are of opinion that great caution ought to be ofserved in pledging the aredit of the Britiah Treasury in aid of loana raiked by the coluntes, they rugard the work now in contemplation at being (ilke the Baint Lawrence Camali) of to mach importance to the whole empire, an to justify them in recommending to Parliament that some assistance should be given towards ith conatruction; nor in there uny mode of affording such aseistance which has been Litherto suggested, which appeara ou the whole so little horthensome to the mothercountry, tud at the same time of so much real zervice to the coloniex, as that which is uow proposed.
3. In conming to the decikion that Parliament ahonld be fuvited to give thid aupport to the projected railway, Her Mrjesty's Government bave not failed to liear in mind that, by enabligg the North American provinces to open this great line of commmication, it may fairly he assumed that a powerful atimulns will be given to their adrance in wealih and popolation, and that the consequent inerease in their resources will render it possible for them to relieve the mothercountry sooner, and more completely, than would otherwise be practicable, from charges now borne by it on account of these colonies. In another despatch of this date, I bave informed yorr Lordslip, that in the judgment of Her Majesty: Aovernment, the Britisb colonies onght to be required, as they become capalie of doing so, to take upon themalver not only the expenses of their Uivil Government, but a portion, at all evente, of those incurred for their protcetion: and Thave pointed out to you, that the British North American provinces, and eapecially Cauada, have now reached such a stage in their progreas, that the clarges for which Parliament is called upon to provide on their account, ought to be rapidly diminished. The conatruction of the proposed railway would greatly contribate to promote this important object. By opening new distriets for settlement, and by the demand for labour which will be created during the progress of the work, the projected railway cannot fail to increase the wealth and population of these provinces, while, by affording a rapid and casy communication betweon them, it will enable them to afford to each other far greater mutual support and assistance that they now can, in any difficulty or danger to which they may be expored.
4. Your Lordship will not fail to observe from the letter which has been uddreased to Mr. Howe, that the assistance which it is propoed to grant to the provinces fowards the construction of the proposed nutway, if to be contingent on provision being made for opening a complete line of commuication from Halifiax to Quebee or Montreal: it is necessary, therefore, to ancertain whether Canada and New Brunawick are ready to john with Nova seotia in raising the capital required for the work in the manaer proposed, and, if so, in what proportion each province is to become responsible for the expense incurred. The question whether it will be udvisable for these two provinces to join is the constraction of the projected railway, if they should be exabled, by the assistance of Parlitment, to raise the required capital at a low rate of intereet, it one for the conaidention of their respective Legislatares; bat so far as I have the memas of forming a jodgment upon the subject, I shonid anticipate that their decision would he in favour of doing so. I infer that this is probable, not lest from what I hive learnt of the actual state of public opinion on this subject in the proyrnees.

VOL. H. N. s.
than from the view which I take of their interest in the work. Though I can well helieve that there would be much room for doubting whether the railway would pay á a mercantfle speculation to as company looking to traffic only for its remuneration, the case is rery different when it is regarded as a poblic undertaking; When yiewed in this light, the warions indirect advantages which eannot fail to arise to the prorinces from posaessing such improved means of commonication, must be considered, as well as the very great additional value which would be eonferred on a vact extent of puhlic lauds which are now comparatively worthless, This is a source of profit from which no advantage can in general acerve to the conaiructons of railways in countries where the soil bas long been appropriated by individuals; on the contrury, in these countries the purchase of land is not one of the least important itoms of the expense to be incurred in snch undertakings; but where, us in parts of Canada and New Brumswick, a great part of the territory to be travewed by a railway is still unappropriated, and the laud may- lee sold by the pullic, the increased value given to it by being thus rendered accessihle, may render it advantageous to construct a railray, though the traffic is not expected to do more at first than pay the working expenses,
5. If these considerations should induce the legislatures of the threa provinces to combine in undertaking the projected railway, the terms on which they are to co-operate with each other for that object will have to be settled; and in coming to such an arrangement various questions of great difficulty and importance will require to be considered. For instance, it is probable that when the line is completed, the traffic will be far more remunerative at the two exfremities than in the more central portion of it: while at the same time the expense of construction would, from the nature of the country, be precisely higber where the traffic retarns would be the lowest; so that if each province were required to pay for the formation of the line through its own territory, and to receive the returns from the traffic through the same, it would follow, that while the expense to New Brunswick would be the greatest, its receipts would be the smalleet. On the other hand, as I have just observed, one of the most important sources of profit from the construction of such a railway as that now in contemplation, would arise from the sale of land of which the value wonld be inereased by the work: and it appears from the papers before me, that New Brunswick would probably derive a greater profit from that source than the two sister provinces. Whether the result uyon the whole would be, that each province, considering, these various circnmstances, ought to take upon itself the construction of the railway through its own territory, or whether, on the contrary, any one should be asaisted by the others, is a point on which I bave not the means of forming a judgment; and I would anggest to you, that the best course, with a viev of arriving at some practical result, would be, that a deputation from the Executive Councils of the tivo lower provinces should proceed to the seat. of Goverument in Canada, in order to confer with your Lordship and with your Council for the purpose of coming to some agreement upon the subject, which, after being approved by the Legislatrres of the several provinces, might be submitted for the sanetion of Parliament.
6. It does not appear to me that if such a conference should be held, it need occupy any very great length of time, or that much difficulty would ariee in coming to an arrangement for the conatruction and working of the projected railway, le which the expense of the undertaking on the one hand, and the wifyantagen to be derived from it on the other, might be fairly apportioned

Refon the Hatifax a
6; 66
between the different provinces. Heratker I may probably be enabled to offer somesuggeatione ns to the mamer in which this might be accomplished; but at present I have ouly to add, that I shall transmit copies of this despatch to Sir Edmand Head and io Sir Jobn Harvey, with instractions to them to communteate with your Lordehip without delay on the important sulject to which it relates: and it will gipe me the highest satiafaction if the result of these communications should lie the umdertakiog of a work, which, if completed, cannot, 1 believe, fail to add greatly to the prosperity of the British provinces in North Ameriea, and at the same time to give additional strength to the ties which conneet them with each other and with the British Empire.

I am, de,
(Signel)
GREY
The Right Hon. the Earl of Elgin and Kineardine, \&e. \&e. \&e. PAPER IV,

Gunfowder Bulbdings. By Captain Yonke, R.E.
Bemponas in which the several procesees of manufactoring gunpowder are carried ob, were generally constructed entirely of wood, on the principle that in the event of an explokion taking place, but little resistance was offered by the walls and roof, and thus the damage done to the building would be but slight. This may hold good as regards the first process, that of the incorporating of the three ingredients, where the composition bas not attained to the explosive power which it afterwarde obtains by the higher processes of pressing and gramalating. The quantities alao in each incorporating mill are comparatively small, conkisting only of two charges of 42 Ibs, each. In the higher processes, not only are the quantitien considerable and the explosive powers great, but an impslpable powder or dust is created, which, penetrating through every creviee, coven the inside and outside of the walls and roof, and settles upon the leaves and branches of the surrounding frees, and, falling upon the ground, forms in dry woather a (rain eurrounding the building to some distanee. In the event, therefore, of in explosion taking place in a buitding (suppose in one where the mill cake is broken), the force of the explosion of the gunpowder under process, assisted by that of the acerumulations of dust in all parts of the building, woald be suffivient to blow lighted particles of the building to a considerable distance, which, alighting upon or near to a similar boitding, would fire the dust before alluded to, and cause a second explosion, and soon. The great explosion at the Government manufactory here in 1843 was much increased in this way; and that at Hounslow, in Mareh, 1850, gave a still clearer proof of the wnong construction of the several buflding there. An exploxion in one building caused the consecutive explonionh of five others placed at distances of from 70 to 190 yards apart, and within the apparent abelter of a fine plantation of firs. Mesars. Curtis, the ownens of these mille, then tarned their uttention to the consideration of what were the bost materials with which to construct their buidings. Among other trials, the beet
appeared to lue that of making the root entirety of coppor, the fruming made hollow of sheet copper, and the roofing of sheots soldered together and tied down to torivontal wires 1 foot apart, kept in their places ly emall hookn on the principale; the walts of the boilding were, bowever, of the nsual weather boarding. to consequence of the great expansion and contraction of the eopper, fhe solder (I have becu lately informed by une of there gentlemen) soon fell oul, and, the roof becoming leaky, the whole was removed; some better mode of joining the sheet together by lapping over the edges might, howevor, have heen tried.
This copper roof bas been replaced by a flat wooden one, zupporting a lank fof water. Although lighted particles falling upon this roof would be thus extinguiahed, yet at the duat can eacape througlb the weather boarding of the vides, it is not attogether recure frosa explosion by contact.
As lig the Annual Dastimate for 1850-1, the Engineer Department received au thority to erect a building at this station for the reception of a new breaking down machise, a good opportunity was offered for taking info consideration what were the beat materisls with which to construct a building of this nature. The following was the mode proposed by me, and eventually approved of. The walls to be of brick, lined with $\frac{1}{2}$-inch slabs of Bangor slate. The framing of the roof to lee as light as possible, and of the American bemlock pine, which possesses the property of not burning with rendiness, requiring astrong fire to consame it. The roofing to be of Winch Bangor slates 4 feet 3 inches, by 8 feet 6 inches, serewed down to the principals with $1 \frac{1}{4}$-inch copper screws, the joints to be covered with a elip of the sume slate 8 inchea vide, also screwed down to the nafters, The liring of slate prevents any grit from the brick walls fatling upon the floor; and the slabs heing large and the joints ferm, and these rubbed and well puttied, no dust ean escape, as it does in a wooden loilding, and no accumulations of it take place within the bnilding. This lining has been painted two coats of atone colour, giving it a light and smooth appearance, and should any fractare take place, it will be readily detected by the difference of colour.

The accompanying plan and sections will show this lailding as completed for the reception of the water-wheel and machinery constructed for it at the Inspector of Artillery's Department, Woolwich. The distances between the principals must depend upon the exact breadth of the roofing slates, and is 3 feet 6 inches on the average. The tension bolts, of $\begin{gathered}\text {-inch copper, pass }\end{gathered}$ through the wall plates, and are four in number. The suspension bolts are of the same material and size. All the floor hinges, nails, and screws used in the entire building are of copper; the door is covered with tanned leather nafled to the floor with $1 \frac{1}{4}$ inch copper hoat nails, to prevent the gumpowder dust falling through the flooring boards, and gradually accumblating. To present comenation on the rool within the building, openinge are made in the front and rear doors, and one of Arnott's ventilators fixed in the gable next the tail stream.

The water-wheel houre consista of a roof of galvanized corrogated iron supported on a framing of hemlock.

It is, perhaps, to be regretted that galvanized iron has not been fairly tried for gumpowier buildings, as it appears to possess so many of the qualities required; but it has been thought that the saltpetse lodging upon the aurfice of the imer portion of a roof construeted of this material would corrote it, and in time cavse particles of the inon to fall into the composition under procesn; this might, however, be obviated be periodically painting the internal portion of



Frame Wirt lo carry the gaivinised
Corrugated Inve Rof co Hacer-Hind
Corrugated hro Reof to Water-Whee.


the roof. A more serions objection has also been offered-of its danger from lightning; Professor Faraday having given it as his opinion that in a roof of this material the chances of danger from lightning were one in 10,000 , an opinion which might almost be considered as in its favour, particularly as it is well known that a flat surface of iron does not stiract lightining. It is, how ever, perhaps more advisable where gumpowder is concerued, to be on the arfe side.

F. A. YORKE, Capt. RE.

Waltham Albey, 30ch May, 1851.

## PAPER V.

Demolition of the Forts on the Ganton Kivers. By Lieut.Colonel
Philfpots, R.E. Phillpotis, R.E.

> (Copy.)
> Vietoria, Hong Kong, 15th April, 1847.

Sir,
I EAVE the honour to report to you, for the information of the Honourable the Major-General Commanding, that in obedience to his directions, conveyed by your letter of the 4th instant, I proceeded on the morning of the 5 th, at seven o'clock S.N., accompanied by Major Aldrich, and the other officers of Engineers, together with the detachment of Royal Sappers and Miners, and a supporting party consisting of the Grenadier Company of the 18th Royal Iriah Regiment, minder Captain Campbell, in the boats of H.M.S. Fulture, for the purpose of destroying the stone tower, or keep, within the fort, called the French Folly, as well as any defensive arrangements that might be found in the Dutch Folly and Rouge Forts, which had been reported to the Major-General on the previous day to have been re-armed and preparing for action.
The French Folly Fort, which is situated about two miles below the city, on the north side of the river, opposite to the Western, or apper end of Napier's Island, though much smatler than either of the Anunghoy Forts, is far more formidable; fuasmach as benides standing on à amall island, that renders it very difficult of acceas on alt sides exeept by boata, it bad a atone tower, or keep, 54 feet by 42 feet, and 24 feet bigh, built of very large ashlar; on which 12 guns were mounted, that completely commanded the parapet of the battery, and thus aflorled a heavy pluaging fire over it.

The walle of this battery are 8 feet thick and 14 high, ahove the level of the river. There are 24 heavy goms mounted on it, a fienr-d'eau from 8 to 12 inches in diameter, which, if properly kerved, would effectually prevent any vescele from gassing up or down the river,

Over these guns is a banquette, with loopholes for musketry, the whole forming a very strong defence against any attempt that might be made fo take it by assault.

When this fort was taken under the Major-Genenal's immediate aupervinfon, on the Srd instant, by the party under Major Atdrich, I.E., tho guns were all xpiked; tout as the garrison threw water on the powder in the magazine befone they ovacuated it, we lad no: then the meane of blowing it uf:

## 94 demolition of the forts on the canton river.

On approseling the fort on the 5th instant, Major Aldrich landed with the eupporting party, and having ascortained that if was in the same state as when we left it on the ard instant, I directed bin to cause the party fo extend round she neighbourhood, in order to keep the mob from molesting ws, and likewise to drive awny the inoffeusive inhatitants to anch a distance as would prevent them being injared by the explosion.

Acting on the principle laid dova by the Major-General for onr guidance on this expeditlon, not to do anything that would in any manner injure the defencetess inhableante, nor, indeed, to do any other injory to the forts, हe., on the river, than merely to render them uecless for the time being, I considered it desirable only to employ such a quantity of powder as would merely throw down the keep, without destroying the outer walls of the fort, and thuy save the people who reside all around it from suffering any ill consequences frem the explosion.

I accordingly directed the charge of puwder to be limited to 300 lbs , and while the Sappers, under Lieut. Da Costa, R.E., were placing the powder in the magazine, and prepsaring it for explosion, 1 directed Capt. Durnford, R.E., to make as correct a sketch as possible of the fort, \&ic., in order that he might be able, at his leisure, to prepare a plan of the work for the Major-General, showing the effect prodnced.

While these preparations were going on, Lieuts. Pasco, Coote, and Durham, R.N., with the pinnace and paddle-hox boats of H.M.S. Vulfure, the former carrying a 12 -ponnder carronade, and the two latter a 24 -pounder carronade each, with a detachment of the Royal Marine Artillury under Lieat. Davis, were employed in driving away the numerous boats and junks that were anchored close under the walls of the fort.

These arrangements being all made, the supporting party withdrew, and re-embarked. I left Capt. Duruford, R.E., to complete the train, and fire the charge, on a signal being given, as soon as the boats with the troops had pulled off to a sufficient distance to be out of danger.

Capt, Dornford performed this duty in a most satisfactory manner. A short time after the signal was given for the explosion, lee was seen pulling out to the rest of the party in the gig of the pilot, und in five minutes afterwands being the time agreed upon, a low rumbling sound was heard, a large dense make of black smoke was seen to rise from the fort, and when it had sulsided, the keep, with the exception of a portion of the west end of the wall, was no longer visible.

On returning to the fort, in order to see the effect produced by this exploijon, I found the keep entirely destroyed, not a vestige of it remained standing except the wall of the west end; which, however, was so much shaken as to remder it highly dangerous to pass near it. The large hewn stones which had been used in building it (many of them 8 feet in length) were averhanging the foundation, ready to fall at any moment. At the same time the walls of the aurrounding battery remained unizjured, with the exception of two cracks that had been made on the eouth side, about $S 0$ feet apart, hetween which two of the heavy gans had foreed open the doors, by which the embrasures were closed, and their muzzles appeared ontaide.

I have, \&c., de,
(Signed)
GEORGE PHILLPOTTS,

## Captats Bnoces

 Licut-Col, and Com. R.E.
## Aiscistant Aljutart-Genemal.

P.S. I inclow the Plan made loy Capt, Durnfond, showing the atate of the fort before and after the explozion.
G. P.




Plan, Suath Elevation and shetches of the Four Sides of the IIt after the Explasion $5^{\text {th }}$ Apryl 1847.


South ETevation


## PAPER VI.

## Cibcular Instbuotions to the Comanading Engineer.

The original copy of the following document was left at Corfu by the French, when they evacuated the island in 1814. Its date shows that it was drawn out after the French army had been destroyed in Russia, and when the fortresses on the Vistula and the Oder were in a state of siege. The translation was made from a copy of it certified and sent to Lieutenant-Colonel Pasley (now MajorGen. Sir Charles Pasley) by Lieutenant Charles Wright, of the Royal Engineers, and lithographed at the Royal Engineer Establishment, Chatham. It is again brought forward, as being a useful summary of the principal points to be attended to, in drawing up a report on the state of a fortress.

## Lemerer of the Firat Insapector General of Engineeres to the Director of Fortifications.

Paris, 15th April, 1813.

## Dear Sib,

The 86th Arlicle of the Imperial decree of the 24th December, 1811, directs that there shall be sent into all the fortresses, to be deposited in the archives of the place, a report which shall point out the state and means of defence of the fortress, as well as the part it might bear in offensive or defensive operations on the fron. tier, or on the sea-coast.

This memoir, which is more particularly intended for the use of Commandants, should show the actual state of the defences of the fortress in the most minute detail.

The materials which exist in the Depot of Fortifications furnish, on many points, but very incomplete information. I therefore send you a copy of the form I have adopted by making out such reporte,
Should you not have time yourself to put this report in proper form, or be able to get it done, you can send me the original materials for it containing the information required. A copy or an abridgment of the papers you transmit will be made out by my order in the Depot of Fortifications according to the proper form, and will be sent to you immediately afterwards.

> Je vous salue, sc.,

CONTE DEJEAN.

An Historicat. Mramori of the Present State and of the Defences of the Fortress of ——and its Dependencies ; intended to show its State of Repair, its Advantages or Disadvantages, as well as those of its Ontworks; and what Conneetion it may have with the neighbouring Fortresses, or with offensive or defensive Warfare.
Drawn up in conformity with Article 86 of the Imperial Decree of the 24th of December, 1811, for the purpose of being deposited in that Office of the Fortress which is to contain the Maps and Plans ordered by the same Decree,

## CHIAPTER I.

The History of the Fortress as it relates to the Defence, and containing a Chronological Account of the Military Events in which it has taken any part.
(Remark what are the best books to furnish material for this history, and if there has heen notbing published on the fortress, give all the necessary information to complete this chapter.)

## CHAPTER II.

A Concise Descriptive Sketch of the actual State of the Frontiers, of which the Fortress forms a part, Its Topography, its Situation, and the part it might act in the Defence of the Territory.
(The title alone of this chapter is sufficient to show the information it must. give.)

## CHAPTER III.

Description of the Fortress, and of its Environs, and the Resources which they may afford for the Provisions and Supplies of every Kind.
(Contained under three Articles.)
Articles I.
The description of the Fortress.
(Divided into two Sections.)
Section First of Abticle First.
The Fortification.
(Divided again into four Paragraplis.)
18t. Of the Main Enclosure.
2nd. of the Outworks.
3rd. Of the advanced Works.
(This description should comprehend all existing works, and such of those ordered to be constructed as are on the point of being finished; that is, an exact report of the state of the fortress, of its outworks, and advanced works, explaining the purpose for which each several work of the fortress is destined ; the state of the countermines, and the purpozes for which they are intended; the bridges actually constructed, and those which it would be necessary to form in the casea of the different supposed attacks; the rafts or boats which should replace them
under certain circomstances, in order to communicate with the outworka, the posterns to be formed in order to secune communications, \&c.)

4h. Tnundations, Slaices, Dykes, Batardeaux, \&e.
(In maritime fortressee, and such as are susceptible of being protected by inandations, indicate in a clear manner the purposes for which the sluices, dykes, Eco, are destined; whether they are for the purposes of navigation, or for defence, Explain in a precise manner the ground that may be flooded, the means of forming the inundations, and the time required for that purpose; whether they could be drained or not; whether they favour navigation or machmery, or otherwise, \&e; also the obstacles or delays which either the season, or the presence of an enemy, inight cause to their formation; and lastly, the means by which an enemy might Crain them.)

## Section Secomd of Abticls Fbiot. <br> The Interior. <br> (Divided again into five Paragraphs.)

let, Of Military Buildings and Establishments.
(Here show the situation, the number, and the description of military buildings, the parpoeed for which they are intended, and how they are occupied. State the use they would be made of in case of siege. State whether the bakehouses are under bomb proofs, and if not, what means are required to make them so, or to place them in proper casemates; make known also the state and capacity of the casemates.)

2nd, Of other Publie Buildings and Establishments.
(State auch as might be occupied in case of necessity with advantage to the defence, after making the necessary alterations. Report what resources of this deseription could be obtained from private houses, and particularly from their cellars.)
3rd. Of the Squares, Esplanades, and other places most favourable for assemblies, or for making depots of Wood and Forage.
(Consider these places with regard to the number of troops that could be formed there, and whether they would favour the formation of unlawful assemblies Point outt aleo the least exposed situations, and those most proper for the formation of depots of wood and forage..

4th. Of Streams of Water through the place, Bridges, Basins, Fountains, \&c.
(Make known the resources which they afford to the fortress; state the rivers or canals which pass through the town, as they may be counected with the defence, if they would facilitate the operations of gan-boats. In towns where there are no streams or riverwater fit to drink, state whether the provisions are suffcient, and not liable to be turned off; whether, in such a case, the wells would be sufficient, or whether it would not be necessary to form cisterns, de.)

## sth. Of the Population.

(This article is intended to show what use may be made of the inhabitants in the defence of the place, or in the construction of the works, and it ought therefore to show the number of men which might be usefully employed.)

Amticele IL.
Description of the Environs.
(Divided into three Sections.)

## Sechos Frret of Autrcle Sgoosid. of the Circle of Altack.

vol. II. N. s.
(State the nature of the ground round the fortress, and the spot which is most favourable for the opening of the trenches. This description ought to make known such undalations of ground as are either favourable or detrimental to defence.)

## Sectron Second of Article Second. <br> Of the Circle of Investment.

(In describing the ground within the circle of investment, explain what difficulties, or what resources, the enemy would meet with for his camp, or in the formation of his lines of circumvallation and countervallation.)

> Section Third of Abyicle Second. Of the Circle of Action.
(This article should explain what posts and positions the garrison might occupy, and the fortresses they could communicate with. It ought to contain an account of the roads, canals, rivers, and other particulars which might either confine or favour their commumications.)

## Abticle 111.

Of the Resources which the Environs of the Portress might afford as to Provisions and Materials.
(Divided into two Sections.)
Segtion First of Armicle Third.
Of Provisions and Forage.
(State what the environs of the place might furnish (in a moment of pressing necessity) in grain, flour, liquor, cattle, forage, \&c., as subsistence for the fortrees, and what would be the most speedy means of collecting them.)

## Seotion Second of Article Third. Of Timber of all Descriptions.

(State the quantity of wood for fuel, gabions, fascines, pickets and hurdles, for palisades, blinds, bridges, \&c., which might be procured from the country in the neighbourhood. Give in detail an account of the wood of every description necessary for a state of siege, and report what forests or woods it might be most easily obtained from, and at the lowest prices, as well as the cheapest and quickest way to fell, transport, and convert it.)

## CHAPTER IV.

Of the Defence of Fortresses.
(Contained under two Articles.)
Abticle I.
Of the Defence against Irregular Attacks.
(Divided into seven Seetions.)

## Section Firbt of Abticle Fiest. <br> Of Surprises.

(State what poinis might favour a surprise, and which are the most important to watch.)
Secmor Seoond of Abricle First.
Of Escalades.
(The came obserrations as in the above.)

## Serton Thim of Ahmele Fusp. Of an Attack by Main Force by the Petard.

(State the places most exposed to this sort of attack, and the precautions which ought to be taken to guard against it.)

## Section Fourth of Article First. <br> Of a Bombardment.

(State how far the place has to dread this species of attack, and the resourees which it contains to secure itself against it.)

## Section Fifte of Article First. of a Blockade.

(State the resources which the fortress and its environs poesess for resisting this sort of attack.)

## Abticle II.

Of the Defence against a Regular Attack or Siege, (Divided into four Sections.)

## Sburios First of Abtiole Shoond.

Of the Investment, Camp, and Lines of the Enemy.
(State, according to local circumstances, the obstacles which the enemy may meet with, and the means that should be employed for embarrassing him in these operations.)

## Section Second of Article Second. <br> Of the Opening of the Trenches and Parallels.

(The point best adopted for the opening of the trenches being determined, state the difficulties that the enemy may meet, and the resources of the benieged for retarding his approaches.)

## Section Third of Artiole Secosi.

Of the Attack and Crowning of the Covered Way.
(State, according to local circumstances, the means there may be of retarding this period of the siege, and of rendering it destructive to the enemy.)

## Section Foubth of Abticle Second.

Of the Descent and Passage of the Ditches of the Ontworks.
(In following step by step the operations of the enemy, state the obstacles he ought to meet with, and the resources which the works afford to retard his pro. gress.

## Section Fifth of Article Second.

Of the Breaches and Assaults, the Advanced Works and Outworks, and Lodgments on the Breach.
(Similar to those of the last Paragraph.)

## Seotron Sixth of Article Second.

Of the Breach, Passage of the Ditch, Assualt and Lodgment on the Body of the Place.
(State the difficulties which the enemy must vanquish, in order to be able to come to the ussault, and the reeans for repulsing him, or preventing him from forming his lodgments in the boily of the place.)

## Section Seventh of Article Second.

The Retrenchments and Capitulations.
(As a Commandant can never be authorised to capitulate until he has resisted to the very last extremity, state the means to be employed for prolonging this resistance by means of retrenchments constructed behind the breach.

## CHAPTER V.

Of the Fortress, as it is connected either with Offensive or Defensive Warfare.
(Divided into three Articles.)
Article I.
Of Detachments and Reconnoitring Parties, and of the Surprise of Parties of the
Enemy.
(The topographical situation of the town with relation to the neighbouring for-
tresses, or to the frontier, and the nature of its locality, must determine the part
the garrison can act under such circumstances.)

## Ahticle II.

Of Escorts, Convoys, Removal of Sick and Wounded.
(The communications more or less easy with the neighbouring fortresses, the strength of its garrison, and the nature of its establishments, have their influence upon the protection which it may afford to our convoys, and the resources it may possess for the removal of sick or wounded.)

## A rticle III.

On the Attack of the Enemy's Convoys, and of Harassing his Columns in a Retreat.
(State the resources which the fortress may afford, whether it be by its positions or by its garrison, for intercepting the convoys of the enemy, or for harassing him in a retreat.

## PAPER VII,

## Additions to the Barracks at Forton, to accommodate the Pobtsmouth Division of Royal Marines, By Capt. James, R.E., F.R.S.

The barracks formerly oecupied by the Royal Marines in the town of Ports. mouth being very much out of repair, and not affording the accommodation required by the Division, either for the officers, the men, or parade-ground, and its cramped position between the ramparts and the houses of the town not admitting of such enlargement or alterations as were required, the Lords of the Adminally directed me to select a site, and make a design for a new barracks, to accommodate 1000 men in barracks, with all the necessary quarters and offices required for the Division.
The site which I proposed for the barracks was the field between the Royal Clarence Victualling Yard and the lines of Gosport,

Negotiations were commenced for obtaining this site from the Ordnance, which, after some delay, was met by a counter proposition on the part of the Ordnance, vix., to exchange the barncks at Forton, outside the lines of Gosport, for the Old Marine Barracks in Portsmouth. This proposal was accepted, and the exchange soon after effected.

I was then directed to design such additions at Forton Barracks as wonld he necessary to give accommodation for the full Division, which consiats of -

1 Colouel Commandant.
1 Colonel 2nd Commandant.
4 Lieut, Colonels.
1 Barrack Master.
1 Paymaster.
2 Adjutants.
2 Quartermasters.
1 Surgeon.
1 Assistant Surgeon.
12 Captains.
24 Lieutenants.

2 Serjeant Majors.
1 Quarter-master's Sexjennt,
I Barrack Serjeant.
1 Adjutant's Olief Clerk.
1 Paymaster's ditto.
1 Armonr Serjeant,
1 Band Master.
60 Serjeants.
50 Musicians.
1000 Men.

I was subsequently ordered not to provide accommodation for the barrackmaster, paymaster, or surgeon, who were to receive lodging-money allowance, and reside out of the barracks

The barrack at Forton is one of the finest in England, and in accepting the offer of exchange, the expenditure of the large sum of money which would have been required for new barracks was avoided.

The barrack, when trausferred, consisted of the four pavilions numbered 1, 2, 3,4 , on the plan, and was capable of containing 48 serjeants, and 832 men; but as the lower part of pavilion 4 was occupied as 4 meas establishment for the officers, and pavilion 1 as a surgery and hospital, and part of the other pavilions were occupied as school-roome, tailors' slopy, barrack-master's and quartermaster's stores, the accommodation for the effective force was limited.
one in addition to hid sitting-room and hedroom. An ample supply of excellent water is obtained from a well in the rear of the building. A fatigue party of 4 or 5 men ean fill, by means of a three-throw pump, the cistern that supplies the Quarters, in about half un hour.

Owing to the great number of detachments of Marines which are serving in men-of-war in all paris of the globe, and the great strength of the Division, the offices for the paymaster are neceesarily on a large acale ; the men preaent with the Division are paid by 4 pay-serjeanta, at windown in the offees opening into a wide passage on the ground floor; the paymaster and his clerks have offices over these.
The estimated cost of the principal block of buildingd was 14,0002 , exelusive of the fitments and furniture, and it was not exoceded.
The following remarks appeared in the Porlanouth Thacd of 11th Janaary, 185l, and were copied very generally into other paperk. I have not the least idea who the representative of the editor, or the gallant veteran officer alluded to, may be. "We scarcely know which to admire most in the structure, from the descriptive report furnished by our representative, who was escorted over the building on Wednesday by a gallant veteran officer and the contractor. To begin, however, with an effort, the cellarage is ample enough to contain stock for a siege three times the length of that of Troy, if compulsory, The kitchen is replete with every appliance of modern art and culinary perfection, lofty, commodious, and healthy; even the palace of the Sovereign is not better supplied with the necessaries and auxiliaries of the cuisine to a more gheous extent. The arrangements of the pay department are unique, but must be inspected to be understood and properly appreciated. The field-officers' and subalterns' quarters are as ample and elegant as a generons commission could design, and yield the most general astisfaction. The grabd entrance to the mess-room is capacious and classic in its design, and exhibits in its external features the welcome to its hospitalities within. Branching off on either side of the eutrance-hall, are handsome proportioned diniog-room and library, large, well-lighted, and in suitable keeping with the grandeur above. Facing the hall of entrance, a gallery for the accommodation of the band of the Corps has been erected, and proved to be admirably placed for giving effect to the performances of the tatented oceupanta, Ascending the grand stairease (and it is grand in the truest acceptation of the term), we arrive at the banquetiugroom of the Corps, a right regal ball of state, whose proportions are commensurate with the extent of the hompitality known to be so generally exercised by the Royal Marines. When equipped, this banqueting-room will be the most maguifieent of the kind in the kingdom, and most probably out of it. The Commandant's offices, on the right of the entrance-gate to the parade-ground, and thoze of the non-commissioned officers in comnection with it ; also the adjutant's room, courtmartial room, orderly room, the sehool-rooms for boys and girls, and residences for master and miatress, on the left of the entrance, \&c., de, present featiares of accommodation and convenience which no official can occopy, or visitor behold, without being impresed with the everywhere apparent fact of the utmost convenionce and comfort having been studied in this remoral of the Royal Marinen to Forton, where they may now be considered ak establibied an permanence All unite in giving the Admiralty the warmest praise for their generous bounty and consideration, in 8 b bandeomely berthing their gallant representatives in urms. First cost is generally least, and assuredly it was far better and more






## shuters

$\approx$
se Fexe



H James.
$\operatorname{Cap}^{t} R$.E

Section on the line A.B. Plates 2 ant


TRANSVERSE SECTION.

economical in the Admiralty thns to expend a titlle more at starting in thin matter, than, lig hotching up a heterogeneous mass of shapeless buildings (which on the firat exigeney for increased secommodation would have to be pulled down), pay, after all, through the nose for the requisite accommodation,"

I lave great pleasure in availing myself of this opportunity to acknowledge the valuable assistance I received from Mr. Crew, the Clerk of Works, who superintended the execution of the work under my dircetion.
H. JAMES,

Capt. R. E.

## PAPER VIII.

## By Major-General G. G. Lewrs, C.B., R.E.

## De la Defense Natrosale el Anoleterre. Par le Baron P. E. Mavrece, Captain du Génie de la Confédération Suisse, Aucjeu Elève de IEcole Polytechnique, \&c. \&c. 1851.

This work of the current year serves to keep alive the attention of militury men to the defencelers state of Great Britain; and the notice gived the emppiler of this paper an opportanity of recurring to his previous inquiries ou this subject. (See the 9 th and 10th Volume of "Professional Papers," Quarto Edttom.)

In regard to M. Maurice's propositions, embracing, firat, the opinions of different persons who have published their different schemes for the defence of our cousts, and our resources; secondly, the preparations for the attack and defences of England in 1803; the resources of France and England in 1850, and the chances of anceess of the former, with the present state and defence of the latter; lastly, M. Maurice's inquiries into the liest mode that England alould follow, whether to fortify the coast, or secure London by detached forts, or ly an 'enceinte continue, or to have recourse to entrencled camps,-It is proposed to extruct such portions as are new, and to give them in the author's owi worde, and not to disenss the value or the accuracy of his propositions; and then to recur to the compiter's former opinions and suggestions for the defenee of the South Const of England.
"1. Quand Napoléon conçut sou plan d'invasion, il dut cloisir une bane d'opération étroite, parce que, ne disposant que de moyens de transport d'ua très petit tommge et très peu capahles de résister à un gras temps, il hii fallait choisir la ligue de traverove la plan courte. Avec la vapeur la question change de nature. La France pent prendre la cite de Brest à Calais pour sa base d'operation, et choisir see points de débarquement.
"Supposions pour un moment que les deux grands ports militaires frangais de la Manche serunt les points de départ des escadres de l'arnée d'invasinn, cherchons les distances muyennes de ces ports à certains points des côtes d'Angleterre, et dubord necn-poms-nous à determiner ces points.
${ }^{4}$ En suivant la côte est-sud-ent de lile, du Nord-Foreland au cap Lizarid, fos puims plus ou moins fortifiés tont: Sandeate, Deal, Douvres, Wulmer, Hythe, Bin the ume,
VoL., It. N, S,

Dean-Church, Portemouth, Dartmouth, Falmouth, et Plymouth ; et du Nond-Furchand in 'embotchure de la Tamine, Shecrness, Chatam, et le fort Tilbury, zans parler des tours Mavtelfo eonstruites sur quelques points du littoral, mais gui sont plutot des sentinelles gante-ites que de yraica fortifications. Evitant donc autant que poasible d'aborder ces mints fortities, if l'exception dum des ports militaires, dout, suivant nout, il importe (aimai que nous le verrons plua loin) de s'emparer dès le commencement, nous trouyerops les dibtances suivantes:
" De Ereat . $\left\{\begin{array}{r}\text { gation à la vapeur, donne une distance de } 17 \text { heures, } \\ \text { à Vembouchure de I'Avon, } 433 \text { kilom., ee quif donne une distance }\end{array}\right.$ de 27 heures.
ia Rye, 222 kilom., ce qui donne une distance de 14 henres.
" De Charbourg _a Portamouth, 133 kilom., ce qui donne une diitance de 8 heures.
" Le niaximum de temps nécessaire pour franchir ces distances est done de 27 heares; mettons-en de 30 a 34 , à cause des retards quí entravent toujours les convois un peu מеmireux.
" Munis de ces données, nous croyons qu'il serait avantageux pour la France de chuisir trois points de débarquement. Le premier serait à l'embouchure de l'Avon, de manière à établir immédiatement le corps d'armée de l'aile ganche ì 6 étapes de Londres. La ligne d'opération des Frangaís de 1'Avon à la Tamise, vers Londres, tend ainsi ì couper les communications des comtés du nord avec ceux du sud-ouest, et force les Anglais à diviser leurs forces; le second serait en arrière de Plymouth qu'il faudrait assieger du cốté de terre, parce qu’il importe d'occuper un port militaire pour y protéger la flotte de débarquement contre les attaques de la flotte anglaise, et pour sétahlir fortement dans le pays, dès lentrée en campagne.-Plymouth eat plas rapproché de Brest que Portsmnuth; il est moins bien defenin, et sa prise tait tamber nécessairement entre les maius de l'assaillant les places de Dartmouth et de Falmouth, le Devonshire et la presquile du Cornouailes, pays abondants en gnims, en páturages, et en chevaux. En outre de Plymouth à Briatol, il n'y a que 155 kilomères, ce qui permettra an corps darmée de laile ganche de se mettre en communication avec celui du centre. Enfin la forét de Dartmoor fournira d'abondants approvisionnements à Tarmóe pour la confection des gabions, saiucissons, clayomages, et bois de consiruction de toute sorte qu'exigers le siége de Plymouth. Le troisième point de débarquement serait la cóte et le nouveau port de Rye.-Rye est à 96 kilomètres, soit S étapes de Landres; c'est un des points les plus rapprochés de la mètropule; le corps d'armée prineipal qui débarquerait en ce point, foruant l'aile drôte de l'armée d'invasiun, devrait purter tout son effort directement sur Londres. Mais, dirn-tnn pout-étre: Pourquii ces trois points de débarquement au liet de réunir toutes les forces agressives sur un soul puint? Parce qu'une seule armée de 150 mille hommes trouvera bien moins facllement les voitures et les chevaux de rêquístion nêcessaires pour le trinsport de ses manitions, de ses pares, ut de zos vivres, que trois corps d'arnte aéparés. Parce que le cóté fauble de larmèe réguiliềre auglaise êtant sont petit nombre, il mat micux la forcer ì se disséminer et ì agir conte trois ascailants séparémeat yue contre uit senl tout a la fois ; 11 y a deux chances de plus pour lassailant de rénciir. D'ailleurs, nons n'hésitons pas à conseiler que les operations des trois corps d'armée d'invasion soient combinées de façon à les faire marcher sur Londres simultanáment et comrentriqumacht.
"2. Nous avons dejà réponder implicitement ia cette queation dans le paragraplie proceident,
4134. Shus lavone dit : il importe d'étre maitre dun port nititaife important pour y abrier la flote de débarquement, pour avoir un point duppui zolide sur le sol anghais, et pour $\begin{aligned} & \text { trouver do nuite dee upprovisiouncments en boie, en mateviel, en mumitions }\end{aligned}$ de tinte sortes.
Nous asous choifi Plymouth parce quer sa rade ne peut pas contenir une suysi rasto flote dedefense puie celle de Spit-Head devint Portsmonth, parce que lee abnrde de la rividrere de Portsmouthi, indópendamment de la grande flotee qui pourruit a'y emhomer et courrii les appriaches de Portsar-Sland, sont defendus, à droite, par le fort Ciumherlawd, deux fortes lunettes et le Sonterefoef, à gauche par le fort Monktwa, en avant d'Alverstock, et par le BloodNimes. S'engiger dans le canal du Solent pour wasaye win deborqument sur la tive dmite du Soutliampton-Water semit hasardeux, paren que lo Sulent est trop sarreillé. On débarrquement dans le Whitesand-Bay (Cornumilles) offre plus d'avantages. Bxaminons, en effet, la position de Plymouth. Il est lati an fond du Sound, entre le cannal dit le Cat- Water ià droite, et celui dit l'Homour à gaucho: eva furtifications consistent, à Tentréa de ta baie, en un fort hiti vers lembouchure du Yealm, en un fort avec batteries placies dans live Saint-Nicholas ì 1300 mètres cuviron du Fieher'-Nose, oì se traive un fort hastiomí qui couvre la ville de Plymouth proprement dite, et en une enveinte bastiomnée trẻa resserréc qui couvre le dockyard mifitaire du côtè de Devaoport-sans nayrages avancés. 8i líumée d'invasion débarque a IortWrinckle par example (Wlititesand-Day), elle trourena immédiatement des rontes poir son artillerie et zes convoís, et tandis qu'une division se dirigera par Anthony uir Clarhend, vù elle pourra prendre position à mille oul 1200 mètres des dockyarde sur la rive droite de 1 Hamoaze, une antre division pourra aller se poster anr le moot Edgecurnie, et bombarder les arsenaix et le fort Saint-Nichiolas.- Dans tous les cas, en perdiant un peu plas de tewpg, I'eniemi poura contoarner la poaition, et commencer réguliérewent le siegee đe lencecinte du doekyurd du cóté de la ville de Devonport, qui eat zans défense лисиие
" Las prise de Plymauth Eait tomber du mème coup tons his porta secondaires, tels que Dartmouth, Falmouth, et lirre à l'armée d'invasion le Cornouailles et le Devonshine, provinese riclies un hlés, en paturnges, et en cheranx.
 T'Aver, I'autre daos le Whitesmd-Bay. Supposons Plymouth attuqué à la förs du cuité du mord et par la rive gauche de l'Hamoaze: une foís qu'ill auen été pris et necopé, noun pensone que le corps đ'arnée expéditionnaire $\mathrm{N}^{3}, 2$ doit marcher sur Porumouth, 1attaquer du còté de Gosport, et 'én emparer avant que de marcher zur Londres. En effet, La marche difecte sur Londrea exposerait larnée à étre prise en flune par lea troupen de la garniom de Portamoutb, à vair ses convois interceptéé, see communieationn conpéas. Si, au contrarie, Portsmuuth est pris, voilà un nonveau point dappui tria important, plas rapproché de Bristol que Plymouth, et sur lequel des comvois de renfiuts peavent étro diriges de Cherbourg, du Have, et de Dieppe.
"Examinona les defennes de Portsmouth. Placie entro Pnotmmath-Harbons et Langston-Harbour, tille de Portsen est défendue all nand, ronmene nous linvone dit, pas the enceinte contioné, et an midi par los forts Cumberland, Southeas, of jar deus lunettes bastionnée, situéed a 1200 mètres Iune de lautre. Les villos de Portsera et de Portsmouth sont convertes il 'ost par des enceintes bastionuées avec demi-lunes, cliemin couvert, et des fosses a l lean. Les approches de Fortsea semient faciles pour un ennemi quí aurait
 où il pourrait s'tablit. Mais il faudrait pour y pénétrer traverser des manais, et pasecrì portéc des hauteurs de Ports-Down, position redouhtable, d'ŭu on aunait puine à chasser mème les milicen et les volontaires, qui 's'y smaient rethauchias avec du canm, et qui
 rable. En outse, Karmie dianvaion devnit citaparer fire forte du lifteral puor ne pat eitre pruc i devers dans ses ravaux d'attague conter Ferlemumili.
" De lhatre cỏté du havre de Porismouth, se trouse la ville de Gosport; elle est protegée à Voucst par une enceinte bastionnée simple, sans demi-lunes, ni onvragea avancess. Léntrve du lavre et du part de Gosport eat défendue par lo Forie Monktom, le Blockhouse, et plua bas pur les forts Burrow et Priddy's-Hard. A partir du fort Monkton une ligne de redans a été consturite pout empecher un télaruqnement dans ia prosquille terminée par Gilkicker-Point. Leas détenaes de Gosport sont friblea : nous nhếsitons pas ì penser que larmée, en débouchant dans la presquille par la ronte de Southmpton, et so développant d'Elson à Alveratock pour commencer le siége de la rille, rensoirsit à sten emparer; Gosport une fois oceupé, Portsmouth, ses theck ef sus arsenaux, sont príe d̀ dos, ot doivent nécenaircment be remire, sous peine d'étre brâlés.
" 5 , Nous croyons fermement que le point objectif unique des opérations dea trois corps de débarquement doit ètre la métropule,
"Londres n'est point fortifié, comme no sait, Londres est la tête at le creur đe l'Angleterne; c'eat le centre d'oí partent tous les mouvements, et où gravitent toutes les pensles et tour les iotérêts du peuple anglais. 'Maitre de Londres,' dit le Frazer's Magazine, 'Tennemil pourrait nous imposer les conditiones les plus ignominieuses.' Londres pris, Woolwich, Ohatam, et Sheerness, ne peuvent pas faire une longue résistance. Le premier de ces ćublissements n'a aucun ouvrage défensif; les deus autres ont été surtout fortifiés contre des attaques venant du côté de la Tamise.
${ }^{*} 6^{\circ}$. Après les réflexions auxquelles nous venons de nous livrer, la réponse à cette sixieme question devient plus facile: car il résulte evidemment de la discussion précé dente que le corps d'armée de l'aile gauche ne rencontrera atcune place forte sur sa route; il devra done être composé d'infanterie, de eavalerie, et d'une artillerie très mobile et trés nombreuse, parce quil anm à combattre des troupes très hatiles ì manier cette arme, aujourd'bui sonvenine sur les champs de bataille.
"Le corps d'armés du centre devva transporter avec lui un grand parc de siége et un corps nombreux de sapeurs du génie, parce qułl anra à faire celui de deux établissements militaires fortifís régulièrement, quoique d'une manière incomplète. Enfin, le corps de laile droite qui opérera suivant la plus conrte ligne menant au point objectif, devant naturellement rencontrer la plus ónergique résistance, devra être aussi le plus fort en infanterie et en cavalerie ; nous lui domerons une artillerie calenlée à raison de plus de 3 bouches à feut par mille hommes, et 20 bouches à fen de siifge, dans le cas où il serait jugé prudent de s'emparer de Donvres, des batteries de Hythe, et des forts de Eastbourne et de Deanehurch, pour assurer les commumieations de l'armée arec Boulogne et Calais, avant que de narcher sur Londres.

Voici done le tableau de ces 3 corps d'armée; on verra que nous avons exagéré le nombre des voitures de transport et celui des chevaux afin de ne ríen négliger dana nos calenls. Nous savons quäl n'est pas dans l'nage des Français de trainer après eux beauenup deces incommodes impeethmenta belti, gu'ils se nourrissent aisement en campagne, et que la sobriété du soldat et de l'officier surtout est proverbiale. L'officier frayçaise n'a flas les babitudes de conffort qui suivent même en campagne lofficier anglais, et qui obligent les armées anglaisen ì trainer aprés elles des convois interminables.

## No. 1.-A Mriáre di Rristal.



| Artill. de campagne | Voitures. | Infanterie . | Hommes 25,000 |
| :---: | :---: | :---: | :---: |
| Vivres . | . 387 | Cavalerie | 5,000 |
|  | 7 | Artillerie | 1,000 |
|  |  | Génie | 500 |
|  | 1,194 | Train des équipages | - 661 |
|  |  |  | 32,161 |

" No. 2.-Armée de Plymouth.

" $\mathrm{N}^{\circ}$. 3.-Avmée de Rye.

| Canons. |  | Chevaux. 12,000 |
| :---: | :---: | :---: |
| Artill, de campagne. 250 | Cavalerie |  |
| Artill, de siége . 20 | Artillerie de camp. | 1,000 |
|  | Artillerie de siége (à 6) | 120 |
| 270 | Voit, artill. de campagne | 10,080 |
|  | Voit, artill. de siége | 1,772 |
|  | Pare du génie | 28 |
|  | Vivres | 2,838 |
|  | Bâts | 848 |
|  | Total . | 28,686 |
|  |  | voitures. |
| Artillerie de campagne, dont 1 chevaux et 100 à 2 chevaux | 0 à raison de ( 5,2 | 2,000 |
| Pare, artillerie de siége | . . . | 443 |
| Pare du génie |  | 7 |
| Vivres, dont 500 à 4 chevau | et 418 à 2 chevaux | 918 |
|  | Total | 3,368 |


| Infanterie |  |  |  |  |  |  |  |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| Homwes. |  |  |  |  |  |  |  |

## Reicapitulation.

| Bristal |  | $\begin{aligned} & \text { Hommes, } \\ & 32,161 \end{aligned}$ | Chevaux. $11,108$ | $\begin{gathered} \text { Voiturss } \\ 1,194 \end{gathered}$ | $\begin{gathered} \text { Canous } \\ 100 \end{gathered}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Plymouth | . . | 48,187 | 18,012 | 2,814 | 166 |
| Rye | - . | 76,502 | 28,286 | 3,368 | 270 |
|  |  | 151,800 | 57,806 | 7,276 | 536 |

"Dans le cas où Iévaluation que nous venons de faire du nombre de voitures nécessaires au transport du matériel d’artillerie et du génie, considéré comme indispensable pour le siége des fortifications de Plymouth et de Portsmouth, pourrait paraitre exagérée ì nos lecteurs, nous rappellerons simplement le nombre des projectiles de toute nature, et de kilogrammes de poudre qui fut consommé au siége de deux petites villes d'Bspagne, en 1810, Cindad-Rodrigo et Almếda.
" Cindad-Rodrigo avait 2 enceintes; la première consistait en me ceinture de murailles flanquées de tours, la seconde en 7 fronts bastionnés avec fossés et ouvrages avancés. La garnisou était de 4,900 hommes: elle soutint 39 jours de tranchée onverte.
" Les Français consommèrent 18,286 boulets de 24,16 , et 12 ,

| $"$ | $"$ | 14,859 bombes et obus, |
| :---: | :---: | :---: |
| $"$ | $"$ | 60,900 kilogrammes de poudre, |
| $"$ | employèrent | 22,700 sacs à terre, |
| $"$ | $"$ | 600 saucisons, |
| $"$ | $"$ | 2,615 gabions. |

"Almérda avait 6 fronts bastionnés, avec demi-lunes et places d'armes saillantes et rentrantes, et 5 mille hommes de garnison: elle soutint 15 jours de siége, pendant lesquels les Français tirèrent 10 mitle coups de canon avec 64 bouches à feut de gros calibre. Nous n'avons, done, rien exagéré dans l'effectif de notre matériel.
${ }^{4} 7^{\circ}$. Londres rayoure et communique par des routes de fer avec les villes ci-après de la partie est et sud-est de l'ile :
"Woolwich, Rochester, Chatam, Whitstable, Margate, Ramsgate, Deal, Sandwich, Douvres, Folkstone, Maidstone, Wells; par le South-Bastern et le Brighton Railway.
"Avec Croydon, Hastings, Eastbourne, Newhaven, et Brighton ; par le Brighton Railway.
"Avec Shoreham, Arundel, Chichester, Fareham, Gosport, et Portsmonth; par le South-Coast Railway.
"Avee Guildford, Winchester, Southampton, et Dorchester; par le Bouth-Western Railway.
" Avec Bristol, par le Great-Weatern Railway.
" Et avec Exeter et Plymouth, par 1'Exeter et South-Devon Railway.
"Bientót Weymouth sera relié à Londres par le Great-Western, auquel s'embranchera le Wilts-Somerset Railway a Westbury.
"Il résulte de là (à ne considérer que la partie sud-est des Iles Britanniques) qu'il n'y a pas un point de la côte, de Woolwich à Plymouth, qui ne soit mis directement en communication avec la métropole. Cherchons maintenant à quelle distance et à combien dheures en sont les points principaux.
" De Lowdes ì Plypouth, il y a 222 milles, qui, à raison de 1,609 mètres pour 1 tuille, font 855 kilom. 19 ; et, à raison de 40 kilom. à theure, $8 \frac{1}{2} \mathrm{~h}$.

" Ces villes (sauf celles marquées d'une astérisque) sont mises en communication avec la métropole par le télégraphe électrique, et il est probable que d'ici à peu de temps elles Je seront toutes. Bxaminons maintenant, à l'aide d'un calcul scrupuleux, de quelle utilité seront à la mobilisation de l'arnée anglaise les nombreuses lignes de chemins de fer dont le pays eat sillonné, dans l'hypothèse que nous avons adoptée de línvasion de IIle par trois corps d'armée séparés.

- Nous avons donné plas haut un dénombrement des forces régulières de terre et de mer, pris sur une moyenne de quelques années ; mais au point où nous sommes arrivés de notre travail, il importe de ne rien avancer à le légère; nous avons done dû chercher à nous procurer un état exact des furces de terre pour l'anwée 1850. Cet état, le roici :-
"Cavalerie, Infanterie, Avillerié, et Génic.

"A quoi il faut ajouter les corps suivants:

"Ainsi done, si nous omettons, comme cela doit être, tous les corps de l'armée régulì̀re de terre, disséminés dans les colonies anglaises et celui qui occupe l'Irlande, et sì nous $y$ ajoutons le corps des enrolled pensioners et celui des dockyard-men, nous arriverons à un chiffre de 75,843 hommes. Mettons, à cause des hommes malades ou empé chés, 74 mille. Sur ces 74 mille hommes de larmée mobilisable au premier appel, nous devons encore déduire les troupes casernées à Windsor, á Hyde-Pare, à la Tour de Londres, à Westminster, à Portsmouth, à Plymouth, et à Chatam, et qui ne quitteraient certainement pas ces garnisons au moment d'un danger pressant. Leur effectif est, d'après un tablean que nous ayons sous les yeux, d'environ 9,568 hommes ainsi répartis:-
" \(\left.5,260 \mathrm{~h} . \quad \begin{array}{c}à Windsor, Hyde-Pare, <br>
Westminster, la Tour <br>

de Londres .\end{array}\right\}\)| Grenadier-guards, Cold- |
| :--- |
| stream-guards, Scotch |
| fusileers. |


| 1,308 | Idem. $\quad . \quad$ Wife - guards, horse- |
| :--- | :--- | :--- |
| guards. |  |

## 9,568 h.

" Il resterait donc, après avoir fait cette déduction, une arnée de 64,432 hommes, mobilisable au premier instant, et composée de soldats aguerris ; quant aux 4,700 hommes de milice et aux 18,441 hommes d'Yeomanry, nous n'en faisons mention que pour mémoire : il ne nous parait pas possible de les classer parmi les troupes qui seraient prêtes à Jutter immédiatement avec des régiments de ligne bien exercés et bien disciplinés. Cela ne se pourrait sans témérité qu'après leur avoir donné quelques mois de service sous les drapeaux pour les plier à la subordination, aux manceurres et au dur apprentissages des fatigues de la guerre.
"D'après l'hypothèse que nous avons admise d'un débarquement sur trois points différents, le canal de Bristol, Plymouth, et Rye, larmée mobilisable de la GrandBretagne devrait aussi, au premier moment, se partager en trois corps destinés à marcher aut devant de l'ennemi. Nous admettons que le centre des opérations serait Londres, comme cette capitale est aussi le neud où aboutissent et se criisent toutes les lignes de chemins de fer qui silloment l'empire, c'est de là que partiraient par des convois spéciaux lea trois corps d'arniée que nous évahrorons chacun au tiers de l'armée disponible au prersier instant, soit an tiers de 64,432 hommes ou 21,477 hommes aunsi répartis entre les trois armes, d'après les règles en usage :

| Infanterie | . . | . |  | 14,173 b. |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Cavalerie | . |  |  | 4,295 |  | In total. |
| Artillerie | . |  |  | 2,684 | ! | \% |
| Train des eq | upages | . | . | 325 | 南 | " |

et 84 bouches à feu, ou 14 batteries de 6 piéces, it mison de 4 pièces par mille hommes.
" Calculans maintenant le nombre de trucks et de wagons nécessaires pour transpurter cette armée ; b́valuons le poids à déplacer, le nombre de locomotives nécessaires pour le remorquer, et le tempa rigoureusement nécessaire puur le transporter de Londres au lieu de sa destination.
" 1 . Infunterie. تn suldat đlinfanterie pèse, armé et équipé, 90 kil. Un wagon de 36 places pèse, non chargé, 3,300 kil, et chargé 6,$540 ; 25$ wagons transporteront 906 hommes, force de 1 bataillon ordinaire, anxquela il conviendrait dajouter 2 wagons à marchandises et à bestiaux pour le transport du cheval du lieutenant colonel et de $4,000 \mathrm{kil}$, de bagages: cès wagons pèsent $3,600 \mathrm{kil}$, ee qui donne un total de $11,600 \mathrm{kil}$.
"Paide du convoi d'un bataillon:
25 wagons à vogageurs, a 6,540 kilogr, chaque $\quad$.
2 wagons a bestiaux et bagages

Total du poida du convoi du bataillon $\quad$| $168,500 \mathrm{k}$. |
| :---: |
|  |

" Pour avoir le poids du convof du corps de 14,173 hommes, if faudm multiplier lea chiffres ci-dessus par 15, ce qui domera :

" 2 . Cawalerie.-Les chevaux sont commodément distribués par 6 dans les wagons dits à bestiaux et à marchandises, qui peuvent, en outre, recevoir 4 hommes. Un wagon à bagages peut contenir 12 selles paquetées et 4 hommes. Un wagon chargé de 6 chevaux et 4 hommes pèse $6,770 \mathrm{kil}$. Un wagon chargé de 42 selles ot 4 hommes en pèse 5,376.
"Prenons l'évaluation du poids d'un escadron de 126 hommes, nous aurons, d'après len données ci-dessus:

"Poids du convoi portant les 4,295 chevaux et leurs cavaliers:


[^6]VOL. II. N. S.

"Ces brigades sont servies chacune par Artilleurs: 1 capitaine, 1 lieutenant, 6 sonsofficiers, et 60 canonniers. Train: 1 lieutenant, 1 sergent, 3 caporaux, 1 trompette, 1 marechal ferrant, 1 forgeron, 1 charron, 1 bourrelier, et 50 conducteura. Bn sorte que

$$
\begin{aligned}
& \text { Le personnel est de a artilleurs . . . . . . } 68 \\
& \text {. train et conducteurs . . . . } 60 \\
& \text { Le matériel est de : voitures et pièves . . . . } 15 \\
& \text { chevaux . . . . . . } 91
\end{aligned}
$$

" En admettant une plate-forme ou truck pour 2 voitures, 2 ou 3 hommes, et quelques bagages, un wagon à bestiaux pour 6 chevaux et 4 hommes, et 2 wagons à voyageurs pour les officiers, complétés par leas sous-officiers et canonniers, le matériel se composerait, pour une brigade ou batterie :
" 1 . De 8 trucks portant 15 voitures et 24 hommes ;
" $2^{\circ}$. De 16 wagons-ccuries portant 91 chevaux et 64 hommes ;
" 3 . De 2 wagons à voyageurs, portant les officiers et les 40 houmes restant.
"Maintenant, quel serait le poids de ce convoi?
" La pièce de 9 , équipće et approvisionnée, affut et avant-train cumpris, pèse $1,992^{k} 52$, Son caisson chargé pèse $1,319^{k} 88$. L'obusier de 5 po. 1 , équipé et approvisionné, affot et avant-train compris, pèse $2,084^{k} 98$. Son caisson chargé pèse $1,385^{k} 61$. Uaffüt de rechange pèse 1,772 kil. ; le chariot de pare, 1,803 . Le chariot-forge pèse $1,787 \mathrm{kil}$. Nous avons vu que le wagon ì voyageurs pèse 3,300 kil, le truck en pèse 9,000 , et le wagon écurie 3,600 kil.-Nous aurons done:
a. 8 trucks portant les pièces, les voitures, et 24

$$
\text { hommes . . . . . . } 75,554^{k} 59
$$

ל. 16 wagons portant 91 chevaux et $64 \mathrm{~h} . \quad . \quad 106,2210$
c. 2 wagons a voyageurs pour les officiers, sons-officiers,

| et les hommes restants . . . . . |  |
| ---: | :--- |
| Total du poids du convoi de la brigade | $\frac{11,970}{} \quad 0$ |
| $198,145^{\mathrm{t}}$ | 69 |

"Et pour 14 brigades ou batteries semblahles, et 9 wagons ì voyageurs portant une réserve de 332 honmes, complément des 2,684 , nous aurons un poids total de $3,764,610$ kil.
"Train des Equipages.-Nous admettons qu'il n'y a pas lieu à pourvoir à des voitures de vivren pour larmée anglaise opérant en Angleterre, comme nous l'avons fait pour l'arméa française, à mison de 12 voitures pour mille hommes: maik, afin de ne rien
niégliger, ninus ealeulerons le transport, de Londres aux points de delarquement, des bommes du tmin qui pourraient être appelés plus tard à suivre larmée dans des marches sur des grandes rontes, avec des convois de vnitures.
" 325 fommed et 9 wagouns à vogageura forment un poids total de 58,750 kil.
"Eir récaptulant, nous trouverons que le poids total du convoi de l'armée dirigèe de Londres sur Plymuath, Bristol, ou Ryde, sera de 12,184,092 kil, soit 12,134 tomnes de mille kilogr.
"La question quif se presente ensuite eat de savair combien il faudrait de convois et de tocomotives pour effectuer le transport de ces 12 mille tomen, et ì quelle vitesse ils devront marcher.
"Posons d'abiord quelques règles fondamentales :
" 1 ', Les locomotives en usage actuellement peuvent remorquer, a la vitesse de 40 kilom. a Theure, une charge de 80 tounes ;
$" 2 "$. Biles peavent en remurquer 140 , à une vitesse modérée de 20 à 25 kilom.;
" 3 . Une locomotive en bon état ne peut remorquer un train plus loin que la distanoe de 800 kilom.;
" 4 . Avec \& locomotives a ta suite I une de lautre, on peut doubler un convoi.
" 11 résulte de ces principes quill faudrait, pour transporter les 12 mille tonnes de Londres ì une distance de 300 kilom, : 152 convois de 80 tonnes, marchant ayee une vitesse de 40 kilom. ì Pheure, ou 97 convois de 140 tonnes, marchant ì 20 ou 25 kilom. par heure, Bt , si on double les convois : 76 convois de 80 tonnes, remorques par 152 locomotives, ou 59 contois de 140 tonneß, remorgués par 97 locomotives; Plymouth étant ì 835 kilom. de Londree, il faudra pour 4 convoie de cette direction un nombre double de locomotives, soit 304 marchant à 40 kilom., on 194 marchant a 20 ua 25 kilom., d'où il résulte qque nous pouvans établir le tahlean suivant:-
"TRANSPORT DBS TROIS CORPS D'ARMBE ANGLAIS.

| DISTANCES, | Numbre de manvis de vo tobines, | Nombre matives. | Convois doables. | Nombre de loenmatives | $\begin{aligned} & \text { Nomive } \\ & \text { de } \\ & \text { convoin } \\ & \text { del 110 } \\ & \text { touna, } \end{aligned}$ | Nombre de lovemantives. | Convols doubles | Nombre motives. |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| a Plymo | 152 | 304 | 76 | 304 | 86 | 172 | 43 | 172 |
|  | 159 | 152 | 76 | 159 | 86 | 86 | 48 | 86 |
| \% 1 Bristol | 152 | 152 | 76 | 152 | 86 | 86 | 48 | 86 |
| Totaix . . . . | 456 | 608 | 228 | 608 | 258 | 844 | 129 | 344 |

[^7]tance mojenne à Londres est de 951 kilom., snit 6 heores $\frac{1}{4}$, à raison de 40 kilom. a l'heure. Il faut bien donner au moins un jour pour rassembler et embarquer les troupes et disposer les convois. Maintenant, le transhordement des troupes des gares d'arrivée aux gares de départ, et la répartition des bataillons dans chacun des 3 corps d'armée de defense, prendra bien encore au moins un jour. Cela fait, par conséquent, 30 beures I ì ajouter aux 3 sommes de temps préédemment indiquées. Nous aurons ainhi:

Temps écoulé entre le sigual donné de Plymouth
à Londres, et larrivée de l'arncée de secours $+108^{\text {h }}+\frac{3}{8}$ ( 10 joura.)
Temps êcoulé eutre le signal domé d'Hastings
et larrivée de l'armée de secours. . . 109b. 1 ( 9 jutra.)
Temps écoulé entre le signal donné de Bristol et Tarrivée de l'armée de secours . . $111^{\mathrm{n}}$ ( 9 jours.)
"Nous verrons plus loin qu'un corps d'avant-garde aurait le temps de débarquer sur la cote avant que lannée de secours ne fût arrivée, il pourrait donc anssi couper en plusieurs points les rails des voies ferrées, ou préparer tout à loisir une embuscade d'où quelques pièees de canon pourront jouer aur le premier convoi quí paraitra, briser les locomotives, et faire prisonnières les troupes contenses dans les wagons. Si l'attaque de Plymouth, par example, est précédée par une action navale et un bombardement qui occupe la garnison, le débarquement d'une partie de l'armée pourra avoir lieu sana être inquiété ; car, tout en rendant une hante justice à la bravoure et au patrintisme du peuple anglais, on nous aceordera (et les écrivains militaires nationaux eux-mémes ne le nient pas) que la population des campagnes a peu d'aptitude poar le métier des armes, pour s'enrégimenter, et peu de chance pour affionter seule avec succès une troupe aguerrie.
"Enfin, on trouvera peut-etre que le résultat auquel nous arrivons est bien loin de celui announcé dans les documents anghis, où l'on parlait ' deeavoyer en 12 heures 80 mille hommes à la cotte,' par les chemins de fer ! Nous en convenons, mais c'est que tout simplement notre résultat est basé sur des calculs exacta, et que le premier était un ré. sultat approximatif indiqué un peu à la légêre, en ne tenant compte ni du poids des troupes, ni de celui des voitures, trucks, de., ni du temps nécessaire pour mettre en mouvement une série de convois.
" $8^{\circ}$. Nour abordons maintenant une question d'autant plus difficile qu'elle est plus nouvelle ; nous voudrions ponvoir en écarter tout ce qui est du domaine des conjectures pour ne baser notre argumentation que sur des données d'expérience; maia malheureusement ces données manquent sur quelques points, et il faut $y$ suppléer par des interpolations. Les lacunes que nous n'avons pas pu remplir se rapportent nu maximum de capacité d'emménagement ì bord des bâtiments de guerre à voile et ì vapeur, quand il ne s'agit que d'une courte traversée. Toutefois, nous avons rénssi à obtenir comme certaines les domnéea suivantes :-

Voiles.

|  | Classe du vaiseau. | Hommer aree armes et bagages. |
| :---: | :---: | :---: |
| Un vaisseat de ligue prat recevoir à |  |  |
| son bord, en dehors de son équupage | 120 canons | 800 |
| ILI. | de 100 ai 90 | 700 |
| Id. | de 90 a 74 | 600 |
| Une frégate | de 60 | 500 |
| It. | 60 a 40 | 400 - 850 |
| Une corvette de $1^{\text {re }}$ classe | ... | 250 |
| Id. de $2^{5}$ elasse |  | 60 à 50 |
| Vapours. |  |  |
| Une fregrate de 640 i 450 chevaux | ... | 1,400 d̀ 1,200 |
| Et pour une courte traversce |  | 2,000 |
| Une corvette de 320 a a 920 chevaux | $\ldots$ | 600 is 400 |
| Un aviso de 180 à 160 chevaux |  | 300 |

" Une fregate de 650 a 450 chevaus pent enharquer 900 hommes avec leurs bagages, et 100 chevaux équipés.
"Une enrvette de 320 à 220 chevaux peut embarquer 300 hommes avec armes et lougages, et 70 à B0 chevaux équipés.
"En aviso de 180 is 160 chevaux peut embarquer 100 hommes avec armes et bagages, et 20 chevaux équípés,
"Une frégate à vapear peut remorquer à une petite vitesse 2 vaisseaux de ligne de 100 a 90 canons, et un navire de 800 tonneaux a une vitesse ordinaire.
"En vapeur de commerce, convenablement disposé pour Jinstallation, prurrait embarquer pour une courte traversée 76 chevaux et leurs cavaliers.
" Un bìtiment de commerce de 800 à 500 tonneaux pourrait, avec les installations convenables, recevoir 60 chevaux et 10 voitures pour ume courte traversée.
"Bnfin, des documents puisés à une source authentique nons out appris qu'en 1849, 6 frígates à vapeur de 450 chevaux,

| 2 corvettes | id. | 220 |
| :--- | :--- | :--- |
| 1 crrvette | id. | 160 |

Et 2 transporta remorqués,
ont suffi pour embarquer à Toulon, transporter à Civita Vecehia, et y débarquer 2 brigades ( 10,000 hommes) environ avec tout leur matériel, et cela en 10 jours, aprés Pordre transmis de Paris par le têlegraphe.
"En 1830, lors de l'expédition d'Alger, il s'agissait de pourvoir an transport de 1,876 officiers, 85,681 sous-otficiers et soldats, de 4,512 chevaux, et de 180 bouches ì feu de aíğge et de campagne'. La flotte jugée nécessaire pour cette vaste entreprise fut composée de 100 bâtiments de guerre, dont 7 à rapeur, et de 602 trausporto de toate expèce.
" Voici quelle était en détail la composition de la flotte réunie à Toulon:
" 11 vaisseaux de ligne, 23 frégates, 7 corvettes de guerre, 26 bricks, 29 corvettes de charge, galuares ou bombardes, 7 bâtiments à vapeur; total: 100 navires de guerre muntés par 27 mille marins;
" 377 transporta, 140 bateaux catalans, 55 chalands, 30 bateaux plats ou radeaux; total : 602 navires de transport, etc.
" 8 i maintenant le lecteur reporte les yeux sur le tableau de l'effectif de l'armée dinvasion, arant de les jeter sur le tableau ci-dessons, il verra que, d'après les données indiquées précedemment, la flotte françaisc actueile suffirait pour embarquer cette armie avee tout son matériel.

"tablead de la contenance des batiments a voile et a vapeur.


1 La lettre $c$, en haut du chiffre entre parenthéses, désigne les pièees de campagne; la lettre $s$ celles de siége.
${ }^{2}$ La lettre $c$, en haut du chiffre entre parentheses, designe les chevaux de cavalerie; la lettre $t$ ceux de trait
＂Ainsi， 982 bátiments de tonte sorte，dont 857 pris dans le commerce，a vapeur ou à voile，et du plus fort toanage possible，suffiraient pour transporter le personnel et le matériel de larmée tels quills résultent des tableaux que nous avons donnés précédem－ ment．Ce resultat，rapproché de leffectif de la flotte qui servit pour l＇expédition d＇Alger，pent surprendre，au premier coup d＇eil；mais on observera que cette diffé－ rence est đue à la grande supêriorité de contenanee des bìtiments à vapeur sur les batti－ ments à voile，à cause de leur moindre équipuge et de leur moindre armement．En 1880，on ne be servit que de 7 vapeure；ici，d＇après notre calcul，on en employerait près de 400 ，dent 100 vapeurs de goerre．
＂Occupons－nous maintenant de la répartition de Veffectif particulier aux 8 corps d＇armée destinés à Bristol，à Plymouth，et à Rye，avec le matériel affecté à chacuir，en ayant soin de proportionner les furces navales de chaque escadre a la longueur de leur traversé，au but quelles auraient ì remplir，et aux circonstances qui，selon toute appa－ rence，nccompagneront leur débarquement．
＂TABLEAU No．1．－ESCADRE DE HAVON OU BRISTOL（BREST）．

| DENOMINATIONS， | 告 |  |  |  |  | 薜 | 免 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 4 vaisseaux de ligne．．．．．．．．． | 500 | ＂ | 2，161 | ＂ | 3 | $24^{6}$ | ＂ |
| 10 friggates ì voile ．．．．．．．．．．．．． | 4,500 | $\cdots$ | ＂ | ＊ | 8 | $40^{\circ}$ | 11 |
| 6 frígates à vapeur ．．．．．．．．． | 12，000 | ＂ | n | 3 | ＂ | 9 | ＂ |
| 20 corvettes ì vapeur， $2 \times \mathrm{cl}$. ． | 8，000 | ${ }^{\prime}$ | ＂ | ＊ | 3 | $36^{\text { }}$ | ＂ |
| 66 vapeurs commerce．．．．．．．． | ＂ | 5,000 | ＂ | 5，000 | 3 | ＂ | n |
| 78 batiments de commerce （transports） | ＂ | \％ | ＂ | ＂ | 4，560 | ＂ | 807 |
| 184 | 25.000 | 5，000 | 2，161 | 5，000 | 4，560 | $100^{\circ}$ | 807 |

＂Cette escadre，destinée à faire route de Brest a l＇embouchure de l＇Avon，quí en est éloigné de 438 kilom．environ，est composée de 40 bâtiments de guerre et 144 transports．Sur les 10 navires de guerre il y en a 26 à vapeur，dont 14 pourront don－ ner la rémorque aux 14 vaísceaix ou frégates，en cas de ventes contraíres ou de calmes， et les 12 autres escorter les transports．Supposons les vaisseaux de 90 canons，les frégates de 40 ，et les corvettes de 20 seulement，an verra que，tout en ctant motile， elle est de force à lutter avec des forces imposantes，si elle rencontre une flotie canemie dans le canal de Bristol．
＂Léscadre compris dans le Tableau No．2，étant destinée à une courte traversée （ 260 kilom．），et surtout à attaquer un partmilitaire défendupar dex fortifications et probable－ ment par me flotte，nous la supposerons compesce de forts liatiments，c＇est ij dirc，que les vaisseaus de ligne seront．en général，de 100 canmes，et les frégates à voile de 60 ou 50. Neanmoins an verra que les hatiments de guerre à voiles sont an nombre de 29 ，et ceur à rapeur au numbre de 30 ，de manière de ce que ceus－ci puissent tonjoura prêter aux autres un utile appui．Cette escadre porte environ 2,200 bouches ì fell，sams coupter les pietces deatinées à ètre débarguées ；elle pent đonc facilement protéger un ounvoi de 151 baiti－ ments de transpart，combature une eacadre dina les caux de la Manche et bombarder Plymouth pendant que les frégates a vapeur débarqueront de linfanterie et de l＇artillerie pour ouvrir la tranchée du coté de terre contre lea fortification de la ville．

TABLRAU No．2．－ESCADRE DE PLYMOUTH（BREST）．

| DENOMINATIONS． | 妾 | $\frac{4}{5}$ $\frac{1}{8}$ d | $\begin{aligned} & \text { 은 } \\ & \text { 흘 } \\ & \text { 들 } \end{aligned}$ |  |  | 咅 | 震 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 10 vaisseaux de ligne．．．．．．．．． | 7，000 | ＂ | ＂ | ＂ | ＂ | $60^{\circ}$ | ＂ |
| 19 frégates à voile ．．．．．．．．．．．．． | 8，550 | ＂ | ＂ | ＂ | ＂ | $40^{\circ}$ | ＂ |
| 8 frégates à vapeur $\ldots \ldots \ldots$ | 9，450 | ＂ | 6，550 | ＂ | ＂ | ＂ | ＂ |
| 1 frégate mixte．．．．．．．．．．．．．．．． | ＂ | ＂ | 600 | ＂ | ＂ | $40^{\text {c }}$ | ＂ |
| 1 corvette mixte ．．．．．．．．．．．． | ＂ | ＂ | 250 | ＂ | ＂ | $26^{\text {e }}$ | ＂ |
| 1 sloop id．．．．．．．．．．．．．．． | ＂ | ＂ | 200 | ＂ | ＂ | ＂ | ＂ |
| 19 avisos à vapeur ．．．．．．．．．．． | ＂ | ＂ | 5，537 | ＂ | ＂ | ＂ | 1 |
| 66 vapeurs commerce．．．．．．．．． | ＂ | 5，000 | ＂ | 5，000 | ＂ | ＂ | ＂ |
| 85 battiments à voile，id．．．． | ＂ | ＂ | ＂ | ＂ | 5，084 | ＂ | 832 |
| 210 | 25，000 | 5，000 | 13，137 | 5，000 | 5，084 | $166^{\text {c }}$ | 832 |

TABLEAU No．3．－BSCADRE DE RYE（CHERBOURG）．

| DENOMINATIONS． |  |  |  |  |  | 䓵 | $\frac{\stackrel{y y}{4}}{\frac{2}{0}}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 10 vaisseaux de ligne | 6，000 | ＂ | 1，000 | ＂ | ＂ | $60^{\circ}$ | ＂ |
| 9 frégates à voile ．．． | 3，050 | ＂ | 1，000 | ＂ | ＂ | $36^{\text {c }}$ | ＂ |
| 30 corvettes id．．．．．．． | 4，800 | ＂ | ＂ | ＂ | ＂ | $66^{\text {c }}$ | ＂ |
| 44 bricks id． | 7，920 | ＂ | ＂ | ， | ＂ | $88^{\circ}$ | ＂ |
| 38 transports id．．．． | 5，700 | ＂ | ＂ | ＂ | ＂ | ＂ | ＂ |
| 50 cutters，sloops id． | 5，000 | ＂ | ＂ | ＂ | ＂ | ＂ | ＂ |
| 7 frégates à vapeur． | 12，830 | ， | ＂ | ＂ | ＂ | ＂ | ＂ |
| 1 vaisseau id．．．．．．． | 2，000 | ＂ | ＂ | ＂ | ＂ | ＂ | „ |
| 2 corvettes， $\mathrm{I}^{\text {re }}$ cl．id． | （700）1，400 | ＂ | ＂ | ， | ＂ | $20^{\circ}$ | ＂ |
| 34 avisos id．．．．．．．．．． | （400）11，300 | ＂ | 2，300 | ＂ | ＂ | ＂ | ＂ |
| 1 corvette mixte | （250）＂ | ＂ | 202 | ＂ | ＂ | ＂ | ＂ |
| 159 vapeurs de com－ merce | ＂ | 12，000 | ＂ | 12，000 | ＂ | ＂ | ＂ |
| 199 bâtiments à voile de commerce ．．． | ＂ | ＂ | ＂ | ＂ | 11，928 | \％ | 2，007 |
| 584 | 60,000 | 12，000 | 4，502 | 12，000 | 11，928 | 270 | 2，007 |

"Lescadre de Ryy est la plus forte dea 3+ dans son trajet assez court, il est vrai, du port de Cherbourg aus cátes de Kent, elle peut rencontrer lescadre du (home servioe), qui etait, en 1846, de 6 vaisseaux et de 6 frögates, uans compter les ateaniers de guerre; il importerait dane de la partager en plasieurs divisions ; mais il west pas de notre compstence d'entrer dans des détails anasi rechniques, Toutefoie, il nous semble que, pour belairer la marche de cette grande flote de plus de 580 hâtiments, dont 224 navires de guerre, il pourrait étre convemahle de former une division compnsée de 1 ou 2 frégates ì vapeur et de 15 á 20 avisos, पuii jetteraient sur les côtes 6 ou 8,000 hommes pour préparer Jopération du debarquement de cette puissante arméer. Il resterait alors, pour le protéger, 11 rainsuux, 15 frigaten, et 3 grandes corvettes, c'ent-àdire, plas de 1,500 benches ì fen, suns compter lea bricks et les corvettes à voile, quie en représentent plus de 1,300 .
" Nous venons de voir que le port de Brest devrait pouvoir réanir 394 bitfimente, dont 99 grands navires de guerre, soit id voile, soit à vapeur, soit mixtes, et celuỉ de Cherbourg 684 , dont 226 bítiments de guerre. Ces deux vastes ports sont dans lea meilleures conditions possiblea pour proteger ces armements, il v'y a donc la luccune difficulté matérielle. Il ne parait pas en exister de plas graves à concentrer, 60,000 hommes d'infanterie sur Cherbourg et 50,000 sur Bresh, sauf la perte de temps ré sultant dea dernières ètapes quill fandra faire effectuer à pied à la troupe, faute de chemins de fer aloutissant à ces deus villes. Et c'eat peutétre ici le eas de déplorer la lentent inconcevable avee laquelle dea lignes ai utiles (puisqu'elles mettaient en communiration deus dea principaux porta de France avec le métropule) ont été poussées jusqu'à ce jour!
"Il eat bien évident que lea corps quì Feraient partie de larmée expéditionnaire seraient pris dahs les garnisons les plus rapprachées de ces deux ports, ou par leur situation topogtaphique, out par les rontea de ferr. Ainsi, pour le génie, ce seraient les villes d'Arras et de Metz qui fourniraient les troupes et le parer Toutea drux conmumiquent avec Paris par des chemins de fer. De Paris, le détachement deatiné anx escadres de l'Avon et de Plymouth prendra le chemin de fer de Nantes, et de Nantes on le dirigers aur Brest par mer ou par étapes de 28 kilom. Le détachement destiné à l'escadre de Ilye prendra le chemin de fer de Paris à Brrenx, et de là marchera par étapes sur Clierhourg; les garnisons de Stmisbourg, Metz, Rennes, ef Douai, fourniront lavtilleriez des conveis spéciaux amèneront les troupes et les parcs de Strashourg, de Metz, et de Douai; et le régiment de Rennes sera acheminé sur Brest par étapes. Les $E_{\text {Equipuges militaines viendrant de Laon, de Vernon, et de Paris. La cavelerie sera prite }}$ dans les garnisons du Mans, de Poitiers, de Paris, de Chartres, de Limoges, Niort, Nantes, Chitcaudur, pour Brest; daus celles de Cambrai, Valenciennes, Neaux, Versailes, Fontainebleau, Saint-Germain, Melun, Lille, Arms, Provins, Tours, Verdun, Rambouillet. Compiègne, Abbeville, et Vendime, pour Chenbourg.
"L'infunterie destinée à s'embarquer ì Brest ( 50,000 hommes) se recrutera dana lea garnisons de Saint-Briene, Lorient, Angoulème, Nantes, Napolém-Vendée, Rennes, Vannes, La Rechelle, Laval, Paris, ete.
*Celle destinée à Cherbourg ( 60,000 hummes) se reeruters daus les garnisons de Vereailles, Arras, le Havre, Caen, Duuai, Aruiens, Dieppe, Itankerque, Blois, Valenciennes, Laon, Onteans, Lille, Brreux, Verdun, Soinzons, Troyes, Paris, et Cherbaurg.
"Les chemiins de fer de Strasbourg, du Nord, de Dieppe, du Eavre, de Bouen, de Chartres, de Nantes, et de Lyon, serviront en partie aut transport du personnel et du matêriel de cette nombreuse armée; malheureusement, aussi que nuus Iasons déjd nharrvé, les dernièrea étapes devront se faire à pied, paiaqu'ancone ligne dáaboutit encore nià Brest ni à Cherbourg.
"Serait-il bien difficile de rêurir davarice à Cherboung et à Brest les lîtimenta de guerre et les transporte nécessaires à l'expedition? Nons pensons, nohs, que, si la
gnerre thá pus été prématorément déclarée, il sera facile au gouvernement de diriger sams bruit, de Toulon et de Rochefort, sur Cherbourg et sur Brest, des navirea à voile et des vapeurs de guerse. Quant aux transports, ils pourront se réunir d'abord par groupes à Calais, Boulogne, Dieppe, le Havre, et gagner de là les deux ports militaires pour y recevoir lear chargement; mais ces préparatife devront se faire prademment, pour ne pas damer à l'Angleterre de prétexte pour Jeur courir sus avant la déclaration de guerre,

- Maintenant, il peut étre curieux de sedemander combien de temps pourrait prendre l'embarquement des troupes et du materiel. Pour répondre à cette question, il est nécossaire de se reporter aux préeédents. Bn 1830. Nembarquement de 37,500 hommes pour l'espédition d'Alger prit 3 joura; d'apres cette donnée, celle des 9 escadres destinées à Yembonchure de l'A von et à Plymouth en prendrait 6, et celui de l'escadre de Rye 6 egalement. En 1880, il s'écoula 55 jours entre la proclamation insérée au Monitur le 20 avril, et la première dépeche datée de Torre-Chies, le 14 juin. Il est certain que si jamais la France se décidait à teuter l'invasion de 1'Angleterre, entre le moment de lembarguement des troupes et celuî de leur arrivée de l'autre côté du canal, le temps serait beaucoup plus court. Nous ne compterons pas le tempe nécessaire à la concentration des tronpes et du matériel et celii de la remion des flottes, car tant que ces preparatifs se feraient en secret, l'Angleterre ne devrait pas prendre d'ombrage ; admettons, sans sortir pour cela du domaine des probabilités, que le secret ne soit trahi que dès que les corps se prépancront à l'embarquement, le méme jour il sera porté de l'autre côté du détroit avee la déclaration de guerre; de Brest à l'embouchure de l'Ayon, il y à 34 heures pour une flotte qui pent être remarquée par de puissants steamers, et 17 beures jusqu'à l'entrée du Sound. En conséquence, 7 jours et 10 heures après Pordre envoyé de Pariz pour embarquer, T'escadre française No. 1 serait à I'embouchure de l'A von; 6 joure $\frac{1}{\frac{1}{2}}$ après, l'escadre No. 2 serait derant Plymouth. De Cherbourg à Rye, il y a 14 heures. Lescadre No. 8 mettrait done à peu près le même temps que la précédente à embarquer et tramsporter son corps d'armée devant les cótes de Kent."
"Si le lecteur prend la peine de relire Iopinion des hommes de guerre anglais qui avaient mission pour se prononcer sur cette importante queation, il sera forot de con-venir-qu'ł part l'augnentation de l'effectif de l'armée de terre, il n'y avait pas grande uniformité dans les conseils donnés au gouvernement. Il est vrai que la question n'ent pas simple. Pour étre résolue d'une manière convemable, il importe de poser d'abord certains principes fondamentanx.
"A. Ia défense d'un payn quelconque repose principalement sur trois chosea: $1^{n}$, ses places fortes; $2^{\circ}$, ses armées de terre (et de mer, si elle a des frontièrea maritimes); $3^{\circ}$, ses moyens accessoires de défense, tels que les montagnes, les parties de pays inabordables anx convois et à l'artillerie, et dans un sens inverse, les canaux, les chemins de fer, et les lignes de télégraphe électrique, comme facilitant la circulation du dedans au dehors, les concentrations de troupes, et les mancuyres sur les flancs de lennemi.
"B. Si le pays attaqué n'est pas, comme la Suisse, l'Italie, ou la Hollande, un paya decentralisé, sil est comme la France ou l'Angleterre, qui vivent de la vie de leur métropole, il importe que cetle métropole ne soit pas exposée à ètre enlevée par un hardi coup de main de l'ennemi, à la suite d'une bataille gagnée. Napuléon le dit, dans le valume ix, de ses Mémeives: 'Si, en 1805, Vienne eàt été fortifíés, la bataille d'Ulm n'eit par décilé de lissue de la guerre, le corps d'armée que commandait Kutusow y aurait attendu les autres corps de l'armêe russe dêja arrivés à Olmiitz et larnié du Prince Charles, arrivant d'Italie.
" + Si Berlin avait été fortifiée en 1806, l'armée latue à Jéna s'y fut rallié, et l'armée russe l'y eât rejointe.
" 8 i , en 1808, Madrid avait été unie place forto, larmée framgaise, après leo victorres
d'Rapinota, de Tudella, de Burges, et de Sonmosierra, neoot pas marché nur cette capitale en laibsant derrière Salamanque et Valladolid l'armée anglaise du Général Moore et Parmée expagnole de ta Romana; ces deux armées anglo-espagaoles se fuseent réunien sous les firtifications de Madrid à larmée d'Aragon et de Valence,
" 'Si Paria eat été une place forste, en 1814 et 1815 , capable de résister peulement huit joure, quelle influence cela nhaurait-il pas eue sur les èvénements du monde ?'
"Bufin, en parlant de Poccopation de Londres par lea Francais, nous avona vu un journal anglais (royez p. 108), délarer que, 'Maitre de Londres, Jennemi pournit imposer au pays les conditione les plus ignomizieuses.'
"Ces principes tme fois posés, examinons quel serait le meilleur plan de défense nationale à adopter pour 1'Angleterre:
"Conviendrait-il de creer min grand nombre de places sur le littoral, indépendamment des parts fortifiés et des ouvrages défensifo quil existent déja ?
"On voit donc bien que si le peuple anglais se résignait à voir fortifier si capitale, noneéplement l'opération matérielle ne serait pas impraticable, avec des sacrifices et un peu de patriotisme de la part des habitants des faubourgs, mais encore quielle serait la meitleure sauvegarde du payz.
"Comme d'ailleurs, ainsi que nous lavons dit, nous ne pensons point que jamais lopinion publique se laisse forcer la main jusqu'a consentir à voir Londres devenir une place de guerre, nous allons chercher quel serait le meilleur plan à adopter, à défaut de celoi-là, pour résister ì une invasion étrangère.
"Evidemment ce sont de grands camps retranchés, placés asses loin de la capitale, pour qu'à la suite d'une action heureuse pour ses armes l'ennemí ne l'occupe pas du méme coup, et reliés entre eux par des chemins de fer de ceinture, qui permettront aux troupen de se porter rapidement sur le point menacé. Ces camps devraient, en outre, âtre en cenomunication fahituelle avec la métropole par des lignes de fer aboutissant directement sur leurs derricres.
"Nons ne fixerous pas les emplacements de ces eamps ; il fatdrait avirir des accidents de ternin que présente la contrée à 10 milles de Loudnes environt une cmuaissance que nous ne possédons pas ; mais nous pensons que Ies indications du Colonel Lewis devriient être saiviea: it indique Shooter's-Hill, Croydon, Kingston, Windsor, Marlaw, et HyghWyenmbe. Voila pour le sud-est; mais il faudnait compléter is ceiuture an nord et à leat.
" 11 eat clair que le choix de ses emplacements decra dêpendre de plusiears sortes de considèrations:
" ${ }^{\circ}$. De leurs avantages stratégiques.
" 2 . De leur proximité des villes, villages, propriéles particulières, proximité tantót à éviter, tantôt à rechercher.
" 3 . De la direction des chomins de fer quilea traversent, de celle des courd d'eau, canaus, routes, qui se trouvecont a leur portée.
"Nous conseillerions pour les camps retranchés lemploi de la fortification mixte, cent-ì-dire, létablisscment enil temps de paix d'ouvragen à escarpes revétues en briques et a talua intérieurs également revêtus, pour empécher les ingures du tempt et ley dégradations que déformeraient par trop leurs profils. Pour courrir le camp, nous donnerions la préférence aax ligaes bastionnías el à balterier délackèer, parce quee ces lignes réunisens les avantages propres aux lignes continues, et à celles ì intervalles; efles permettent une défense active ef des retours offensifs. Linfanterie eat ì couvert, Jartillerie balaye lo

[^8]terrain en avant, et la carnlerie peut charger par les intervalles. Les trois armen se prêtent aínsi un mutuel appui.
"Ainsi que gous l'avons dit précédenment, naus n'essayerous pas d'evaluer exactement Ia dépense de ce camp retranché; mais nous doutions fort qu'il s'êlevat au quart de la somme de 10 millions de francs, dont parle M. le Colonel Lewis, ponr un camp de 25 mille hommes, areo des escarpes de 4 mètres de liauteur, et seulement en bome maçonnerie : dea talus intérieurs maçonnés en briques, et des contrescarpes nuan revêtues, il nous semble qque la construction des uix fronts serait exêentable pour 2 millions et demi de francs. Celle des bariques (en prenant les prix. de France) monterait envirom à la somme de 396,760 fr. pour un seul camp.
"Six ou sept camps retranchés placés autour de Loudres, à 10 on 15 milles de distance de la ville, appoyés à des rivières on placés aur dea hautrurs, donnenient à une armée de 60,000 hommes, et surtout de 60,000 Anglais, le double de sa valeur réelle, en lui permettant de livrer des batailles défensiver, genre d'action auquel le calme et la fermeté naturelle au caractère national la rendent éminemment propre. En outre, ce systéne de dêfense, sill était adopté, et si les ouvrages qu'il néceskite étaient exécutés peu ì pets, nentrainerait pas le pays dans des dépenses incompatibles avec le dóveloppement des grandes entreprises commerciales et industrielles auxqquelles il aime à se livrer.
"Il résulte de ce Mémoire sur la dêfense nationale en Angleterre trois conséquences eapitales :-
" 1 . Les chemins de fer anglais ne pervent contribner $q^{\text {we }}$ dans une certaine meanke à la défense du pays, et il serait imprudent de croire qu'ils forment la sente sauvegarde, comme on I'a avancé.
" $2^{\circ}$. Quel que soit le mode de fortification qu'on adopte, forts detachés, enceinte continue, ou camps retranchés, il faut nécessairement couvrir la métropule, et abundonner lidée de créer de nouvelles citadelles sur le littoral.
" $3^{\text {² }}$. Le personnel de l'armée de terre active doit être nécessairement angmenté, quel que soit le syatème de défense adopté, et cela plus tôt que plus tard, paree que la flotte ne pourra jamais à elle seule empêcher un deharquement sur les còtes d'Angleterre.
"Le travail que nous livrons à l'appréciation des hommés politiques et des hommes da guerre de la Grande-Brelagne sera lo, nous lespémns du moins, avec la persuasion qu'il a été dicté par un sentiment de complète impartialité. Et comment pourrait-il en être autre autrement? Lauteur n'appartient-il pas à un pays dont la destinée et le devoir sont de rester toujours neutre au milieu des conflits deses puissants voisins. On pourrait so demanđer s'll y a opportunité dans cetfe publication. Les événements dont depuis deux ans l'Europe est le théaitré, et la politique ndoptée par M. le ministre des affaires éirangéres en Angleterre, répondront pour nous. S'il eat permis d'espérer que la paix ne sera pas troublée, et que les grands gourernements de l'Europe continueront à virre en boune harmonie les uns avec les autres, afin de mieix réprimer chez eux les écarts désordonnés de I'esprit révolutionnuire, qui peut prévair les perturbationa que l'Egypte et Constantinople peuvent apporter un jour dans T'équilibre eurupeen ?
"L'Angleterre a raison d'avoir foi dans son étoile et dans la suprématie maritime que de longues Iuttes lni ont acquise; mais il serait sage à elle de ne pas en conclore qquele est invulnêrable. La navigation à vapeur, les chemins de fer, et le télégraphe électriques ajoutent pnissumment à ses ressources de défense ; mais ils facilitent aussi les moyens d'attaque, et aplanissent les routes qui conduisent à ses rivages. L'Angleterre a démesurément étendu ses enterprises commerciales et industrielles, en comptant sur in lung avenir de paix. Vojci trente-cinq ans que cette paix dure; sila guerre echatuit tout d'un
coup, serat-elle prebe à la soutenirł. Telle a été la pentée quif a emu quelqueb-uns des hommes éminents de la Grande. Bretagne, et qui leur a mis la plume à la main'.
"Telle eat aussi l'importante question qu'il nous a paru interessant de traiter ì un point de vae purement apecial et scientifique. Nouşaouhaitons de n'ëtre pas reaté trop au-densous de la tâche que nous avions entreprise."

There are two points to which it is not easy to put a negative to M. Maurices Finst, the probability of an armament reaching the English coast umdisturbed, and that the facilities of defence afforded by railways are very much exaggerated, and their valoe overrated in conveging infantry, artillery, and cavalry, to the points of debarkation. All that can be depended upon in the first instance is, that our navy should prevent a second attempt and the arrival of reinforcements; and in the second case, that the resourees of the riilway establishments should be devoted to the trameport of troops and their supplien under the control of the Quarter Manter General's department.

We mues, therefore, in considering any system of defence, concede the posaibility of an armament reaching our shores, and consider the means of repelling a hostile force on the spot, and view the railway only as the support to the troops actually engaged.

These considerations have engaged the attention of the compiler of this paper in his former speculations on this subject, and his propositions of defence are based upon them. Having in view, likewise, the improbability of any debarkation of an army occurring to the westward of Hampshire, these propositions were-*

1. That it was necessary, on the first rupture with France, to have atationed on the coasts a certain forec, distributed in localities calculated to meet any astempts to delark an army on our southern shores.
2. In the event of this presaution failing, that we ahould lave other resourcen; 1st, by a few places well fortified, parallel with, and at sowe diatance from, the southern shore of England; snd 2ndly, by a range of entrenched camps in the vicinity of London.

To carry out the firet suggeation of defence, it was deemed desirable, during peace, to construct larracks at certain localities, close to the coast line, and that they should form permanent posts, pmovided with every requisite for stores and provisions, and ready means to convey their garrisons to the points fhreatened by the railways, which now run parallel with the coast-the garrisons being about 2000 men, each composed of two or three battalions of infantry, two squadrons of cavalry, and two batteries of artillery. That if the precantions were not taken daring peace of eatabliahing these posts, it would be too late at the breaking out of a war, as it would only be at the commencement of hostilities that an enemy would have any chance of success. Hence it is that military men urge the public to consider the necessity of such defences as are required being constructed before they are wanted.

Recapitulating the former suggestions, in the probable order of their being brought into play, supposing is flect hovering aloug the accesaible points of our nouthern cossts in force, we have considered that the only mode of mecting an enemy in their attempt to land can be, ly having a moveable force in railway

[^9]waggons parallel with the hostile lleet; and when it anchors "the train will hatt, and the troops move to the shore ; the infantry will place themselves under cover of the beach, or epaulements thrown up by them at the moment, $t 0$ obtain security from a cannonade which will precede their attempts to land. The field battalious will take up such positions as will bent see the approach to the shore, and afford protection to themselves ; and the eavalry take advantage of some natural cover near the threatened point, dikmount, and wait until the enemy's boats touch the shore. This is the period for cavalry to act, to dispute the land ing, charging with vigour the troops scrambling out of the boats, unformed, and necessarily in great confusion; the feld-guns having previously kept a consfant fire on the boats from 1200 yards distance, with round, shrapnel, and case shot, for a period at least of a quarter of an hour, and the infantry, musketry, \&e, for five minutes.

In recisting an embarkation, the imporiant point is never to allow the troops to form when they jump on shore; but, by repeated attacks of cavalry, and charges of infantry, keep the enemy in confusion (until he is destroyed or surrenders), which a well-judged application of artillery and musketry fire will contribute materially to effect.

Indeed, it may be considered as an axiom, that no landing could be succeasfully effected in the presence of 2000 men well prepared, as explained above.

But to accomplish this, it has been suggested as necessary that certain localities should be occupied, such as

$$
\begin{aligned}
& \text { Ashford, } \\
& \text { Battle, } \\
& \text { Lewes, } \\
& \text { Shoreham, } \\
& \text { and Chichester; }
\end{aligned}
$$

and those places now destitute of accommodation should have barracke, stores, and everything requisite necessary for a mixed force provided ; and railway carriages kept in sheds, with locomotives ready to move at a moment's notice. And that these essentials should be provided during peace, in which the troops, artillery stores, provisions, and ammunition, could be placed in a few hours, on the probability of a war. This is not involving the country in a vast cost; probably half a million, or $600,000 \%$ of money, divided into an expenditure of three years $\%$. It was thought likewize, that these Barrack Stations might advantageously, with a trifling additional expense, be made secure posts of defence against desullory attacks, and be occupied by local troops, in the absence of the regular forecs, in the event of an invasion.
M. Maurice, among his several propositions, as alluded to before, gives an unreasonable leogth of time for collecting our scattered forces, but we apprehend it is not material what the period may be, if they are distant; and hence it is that we urge the importance of having military stations near the coast, ready prepared to receive our troops at the moment of danger; and thas assembled, would be soon organized, brigaded, and practised in moving to the shore by the milway

[^10]Waggons provided for them; very eskential, likewise, in respect to training, especially the hones, for this mode of conveyances.
The second proposition, eupposing that an enemy lad effected a landing, and secured himself on shore, was the consideration of a parallel line of defence, by the consiruction of three fortified placen between Lendon and the sea conata; and, under the nupport of these works, to defend the approaches to the capital, and diepnte any available advantagcous picee of grownd, so as neyer to allow the enemy to move, except in great force; and by these means render the advance an operation of ten days, which otherwise, without the defences alluded to, conld be accomplished in three days.

If. was thought that ground might be strongly entrenched, so as to afford a Place of Arus: First; near Tunbridge Wells, to command the communications from the coasto between Dungeness and Beachy Head, and support any defensive operations in the difficult country of the weald of Kent and Sussex. Secondly, at a spot near Balcombe, to command the communications to London from the coasts between Beachy Head and the month of the Arun River, and support likewise defensive opentions between it and the point of embarkation. The natare of the country greatly favours the advance of an enemy, being open, with many roads concentrating on the capital. This Place of Arms ahould be considerable, and well Fecured, as its position would greatly influence the advance of an enemy. Thisily a position on the banks of the Arun River, about fifteen miles from ite mouth.

What the nature of the defences of these three fortified places should be, it is unnecessary to discuss, but they should be strong enough to resist a coup de main, and require heary artillery to reduce them, that is, involving a siege operation ; the aggregate cost would be about 600,000 . Contemplating, then, that they were eatabliehed, armed, and equipped, and those near the coasts were completed, we will resmme the supposition of the enemy being on Ahore, secured and ready to move forward, which would be the mode of defence best, to alopt uatil we had suck an army collected and organized in force to meet him advantageonaly on the field of battle?

It would seem to be that we should form thase troops that were too late, or umable to repulse the enemy, into fliree divisions; giving three-fifths for disput ing the advance to London, one-fifth to hang on the enemy's flank to the castward, retreating, if presked, on its supports, keeping up its railway communieations as long as possible; and one-fifth to act on his tlank to the westward, also retreating, if pressed, towards Portamouth ; diaputing the passage of the rivers, and prevent him foraging and moving in small lindies; in these flank operations they would bo assiated by any local, irregular, or partizan corps, which should occupy the roads diverging from the coast between the milway lines, on which the regular troops are acting.

An enemy thus placed between theee columns, which would be inereasing in strength every hour, cau only advance on London by separating his force, however large, into four parts ; one to secure his position on the sea shore, two to secure his flanks, and the major part to move on London. It has been assumed, in the Ninth Volume of "Profesaional Papers," that the attempt could not be made with less than $1 \mathrm{H}, 000$ wen; we conceive, therefore, this ruast be diminished to 80,000 , in order to preserve his starting-pointe and flanky ; with this force, 80,000 , the enemy would probably move in three columes on different roads, sufficiently near for mutual support. This operation, necessarily glow, in order to clear the front

## 128

 DE LA DEFENSE NATIONALE EN ANGLETERRE.of opposing forces, would not exceed ten miles a day, and in fact would be an advance in order of battle. The third day he would be obliged again to detach largely to secure bis flanks, by investing the fortified places right and left. This would reduce his forces to 65,000 of nll arms. The fourth day, it may be a question whether, with this diminished army, he might not be obliged to fight a pitched battle in some advantageous position * prepared for it. This the enemy may chose to avoid, by turning the position and pushing on to London.
Quoting a queation, cousidered bypothetical, in the Ninth Volume, "It is proposed to imagine a system of defence capable of meeting such a contingency (the near approach to London): the position which it is conceived would form an advautageons line to eover it extends from Woolwich to Windzor, about thirty miles," the points to be fortified being

Woolwich,
New Croydon,
Kingaton-on-Thames,
Windsor.
This forms the third and last line of defence deemed capahle of being taken up between London and the coast; and sapposing, again, that the above points were occupied in strength, and our whole disposable force collected, with the exception of the moveable columns acting on the flanks of the army and the garriscns, it would be impossible to pass between these points; we may then prepare the ground for an advantageous field of battle, and the matter would be brought to a close by a general action.
It may be asked, why diminish our effective army by garrisons and detachments? To this it may be observed, that at the commencement of war a very large portion will be unfit to take the field and meet an enemy in battle; but it conld be well employed in garrisons, and brought gradnally into an effective state, by acting on the flanks of the enemy. At the commencement of hostilities it would be difficult to collect more than 50,000 effective regular troops to meet an enemy in the field, and then only after diminishing our garrizons of the regular force in every part of the kingdom, and supplying their places with new levies. To this force would be required 50,000 of the army in reserve, or that raised in the emergency of the moment, and probably only clothed, armed and supplied with experienced officers, and non-commissioned officers; and another 50,000 of local or volunteer and partizan corps, would be required on the apur of the danger These 150,000 comprising

> The army of reserve,
> The effeetive army,
> Sedentary irregular corps.

The foregoing olservations on the defences of the soath coast of England, which the work of M. Maurice has occasioned, will probably interest few beyond the military profession ; yet there is no doubt of the fact, that the United Services in France take an interest in the speculation, without any particular ill-will to this country. Therefore, as a mere question of attack, hypothetically considered by M. Maurice, it is met by a cometer proposition of defence, as explained above.

But there are several ways of viewing the specalations of conquest, fostered by the army and navy of France: to lecre things to chence, to the probable supre-

[^11]



## CONCRETE BLOCKS USED FOR ALDERNEY BREAKWATER. 129

mecy of the British naxy, or to the possibitity, in the exent of war, that the French will have ofler occupations. To these we must, for the present, leave the defenceless state of the country.

The attempt to excite the fears of the public, or awaken the serious attention of Government, so as to consent to the organization of an army of reserve of 50,000 men, ready to be called out, armed, officered, and equipped (somewhat upons the principles of the embodied pensioners), or to the construction of works and defences, may be deemed hopeless.
G. G. L.

November, 1851.

## PAPER IX.

Description of Conorete Blocks used in the Formation of the Breakwater of the Harbour of Refuge, Alderakey, Chansel Islands, May, 1851. By Captain F. C. Hassard, R.E.

Attrough the use of concrete in the shape of blocks for breakwaters, \&c, is no novelty, still a description of those used in the island of Alderney, for the construction of the breakwater now in progress, by the Admiralty, may be interesting and instructive, and especially so, as their goodness and durability have been so severely tried in many heavy gales there, and also from their being so well adapted to form an artificial foundation.

These bloeks are of different lengths, from 4 feet 6 inches to 7 feet 6 inches, in order to break bond in the construction of the work, and are placed under water by means of the diving helmet, as a foundation to the external and internal walls, as shown in section. (See Plate.)

They are made in the following proportions, the materials being measured separately, in a dry state, in proper boxes.

The Portland cement blocks consist of -
2 parts coarse shingle,
2 do. fine,
2 do. sand,
4 spauls of the island sandstone,
1 Portland cement.
11
The lime blocks:-
2 parts coarse shingle,
2 do. fine,
1 do. sand,
2 spauls of island stone,
1 part of ground Aberthaw lime.
$\overline{8}$
VOL. II. N. S.

They are made in strong frames or boxes (hereafter described), accurately con strueted, true, and square.
Two picces of manuce, or island stone, are introduced for lifting the blocks with lewises (fig. 2). The stones are 2 feet 6 inches minimum length, roughly squared to 12 inches at bottom and 10 inches at top, with a roumd levis-bole in the top of each, 5 inches deep and $1 \frac{1}{4}$ inch in diameter. (See fig. 2.)
The materials are well mixed and heaten together with wooden beaters, and incorporated with a due quantity of water, and are thrown into the boxes in a semi-fluid state, well rammed down around the lewis-gtones, so as to form, when set, a solid mass.

A superintendent marks and dates each block. The frames are taken off after from two to three days, according to the weather.

The Portland cement blocks are tested by lifting them four days after they are made, and the lime blocks eight days after.

If they do not support their own weight, they are rejected.
None of the cement blocks are allowed to be used in the works in leas than two months after making, and the lime in less than four months, if made in summer, and six in the winter.

A block, 6 feet $\times 3$ feet $\times 3$ feet, or 2 cubic yards, weighs as follows $:-$
Tons, Civts.

| Mortar | . | . | 8 | 10 |  |
| :--- | :--- | :--- | :--- | :--- | :--- |
| Cement | + | . | . | 8 | 14 |

One mason and six labourers make four blocks per diem, materials being close at hand.

An improved method of lifting the blocks has lately been adopted, as shown in figs. 6 and 7, as the lewis-stones before described were sometimes split in driving iu the leivis, which of course destroyed the block. To remedy this, a block of wood, 7 inches in diameter by 6 inches deep, is placed in the same position as the atones, (that is 1 foot 6 inches from the side and ends), and the materials filled in around them, which are allowed to set sufficiently, and the block is then withdrawn. A shoulder is formed by two pieces of stone, and the block completed, previonsly having a pleec of wood, with an fron bolt in it (fig. 9), placed over the hole (fig. 5). Before the bloek is uncased, the former (fig. 9) is withdrawn, which leaves the space for the insertion of the key (fig. 10), which is inserted and turned round as shown in figs. 6 and 7.

A better method than uxing the wooden plug is shown in fig. 8 , which is two pieces of conerete, moulded previously, which are placed together at the bottom, as shown in the figs. $5,6,7$, and the material filled around them at once, It has been foumd most convenient to make these blocks on a block ground ; or mather a series of lottoms of eases, as in fig. 1, are laid, with sufficient space to enable a free passage between them. A moveable crame is erected over them, and they are lifted and piled one over the other until required for use,

## Blook Cases.

The eases are made of 3 -inch planking, bolted through with 3 -inch iron bolts between the cross-pieces. The four sides of the case are placed on a bottom (fig. 1). and mecured tightly together by four iron bolts, which are tightened as required by iron washers (vide figs. $1,2,3,4$ ). The end-pieces are notched into the sidepieces, and ure strengthened at those pointe by a piece of rough timber, as ahown in elevation (fig. 8), and are bound on the top with iron, to prevent the wear and tear diminishing the size of the block. They are then filled as before deacrilied.



The cost of these blocks will of course vary at every place with the priee of material ; but it may be useful to know that a cement-block of 2 cubic yards will require $5 \frac{1}{2}$ bushels of cement, and a lime-block of the same size $6 \frac{1}{8} \mathrm{cwt}$. of blue lias or Aberthaw lime. These blocks have been found to resist most effectually the action of the sea and weather, and have been thrown off the breakwater without other damage than the edges being slightly chipped where they have come in collision with the rocks and stones.

November 15, 1851.
F. C. HASSARD,

Capt. R.E.
(2)
A CATALOGUE
OF-THE
PUBLICATIONS
08
J OHN WEALE,
ON
ARCHITECTURE,
CIVIL, MECHANICAL, AND MILITARY
ENGINEERING,
AND ON
NAVAL ARCHITECTURE, AND SOME ON MEDIRVAL ART.
Tonion:

No. 59, HIGH HOLBORN.
1851.

Hughes, Printer, King's Head Court, G ough Square.

## INDEX OF AUTHORS AND WORKs.

## The figteres refer to the gaget.

Adeock, $\mathrm{H}_{1,} 15$
Aide-Mémnine, 03
Alphiabets, 86, 67
Appendices to Trudgold, 11, 12
Aqumiluct, 37
Arelict. 23
Arebos, 93 , Contractor's
Pócket Book, 9
Architectural Drawlas Book, 34, 68
Archifecture, 63, 67, 6i9
Arehifecture of Aretropolls, 8
Armatrong, $\mathrm{R}_{\text {, }}, 71$
Artilery, 32,39
Atmonpheric Railweys, 17
Balcer, T, 70, 71
Barlow, $\mathrm{y}_{4} 24$
Btand, W, H, 53
Bland, Wis
Bailers, 71
Botanic Gardena, 66
Bridges, 20, 25, 23, 07
Buchanan, 24
Buck, G. W. ${ }_{y} 23$
Building, 5
Act, 81
Burgoyne, Sir J., 4S-52, 69
Burnell, G. R, 22
Cabinet Makins, \&e., 34, 35
Curpentry and Joinery, 3,26
Carr, J., 23
Cements, 30,70
Churches and Chapels, 86,59 , $60,61,64,65$
Civit Enginecring, 69
Clark, E., 29
Clocker and Watcher, 71
Conservatories, 66
Contractor's Pocket Book, 9,10
Cornish Engine, 4,19
Curves, 18
Day, J. 17
Decoration, $53-55$
Denison, E. B., M.A., 71
Dictionary of Termi, 69,72
Dilapidations \& Nuirances, 8
Dobson, E., 16, 17, 33
Domestic Architecture, 61, 66
Draining, 69
Dredging, 40
Ecclesiartical Art, 53-57
ElixabethanArchitecture, 10, 65
Eagiacer's and Contractor's
Porket Book, 10
Enginecring Drawing Book, 59,68
Estates, 31
Fairbairs, W, 23
Fergusson, J., 27, 29, 6:
Fortifications, 53
Freach Ornainent, 35
Frome, Captyon Surveying, 43

## Gailhabaud, 57 <br> Galton, T., 18 <br> Gardens, 66 <br> Gardner, E. V., 16 <br> Giblons, D., 31, 32

## Gothic Archite turv. 63-65

 Gradients, isGreat Britaia Iron Steam Ship,
10, 11
Gregery, Dr, Otiathut, 10
Harbouro, II
Hart, J. 29
Hisviland, 34
Hether, 1, F., Mr.A., 7
High Preraure Eakinct, 4, 11
Honsed of Parlinment, 21
Auntiagton, S. I., 18
Hydnutice, 22,70
Tndla, 6n
lowond, W, 31
Irom, 24, at
Iron steam Yearle, 10, 11 Imilian Jural Architecture, 7

Jerusalem, 63
Jones, Majaz-Gen. Bir Jt, 39
Kemp, 66
Knuwles, 38
Law, H. 10
Leeds, W. H., 8, 03 Leithart, 33 Lewis, Columel, $49-52$ Lighthouser, 70
Lascometive Engines,4,14,15,70 Lodges, as
London Guide, 7
$\longrightarrow$ Sfap of,
Machinery, 24, 25, 82
Marine Enginer, 4
Dathematical Series, 70
Ifathematico for Pract. Iten, 10
Mathems. W., 99
Afechanic's Warkahop, 29, C9
Mechanical Drawing Mook, 59
Sediartal Art, 53- 57
Meteorology, 33
Military and CivilEngineering 43-52
Mill Work, 24, 25
Mineral Veinv, 35
Mints, 38
Momments and Chinuney.
Pienel, 35,37
Mrushet, in
masiet,
Masic, 71
Naval Architecture, $37=32,71$
Oblique Anclice, 24 , 29
Ornament, $35,36,65$
Ornamented Iron Work, as
Psinted Glas, 53-25, 59, 60 Patmer, H. Hi, 29
Frmbout, Cotant, 14, 15
Papers of the Chrpe of Royal
Engineets, $4: 10$ - 88
Parker, Oharler, 7
Parken, 35.66
Patenth, if
Peacocke, IR. A+, 29
Poake, J., 71
Pole, $W_{21} 13,14,27$

Fort ni Londati. 27
Practical Philtasuplyy, 28, 69 Prianos, 41

Tublie Worki of Ameries, 27 , 24
Pugin, A, TF. G :
Pumpmas Erginet, 37

| Quartenly Papers on Arcli- |
| :--- |
| tecture, 54 |$\frac{\text { Engi- }}{\text { necring, } 30-i 1}$ En

R-iltwayn, 15-18, 71
Reld, Liest.-Cul. 32, 43, 14
Keanie, Geobler, 24
——, sir Johit, 3, 67
Rivers, 29
Roofs, 24,26
Roynl Eingineer , 43-52
Rudimentary Werks, 60-71
Etural Architecture, $7,06,67,70$
Screw Propelling, 12 Sepulchrad Monuments, 57 Ship Brilding, 37-39,71 shop Fronts, 7
Siuges, 83
Smith, Major, M.E., 30, 33 Spencir, 0. ©., 71
Spragu, 57
Stalned Glass,59-55, 59, 60
Staincazes and Hovi-rails, 6 stadkartt, 39
Stcam Engine, 4, $11-16,69$
Steam Navigation, $10-12$
Steel, 24
Stephenson, $\mathrm{B}_{1,} 17$
Sterenson, A., 70
St. Panl's, 67
Strength of Xraterials, 23, 24 Stuilent's Guide, 33
Suffolk Antiguities, 6
Summericld 88
Surveying 43,71
symbolle Colours, 33
Tahlea, 31
Temple Churob, 59, 60
Templeton, W, 28
Thorman, I.. 16
Tidal Itivers, 19
Tools, 24. 25
Transactions of the Iusfitution
of Civil Enginerrs, 41 - 43
Travelters' Club, 69
Trudpold, 4, 23, 26
Thibular Dridgei, 2s, 70
Yentilating, 30,71
Veriadahe, 7
Yilla Architectore, 7
Warming \& Ventilating, 30,71
Water, 37
Water, Whecls, 9
Watir Whecls, 29
Wiclateed, T., 13. 14
Wiphtwiel, G., 64
Withs, Prof. F, R, S, Cam, ng
Vitome, B, P., 68
Wood Wirk, 5
Woodn, J., 64

## JOHN WEALE'S

AMEXDED

## CATALOGUE OF WORKS.

1. 

## SIR JOHN RENNIE'S WORK

## THE THEORY, FORMATION, AND CONSTRUCTION OF BRITISH AND FOREIGN HARBOURS.

## 玵ustrateo by numeraus eframptes.

The history of the most ancient maritime mations affords conclasive evidence of the importance which they attached to the construction of secure and extensive Harbours, as indiepensahly menenary to the extension of commerce and navigation, and to the suecessful eatablishment of colonies in distant parts of the globe.

To this imporfant subject, and more especially with reference to the yast extension of our commerce with foreign nations, the attention of the British Government has of late years been worthily directed; and as this may be reasonably expected to enlance the value of any information which may add to our existing stock of knowledge in a department of Civil Engineering as yet but imperfectly understood, its contribution at the present time may become generally useful to the Engineering Profession.

Impressed with these views, the Author, at much personal inconvenience and at considerable expense, feels it his duty to contribute to the accomplishment of so desirable an object, by the publication of the results of the experience accumulated during the life and practice of the late Mr. Rennie, in conjunction with his own labours; and as it is most desirable to adopt the means of giving exteosive circulation to the subjects selected, it has been determined to produce the work at the lowest possible price.

Seventy-four plates, comprising nearly one hundred subjects, are already engraved, and those which illustrate the following ancient and modern Harbours are ready for publication; viz.

| Agina. | Cherbourg. | Halicaroasam: | Newhaven. | Sidom. |
| :---: | :---: | :---: | :---: | :---: |
| Ancona, | Chester. | Hartlepoal. | Nisita. | Stanehi |
| Antium. | Civita Vecella, | Holyliead. | Northfent. | St, Michant, |
| Ardrossan. | Clyde. | Howth. | Palermo. | Sunderland, Svracuse. |
| Athens, | Delaware. | Hall. | Peterbead. <br> Peinta Dileania | Tarentum. |
| Belfast. | Domaghadec. | Kingstarn. I, ith. | Panta Dolgaria. <br> Port Patriek. | Tunis |
| Berwick. Boudran. | Douclas. Dover. | Eeith. Liverpopl. | Purzoli. | Tyme. |
| Bridlington. | Fraserburgh, | Mersima. | Famsgate. | Tyre, zee se. |
| Brindie. | Gensm. | Miachum, | Jye. | \%e. sre, se. |
| Carrickfergus. | Girgenti, | Myrdus. | Searborough shecrneal. |  |
| Carthage. | Greenock. | Naples- | shecroesw. |  |

Fifty more subjects are in the hands of ewinent engravers.
To these it is intended to add numerous details of the principal Euglish and
JOHN WEALE'S AMENDED CATALOGUB FOR 1851.

Continental Harbours, with historical, theoretical, and practical explanations; and it is unticipated that the work will thus obtain the patronage which its novelty and importance are presumed to merit.

The plates and letter-press will be printed in folio, in the best style; and both are in such an advanced state as to gnarantee the publication of each Part, containing six plates, with the descriptive letter-press, on the 1st of each succeeding month.

Each Part will be delisered in a handsome wrapper, price 12s, for prints: or 188 , with proof impressions of the plates; and the work will be completed in Twenty Parts.

Subscribers are requested to forward their names and addresses, as it is intended to print a list of the names of those who by their patronage may promote the successful progress of the publication.

Parts L. to V, are already pablisbed. Parts VL. and VII, in May, 1851, aml the continuation will be regularly issued every month, till completion.

## 2.

## TREDGOLD ON THE STEAM ENGINE.

In Monthly Parts, price $28.6 d$. eacb, in 4to, illustrated by upwards of 200 engraviugs and numerous wood-cuts, a new and much extended edition of

## THE STEAM ENGINE,

## IN ITS PROGRESSIVK AND PRESENT BTATE OF IMPROVRMENT :

practically and amply elucidating, in every detail, its modifications and applications, its duties and consumption of fuel, with an investigation of its principles and the proportions of its parts for efficiency and strength; including

## EXAMPLES OF

Division A. -1 . Locomotive Engines for Railways, practically drawn and explained,
B.-2. Morine Engines for Sea and River Service, with the Construction of Stenm Vesseln, Britivh and American.
C.-3. Stationary Encines employed for all linds of Manufacturing Purposer.
D.-4. Enginen euployed in Afines for raising Water, of for supplying towns with Water.
E.-5. The Cornish Pumping Engine, and its several effective duties,
F.-6. Engines for Mill-work-Flour-Mills-Cotton and Spinning Factories - Sugar-Refining, \&e. \&e.
G.-7. High-pressure and Non-condensing Enginer, Forcign and English.

Tae well-known and highly appreciated Treatise, Mr. Tredgold's national Work on the Steam Engins, founded on scientific principles and compared with the practice of the best makers - also showing easy rules for construction, and for the calculation of its power in all circumstances-has commanded a most extensive sale in the several English editions, and in Trauslations on the Continent. These editions, now out of print, have been generally limited to the purchases made by the principals of firms-the price of the work having caused it to remain as a sealed book to the working engineer, the student, the amateur, and the apprentice.

This new and much extended edition will embrace all the most recent im-
provements in the construction and practical operations of the steam engine at home and abroad; and for the purpose of rendering the work more intelligible for study and more practically useful, the algebraic and mathematical calculations will be reduced to simple arithmetic, by wrich means it will become accessible to all grades of persons, who will thas be enabled to possess, at the moderate expense of $28,6 d$. monthly, a work which theoretically and practically elucidates the distinguishing peculiarities of the several kinds of steam engines.

As the work will be divided into several sections, either of which may be purchased separately, working engineers will be thus enabled to select those portions which more eapecially apply to the objects upon which they toay be respectively employed : every new and useful improvement will be amply noticed, and placed before the subseribers in a practical and usefut form.

The superior engravings by which this edition will be illustrated are eminently calculated to create and mature the abilities of a numerous and ingenious class, by whom they have hitherto been unattainable; and to whom this work is now addressed.

Practical engineers, and others interested in the production of this work, are ibrited to formard suel suggestions and contributions as may enhance the high character it has already acquired, developing the practice in the several useful applications of the art by which steam is used, under various modifications, as a motive power.

Several scientific men, extensively and practically employed, have undertaken to contribute original and really practical papers of the utmost utility; by which the value of this extended edition will be much increased. A copious Index for reference will be supplied, which will reuder the work accessible to all classes.
Division A. Locomotive Engines, 41 plates and 55 wood-cuts, complete, making Vol. I. In half-morocco binding, price E2, 12s, 6dt.
*** Some few copies with the plates printed on atlas folio, and text in quarto, price $£ 3.3 \mathrm{~s}$.
Diviston B. Marine Engines, British and American, numerous plates and wood-cuts, making Vol. II., in the course of publication.

## CARPENTRY AND BUILDING.

## 3.

Now complete in 2 volumes 4 to, with 190 plates, price $.22 .16 s$, in cloth boards, lettered.

## C A R P E N R Y:

a comprehensive and useful work for Carpenters, Builders, Workmen, and Students in Architecture.
Vol. I. comprises the purely elementary - B book of lines;-geometry;practical rules on the art of drawing for the operative buider and young student in architecture:-rules for drawing buildings;-principles ami practice of colouring, and putting in effects for architectoral drawing, \&e.

Vol. II. consists of subjects of practical atility and of recent desiga and construction io the Classie and Italian styles;-plans, elevations, and details
of club-houses, taverns, shop fronts, verandahs, dee; ancient timber constructions, opeu roofs, \&ic.

|  |
| :---: |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

The preceding works may be had in separate forms for the convenience of purchasers, each having a diatinctive title.
Vol. I.-Elementary part, complete:
Nicholson's Carpenters' New Guide: a book of lines considerably improved, with additions to the present time, and containing an Introduction to Practical Mathematics and Mensuration, together with practical rules on drawing, for the operative builder and young student in architecture. 74 engravings, cloth boards, price £1. 48.

Vol. II.-Complete, Practical :
Staircases-details of the constructiou of wooden columns-plans and elevations of club-houses-twenty-six illustrations of verandahs-practical illustrations of architecture - roofs and ecclesiastical wood-work joinery of Windsor Cassle, and at Lilleshall, Salop-shop fronts, \&c. 116 plates with text, cloth boards, price . $\mathbf{E 1 . 1 2 \%}$.
4.

STAIRCASES AND HAND-RAILS.
Practical Examples and Illustrations of Staireases and Hand-Rails, improved to the present time, with several Elizabethan examples, - geometrical stairs,-plan and section of a geometrical staircase and level landing, with quarter space of windows, - plan and section of a geometrical staircase, with whole space of windown-oylinders for strings, casings-off, \&ec, With text and 44 plates, price 18 m ,

JOKN WEALEI'S AMENDED CATALOGUE FOR 1851.

## GUIDE OF LONDON - ITALIAN ARCHITEGTURE. 7

5,

## VERANDAHS.

Select Examples and Designs of Modern Verandahs, consisting of elevations, sections, and details, principally selected from the best examples taken from Brighton, 26 plates, cloth boards, price 12 s .
6.

In 1 volume, illustrated by 205 engravings, price 98 . LONDON AND ITS VICINITY EXHIBITED IN 1851;
comprising its History (Ancient and Modern), Antiquities, Galleries of Art, Public Works, Arts and Manufactores, Learned and Scientific Societies, Public Libraries, Club-Houses and social Institutions, Corporate Bodies, and Government Oifices, Observatories, \&c., \&c., \&c-; together with such useful references as are uecessarily comprehended in a work of this nature, and an elaborate Map, accurately and scientifically laid down from the reeridian of St . Yaul's.
7.

## A MAP OF LONDON

## TRIGONOMETRTCALLY LAID DOWN.

A Finding Mar of London and its neighbourbood, drawn and laid down from the several points taken from the meridian of St. Paul's, under the direc-
tion of the Ordnance Department tion of the Ordnance Department.

Size: Map 3 ff . 2 in . by $2 \frac{1}{2}$ feet, price, plain in a sheet $28.6 d$.

8.

## SHOP FRONTS.

Select Examples of Modern Shop Fronts, consisting of tested elevations, with the sections and details. 9 plates, cloth boards, 68 .

## 9.

ITALIAN RURAL ARCHITECTURE.
In one vol. medium 4 to, 72 finely executed plates, price in cloth neat, E1. 16 s .
THE RURAL AND VILLA ARCHITECTURE OF ITALY, portraying the several very interesting examples in that country, with estimates and specifications for the application of the same designs in England; selected from buildings and scenes in the vicinity of Rome and Florence, and arranged for Rural and Domestic Buildings generally.

By Charles Parker, Architect, F.I.B.A., se.
JOHN WEALE'S AMENDED CATALOGUE FOR 1851.

## ARCHITECTURE OF THE METROPOLIS.

10. 

## ARCHXTECTURE OF THE METROPOLIS.

A new edition, with $1 / 6$ plates, and about 800 pages of letter-press description, half-hound in morocco.

## ILLUSTRATIONS

## or

## THE PUBLIC BUILDINGS OF LONDON:

originally edited by the late Augustus Pogis, Jonevit Gwint, J. Butros, and others,
and newly edited and enlarged by W. H. Leens.
This is the only work which describes fle vurious stroctures of the Metropolis areditecturally by means of plans, clevations, and occasionally both sections and interior views, thus affording a complete and correct knowledge of each edifice in its entire arrangement in all its parts and ditmensions.
As studies for the Architect, the subjects contained in this work atrongly recommend thiemselves,-more particularly 80 , as of the majority of them no plans and elevations are to be met with in any other publication, which materially enhances the interest of this collection, while it preserves to us authentic and tolerably complete records of many buildings which no longer exist. Among these ane Cabliton Bowse, illastrated with several plates, including sections, and a plan of the private apartments; the late Engush Oprra House; Mr. Nash's Gallyur, (which has since been dismantled of its embellishments), \&c., \&ce.
To architects, builders, stuilents 13 architecture, and amateurs, this desimble work for professional use and stuily is offered at an extremely moderate price.

LIST OF PLATES AND ABSTRACT OF SUBJECTS. FIRST DIYABION.

Adam. R., archilect.-All Saints' Chureh, Poplar.-All Souls' Church, Langhan Place.-Ancient Theatres.-Aitley's Amphitheatre.
Bealey, S., archítect.- Berlin, theatre at. $^{\text {B }}$ Bordeaux, theatre at.-St. Bride's Church, Fleet Street ; spire, interiar, and altur-piece,-Burton, Decimus, architect.
Chelsea, church of $8 t$. Luke at,- Churches, remarks on galleries in.-Cockerell, C.R., ar-chitect.-Calosseam.-Covent Garden, St. Paul's Church.-Govent Garden Theatre.
Dimensions of domes.-Diorama.-Dormes, table of dimensions of the principal ones.Drury Lane 'Theatre.-Dunstan's, St., In the Enst, tower of,-Dunstan's, St., in the Weat, Fleet Street.
Elmes, Mr., his plan for improving the aren around St. Paut's,-English Opera Housc. Gallery, Rogal, and staircare, House of Lords. -George's, Str, in the East,-George's,Stn, Itoomshury, its steeple,-Gibbs, James, architect.
Halls, dimensions of.-Hanover Chupel.Hardwick, T., architect.-Hawkamour,N.,
arehitect. - Hoymarlet Theatre, - Henry the VIIth's Chapel,-Hope, Mr.-House of Lords, staircase, and Royal gallery.
fuwond, Measrs., architects.
James's, St., Piccarilly, -James, 5 t,, Theatre.-Jones, Inigo, architect.
Kinights Templars. - Kinights Hospitallers. Law Courts, Westminster.-Lyceum Theatre. Mary, St., Woolnoth, church of-Mary-lebone Clurch, account of,-Mary-le-Bow, St., church, steeple.-Moller, architect.Monumentr at St. Paul's.
Nash, J., architect.-Newman, J., architect. Opera House, Italian.
Paul's, St., Cathedral : description of the former cathedral; history of the present edlifice ; deacription : compared with St. Peter's ; monumental scalpiture.- Paul's, 8t., Corent Garden,-Peter-le-Poor, St., church of.-Porticoes, remarks on, by J. B. Papworth.-Pugin, A., architect.
Talph, his opinion on Sit. Steplien's, Walbrools; and St. Paul's, Covent Garden.Repton, G. S., architect.-Royal Amphitheatre, Westminster.

JOHN WEALE'S AMENDED CATALOGUE FOR 1851.

Sayage, James, arehitect; his fustification of thin tower of Chelsen Chureh,-Shaw, J., arehiteet. - Smirke, Sir R., areliferti Soane, Xir J, architect, -Spires, remarke soane, xir Jt, architect,-spires
un.-Stephea's, St, Walbroilc.
Temple Clunch, history i munuments: de seriptim.-Thestres, rewarks uth-Thomonal, areliteet.

Wallorook, St, Steplien's.-Walpole, Hirace, lis uplniou nf St. Paul's. Corent Garden, - Hetminster Ahiey, - Weatminster Hall.-Willement, T., painted Window by, Hall.- Willement, Th, painted window by,
in St. Dunitan's West-Wison, E., J., in St. Dunitan's Weit-Wilson, E. J.,
rumsrles of spires by, descriptlon of rumsike on spires by, description of
Weatminster Hall.-Wren, Sir Chrinto-pher.-Wyatt, Benjamin, arehitect.
stecosp divisrok.

Atraliam, It, and Alam. Nubert, architectorArch. Grem Purli--Athburnham Howere Hant of Eugtumi, account of; New Divilend Pay Oftice,-Bakeri, G.. arohitect,-Banquiting House, Whitehall-Barry, C., arclitect.-Barsy, James, painter.-Bel. gruve Square. - Bethlchem Hospital:Blickfrian' Britge.-Bonami, Jus., armhf-teet,-liridges.-Londoa Bridee,-British Mureum, account of; description of the Dew huidians-Bronks. W.: architect Burliniston House,-Burton, D. Direliteet.
Carlton Paluce,-Chambers, Sir W., archi-tect-Christ's Hospital, New Hall.-Club-
 - Cinh-Home, Enivernity.-Cookerell, E. R., architect, - Collage of Physicams Warwiek Lane; and Pall Mall EwhColumn. the York,-Carn ExchangeCornvall Terrace.-County Fire OffiesCusturn House.
Dance, $\mathrm{Mr}_{\text {t, }}$, architect:-Dould, Ralph, enginear.
Eaton Square.
Fishmongers' Hall: former hailding : new Hall: interiur deteribed.-Freconssons Hall.
Galleries, dimensiuns of various:-GandyDeering, architeet.-George's, 3 , , His pital.-George's, St.. Blommshury, portieg of.-Grecian architecture, modern, remarike on,-Greenough's, Mr., Villa.
Hollam Hunae.-Hollind, H., architect.Hone's. Mr. House,-Hirse Guards.Hostital Bethlehum, - Hokpital, st, Gearge's.
India Hense.-Intereolamniation, remarle on the term.
Tones, Inifo--Jupp, B., architect.
Kendall, H. F., architect,-Kent, W., arehi-tect,-King's Callege.

Inatitution,-London University,-Landon Bridec, the old onet the new ope.
Mfansinn Hause,-Mark's, St., North Audiey
Street, - Musum, British, - Muscum,
Snancath-Mrylne, R., architect.
Nasi, J., arcliteet.-Namh's, J. House and Gallery, - National Gallery.-Nowgate.
Palace, Buckingham: interiur, sculpture gallery t atate iphartmentri- Popworth's remarlis nu Sumerset Houne ; on Engtioh Villas.- Pirmico Institution, pertico of.Vites, W-, seutpture br-Fiemarls ou the Rengat Exchame. - Partico, st. George' Horpitals Nitional Gallery + Londan Univenity 86 . Martin'e St .George's, Btomas: bury; Carlton Palscet-Post Ófice,-Privy Cauncit Oilice, $k$,
Halph. Mn-Regent) Tark,-Rennie, J. enginecr.- H thlarts, $\mathrm{B}_{4}$, arehitoct-Hoya Exrhange; deatructimi of the buliding by fire--luasell motitution:
Samilby, T., arehitect.-Saunders, G., arehis-feeti-sinw, $X_{11}$ armhifeet. - Sion Park Gateway.-Smitho, Sir Robert, arehiteet. -Smifl, (f., architect.-Snase, sir J., architect, his House an 1 Musemm,-Enciety chitect, his Homse andarueum, Sonaer nt Arts.
\#ridie.
thatar, Sir T., architect.-Telford, Mrr, his opinion of the Mansiou Bhase,-Temple Har.-Terraces in Regent's Park.-Trarellevs' Club. House
Vardy, Atr., architect.-Vouzhall Bridgt.Villa, Mr. Burtom's-Villu, Mr, Greep-ourh't.-Villa, Mr. Kemp's.
Erion CInl-Heuse, - University DittorVxhridec Hous.
Walpole, Hurnee, his character of L.ord Burlington: remark os Burlington House. lington: remarke S, arehitect-Waterino Bridge.Wetminater Hrilpt-Welliagton Bowse. Wentminater Bralge,-W einagton arowse.
Wilkins, W., and Wren, sir C., anchitects. Wilkins, W., umd Wren, sir C., srehitects.
York Column,-York Stairs Water-gate, \&c.

## 11.

In morocea back, price 6s.

## The ARCHITECT'S, BULLDER'S, AND CONTRACTOR'S POCKET BOOK OF PRICES, yOR 1851,

corarrising the prices of materials used in building; cost, as establifhed by Her Mojesty's Othee of Woods and Works; with remarks ont the rates at which they bave been taken by the lmilders and contractors employed; together with Notitia Architectomica,-principles of construction-on semvers, and samitary regulations.

JOBN WEALE'S AMENDED CATALOGUE TOR 1851.
12.

In moroceo took, price 6s.
The ENGINEEL'S AND CONTRACTOR'S POCKET BOOK, REVISED FOR 1851.
15.

In one large vol. 8 vo, third edition, revised and enlarged by B. H. Law, C.E., with engravings, price 2 la. in atroug half-marocco.

## MATHEMATICS FOR PRACTICAL MEN :

being a commou-place book of principles, theorems, rules, and tables, in varions departments of pure and mixed mathematies, with their application especially for the use of Civil Engineers, Architects, and Suryeyors.

## By OLINTHUS GREGORY, LL.D., P.R.A.S.

The plates are folded in the book, bot spaced out for reference whilst reading any part of the work, and consist of

1to 5. Geometricul diaurnme-aso figure. f. Detaile if a birent meterurticel.
․ Fenton, Mfurray, \& Ca's steam enfing.
3. A sitshorne culine cuastrusted by Thor. Middleton, London.
9. A six-horre encine, alites, eylinder, \&e.
. A akberto

1. Tongitudinal section offocomotive engioe. I. Transfecrie rection of do.
2. Scetions of the cylinders of Wonlr's eagine, Corriab engine, and Atmoopherie eogine.
isometrical peripective.
3. 

## separate prints or

ELIZABETHAN ARGHITECTURE AND ORNAMENT.
The work on Elizaberlan Areliftecture, published at 36 s., being out of print, some few of the engravings may now be had at 18 , each, as follows:

Vlew of entranes gate lodge, Claverton.
Claverton terrace-work.
View of Claverton Hounc-entrance.

Details of serecu of an old howiont Petomidd.
John Thorpe's desiga for Land Burleigh.
Fac-simile of un old draving on purchiment,
by Fobert Pyte. (Henry vilt.)
Serven and stairease, Clavectati.
Batusters, ztairs, dee, Claverton.
Compartment carving, do.
Door carring, do.
Chimnos-picec, do.
Chimnoy-picese do,
Details of climney-piece.
Detriiss of pilastern.
Details of balustrades.
Plan of the pld Manor-House, Claverton.
Interior and chimnors-piece of the ald Duke's
House, Bradford.

Chimney-piece, \&c., st Bradford. Staircase to offiress, Holland Houne. Entrance porch of do.
Sercen at Corsham House, Wils.
Phtn nf John 'Thume's Honse. Phat if Jahn 'Thorfie's House.
Phan of do, (snothere) Plan of do, (another.)
Vlimhethen ornaments. Elizaliethan ormamente. Skerch.-Jnhn Thurpe. Elizabichan pulpit, North Cray. Ombipartment of den, on a larger scale. Detmite and chrvings of do. Klizaliethan cellingy-Eiristol. Ceilinga-Dake's Houte.
Chimney-piece, Star Chamber, Weatminster. Vorth wide of the Star Chamber. Vorth suide of the Star Chamber.
Campod onk pilasters at Petersfield. Anvient pipe-heads at Claverton. Cleansing fountain at Nuremburg. Details of staircase, Holland Honse.

STEAN NAVIGATXON.
15.

In atlas folio size, with 25 rery finely engraved plates by La Keux, price $25 s$. THE GREAT BRITAIN ATLANTIC STEAM SHIP OP 3500 TONS,
constructed of iron, with engines of 1000 to 2000 horse-power, and the screw propeller ; wifh icaleठ and figured dimensions to all the parts.

JOEN WEALE'S AMENDED CATALOGUE FOR 1851.

## LIST OP PLATES of TIE GRLAT DBITAIN.

1. Section of fore end of engine-rwom, looking aft.
2. Section at after eod of the boilers.
3. Bettion through the centre part of the engias-room, looking forward.
4, 5, Flans, elevations, mad sectims of the cylindert.
6, 7. Main driving slaft and cranks, detalls. 8,9. Section at the fore end of the boilem.
10, 11. Air-pump, connecting-rod, elevation and plan of the parallel mition, airpaups.
12, 13. Piston, ruds, and parallel motion blocks, with plan.
14,15 . Section showing the manner of cany-
lig the cargo deek, and dispoaition of the plate-alcepers in the ship's bottom, after end.
10, 17. Sectioniat the after end of the ressel, shoming sleepers and fower carion dect, 18, 19. Upper carga deck, forward, Showing the mode of fixing to the sides of the vessel.
20, 21. Plan of the engine and boiler-room upper deck.
29, 23. Longitudimal section through the engines and boilera.
24, 25. End clevation of the acrew propeller ; eloration of the after enil of the reisel, showing serew propeller and ruider.
4. 

In one very large-sized plate, finely engraved by Lowsx, price $10 \%$, with seales and measures,

THE SHEER DRAUGET, HODY PLAN, AND BOTTOM OF THE IRON SHIP GREAT BRITAIN.
17.

COMPREHENSIVE AND COMPLETE WORK. THE APPKNDICEB TO THE ELADORATE EDTION OF
TREDGOLD ON THE STEAM ENGINE AND ON STEAM NAVIGATION,
complete; being the Appendices A, B, C, D, E, F, and G, and not included in the new edition of Tredgold;
comprising very amply illustrated subjects on Steam Navigation, Steam Vessels, both of iron and timher, steam engine in the Government Arseral, Woolwich; marine engines; an investigation and complete development of screw-propelling, and an elahorate treatise and defailed illustrations of the Cornish engine, \&ce.

Collected and bomnd uniformily in one folio volume, with the text in medium quarto, half-cloth boards, price £ $5.158 .6 d . ;$ forming a complete and separate work from any edition of Tredgold on the Steam Eogine.
The engravings are on a large scale, for practical use, and were drawn, explained, and corrected under the direction of the following scientific gentlemen: Messrs. Laird, Liverpool; Seaward, Limehouse; Fairbairn; Oliver Lang, H. M. Shipwright, Woolwich; William Pitcher, Northfleet; Miller and Ravenhill; Sir Willims Symouds, \&e, \&ce., Ec.

## APPENDIX A, B.

## LLST OF SUBJECTA ANT PLATES.

Iron steam yacht Gloue-woma, ennstructed by |ranght linet at bottom, fore body to a Mr. J. Laird, Birkenhend. large icale, by Mr. J. Laird.
tron steam ship Muliblote, belanging tir the Plans of 1ic engines of po-horse-power cach, Geneal 8 tram Navigation Company, 50-iveh eylizders, $6-6$ stroke, abade by $G$.

JOHN WEALE'S AMENDED CATALOGUE YOR 1851.

Forrester and Co., Lisempoot, and nitted on board the Rainhoie.
Sile eleration und aecilion of atitto
Tranyyerse suection of ditto.
Draught of the Americun armed steam ship Friton. Half the main breadth, 17 feet ; distance between the water lines, 2 iect; fore and after body precisely alike.
Plant of upper and fouer declis of thin Admiralty yaelit Btack Eogle, with fittingt, \&e. Mams of upper and lower decks of the inan
 steam sacht Nevka, inilt tor the Etaprea
of Itasia, by Mfesm, Fairbairn and Co. of Itasia, by Mrush, Fairbairn and Co.
Dranght, tetfon, ind fones of the Neeke.
Dranght, teetfon, and lines of the Neeks,
Crous rection of ilito, showing engines, com-
Crous rection of ditto, showing eng
struetiun nf vessel, and padfics.
Boly plan, cronk aection, ani sulons; show-
ing joinlngs, fittings, and decorations.

Mr. Joban Hague?s 12 -bone condensing engine, in operation at the Arnenal of Woolgine, in coperation at the Armenal of Woot-
wich: elevation, with dimemsions of parts Wich: elevation,
and refurnces.
and refernences.
Plan, ditto, ditto.
Sectivb, thowisg loiler, \&e., ditto.
End section, showing furnace, \&c., ditto. Mr. Lang's mode of connecting the atem, atern-poat, and keel together, for any description of vessel; and 3fr. Lang's method of framing the ribs and keels of steam vessels, with a plan of timbers explained, sectional parta, and dimensions.
Chaproan's draught lines uf botfom, fore and aft hodien ; and Mrs. Whitelaw's, of Glasgow, new coptrivances in the steam engiie.

Several of these plates itre of large size, and useful to practical men.

## APPENDIX C.-Price 148.

## LIET OY SVBJECIS AND PLATEE.

General elevation of the starbeard encine and baiters of the Cyctopm, showing the relative position of all the parts connected therewith.
Fod virwn of both engines at the pudilt e thaft, with a sectian of the vessel taken at the same point, \&ce.
Front clevation, section in elevation, and plan of the eyliniler, atcam nozzles, and slide geir, with detaile of the eccentrie, $k \mathrm{k}$.

Different views of the condensing apparatus, feed and bilge pumpt, ze,
Details of the parallet motion, counectingrod and piston, cross-bead, kc.
Elevations of part of one paddle-wheel and shaft, ke.
Front elernation of twa boilers, \&ce.
Transrerse sections of two boilers, \&.
Plans of the four boilers, kc.
Appendages to the boilers, \&ke.
Together with several defails scattered over the plates.

## APPENDIX D.-Price 108. 6d. <br> THE ARCHIMEDEAN SCREW, or SUBMARINE PROPELLER,

 MLDETRATED :describing also the inventions and experiments on this important sulbject. By ELIJAH Galloway, C.E.

## APPENDIX I, F.-Price \&1, 58\%

LIST OF su Biscts.
West Indian mail steam packet Iris, by Mr. H. M. steam frigate of war Cyclops, by Sir Pitcher, Northtiet.
The Orion Ipswich steam packet veasel, by Mr. Real, Ipsyich.
Engines of the Isis, by Messri. Miller \& Co,
The plates are very
Sheer draight anif profile of mboard works and after body of the Rogal winii Weat Inda packet Jris.
Lines of bottom, ditto.
Plan of spar deck, shawing Captain Suith's life-boats.
Plans of upper and lower decks, difto.
Midship section, ditto.
Sheer draught, lines of bottom, and after body
of the Orion Ips wich Iron packet.
Plan of ileck of difto.
Longitudinal eleration of one of the engines of the Zris.
Eod eleration of ditto, thowing paddifer, slaift,
and construction of versel.

Wm. Symonds, Surveyor of the Navy.
Engines of the Dee and Solway West India muil atenm packels, by Measrs. Scott, Sinclair, and Co.
rge, and comsist of
Plan of the engines of the Isis, together with the boiless, engine-room, sec.
Sheer draught, profile of inboard works, with lines of bottom, and after body, of Her Majesty's steam frigate Cyclops.
Plans of upper and lumer decks of ditto.
Sketch of spurs, sufls, \&ec, of ditto.
Transverse section, and part of frame-work of ditto, shoring the admirable construction of thas vesmel.
Longitudinal eleration of one of the engines of the Royal mail Wert India packets Dee and Soleray.
rwo cha rieka uf ditiu.
Plan of ilitro.

JOHN WEALE'S AMENDED CATALOGUE FOR 1851.

## APPENDIX G.-Price £1. 12.

## THE CORNISH PUMPING ENGINE:

designed and constructed at the Hayle Copper-House in Corawall, under the superintendence of Captain Jenkins; erected and now on duty at the coal mines of Languin, Department of the Loire Inférieur, near Nantes. Nine elaborate Drawings. Historically and scientifically described

By WILLJAM POLE, ER.A.S., Assoc, Inst, C. E., Aec LIST OF THE PLATKS.
Plan of the engine and boilers.-Side elevation | Details of air-pump, eosdensers, feed-pump, of engine. sc.
Ead view of engine and boilers.
Ditto boiler and boiler apparatus.
Elesabion and sectians of pumps anid pitgearing, \&c. work.
The text in a 460 volume, and plates in a large folio size.

## 18.

Eight large atlas folio very fine lihe engraviugs, by Gramwins, from elaborate drawings made expressly by Mr. Wicessecis, in a wrapper follio, together with a fto explanation of the plates, containing an eograving, by Lowex, of Harvey and West's patent pump-valve, with specification, price $£ 2,28$.

THE ELABORATELI ENGRAVED

## ILLUSTRATIONS OF THE CORNISH AND BOULTON AND WATT ENGINES

ERECTED AT THE EAST LONDON WATER-WORKS, OTD FORD. By THOMAS WICKSTEED, C.E.

> CORNISH ENGINE,

1. Side elevation of the engine, porap, and stand pipe, with longitudinal section of the enifinc-home.
2. Longitudinal section of the emgine, Ace., on an enlarged scale.
3. Plan of the hoiler-bisuse and four cylindrical boilens, two of which, together with the warning tube, are shown in section. Plan of the eqgine-house and Engine, with pump, and stand pipe. Longitudinal section of the cataract for
opening the equilihrium valve, Elevation of ditto for openings the exhaustion and ateam valves.
4. Fronk eleration of the face of the boilers 3 cruts seetion of the four boilers and the warmine tube, showing the side and botfom flues, the bridge, fire-bars, and despending tlues to bottom flue Longitudinal section of oae bniter and bottom flae, showing the end and main flues in crose rection, bse.

## BOULTON AND WANT ENGTNE,

1. General elevation of the enfine, main pianp, air vessel, \&e., with lovgitudinal scetion of the engine-house and well. Elevation of the eyliader, air-pump, and condenser, with trassvene ection of the engine-hone through the cold water cistera.
2. Langitudinal section of the engibe-house and eligine, main pump, air venuel, Enc., fo an enfarved scale.
3. Plan of the boiler-hotese and two beilers,
showing the grates and seating of one lioiler and section of another through the internal flue. Ptas of the engisehouse and eqgine, with pump, air versel, sec.
4. Langitudinal section of the boiler-bouse and one boitec. Transrerse section of the boiler-hmuse, with transverne seetion of one boiler, and front elevation of the fure of the other, with Stanley's fire-feeder.

JOHN WEALE'S AMENDED CATALGGUE FOR 1851.

14 LOCOMOTIVE AND HIGB-PRESSURE ENGINES.
19.

In 4to, price 6s.
AN EXPERIMENTAL INQUIRY
concerning the relative power of, and useful effect produced by, the CORNISH AND BOULTON AND WATT PUMPING ENGINES,
AND CYLINDRICAL AND WAGGON-HEAD BOILERS.
By THOMAS WICKSTEED, C.E.,
Engineer to the Bast London Water-works.

THE HIGH - PREBSURE ENGINE.
20.

In 2 vols. 8 vo, with 28 fine plates by Gladwin, (complete work,) price $16 s, 6 d$.
THE HIGH-PRESSURE STEAM ENGINE:
an exposition of its comparative merits, and an essay towards an improved system of construction adapted especially to secure safety and economy. By Dr. ERN8T ALBAN.
Translated from the German, with Notes, by W. Pole, C.E., F. R. Ast. Soc., Assoc. Inst. C. E.

## THE LOCOMOTIVE ENGINE.

21. 

In demy 8vo, extra cloth boards, price 12 s .

## THE THEORY OF THE STEAM ENGINE;

showing the inaccuracy of the methods in use for calculating the effects or the proportious of steam engines, and supplying a series of practical formulx to determine the velocity of any engine with a given loud, the load for a stated velocity, the evaporation for desired effects, the horse-power, the useful effect for a given consmoption of water or fuel, the load, expansion, and counterweight fit for the produetion of the maximum useful effect, sic. With an Appsndix, contaiaing concise rules for persons not familiar with algebraic signs, and intended to render the use of the formulæ contained in the work perfectly clear and easy.

By COMTE F. M. G. DE PAMBOUR.

## 22.

In 4 to, with engravings, price 7 s .6 d . EXPERIMENTAL RESEARCHES UPON THE LOCOMOTIVE ENGINE,
recently made by MM. Gouns and Chatelise on the Versailles and Paris Railway.-Translated by R. Lloyw, C.E.
23.

In 8vo, extra cloth boand, with plater, a tecond edition, with considerable additions, price 18 r.

## a practical traatise on <br> LOCOMOTIVE ENGINES UPON RAILWAYS:

The construction, the mode of acting, and the etfect of engines in conveying heavy loads; the means of aycortaining, on a general inspection of the machine, the velocity with which it will draw a given load, and the results it will produce under various circumstances and in different localities; the proportions which ought to be adopted in the construction of an engine, to make it answer any intended purpose; the quantity of fuel and water required, \&e.; with practical Tables, showing at once the revults of the formule; FOUNDED URON A GREAT MANX NEW EXPEBEMENTS made on a large scale, in duily practice on the Liverpool and Maschester and other Reilways, with different engines and trains of carriages, To whieh is added an Appesprx, showing the expense of conveying goods by means of locomotives on railroads.

By COMTE F. M. G. DE PAMBOUI.
24.

In 12 mo , price 2 s . 6 d, in hoariss,

## RULES AND DATA FOR THE STEAM ENGINE,

 BOTH STATIONARX AND LOCOMOTIVE;and for Railways, Canals, and Ternpies Roads; being a synopsis of a course of eight lectures on Mrchanical Philosophy; illustrative of the most recent modes of construction, and an exposition of the errors to which patentees and others are liable.

By HENRY ADCOCK, Civil Engineer.

## RAILWAYS.

## 25.

In 1 rol, flo, with 50 engravings, half-bound in morocco, price £I. 16 .
THE PRACTICAL RAILWAY ENGINEER:
Examples of the Mechanical and Engineering Operations and Structures combined in the making of a Hailway.

CONTENTS.
Curves, gradients, gauge, and slopes. Retaining walls, bridges, tumnels, \&cc. Earthworks, cuttings, embankments, Permanent way and construction. and drains.

Stations and their fittings.
*** This work was originally published in three portions. Part III. is still required to complete many copies, and may be had separate, price 15 s .

JOHN WEALE'S AMENDED CATALGGUE TOK 1851.
26.

In 1 vol. imperial 8 vo, with 15 folding plates of works executed, containing tables and explanatory text, price 16 s.

## AN RASY INTRODUCTION TO BALLWAY MENSURATION,

illustrated by drawings from original works that have been carried out upon various English Railway Lines, showing a plain and easy method of taking out quantities of erery description of Railway work and estimating them, and setting ont work for the making of Railways generally.

By E. V. GARDNER, C.E.
CONTENTE.
Elementary Introduction, with wood-cuts.-Contract Specifications.-Measurement of Earthwork.-Raitway Curves, Tunnelling, \&c., \&c., \&c.

## plates.

1. Section, part of the Keymer bramelr of the London and Brighton Railway.
2. Small barrel culverts on the Ealisbury lirnech extension Railway.
3. Large culverts with wing walls on the Salisbury branch extenuion Railway.
4. Open culverts on the Salisbury liranch catension Railway.
5. Open culverts on the Salisbury liranch catension Raisay,
6. Bridge for stream at 9 miles 3s ane chains alton Rortway.
7. Occupation bridge over the Farnham and Alton Railway.
8. Timber viaduct, Bricklayers Arus lranch of the London and Brighton Ruilway.
9. Inclined bridge for turngike road over Railway from Winchester to Southampton.
10. Viaduct over streams as Milfond, Solisbury brinch extension Railway, 2 plates.
11. Timber viaduct, Therworth Salt.
12. Timber viaduct, with Iron tension rouls for any length.
13. Part of a Railway plan, and the section of it, with the curses set out, and off-sets.
14. Sections of Railway, in emhankments and cuttings, with cutside fencing, ditelies, \&c.
15. Part of the plan of the Syaton and Peterboroagh Railmay, with curres set off.
16. 

In royal 8 vo , with plates, extra cloth boards, price 58 . An Historical, Statistical, and Scientific Account of

## THE RAILWAYS OF BELGIUM

 FROM 1834 то 1842.Translated and compiled from official documents by E. Dorson, C.E.
28.

In 1 vol. 4 to, 25 plates, price 12 s .

## THE TAUNUS RAILWAY:

a concise account, historical, statistical, and mechanieal, of the Railway from Frankfort to Wiesbaden, with 25 steel and wood engravings of stations, plans, carriages, \&e.

By ROBERT THORMAN, C.E.

## RAILWAYS-AMERICAN AND ATMOSPHERIC.

## 29.

In royal 8 ro, 28 plates, extra cloth bds., price 12 .

## ENSAMPLES OF RAILWAY MAKING;

which, although not of English practice, are submitted, with practical illustrations, to Civil Engineers, and to the British and Irish public.

## contents.

1. Preliminary observations recommendatory of the adoption of a more economical mode of railway making in connection with the great lines already in operation, and a much further extension of a principle of railways for less advantageous traffic than the great lines afford, yet essential for the development of the resources of the country, by employment of material of a less cost. Landed proprietors would find their adrantage in the improvement of their land by a quick transit, and, consequently, more ready sale for their produce. In some instances the material is on their estates.
2. Mechanical Works on the Utica and Syracuse Kailroad, explanatory, with specification and cost of this, one of the best constructed railroads in the United States, made over Awamps, creeks, and valleys, at a cost of $£ 3600$ per mile.
3. Historical, statistical, and scientific account of the Railways of Belgium from 1834 to 1842, by E. Dobsos, C. E., explanatory of the Railroad from Ostend on the coast to Cologne in Prussia.
4. 

In small 8 vo, third edition, price $8 s$.
A practical treatise on the
CONSTRUCTION AND FORMATION OF RAILWAYS.
By JAMES DAY, C.E.

## ATMOSPHERIC RAILWAYS.

31. 

In 4to, with 27 tabular engraved plates, medium 4to, price 78.
REPORT ON
THE ATMOSPHERIC RAILWAY SYSTEM. By ROBERT STEPHENSON, Bsq., M. P.
32.

In 4to, with 10 plates, price $7 s .6 d$.
Tbree Reports on improved methods of constracting and working
ATMOSPHERIC RAILWAYS,
By R. MALLET, C.E., Dublin.
JOHN WEALE'S AMENDED CATALOGUE FOR 1851.


## RAILWAY CURVES - GRADIENTS-MEASURE.

40. 

In 8 vo , in boards, price 18 s .
Tables and Rules for facilitating the Calculation of EARTHWORK, LAND, CURVES, DISTANCES, AND GRADIENTS, required in the Formation of Railways, Roads, and Canals;-also Essays on the Prismoidal Formulee, and ou the power required upon Inclined Planes, By J. B. IHUNTINGTON, C.B.
41.

In 8vo, third aud much improved edition, with plates, price 7s.6d.

> A TREATISE ON

THE PRINCIPLES AND PRACTICE OF LEVELLING, showing its application to porposes of Civil Engineering, particularly in the Construction of Roads; wilh Mr. Tetronn's Rules for the same.

> By P. W. SIMMS, C.E.
42.

In a sheet, price 2s., a Table showing the Acres, Roods, and Perches in IRISH PLANTATION AND BRITISH STATUTE MEASURE,
In any given number of superticial feet, from 1 perch to 5 acres. By HUGH RICE, C.E.
43.

Second edition with additions, in 8vo, with engravings and wood-cuts, cloth boards extra, price $12 y$.
OUTLINE OF THE METHOD OF CONDUCTING A TRIGONOMETRICAL SURVEY,
for the Formation of Topographical Plans; and Instructions for Filling in the Interior Detail, both by Measurement and Sketehing; Military Reconnaissance, Levelling, \&ce, \&c., together with Colonial Surveying ; with the Explanation and Solution of some of the most useful Problems in Geodesy and Practical Astronomy ; to which are added a few Pormule and Tables of general utility for facilitating their calculation.

By Captain YROME, Royal Eugineers, P.R.A.S., \& A.I.C.E.
44.

In a sheet, price $2 s$.
TABLES FOR ESTIMATING EARTHWORK.
By HENRY LATY, C.E.
JOHN WEALN'S AMENDED CATALOGUE FOR 1851.

## BRIDGES.

45. 

In 4 vols, royal 8 vo, illustrated by 138 engravings and 92 wood-cuts, bound in 3-vols, half-morocoo, price . 4.10 g ; ; or the plates printed in a superior and an athis form, very neatly bound, price $\mathbf{E 5} .15 \mathrm{~s} .6 \mathrm{~d}$.

## THE THEOIK, PRACTICE, AND ARCHITECTURE

OF

## BRIDGES OF STONE, IRON, TIMBER, AND WIRE; WITH EXAMPLES ON TRE PRINCIPLE OF SUSPENSION.

DHVALONS OF THE WORK.
Thiony or Bumgrs. By James Haun, King's College, London. Geseral. Princifles of Construetion, \&C. Translated from Ganthey. Tasony of the Aren, \&c. By Professor Moseley.
Papelis on Foundations. By T, Hughes, C.E.
Account oy Hefchsson Bridge, Glasgow, with Specification, By the late Robert Stevenson, C.E.
Mathematical Prisciples of Daspge's Suspension Bridge.
Essay and Treatises ox tar Peactice and Abchitecture of Bbidges. By William Hosking, F.S.A., Archt' and C.E.
Specification of Chester Des Bhidge.
Practical Description of tal Trmer Beidges, Se.,onthe Utica and Syracuse Ratmond, U. S. By B. F. Isherwood, C. E., New York.
Description of the Plates.-General Iudex, \&e., \&c., \&c.

## LIST OV PLATES.

1. Centering of Ballater bridge across thie river Dev, Aberdecashire.
2. Town'a American timber bridge.
3. Don, Aections.
4. 1bis. do.
5. Ladykirk and Norham timber bridge over the 'Tweed, by J. Blackmore.
6. Tumber hridge over the Clyde at Glazgow, by Ithbert Stevenson.
7. Elevations of arch of do.
8. Transverse aection of do.
9. Sectim of foot-puth on do., E.c.
10. Oecunation bridge over the Calder and Helible Navietion, by W. Bull.
11. Newcsutle, North Shields, and Tyne-
 Iington Dean, plans and clevations.
12. 10ts do.

1i. Din, sections.
14. Ditto Across Ousc Burn Dean, plan and clevation.
15. Do., do,
16. Inometrical view nf the upper woaten britlecat Elyswille over the Patopsco, on the Baltimore und Ohio Railroad. 17. Elevation and plan of do.
18. Sectinn of do.
19. Longltutinal isction under the central arelway of Old Lomdon liridge, showini the sunk weir recommended by Ar. Smeatim to hold the Nater ap for
the lienefit of the water-works, ke., in 1763; scetiuga of the sarse.
20. Man and elevation of timber lridge for Westminster, as tlesigued by Wesley.
21. Hall-cleyation of ditto for Weatminater, as designed ly James King.
22. Westminster timber bridge adapted to the atone piers, by C. Labelye.
49. One of the river rilss of the centre on which the midall arelh of Westainster bridge was turned, exteniling 76 feet, designed and executed by JamesKing,
26. Long elevation and plan of Westminster britge.
25. Elevation of the foot bridge over the Whitidder, at Abbey St. Bathen's.
26. Weymntuls bridge, elejation and plan.
27. Yery lung elevation of Hutcheson bridge, Glassow, by Robert Steveneon.
29, Langitudinal section of litto, showing the progress of the works in 1832.
99. Cruss artuion of do., nhowing the buildias apparatus ind cenire irames. 30. Cross soction of Hutcheson liridge. 31. Plan of southern abutment of tlo. 32. Section of ahutments of do.
33. Toll-hgusea uf do.
34. Bridge of the Schuylkill at Market Stroet, Pliladelphia.
35. Details of do.
36. Plan of the wood-work in the wtarline of the sumall pies of Cbeputow hrilige.
37. Lonkitudiral acetien througb one of the large piers.
39. Datalie of Cliepiton bridge.
32. Plan, elevation, and rections of the centrat arch of Landon tridge.
40. London and Croydon nuilvay briage nur road from Croydous to Sydenham, plans, elerations, and sections.
11. London and Croydon railway bridge on road from Normend to Brumley, do.
42. London and Croydon railway lifilige at Sydenham, ilo.
 the ralley of the river Weat, on the Durham junctiun nillyay,
4. Eleration of Chepatow britge.
45. PilinE auil timber foundations of one of the large piers of Chepstow bridge.
46. Phan of pier, elevation of do.
47. Enlarged sextion of one af the piers.
d5. Neweciatle anit Carlitite nuitway linidgr, aver the river Tyne at Scotawood, by John Blackunare, plan and elevation.
49, 50 . Scetions and details of do.
31. Elevation and plan of liridge orer the Eden at Cartiale, by Sir In. Smirite.
52. Eleyation of ane of the arches, with a pirr, nad the north aliutment.
s2a. The centering used for the arcliea of do.
*3. Plan and elevation of the bridge erected over the Thames at Staines.
84. Elenation and plans of the Wellealey bridec at Limerick.
85. Elevation of pier and half-arch, with longitudinal seetinu, plain and section of baluster, tranaverse section through the cownu and apandril.
56. Bridge of Jena, plan and eleration.
57. Do., elevation of one of the land arches, with section of toving-path and retaining wall, tramivene section of the bridge at the springing of an areh, plan of do., trantresse section of the bridge through the ceatre of one of the land arches, plan of the abutacrits, retaining walls, \&e.
58. Elevation of the Devil's bridge aver the Serchio, near Lucea, Ituly; plar, elevation, anil erosas action.
50. Bridge across the river Forth at Stirling, by R. Sterenton, elevation.
6i. Longituitinal seetion of the same.
61. Timber bridge on the Utica and Syracuse Railway, United States, spaus of 40 and 30 feet.
Re. Do., span of (6) ficet.
63. Do., clevation, plan and crose section, opan of 88 feet.
63a. Do., isonetrical projection.
61. Do., plisn, elevation, and croas section, pran of 88 fect.
6 k . Timber bridge, span of 82 feet.
66. Alutument fro a britge of 59 fect nyair over the Oneida Oreck.
60. Treatle lridge; Oavila Creek Valley, apan of 39 teet.
67. Do, elevation of apan of 100 fect.

67\%. Do., isometrical prejection of truss, connectian of floor behmor, and crons section.
as, Treitle biridge, Onondago Creek Valloy, span of 29 ted.
6. A mruat yariety of details of joinery. Ged. Pile-driving machine.
70. Thometrieal projections.
70. Inometrical prajections of iton plate. Z0, Dor
70e. Do.
2ed. Do.
zio. Do.
2iv. Do., culverts.
7.
7. Remains of the bridge over the Adda, at Thato, the Milanese.
Zy. Ely irme brides, near cathedral.
73. Details of do.

2t. Do.
76. Heddees bridpe, over the Aire, Yorkshire, detalis of the iron-work,
77. Do.
28. Do.
29. Do.
50. Do., sections of strueture.
81. Do, plan iron balustrades, \&e.
89. Don, dctails.

6\%. Do, eleratinn.
8. London and glackwall Railway bridgo over the Les, eloration and plan.
B5. Do, teetions and details.
ai. Do., cections, enlarged view of ruiling.
87. Inomutrical projection of the anspensiá bridecat talloch ferry, conatructad en 3tr. Dreller's principle.
89. Penviet't deyign for the bridge over the Seine at Melum, sections, ze.
89. Brighton chain pier. purtions of eonstructive detail.
90. Wreck of do, in Oct. 1833.
92. Dos
92. Lougitudinal and trausvene sertion of cati-iron swing bridge.
23. Lengitudinat section and transverse dow, plan of tarminc-plate, roller frame, and hied-ptate of eant-iton swing biridge.
94. Elerition and plan of cast-aron awing brider, Plymouth.
95. Gerratdin Horte brigge, Cambritge, erected by thic Buturley Compiny, (W). C. As glane, Alemition and plan.
v6. Do, Itections and dietails of do.
97. Do, iramavence sertion of flo.
93. Fribourg suapension brides, geocral elevation, with a section of the valley of the Sarine and of the niooring shafts, kee; gresenal plath, emis of main yiert, wilh approaches enlarged, ke.
09. Do., sections and details of do.

100, 100a, Dat de.
101. Pnufosur Moseley'i diagranis of the selk
102. 130.

1us. 10.
10i. Kohert Stevenvon's eleration of a chain liridge upon the eatearian prineiple.
105. Robert Stevenvon's chain bridge, ptan and section of do.
106, Do., longitudinal section.
107. Do., sections, back of arehed accersea; plas of pier, showing the cables, yc. 108. Elecation and plan of Darlaston Lirilles staffordshire, hy Thes. Telfanl,
109. Longitudinal and transrene sections.
110. Centering for do.
11. Halfelervition, sections, \&e, of Bascule iron bridge for Wellealey Douk works. 112. Plan of do., Rections, ke.
113. The Ouse Valley viaduct, Londun and Brighton railway, longitudinal rection, section of wing zall, transverse soction of roofed recerses and pilastern.
113a. Etevation of north abutment and eight arches of do.
114. Transverse section through centre arch. 11a. Plan of smpentructure, plan of foundi-
tions, transercee section through relieving arebes of the Ouse Valley viadoet.
116. Detaite of do
117. Plan of swivel bridge, nhowing ribs, windlast, ke
118. Elevation of front rihs, show ing sections. falling hand-rails, \&e.; longitudinal sections, cmedtections, \$ke.
119. Cast-irum wwivel lridge on the Newry canal, half-elevation, plab, transverse seetions, se.
1:0. Do., plan of masoary of abutments, base ringsend platform of railyay, sections thriugh, plans of ahutments, \&c.
121. Wire bridice over the Fosse nt Genera, elecation, plan, and several details.
192. Weitern Railroai, Connecticut, niver hridge, eleration, plan, iectiont, and fletalls.
** These volumes are ample and diffuse in the explanation and instruction of every principle in this arf, and may be truly eateemed as the only comprehensive work of the kind extant.

## 46.

In 1 vol. $8 v o$, or in Parts I. II. 1II. and IV. complete, 40 plates, price 6 s . in parts, or $\mathbb{E 1} .5 \%$, uniform in half-moroceo.

## BRIDGES, SUPPLEMENT,

 A CONTINUATION OF THE PREVIOUS WORK.Being a supplement to the work entitled the 'Theory, Practice, and Architecture of Bridges of Stone, Iron, Timber, and Wire;' comprising recently constructed wrought-iron and tubular bridges, and other kinds of bridges, British and Foreign. Edited by Geo. R. Burnell, C.E.

## OBZIQUE BRIDGES

47. 

In imperial 8 vo, 3rd edition, with additions. 11 plates, extra cloth bds., 88 .
A PRACTICAL TREATISE ON THE CONSTRUCTION OF OBLIQUE ARCHES.

## By JOHN HART, Mason.

48. 

In 2 vols, royal octavo, comprising text, and folio volume of plates, some of which are coloured; price $24.148 .6 d$. , or on large paper, $\mathcal{E} 6,6 \mathrm{~s}$.

## THE

BRITANNIA AND CONWAY TUBULAR BRIDGES; with general inquiries on beams, and on the properties of materials used in construction.
By EDWIN CLARK, Resident Engineer.
Published with the sanction and under the supervision of R. Stephenson, Esq.

## TUBULAR BRIDGES - STRENGTH OF MATERIALS.

49. 

In 4to, with a large plate, price $3 \mathrm{~s}, 6 \mathrm{~d}$. Description to Diagrams for facilitating the CONSTRUCTION OF OBLIQUE BRIDGES.

By W. H. BARLOW, C. E.
50.

In 4to, with 12 large folding plates, estra eloth boards, price $14 s$.
A PRACTICAL AND THEORETICAL
ESSAY ON OBLIQUE BRIDGES. By gernge watson buck, m. Inst. C.E.

## 51.

In demy 8vo, with 107 wood-euts, extra cloth bds., price 7 s . Experimental Essays on the Principles of Construction in ARCHES, PIERS, BUTTRESSES, \&c.; made with a view to their being useful to the Practical Builder. By W. BLAND, Esq., of Hartlip, Kent.

## 52.

In one vol. royal 8 vo, with several illustrative plates, price $£ 2.2 \mathrm{~s}$. THE CONWAY AND MENAI TUBULAR BRIDGES, with the experimental explanations.

By WILLIAM PAIRBAIRN, C.E.
** Some few copies of the plates printed in folio, the text in 8vo, both very neat in half-moroceo, price £2. 158.

STRENGTH OF MATERIALS. 53.

In 2 vols. Sro, price e1, $4 s, 4$ th edition, wouch improved and enlarged by Eaton Hodokinson, F.R.S., \&c., Manchester; vol. ii. being entirely composed of Mr. Hodgkinson's experiments.

## A practical essay on

THE STRENGTH OF CAST IRON AND OTHER METALS;
intended for the assistance of Engineers, Iron-Masters, Millwrights, Architects, Founders, Smiths, and others engaged in the construetion of machines, buildings, \&ec.: containing practieal rules, tables, and examples founded on a series of new experiments; with an extensive table of the properties of materials. Illustrated by several engravings and wood-cuts.

By THOMAS TREDGOLD, Civil Engineer.
JORN WEALE'S AMENDED CATALOGUE FOR 1851.
34.

In 8vo, a new edition, with corrections, revised by J. F. Hsather, M.A., and with considerable additions by Prof. Willis, of Cambridge; several plates,

> A TREATISE ON

THE STRENGTH OF TIMBER, CAST IRON, MALLEABLE IRON, AND OTHER MATERLALS;
with rules for application in arclitecture, construction of suspension briages, railways, \&e.; and an Appendix on the powers of locomotive engines on horizontal planes and gradients.

By PETER BARLOW, F.R.S., \&c., \&c.
55.

In 1 large and thick royal 8 vo vol., with several plates, extra cloth boards, price E1. 10s.

## PAPERS ON IRON AND STEEL,

Practical and experimental, with copious illustrative Notes.

> By DAVID MUSHET, Esq.,

Honorary Member of the Geologieal and the Quebec Literary and Historical Societies ; of the Institution of Civil Encineers of London; Corresponding Member of the Wernerian Natural History Society, Edinburgh.
56.

In 4to, with 8 large engravings and text, 6s. sewed in a wrapper.
AN ACCOUNT OF THE CONSTRUCTION OF THE IRON ROOF OF THE NEW HOUSES OF PARLIAMENT; with elaborate engravings of details.

## MACEINERY.

57. 

The text in 1 large vol. 8 vo , and the plates, upwards of 70 in number, in an atlas folio volume, very neatly half-bound in morocco, price £2. 10 s .

## PRACTICAL ESSAYS ON MILL-WORK AND OTHER MACHINERY;

WITH EXAMPLES OF TOOLS OF MODERN INVENTION.
First pablished by Robert Buchanan, M.E.; afterwards improved and edited by Tromas Tredgold, C.E.; and now re-edited, with the improvements of the present age,
By GEORGE RENNIE, F.R.S., C.E., \&c., \&c., \&c. CONTENTB OF THE PLATES.

1 to 20 consist of drawings of mill-workand machinery, published under the superintendence of the late Mrr. Tredgold, and now reprinted.
20a, Diagrany of Prufesar Willis on the trech of vibets.
21. Bramai's oriefinal alide tool, with slide rest and head in oue.
22. $\frac{\text { ren tathe for turning spheres- }}{\text { elevation und ead view. }}$
23. Plan of Bramah's slide tool. 24. Nasmyth, Gaskell, \& Co.'s great boring 25. lathe.
lathe.
26. Levis's foot lathe, plan and eleration. 27. . tion and slide riew.
28. Bennie's tathe for turning gun-barrels, elevation and section.
29. Nasmyth's portable hand drill, ivor drith.
10. Nasmyth, Gaskell, and Co.'s wall side driling raschine,
31. Hick's nalial dillinale villar drill.
39. Lewis's uprieht ding maeline.
. chine.
33 (A). Ditto, ditto, side elevation.
34. Namyth, Gaskell, anil Cob'd key grooving or slotting mashine.
35. Sharp and Robert's slotting machine.
36. Nasuyth, Gushell, and Co,'s macline for cutting key grooyes in wherls.
37. (for cutitik data in erank.

37 (A), Lewis' eslotting and paring machine. 36. Fox's screw cutting machine, elavation and plan.
38 (A). Narmyth, Gnokell, and Co,'s large acrewing machine.
38 (B). Hick's bolt-screwing timeluine.
39. Nasmyth, Gakell, and Co,'s relf-actions nut cutting machine.
40. Lewis's mactine for cutting the teeth of savall metal whects
$40(A)$, Jewis's macline fur cutting the teeth of large metat whiceli, elevation and end view.
41. Namyth, Garkell, and Co.'s machine for cutting tecth of trooden wheel models.
II (A) Mr, Clawet's machine for eutring the teeth of woodes and irou model wheels.
12. Nusmyth, Gaskell, and Elo's vertical boring machine for cylinders.
4. Itick's vertical boring machine, elevation and plan.
45. Mf. Nichntas Forq's machine for planing inon.
46, Nasmyth, Gaskell, and Co.'s millwright's planing machine, tool woreable, thol fixed.
47. Ditto, ditter

12 (A), Ditto.
17 (B). Hick's planing machine.
47 (C), dittu.
14. Nasmyth, Gatkell, and $\mathrm{Co}^{\prime}$, plate vutting and pronching machine.
40. Fairbairn and Co.'n plate bendios, also Atrarin. $\mathrm{N}_{4}, \mathrm{G}_{4}$ and Ce.'yplatecutting machines.
50. Khuniard and Co,'s pancling maehine: Hich's mandril for expanding rines,
51. Maudalay and Field/g machine for punching boiler plates.
33.

52 (A) , M, Cave's steam punching machine, deration, end view, and details.
53. Fairbairn und Co''s riveting machine, plan and eleration.
54. Nasmyth, Gaskell, and Co.'s douhle fure grivdivg machine, plan, side, and end elevations.
A tignette of Jumen Namyth's drawing of the old slale reat priticiple.
Ditto, yarts to larger dimensiun.
Ditto, tilustrative figure of the priseiple of the planing machine.
Dikto, of the whel cutting machine.
Distw, of the acrew cutting machias.
43. Nasmyth, Gashell, and Co.'s large ditto

The whole forming 70 fine plates, for the most part eagraved by Lowny and Le Kevx, and 103 wood-euts.
Some few copies with the plates folded, in 2 vals, large 8 yo, elegantly hound in lialf-morocco, price it 2. 10s.
58.

Text in royal 8vo, and plates in juperial folio, price 18 r .
PRACTICAL EXAMPLES OF

## MODERN TOOLS AND MACHINES:

a supplementary volume to Mr. Rensie's edition of Bucbasan ' On MillWork and other Machinery;' by Tnzncoln.
The work consists of 18 plateg, elaborntely drawn and engraved, of the machinery of Messrs. Maclea and March. Lecds; Messrs. Whitworth aud Co., Manchester; and Messrs. Carmichael, of Dimdee.

LIST of HLATES

1. Maclea and Afarch's fluting maclihe, end view and details.
2. Pinn and vide elevation of in.
3. Maclea and March's amall fluting machine and lathe, elevation and stexion.
4. Mtan and sererat detaile of to.
5. Maclea and March's machine fa cot ruts. elevatim, end, and scie.
6. Plau and detaila of do.
7. Mrelea and March'e serewing mashilic.

| 7. |
| :--- |
| $\%$ |
| 8. |


$\qquad$ parts and detrils.
11. Maclea and Mrarch'r gantry, paidde, compound rest, and fuce plater for do.
19, Elevatiun of io.
11. Whitworth': pafent self-acting lathe. elevation, Ke, engraved by Giudsin.
估, - - luving tnachine, engraved by Glatwin. - , enid

17. Sovation sud section, by Gladwin, plan
to a large scale, engraved by Gladwin.
18. Mersre. (Marmichalls, planing mayline. eloration, engraved hy Ghatrin.

JOHN WEALE'S AMENDED CATALOGUE FOH 1851.

## TREDGOLD ON CARPENTRX.

59. 

In 1 large vol, 4 to, 3 rd edition, 50 plates, edited by Prier Bariow, P.R.S., half-botnd iu marocco, price tes.2\%.

## TRE

## ELEMENTARY PRINCIPLES OF CARPENTRY:

a treatise on the pressure and equilibrium of timber framing, the resistance of timber, and the comstruetion of floors, arches, bridges, roofs, uxiting iron and stone with timber, \&e., with practical rules and examples; on the nature and properties of timber, including the methed of seasoning, and the causes and prevention of decay; with descriptions of the kinds of wood used in building; also numerois Tables of the seantling of timber for different purposes, the specific gravities of materialh, \&c.

By Thomas tredgold, Civil Engineer.
With an Appendis, eontaining specimens of varions ancient and modern roofs. CONTENTE OY PLATES,

1. Equillbrium and pressure of beams.
2. Pressare of beams and centre of gravity.
3. Equilberium and pretsure of heans and framing:
4. Nailed floorng.

5 to 9 . Roofs.
10. Rools that haye boen erected.
11. Roof of the Fiding-huuse at Dloneow.
12. Domes.
13. Partitions and eentre.
11. Gentres fur stone brifees: centro wed for thie bridpe at Neuillys" for the Waterloo bridge, und Conon bridge.
15. Centres for stone bridiges.
16. Bridges.
17. Pitto, double plate.
18. Construction of hrisges.
19. Bridges, double plate,
20. Bridges and juiais.

21, Joints.
22, Joints and straps.
23. Boof and construction of the Pantheon. Oxford Street.
a4. Ditto.
25. Section of roof of Hall, Parkhurst Prison.
26. Section of roof of New Salonn, Acaleany of Arts, Florence.
77. Longitudinal section of ditto.
28. Truss of the roof of the Ducal riding. house, Modens, double plate.
29. Truncated roof of ditio.
30. Truss of roaf of ditto.
31. Section of the roof orer the Exchange, Genera, douhle.

A2. Woot of trais of roof ower the new theatrit at Ancunaz ditto, Palazzo Verchio, iloremees dittn, eathedral, Veceblio, Horegee
33. Reoff of the cathicdral at Leghom, ditto.
34. Detailh of frouf of Chrisi's Hospital, ditta.
35. Ditto.
36. Longitudinst mection of 8t. Drustan's chureh, Theet Street, double.
77. Kouf and plan of ditto, ditto.
38. Dehails nf dittm, ditto.
59. Lengitudinal section of truse executed at White Comalit fivere, dauhle.
10. Trunsverse section of ditto, ditto.
41. 'Iruss at the Thames Plate Glati-wnrlas : Truss at the Princess's Thentre, Oxfonl Street t tras at a house is Herkeley Sq .
42. Roof uf iron and fimber at Notfaghmu Water-works, treble plate.
49. Cast-lron ronf over the numbel roam of the Butterley Company, trehle
44. $\longrightarrow$ smithery of the Hutterly Coumany, ilitto.
47. Iron and timber roof over the engine maniufictary of the Putterlicy Company, iltto.
36. Ttoof of the pasengera' shed at the fanedon Bridge station, Croydon Rallway, double.
47. Thaf to King's Callege Chape1, Cambridere, ditto.
95. Difto, tranrverve sertíne.
19. Tetails, ilitto.
50. Details, alitto.

Portrait of Mr. Tredgold, and several wood-cnts, showingiron shoes for roofs, \&ce.
${ }^{*}{ }^{*}$. Some copies of the plates 23 to 50 , with text description, are printed
separate, to make the second edition equal with the present edition, price 21. 12.
60.

153 plates, half-bound in moroceo, very neat, pried $\mathbb{E 4} 4.45$; some of the plates coloured, price E5. 5 s.

## PUBLIC WORKS OF GREAT BRITAIN;

## cQNBISTIKG OF

Railsays, Rails, Chairs, Blocks, Cuttings, Embanloments, Tunnels, Oblique
JOHN WEALE'S AMENDED CATALOGUE FOR 1851.

Arches, Viaducts, Bridges, Stations, Locomotive Engines, \&e, ; Cast.Iron Bridges, Iroo and Gas Works, Camals, Loek-Gates, Centering, Masonry and Brickwork for Canal Tunnels; Canal Boats; the London and Liverpool Docks, plans and dimensions, Dock-Gates, Walls, Quays, and their Masonry; Mooring-chains ; Plan of the Harbour and Port of London, and other important engineering works, with descriptions ind specifications; the whole rendered of the utrost utility to the Civil Engineer and to the student, and as examples to the forcigo engineer.

This werk is of an imperial folio size, the drawings and engravings have been executed by Eminent Artists, and no expense has been spared in readering it highly essential for practical wee; also, as an ornamental solume of important Enginecring Works in several parts of the kingdom. There are some plates in the volume that masy be preferred in colours, viz. the elaborate subject of the Blisworth Cottings, on the Birmingham Line, 18 plates, geologically coloured; Glasgow and Gairukirk Railway Cutting through Moss.
61.

22 plates, large folio, bound, price E1. 1s.
THE HARBOUR AND PORT OF LONDON, sctentipically, commerchally, and historically described.

## 62.

In 8 vo , with plates, price $2 \mathrm{~s}, 6 \mathrm{~d}$.
OBSERVATIONS ON

## THE BRITISH MUSEUM, NATIONAL GALLERY, AND NATIONAL RECORD OFFICE;

With Suggestions for their Iroprovement. By JAMES FERGUSSON, M.R.I.B.A.
63.

In one vol. imperial $8 v 0$, uniform in size with Mr. Tergusson's 'Jerasalem,' and his work 'Of the Principles of Beauty in Art,' \&c., price 12 s.

AN ESSAY ON A

## PROPOSED NEW SYSTEM OF FORTIFICATION:

With Hints for its Application to our National Defences. By JAMES FERGUSSON, M.R.I.B.A.

## 64. <br> PUBLIC WORKS

or
THE UNITED STATES OF AMERICA.
In two parts, imperial folio, comprising the following very important works:COKTR2VGB OF FLAATES.
 grising elevations of building, roof, biper, 太ce, ; Ent meters, washers, se.
Eleration, nection, and plon of the re-
details, furnaces, retorts, sectives uf ;
JOHN WEALE's AMENDED CATALOGUE FOR 1851.
serpoir dam neruss 8 watara. Pennyylvania, ereeted by the Uniou Canal Co.
15. Eleration, section, elaamber, and plan of the entlet locke on the Schuy rock- fates and iletaily of ditto.
17. Triangulation of the entrane into the Bay of Delawar, Exhibiting the exact payition of the capes and alualls, with mercition of the capes and nawala, wits. 16. Map of the Delawar breakwater, with the detailed topugraplyy of Cape Beas lopen, and section of breakwater.
19. Map of the Philailelphia water-works.
20. Ground plan of the norihern half of do.
21. Dam, end yiew of water-wheel, KC.
2. Dain, sections of 7 pier, \%e.
23. Views, section, dex, 㫙 force pumps.
84. Teproreil stop-cock, reducing pine, circalar pipe, daulde and siagle branch cular pipe, bevillulh plige, \&e.
35. Ptan of a dam, sanily and Beaver canal it plan of abutment, cross neetion, gravelling, \&e,

P6 and 27. Plan, elevation, and crose aection of a lift lock, Sandy and Beaver canal. 2is. Gate, front viow; frobt vicw of falling gate, mitre sill, soction, Ne.
29, 30. Eastern division, and Sandy and Heaver camal, Olio, front view, foundation plan, end view, \&e., of abutment.
31, s2. Man of the tye river dam acruas James river and Kanawha camal.
35. Lock on dittor plan of 8 -feet lift, and sections.
31, 35. Plan of a wooden lock of 8 -feet lift, several sections.
20, 37. Plan of Ravenna aqueduct, in elevations aud sections? horizontal nection at surface of water, plan of pier abutment and wing-walls, \&e.
135. Farm Bridgr, James river and Kanawha canal ; clevation, plan, longitulinal and cross sevtion.
39, 40. Aqueduct orer Byrd Creck, on the same canal ; elevation, abutment of wings, horizontal section at surface of water, tranaverse section, \&c.

The plates are engraved in the best style of art by the Le Keuxs from elahorate drawings made expressly for the work. Care las been taken that each subject contains cvery dimension necessary to show proportion and parts of construction.

Price E2; and in an Svo vol, price 6s. (sold together é2, 6s.)
REPORTS, SPECITICATIONS, AND ESTIMATES
or

## PUBLIC WORKS OF THE UNITED STATES OF AMERICA :

explanatory of the athas folio of detailed engravings, elucidating practically these important eugineering works.
65.

In one small volume, with many plates aod wood-cuts, second edition, corrected and improved, neatly bound, price $4 s .6 d .$, the

## OPERATIVE MECHANIC'S WORKSHOP COMPANION,

 ANDTHE SCIENTIPIC GENTLEMAN'S PRACTICAL ASSISTANT; containing a great varicty of the most useful Rules in mechanical science, divested of mathematical complexity; with numerous Tables of practical data and calculated results for facilitating mechanical and commercial transactions.

By WILLIAM TEMPLETON, Anthor of several useful Practical Works.
66.

In 18 mo , in boards, comprising 390 pages, price $5 s$.
A SYNOPSIS OF PRACTICAL PHILOSOPHY, alphabetically arranged, contrining a great variety of Theorems, Formulx, and Tables, from the most aceurate and recent anthorities in various branches of Mathematics and Natural Philosophy: with Tables of Logarithms. By the Rev. JOHN CARR, M.A., lute Fellow of Trinity College, Cambridge.

[^12]
## HYDRAULICS.

67. 

In 4to, with plates, price 7s. 6 d .
PRACTICAL AND EXPERIMENTAL

## RESEARCHES IN HYDRAULICS.

By R. A. PEACOCKE, C.E.
68.

In 4to, with illustrative plates.
A SYSTEM OF APPARATUS,
for the use of Lecturers and Experimenters in Mechanical Philosophy, especially in those brauches which are connected with Mechanism,

By the Rev. R. WILLIS, M. A., T. R. S., \&ce, \&ce., Jacksonian Professor in the Univernity of Cambridge.
69.

In $8 v o$, with 19 plates, in boards, price $9 s$.
AN HISTORICAL AND SCIENTIFIC DESCRIPTION OF THE
MODE OF SUPPLYING LONDON WITH WATER; and a particular account of the different Companies so engaged, with an exposition of the attempts to adopt other modes ; together with an account of the contrivances for supplying cities in different ages and countries.

By the late WILLIAM MATTHEWS.
70.

In 8vo, with 2 plates, price $2 s$. $6 d$. REPORT ON THE
IMPROVEMENT of the RIVERS MERSEY and IRWELL, between Liverpool and Manchester; describing the means of adapting them for the navigation of sea-going vessels.
By the late HENRY R. PALMER, F.R.S., V.P. Inst. C.E.
71.

In 4 to, with plates, price $78.6 d$.
WATER WHEELS WITH VENTILATED BUCKETS. By WILLLAM FAIRBAIRN, C.E.
72.

In 1 large 8 vo volume, with plates, second edition, price 48.6 d . REMARKS ON
THE IMPROVEMENT OF TIDAL RIVERS. By DAVID STEVENSON, C.B., F.R.S.E., \&c.
joHn weale's amended catalogue for 1851.

## BUILDING STONE-CEMENTS.

73. 

In ffo, with very fine plates, a new edition, corrected and extended, 5s, sewed. Report and Investigation into the Qualifications and Fitness of STONE FOR BUHDING PURPOSES,
Mone particularly for tie new houses of parliament, and expressly inquired into by Commissioners appointed by Her Majesty, viz. Sir T. Henry De la Beche, Chas. Barry, Esqu, and C. H. Smith, Esq.
74.

In 8 ro, with a large nectional plate, price 18. fid. OBSERVATIONS ON KENTISH RAG STONE AS A BUILDING MATERIAL.
By JOHN WHICHCORD, junior, Arehitect.
75.

In 8 vo , with plates, extra cloth boards, price 108.6 d .
CEMENTS:
a practical and scientific treatise on the choice and preparation of the materials for, and the mannacture and application of, Calcareous Mortars and Cements, artificial and natural, founded on an extensive series of original experiments, By M. L. J. Yicax, Chiaf Eugineer of Roads, \&e. Translated from the French; with mumerous and valuable additions and explanatory notes, comprehending the most important known facts in this science, and with audditional new experiments and remarks.

By Major J. T. SMITH, Madras Eugineers, P.R.S., \&c.

## WARMING AND VENTILATION OF BUIGDINGS. 76.

Second edition, in 1 vol. 8vo, with plates, price 68 . A popular treatise on the

## WARMING AND VENTULATION OF BUILDINGS;

showing the advantages of the improved system of heated water circulation, \&c.
By J. C. RICHARDSON, Architect. LIST OF PLATES.

1. Elevation of heated Water apparatus, and its application in buildings.
2. Apparatus used at the Britisit Museums to warm rooms, with details of fumace.
d. Section of premiseb of R. Cadell, Sort. Edinburgh, showing the system of wurming.
3. Method of warming at the Register Offiec. Edinburgh.
5, Method of warming the New Justiciary Court, Edinburgh.
4. Strathfieldaye House, a seat of his Grice thie Duke of Wellington-Irometrical view of cloned tubes for warming.
5. The Atlas Insurnen Offer, Cliespoide.
6. Apparatus at the Earl of Radnor's, Colesfill; and the Patent OWice, Lincoln's Ino-Fields.
7. Vinery and forcing-house, \&c.
8. Plan and section of gallery, pieture room and monk's roomat the Soane Museum, showing the method of warming.
9. Methods tor ventilating and warming private houses and buildings.
10. Example of ventilation and warming in a primate building, with details.
11. Method of ventilation and warming at Sir Robert Smirke's office.
12. Practieal illuntration of downmard ventilatiou and warning, applied in cells
intended for the military confinement
of prisotert ;-an arrangement which
prevents sunnid being eomveyed.
13. Hinstration of Mr . Berohiandt's syatem of
hrated air for warming and airiog build-
ingh, comolithiurifying appatatus, ese.
14. Sir H. Dary's plan for warming and
ventilating the Howae of Londy (in
1811), copient from his nriginst drav-
ing :-air machine or fanner for ventilation.
15. Section of the temparary House of Coms. mons, showing Dr. Reid's syatem for Warming, ventilation, and the transmission of sound.
16. Illuatration of Dr. Arnott's air atove, and systam for warming and rentilating rootns.

## 77.

In $4 t 0$, with 10 plates, price 12 s .

## MODERN PRISONS:

their construction and ventilation.
By Lient.-Col. JEBB, R.E.
The plates of this work fully develop the sadopted system of ventilation in the large establishments under Government control.

## 78.

In 12 mo , a new elition, with the Government Table of Annuities, and other receutly adided valuable Tables, price 7 s . boards.

## TABLES FOR THE PURCHASING OF ESTATES,

frechold, copyhold, or leasehold, annuities, \&c., and for the renewing of leases held under cafthedral churches, colleges, or other corporate bodies, for terms of years certain, and for lives; also, for valuing reversionary estates, deferred annuities, next presentations, \&c. Together with several useful and interesting Tables connected with the sulject. Also, the five Tables of compound interest.

By W. INWOOD, Arehilect and Surreyor.
79.

In a small and convenient volume, half-hound in morocco, price $3 s .6 d$., The

> NEW METROPOLITAN BUILDINGS ACT:
recently passed for the regulation of all kinds of building in and about London. Published under anthority, with diagrams, notes, and copious index, and arranged for the use of tmagistrates, the legal profession, architects, surveyors, builders, and land and house proprietora.

By DAVID GIBBONS, Esq., Special Pleader.
80.

P'ublished by authority, in small 8vo, uniform with the 'Metropolitan Buildings Aet,' $7 \& 8$ Vror. cap, 84 , price 2s. $6 d$. boards.

> PROCEEDINGS UNDER THE
METROPOLITAN BUILDINGS ACT;
containing a collection of Awards made by the Official Referees; the Modifications sametioned by the Commissioners of Works, ke; and some account of the Oitice estahlished under that Act. To which are added Tables of Fees and a list of District Surveyors.
81.

12 mo , price 2 s .6 d .

## A MANUAL OF THE LAW OF FIXTURES. <br> By DAVID GIBBONS, Esq., Special Pleader.

A work written for the use of builders, house agents, and house and land proprictors.
82.

In demy 8 vo, a new and much extended edition, price 16 s .
A treatise on
THE LAW OF DILAPIDATIONS AND NUISANCES. By DAVID GIBBONS, Bsq., of the Middle Temple, Special Pleader.
83.

In one vol. Ato, price E1. 18 , in boards.
PROGRESS OF MACHINERY AND MANUFACTURES IN GREAT BRITAIN,
as exhilited chiefly in chronological notices of some letters patent, granted for inventions and improvements from the earliest times to the reign of Queen Anne.

This work has been got up at a considerable cost of time and money.
** It is intended by II. M. Government to take up the subject from the termination of this volume. It is the commencement of a most valuable antiquarian, historical, and mechanical account of the progress of manufactures and machinery in this country, in addition to its showing the settlement, rise, and fortunes of many families now of the British aristocracy.
84.

Third edition, in royal 8vo, boards, with 13 charts, \&ce., price 12 s.
AN ATTEMPT TO DEVELOP THE LAW OF STORMS
by means of facts arranged according to place and time; and hence to point out a cause for the variable winds, with a view to practical use in navigation.

By Lieut.-Col. W. REID, C.B., and R.B., late Governor of Barbados.
85.

In royal 8 vo , mniform with the preceding, price 98. , with Charts and wood-cuts.

> THE PROGRESS OF THE DEVELOPMENT
> of THE

LAW OF STORMS AND OF THE VARIABLE WINDS;
With the practical application of the subject to Navigation.
By Lieut.-Col. W. REID, C.B., F.R.S., dec., \&ce, \&c.
joun weale's amended cataloguk for 1851.
86.

In 1 vol. royal 8 vo , with plates and a large plate of Meteorological Phenomena, price £1. 18.
TRANSACTIONS OF THE METEOROLOGICAL SOCIETY, Instituted in the year 1823.
87.

In 1 vol. 8 vo , with 11 plates, price 58 .
MINERAL VEINS;
Practical Observations on their Mechanical Structure, Mode of Formation, the
Repletion or Filling, and their Intersection and Relative Age.
By JOHN LEITHART, Mine Agent.
88.

In 1 vol. Svo, price 7 s , 6 d . in boards.
OBSERVATIONS ON THE DUTIES AND RESPONSIBILITIES anvolved in
THE MANAGEMENT OF MNTS.
By Major J. T. SMITH, H,E.I.C. Engineers, F.R.S., F.R.S.N.A., Master of the Madras Mint, A.M. Cor. Eng. Inst.
89.

In 1 vol. $4 t 0$, with illustrative engravings, extra cloth boards, $10 \mathrm{~s}, 6 \mathrm{~d}$.
AN ESSAY ON SYMBOLIC COLOURS,
in antiquity, the middle ages, and modern times. Translated from the French of Le Baron Frédéric de Portal, Maitre des Requêtes, Chevalier de la Légion d'Honneur.

By william INMAN, Architect, Assoc. Inst. C.E.
90.

A new and much extended edition in the press, in 1 volume 8 ro , with plates.
THE STUDENT'S, BULLDER'S, AND ARCHITECT'S INSTRUCTOR
in the art and practice of measuring the various artificers' work in building generally: a complete code of instructive rules and examples in the practice of measuring, abstracting, and bringing the quantities into bill, and valuing the several works performed by the different artificers in the erection of buildings.

By E. DOBSON, Assoc. Inst. C.E.
contents.
Introductory remarks and objects of the work.
On measuring-abbreviation-rotation-abstracting \& bringing the quantities
into bill-valuation-finding and calculating the decimal for day labour.
Measurement of digging.-Ditto in sidelong ground.
Brick-work of different kinds.-Valuation of, with an engraving illustrating
John weale's amended cataloguk for 1851.

## 34 MEA8URING AND VALUATION.

the mode of measuring.-Abstraction of, refation, vice, and calculation of lahour.
Paving, measurement and valuation of.
Slaters' work, tiling, \&e. do.
Carpenters and joiners' work of the sevent kinds, valuation of, with four engravings, exhibiting the mode of measuring and valning floors, the interior of rooms, centering, brackating, pilasters, \&ke, door cases, linings, sashes and frames, bhutters, staircases, sce.

## Sawyers' work.

Stonemasons' work, measurement and valuation of the different kinds, with two engravings, showing the mode of measuring staincases, steps, landings, copings, window sills, curbs, string-courses, plinths, architraves, niches, columns, blockings and cornices, stone facingz, \&c.
Plasterers' work, measurement of, rotation, \&c., with an explanatory engraving. Smiths and ironmougers' work.-Plumbers' work, valnation of.-Painters and glaziers' work, do.-Paper-hangers' work, io.
91.

Just published, price 2 s . 6 .. , or mounted on cloth, 38 .

## THE CONTRACTOR'S WAGES TABLE. <br> By EDWARD JOHNSON.

The Table is printed on a large shect, and shows the various amounts AT oxces from $\frac{1}{7}$ to 32 days, advamcing regularly $\frac{1}{}$ of a day eachi time, and rated from 1s. 6d, to 6s. per day.
92.

In long and narrow size, for the workman's pocket, bound, price $2 s, 6 d$.
THE IMPROVED PORTABLE MEASURER;
containing new sets of Tables for solid and superficial meastrement; with scales of prices, and other useful calculations.
By JAMES HAVILAND, Timber Surveyor, \&c.
93.

In 1 vol. 8 vo, price 5 s., a new edition, in boards.

> TABLES OF

## SPECIFIC GRAVITIES OF ALL SUBSTANCES ;

their superficial and solid contents; land measuring; together with a computation of the differcmce between the old and new weights and measures; also a definition of mechanical power in the practical use of machinery; the prices of the work of mill-wrights and other arlificers ; with Tables of interest, discount, \&e.

> By JAMES HAVILAND, Surveyor.
94.

Bound and lettered, in 4 to, price $£ 1$. 1s.
CABINET MAKING AND UPHOLSTERER'S DESIGNS:
The modern style of Cabinet Work exemplified, together with the Supplement: 100 plates.
By THOMAS KING.
JOHN WEALE'S AMENDED CATALOGUE FOR 1851.
95.

With 37 plates, 4 te, price 9k, bound and lettered. THE UPHOLSTERER'S GUIDE:

Rules for cutting and forming Draperies, Valances, \&e.

> By THOMAS KING.
96.

Small folio, 60 plates in boards, price $20 \%$.
DESIGNS FOR FURNITURE, PLAIN AND MODERN,
consisting of Tables, Sofas, Chairs of several kinds, Sideboards, Commodes, Wardrobes, Ottomans, de.
97.

In fto 200 dexigns in 100 engravings, very neaily half-bound in moroceo, price $£ 1$. 5 s.

## OLD ENGLISH AND FRENCH ORNAMENT,

yor interior embellismment, and poll carvers and decorators; with designs for Doors, Windows, Fire-places, Chimney Glasses, ornamented Furniture, \&e. By Chippendale, Johsson, Inigo Jones, Lock, and others.
98.

In imperial 8 ro, 41 plates, extra eloth boards, price 16 s. dESIGNS YOR

## MONUMENT\&AND CHIMNEY-PIECES.

 By WILLIAM THOMAS, Architect.Tombs, monuments, for churches, chapels, snd burial grounds, 17 plates: chimney-pieces, in several styles, 24 plates.

## 99.

In imperial 4to, with 50 fine engravings, and 2 fine wood-cuts of the past and present entrances at Hyde Park Corner, drawings contributed by Decimus Buaton, Esq, half-bound in moroceo, price £1. 4s

## DESIGNS OF

ORNAMENTAL GATES, LODGES, PALISADING, AND IRON-WORK OF THE ROYAL PARKS,
with some other designs equal in utility and taste, intended for those designing and making parks, terraces, pleasure-walks, recreative gromonds, \&c.
Principally taken from the executed works of Decimus Burton, architeet; John Nash, arehitect; Sydney Smirke, arehitect; Sir John Soane, architect; Robert Stevenson, C.E.; Sir John Vanbrugh, atehiteet; and Sir Christopher Wren, architect.

```
LIST OY THS SUByECTS.
```

1. Gates to the royal entrnee, St. James'a Park.
2. Compartment of ditto, enlarged.
3. Plan of St.James's Park.
4. Flan of Hydo Park:
5. Plan of Resent's Park.
6. Marble arch (ther late), Buckingham Palace, plas aud elevation.

4 Minlico lod roufaltin, plan and eletation. A, Colaminule, Livilo Jorls, entnemmo frome Piecurlily plar anit clevatiun.
 frout and side devasimas asa plan.
lvi Blyde Jark lodge, front aind side elevations and plais.
11. Hamant Suciety Tecolving- Houne, plau and elevation.
12. Grusveunr foulge, frint and shdeclovationi and jilan.
13. Stanhome forfer, din. Ato.
14. Gumbesiant loder, do. do.
15. Gloneeter lodge, elevaifion aind julan.
16. Hanover locge, elevation and plant.
18. Tampat Hyse Hark Comer, with detafle. 18. Gates cetifie of entonnade, flyde tharla;
10. Details of ditto, quarter fill sian.
10. Detais of durto, guarter rai siom.
10. Tailing at the head of the Serpentine river, dwart gatox to royal entramee dwari railing to lodgr, Hyde Park.
21. Stanhope gate rails, dittor.
22. Cumberlanil gafer rails, ditto.
23. Parts and details of precedin=
25. Railing, Park Square, Hecent's Park.
25. York gate railing. Regent's Hark.
26. Railin5, York Terrace, ditfe.
47. Briling, Cheater Terrace, ditto.
25. Tailing lar Camiridge and Gloncester Terraces, do.
29. Foot-gate anil half nf carriage-gate, Cambrider Place, ditto.
30. Railing, Filucester Gate, difto.
31. Railong, Clarente Gate, fitto.
78. Ditto. diteo, ditto,
13. Hailing, Hanover Gates, ditto.
4. Itailing, Sussex Terrace, ditto.
25. Hiailing, Hanover Terrace, ditto. 36, Iamp and railing, Chelsea Hospital. 37. Parte of imon-Work, ditto, to a larger seale. is. Gates, Hampton Eourt, (Sir C. W'ren.-) ij). Ditto dito. ditto.
36. Parts of irio-wotk, ditto. dieto. 41. Irom-vork of Kinge's stairease, ditto. 12. Irull-work nf Qurca's staircase, ditfo. 42. Tlan and elevation of entrance loderes and imot gates at Greerwieh. (Sir C. Wren.)
11. Ditfo, ditfo, largur scale.
15. Iron gates at Gunnersbury Park.
46. Plan, elevation, and detaile of ditto. 47. Old Buckingham Palace entrance, iron gates in 1737 .
14. Latnp, Stiring Gwatle,
$49 \mathrm{~K} \cdot 50$. Elerations of gates and palisadin5 at the Palace of the Grand Sultan, Constantinople.
100.

A TABLE OF THE WEIGHT OF WROUGHT IRON,

## IN OUNCES AND DECIMATS

accurately constructed to show the Weipht per Iineal Fout of Square and Flat Iron to sis inches wide, extending to 7055 sizer, and adrancing by eighths of an inch in each dimension of breadth and thickness. Also, the Weight of Round Iron to six inehrs dianeter, of all the sizes usually manufsctured; and the Weight of Hoop Iron, for Bond, Kec., up to six inches in width, advancing by sisteenths of an inch.

The whole carefully revised, and artanged in alternate coloured colamns with an urnamental border designed expresely for this worls; and forming a Table of Reference for the use of Architects. Engineers, Buliter, and Contractors for Works generally.

Sizc of the Table, 25 inches by 194 , price 6 k. and on imperial paper 8 s . 6 d . Proof impressions 10s. $6 d$, each, or carefnlly packed for the country and forwarded carriage free, 2 s . extra. A few copics may be had, mounted on cloth, to fold into embossed cases, Byo sise, price 12 m , or, free by post, $12 \mathrm{n}, 6 \mathrm{~d}$, and will be found availahle where portalility is desired.

## 101.

In 1 vol. folio, with 66 phates, half-hound, price $£ 1.108$. COLLECTION OF RILIEVO DECORATIONS, as executed in Papier-Maché and Carton-Pierré by Messrs. Jackson and Son, adapted to all the requirements of interior decoration of Mansions, Churches, Theatres, \&c., \&c., \&c.

## 102.

In folio, in two parts, price 10 x . each, in hoth parts 40 plates. PATENT CANNABIC ORNAMENT,
for Architectural and Orumental Decorations, applicable to external as well as interual enrichments.
103.

On 33 folio Plates, engraved in imitation of Chalk Drawings, price 15s. ORNAMENTS DISPLAYED,
On a full size for Working, proper for all Carvers, Painters, \&c., containing a varitty of accurate Examples of Foliage and Friezes.

JOHN WEALE'S AMENDED CATALOGUE FOR 1851.

## PATENTS, AQUEDUCTS, NAVAL ARCHITECTURE. 37

104. 

In 1 vol. 4 to, price $5 s$.
OBSERVATIONS ON THE
NEW FRENCH LAW RELATIVE TO PATENTS FOR INVENTIONS,
And the Statutes now in force appertaining to Letters Patent for inventions in Great Britain and the Colonies. By CHARLES EGAN, Barrister-at.Law.
105.

In 1 vol. large 8 vo , price 10 s .6 d .
COLLECTION OF THE
LAWS OF PATENT PRIVILEGES
of all the countries of Europe, the United States of North America, and the Dutch West Indies, in the several languages of the countries of which the laws are here given.

By Charles F. LOOSEX, C.E., of Vienna.
106.

In 1 large 4 to volume, with 20 plates, price $£ 1,11 \mathrm{~s} .6 d$. DESCRIPTION OF
THE NEW YORK CROTON AQUEDUCT, in english, german, and french.

> By T. SCHRAMKE, C.E.
107.

In 4 to, with a plate, price 10 s .6 d .
AN ANALYTICAL INVESTIGATION OF THE ACTION OF THE
CORNISH PUMPING ENGINE. By Willlam POLE, c.E.
Fellow of the Hogal Astronomical Society; Aswociate of the Inatitution of Civil Engineers. This, the third Part, completes the 'Treatise on the Cornish Pumping Engine.' Parts I. and II, may also be had.

NAVAZ ARCHITECTURE. 108.

In 1 vol. Ato text, and a large atlas folio volume of plates, half-bound, price £6. 6 。

## THE ELEMENTS AND PRACTICE OF NAVAL ARCHITECTURE;

or, a Treatise on Ship Building, theoretical and practical, on the best principles established in Great Britain; with copions Tables of dimensions, scantlings, \&c.

Illustrated with a series of large draughts and numerous smaller eugravings.
The 3rdedition, with an Appendix, containing the principles and practice
JOEN WEALE'S AMENDED CATALOGUE FOR 1851.
of constructing the Moyal and Mteremtile Navies, as invented and introdaced by Sir Romemt Skpinga, Surveyor of the Navy.

## By JOHN KNOWLES, F.R.S. <br> LIST OP TLATES.

Perapoctive uf the frame of a 100 - rom sliph. Constraction of mir arch, gircles, de.
Comes.
Copatans, crabs.
Cumalucting lindies and bans.
Eloatioy budies.
Plates of Details.-The following are exceedingly large:
Coustruetion 1. Draught of a ohiy propusel to car detail.

the $50-3$, The planking expamuled uf the 50 -run thip.
4. Profile of the inhoard wotks of tbe E0-gan ship.
8. Plann of the gun deck and orlop of do.
firceatle.
6. Plans of the guarter deek, ureeasle, and upper decki of das.
7. Mhir gear capitan of an S0-gun simp, windlam, \&e.t and detals. - i. Midship section of a 7d-gun ship: midahip rection of a 74 -gur ohip, as proposed be Mr. Supdgrass : midehip section of a so-gun fricate; midahip section of a 36 -run frigate, as propused ly 39 . Snodgrass! skecthes of a neve plas pro. posed for framing zhips, and of the brest rande of alopting iron-work in the conatruction, and other details.
9. Steer draught and plaus of $=40-\mathrm{gun}$ frigate, with lameh, \&c.
10. Shert drameht, half-hrealth
and body plans of a sloop of var.
-11. Dranght of the Dart and Arrait aloops, as deaigned by General Bentham.
-12 . A hrig of war, 18 gum.
11. Inboaril works of do.
lower decks and platforms of a brig ufwar.
15. Yucht Royal Sonereign.
16. Tacht bult for the Brinee Royal of Denmark.
17. Plans and neetion of the interior of a firc-ship.
bomh versel.
atrmetion 19, A cutter, upou a new conwith mole offittine aliling keels. 20. Sheer druaght, half-lireadth

Representations of a flying proa. Experiments on stahilify. Scalrs of solidity of tornage and displace.
Maclines for driving anil drawing bolts.
Luogitudimal sectlon \& plan of a 7 d-gun ship.
Cousiruetiun 21, Sheer draught, half-lireadth and body plans of a West Indiaman.
22. A collier brig of 170 tons.
$\qquad$
for m privateer.
24. A fast-viling schouner.
95. A Virginis pilot boat
36. A Berwiek smaek.

Lionden trait. A slanp of 63 tons in the for her capacity aud velocity.
bing,
$\qquad$ ship, thinwint fhe ingg heat of an 80-yun by whole moulding.
martif cutter, yawt, हe,
31. Wherry, life heat, whate bust, स gis, a swift rowine boat,

- 82 . Laying tiff, plan of the fire lundy, shere and half-breadth plan of the fore body, mouldy belonging to the square badies, ke.
-herer and bati. Plan of the after bojy, body, \&e.
- 36 . After body plan, fore body plan, sheer, and half-hereadth plans of the after cant body, sherer and half-breadth plans of the fore cant body.
transems, wherr plan, body nlan, \&e.
nher plan, body nan, 36 . Square fuck, body plans,
sheer and half-breadth plans.
-37. Hawse pieces, cant harse pieces, Ke.
laying off of the haring off of the stem, aheer plans, bidy plams.
-39. Plans, elevations, and weefinm if the different emtrivance for fitting the store-noemy, tee., on the orlap of an oorun shin, showing the method of fitting all ships of the line in future. and boily plans of an Enst Indiaman.


## 109.

Drawn and eograved with dimensions, 8vo text, and folio plates, price 12 s. THE NAVAL ARCHITECT'S PORTFOLIO AND THE STUDENT'S PIACTICAL INSTRUCTOR in the Construction and Draughting of Ships for War, Mereantile, and SteamPacket Service-Iron and Timber.
By H. A. SUMMERFELDT, Lieut, in the Royal Norwegian Navy.
JOHN WEALE'S AMENDED CATALOGUE FOR 1851.

## 110.

The plates in large atlas folio, test in folio, price . E 4. 48.

## NAVAL ARCHITECTURE;

OR,
THE RUDIMENTS AND RULES OF SHIP BUILDING;
exemplified in a series of dranghts and plans, with observations tending to the improvement of that important art.
By MARMADUKE STALKARTT, N.A.
THE PLATES CONSIST OY

1. A long buat for a third-rate, sis figures of rarious draughts.
2. A yacht of 141 toms, ten figuren of sereral drauzhts.
3. A sloop, 391 tons, sheer draught and buthint, fire and aft bodies.
4. A sloop of war, cant timbers.
5. The bot tom and top side.
6. 44 -gina frighte, five and afi, and hottom, a very fine und large engruving.
7. Draughts, several.
8. The shift of the planks in the top side,
and flie dieposition of the timbers in do.
9. 74-grim ship, sheer traught and bottom, fore and aft hodies.
10. Draughto, aeterni,
11. Right aft, a level view of the stern of a 74 -gun ship, side view of the head and quarier gallery, \&e.
12. A cutter, drandits, Sce.
13. Kraet method of ending the lines of tilf rent lections.
14. A frikate, aheer draught, bottom, fore frizato, sheer
and aft hodien.
${ }^{*}$. ${ }^{\text {* }}$ These plates exbilit fineness and correctiess of drawing and engraving, and upou a large scale of rarc occurrence.

## CIVIL ENGINEERSNG.

111. 

In 6 vols, medium 4to, with numerous elaborately engraved plates, price © 7.7 s .

## QUARTERLY PAPERS ON ENGINEERTNG,

comprising useful papers on civil and mechanical engineering, and the biography of some Engineers, atmong which will be found memoins of James Brindley, William Chapman, Samuel Clegg, and William Jessop;-papers on atmospheric and other railways, on steam engines, locomotive engines, and Cornish pumping engines ; on dredging machines, on docks, harbours, jetties, piers, breakwaters, and havens of safety; progress of the Thames tunnel folly narrated, accidents, remedies, \&e.; engineering of the United States and Holland; iron roof to the new Houses of Parliament; on the manufacture of hricks and tiles; on slate quarries; on suspension and other bridges; on inventions and patents; on water-wheels and supply of water, and on hydranlies ; on drainage, \&e., \&c.

## VOLUME $I$.

Memoir of James Brindley, C.E.
Memoir of William Chapman, C.E.
Dredging machine.
Account of the engines of the Russian steam frigate of war, Kamschatka.
Hints on some improvements of the steam engine.
Notices of works on eugineering.
On the setting out the ground for railways and canals.
On the utility and coustruction of the dredging machine.
On the construction of jetties and breakwaters.
25 engravings and wood-cnts.
112.

VOLUME II.
Report on the Kingslown and Dalkey atmospheric railway.
On a novel method of applying atmospheric pressure.
Memoir of Samuel Clegg, C.E.
Peelet's treatise on heat.
On dredging. By Messrs. Buey, Curtis, \& Kennedy.
Harbours of the south eastern coast.
Restoration of Herne Bay pier.
Examples of engineering in the United States.
On havens of safety.
Report on Holyhead and Port Dynllaen Harbours.
On the loss by friction in beam and direct action steam engines.
On the engineering of Holland.
On the consumption of fuel in locomotive engines.
Sir John Macneill's report on the atmospheric railways.

$$
50 \text { engravings. }
$$

113. 

VOLUME III.
Peclet on heat.
On the harbours of Holyhead, \&e.
On the construction of a harbour in connection with Granton Pier.
Iron roof of the New Houses of Parliament.
On slate quarries.
Woolf's patent steam engine.
Lectures on American steam navigation.
Arago on atmospheric railways.
Cast-iron bridge at St. Petersburg.
The Thames Tunnel.
On road making.
Oa the manufacture of bricks and tiles in Holland.

$$
28 \text { plates. }
$$

114. 

VOLUME IV.
Hydrostatic and hydraulic docks, patent slips, \&e., of the United State3.
Ancient and present state of the harbour of Rye.
$\mathrm{O}_{\mathrm{n}}$ the application of atmospheric pressure to railways.
On the construction of suspension bridges.
On the principles and practice of application of water power.
Experiments on locomotive engines.
Introduction of steam engines into Naval Arsenals and machinery, \&ce.
On forming foundations under water and on bad ground.
On the improvement of the River Medway, and of the Fort and Arsenal of Chatham.
On the improvement of Portsmonth Harbour.
Analytical investigation of the action of the Cornish pumping engine.
On water wheels.
On French and English patents.
Reports on the constructing and working atmospheric railways.
38 plates.

## VOLUME V.

On the machinery and manufactures in Great Britain, from the Saxon era to the reign of Queen Anne.
Researches in hydraulics.
The Thames Tunnel.
Arnollet's atmospheric railway.
German railways.
Sunderland docks.
$\frac{53 \text { engravings. }}{116 .}$

## VOLUME VI.

On the principles and practice of the application of water power.
Experiments on locomotive engines.
On the introduction of steam engines into Naval Arsenals.
On the mode of forming foundations unier water and on bad ground.
On the improvement of the River Miedway, and of the Fort and Arsenal of Chatham.
On the improvement of Portsmouth Harbour.
Analytical investigation of the action of the Cornish pumping engine.
On water-wheels.

## 30 Plates.

The Work complete in 6 vols. elegantly balf-bound in red morocco, price E 8. 8s.
"* But very few complete coples of this work now remath on hand; a large portion of the stock haring becen destroged by jore wh the warthote of a Beokbinder, who had the cave of it for coilation.

## 117. <br> TRANSACTIONS

OF

## THE INSTITUTION OF CIVIL ENGINEERS.

## volume t .

In 4to, containing a portrait of the late President, Thos. Telford, Esq., with 27 finely engraved plates, and numerous vignette embellishments of portraits of Engineers and their works, price $30 s$. extra cloth bds.
LIST of subjects.

Introduction, with illustrations.
An account of the harbour and docks of Kingston-upon-Hull. By Mr. Thmparex, Resident Eugineer to the Hull Dock Company.
On the locks commonly used for river and canal navigation. By W. A. Provis, M. Inst. C.E.
Improved canal lock. By J. Fiexd, F.R.S., V.P.
On the strain to which lock gates are subjected. By P. W. Barlow, C.E. On the hot-air blast. By J. B. Nerisos, C.E.
On the relation between the temperature and the elastic force of Steam, when confined in a boiler containing water. By John Parex, M. Inst. C.E.
On ventilating and lighting tumnels, particularly in reference to the one on the Leeds and Selby Railway. By J. Walker, F.R.S., L. \& E.
Particulars of the construction of the Lary bridge, near Plymouth. By J. M. Rendel, C.E.
Experiments on the power of water-wheels.
On the construction of oblique bridges.
JOHN TVEALE'S AMENDED CATALOGUE FOR 1851.

## CIVIL ENGINEERING.

Account of coals used in colce ovens and retorts, and coke produced from one year's work at the Ipowich gas-works. Communicated by W. Cubitr, P.R.S. An approximative fule for calculating the velocity with which a steam vessel will be impelled through still water, by the exertion of a given amount of mechanical power, or forcible motion, by marine steam engines. Communicated by Jous Fanex, C.S.
Oa the effective power of high-pressure expanive condensing steam engines, commonly in use in Cornish mines. By T. Wicksterd, C.E.
Description of the plan of restoring the arch-stones of Blackfrian' Bridge. By Mr. James Coorer, C,E.
On the force exerted ly lyydraullic pressure in a Bramah press; the resisting power of the cylinder, and rules for computing the thickness of metal for presses of various powers and dimensions. By Petka Barlow, P.R.S., de.
Account of some experiments on the expansion of water by heat. By the late T. Thedgold, C.E.

On procuring supplies of water for cities and towns, by boring. Come municated by Jome Seawand, C.E.
Account of several sections throngh the plastic clay formation in the vicinity of London. By Willida Gravatt, I.R.S., C.E.
Accounts of horings for water in London and its vicinity. By Jonn Donein, M. Inst. C.E.

Description of the method of roofing in nse in the Southern Concan, in the Bast Indies. By Lieut. Fras. Outhaar, Bombay Engineers.
Esperiments on the resistances of barges moving on canals. By Henry R. Palamb, C:E.
Elementary illustration of the principles of tension and of the resistance of bodies to being torn asunder in the direction of their length. By the late T. Trededed, C.E.

Details of the constraction of a stone hridge erected over the Doria Riparia, near Turin. By Chevalier Mosca, Engineer and Arelitect to the King of Sardinia, \&e., \&ce. Drawn up and communicated by B. Ahbano, C.E.
Memoir on the use of cast fron in pilling, particulariy at Brunswick Wharf, Blackwall. By Micharl A. Bortimick, C.E.
Account of the new or Grosvenor bridge over the river Dee at Chester.
Aecount of some experiments made in 1823 and 1824, for determining the quantity of water flowing through different slaped orifices. By Bryan Donkin, P.R.A.S., \&e.
On the clanges of temperatire consequent on any change in the density of elastic fluids, considered especially wifh reference to steam. By Teomas Wenster, M.A., Trin. Coll., Camb.
Method of representing by diagram and estimating the earthwork in excavations and embankments. By Mr, John James Watseston, C.E.
Remarks on Herm granite. By Fremeriok C. Lukis, of Guernsey, in reply to inquiries from the President: with sowe experiments made by the latter on the wear of different granites.
Experiments on the force required to fracture and crush stones; made under the direction of Mears. Bramar and Sons, for B. Wyatt, Architect.
Canal boat expcriments. By Sir Jons Macsemb, C.E., R.R.A.S., M.R.I.A.

## 118.

volume II.
In 4 to, containing 23 finely engraved plates, price $28 s$ s. extra cloth bds. hist of subjects.
Account of the bridge over the Severn, near Tewhesbury, designed by the late

Thomas Telford, Esifo, and erected mender his auperiatendence. By W. Mackenzie, C.E.
Series of esperiments on different kinds of Ameriean timber. By Sir W, Demison, Capt. Royal Engineers, 1.R.5., bec.
On the application of steam as a moving power, cousidered especially with raference to the cconomy of stmospluric and high-pressure steam. By
Georas Horwonvar Patars, O.E. George Holwonthy Palaner, O.E.
Description of Mr. H. Guy's methoid of giving a frue opherical figure to balls of metal, glass, agate, or hard substances.
On the expansive action of steam in some of the pumping eogines at the Cornish mines. By Wrusum Joary Hexwoob, P.G.S., Secretary of the Royal Geological Society of Cornwall, H. M. Assay-Master of Tin in the Duchy of Cornwall.
On the effective power of the high-pressure expansive condensing engines in use at some of the Cornish mines. By Tromss Wrektredd, C.B.
Description of the drops used by the Stamhope and Tyne Railroad Company, for the shipment of coals at South Shields. By Trosas E. Harkisos, C.E.
On the principle and construction of railways on continuous bearings. By Joun Reynolds, Esq.
Wooden bridge over the River Calder, at Mirfield, Yorlslire, designed and erected hy Wifliam Bums, C.E.
A series of experiments on the strength of east iron. By the late Frawcis Вдаман, C.E.
On certain forms of locomotive engines. By Eoward Woods, C.B.
Description of Youghal bridge, designed by Alesander Nimmo. By Joun E. JONEs, C.E.

On the evaporation of water from steain boilers. By Josman Parees, C.E.
Account of a machine for cleansing and deepening small rivers, in use on the Little Stomr river, Kent. By W. B. Hars, C.E.
Description of the perpendicular lifts for passing hoats from one level of canal to another, as erected on the Grand Western Canal. By J, Gkern, C.E.
On the methods of illominating lighthonsers, with a description of a reciprocating light. By Major J. T. Samth, Madras Engineers, P.R.S., \&e.
Experiments on the flow of water through small pipes. By W. A. Provis, C.E.
Experiments on the power of men. By Josaua Fueld, C.E., P.R.G.S., \&e.,
Particulars of the coustruction of the floating bridge lately established across the Hamoaze, between Torpoint and Devonports-By J. M. Kenden, C.E.
Appendix-Officers, Members, \&c.

## MILITARX AND CIVIL ENGINEERING.

119. 

## PAPERS ON SUBJECTS CONNECTED WITH THE DUTIES or

## THE CORPS OF ROYAL ENGINEERS.

VOEUMI t .
In 4 to, 2nd edition, with plates and wood-cuts, extra cloth boards, price 168. contents.
On assaults. By Lieut.-Colowel Reid, R.E.
Account of the attack on Fort Laredo, near Santoña.
JOHN WEALE'S AMENDED CATALOGUE FOR 1851.

Notes on cmerete. By Capt, Sí WV. Dixisos, R.E.
Method adopted for underpinning with concrete the store-houses in Chatham Dockyard. By the same.
Conerete bomb-proof ereeted at Woolwich, with detailed experiments as to the effect produced on it by the fire of artillery. By Capt. Alexandea, R.E.
Concrete sea wall at Brighton, and the groins which defend the foot of it. By Licut.-Colonel Rerd, R.E.
Groins used on the coast of Sussex for proventing the encroachment of the sea. By Capt, Luxmoons, R.E.
Table for determining altitules with the momitain barometer. By S, B. Howlett, Chief Draughtsman, Ordaance.
New method of making perspective drawinge from pluns and dimensions. By the same.
New field protractor and sketch-book. By the same.
New method nf plotting a survey. By the same.
New station pointer. By the same.
New line divider and universal scale. By the same.
Causes which led to the construction of the lideau canal, connecting the waters of Lake Outario and the Ottawah; the nature of the communication prior to 1827, \&e. By Capt. Froms, R.E.
Account of the failure of a part of the Brighton chain pier, in the gate of the 30th of November, 1836. By Lient-Col. Rem, R.E.
Landing wharf erected at Hobbs' Point, Milford Haven, for the accommodation of the steam packet establishment, diving bells and machinery used in the erection, \&e. By Captain Savage, R.E.
Extracts from a Report on the copper pontoons used in the Neapolitan service, in 1805, with remarks on the inefficiency of all open pontoons of the common rectangular form, for the passage of rapid rivers. By Major-Gen. Sir C. W. Paslex, \&c., \&c.
Investigation of the position of the horizontal axis of a self-acting sluice-gate, from the 'Mémorial du Génie.'
Kyan's process for the preservation of timber from dry-rot, with a description of the tank erected for that purpose in the Royal Arsenal, Woolwich. By Lieut.-Colonel Alderson, R.E.
Hints for the compilation of an Aide-Mémoire for the Corps of Royal Engineers. By Lieut..Col, Rem, R.E.
120.

VOLEME II.
In 4to, 2 nd edition, with plates and wood-cuts, extra cloth bds., price $£ 1.58$. contents.
On intrenchments as supports in battle, and on the necessity of completing the military organization of the Corps of Royal Eugineers. By Lieut.-Col. Reid, R.E.
Notes on the charges of military mines. By Capt. Sir W. Denrson, R.E.
Account of the demolition of the glacière bastion at Quebec, in 1828.
Demolition of the south face of Fort Schulemburg. By Maj. Marshall, R.E.
Demolition of the piers of the entrance chamber of the large basin at Flushing, in 1809. By Major-Gen, Fanshawz, R.E.
Extract of a letter from Colour-Serje. Harris, Royal Sappers and Miners, to

Col. Paktavy, R.E., on the mode in which a atranded ship was blown to pieces.
Notes on the formation of lreaches by artillery. Experiments at Metz, and practice agaiest Carnott's wall at Woolvich. By Capt, Sir W. Denisox, R.E. Memoir on the fortifications in Weatern Germany.
Ou contoured plans and defilade. By Capt. Harness, R.E.
Report on the Manchester, Cheshire, Staffordshire, and the South Union lines of railsay. By Col, Alpenson, B.I.
Rídeau damy. By Capt, Sir W. Dentson, R.E,
Memorandum of the manner in which the several repairs of the chain pier at Brighton have been executed, together with some reflections on its construction and durabillty. By Major Piper, R.E.
Further observations on the moving of the shingle of the beach along the coast. By Lieut-Col. Reid, R.E.
Coust defences in Holland. By Captain Sandmaar, R.E.
Iturricanes. By Lieut.-Col. Rero, R.E.
On the fact of small tish falling during rain in India. By Capt. C. W. Gasast, Bombay Eugincers.
Insiractions for making and registering meteorologieal observations in Southern Africa, and other countries in the South Seas, as also at sea. By Sir Joha P. Herscaell, K.H., I.R.S.
Construction of barracks for tropical climates. By Capt, Smyth, R.E.
Memorandom relative to a syatem of barracks for the West Indies, recommended by Col. Sir C. P. Sautz, C.B., R.E. By Capt. Brandreth, R.E.
Description of barracks nt St . Lucia, in Jamaica.
Memorandum with reference to the aecompanying sketches of the officers' barracks erected at George Town, Demerara. By Mr. Cuming, R.E.D.
Captain Sandbam's mode of curing or improving smoky chimneys; with remarks also on Count Rumford's system, \&e.
Notes on concrete. By Capt. Sir W. Denison, R,E.
On a reflecting level, invented by Lieat.-Col. Busex, du Corps du Génie. Translated by Capt. Yolwasd, R.E.
Memorandum on paving stables. By Lieut,-Col. Alderson, R.E.
Method of taking perspective outlines from nature. By S. B. HowLETT.

## 121.

## VOLUME III.

In 4to, with several plates and wood-cuts, estra eloth boards, price $£ 1.5 \mathrm{~s}$. contents.
On the lines thrown up to cover Lishon in 1810. By Gen. Sir J. T. Jones, Bt. On the defence of Cadiz, and explanatory details of the position intrenched by the British troops under Lient.-Gen. Grawass, in 1810.
On the model towers approved by Napoleon. By Capt, Laryan, R.E.
On the demolition of revetments of some of the old works at Sheerness, 1827.
Letter from Lieut.-Col. R. Thossos, R.E., ou furuaces for heating shot.
Memoir on Posen. By T. K. Stavgrisy, Esq., late Captain, R.E.
Report on Beaufort bridge. By Capt. Nelson, R.E.
Sketch of the suspension lridge over the Lahn at Nassan. By the same.
Description of the works on the Ridenu caval. By Capt. Sir W. Denison, R.E.
Mode of bending timber adopted in Prussia. By Capt. Neison, R.E.
On the coffer-dam used in the construction of the piers of the Alexandria aqueduct. By Capt. Turnburi.

JOBN wEALE's AMENDED CATALOGUE FOR 1851.

## 46

MILITARY AND CIVIL ENGINEERING.
On the we-arch wooden linidge, of 205 feet spam, at Paradenia, across the Mahavillaganga, in the island of Ceylon. By Capt. Oloniesiaw, B.E.
Description of a series of liniges crecled across the river Ottawa, connecting the provinces of Upper and Lower Canada. Hy Capt. Sir W. Demison, R.E.

On a baromieter that requires no corrections either for zero or for temperature. By S. B. How lett.
Nolea to aid in correcting the operation of ascertaining the leights of mountains by means of boiling water; furnished by Lient.-Col. Ond, R.B.
On the decomposition of metallie iron in sull water, and its reconstruction in a mineral form. By Lieut.-Col. Rerp, R.E.
On the effiect of elimate on Xorbhhire puring. By Major-Gen. FAnshawn, R.B. Report of paving stables at Brighton.
Experiments tried at Quebec as to the properties and adliesive qualities of cements, in November, 1834.
Proof of an earthenware pipe for Lient. Denison. By Mr. Baamah.
Deseription of a drawhridge on the London and Birmingham Railway, at Weedon. By Lieut.-Col. Jezb, R.E.
Table of the description and weight of the packages of various articles of traific. By Lieut.-Col. H. D. Jones, R.E.
Appendix.-Note on Lintz
122.

VOLUME IV.
In 4to, with 30 plates and numerous wood-cuts, extra cloth bds. price $£ 1.8 \mathrm{~s}$. contents.
Memoir of the professional life of the late Captain Drummond. By Capt. Larcom, R.E.
Letter from Capt. George Thompson, B.I.C. Engineers, to Col. Pastery, R.E. Memorandum of the engineer operations at the taking of Ghuznee, in 1839.
Notes on Brixen and Verona in 1838. By T. K. Staveley, Esq., late Capt. R.E. Nates on shot furnaces. By Captain Nelson, R.E.
Description of a new steam apparatus for drying gmporder in the Royal laboratory at Woolvich, as proposed by Capt. Cayris, of the R.A.
Memoranda on blasting rock. By Major-Gen. Sir J. F. Burgoyne, K.C.B. Passage of the Indus. By Lieut. H. M. Duband, B.E.
On lodging troops in fortresses at their alarm posts. By Lieut.-Col. Rerd, R.E. Memoranda relating to the well in Fort Regent, Jersey. By Major Hazey D. Jones, R.E.

Notes on the island of Ascension. By Lieut,-Col. H. R. Brandreth, R.E.
On the dam constructed across the waste channel at Loag Island, on the Rideau canal. By Lieut,-Col. Bolron, R.E.
Engineer details. By Capt. Nerson, R.E. Principally collected at Bermuda. On the new victualling establishment at Devonport. By the same. Accompanied by drawings of cast-iron roofs.
Satety-box for connecting a locomotive engine and tender to the train. By S, B, Howlett.
New weigh-bridge in Woolwich Dockyard. By Capt. Sir W. Denison, R.E. Single coffer-dam across the entrance of the new dock in Woolwich Dockyard. By the same.
Notes on injecting cement or lydradic lime into leaky joints of masonry. By the same.
On the employment of sand for foundations in marshy or soft soil.

Description of the milling bridge at Fort Regent, Jersey.
Description of the roof of the chapel of the Royal Artillery barracks at
Woolwich, showing the failure of the principals, and the mode of restoring them. By Capt. Sir W. Denison, R.E.
Wharf cranes made by the Butterley Cormpany. By J. Ginnos, P.R.S.
Cast-iron bridge erected over the river Trent, tiear the confluence of the Trent
and Soar, on the line of the Milland Cornties Railway.

- 0 . I have printed teveral over conies of the Semoir of Captain Drummond, out of reapect to his memory. Copiea may be had, gratis, by any frienits of the deceaned, out any Oificern of the Corps of Royal Engivers; also by the Ođfern of the Bengal, Bombay, and Madrus Enginem. J, W.

123. 

VOLUME $V$.
In 4to, 60 plates and numerous wood-culs, extra cloth bds., price £1. 16s. contents.
Notes on Genoa and Lyons. By T. K. Stuveley, Esq., late Captain, R.B
Report on the last 150 miles of the Cireat Fish river, South Africa. By Capt, Nklson, R.E.
Operations for remoring the wreck of the 'Equitable' barque, in the Fultah reach of the river Hooghly. By Captain W. R. Fitzazrald, B.E.
Madras lighthonse. Report of progress in the execution of the new machinery and illuminating apparatus, By Major Smrre, M.E., F.R.S.; \&e.
Method of illuminating lighthonses, with a description of a reciprocating light. By the same.
New system of fixed lights. By the same.
New hydro-pneumatic lamp. By the same.
Experiments on various woods, both foreign and domestic. By Capt. Nelsos, R.E.; the late Capt. Young, R.E.; Sir Rouent Seppings; Capt, Smyti, R.E.; and Capt. Sir W. Devison, R.E.

On the canal navigation of the Canadas. By Lient.-Col. Pumblats, R.B.
Traversing crane used by the Butterley Company in erecting east-iron bridges and other public works. By Joseph Gernns, F.R.S.
On the mode of bailding houses, \&c., in the island of Malta. By Lieut.Col. Harry D. Jones, R.E.
On drawbridges, from the French of M. De Poncelet. By Lieat. Douglas Galton, R.E.
Description of the machinery in operation at the Royal arsenal for the manufacture of leadeu bullets by compression. By Capt. Sir W. Denison, R.E. Description of a dock lately constructed at Woolwich. By the same.
Description of the machinery employed in. Deptford Dockyard for spining hemp and manufactaring ropes and cables. By Mr. Johs Mrers, F.L.S.
Theory and practice of sinking Artesian wells. By Lieut.-Col. JERE, R.E.
Ou painting timber when exposed to damp. By W. Lavpir.
On copying maps and plans. By 8. B. Howakit.

## LIST OE PLATES.

1. Map of Genos and itz exvirons.
2. Plan of the fortitication of Lyons.
3. Plan of the fortibeatiun of Lyons.
4. Detalle of the operations for retmoring the wreck of the Equifathte.
5. Machinery attached to spparatus belonging to the Madras lighthouse.

5, 6, Elevation and section of a new lydropreumatio lamp-flatg-staff lights construeted for the port of Cochin.
7. Sketch of the line of water cormmunieation Frow the fort of Lalke Erie to Moritreal. B to 13. Man of one of the locks on the St.

## 48 MILITARY AND CIVIL ENGINEERING.

Iavrence canal-clevation of one side. $\mid 25,22$. Machine for courpressing Vullets.

Lam longitulinal suetion throurb the and the the foundation-rmper gate, centre wrence canat-ntan of the imat, St. Lawreace canab - . shuting vils. work for opening and shutting vaire-
gates-for adjusting iriction rolfer-for gates-for adjusting friction rolle
opening and shutting lock- हates.
11, 15. Traversing crane used by the Butterley Company.
15, 17. Detaile of the mode of builaing houses in the inlanid of Malta.
18, 19, 20. Details of the construction of drawbridges.

21, 24, 215. Eastern dock in Woolwich Dock yard - large slaice, ditto-east-iron capstan, ditto.
26 to 42. Mans, sertions, and details of the machinery emploged in Deptford Dockyard for apinmink hemp and manufacturing ropes and cables.
I3 to 44, Sections, Ae, of the Artenian well at the Model Prison, Caledonian Road; with implements, tools, ke.
49 to 60 . Plans and sections of works at the itland of Ascension.

## 124.

VOLUME VI.
In 4 to, with 64 elaborate and fine plates, and 30 wood-cuts, estra cloth bds., price E1. 16 s. CONTENTS.
Notes on the field equipment of the Engineer Department with the Bengal portion of the army of the Indus. By Lieut. Durand, B.E.
Notes on the defensive works of Jellalabad.
Notes on Acre and some of the coast defences of Syria. By Lieut.-Colonel Alderison, R.E.
Report of experiments in blowing in gates, made at Quebec in 1840.
On the reconstruction of the Admirality sea wall at Haslar Beach, Portsmouth. By Lieut. Beatson, R.E.
Practical essay on the strength of cast-iron beams, girders, and columns; in which the principles of calculation are exhibited in a plain and popular manner. By Willha Turnbull.
Hydraulic press for proving girders.
Description of the saw-mills and machinery for raising timber in Chatham Dockyard. By G. D. Deamaex, C.E.
Description of a saw-mill used in America.
Description of a wooden swing bridge over the Grenville canal, Canada.
On combining mechanical vencilation with warming by steam heat, as adapted to public buildings. By Mr. Spencer.
The patent American stearn pile-driving machines. By the same.
The American railroads formed on a foundation of piles.
On the method of raising buildings by screws, in Canada and the United States. By T. Hounslow, F.W., R.E.D.
Demolition and removal by blasting of a portion of the Round Down Cliff, near Dover, in 1843. By Capt. Huterinson, R.E.
Experiments on a shot furnace at Malta.
Description of iron roofs. By Captain Sir TV. Denisos, R.E.
On the use of fascines in forming foundations to buildings. By Colonel Lkwis, R.E.
Experiments carried on in Woolwich Dockyard, for ascertaining the resistance of briek-work under various conditions.

Frontispiece, View of Gaxa from Saxison't Mount, with the Bgyptian eneampment. 1. Sapper and Miarr tool rack.

2 to 4, Defensive works of Jellalabiad, ell-
virons of ditto, and sertions of the fortitications.
5. Plan of St, Jean d'Aere, 1799.
N. W, view of Triberia and the Sea of
JOHN WEALE'S AMENDED CATALOQUE FOR 1851.
 chorage, N. E. view of the Convent. afount Carmel, and Enginects' encampment.
N. iV + siow of E1 Ariseh.

Yien of the bech it Ascalon.
6. Plan of Gaza, de.

North view of Jaifa from the anchorage. N, E, view of ditto.
7. Jufla and its vicinity, 1512.

Ace from the aca, S. W\%, view, and Acre from Mount Cour de Idon, east view,日. Plan of Caiffa.
9. Nan and wetion of the fown and tlefesee of St. Jean I'Acre.
10. Dite, howing thepuitinu of ifie renelt,
11. Seetion of lureach, \&e., St. Jean I'Aere, 19. 81eteti nf the barior gatco. Quebee.
13. Sea walf or bryakwater at Haslar Heach. 15. Sections and elerationa of ditto.
15. Seetions of iron girders.
dimenions.
17 and 18 . Portablehydraulic preas for proying cast-inno girders.
19 to 28. Mhehinery oonneeted with the sammills in Chasham, Deckyard.
99. Plan, elevation, and section of the swing bridese of the line of the Greaville eanal.
81 to 34. Stemm warming and rentilatiog muchinery at the Reform Clab-House, 35 to 38, Patent Awerican steam pile-ifriving machine, with details, Kec, Ne.
32. New Yurk and Erie pille railroad. in Mode of raiains buildingss in Coutada,
4160.46 and $4^{\circ}$. Rnual Down Clif, Dover - sections of face, plam of mines, detaits of batteries, \&c.
45 and 46. Details of furnace for heating shot. 47 to 38 . Elevations and plase of iron roofs.

## 125.

VOLUME VII.
In 4 to, with plates and wool-cuts, exira cloth boands, price $£ 1.10$. contents.
Report on the application of forts, towers, and batteries to coast defences and harbours. By Col. Lewrs, C.B. R.B.
On the conitruction and ventilation of prisons. By Lient.-Col. Jebn, R.E.
On the condacting power of water as applied to submarine explosions by Voltaic electricity, with details of apparatus. By Lieut. Hurcuisson, R.E.
Description of the bridge aeross the Kat River, at Fort Beaufort, Cape of Good Hope. By Capt. Walpoes, R.E.
Addition to 'Notes un Acre,' \&c, By Lient,-CoL. Aldenson, H.E.
Notes on swing or flying bridges. By Capt. Nelsos, R.E.
On transition lime and limestone ns obtained from different quarries at Plymouth. By Capt. Necsos, R, E.
Description of a suspension bridge erected over the canal in the Regent's Park, upon Mr. Dredge's jriaciple. By Capt. Sir W. Denisoss, R.E.
Description of the balance gales at the compensation reservoir of the East London Water-worts at O11 Ford, desigmod and crected by Thomas Wicksteed, Esq., O.E. By Capt. Sir W. Dhanson, R.E.
Description of a small observatory erected at Chatham. By Capt. H. D. Habness, R.E.
Experiments carried ou at Chatham by the late Lient. Hops, R.E., on the pressure of earth against revetments, and the best form of retaining-walls.
Account of the failure of a floor in Ldinhurgli, in 1833. By Lient.-Col. Thomsos, R.E.
The construction of an fron beacon at the Harbour of Black Rock, Comecticut. Railways. By G. Drysdale Disarpsiv, C.E.
Mode adopted for repairing and anpporting the weatern refajing-wall of the London and Birmingham extension Railway. By the same.
On the system of drainage of low lands in Holland, the mechanical means cmplojed therein, and the differences of cost, 太c. By (. W. Hvasms, C.E., Enited States' Army.

APPERDIK.
Adicuila to the ancount of the operations at the Round Dowa Clit, Dover, inserted in the sixth volume. Dy Cnpt. Hurcaiseos; R.E.

JOHN TVEALE'S AMENDED CATALOGUE TOR 1851.

## 50 MLLTTARY AND CIVIL ENGINEERING.

On the means of prevenling damip in walls.
Kxperiments on an open cast-iron girdor.
Notes and experiments on iron girders.
Experiment performed at Bricklayers' Arms Station, South Eastern Railway. On the condensatien of gravel and sand. By Lieut.-Col. Trosison, II.E.
Experiment on the strength of the principals of a wrought-iron roof.
Memorandum on the use of asphalte in covering casemates.

## 126. <br> voluare vilf.

In 4to, with plates and wood-cuts, extra cloth boards, price $£ 1.10$. contenty.
Destruction of loridges on the Shamnon. By Lieut.-Col. II. D. Jones, R.E.
Notes on platforms. By Lieut.-Col. Portloces, R.E., P.R.S., \&e.
On siege gun and mortar platforms. By Lieut.-Col. Alprasos, R.E.
On the superior slopes of parapets. By Lieut.-Col. Pomilock, R.E.
Loopholed barrack, intended as a keep for a square fort. By Cspt. Fams, R.E. Machinery used in the manufacture of camon at the Royal Arsenal, Woolwich. Coffer-dam constructed in Devonport Dockyard. By Capt. Buroman, R.E. Nusuyth's patent steam hammer.
patent steam pile-driving machine.
Failure of the masonry at Fort Neuf. By Lieut.-Col. Tromsos, R.E.
Horizontal loopholes. By Lieat.Col. Almersos, R.E.
Horizontal loophole and loopholed window, proposed by Lieut,-Col. Oren, R.E.
Mode of constructing a breakwater, and of stopping the movenent of shingle on the sea coast. By Lieut.-Col. Yuce, R.E.
Railways. By G. Drysdale Dempsey, C.E.
Journal of practical operations in mining, at Chatham, in 1844; with an Appendix by Lieut. Penrice, R.E.
Survey of a line for a canal to unite the Bay of Fundy with the Gulf of St. Lawrence. By Capt. Crawhey, R.E.
Method of reclaiming the Tantamar and adjoining marshes from the sea. By Capt. Crawley, R.E.
Description of an engraved protractor. By S, B, Howlett.
General Index to the First Seren Folwmet.
127.

VOLUME IX.
In 4to, with plates and wood-cuts, extra cloth boards, price £1. 16 fr . contents.
On the value of fortresses, intrenched camps, and fiehl fortresses (places du moment) ; their application to the present system of railmods for the protection of the Metropolis south of the Thames; including some notices on the works at Lyons and Paris. By Col. Lewrs, C.B., R.E.
Account of the battle of Mecannee, with a plan. By Lieut.-Col. Widdrnaron. Project of defence. By Capt, Bainbugge, R.E.
Draw-bridges at Bermuda.
Description of wrought-iron roofs erected over two building slips in the Royal Dockyard at Pembroke. By Capt. M. Willlams, R.E.
Irou roofs erected over building slips in Portsmouth Doekyard.
Description of a water-course, wharf, and water-whech, crected at Wall ham Abbey, Essex, in 1845, with the mode of construction. Communicaled by Capt. Chawley, R.E.

JOHN WBALE'S AMENDED CATALOGUE FOR 1851.

Description of a large chimney for conveying the smole from the varions buildings connected with the sieam machinery factory in Woolwich Dockyard.
On the destruction of the bridge at Carrick on Shanon by gunpowder, 1845. By Lieut.CoL. II. D. Jones, R.E.
Memorandum on the allerations made in a cast-iron pump at the Jesnits' Barracks, Queliec, to enable it to resist the action of frost. By Capt,
Stkakrs, B.E. Stebelin, R.E.
The taper chain tension bridge at Ballee Khal, near Calcutta, in its renewed form, after the failure in 1845. By Majur Goobw Yn, E.I.C.E.

Statement of the proof to which the bridge was publicly suljected.
Report of the method adopted in sliuging and fastening the several chains, rohls, beams, and other iron-work.
Report of the Committee assembled to investigate the canse of the fall of the luinge.
Appendix to the preceding Report.
Copy of a letter from Major Goodwyn to Major Gereenr.
Extract of a letter from Major Goodwrs.
Formule for a suspension bridge: links of any length and weight.
Oas suspension bridgest By Capl. Hatwwss, R.E:
On embrasures. By Lieut. Pemmee, R.K.
Railways. By G. Deyspane Dempaey, C.E.

## 128.

VOLUME $x$.
In 4 to, with 85 plates and illostrative wood-culs, extra cloth boards, price t21. 10 s.

CONTENTS.
Memoir of the professional life of the late Lieut.-Col. Brampremer, R,E. By Col. Lewis, C.B., R.E.
On the defence of the country south of Tondon; a sequel to the first article in the 9 th volume. By the same. With a plan.
Report on the 'Great Britain' steamer, ordered by the House of Commons to be printed, 16 th July, 1847. By Capt. Williams, R.E.
Explaiation of the battle of Meeanee. By Major-General Sir William Napiex, K.C.B.
The doctrines of carpentry examined, in their application to the construction of a roof. By Lieut.Col. CaArles Waddington, C.B., of the Bombay Engineers.
Description of the mat covering sheds used at Hong-Kong in the erection of the Ordnance buildings, and of the mode adopted by the Clinese in transporting and raising heary weights for these bnildings. By Major Aldrich, R.B.
Campaigo on the Sutlej, 1845-6. By Colonel Lewts, C.B., R.B. With nupublished dispatclies of Lieut.-General Sis Harry Smith, G.C.B.; and some account of the parsage of the Sutlej ly the British army, in February, 1846, by Captain Yvls, Bengal Engineers.
Mode of closing windows at Pisa. By Lieut.-Colonel P. Yule, R.B.
A rebuffant system for the construction of fion tension bridges. By Major Henry Goodwyn, Bengal Engineers.
Apenabix-I. Memoir on the quantify of fion mecessary in a tention chain bridge. By the Rev. H. Peatr.

JOHN WEALE'S AMTNDED CATALOGUE FOR 1851.

## 52

Appespox II. Rehuri of preperities in coltivation at St. Lucis, indicated by the numbers on the map of the illand.

## HET OV NLATES.

1. Mfop if tho country wouth wi Landon, to explain Colanel Lewis's Paper ua the System of Defence.
1 and '9. Elevation and plan of the lireakwater formed for the protection of the Great Erifain stean ahip while on the tands near Dundruns, Intand.
and 5. Mode af carrying grumite columns and ratame trifther by mannai labour in Bangokong, us adopedlage lis enertion of ti
that statian.
2. Position of the Britith miny on the Sutlef, January 19th. 1846,
3. Man of the batele of Periscalals, on the 21st and 2 and December, 1655.
4. Han of the battle of Aliwal, oa the 23 th Januury, 1846.
5. Plan of the batule of Salimon, on the toth Yeliruary, 146.
10, 11, and 12. Plans to explain the prasago of the Sutlej by the Britich army, Jith tions and sections of the boate forming the pontoons.
6. Donlle brides seruas the Sutlej, at Nusrur, in March, 1846.
7. Wreck of the Brichtos chain pier, as acen Octoleer 16, 1839
8. Sketchesillatrative of three experiments Sketchesilluitrative of three experiments
umdertaken to tent the taper chain resultant system of iron suspension bridere; with
9. General eleration of the taper chain tenaion bridge on the - resultant syitem proposed to be erected over the Jumna, at Agra.
10. Aection therough sbotment and toll-bouse, plans and details.
11. Bird'serte view of half-chainfrant view of oblique rods, \&ce. - detailed clevation curve, \&e, se., \&e.
4, 5. Sections, details, \&e.
Topographieal map of St. Lascia, executed by orict of Licut,-Col. Reib, R. E., late Governor in Clief of the Windward Islanils, \&er, \&e., Nc.
With othen engraved on wood.

## MILITARX WORES. <br> 129.

In royal 8 vo, Parts I. II. III, IV. \& V $n$, with near 400 eugravings and woodcuts, price E 3.16 .

## AIDE-MÉMOIRE TO THE MILITARY SCIENCES,

## FOR THE USE OF THE CORPS OF ROYAL ENGINEERS AND

 THE EAST INDIA COMPANY'S FORCES.Colouel Levis, R.1., during forty years of constant employment in three parts of the globe, has observed the waut of an Aide-Mémoire, or memoranda of reference, when fir from practical works and practical men.

In the course of long services, the Engineer is at one fime employed in the ficld,-in the attack and defence of places,-in the construction of works and bridges; at other times, in the colonies and remote stations; and, being perhaps the only professional person present, is culled upon to fornish plans and estimates for the execation of civil and military buildings,-for canals, railroads, \&e.

If this is the common rontine of an Eugineer Officer's duty, is be prepared to -meet all emergeucies? and cin he find a library of reference in a few volumes to afford the desirablo assistance to memory ?

Thus fir this has not been possible. Colonel Levis has therefore proposed ta have this want supplied by the united exertions of the whole Corps of Rogal Engineers and ly those of the Enst India Company's Service, whose duties are as raried in climate os in their nature.
The terin 'Aide-Mémoire' is selected as not involving the Editors and Contributors in the necocity of giving complete treatices, as implied by the words Bneyclopredin, Diclionary, and Manual.

Fart VI., completing the work, is in a forward state.

## ARCHITECTURE,-ECCLESIARTICAL DECORATION, 53

130. 

In 3 vols. 8 vo, with 26 elaborate plafes, eloth boards, price $£ 2.2 \mathrm{r}$.
Third edition, enlarged and edted by Lieut.-Col. Hamay D. Jones, R.B.
JOURNAL
0
HESIEGE8
carried on by the army under the Duke of Wellington in Spars, between the years 1811 and 1814, with an account of the Linis of Torkes Vedras. By Major-Gen, Sir JOHN T. JONES, Bart, K.C.B.

## 131.

In 1 yol, royal Bvo, price 7 . $^{\text {. }} \mathrm{id}$, in boards.

> AN ESSAX ON

## THE MODERN SYSTEM OF FORTIFICATION

alopted on the Rhine and Danube, anil followed in all the works constructed since the Peace of 1815, in Germany. Illustrated by a copious Memoir on the Fortress of Coblentz, and accompanied by beautiful plans and sections of the works of that place.

By Lientenaut-Colonel J. I. HUMFREX, K.S.F.,
Formerly of the Rogal Artillery and Royal ginif Corps, and late Commanding Encineer to the Curps of Cantalivia, Author of ferwal Military Warhe, ove. Long resident in Germady. where hie had opportunitien of collerbag information from the beat sources.

## 132.

In 1 vol. small 8 vo , in boards, price 5 s .
AN ELDMENTARY TREATIEE ON

## ARTILLERY AND INFANTRY,

adapted to the service of the United States, desigued for the use of Cadets of the U. S. Military Academy, and for Officers of the Independent Companies of Volunteers and Militia.

By C. P. KINGsbury.

## ARCEITECTURE.

Archæology, Coloured Works on Decorative Art, Stained Glass, Ecclesiastical and Interior Decoration, \&e.
133.

RICHLY PAINTED and STAINED GLASS WINDOWS, asd mighly wrovgut
ECCLESIASTICAL DECORATION.
In $\ddagger$ wo volumes, imperial folio, elegantly bound, priee $£ 10.10 \%$
DIVERS WORKS OF EARLY MASTERS IN CHRISTIAN DECORATION:
with an Introduction containing the biography, journal of travel, and contemporaneous associations in art, of ALDEET DURER, notices of his master Worlgemutr and his friend Prbcebryara; Adaat Khaypt, and his Sacrament-House at Nuremburg; with some Euglizh examples of paiuted

JOHN TVEALE'S AMENDED CATALOGUE FOR 1851.

## 54 ARCHITEOTURE.-ECOLKSIABTICAL DEOORATION.

and stained glams of an corlier date; the ameient Chureh and SacramentHouse at Limbourg: the worly of Dims and Woutar Canasti, de. Also a meelinct account, with illostrations, of painted and stained glass at Gumba, ion Hollimd, and the Chareh of St. Jacques at Liége.

This work embraces, priweipally, a period of art original and profound in its characler: its desiga is of the highest gramdeur and achievement of legendary art, especially inspiring veneration in its development and in the Decoration of Christian devotedncas; uniting also a profusion of examples alike applicable both for Domestio and Eeclesiastical uses. At the present time, when the requirements are manifested by an ardent search for truly ancient data, this Work opens to all that is desired by its practical application of bold, massive, eariched, and minute deagn.

Alabrt Dureb, Adas Khayft, and the Crabethis, pre-eminent in their art, were founders, each in their school, coeval with and subsequently to the ages of Maximilian and Charles the Pifth,-periods rich is the birth of ath which spread its lindred genius in Germany, Italy, and the Low Countries. Of the first, his life, his journeying, his attachment to Luther and the dawning age of religions toleration, adding a critical examination of his numerous works, are for the first time fully portrayed, with some admirable vignette illustrations: of the second, the celebrated Sacramenthauschen at Nuremburg, with a beantiful engraving of the same by Mr. John Le Keux: of the third, the biographical account of these extraordinary men, with a critical notice of the Windows in the Church of St. Joln at Gouda, and some magnificent coloured illustrations of the same: of the Painted Ceilings and Decorations of St. Jacques at liége, together with the extraordinary examples of Glass-Painting, brilliant in colour and sublime in effect ; complete and comprehentive; forming most important eubject matter of these volumes, to which are added some Raglish examples, forming and contrasting a comparative display of Glass-Painting of carly and later times.

The work, which is bound elegantly, has been honoured by the highest patronage, and by the periodical and artistic press.
"We do not perliaps enourh ettinate the avistance which was once given both to purgose and permeption by the ieving of wonder which with us is destroyed, partly ty the ceaveles calls upon it, partly by our habit of either diwcorering of anticipating a reason Gor every thing. Of the nimphicity and mady surprise of heart which supported the spirit of the older paintets, an interoting example it seen in the Diasy of Abert Durer, lately published io a wark every way valuatile, hut especially so in the carcfulness and richness of Wta iflustrations, 'Divers Workn of Karly Mfartem in Chiristan Decoration,' Edited by John Weale, Loadod, 2 sols. folio, 1016."-Luartedy Revicu, 1817.
134.

In 4 vols., complete, meilium $\$ 10$, in cloth boards, with about 500 wood, steel, and copper engravings, many of which are highly and expensively coloured, price $£ 6$. 68 ; ; or $£ \mathbf{E 7} .17 \mathrm{~s}$. Gd. in half-morocco, gilt leaves.
QUARTERLY PAPERS ON ARCHITECTURE, \&c. under the following heads.

Ancient Timber Roufs.
Autiquities.
Archusology.
Architecture.
Gothic Arelistecture.
Eeelesiastical Architecture.
Encaustic Tiles.
Essays.

Heraldry.
Interior Decorations.
Italian Church Plate.
Painted and Stained Glass. Polychromy.
Symbolic Colours.
Art of Staining Glass.
Monograms.

JOHN WRALE'S AAENDED QATALOCOE FOR 1851.

These volumes, when erranged, are bound in the following order; CONTENTS OF VOL, $t$.
Essay on those powers of mind which have reference to architectural study and design. By Gzo. Moole, P.R.S., \&e.
Life of the late William V. Morrison, of Dnblin, architeet.
Architecture in and about St. Omer. Hy the fiev, A. Sucklirka, LL..B.
Primitive churches of Norway.
On the pointed style of arehitecture in Belgium. By M. A, G. B. Sonay es: translated by Henry Ausfin, architect.
On the present condition and prospects of architecture in England. Dy Geo. Wightwick, arehitect.
Ancient English gothic arelitecture. By the same.
Modern English gothic architecture. By the same.
Outlines aud characteristics of different architectural styles. By W. H. Leens.
On the Hall of the Middle Temple. By Bowano Smakrg, Ebq., F.S.A., ke.
Review of the publications of the Oxford Architectural Society.

> CONTENTS OF VOL. il.

The Temple church. By Srdney Sanake, arehitect, F.S.A., F.G.S. Church of St. Margaret, Stoke-Golding. By T. L. Walxer, architect. Church of St, James at Líge. By the Edrror.
Beaulieu Abbey, Hants. By O. B. Canter, architect.
Penton Meusey church, Hants. By the same.
Headbourn Worthy church. By the same.
Bishopstone cburch, Wilts. By the same.
Collegiate church of All Saints, Maidstone. Dy J. Wrateroomp, jun., architect. On the polychromatic decoration of the middle ages. By the same,
Church of the Holy Cross, Binstead, Itle of Wight. By J, K. Wathess, arch!,
Ancient basilica, church of San Clemente, Rome. By R. W. Myine, archt.
CONTENTS OF VOI: 11f,
An ancient erueifix.
On desecration.
The Suckling Papers.
Churches, geneaology, heraldry, and architecture of the county of Essex. By the Rer. A. Suckitis. LL. B .
On symbolic colours, in three sections. By Wilmans Inman, architect.
On stone used for building, particularly that for the new Houses of Parliament. By C. H. Satith, sculptor.
Examples of ecclesiastical perpendicular roofs. By Henry Churron, architect. Encaustic tiles, examples remnining in St. Marie's Abbey, Beaulieu.
Rood loft, Compton Basset church, Wilts.
CONTLNTS OF VOL, IV.
Mary, Queen of Eugland, and her consort, Plilip II. of Spain.
Account of the painted glass windows of the ehureh of Gouda in Ifolland.
Art of painting on glass. By Dr, M, A. Gessent,
Selections of painted and stained glass from York, By Messrs, Belu and Gousd, architects, York.
Account of painted and stained glass iu West Wickham church, Kent. By John G. Waharr.
Painted or stained glass from Wimehester cathedral. By O, B. Carter.
The art of painting on glass. By E. O. Frombero.
Artistic ecclesiastical decoration. By John W, PApwontn, architect.

## 56

Ornamented and illuminated lefters and miniatures of the fourleenth century. Monograms, old architeetural ornament, \&ce.

The greater portion of these Papers have richly engraved and ornamental and coloured plates, immediately following the papers to which they have relation, and in the binding of the perfect copies it has been mecessary to adopt a more classified arrangement than could be done in the publication of the work as issued in parts. Subscribers whostill relain their copies unbound will find their advantage in confiding the same to the Editor for binding.

## 185.

In 1 rol, imperial $4 t 0$, half-hound in moroceo, price $£ 1$, If.

## REMAINS OF ECCLESIASTICAL WOOD-WORK,

Measured and drawn on the spot by T. TALBOT BURY, Architect.

## HIST OF PLATLS.

1. Stalls and bools-board in Bridgownter church.
2. Seate in Wertonzoyland church, Somersetshire.
3. Stalls in Wantage church, Berlowire.
4. Beats in Bishop's Lydeard churehi Somersetahire.
5. Stalls in Swinhrook church, Oxfordhhire and Cobham church, Kent.
6. Seats, \&e., St. Mary's, Bury St. Edmund's.
7. Stalls in Lavenham church, Suffulk.
8. Sereen on the south side of the chancel Lavenham church.
9. Screen at the end of the north aimle. lavenham chureh.
10. Sereen, Northfleet elurch, Kent.
11. Sereen in the nortl aisle, St. Andrew's, Brigstoel, Nurthamptonthire.
12. Screen in the north aisle, St. John's, Aldenham. Hertforduhire.
13. Chaseel sereen, St. Peter's, Berkhampatead, Hertfordshire.
14. Screens in Lavenham clurch, Suffolk. 15. Reofs in ditto.
15. Roofs in Burfont church, Oxfordshire. 17. Thofis in Wantare church. Herkshire, 18. Roof of the nave, St. Mary'll, Bury St. Edmund's.
16. Ditte, Bt. Mfary. Westonzoglanh 20. Pulpius in Bridgewater church, Somersetshire, and Swinbrook church, Oxfordshire.
17. Ornmental engraved title-phge.

A very few copies on Indin paper proofs, very neat in half morocco, price © © 1. 11s, 6d.

## 136.

In imperial 410 , very neatly half-bound in morocco, with 20 beautifully coloured and illominated plates, price $£ 1.58$.
ALPHABETS, MONOGRAMS, OLD ARCHITEOTURAL ORNAMENT, SACRED ILLUSTRATIONS, BORDERS, COLLECTED ON THE CONTINENT AND IN ENGLAND.

1. Minlature \& border, from an origeinal 2 HS , 9. Ornamental lettered nitle-pace.
2. Capitals and letters of the tith and 1 sth centuries.
3. Capital lettere of the 14 th century.
4. Capital letters of the 14 th century,
5. Eapital fetfes and naeral writing and music of the 14th century,
6. Monogram, singular and eniamentol.

7. Iltaminated alplatietr of the lith century.
8. Iarge illuminated capital letsera if da.
9. Illuminated alphabets of the date 1 sio .
10. Sinzular urnmmental capital Ittter from Raptinte Fulessi, 1518.
11. Jarke eapital lettern illuminated, of the

## 14th eentary, <br> 18. Canital lenters is do

1.. Gierimanemenacetid lettern.

15. Alphabiets of the 1atis ec
16. Alphabets of 1512 date.
17. Letters of Alliert Durer, 1500.
17. Letters of Alhert Durkr,
18, Grotespue letters, 1512.
18. Grotespue letters, 1512.
19. Omaisuataleldheeli entea
19. Ormatsestal old lieeli enter
20. Ditto.

The plates all vary in denign and groterqueness.
137.

## NEW FRENCH WORE

о未 тн:

## ARCHITECTURE OF THE MIDDLE AGES, riost

## THE FIFTH TO THE SIXTEENTH CENTURIES,

and the Arts dependent upon it, Sculptore, Mrural Painting, Mosaics, Glass Painting, Iron Work, \&ce, from unpublished drawings of the principal Architects of Prance and other countries. By JULES GAILHABAUD.

The design of the work will be nlso to form a noble collection of Examples of the numerous poblie and privale edificen of the time, in the various styles of Art, from the magniticent cathedrnl, to the delicate sculptore which may enrich the simplest dwelling; and from the gorgeous coloura of the painted wiedow, to furniture and ornamental iron-work.

The work may be considered both as an Encyoloptedia of Arehitecture, and at the same time a choice selection of models for the practical use of Architects, Painters, and Sculptors; while Examples in the suhsidiary branches connected with Archilecture, preyent facilities for artistic stady in Mural Painting, Mosaic, Carving, Ornamental Fron-work, and Bronze.
The Drawings are by the most able Architects, so that the monuments may be reproduced with scrupulous exactness ; and to accomplish this object still further, the chief edifices in each country lave been drawn by native artists, with the view to their characteristic details being more faithfully delineated, and in this respect have secured the hearty concurrence of the most eminent artists in the various countries of Europe.

## TELMS OF 8UBBCRIPTION.

The work will form from 150 to 200 Parts, in royal $4 t 0$, and will appear every fortnight. Each Part will contain two engravings, or one coloured plate, and will be accompanied by Historical and Archaological Notices, forming a series of Monographs, of which the whole collection will be composed. Parts I. to X. are already issued.

The price of each Part is $2_{s, n}$ or, on India paper, 2s, 6 d .

## 138.

## designs for sepulchral monuments.

## By A. P. SPRAGUE, Architect.

The existence of a Work upon this sulject has loug been a desideratum, and it is presumed that, in offering to the public a series of original desigus in Monumental Architecture, it will be receivel as an effort to guide the taste to the choice of more suitable erections than have heen usually dedicated to the memory of the departed, and to lead to the exclusion of such memorials as must ever be looked upon as unworthy the object for which they were erected, from the painful incongruities they present, as regards their association with the venerated edifices wherein they are introduced.
It is a well-known fact that, in the erection of mortuary monuments, a lamentahfe absence of propriety has been generally dirplayed, as is abundartly exemplified in almost every church and church-yard throughout fhe kingdom;

JOHN WEALE'S AMENDED CATALOGUE FOR 1851.
and, althougb the want of a work upon the subject has long been felt, no publication has hitherto appeared which has been found sufficiently practical.
The work is intended to bo of a comprehensive character, and will comprise designs calculated to meet the views of persons of all religions denominations, and various degrees of expenditure, consisting of Tombs, Mural Tablets, Head Stones, Grave Crosses, did Floor Slaha,-in some of which, forms for inscriptions will be introduced, in order to show their proper positions upon the monument.
To the Reverend the Parochial Clergy it is respectfally submitted that an appropriate work, upon a subject so sacred and important, can hardly fail to prove a desirable acquisition, as an authority to guide in the fature introduction of sepulchral tuemorials into the edifices over which they preside.
The work will be comprised in Ten Parts, and issued Monthly ; each Part containing five quarto plates, price $2 s .6 d$. The work, when completed, and appropriately bound in cloth, will be charged E1. $7 \mathrm{f}, 6 \mathrm{~d}$, and to non-subscribers t1. 10s.

## 139.

A Drawing Book for Students in Architecture, Civil Engineering, and Mechanics. In folio, with 30 plates, hound in cloth, accompanied by a descriptive Text in 12 mo , price 1 Gs .

## A SERIES OF INSTRUCTIVR EXAMPLES

## IN

## ARCHITECTURAL, ENGINEERING, AND MECHANICAL DRAWING.

illustrated by 30 large folio Engravings of recently constructed Works in England, with explanatory Detaila, Sectional Parts, \&e., selected as an Elementary and Practical Introduction to the Prolessional Student in the commencement of his career; also recommendatory for Tuition at the Architectural and Engineering Clasees at King's College, College for Civil Engineers, Durham College, Glaggow College, and the various Scientifio Schools now establishing in different parts of Eugland.

## LIST OF PLATES.

Ascuitkcture.

1. The five orders of Architecture, vis. Parthenion at Athent. Erectheus ai Athens, Juniter Stator at floms, Palladio's Tuscan orier, and the Composite from the Baths of Dibeletian at Rome, drawn with measures and names of partw.
2, Their entablatures, drawn with measures and names of parts.
2. Plan, eleration, atad section of the National School, Totienham, with very full dimensions.
3. Pront elevation of the United States Bank, Philadelphin, drawu to a scale
4. Lengitudiaal tection of don drewn to a seate.
5. Ground plan of ilo, drawn to a scale.

Civil rxainrimixg.
7. Weir for Bromley Mill, Eencral plan, plas of grating, transverse section, dimensions.
8. Eleration and plan of Newport Rood Hiridge acrost feeiler of bute ship Canal, Cardiff, with dimensiens and names of parts.
0. Cross and longitadinal sections, with plan of culvert for conveging the feeder ander Glamarganshire Canal and Merthyr Road, with dimenvion.
10. Overfall at the north-west evener of Cardiff Castle: plan, elevation, transverse section, \&ce, with dimetsions and names of parts.
11. Transverse acetion of the Tunuel on the Thames and Medwny Canal, with centresund dimensiums, ind nsties of garts.
12. St, Katherine Docla, forms of piles, iron shoes for eullerodam, dimeniluns,
13. Forncastle Tuanel, seotion of tranel and elevation of eentre, zection of bridering, section of tumacl thruagh the centre of a standurd and bearec of the haul. ing-path, longitudiest sectione and eleration of toring-path, plan of the upper part of the towinis-path, ke..
 with num
of parts
14. Communtiation tack of ifo., with semerat inetractive detsils, with dimemaions and ammes of garts.
15. Taff Vale Itsilway culverts, several dlinensions, anid names of ports.
16. Tunael on the London and Blinningham Itnilway, sections, plans, ze., with dil. mensions.
17. Telford's 'timber turo bridge on the Grand Surry Canal, plan and elevation, screw jucks, double levcr, \&cen with dimensions sind names of parts.
18. Pug Mill, plan and elevation, elevation of burrow, details and dimenions.
9, 20. Plans for parish and distriet survey. ing, bills in capital letters, \&c. Ilan and seetien of part of the London and York Railway, cross and longitudinal sections for railway plan framing, with dimensions and names of parts.

MKCHABHCAL RNGANEBBIMA.
31. Mode of drawing spiral screws, elevation of uashine worked by an eccentrie for cutting holes in metal plates, elevation of the governor of a steam enwiac, elevation and plan of endless engine chast.
27. Mnle ani female serews, with sections and ptans.
25. Method of traving tootheid whecls, method of lrawing head toothed wheels, elerations, plans of pinions, Bic.
24. Metbod of drawing bevelled tonthed wheels, edye viek, plan of vinion, \&ce.
25. Bevelled gear wheels, plan view, oflique view, edge view, \&c.
26. Emiectiou of toothed wheelr, plau view, edge view, ohlligue view, ke.
27. Cnabe for raising heary weights, end clevatient and vile elevations.
2v, Iron works, plan and eleration of machinery for rolling bur iron, plan and eleration of titt hammer, section of puildling furozer, plan and clevatiou of puldiling furnace, and muchine for slitting, with referenocs to parts.
89. Gothie, Tuilor, and Elizaliethan capital letters, with numerals.
30. Various styles of letters for writing on onginecring plans, as showa in the title.

## 140.

In 4 to, voands, price 4 .

## THE ART OF PAINTING ON GLASS, OR GLASS STAINING:

comprising full and complete directions for prepariug the necessary pigments and flaxes ; for laying them upon the glass; and for the process of fixing or burning the colours in: wifh deacriptions of the furnaces and apparatus requirel for the various openations.

By Dr. M, A, GESSERT, Author of the 'History of Glass Painting.' Translated from the German by Wm. Pole, F.R.A.S.. F.G.B., Assoc. Inst. C.E.

## 141.

In large 4 to, neatly half-bonnd and lettered, price $£ 1.11 \mathrm{~s} .6 \mathrm{~d}$.
THE ARCHITECTURAL EISTOHY AND ARCEITECTURAL
ORNAMENT, EMBELLISHMENTE, AND PAINTED GLASE, OF
THE TEMPLE CHURCH, LONDON ;
consisting of 30 very elaborately drawn engravings, many of which are highly coloured and produced by Mr. Owen Jones, \&c., in the best style of art; drawn from admeasurements ; and with descriptive text by Sydnex Smake, Architect.

The atainel glase nindowr, E. end, and of $\mid$ The ritained glass E. window of tower, in the N , and 8 . aiales, in eolours, fac-simile.) colours, fac-simille.

JOHZ WEALE's ASIRNDED CATALOGUE VOK 1851.

Decorations of eciling, in colours, fac-simile. Plan of the celling.
Decorations of the rpandrits, in enlours, fac-
simile.
Alear, in colours, and in beautiful fac-rimile.
Decorations of archways, in colours, do.

Compartments of inforium.
Carred oak ellows to seats.
West vnd of Benchers' seats.
Details, capitals, columns, bases, \&e., \&ce.
Whan of the whole structure, engrared by Le Keux.

A few copies on large and imperial size, extra half-binding, $£ 2.12 \mathrm{~s} .6 \mathrm{~d}$.
142.

In 4to, with 28 plates, highly wrought in colours, E1. 16s, half-morocco. STAINED OR PAINTED GLASS OF WINCHESTER CATHEDRAL:
the antiquities of Winchester Cathedral, is respect only to its magnificent stained or painted glass, the richest and best selection, made by Owes B. Canter, Arehitect, Winchester. The engravings all in fac-simile, and highly coloured, embracing some of the finest examples extant of this admired art.
143.

In 4io, with 10 plates, and wood-cuts, in fac-simile, 58. STAINED GLASS OF CANTERBURY CATHEDRAL ; AND
PRAGMENTS TOWARD THE HISTORY OR STAINED GLASS AND THE SISTER ARTS OR THE MIDDLE AGES.
14.

In $4 t 0$, with 6 plates, in cloth boards, price 7 s .6 d .
AN HISTORICAL ACCOUNT OF THE
CHURCH OF ST. MARGARET, STOKE-GOLDING, Letcestershire.
145.

Price $4 s .6 \mathrm{~d}$. in extra style of binding; in a sheet, 3 s .6 d .

## A CHART OF ANGLICAN CHURCH ORNAMENT;

 wherein are figured the Saints of the English calendar, with their appropriate emblems; the different styles of stained glass; and various sacred symbols and ornaments used in churches.The stained glass in beautiful fac-simile.
146.

With 18 elaborate engravings by Mr. Johu Le Keux; price 108. 6d. half-bound; India proofs, large paper, 18s.

THE ARCHITECTURAL HISTORY AND ANTIQUITIES OF THE CHURCH AT BISHOPSTONE, WILTSHIRE,

JOHR WEALE'S AMENDED CATALOQUR YOR 1851.

## $14 \%$.

By the same author, uniform with the above, price 48 ; in a sheet 3 s .

> EXAMPLES OF

## ANCIENT DOORWAYS AND WINDOWS;

arranged to illustrate the different styles of Gothic architecture, from the Conquest to the Reformation.
It has been the aim of the author of this little chart to present such examples as may most clearly illustrate the successive changes in style, together with a few remarks on the characteristic pecoliarities which marked each period. The names of the buildings from which the examples are seleeted are in all cases given.
148.

In 4 to, with 5 engravings, $78,6 d$. sewed in a wrapper, (only a very few copies printed,)

## MODERN ENGLISH GOTHIC ARCHITECTURE.

149. 

With 13 fine and very elaborate engravings, some of which are coloured, price $10 s .6 d$. half-bound; India proofs, large paper, 18 s.
THE AROHITECTURAL History and ANTIQUITIES OF THE COLLEGIATE CHURCH OF ALL SAINTS, MAIDSTONE;
with an essay on the polychromatic decoration of the early and middle ages.
150.

In 1 vol. imperial 4 to, with 20 fige plates, neatly half-bd. in calf, price $£ 1.58$. studies of

## ANCIENT DONESTIC ARCHITECTURE;

principally selected from original drawings in the collection of the late Sir William Burrell, Bart.; with observations on the application of ancient architecture to the pictorial composition of modern edifices.

## L.15T OF TLATES.

1. Pasvingworth, in Waldon.
2. Chequers Court, Buck.
3. Ote Hall, Susses
4. Tannerh, in Waldon, Sussex.
5. West frovt of Riverhall, Suser.
6. Harrold, Eedfordshire.
7. Yavorland, Iale of Wight.
8. Went fruat of Plumpton Place, Sussek.
9. Packohill, Sussex.
10. Ewehunst, Suscex.
11. Tremstrick Place, Susiox.
12. Hammond's Place, Susser.
13. N, E. View of Brandeaton Hiall, Suffolk.
14. E. Vietp of Derm Plaee, Horsham, Sussex.
15. Mr. Clutton's, Cuckicld, Sussex.

1f. Suddlercomb or Seleomhe Pase, Snasex.
17. At Lincoln.
17. At Eincoln, 'Jowen, Suases.
18. Corkinaus Lincolit.
19. As Lathcoti.
20. West Gate, Peterhiorough.
151.

In 4to, with 66 fine illustrations in wood-cuts and plates, some of which are coloured, vol. 1 complete in boards, leather backs, price $£ 2.2 \mathrm{~s}$.

## MEMORIALS OF THE

## ANTIQUITIES OF THE COUNTY OF SUFFOLK;

or, Historical, Genealogical, and Architectural Notices of the towns and villages; comprising the Hundreds of Wangford, Mutford, and Lothinglaud.

By the Rev, ALFRED SUCKLING, LL.B.,
Rural Dean, Rector of Barsham, and Member of the Archirological Institute of Great Britain and Ireland.
Only a very few copies printed on large paper, price £2. 12s. 6d.
152.

In imperial folio, highly-finished lithographed engravings, price in half-moroceo $£ 2.12 s$. $6 d$. , with descriptive text in 8 vo , to accompany.

> ILLUSTRATIONS OF

## THE ROCK-CUT TEMPLES OF INDIA;

desigued to illustrate the architecture of the Buddhist and Brahminical caves and monoliths, from the earliest to the latest periods at which such works were execnted in India.

By JAMES FERGUSSON, Esq., F.R.A.S. and F.R.G.S.

## 153.

REVIVED ITALTAN.
In large $4 t$, very neat half-morocco, gilt tops, price 18 s.

```
STUDIES OF
```


## MODERN ENGLISH ARCHITECTURE. THE TRAYELLERS' CLUB-HOUSE, By CHARLES BARRY, Architect. <br> Illastrated by engravings of plans, sections, elevations, and details, by J. H. Le Keux ; <br> With an lssay, including a description of the building, by W. H. Leeds. list of plates.

1. Ground plan of the building.
2. Principal plan.

3, 4. Front and baek elevations.
5. Langitudinal section through A to B,
6. Longitudinal section through C to D .
7. Details of the priacipal front: windowa, ground floor, section of cornice of window head, of under part of window, of ornament in string-couric, elevation of console, baluastrade to area front.
8. Details of the principal front : seetion of principal cornice, eleration of comice,
plaster cap and entahature to window, cleration of one-pair window, clevation of cornice, \&c.
D. Details of rear front: elevation of onepair window, section of window head, eleration of block and cornice, section of principal cornice, section of window eornice, die.
10. Details of drawing : plan of ceiling, bead. mection of cove of ceiling, enriched panel of ceiling, section of earnice, climney-piece, \&e.
john weale's amended catalogur for 1851.
154.

In I vol. imperial 8vo, with five plates, extra cloth boards, price 168. ; or in elegant balf-morocco, jrice 208 .

> AN ESSAY ON

## THE ANCIENT TOPOGRAPHY OF JERUSALEM;

with restored plans of the Temple, \&e., and plans, sections, and details of the church built by Constantine the Great over the Holy Sepulchre, now known as the Mosque of Omar, and other illustrations.

By JAMES PERGUSSON, F.R.A.S, and F.R.G.S.,
Author of the '11lustrations of the Rock - Cut Temples of India,' and
'Pieturesque Illustrations of Ancient Architecture in Hindostan.'

## 155.

In $4 t 0$, very neat in half-moroceo, with about 130 illustrations on wood and copper, price $15 s$.
the true principles of

## POINTED OR CHRISTIAN ARCHITECTURE.

## By A, WELBY PUGIN, Architect,

AND PROYESSOL OY RCCLRELASTICAL ANTIQUITLES AT ST. MARIE'S, OSCOTT.
The following important facts are fully explained in this work.

1. That all the ornaments of pure pointed cdifices were merely introduced as decorations to the essential constructions of those lnildings.
2. That the constraction of pointed architecture was varied to accord with the properlies of the carious malerials emplayed, shown by ancient examples of stone, timber, and metal construction.
3. That no features were introduced in the ancient pointed edifices, which were not essential eilher for convenience or propriety.
4. That pointed architecture is most consistent, as it decorates the useful portions of buildings instead of concealing or disguising them.

5 . That true principles of architectural proportion are found only in pointed edifices.
6. That the defeets of modern architecture are principally owing to the deparfure from ancient consistent principles.

## 156.

Hlustrated with 10 plates, and uniform in size with the 'True Principles of Pointed or Christian Architecture,' as a companion to the above, halfbound in moroceo, gilt leaves, price $108.6 d$.

## AN APOLOGY FOR THE REVIVAL

OF
CHRISTLAN ARCHITECTURE IN ENGLAND.

By A. WBLBX PUGIN, Architect.

In this treatise the following ratters are set forth:

1. The incoasistencies of modern English architecture, with critical remarks on several struetures recently erected.

JOHN WEALE's AMENDED CATALOGUE FOR 1851.
2. Christian architecture defended against several objections.
3. The inconsistency of the revival of classic arehitecture in the 16th century.
4. The propricty of reviving pointed urchitecture in all modern ecelesiastical buildinga.
5. The propriety of reviving Christian sepulehral memorials.
6. The propricty of reviving pointed arelitecture in civil buildings of every class, considered with reference to climate, arrangement, and destination; with the modifications and alterations that are allowable to suit present necessities.
7. How far the modern mechanical inventions are available in the execution of Christian buildings at the present time.
8. The priuciples of Christian and pagan sculpture considered, and Christian arehitecture proved to afford the greatest senpe for the exercise of that art.
9. The intimate connection showa betweca the existing system of government in England and that of our Catholic forefathers.
10. England the most fawourable country for the revival of Christian architecture; with reflections on the many glorions remains of Catholic antiquity which it contains.

## 157.

In 1 vol. 8 vo, with about 200 wood-cuts, neat in cloth boards, price $8 s$,

## HINTS TO YOUNG AROHITECTS:

comprising advice to those who, while yet at school, are destined to the profession; to such as, having passed their pupilage, are about to travel; and to those who, having completed their elucafion, are abont to practise; together with a Model Specification, \&c.

By G. WIGHTWICK, Architect, Author of several Architectural Works.

## 158.

2 vols. 4to, upwards of 70 plates and wood-cuts, price $\mathfrak{e} 2.2 \mathrm{~s}$. LETTERS OF AN ARCHITECT trom FRANCE, ITALY, AND GREECE :
or, Critical Remarks on Continental Architecture, ancient and modern, and on the Classic Architecture of Greece.
By JOSEPH WOODS, P.A.S., F.L.S., P.G.S., \&c., \&e.
159.

## TưMr बrcbitecture.

In folio size, price $£ 1$. 18 , in boards.

## INTERIOR DECORATIONS, DETAILS, AND VIEWS OF

 SEFTON CHURCH, IN LANCASHIRE.Brected by the Molineux family (the ancestors of the present Earl of Sefton), in the early part of the reign of Henry VIII.
The plates ( 34 in mamber) display the benutiful style of the Tudor age in details, ornaments, sections and views, etehed in a masterly style of art.
john weale's amended catalogue for 1851.
160.

In one fhin 8 vo vol., eloth boards, with 8 plates, price $48,6 i d$,

## AN ATTEMMT

## TO DETERMINE THE EXACT CHARACTER OF ELIZABETHAN ARCHITECTURE;

illustrated by parallels of Dorton House, Hatfield, Longleat, and Wolaton, in Eugland, and the Palazzo Della Cancellaria at Rome. LIST OF PLATES.

1. Palarro Delta Cancellaria, Iy Dramante 1405, - Lopgleat Bousc, by Jolin of Padoa, $1 \times 67$.
2. Part of Ratheld Hewse, 164 ; Wollaton Hall, by Joha Tborpe, 1880.
3. Ground plan, 太c, of Dorton Houne, Bucks.
4. Screen in the Hall at Dorton Houre; 5. Tonsitudimal mection of staircase of dor 6. Transverse soction of stairrase of do. 7. Ohimney-pieco in Quecn Elizabech's room, Dortan House.
5. Celling in Queen Elizabeth's room, do.
6. 

2 vols. folio, bound in 1, with 130 plates, price £4.4s.
MEMORLAL8 OF

## ANCIENT GERMAN GOTHIC ARCHITECTURE;

 OR.
## Uhe Grchitectural Gitiquities of Sermann.

My GEORGE MOLLER, of Darmistadt, Architect to the Grand Duke of Hesse. With a description of each edifice, and an essay on Gothic architecture, with reference to its origin and progress in England; in the German language, aecompaniet by an English translation, by W. H. LeEDs.
'The Transition, or Early German, has 'Dr. Moller's work (Denkmachler der not yot, 80 fir as 1 know, received much $\left\lvert\, \begin{aligned} & \text { Deutselien Baulkunst) already contains ex- } \\ & \text { cellent apecimens of erery stryle of German }\end{aligned}\right.$ diatinst attention. Dr. Moller, however, in the coune of his ratralide Denlmakhler, han recently given us execlent repreaentations of the caihedral at Limilurg, on the Lahn, which is a very admirable specimen of this Kinds and has noticed the intermediate and Kind siod has noticed the intermedate and
transition place which this edifiec sems to oetransitiou place which this edisice seems to ve;
sapy in the development of the fierman atyle.? -Whowell on Germas Churehes, p, 23 .
buildings, and offern additional interest and heauty in each new number,- Whewell on Germinn Churches, Pp. $28,29$.
'The church of St. Catharine, at Oppenheim, near Worms, also in part a ruin, is another fine example of this ityle, and has been worthily illusirnted in the magraificent work of Dr. İfoller.'-1bld. p. 113.

## 162.

## GRECLAN ORNAMENTS :

a neries of examples, in 21 plates, of Grecimn Ornament, in royal folio, very finely engraved from drawings made by celebrated architects, price 158.

## CONTENTS OV THE WORK.

Details of eeiling of the Propylea at Eleusis.
Order of ante of inner vertibules, at Eleusis. Capital of the antie at large, at Eleusis. Framents found at Eleusis.
Tites and sther details of the Temple of Diana Propylan, at Eleusis.
Capitals and profile uf the Temple of Nemeris, at Ithamnus.
Ornsmental moolding, jomhy, mouldinge of interiar cornice, the painted mouldines of the panels of the lacumaia, \&e., of the Temple of Nemeris, at Thammus.

Details of the roof, tiling, \&e, of ditto The chairn and sepulchral basereliefs fonsd in the eclls of the Temple of Themis, at Rhammus.
Athenium seppulchral marbles, capitals, and triglyphs, at Delon.
Entaifluture of the order of the peristyle and rouf, oroaments, \&e., of the Teciple of Apollo Eyicurus, at Bassie.
Details of sculptured and pulated shafts of columns of the sultertancous chamber at Mjecnie.

JOHN WRALE'S AMENDED CATALOGUE FOR 1851.

Hestored elevation to the entrunce of the suhterrameous elhamher at Mrcense, commonly ralled the Treasiry of Atras.
Marble stele, in the posecision of Mr. Gropilus, at Athers.
Ternootta antefisa, at Athens, and marble framments from Jelphi.
Pithister capitalt frum stratoniec and Hellcarnasats.
Frasments from Halicarnassus. Teos, and Temule of Apollo, at Branchydie, near Miletis.
Eotasis of the columus of the portica of the Jropylea.
This work is very desirable for sculptors, modellers, masons, (in designing for moumments, tombs, tablets, \&e., builders, and arehitects. Those who possess the Dilettanti Work of the Unedited Antiguities of Attica, and the supplementary volume of Antiquities of Greece, Sicily, \&c., will not need this work, as the subjects are selected from them.

## 163.

## 細omestic बrchitecture.

In Jarge 4to, with 19 fine engravings, price £1. 1s, extra cloth boards, or on large paper, proof impressions, price e1, 11s. 6d.

## ARCHITECTURA DOMESTICA.

A series of very neat examples of interiors and exteriors of residences of the gentry erected in Hamburgh and its neighbourhoorl; principally in the Italian style, with ornamental pleasure-grounds, verandahs, detached cottages, \&e., \&c.

## 164.

In demy 12 mo , with illustrations, price $2 s .6 d$. , Practical Observations made on a Visit to the

## BOTANIC GARDENS, CONSERVATORIES, GARDENS, AND PARKS, <br> IN LONDON AND ITS VICINITY.

By EDWARD KEMP, Landscape Architect.
165.

In 8vo, with illustrative plates, price 7 s .

## COTTAGES AND HOUSES FOR THE PEASANTRY AND FOR EMIGRANTS:

ELEMENTARY AND PRACTICAL INBTRUCTIONS ON THE ART OF BUILDING COTTAGES AND HOUSES YON THE RUMBLER CLASSES:
an easy method of construeting earthen walls, adapted to the erection of dwelling-honses, agricultural and other boildings, surpassing those built of timber in comfort and stability, and equalling those built of brick, and at a considerable saving. To which are added, Practical Treatises on the manufacture of bricks and lime; on the arts of digging wells and draining; rearing and managing a vegetable garden; management of stock, Sx. For the nse of emigrants ; for the better lodging of the peasantry of Great Britain and Ireland; and the improvement of those districts to which the benevolence of landed proprietors is directed.

## 166.

2nd edition, 4 to, engraved on 31 plates, plans and elevations, price 12 .
VILLAS AND OTHER RURAL BUILDINGS. By the late EDMUND AIKIN, Architect.

## PLATES OF BRIDGES.

167. 

3 feet 6 inches by 2 feet, on a scale of 25 feet to an inch, price $£ 1,18$.
LONDON BRIDGE:
a large magnificent plate, containing plan and elevation of this great national work, with the very interesting reference of dimensions, materials, time, and cost; engraved in the best style and elaborately finished by J. W. Lowry, from original drawings and admeasurements.

Constructed by Ste John Rennie, C.E., F.R.S.
168.

Plan and elevation, scale 10 feet to 1 inch, price 10 s ; on India paper, 15 s .

> STAINES BRIDGE:
a fine engraving by J. H. Le Keux, under the direction of B. Albano, C.E., from his drawing presented to the Institution of Civil Engineers, and made from the original drawings and admeasurement, with permission of George Rennie, Bsq., F.R.S., the Engineer.

## 169.

## SECTION OF ST. PAUL'S CATHEDRAL:

the origimal splendid engraving by Gwyn, of the section of St. Paul's Cathedral, decorated agreeably to the original intention of Sir Christopher Wren; a very fine large print, showing distinctly the construction of that magnificent edifice.-Price 10s,

This is a magnificent plate, the only one of its kind, showing constructively the genius of Sir Christopher Wren.
170.

In 4 to, price $12 \%$. bound in cloth, illustrated with 26 large plates and 17 wood-cuts.

## a manual of

WRITING AND PRINTING CHARACTERS, BOTH ANCIENT AND MODERN.
By B. P. WILME, C.E., M.R.I.A., \&e.
sohn weale's amended catalogue for 1851.

## MAPS AND RLANS. <br> 171.

In 4to, half-bound, plates plain ©1. 48., or coloured, half-bound in morocco, price £2.

## A HAND BOOK FOR <br> MAPPING, ENGINEERING, AND ARCHITECTURAL DRAWING.

By B. P. WILME, C.E., M.R.LA., \&c. CONTENTS.

1. Map Detalls,-North points-borders for plans, \&e,-map drawing; showing every process from the field-book to the finished map-map engraving-map writing-desigas for titles-designs for trees from nature-hill shading-conventional signs used in civil, military, and nautical maps-railway plans and sections.
2. Geological diagrams and sections.
3. Alphabets, ancient and modera, with rules and examples of the mode of constructing them.
4. Architectural drawing, showing also the method of colouring differeat materials.
5. Stencil plates applied to the lettering of maps and plans, with observations as to their more extended use for colouring the same.
6. Flourishing-examples of.
7. Colours-use of, as pure, compounded into tints, and contrasted.
8. Instruments-mathematical and others, used in map and plan drawing.
9. Specimen plate of highly finished map drawing, exemplified in lithography.
10. Example of surveyor's field-book, and map plotted therefrom.

## RUDIMENTARY SCIENTIPIC WORKS <br> FOR BEGINNERS.

In courne of publication, in a neat and convenient size, a Series of original and useful volumes, by esteemed writers, forming a Rudimentary Course for the easy comprehension of the leading principles of various Sciences.

It has been remarked, that "those who are in the ship of Science ought to remember that the disciples cannot arrive without the aid of boats"" Popular treatises are to Science what boats are to large ships; they assist people in getting aboard; but as no one would trust himself to a weak or fietticient boat, so no one ought to begin the study of Science with an imperfect guide. It sometimes happens that popular treatises are made to appear eacy by the omission of those very details which are most essential to be known: they state results without going through the necessary processes by which those results are gained: they deal largely in facts, and leave priuciples untouched.

The only method of avoiding this error is to coufide to men, who are masters of their respective subjects, the tank of drawing up Popular Introductions to the several branches of Scieuce. The Publisher trusts that the following list of names will be a sufficient ganrantee to the Public that what he proposes to attempt in the cause of Popular Instruction will be done well, and that these little treatises will fully answer the purpose for which they are intended, namely, to become convenient anit acenvate Guide-Books in Government and other Schools, and in Popular Institutions gencrally, while their low price will place them within the reach of all classes carning their daily bread, to many of whom a lnowledge of the elements of Science is a

JOHN WKALE'S AMENDED CATALOGUE FOR 1851.
positive gain in the commom purstats of life, at well at ameans of winning from gross iastes, and presenting to the mind noble and wortly objects of study.

## 172.












 Author of 'Railwaye in Belgium'

## 18.

18.     - Mrick-MAKIKG, TLLE-MAEISE, by the same, vol. $\hat{i}$.
19. $\longrightarrow$ is.

20. 





7. - Use op 1xspugaskrs (generally), by J. F. Heather, M.A., of the Royal a Military Academy, Woolsich, 2nded. in.

Conspryetrina Cranes for the Erection of Buildinge and
29. - for Roisting Goods, by J. Glynn, P.R.S., C.E. Whicten
3. - Anx or BListixa Rocks and Quarkrixa, and on Stosis, by Mfajor-Gen, Sir John Burgoyne, K.C.B., R.E., स.C., Ee.
Dicrionakyop Tkams uted bydrelitects, Huildern, Civiland Mechanical Elogineers, Surveyors, Artist, sthip-biiders, \&c., V.i.
31. - Tol, $\mathrm{li}_{3}$

In
32.
33.
31
$\overline{\text { ב. }}$ wot, iii. $\quad . \quad+\quad . \quad . \quad . \quad$. is


## SERIES OP RUDIMENTARY WORKS

## OF MATHEMATICAL SCIENOE FOR BEGINNERS.

The Series of Rudimentary Works for the use of Beginners has realized the anticipated success from that portion of the public who seek the attainment of those objects of Science which belong to the liusiness of life, and the lughest and most useful subjeets in the Elemeats of Art and Scieuce. Pursuing the tame path, to render further aid to poblic initraction, oud to direet the attention of the Eeals and Principals of the several Coilleges and Schouls of the Uuited Kingdom, and the Royal Military Academies, to these serial works, it is intenked to publish an Elementary Course of Mathematics for the ure of Beginaers anit for Practical Men, at Is. each volume.

It has been olserved by Bonnyeastle, in the Preface to his admírable Ele-
JOHN WZALE'S AMENDED CATALOGUE YOR 1851.
mentary Work oth Agebra, that "Books of Rudiments, concisely written, well-digested, and methodically arrauged, are treasures of inestimable value, and too many attempts camot be made to render them perfect and complete"

## 173.

The Sulgects ane ar follenozz (alt are pubtiated untess utherwise espressed.)
35. Tienewtaey Tenatink of AmpHastic, with numerous Mathematieal and Commercial Examples, for Practice and Self-Examination, accond edition, currected, ly James Haddon. M, A., King's College.
 Morms of Commercial Documents, in English, French, German, and Italian, Mereantile Plrascology, dee, forming a eimplete Introduction to the Countiong House, by ditts.
14.
37. Ebmentary Tematié os Alosbea, vel. i., by ditto : :
38. - Pisccifuks of Gnaserar, by Henry Law, C. E. (in the pinene
49. Pancir uks or Gmaner, by heary Law, by Jamea Hann, Pro-
fessor, King'e College

4. Flements asb Practice on Mfeneumation azid Gkodkyr, by T. Haher, C.E.' 41. Rontasexamy Theatise on Lobabitines, val. L, by Hebry Law, C. E. 15. Mathematical Tables fir facilitating Astronomical, Nautical, Trigonometrieal, and Losarithmic Caleulations, vol. II., by ditto

47. Paificiplifs Axd Pnactice oy Staticy Axd Dymastice, by T. Baker, C.E., (in (he jread)
45. Tanueraxp Peactiog of NaUtical Aithosiosux \& Nivigation, (in the prosu) 4f. Diperzeriaz Cayculus, in which the Priaciples will he clearly clucidated, (in the greas)

Is.
50. Integakal Galcolés, in which the Principles will also beclearly elucidated, (in the
 Professiv, King's College

- Divperential do. vol. zih, by J. Haddon,

King's College

## 174.

The whole of the following are puslished.
53. Ropimentary Thedties ox Cottagn Bulldixg; of Hints for Improving
 particularly the Conway and Britania Bridges, describing the Experiments made to determine their form, strength, and efficiency, together with the construction of the same, the floating and raising the tubes, and other wrooght-iron constructions Ant of Makivg Foundations, Conceste Wokes, ke, by E. Dobson, C.E.


JOFN WEALE'S AMENDED CATALOGUE FOR 1851.


 lineop, volt 1.
 HAKIKG, and the MAKENG or CakALs, de, by T. Haker, C.E.,
with 1llustration, vol. i.
 Illustration, by Lowland Mraelomald stephensum or CLocis and WAYCH-MAKixg, with a Clinpter on Causen Clocks; with Illustratinns, by E. B, Desinon, M.A.. Author of two pryers on Clock Encupements, in the
Cambridge Rhilooojhival Thasactions, vol. $\ddagger$.
 Errio, vol/ ii.
Elemencra of Mrenic, widh Plates of Exataples, by C. C. Spencer,
Profeanor of Muic, vol. Professor of Muic, Vol. 1. Phicucicier of Mrosic, with Mates of Examples, is ditto, vol ii. and phactical Thisatisk on Burlers, for all kinils of Steati Engines, by Eobert Armstrong, with wood-cuta . . .

## 175.

The fillawing are not yet pwblished, but are in preparation.
80. Bubuentahy Tekatine os Hybjaulic Exgingeaing, ami on Tungelling through various kinds of Strata, with Plates, forming a thimd yol, of the Enginecring (and completing that subject) published in the Firat Serien, by H. Law, C.E,



98. - Concraosoor, \&c. (Fossils and shellse, by 8. W. Woodwand, Arnciate of the Limmenn Bocluty, of the Naturai History De: partment of the British. Aluseum, ke. ke., vol. i.

87. - Descursiys Gisosmerix, Applicable as a firit bouk, by J. E, Heather, M.A. . .
83.
89. - Allas of Plates, tuillustrate tho above:
Heather, M.A.

 3.F. Heather, Mr,A. . Atlas of Plates illustrative (drawingbook), ublong 4to, ly 1. F. Heather, M. A .

93. | (text), by J, F, Heather, M.A. A. A. Mechanieal Engineering |
| :--- | (book), oblone 4 to, by J, F. Heather, M. A. by, F, Heatker, M,Are . . . Tuenfise bix Haebouns and Coast Engimekiong, by Thomas
94.     - Tueneise wir Haezouns and Coast Esgineking, by Thomas
95. Divio, the Coutinuation of the same subject, vol, ii. huirn, C.E., with Illustratiogs Ancm .

 STEADIEG, by G. H. Andrewz, Agricultural Epgineer Andrems, Acriciltaral Engincer
96.     - HE AQMEULTURAL FiELD ImpLemeats, by $\dot{G} . \mathrm{H}$. 18.

JOHN WEALE'S AMENDED CATALUGUE FOR 1851.
174.

Iu 1 vol, desoy 12 mo , with several wood-ents, 564 pages in double colunns; price in green eloth boarkls and letered $5 \%$, or in half moroceo 6 F .
RUDIMENTARY DICTIONARY OF TERMS,
nised in Civil and Naval Architecture, Building and Construction, Early and Eeclesiastical Art, Civil and Mechmical Engineering, Fine Art, Miniog, Surveying, \&e.; to which are added Explanatory Observations on numerous subjects connmeted with Practical Art and Scieuce.

## 177.

In 8 vols, folio, very neatly half-bound in moroceo, price $£ 27$.

## \#ugoale's fotonasticon Anglicanum.

A Distony of

## THE ABBEYS AND OTHER MONASTERIES, HOSPITALS, FRTARIES, AND CATHEDRAL AND COLLEGLATE CHURCHES <br> IN ENGLAND AND WALES; <br> AND ALL SUCH SCOTCH, IRISH, AND FRENCH MONASTERIES as were in any manner connected with the RELIGIOUS HOUSES IN ENGLAND; WITH NUMEROUS ADDITIONS. <br> 

It the ahsence of the original Charters, Leiger-books, Rolls, and other Documents which bave been lost or destroyed since the publication of the Monasticon Anglicamm of Sir Willinm Dugdate, and which are given in that imperishable work, the Monasticon ifself is admitted in all Courts of Law as ecidence on disputed points of owwership. By giving these important docaments in full, by recording where such as still exist are deposited, and by placing them in the moat lucid order, the editors of the new edition have rendered a zervice to the landed interest, which is universalty acknowledged; and by their industry and zeal, the work has been eariched with numerous and valuable additions. The very copious Index, elaborately compiled by Mr. Richard Taylor, Author of the Index Momasticus of the Diocese of Norwich,' will of itself prove the value of the work, as, independent of the religious houses themselves, there is scarcely a single parish in England aud Wales which will not be found in the pages of the improved Monasticon.

By the legal profession on all points where questions arise as to the succession to real property, the disputes respecting adrowsons, small or great tithes, the rights to fisheries and other privileges, which were formerly confercel upon the religious houses of the midale ages, the pages of Dodsworth and Duglate, the lahorions coropilers of the first and second volumes of the 'Monasticon,' Sir Thomas Herbert and Anthony ì Wood, the compilers of the third volume of the original edition, have been consulted; and, indeed, there is scarcely any reported case in which the work is not mentioned.

To the elengy the work possesses an interent not only of antiquarian and historical character, but one which has a more solid claim to their notice. There is scarcely a single parish, as already stated, which is not mentioned in the work, and by its means they are frequently enabled to settle, without employing the costly machinery of the law, questions which arise respecting the property of the church, the boundaries of parishes, and the extra-parochial districts of their livings.

JORN WEALE'S AMENDED CATALOGUE FOR 1851.
Hugher, ''rinter, King'A Head Court, Gough Square.



[^0]:    C. S. HUTCHINSON, Lieut. R.E. Spike Island, August 25, 1851.

[^1]:    July 81, 1851.

[^2]:    * Too voluminous to be inserted in this work. It may be stated, however, that in 1849 , the Legibatures of the three jrovinces pased Acts to the eflect that, If Her Majesty', Government wruld undertake the construction of the line, either directly or indirectly, through the initrumentalisy of a private Company, they would edeh contribute $20,00 \mathrm{~F}$. per annum towards making good any defielency in the income, give the ungranted lands for ten milles on- each wae of the line, and ottain, or pay for all the land required for the line of rallway, for stations and ternini. New Brunswick limited to twenty years her grant of $20,100 \mathrm{i}$, per amom.

[^3]:    I Similar Deapatelies addresed to the Liellt-Governors of Nova Swotia (No. Li:1, Nov 17) and New Brunnwick (No. 78, Nov, )77.

[^4]:    4. This estimate has been considered too low.

    In the Britiah North Americun-a newspuper published at Halifax, of the 20 (h November, L8s0was the following paragraph :-
    "The transportation of a harrel of flour from Ogderaburgh to Boston is 31 rents, exclusive of storage."
    That is $2 r .1$ dit. for a distance of about 400 miles, by railway.
    In England, on the North Western, coals are cartied at Id. per con per mile,
    On the Great Northurn got. per ton per mille.
    On Etrie and New York railroad, 465 miles long, itour is carried at $26.2 \%$, per barrel.

[^5]:    VOL. II. N, S.

[^6]:    " 3 ". Artilltoric.-En Angleterre, une batterie on brigade est coroposée de 6 piềes, 5 eanons et 1 ohusier. (Nous ferons le calcul pour dea pièces de 9 pesant et l'obusier de 5 po, b). Voici la compusition de la brigade

[^7]:    "Passons maintenant au calcul da temps qui devra s'ecouler entrè le moment où tues les convois seront prêts a partir, et le moment de leur arrivée au lieu de leur destination. I'intervalle entre le départ de chaque convoi ne peut ètre au-deseous de 30 minates, à cause des temps d'arrèts indispensables pour prendre de l'eau, du charbon, et pour franchir les gares à une selule voie. Pour 152 convois il faudra done 76 heures,
    "Dane, entre le moment où les convois partiront de Londres pour Plymuuth, quie en est distant de 355 kilom., avee une vitesse de 40 kilom. \& theure, et celui ou its arriveront, il s'čcoulera, en minimum, 88 heuree ${ }^{2}$.
    "De Londres à Hastings (distance 8 heures), if a'ecoulera 79 heures.
    
    Admettons que le télegraplee êlectrique ait dunné à Lundres le sigual de lapproche de la flotte de débarqumment, dè quelle aura éte sigualée au large, il faut que la rapitale, $i$ son turr, doune le signal de la concentration autumr d'elle à toutes les garnisuns éparaes en Angleterre et en B́coses. Nous ayons pris 10 de cea lieux de garnisum, dout la dis-

[^8]:    t. Tous lei militaires comprendront pourquoi nous avons place ecs points stratégiques de déferse ausil pres du point abjectif de l'eanemi. C'est pour quil ne puisse pas, en manuruvant polur eviter eve points atrateqiques, gigner, avant le defenseur, as ligne dopératlon iletensive, et lai eauper at retraite sar Londres.

[^9]:    - Agilation on Nafinal Coglowce Defencelose State of Great Britain
    - Siee mapi of southern soat of England.-Ed.

[^10]:    * It is certain that the debarkation must take place in boats after the fleet had anchored, taking the troops from the vcssels, whifen never can venture to run on sbore anil then laud them. This it an operation of time quite long enough to enable our troops to meet the enemy.
    $\dagger$ This in assuming thar the existing defences would be armed and equipped, and that the entrances to the small navigable rivers on the wea coast are well protected; for the first consideration with an vnemy would be to obtam postention of some mall harbour, which these rivers give at their mouths, for the purpose of landing their stores, artillery, and cavalry.

[^11]:    * Prohably near Reigate, no as to secure the lateral branches of the railways, leading to Tunbridge and Dover on one side, and ouilford and Reading on the other.

[^12]:    JOHN WEALE'S AMENDED GATALQGVE FOR 1851.

