MILITARY BOOKS

Published by

Authority.

LONDON:
PRINTED UNDER THE AUTHORITY OF HIS MAJESTY'S STATIONERY OFFICE
BY HARRISON AND SONS, 45-47, ST. MARTIN'S LANE, W.C.,
PRINTERS IN ORDINARY TO HIS MAJESTY.

(The prices in brackets are those at which the books are obtainable, post free, by Officers, Non-Commissioned Officers, and Men, in the manner prescribed by Appendix XXIII. of The King's Regulations and Orders for the Army, 1912. Applications should be made on Army Form L 1372, and addressed to the Secretary, War Office, S.W.)

ABYSSINIA. Expedition to. 2 vols. and maps. 1870. Half Mor., £5 5*s.* Cloth, £4 4*s.*

AFRICA. Continent of. Geology of. Notes on. 1906. 3*s.* (2*s.* 4*d.*)

AMHARIC LANGUAGE. Short Manual of the. With Vocabulary. 1909. 5*s.* (3*s.* 6*d.*)

ANIMAL MANAGEMENT. 1908. 1*s.* 6*d.* (1*s.* 4*d.*)

ARABIC GRAMMAR. Two parts. 1887. (*Sold to Officers only.*) 10*s.* (10*s.* 6*d.*)

ARMOURERS. Instructions for, in the care, repair, browning, &c., of Small Arms, Machine Guns, "Parapet" Carriages, and for the care of Bicycles. 1912. 1*s.* 6*d.* (1*s.* 4*d.*)
Ditto. Amendments. Aug. 1912; Aug. 1914. Each 1*d.* (1*d.*)

ARMY ACCOUNTS. (*Reprinted from* THE ARMY REVIEW, January, 1914.) 3*d.* (3*d.*)

ARMY CIRCULARS AND ARMY ORDERS issued before Dec. 31, 1892, which are still in force and required for reference. Reprint of May, 1896. 3*d.* (3*d.*)

ARMY ORDERS. Monthly. Each 3*d.* (3*d.*)

ARMY ORDERS. Covers for. 9*d.* (9*d.*)

ARMY ENTRANCE Regulations:—
R.M. Academy. Admission to, during the period of the War. 1915. Provisional. 1*d.* (1*d.*) (*In the press*)
R.M. College. Ditto. 1*d.* (1*d.*) (*In the press*)
Militia and Imperial Yeomanry. Officers of. 1907. 1*d.* (1*d.*)
Special Reserve of Officers, Malta Militia, Bermuda Militia, Channel Islands Militia, and Territorial Force. Officers of the. 1912. 1*d.* (1*d.*)
University Candidates. 1912. 1*d.* (1*d.*)
Military Forces of the Self-governing Dominions and Crown Colonies. Officers of the. 1912. 1*d.* (1*d.*)
Warrant Officers and N.C.O. of the Regular Army. Combatant Commissions as Second Lieutenants. 1914. Provisional. 1*d.* (1*d.*)
See also Commission; Medical Corps; Special Reserve; Territorial Force, Veterinary Corps.

(B 1330) Wt. 12280—954 7M 7/15 H & S

(As to prices in brackets, see top of page 2.)

ARMY LIST. The Quarterly (*not issued in* October, 1914). Each 15*s.* (10*s.* 9*d.*)
Ditto. Monthly to April 1915, inclusive. (*For continuation see below*). Each 1*s.* 6*d.* (1*s.* 5*d.*) (*Not issued in* September, 1914.)

PROMOTIONS, APPOINTMENTS, &c., during August 1914. [Printed in consequence of the temporary suspension of the Monthly Army List.] 6*d.* (6*d.*)
Ditto, during September 1914. [Ditto.] 6*d.* (7*d.*)

ARMY LIST. Monthly. May 1915 and after. Each 1*s.* 6*d.* (1*s.* 5*d.*) (*And see next item*).
Ditto. Supplement containing Promotions, Appointments, &c., Gazetted, and Deaths of Officers Reported, during the preceding months. (The Supplement, June 1915, contains also Lists of Soldiers' Balances unclaimed.) Each 6*d.* (6*d.*)

ARMY PAY, Appointment, Promotion, and Non-Effective Pay. Royal Warrant. 1914. 6*d.* (7*d.*)

ARMY ALLOWANCES Regulations. 1914. 6*d.* (6*d.*)

ARMY REVIEW. Quarterly. July 1911 to Oct. 1914. 1*s.* (Up to July 1914, 1*s.*; Oct. 1914, 11*d.*) (*Publication suspended.*)

ARMY SERVICE CORPS:—
Regimental Standing Orders. 1911. 6*d.* (6*d.*); Amendments. 1*d.* (1*d.*)
Memorandum No. 25. 1*d.* (1*d.*)
Training. Part I. 1909. (Reprinted, with Amendments, 1915). 9*d.* (9*d.*)
Ditto. Part II. Supplies. 1909. (Reprinted, 1914, with new Appendix XII.) 1*s.* 3*d.* (1*s.* 1*d.*)
Ditto Part III. Transport. (Reprinted, with Amendments to April, 1915). 8*d.* (9*d.*)
Ditto. Part IV. Mechanical Transport. (*Out of print*)
Ditto. Amendments, July 1914, to Parts I. and III. 3*d.* (3*d.*)

ARTIFICERS. Military. Handbook. 9th edition. 1910. 1*s.* (11*d.*) (*Under revision*).
Ditto. Amendments. 1912; May 1914. Each. 1*d.* (1*d.*)

ARTILLERY AT THE PICARDY MANŒUVRES IN 1910. Translated from the French. 2*s.* 6*d.* (2*s.*)

ARTILLERY. Royal:—
Officers' Mess Management. (*See* Ordnance College.)
Practice. Instructions—
Garrison. Coast Defences. Seawards. 1914–15. 3*d.* (3*d.*)
Garrison. Siege and Movable Armament. 1914. 3*d.* (3*d.*)
Horse, Field, and Heavy. 1914. 6*d.* (5*d.*)
Standing Orders for—
Brigade of Mounted Artillery. 1*d.* (1*d.*)
Lieut.-Colonel's Command, R.G.A. (Coast and Siege). 1*d.* (1*d.*)
Training—
Field. 1914. 9*d.* (9*d.*)
Ditto. Examples of Ranging. To supplement those given in Sec. 227. 2*d.* (2*d.*)
Garrison—
Vol. I. 1914. 6*d.* (6*d.*)
Vol. II. (Siege). 1911. (Reprinted, with Amendments, 1914). 9*d.* (8*d.*)
Vol. III. 1911. (Reprinted, with Amendments, 1914). 1*s.* (11*d.*)

ARTILLERY COLLEGE. Reports upon the 14th to 18th Senior Classes. Each 1*s.* (9*d.*) (*See also* Ordnance College.)

ARTILLERY. FIELD. The Tactics of (*Von Schell.*) Translated. 1900. 1*s.* (10*d.*)

ARTILLERY INSTRUMENTS. Handbook of. 1914. 1*s.* 6*d.* (1*s.* 4*d.*)
Ditto. Amendments. 1*d.* (1*d.*)
Ditto. Addendum to. 2*d.* (2*d.*)

ARTILLERY MUSEUM in the Rotunda, Woolwich. Official Catalogue, 1906. (*Sold at the Rotunda. Price* 1*s.* 6*d.*)

(As to prices in brackets, see top of page 2.)

ARTILLERY AND RIFLE RANGES ACT, 1885, and MILITARY LANDS ACT, 1892. Byelaws under:—
Aldeburgh, 1896; Ash (Aldershot Camp), 1887; Finborough, 1901; Hythe, 1894; Inchkeith Battery, 1896; Kinghornness, 1896; Landguard, 1887; Lydd—Dungeness, 1895; Middlewick, 1890; Millbrook, 1888; Orchard Portman, 1896; Scarborough, 1902; Scraps Gate, 1886; Shoeburyness, 1895; Southwold, 1896; Strensall, 1900; Wash, 1891; Whitehaven Battery (Cumberland), 1896. Each 1*d.* (1*d.*)
Purfleet, 1911. 1*s.* (9*d.*)
Salisbury Plain, 1900. 4*d.* (4*d.*)

ARTILLERY STORE ACCOUNTS AND THE SUPERVISION OF R.G.A. SUB-DISTRICTS. Notes on. 1914. 1*s.* (10*d.*)

ARTILLERY STORE ACCOUNTS AND THE CARE AND PRESERVATION OF EQUIPMENT OF ROYAL ARTILLERY, HORSE, FIELD, AND HEAVY BATTERIES. Notes on. Sept. 1914. 6*d.* (5*d.*)

BARRACKS. Care of. Instruction in. 1901. 9*d.* (7*d.*)

BASHFORTH CHRONOGRAPH. Experiments with, to determine the resistance of the air to the motion of projectiles. Report on. 1870. 1*s.* (9*d.*)

BAYONET FIGHTING. Instruction with Service Rifle and Bayonet. 1915. 1*d.* (1*d.*)

BAYONET FIGHTING FOR COMPETITIONS. Instruction in. 1*d.* (1*d.*)

BERMUDA MILITIA ARTILLERY. Regulations, 1914. 9*d.* (7*d.*)

BICYCLES. Military. Handbook on. 1911. (Reprinted, with Amendments, 1914). 1*d.* (1*d.*)

BRITISH MINOR EXPEDITIONS, 1746 to 1814. 1884. 2*s.* 6*d.* (1*s.* 11*d.*)

CADET UNITS. (*See* Territorial Force.)

CAMEL CORPS TRAINING. Provisional. 1913. 8*d.* (7*d.*)

CAPE OF GOOD HOPE. Reconnaissance Survey of the, 1903-1911. Report on the. 1*s.* 6*d.* (1*s.* 1*d.*)

CAVALERIE. Translated from the French of Captain Loir. (*In the press*)

CAVALRY OF THE LINE. PEACE ORGANIZATION OF THE; and Arrangements for Mobilization consequent on the establishment of Cavalry Depôts. (Special A.O., July 19, 1909). 1*d.* (1*d.*)

CAVALRY SCHOOL, NETHERAVON. Standing Orders. 1911. 2*d.* (2*d.*)

CAVALRY TRAINING. 1912. (Reprinted, with Amendments, 1915). 1*s.* (11*d.*)

CEREMONIAL. 1912. 3*d.* (4*d.*); Provisional Amendments, June 1914. 1*d.* (1*d.*)

CHEMISTRY. PRACTICAL. Quantitative and Qualitative. A Course of. 5*s.* (3*s.* 8*d.*)

CHEMISTS OF THE RESEARCH DEPARTMENT. Rules and Regulations. 1*d.* (1*d.*)

CHIROPODY Manual. 2*d.* (2*d.*)

CIVIL EMPLOYMENT FOR EX-SOLDIERS. Guide to. 1913. 2*d.* (2*d.*)

CIVIL EMPLOYMENT Regulations. 1913. 1*d.* (1*d.*)

CIVIL POWER. DUTIES IN AID OF THE. Special A.O., Dec. 17, 1908. (Amendments to "King's Regulations," and to "Manual of Military Law"). 1*d.* (1*d.*)

CLOTHING AND NECESSARIES (including Materials). Priced Vocabulary of. 1915. Provisional. 1*s.* (11*d.*).

CLOTHING Regulations:—
Part I. Regular Forces (excluding the Special Reserve). 1914. 6*d.* (6*d.*)
Part II. Special Reserve. 1914. 3*d.* (3*d.*)
Part III. Mobilization, Field Service, and Demobilization. 1908. 3*d.* (3*d.*)

(As to prices in brackets, see top of page 2.)

Clothing Regulations—*continued.*
Amendments to Parts I., II., and III. Nov. 1909; April, Oct. 1910; March, April, Sept., Nov. 1911; Feb., May, July, Sept. 1912; April, July 1913. Each 1*d.* (1*d.*)

COLCHESTER GARRISON. Standing Orders. 1913. 9*d.* (7*d.*)

COMMAND. ALDERSHOT. Standing Orders. 1914. 2*s.* 3*d.* (1*s.* 9*d.*)

COMMAND. THE ART OF. By Colonel von Spohn. Translated. 1*d.* (1*d.*)

COMMAND. WESTERN. Standing Orders. Jan. 1910. (Reprinted, with Amendments, 1915). 6*d.* (5*d.*)

COMMANDS, Military, and Staff in the United Kingdom. Reorganization of. (Special A.O., Jan. 6, 1905, with alterations to date. Issued with Special A.O., Nov. 11, 1907.) 3*d.* (3*d.*)

COMMISSION IN H.M. REGULAR ARMY (from 1st April, 1912). Short guide to the various ways of obtaining a; &c., &c. April 1912. 2*d.* (2*d.*) (*See also* Army Entrance; Medical Corps; Special Reserve; Territorial Force; Veterinary Corps.)

COMPANY TRAINING. Notes on. For the use of the Special Reserve, Territorial Force, and newly-raised Units of the Regular Army. Sept. 1914. 1*d.* (1*d.*)

CONVEYANCE OF TROOPS AND ISSUE OF TRAVELLING WARRANTS. Instructions. 1910. 2*d.* (2*d.*)

COOKING. Military. Manual of. 6*d.* (5*d.*)

COOKING AND DIETARY. Military. Manual of. Mobilization. 1915. 2*d.* (2*d.*)

COURSES OF INSTRUCTION, 1914–15. 2*d.* (2*d.*)
Ditto, at Practice Camps, 1914. 1*d.* (1*d.*)

CREWS OF WAR DEPARTMENT VESSELS AND BOATS AT HOME STATIONS. Regulations for the Appointment, Pay, and Promotion of. 1911. 2*d.* (2*d.*)

CYCLIST TRAINING. Provisional. 1914. 3*d.* (3*d.*)

DIVISION ORDERS. Extracts from. 1880. 2*s.* 6*d.* (1*s.* 9*d.*)

DRAINAGE MANUAL. 1907. (*Reprinting*)

DRAWING PLATES. Military:—
Attack of Dufor's Countermines or 2nd plate of Mines; Carnot's First System; Detached Forts; Concealed Defences, 1, 2, 3, 4; Printing Plate, A, B, C, &c.; Detail Plate, No. 1; Do. No. 2; Neighbourhood of Woolwich; Village and Surrounding Ground. Each 2*d.* (2*d.*)
Attack of Fortress—Preliminary Operations; Do., Distant Attack; Do., Close Attack; Neighbourhood of Metz. Each 3*d.* (3*d.*)
Woods and Villages. 6 plates. Each 6*d.* (5*d.*)
Neighbourhood of Woolwich. Southern Side. 1*s.* 6*d.* (1*s.* 1*d.*)

DRESS REGULATIONS. 1911. 2*s.* 6*d.* (2*s.*); Amendments, March, Aug. 1912. Each 1*d.* (1*d.*); Aug. 1913. 2*d.* (2*d.*)

DRUM AND FLUTE DUTY for the Infantry, with Instructions for the Training of Drummers and Flautists. 1887. 2*s.* (1*s.* 6*d.*)

DYNAMICS. Notes on. (*See* Ordnance College.)

EGYPT. BRITISH FORCE IN. Standing Orders. 1912. 1*s.* (10*d.*)

EGYPT. CAMPAIGN OF 1882 IN. Military History. With case of Maps. Condensed Edition. 1908. 3*s.* 6*d.* (2*s.* 8*d.*)

ELECTRICAL COMMUNICATIONS. FIXED. Instructions as to. 1912. 4*d.* (4*d.*)

ELECTRICITY AND MAGNETISM. Text Book for use of the Cadets at the R.M. Academy. 1911. 2*s.* 6*d.* (2*s.*)

ELECTRICITY. Notes on. 1911. 1*s.* 3*d.* (1*s.* 1*d.*)

ELECTRIC LIGHT APPARATUS. DEFENCE. Instructions for the Working of. 1911. 1*d.* (1*d.*)

ELECTRIC LIGHTING. Military. Vol. I. 1*s.* (11*d.*); Vol. II. (Reprinted, with Amendments, 1915). (*In the press*); Vol. III. 1*s.* (11*d.*)

ENCOUNTER. THE BATTLE OF. By Hans von Kiesling. Part I. Practical. Translated. 1*s.* 6*d.* (1*s.* 3*d.*)

(As to prices in brackets, see top of page 2.)

ENGINEER SERVICES Regulations. Peace:—Part I. 1910. 1*s.* (10*d.*) (*Under revision*); Part II. 1911. Technical Treatises. (Reprinted, with Amendments, to May 1, 1915). 9*d.* (7*d.*)

ENGINEER TRAINING. 1912. (Reprinted, with Amendments, 1914). 6*d.* (6*d.*)

ENGINEERING. Field. Manual of. 1911. (Reprinted 1913). 9*d.* (9*d.*)

ENGINEERING. Military:—

Part I. Field Defences. 1908. 1*s.* 6*d.* (1*s.* 3*d.*)

Part II. Attack and Defence of Fortresses. 1910. 9*d.* (8*d.*)

Part III*a*. Military Bridging.—General Principles and Materials. 1913. 1*s.* (11*d.*); Index. 1*d.* (1*d.*) (*In the press*)

Part III*b*. Ditto.—Bridges. 1*s.* 3*d.* (1*s.* 2*d.*)

Part IV. Mining and Demolitions. 1910. 1*s.* (11*d.*)

Part V. Miscellaneous. 1914. 1*s.* (11*d.*)

Part VI. Military Railways. 1898. (*Out of print*)

EQUIPMENT. INFANTRY. Pattern 1908 Web. 1913. 2*d.* (2*d.*)

EQUIPMENT Regulations:—

Part 1. 1912. (Reprinted, with Amendments published in Army Orders up to Aug. 31, 1914). 1*s.* (11*d.*)

Part 2. Details—

Sect.

I. Infantry. (Regular Army.) 1913. 6*d.* (5*d.*)

I*a*. Mounted Infantry. 1912. 6*d.* (5*d.*)

II. Cavalry. (Regular Army.) 1914. 3*d.* (3*d.*)

III. Army Service Corps. (Regular Army.) 1913. 6*d.* (5*d.*)

IV., IV*a*., and IV*b*. Army Ordnance Corps. Army Pay Corps. Army Veterinary Corps. (Regular Army.) 1914. 2*d.* (2*d.*)

V. Royal Army Medical Corps. (Regular Army.) 1914. 2*d.* (2*d.*)

VI.-IX. R.M. Academy; R.M. and Staff Colleges; Garrison Staff and Schools of Instruction; Military Prisons, Detention Barracks and Military Provost Staff Corps. (Regular Army.) 1914. 2*d.* (2*d.*)

X*a*. Engineer. General. Fortress, Survey, Railway, and Depôt Units. Peace and War. (Regular Army.) 1914. 2*d.* (2*d.*)

X*b*. Field Troop. (Regular Army.) 1912. 2*d.* (2*d.*)

X*c*. Field Company. (Regular Army.) 1914. 2*d.* (2*d.*)

X*d*. Divisional Signal Company. (Regular Army.) 1914. 2*d.* (2*d.*)

X*e*. Signal Company (Wireless). (Regular Army.) 1912. 2*d.* (2*d.*)

X*f*. Headquarters Signal Units. (Regular Army.) 1914. 2*d.* (2*d.*)

X*g*. Signal Company (Cable). (Regular Army.) 1912. 2*d.* (2*d.*)

X*h*. Signal Squadron. (Regular Army.) 1914. 2*d.* (2*d.*)

X*j*. Signal Troop with Cavalry Brigade. (Regular Army.) 1912. 2*d.* (2*d.*)

X*k*. Signal Troop with a Cavalry Brigade not allotted to a Cavalry Division. (Regular Army.) 1914. 2*d.* (2*d.*)

Sect.

X*l*. Signal Company (South Africa). (Regular Army.) 1912. 2*d.* (2*d.*)

X*m*. Bridging Train. (Regular Army.) 1912. 2*d.* (2*d.*)

X*n*. Field Squadron. (Regular Army.) 1914. 2*d.* (2*d.*)

XI*a*. Horse Artillery. Q.F. 13-pr. 1913. 9*d.* (8*d.*)

XI*b*. Field Artillery. Q.F. 18-pr. (Regular Army.) 1914. 9*d.* (8*d.*)

XI*c*. Field Artillery. Q.F. 4·5-in. Howitzer. (Regular Army.) 1913. (Reprinted, with Amendments up to Aug. 1, 1914). 9*d.* (8*d.*)

XI*d*. Reserve Brigades with Q.F. 18-pr. Equipment. Horse and Field Artillery, Staff and Depôts, Riding Establishment, School of Gunnery (Horse and Field), and Mounted Band. (Regular Army.) 1914. 6*d.* (6*d.*)

XI*e*. Mountain Artillery with B.L. 2·75-inch Equipment. Mountain Battery and Ammunition Column. Mule Transport. Provisional. (Regular Army.) 1914. 6*d.* (5*d.*)

XII*a*. Royal Garrison Artillery. (Regular Army.) 1914. 2*s.* 6*d.* (1*s.* 11*d.*)

XII*b*. Royal Garrison Artillery, Siege Artillery, Movable Armament, and Machine Guns in Armaments. 1913. 1*s.* (10*d.*)

XII*c*. Heavy Artillery. B.L. 60-pr. (Regular Army.) 1913. 9*d.* (8*d.*)

XIV. Cavalry School, Netheravon. (Regular Army.) 1914. 2*d.* (2*d.*)

(As to prices in brackets, see top of page 2.)

Equipment Regulations—*continued.*

Part 2. Details—*continued.*

Sect.

XV. Camel Corps School, Egypt. (Regular Army.) 1914. 2*d.* (2*d.*)

XVI. Special Reserve. 1913. 4*d.* (4*d.*)

XVII. Officers Training Corps. 1912. 3*d.* (3*d.*)

Practice Batteries and Drill Guns (Fixed Mountings) of the Royal Garrison Artillery. (Part 2, Sections XII*a* and XVI, and Part 3.) 1909. 1*s.* 6*d.* (1*s.* 2*d.*)

Part 3. Territorial Force. 1914. 6*d.* (6*d.*)

Ditto. Details:—

Sec. IX. Artillery. 1912. 1*s.* (9*d.*)

Ditto. Amendments, April 1912; Feb. 1914. Each 1*d.* (1*d.*)

Sec. X. Engineer. 1912. 3*d.* (3*d.*)

Amendments to Part 2. Feb., April, July (two issues), Aug. 1914. Each 1*d.* (1*d.*)

Amendments to Parts 1, 2, and 3. Nov. 1913. 1*d.* (1*d.*)

Amendments to Parts 1, 2, and 3. Mar., July 1913; April, Aug. 1914. Each 2*d.* (2*d.*)

ESTABLISHMENTS:—

PEACE:—

Part II. Territorial Force. 1913–14. 4*d.* (4*d.*) (*Under revision*)

Ditto. Changes in. Nov. 1913. 1*d.* (1*d.*)

Part III. Departmental and Miscellaneous Regular Establishments and Instructional Institutions. 1913–14. 2*d.* (2*d.*)

Part IV. Headquarters Establishments. Home, Colonies and India. 1913–14. 3*d.* (3*d.*)

Part V. Establishment of Commands Abroad and Summaries of the Military Forces of the Crown. 1913–14. 2*d.* (2*d.*)

WAR:—

Part I. Expeditionary Force. 1914. 8*d.* (8*d.*) (*Under revision*)

Part II. Territorial Force. 1911. 8*d.* (7*d.*)

Part V. Reserve, Depôt, and other Regimental Units maintained at Home after Mobilization. 1914. 4*d.* (4*d.*) (*Under revision*)

Part VI. Departmental and Miscellaneous Regular Establishments and Instructional Institutions maintained at Home after Mobilization. 1914. 2*d.* (2*d.*)

New Armies. 1915. 2*d.* (3*d.*)

EUROPEAN WAR. 1914–15. Despatches (Naval and Military) relating to Operations in the War. Sept., Oct., and Nov., 1914. With List of Honours and Rewards Conferred. With Sketch Map. 2*d.* (3*d.*)

EXAMINATION PAPERS:—

Qualifying Certificates. Sept. 1905; March 1906; Sept. 1909; March, Sept. 1910; March, Sept. 1911; March 1912. Each 6*d.* (5*d.*)

Entrance: R.M. Academy, R.M. College, Qualifying Test for Commissions. Supplementary First Appointments in the Royal Marines. June–July 1912. 1*s.* (11*d.*)

Entrance: R.M. Academy, R.M. College, Qualifying Test for Commissions. Nov. 1912; Nov.–Dec. 1913. Each 1*s.* (11*d.*)

Entrance: R.M. Academy, R.M. College, Qualifying Test for Commissions. Supplementary First Appointments in the Royal Marines. Appointments in the Indian Police Force. Appointments in the Police Forces of the Straits Settlements and the Federated Malay States. Cadetships in the Royal Navy (Special Entry). June–July 1914. 1*s.* (11*d.*)

Entrance: R.M. Academy, R.M. College. Nov.–Dec. 1914. 1*s.* (10*d.*)

Freehand Drawing at the Army Entrance Examination of Nov. 1913. Specimen Paper to illustrate the kind of questions that will be set in. 6*d.* (5*d.*)

(As to prices in brackets, see top of page 2.)

Examination Papers—*continued.*

R.M. Academy, Fourth Class; R.M. College, Fourth, Third, and Second Divisions. July, Dec. 1904; June 1905. Each 1*s.*

R.M. Academy, Fourth Class; R.M. College, Senior Division. Dec. 1905; June, Dec. 1906; July, Dec. 1907. Each 1*s.*

Staff College. Admission. Aug. 1907; Aug. 1909; July 1911; June-July 1912; June-July 1913. Each 1*s.* (6*d.*)

Regular Forces, Canadian Permanent Forces, Special Reserve of Officers, Territorial Force, and Colonial Military Forces. May, Nov. 1906; May, Nov. 1908. Each 1*s.* (11*d.*)

Ditto. May 1909. 9*d.* (8*d.*)

Officers for Promotion. Dec. 1912; May, Dec. 1913; April 1914. Each 1*s.* (6*d.*)

Militia, Imperial Yeomanry, and University Candidates. Mar., Sept. 1904; Sept. 1905; Oct. 1906. Each 1*s.*

Special Reserve, Militia, Territorial Force, and University Candidates. Oct. 1911; March, Oct. 1912; March, Oct. 1913. Each 1*s.* (6*d.*)

Special Reserve, Military, Territorial Force, Non-Commissioned Officers, and University Candidates. March 1914. 1*s.* (6*d.*)

Officers' Training Corps:—

Cadets of the Senior Division. Certificate A. Dec. 1908. 6*d.* (5*d.*)

Cadets of the Junior and Senior Divisions. Certificates A and B. Spring of 1909; Nov. 1910; May, Nov. 1911; March, Nov. 1912; March, Nov. 1913; March 1914. Each 6*d.* (6*d.*)

Foreign Languages. Modern. July, 1906; July 1908; April, July 1909; Jan., June, Oct. 1910; Jan., June, Oct. 1911; June 1912; June 1913; June 1914. Each 1*s.* (6*d.*)

EXPLOSIVES. Service. Treatise on. 1907. 1*s.* 6*d.* (1*s.* 2*d.*)

FIELD ALMANAC. 1915. 1*d.* (1*d.*)

FIELD SERVICE. Manual for:—

Artillery. Field. Brigade. Q.F. 18-pr. 1915. 3*d.* (3*d.*)
Ditto. Ditto. (Howitzer) Brigade. 5-inch B.L. 1908. 3*d.* (3*d.*)
Ditto. Heavy (B.L. 60-pr.) Battery and Ammunition Column. Expeditionary Force. 1910. 3*d.* (3*d.*)
Ditto. Horse. Brigade. 13-pr. Q.F. 1908. 3*d.* (3*d.*) (*Under revision*)
Ditto. Ditto. Appendix to. R.H.A. Battery and Mounted Brigade Ammunition Column. 1*d.* (1*d.*)
Cavalry Regiment. Expeditionary Force. 1913. 3*d.* (3*d.*) (*Under revision*)
Engineers. Balloon Company. Expeditionary Force. 1910. 3*d.* (3*d.*)
Ditto. Bridging Train. Expeditionary Force. 1915. 3*d.* (3*d.*)
Ditto. Field Company. Expeditionary Force. 1915. 3*d.* (3*d.*)
Ditto. Field Squadron. Expeditionary Force. 1914. 3*d.* (3*d.*)
Ditto. Works Company. Expeditionary Force. 1910. 3*d.* (3*d.*)
Headquarters Units. Expeditionary Force. 1911. 3*d.* (3*d.*)
Infantry Battalion. Expeditionary Force. 1914. 3*d.* (3*d.*)
Infantry (Mounted) Battalion. Expeditionary Force. 1913. 3*d.* (3*d.*)
Medical Service. Army. Expeditionary Force. 1914. 3*d.* (3*d.*)
Signal Service. Signal Company (Air-Line). Expeditionary Force. 1913. 3*d.* (3*d.*)
Ditto. Ditto. (Cable). Expeditionary Force. 1913. 3*d.* (3*d.*)
Ditto. Ditto. (Divisional). Expeditionary Force. 1915. 3*d.* (3*d.*)
Ditto. Ditto. (Lines of Communication). Expeditionary Force. 1914. 3*d.* (3*d.*)

FIELD SERVICE POCKET BOOK. 1914. 1*s.* (11*d.*)

(As to prices in brackets, see top of page 2.)

FIELD SERVICE REGULATIONS:—
Part I. Operations. 1909. (Reprinted, with Amendments, 1914). 6*d.* (6*d.*)
Part II. Organization and Administration. 1909. (Reprinted, with Amendments to Oct. 1914). 1*s.* (10*d.*)
Ditto. Amendments, April 1915. 1*d.* (1*d.*)

FINANCIAL INSTRUCTIONS IN RELATION TO ARMY ACCOUNTS. 1910. (Reprinted, with Amendments to Sept. 1, 1914). 4*d.* (4*d.*)

FLYING CORPS, ROYAL. Training Manual:—
Part I. Provisional. 1914. 1*s.* (10*d.*)
Ditto. Amendments. Jan. 1915. 1*d.* (1*d.*)
Part II. Military Wing. Provisional. 1914. 3*d.* (4*d.*)

FOREIGN LANGUAGES, STUDY OF. Regulations. 1913. 2*d.* (2*d.*)

FORTIFICATION, PERMANENT. For the Imperial Military Training Establishments and for the Instruction of Officers of all Arms of the Austro-Hungarian Army. 7th Edition. Translated. 4*s.* (2*s.* 11*d.*)

FRANCO-GERMAN WAR, 1870-71. Translated from the German Official Account. Five Vols. **£6 11*s.* 6*d.***
Also separately, in Volumes in cloth, Sections in paper covers, and Plans unmounted:—
First Part—History of the War to the Downfall of the Empire—
Vol. 1 (Secns. 1 to 5). Outbreak of Hostilities to Battle of Gravelotte. £1 6*s.* (*Out of print*)
Vol. 2 (Secns. 6 to 9). Battle of Gravelotte to Downfall of the Empire. £1 2*s.* (*Out of print*)
Second Part—History of the War against the Republic—
Vol. 1 (Secns. 10 to 13). Investment of Paris to Re-occupation of Orleans by the Germans. **£1** 6*s.* (18*s.* 6*d.*)
Vol. 2 (Secns. 14 to 18). Events in Northern France from end of Nov. in North-west from beginning of Dec. Siege of Paris from commencement of Dec. to the Armistice. Operations in the south-east from middle of Nov. to middle of Jan. £1 6*s.* (19*s.*)
Vol. 3 (Secns. 19 and 20). Events in South-east France from middle of Jan. to Termination of Hostilities. Rearward Communications. The Armistice. Homeward March and Occupation. Retrospect. £1 11*s.* 6*d.* (£1 2*s.* 6*d.*)

Section.
1. Events in July. Plan. 3*s.* (2*s.* 2*d.*)
2. Events to Eve of Battles of Wörth and Spicheren. 3rd edition. (*Out of print*)
3. Battles of Wörth and Spicheren. 3rd edition. (*Out of print*)
4. Advance of Third Army to the Moselle, &c. 2nd edition. (*Out of print*)
5. Operations near Metz on 15th, 16th, and 17th August. Battle of Vionville—Mars la Tour. 2nd edition. (*Out of print*)
6. Battle of Gravelotte—St. Privat. (*Out of print*)
7. Advance of Third Army and of Army of the Meuse against Army of Chalons. (*Out of print*)
8. Battle of Sedan. (*Out of print*)
9. Proceedings on German Coast and before Fortresses in Alsace and Lorraine. Battle of Noisseville. General Review of War up to September. 4*s.* 6*d.* (3*s.* 4*d.*)
10. Investment of Paris. Capture of Toul and Strassburg. 6*s.* (4*s.* 6*d.*)
11. Events before Paris, and at other points of Theatre of War in Western France until end of October. 5*s.* 3*d.* (3*s.* 11*d.*)
12. Last Engagements with French Army of the Rhine. Occurrences after fall of Strassburg and Metz to middle of November. 4*s.* 6*d.* (3*s.* 5*d.*)
13. Occurrences on Theatre of War in Central France up to Re-occupation of Orleans by the Germans. 6*s.* (4*s.* 6*d.*)

(As to prices in brackets, see top of page 2.)

Franco-German War—*continued.*

Section.

14. Measures for Investment of Paris up to middle of December. **4s.** (*3s.*)
15. Measures for protecting the Investment of Paris and Occurrences before French Capital to commencement of 1871. **2s. 6d.** (*1s. 11d.*)
16. Proceedings of Second Army from commencement of 1871 until the Armistice. **3s. 6d.** (*2s. 8d.*)
17. Proceedings of First Army from commencement of 1871 until the Armistice. **3s.** (*2s. 3d.*)
18. Occurrences on South-eastern Theatre of War up to middle of Jan. 1871. Events before Paris from commencement of 1871 to the Armistice. **3s.** (*6s.*)
19. Occurrences on South-eastern Theatre of War from middle of January, 1871. Proceedings in rear of German Army and in Coast Provinces from Nov., 1870 until the Armistice. **13s. 6d.** (*9s. 8d.*)
20. General Retrospect of War from beginning of Sept., 1870 to Cessation of Hostilities. Armistice and Peace Preliminaries. Return of German Army and Peace of Frankfort. The Occupation. The Telegraph, Post, Supply of Ammunition, Commissariat, Hospital Service, Divine Service, Military Justice, Recruitment, and Home Garrisons. Results. **5s.** (*3s. 9d.*)

Analytical Index. **1s. 6d.** (*1s. 1d.*)

Plans—

4. Battle of Colombey-Nouilly. **3d.** (*3d.*)
5A. Battle of Vionville—Mars la Tour. Position of Contending Forces at Noon. **3d.** (*3d.*)
5B. Battle of Vionville—Mars la Tour. Position of Contending Forces from 4 to 5 p.m. **3d.** (*3d.*)
9A. Battle of Sedan. Position of Contending Forces towards Noon. **3d.** (*3d.*)
9B. Battle of Sedan. Position of the Germans in the afternoon shortly before the end of the struggle. **3d.** (*3d.*)

(*See also* SIEGE OPERATIONS.)

GERMAN ARMY. Cavalry. Drill Regulations. 1909. **3d.** (*3d.*)
Ditto. Field Service Regulations. 1908. **1s.** (*10d.*)
Ditto. Foot Artillery. Drill Regulations. Part IV. THE FIGHT. 1909. **3d.** (*3d.*)
Ditto. Manœuvres Regulations. 1908. **3d.** (*3d.*)

GERMANY. The Campaign of 1866 in. With 22 Plans in portfolio. 1872. (Reprinted 1907). **6s.** (*4s. 10d.*)
Ditto. Moltke's Projects for. **1s.** (*10d.*)

GUERNSEY AND ALDERNEY ROYAL MILITIA. Regulations. With the Militia Laws relating to the Islands. Provisional. **3s.** (*2s. 2d.*)

GUNS. Drill for. (*And see* **GUNS.** Handbooks for):—
60-pr. B.L. 1912. (Reprinted, with Amendments, 1915). **1d.** (**1d.**)
18-pr. Q.F. 1914. **1d.** (*1d.*); Amendments. ½*d.* (½*d.*)
15-pr. B.L. 1914. **1d.** (*1d.*)
15-pr. B.L.C. 1914. **1d.** (*1d.*)
15-pr. Q.F. 1912. **1d.** (*1d.*)
13-pr. Q.F. 1914. **1d.** (*1d.*); Amendments. ½*d.* (½*d.*)
12-pr. 12-cwt. Q.F. Land Service. 1914. **1d.** (*1d.*)
10-pr. B.L. 1914. **1d.** (*1d.*)
9·2-inch B.L. Mark IX., on Mark IV. Mounting. Land Service. 1914. **1d.** (*1d.*)
9·2-inch B.L. "C" Mark IX., on Marks V^A. and V^B. Mountings. Land Service. 1914. **1d.** (*1d.*)
9·2-inch B.L. Marks X., X^v., and X*., on Mark V. Mounting. Land Service. 1914. **1d.** (*1d.*)

(As to prices in brackets, see top of page 2.)

GUNS. Drill for—*continued.*

6-inch B.L. Marks VII. and VII*. Land Service. 1914. 1*d.* (1*d.*)
6-inch B.L. Howitzer. 1912. (Reprinted, with Amendments to Dec. 1914). 1*d.* (1*d.*)
6-inch Q.F. Land Service. 1914. 1*d.* (1*d.*)
5-inch B.L. Howitzer. 1915. 1*d.* (1*d.*) *(In the press)*
4·7-inch Q.F. Fixed Armament. Land Service. 1914. 1*d.* (1*d.*)
4·7-inch Q.F., on Travelling Carriages. 1912. 1*d.* (1*d.*)
4·7-inch Q.F. Heavy Batteries. Provisional. 1914. 1*d.* (1*d.*) *(Under revision)*
4·5-inch Q.F. Howitzer. 1914. 1*d.* (1*d.*); Amendments. ½*d.* (½*d.*)
4-inch Q.F. Land Service. 1914. 1*d.* (1*d.*)
2·95-inch Q.F. 1914. 1*d.* (1*d.*)

GUNS. Handbooks for. (*And see* **GUNS.** Drill for):—

6-pr. B.L. Land Service. 1913. 1*s.* 6*d.* (1*s.* 3*d.*)
18-pr. Q.F. Land Service. 1913. (Reprinted, with Amendments, 1914). 1*s.* (11*d.*)
15-pr. B.L. Marks II. to IV., and Carriages, Marks II.* and IV., and Wagon, and Limber, Mark IV. Field Batteries. 1914. Provisional. 1*s.* (10*d.*)
15-pr. B.L.C. Marks I., II., II.*, and IV., with Mark I. Carriage, and Marks I., Ia., Ib., and Ic. Limbers and Wagons. Land Service. 1912. 1*s.* (10*d.*)
15-pr. Q.F. Land Service. 1914. 1*s.* 6*d.* (1*s.* 2*d.*)
13-pr. Q.F. Land Service. 1913. (Reprinted, with Amendments, 1914.) 1*s.* 3*d.* (1*s.* 1*d.*)
10-pr. Jointed B.L. Mule Equipment. 1914. 1*s.* 6*d.* (1*s.* 2*d.*)
9·45-inch B.L. Howitzer. 1906. 9*d.* (7*d.*)
9·2-inch B.L. Mark IX., "O" Mark IX., and Marks X., X*., and X.* Land Service. 1912. 1*s.* (11*d.*)
8-inch R.M.L. Howitzer of 70 cwt. Movable Armament and Armament of Works. Land Service. 1901. 2*s.* (1*s.* 6*d.*)
6-inch B.L. and B.L.C. Guns, Mountings, &c. 1904. 1*s.* 6*d.* (1*s.* 4*d.*)
6-inch B.L. Marks VII. and VII*. Land Service. 1911. 9*d.* (8*d.*) *(Under revision)*
6-inch B.L. 30 cwt. Howitzer. Marks I. and I.* 1915. 1*s.* 6*d.* (1*s.* 2*d.*)
6-inch Q.F. Land Service. 1903. 1*s.* (10*d.*)
6-inch "B" Q.F. Land Service. 1911. 1*s.* (10*d.*)
5·4-inch B.L. Howitzer. Mark I. 1902. 1*s.* 6*d.* (1*s.* 2*d.*)
5-inch B.L. Marks I.—V. 1904. 9*d.* (9*d.*)
5-inch B.L. Marks IV.—V. Land Service. 1903. 1*s.* 6*d.* (1*s.* 2*d.*)
5-inch B.L. Howitzer. 1915. 1*s.*
4·7-inch Q.F. Fixed Armaments. Land Service. 1904. 1*s.* (11*d.*)
4·7-inch Q.F.B., on Travelling Carriages. Land Service. 1910. (Reprinted, with Amendments, 1914). 9*d.* (8*d.*)
4·5-inch Q.F. Howitzer. Land Service. 1914. 1*s.* 3*d.* (1*s.* 1*d.*)
2·95-inch Q.F. Mule Equipment and Man Transport Equipment. 1914. 2*s.* (1*s.* 6*d.*)
·303-inch and ·303-inch converted Maxim Machine (Magazine Rifle Chamber), mounted on Carriages, M.G., Infantry, Parapet; Tripod and Cone Mountings. 1911. (Reprinted, with Amendments, 1915). *(In the press)*
·303-inch Vickers Machine (Magazine Rifle Chamber), on Tripod Mounting, Mark IV. 1914. 6*d.* (6*d.*); Amendments, June 1915. 1*d.* (1*d.*)
0·303-inch Nordenfelt 3-barrel and Gardner 2-barrel converted from 0·4-inch and 0·45-inch M.H. Chamber, Magazine Rifle Chamber, on Carriages. 1900. 9*d.* (8*d.*)

HISTORICAL RECORDS OF THE BRITISH ARMY, viz.:—

Horse Guards. 5*s.* (3*s.* 7*d.*)
Dragoon Guards, 3rd, 4th, 5th, 6th, and 7th. Each 4*s.* (3*s.*)

(As to prices in brackets, see top of page 2.)

Historical Records—*continued.*

Dragoons, 1st, 3rd, 7th, 14th, and 16th. Each 4*s.* (3*s.*)
Ditto. 12th, and 13th. Each 3*s.* (2*s.* 3*d.*)
Marine Corps. 3*s.* (2*s.* 2*d.*)
Foot, 2nd, 6th, 8th, 10th, 11th, 13th, 16th, 17th, 18th, 19th, 20th, 21st, 22nd, 34th, 36th, 39th, 46th, 53rd, 67th, 71st, 72nd, 73rd, 74th, 86th, 87th, and 92nd. Each 4*s.* (3*s.*)
Do. 14th, 56th, 61st, 70th, and 88th. Each 3*s.* (2*s.* 3*d.*)

HISTORIES, SHORT, OF THE TERRITORIAL REGIMENTS OF THE BRITISH ARMY. 67 numbers, each 1*d.* In one volume, 5*s.* (3*s.* 9*d.*)
Ditto. The Scots Guards. 1*d.* (1*d.*)
Ditto. The 6th (Inniskilling) Dragoons. 1*d.* (1*d.*)
Ditto. Revised Editions. 1*d.* (1*d.*) each :—

Alexandra, Princess of Wales's Own (Yorkshire Regiment).
The Bedfordshire Regiment.
The Black Watch (Royal Highlanders).
The Cameronians (Scottish Rifles).
The Cheshire Regiment.
The Duke of Cornwall's Light Infantry.
The Duke of Wellington's West Riding Regiment.
The Durham Light Infantry.
The East Lancashire Regiment.
The East Surrey Regiment.
The Hampshire Regiment.
The Highland Light Infantry.
The King's Own (Royal Lancaster Regiment).
The King's Own Yorkshire Light Infantry.
The Lancashire Fusiliers.
The Leicestershire Regiment.
The Loyal North Lancashire Regiment.
The Northamptonshire Regiment.
The Oxfordshire and Buckinghamshire Light Infantry.
The Prince Albert's (Somersetshire Light Infantry).
The Prince of Wales's Leinster Regiment (Royal Canadians).
The Prince of Wales's Own (West Yorkshire Regiment).
The Prince of Wales's Volunteers (South Lancashire Regiment).
The Princess Charlotte of Wales's (The Royal Berkshire Regiment).
The Princess Louise's Argyll and Sutherland Highlanders.
The Royal Inniskilling Fusiliers.
The Royal Sussex Regiment.
The Royal Warwickshire Regiment.
The Royal Welsh Fusiliers.
The South Staffordshire Regiment
The Suffolk Regiment.
The Welsh Regiment.
The Worcestershire Regiment.

HOSPITALS. MILITARY FAMILIES'. Nursing Staff Regulations, Dec., 1909. 1*d.* (1*d.*)
HOSTILITIES WITHOUT DECLARATION OF WAR FROM 1700 TO 1870. 2*s.* (1*s.* 7*d.*)
HYGIENE. ELEMENTARY MILITARY. Manual of. 1912. 6*d.* (6*d.*)
INDIAN EMPIRE. OUR. A Short Review and some Hints for the use of Soldiers proceeding to India. 6*d.* (6*d.*)
INFANTRY TRAINING. (4-Company Organization.) 1914. 6*d.* (6*d.*)
INSTITUTES. Garrison and Regimental. Rules for the Management of. 1912. 1*d.* (1*d.*)
INTELLIGENCE DUTIES IN THE FIELD. Regns. for. 1904. 2*d.* (2*d.*)
ITALIAN CAVALRY TRAINING REGULATIONS. 1911. Training for Marches, Tactics of Minor Units, and Training of Patrols. Translated. 4*d.* (3*d.*)
JAMAICA. Standing Orders. 1912. 1*s.* (9*d.*)
JERSEY. ROYAL MILITIA OF THE ISLAND OF. Regulations 1914. With the Jersey Militia Law, 1905. 1*s.* 3*d.* (11*d.*)

OFFICIAL COPY.

REGULATIONS

8
Engineers
85

FOR

ENGINEER SERVICES—PEACE.

1911.

PART 2 (Technical Treatises).

Reprinted with Amendments up to 1st May, 1915.

LONDON:
PRINTED UNDER THE AUTHORITY OF HIS MAJESTY'S STATIONERY OFFICE
BY HARRISON AND SONS, 45-47, ST. MARTIN'S LANE, W.C.,
PRINTERS IN ORDINARY TO HIS MAJESTY.

To be purchased, either directly or through any Bookseller, from
WYMAN AND SONS, LTD., 29, BREAMS BUILDINGS, FETTER LANE, E.C., and
54, ST. MARY STREET, CARDIFF; or
H.M. STATIONERY OFFICE (SCOTTISH BRANCH), 23, FORTH STREET, EDINBURGH; or
E. PONSONBY, LTD., 116, GRAFTON STREET, DUBLIN;
or from the Agencies in the British Colonies and Dependencies,
the United States of America and other Foreign Countries of
T. FISHER UNWIN, LONDON, W.C.

1915.

Price Ninepence.

TABLE OF CONTENTS.

NOTE.—For list of abbreviations used, see R.E.S., Part 1.

(11330) Wt. 12280—954 7000 6/15 H & S P 15/328

SECTION I.—MACHINERY.

1.—Supply and Maintenance.

1. W.D. machinery generally is supplied and maintained as indicated in R.E.S., Part 1, paras. 293-297.

2. The Engineers are responsible for the maintenance of such machinery only as they provide. (But *see* R.E.S., Part 1, para. 296 (*c*).)

3. Provision of funds and of labour for working or testing machinery will be made by the branch of the service in charge of it.

4. The D.O. is responsible that the posters* which give instructions to attendants in charge of various classes of machinery are hung up in the engine rooms and complied with. In the case of traction engines on engineer charge, or portable machinery, these posters will be hung up in the engine shed or other suitable position. In the case of gas or oil engines or other special machinery, special posters to be obtained from the makers will be hung up in addition to the ordinary W.D. poster.

In the case of boilers of an exceptional type or working at a pressure above that given in para. 24, special instructions based on information obtained from the manufacturers will be drawn up locally in addition to, or in place of, those given on A.F. G 945.

5. The attendant in charge of any boiler, engine, or machine, is responsible for its economical and efficient working. To ensure this he will periodically check the evaporation of boilers, the fuel consumption of engines, the delivery of pumps, and the output of stone crushers, etc. He will render monthly reports of fuel and engine time to the D.O. for all engines and pumps in continual use on the forms issued in conjunction with A.B. 346.

6. Safety valves, stop-cocks, and other boiler fittings are to be protected from interference by unauthorized persons. The fusible plugs of all boilers will be removed for inspection once every six months and the metal renewed if necessary.

Compositions for prevention of boiler corrosion, etc., are not to be used without W.O. authority. If pitting is not checked by the use of zinc plates, a special report, accompanied by an analysis or a sample (of not less than one gallon) of the feed water, will be forwarded to the W.O.

---

* Viz.:—For hydraulic machinery, A.F. G 849; for pumps, A.F. G 850; for hoisting gear, cranes and lifts, A.F. G 851; for gas and oil engines, A.F. G 853; for steam boilers, A.F. G 945.

Portable boilers are to be properly levelled when in use, with the smoke-box end a little higher than the fire-box end. In the open they must be protected as far as possible from the weather, and from frost (*see* para. 12). Tallow, animal, or vegetable oils are injurious to steam boilers; only mineral oils are to be used for the cylinder lubrication of condensing steam engines.

7. Full instructions for the maintenance of hot water boilers are contained in "Notes on Boilers for the Supply of Hot Water or for Heating Buildings" issued by the W.O. Local instructions based on the information given in this pamphlet will be drawn up for the guidance of persons in charge in accordance with para. 4.

8. Owing to the poisonous nature and the lack of smell of the gases generated in suction gas producers, particular precautions are necessary in using machinery of this nature. The precautions to be observed are laid down in the "Factory and Workshop Act, 1901, memorandum as to the use of water gas, suction gas, etc., Form 827, December, 1908," which, together with a poster (Form 932, Home Office), can be obtained from the W.O. on application, for use as directed in para. 4. Instructions based on this memorandum will be drawn up to suit local circumstances. The oxygen cylinders will be obtained on requisition from the R.A.M.C.

9. The greatest load which any hoisting gear is authorized to carry for the time being will be determined from the results of the annual or other inspections. The maximum permissible working load will be painted on it in a prominent position:—"LOAD NOT TO EXCEED—"

It is most desirable that the chains of cranes and hoisting gear in frequent use should be thoroughly annealed once a year, and tested before being again taken into use. Where only occasionally used chains may be annealed every second year.

10. Regulations regarding the registration and limitations imposed upon the use of W.D. motor cars and road locomotives in the United Kingdom are contained in W.O. circular letter dated 14th June, 1909 (114/Gen. No. 4895), summarizing the various Acts of Parliament concerned.

All mechanical transport vehicles and portable engines on engineer charge are to have the words "ROYAL ENGINEERS" and the name of the station painted upon them. In addition, traction engines, portable engines, and M.T. vehicles, are to have the weight on each axle in working order (*i.e.*, with coal bunkers and water tanks full) painted upon them, and trucks and trailers their tare weight and normal load.

11. The rams of hydraulic machines are to be kept well greased and free from rust. The glands, valves, etc., must be maintained in a watertight condition. Where leather washers, etc., are in use soft soap dissolved in the water (1 lb. to 20 or 30 gallons) will keep them soft.

When hydraulic machinery may be exposed to frost, and it is necessary to keep it continually filled in order to be ready for immediate action, glycerine is to be mixed with the water in the machinery in the proportion of 1 part glycerine to 1 part water.

The striking gear of hydraulic lifts, accumulators, etc., must be frequently examined by the attendant in charge to ensure its being in proper working order.

12. All machinery which normally contains water (*e.g.*, boilers, water cooled internal combustion engines, etc.) or machinery which may contain condensed steam, is to be drained if the machine is liable to be exposed to frost. In frosty weather such exposed engines and pumps are to be turned round by hand before starting work to ensure that there is no ice in the cylinders or barrels.

13. Leather belting exposed to the weather is to be well oiled and carefully wiped down after rain.

14. When a boiler is laid off for a short period it is to be entirely filled with clean fresh water to which caustic soda crystal has been added either in the proportion of 1 lb. of caustic soda per ton of water, or in such quantity as may be necessary to render the water slightly alkaline. If caustic soda is not obtainable washing soda crystals may be used, but the proportion is in this case to be 1 lb. per cwt. of water. The boiler is to be thoroughly examined externally to see that no leaks exist, and it is to be kept full of water till again required for use. When it is found difficult to keep the boiler completely filled, or when a boiler is exposed to frost or laid off for a long period, it should be emptied, carefully dried, and closed up air-tight after having quick-lime introduced in a sheet-iron tray. It is forbidden to leave water standing in a boiler at the working level when the boiler is not in daily use.

Boilers laid up in store for any length of time are to be painted externally with oxide of iron paint, their fittings removed, and wooden blank flanges fixed in their place.

15. The bright parts of engines and machinery laid off or in store are to be painted with a mixture of white lead and tallow. When in store such small fittings as lubricators are to be removed and kept together.

Machinery laid off will be inspected from time to time, and will be turned round at least once a week to see that all parts are in good working order.

16. W.O. authority is required before surplus or unserviceable machinery can be disposed of.

Unserviceable boilers are to be handed over to the A.O.D. for disposal. They will previously be mutilated so as to render them unfit for further use and past profitable repair.

When authority is given for the sale of serviceable boilers a clause is to be inserted in the conditions of sale absolving the W.D. from all liability for accidents which may occur from failure of any part of the boiler.

2.—Tests and Inspections.

17. The Engineers carry out the inspection on first erection and the subsequent periodical inspections of all machinery for whose supply they are responsible (*see* R.E.S., Part 1, paras. 293-297).

A.O. 326 1911

With the exception of machinery, or parts of machines, supplying power (*e.g.*, boilers), no machinery which has been handed over to and is maintained by R.A. or A.O.D., under the provisions of para. 260, R.E.S., Part I., and the Regulations for A.O.S., will be inspected by the Engineers.

18. Every boiler, engine, or machine will be inspected :—

(*a*) On first erection before being taken into use (*see* paras. 19 and 20).

(*b*) Annually while in use (*see* paras. 21-31).

(*c*) After being laid off or in store for a considerable period (*see* para. 32).

(*d*) After undergoing extensive repairs (*see* paras. 22-31).

The machinery officer is responsible that these inspections are carried out and that particulars of any defects or necessary repairs required are forwarded to the D.O. concerned ; D.Os. are responsible that the necessary repairs are carried out.

19. New machinery purchased through the W.O. is inspected during manufacture at the maker's works by the Inspector of Iron Structures. It is sometimes necessary for a further inspection to be carried out after erection at the station before final approval, in which case the contractor or his representative should be requested to attend. In the absence of instructions to the contrary this test will be carried out under the supervision of the machinery officer of the Command.

20. When machinery is purchased direct by Commands the amounts of the contracts will generally be small (*see* R.E.S., Part 1, paras. 339 (*b*) and 353). It will seldom be economical to arrange for inspection during manufacture at the maker's works ; it may, however, be possible in cases of special importance to arrange, through the G.O. i/c Adm. of the Command in which the contractor's works are situated, for a qualified officer to visit the works during the progress of manufacture. Where this is impossible the inspection can generally be carried out by the Inspector of Iron Structures on application to the W.O. In cases where it is not desirable for the reason given above to inspect machinery at the maker's works it must be inspected and approved on arrival at the station.

The local inspecting officer will submit his report (*see* paras. 37 and 38) to the D.O., for transmission to the W.O.

21. The inspection and insurance of all boilers at work at home, except those mentioned in para. 24, is secured by means of running contracts made at the W.O. with certain companies or associations. Copies of the contract are sent to the Command concerned.

Under the provisions of these contracts the boilers are inspected on behalf of the contractors twice a year, once under hydraulic and once under steam pressure. The D.O. is responsible that boilers are prepared for these inspections, with all necessary appliances to hand so that the contractor's inspector may not be unnecessarily delayed. These inspections will be attended by a machinery officer or military mechanist.

New boilers (except those mentioned in para. 24) for stations at home which are purchased through the W.O. are added to the contract list for insurance after final approval at the maker's works. When other boilers at stations at home requiring insurance are taken into use either for the first time or after extensive repairs or after having missed an annual inspection owing to their having been laid off or in store, a report is to be forwarded to the W.O. requesting the addition of the boiler to the contract list, a communication being sent at the same time by the D.O. to the contractor direct requesting him to carry out the necessary inspections under para. 23. When it is desired to remove a boiler from the contract list the W.O. will be informed and the contractor requested by the D.O. to discontinue the annual tests of the boiler.

22. At stations abroad arrangements are made by the W.O. for an annual inspection by an independent inspector when possible; when this cannot be arranged the machinery officer (or if there is no machinery officer in the command the military mechanist) will carry out these inspections in accordance with paras. 23 to 27).

23. New steam boilers both at home and abroad are inspected at the maker's works by the companies or associations mentioned in para. 21. On erection at the station, tests will be carried out by a machinery officer or by a military mechanist in accordance with para. 37.

24. Steam boilers working at a pressure less than 16 lbs. to the square inch are not insured at stations at home under para. 21, nor will it be necessary to include them among those for which an independent inspection is arranged at stations abroad under para. 22. Inspections of these boilers will be carried out annually, and on the occasions enumerated in para. 23 for higher pressure boilers, by a machinery officer or a military mechanist in accordance with para. 26. A.O. 230. 1914.

Boilers for heating and hot water services (when the rising main of the system is permanently open to the atmosphere) need not be insured at home, nor do they require independent inspection abroad; such boilers (except boot boilers) will be hydraulically tested to the pressures given in para. 26 by a machinery officer or military mechanist on first erection or after extensive repairs, and subsequently once every three years. A.O. 356. 1911.

25. Coil boilers for high-pressure heating installations will be tested annually to a hydraulic pressure of 1,500 lbs. per sq. in.

26. When testing boilers a thorough visual inspection will first be made in order to ascertain that the seatings and flues are in

proper repair, that the gauge glasses are fixed at the proper height, and that the steam pipes, fittings, pressure gauges, safety valves and fusible plug (which must be removed) are in working order. It will generally be advisable to remove a portion of the lagging annually to enable the exterior of the boiler to be examined.

The boiler will then be filled with water and hydraulic pressure applied. After it has been ascertained that the safety valves lift at the proper pressure, they will be fastened down and the pressure gradually increased to the amounts in the following table :—

Working Pressure. lbs. per sq. in.			Hydraulic Test Pressure. lbs. per sq. in.
Not exceeding 35			Double the working pressure.*
Exceeding 35	but not exceeding	42	72
,, 42	,,	50	84
,, 50	,,	60	96
,, 60	,,	70	108
,, 70	,,	80	120
,, 80	,,	90	132
,, 90	,,	100	144
,, 100	,,	120	168
,, 120	,,	130	180
,, 130	,,	140	192
,, 140	,,	150	204
,, 150	,,	160	216
,, 160	,,	170	228
,, 170	,,	180	240

For boilers working at a higher pressure than 180 lbs. to the sq. in., special instructions as to testing will be issued from the W.O.

While the pressure is being raised care will be taken to ascertain that the pressure registered on the pressure gauges on the boiler corresponds with that on the standard gauge.

The hydraulic test pressure will be only maintained long enough to enable a thorough inspection of the boiler to be carried out to ensure its tightness under pressure; special attention is to be directed to the tube plates and fire-box. Should the boiler fail in any way under the test pressure or become permanently deformed its working pressure must be suitably reduced.

During the steam test the safety valves should lift at the proper pressure, or should be set to do so. The boiler should be generally examined to see that all joints, stays, etc., are steam-tight.

The boiler will then be emptied and a careful internal examination carried out. On the conclusion of the tests, the date of test, and, if differing from the previous pressure, the working pressure

*Welded boilers will be tested to a minimum pressure of 40 lbs. per sq. in.

for which the boiler is certified will be stamped in a conspicuous position on the front of the boiler.

27. A hydraulic pressure exceeding 40 lbs. per sq. in. will not be applied to any boiler except in the presence of a machinery officer or the inspector of an insuring company or association (*see* para. 21). In the absence of a machinery officer the mechanist may act for him.

27A. The compressed air reservoirs used in connection with Diesel engines are to be tested hydraulically every six months to a pressure of 2,000 lbs. per sq. in. The use of compressed oxygen for charging such reservoirs is forbidden; compressed air or compressed carbonic acid may be used with safety for this purpose. A.O. 326. 1912.

28.*Steam and internal combustion engines when under inspection will be subjected to a test run of not less than three hours' duration against a brake. During the run data will be obtained of the I.H.P. and B.H.P. developed, and of the fuel consumption in lbs. per B.H.P. hour; in the case of compressors or pumps the delivery per lb. of fuel consumed will be noted. By comparing the fuel consumption values so obtained with the normal fuel consumption when at work, as recorded in A.B. 347 (*see* paras. 5 and 36), it will be possible to ensure that the engines are economically worked.

Once a year, preferably at the conclusion of the above test run, the cylinders or barrels of all engines, pumps and compressors will be opened up, their bore examined, and the pistons, valves, etc., carefully examined for signs of wear.

29. Cranes, ammunition† and other lifts, travellers, crabs and davits, will be tested with a weight 10 per cent. in excess of their maximum working load. Special attention is to be directed to the effectiveness of the brakes, which will be tested by allowing the load to descend and suddenly checking it; the safety gear must be similarly tested; both these tests must be carried out at a height not more than 6 ft. from the bottom of the travel of the lift, etc. The stability of travelling cranes will similarly be tested by allowing the load to descend for about 5 ft. and checking it about 1 ft. from the ground. Traversing, derricking, etc., will be tested with the test load, to which the whole length of the lifting chain or rope is to be subjected.

The chains and wire ropes of cranes, etc., will be removed once every two years and tested to 50 per cent. above the working load. Chains will be annealed as directed in para. 9.

30. A visual inspection when at work will generally suffice for machine tools and miscellaneous machinery; steps are to be taken

---

* The I.H.P. of high speed internal combustion enclosed type engines need not be ascertained. A.O. 128. 1912.

† The Engineers are not responsible for the periodical tests of ammunition lifts handed over to the R.A.

to ensure that lathes, drills, planing machines, etc., are running true; in the case of "producing" machines, such as stone crushers, their output should be obtained and checked with previous records to ensure that they are not deteriorating from year to year.

A.O. 315. 1913. Weighbridges, weighing machines, scales, weights and measures will be tested by standards and any defects adjusted. The standard weights will be obtained from the A.O.D. for this purpose when available, otherwise the services and appliances of the local Inspector of Weights and Measures will be utilized and the cost charged to the Vote for works.

Electric generators and motors should be run at full load for a period depending upon the nature of their work (whether continuous or intermittent), and the rise in temperature of their various parts noted. They should run without sparking.

31. Hydraulically worked machinery will be tested hydraulically to a pressure 25 per cent. in excess of its working pressure. Machinery, other than boilers, exposed to the pressure of steam or compressed air will be tested according to the scale laid down for boilers in para. 24, but these tests will only be carried out when there is reason to suspect risk of failure or after such repairs as the patching of a cylinder, etc.

32. Machinery laid off or in store will be inspected at least once a year to ensure that it is not deteriorating and that the instructions laid down in paras. 14 and 15 are being complied with.

33. Reports on annual inspections of machinery are only to be submitted to the W.O. when they disclose defects necessitating immediate and extensive repairs for which no funds are available locally. (*See* para. 37.)

3.—Reports and Records.

34. Records of all machinery for the maintenance of which the Engineers are responsible are kept at the W.O. in order to facilitate the supply of spare parts and repairs when these cannot be carried out by the station.

This machinery is classified as follows:—

(By W.O. Nos.) Boilers, except as stated below:—

A. Steam engines and steam pumps; but when this class of machinery is an integral part of a steam boiler (as in the case of portable engines, fire engine or boiler feed pumps, etc.), no number other than the W.O. number of the boiler will be allotted.

B. Internal combustion engines (except as under P below).

C. Cranes, fixed or travelling; when cranes are permanently connected with a steam boiler or engine no number other than the W.O. number of the boiler will be allotted.

D. Crabs.
E. Lifting travellers.
F. Pumps and compressors (except as under A above).
G. Lifts.
K. Machine tools.
L. Miscellaneous machinery (*e.g.*, stone crushers, weigh-bridges, electric generators and motors).
N. Railway and R.E. mechanical transport wagons.
P. Engines of portable searchlight plants whether horse or mechanically drawn.

W.O. numbers are not allotted to the following classes of machinery :—

(*a*) Boilers which, under para. 24, do not require insurance or inspection by an outside association or company.
(*b*) Drawbridges.
(*c*) Shell and cartridge lifts.

35. Every D.O. will keep a list of boilers, engines and machinery in his division in A.Bs. 335-6-7. These lists will contain a full description (as specified in A.Fs. G 926, G 927 or G 928) of every machine in the division for whose maintenance the Engineers are responsible ; the date and result of every inspection will also be entered.

Station numbers are to be allotted locally to boilers to which W.O. numbers are not allotted. The records of such boilers are to be kept distinct from those of other boilers.

36. A record of fuel and engine time will be compiled monthly by the D.O. in A.B. 347 for each engine at work from the returns sent in by the engine drivers. These records will enable any abnormal fuel consumption to be discovered.

37. Reports on machinery accompanied by the remarks of the inspecting officer will be forwarded to the W.O. :—

(*a*) On first erection (*see* para. 18). The report, which will be made on A.F. G 927 or G 928, will include a full description of the machine together with details of the tests carried out. In the case of machinery purchased locally one of the drawings received from the makers (*see* para. 38) will be forwarded with the report. If the machine has not been allotted a W.O. number, one should be applied for. A.O. 269. 1914.
(*b*) After extensive repairs (*see* para. 18). The report will include details of the tests carried out and in addition a description of the repairs effected.
(*c*) When extensive and unforeseen defects are discovered which require immediate attention and for which no funds are available locally. The report will include a full descrip-

tion of the defects and repairs required together with an estimate of their cost.

(*d*) On change of site at the station or permanent removal to store. The report will state the action taken; it is unnecessary to report the temporary return of semi-portable machinery, stone-crushers, etc., to store.

(*e*) On transfer to a new station. The C.R.E. from whose district the machine is transferred will report its departure, and the C.R.E. to whose district it is transferred will forward details of the tests carried out after the machine has been re-erected.

When machinery is transferred to a new station its full description, together with the station drawing and a record of any extensive repairs that have been carried out upon it, will be forwarded with it; the date and result of its last inspection will also be stated.

(*f*) When recommending machinery for disposal as unserviceable or as no longer required at the station (*see also* para. 16).

The report will include:—

(i) Description of the machinery and of its defects, or reasons for disposal.

(ii) Estimate of the present value of the machinery.

(iii) When it is proposed to dispose of the machinery by local tender, an estimate of the price obtainable.

In the case of the boilers referred to in para. 24 no reports need be forwarded to the W.O. except when such a boiler is supplied through the W.O., when a "first erection" report is required.

In reporting on machinery W.O. numbers will be quoted, and where possible the maker's name and number. This is especially important when forwarding demands for spare parts.

38. When new machinery is purchased through the W.O. two sets of drawings are obtained, one of which is forwarded to the station; similarly when machinery is purchased by stations direct two sets of drawings are to be obtained from the makers, one being retained at the station and one forwarded to the W.O. with the report on first inspection (*see* para. 37).

SECTION II.—DESIGNS AND PLANS.

1.—General.

1. Standard plans are issued from the W.O. periodically for guidance and assistance in preparing designs, but local conditions will often necessitate alterations in them.

2. The following points are to be borne in mind in the preparation of designs and plans :—

(*a*) The scale adopted is not to be larger than is required to show the necessary detail clearly. It is to be drawn and named on the drawing. If drawn to a foreign measure, a relative scale in English measure is also to be given.

(*b*) The title and writing or printing are to be clear and distinct, but not elaborated.

(*c*) Drawings are to be fully dimensioned.

(*d*) The draughtsman, the D.O., and the officer responsible for the design, are to sign the drawing, giving the date of their signatures. (*See also* R.E.S., Part 1, paras. 47, 291 and 310.)

(*e*) The true north (and also all section lines—*see* para. 4) is to be shown on all *plans*.

(*f*) Registered drawings and plans (*see* para. 7) are to bear their register number, as an identifying number, in the right hand top corner.

All drawings and plans are to bear the register number of the file to which they refer.

When several drawings or plans are prepared relating to the same scheme or service, each one is to be numbered as one of a series, and is to show the total number of drawings included in the "set" (*e.g., III of set of five*).

(*g*) Ordnance maps, Admiralty charts, hand sketches, or photographs, are to be utilized in lieu of drawings whenever possible (*see also* para. 5).

Photographs are specially suitable to illustrate progress reports (A.F. K 1301).

3. The following "conventional colours" are to be used when coloured drawings are required (*see* para. 19) :—

(*a*) *Indian Ink* :—

Existing work on working drawings.
Lettering generally.
Lines generally (clearly and boldly drawn).
Private property and public buildings not belonging to the Government ; the latter a darker tint.
Shading to slopes of roofs, earthworks, etc.
Indiarubber.

(*b*) *Chrome Yellow* (gamboge should not be used) :—
Brass and gunmetal.

A.O. 203. 1914.

(*c*) *Raw Sienna* :—
Deal floors.
Fir, unwrought.
Buff brickwork in elevation.

(*d*) *Burnt Sienna* :—
Fir, wrought, except in floors.
Roads and gravelled surfaces.
Terrepleins, banquettes and dry ditches.
Foul water drains, giving the direction of the flow by arrows, also sizes, depths of inverts, and fall of pipes or drains, and position of manholes, traps, ventilators etc.

(*e*) *Crimson Lake or Vermillion* :—
Brickwork, in plan and section.
Contour lines and levels of artificial slopes and surfaces, also figures showing their relation to the datum plane.
Gas pipes, showing valves; stopcocks, syphons and burners.
Section lines and letters of reference, on record plans.
W.D. boundary, *inside* the fences or other extreme limits.
W.D. buildings in block.
Centre lines of machinery.
Numbers showing lettings.

(*f*) *Venetian Red* :—
Copper.
Red brickwork in elevation.
Tiled floors, roofs, etc.

(*g*) *Brown Madder* :—
Mahogany.
Rock, giving the character of the stratification, when known.
Freestone masonry in dressings, etc.
Belting on machinery.

(*h*) *Sepia* :—
Asphalt, a light tint.
Earth in section.
Oak.

(*j*) *Neutral Tint* :—
Cast iron.
Cement concrete, speckled.

Slate in roofing, etc.
Stone walling (lighter in elevation).
Plaster.

(*k*) *Indigo* :—

Lead, zinc.
Glass seen from without.
Government (other than W.D.) buildings and boundaries.
Hard stone dressings, stone floors, stairs and steps.
Encroachments.

(*l*) *Cyanine Blue* :—

Water. High water line being distinguished by a narrow edging of blue below it, and low water line by a lighter edging softened off towards the water.
Water pipes, giving direction of flow by arrows, sizes of pipes, positions of hydrants, etc. Soft-water pipes to be distinguished by dotted lines.
Wrought iron.

(*m*) *Cobalt* :—

Glass seen from within.
Natural contours and levels.

(*n*) *Green* (Hooker's green should not be used) :—

Grass.
Proposed alterations and additions on an existing plan, except in working drawings when existing work to remain will be coloured in Indian ink, and new work in the proper conventional colours. A.O. 230. 1914.
Storm-water drains when a separate system exists.

(*o*) *Purple* :—

Steel.

4. Section Lines (which are to be repeated on every plan of the set, including foundation and roof plans) are not to be broken more than is necessary to give the required information.

5. A site plan is to be attached to large scale drawings of buildings, or of small portions of land, in order to show their locality. A portion of an ordnance map, chart, or hand sketch, pasted on the corner of the drawing, will usually suffice.

6. Large drawings are not to be folded. For transmission by post they are to be rolled, with such information as will enable the recipient to identify them, on wooden or pasteboard tubes, the ends of which should project beyond the drawings.

7. A register (A.B. 145) is to be kept in every drawing office of all working drawings and record plans on charge, as well as of any sketch designs which may be of permanent value (*see* R.E.S., Part 1, para. 113). All issues and returns of such drawings and plans are to be noted.

8. Drawings and plans of temporary value are to be guarded separately from the registered plans, a list being enclosed with them.

2.—Sketch Designs, and Plans to elucidate Reports, Re-appropriation Proposals, etc.

10. Sketch designs (including those submitted with A.F. M 1426, as directed in R.E.S., Part 1, para. 290), and plans to elucidate reports and re-appropriation proposals, etc., may be drawn in pencil on paper.

11. Plans showing proposed or approved sites (*see* K.R.) are to be drawn in ink on tracing cloth (but *see* para. 2 (*g*)).

12. The area of site plans or charts is to be sufficient to show the whole of the surroundings which influence the selection.

The recommendations of the C.R.A. and C.R.E. will be transmitted with all site plans for works of defence. Such plans are to be confidential.

13. Sketch designs for the construction or revision of works of defence, all of which are confidential, will include :—

(*a*) A contoured plan (scale about 30 ft. to 1 in.) showing the position of the proposed work, the arc of fire or view for each emplacement, P.F. cell, etc., all W.D. boundaries, and existing or proposed paths.

(*b*) The arrangements of the emplacements, stores, magazines, and accessory buildings, with details as to water supply, illuminants and drainage.

(*c*) The dead water area, to be shown in colour on an Admiralty chart.

(*d*) The approximate cost of the service.

(*e*) Any other details which may assist the preparation of working drawings (*see* para. 20).

All such designs are to be referred to the W.O. (*See* R.E.S., Part 1, para. 380.)

14. Sketch designs for other services are to show such of the following as are appropriate :—

(*a*) A plan of each floor on which only those fittings are to be indicated as affect the drainage or the size and proportions of the rooms (*e.g.*, beds).

(*b*) The position of the doors (showing on which jamb they are hung), windows and fire places.

(*c*) A roof plan, indicating the position of the trusses.

(*d*) One or more skeleton elevations.

(*e*) One or more sections.

(*f*) The approximate cost of the service.

(*g*) The number of men, horses, etc., for which accommodation is provided.

The approving authority for such designs is given in R.E.S., Part 1, Table H (*see also* para. 291).

15. Instructions as regards the sketch plans required to illustrate, proposals for new rifle ranges are given in Musketry Regulations, Part II.

3.—Working Drawings.

16. Working drawings are usually prepared locally; but when a new type of design or construction is to be adopted, or when the work of local draughtsmen is in arrears, they may be prepared at the W.O. As regards works of defence, *see* para. 20.

As regards machinery *see* R.E.S., Part 1, para. 346, and Section I of this book.

17. In order to avoid delays in the execution of services, it is necessary that the working drawings should be commenced as soon as the execution of the work is sanctioned, the sketch design approved, and the site selected (*see* K.R.). The instructions given in R.E.S., Part 1, para. 290, aim at the completion of the working drawings before the commencement of the financial year during which the execution of the service is approved.

18. It is not necessary to submit working drawings to the higher authority which may have approved the sketch designs (*see* paras. 13 and 14), unless instructions to this effect are given when the sketch design is approved, in which case the latter is to be returned with them. It will usually be necessary to submit the working drawings of large drainage installations to the W.O.

19. After being drawn in pencil, and passed by the officer responsible, working drawings are to be traced for reproduction by sun-printing.

As dimensions cannot be accurately measured off a sun-print owing to the distortion which may take place during reproduction, the tracing is to be very fully dimensioned.

The number of copies of sun-prints required varies with the proposed method of execution of the service. (*See* R.E.S., Part 1, paras. 337 and 345 (c).) It will usually suffice to colour three copies, one for the contractors, one for the superintending officer, and one as record plan (*see* para. 30).

20. Working drawings for large services affecting works of defence, all of which are confidential, are to include:—

(*a*) A general plan of the work, with sections.

(*b*) A "Top" and "Under" plan (scale about 30 ft. to 1 in.), with elevations and sections as required.

(*c*) A block plan giving the following information:—The number of men for whom shelters are to be provided, existing and proposed roads and paths, the boundaries of W.D. land, existing and proposed illuminant and water mains, surface and four drainage systems.

(*d*) Details, including foundations, ironwork, etc., as required.
(*e*) Heating, lighting, water supply, and drainage arrangements.

(*a*) and (*b*) are prepared at the W.O.
(*c*), (*d*) and (*e*) are to be prepared locally.

21. The information given on working drawings for other services is to include (in addition to that specified in para. 14), such of the following as is appropriate :—

(*a*) The floor space and cubic space per head.
(*b*) The net glass area per 100 cub. ft. of room space.
(*c*) Existing and proposed roads, paths, and boundary walls.
(*d*) The adjoining buildings.
(*e*) Existing and proposed illuminant and water mains, surface and foul drainage systems.

22. The multiplication and elaboration of working drawings is forbidden (*see* para. 2 (b)) ; but at the same time it is necessary to provide all the information required, together with the Bills of Quantities (if any), and specification, to enable the Superintending Officer to supervise, and the contractor to execute, the work without dispute.

In the case of large services, a " set " (*see* para. 2 (*f*) will include :—

(*a*) A block plan (on which is to be inserted the information referred to in para. 21).
(*b*) Plans of the foundation, of each floor, and of the roof.
(*c*) Elevations of each face, and section as required.
(*d*) Details as required, including heating, lighting, water supply, and drainage arrangements.

In the case of small services, the sketch designs (slightly amplified if necessary) will usually suffice.

23. Fixtures to be obtained by means of the D.F.Ws. Special Contracts are to be indicated merely by a reference to the " W.O. Pattern Book " plate.

24. Although working drawings are not usually required to accompany specifications for new machinery, a block plan showing its position with reference to surrounding buildings, etc., is necessary. The direction of belts, and the speed of pulleys and shafting, are to be indicated.

4.—Record Plans.

General.

25. Record plans of all new W.D. buildings, etc., are to be prepared locally, in duplicate, during the execution of the service to which they refer. On its completion one copy of the plan is to be sent to the W.O., and the other retained by the C.R.E. (But *see* paras. 27 (*a*), 29, 30 and 33.)

The local copy of the record plans of all existing buildings, etc., is

to be revised annually, so as to include any alterations which may have been made to the property during the year, and will be transmitted to the W.O. on the 1st July. On its receipt the W.O. copy will be transmitted to the C.R.E. for amendment and use as the local copy until next year.

When correcting record plans erasures are not to be made.

The authority for the alterations or reappropriations is to be quoted on the plan.

If no alterations are necessary a communication to this effect is to be made specifying the plans to which it refers. The plans themselves are not to be sent.

26. The normal staff of draughtsmen allotted to commands should be sufficient to admit of the preparation of record plans for small services as well as for the annual revision of existing record plans. When the preparation of record plans for large new Part 1 Services has to be taken up, it may be necessary to apply for temporary assistance (*see* R.E.S., Part 1, para. 263). Such temporary assistants are not to be employed on the preparation of confidential plans.

It is important that the amendments to record plans are not allowed to fall into arrears.

Record Plans for Works of Defence.

27. All record plans affecting works of defence are confidential. For procedure as regards alterations to existing plans *see* para. 25. In the case of new works a "set" of record plans includes:—

(*a*) An Admiralty chart, showing the arc of fire of each gun, the arcs of traverse of the electric lights, the dead water area in each case, all datum posts and tide gauges, and the positions of any war signal stations in the vicinity.

This chart will be marked "Secret": no copy of it is to be made.

(*b*) A general plan of the work and surrounding country on a scale of 25-ins. to a mile, showing the extent of W.D. property, the features of the ground (by contours or spot levels), the positions of F.C. and B.C. posts, position finding cells, and depression range finder pedestals.

The altitude of the crest and of the other principal parts of the work is to be inserted and referred to the same datum plane as the other altitudes figured in the plan

A complete plan of the electric light engine rooms, etc., including details as in (*e*) below, is to be prepared on similar lines, and kept distinct from plans of other work.

(*c*) A block plan to a scale of 30 ft. to 1 in. on which the following information will be given:—The local nomenclature of the several parts of the works, the armament, the capacity and identification of the magazines and shell stores, the cubic contents of stores and tanks, the living

accommodation (peace and war) in casements, shelters, quarters, etc., the underground drains, the lightning conductors and their connections, the authority for commencing the work, the dates of commencement and completion, the estimated and actual cost, the nature of the soil, and the depth of permanent moisture. It will also be stated whether the drawings have been prepared from actual measurements.

(*d*) A general top plan (*see* para. 20 (*b*)) of the work, to a scale of 30 ft. to 1 in., with sections as required, having contours at 1 ft. vertical intervals, and the magazines, etc. shown in dotted lines.

(*e*) Detailed top and under plans, with sections, to a scale of 10 ft. to 1 in., of the portion occupied by the gun emplacements and magazines.

Similar plans of the E.L. emplacements, accumulator rooms, engine rooms, F.C. posts, P.F. cells, military war signal stations, etc. Any portions requiring greater detail will be drawn to a scale of 5 ft. to 1 in.

28. Details of machinery will not be shown in these plans; sufficient information is to be given to enable the various machines to be identified. The course and general dimensions of shafting, belts, and hydraulic and electric mains, are to be shown.

29. A record plan showing the whole of the defences of a harbour will be sent to stations concerned from the W.O.

Record Plans of Buildings not affecting Works of Defence.

30. The record plans required for buildings not affecting works of defence consist of a coloured "set" of working drawings (*see* para. 19), for each building and of a "Skeleton record plan" showing each building, barrack, or set of barracks, in the C.R.E's. District. The set of working drawings is for local use only; no copy is required at the W.O.

31. The skeleton record plan is to be prepared (to a scale approximately $\frac{1}{500}$), in ink on tracing cloth, based when possible on an ordnance survey sheet, and is to show:—

(*a*) The arrangement and appropriation of all rooms, doors, windows, fire places, stoves, stall divisions in stables, etc., on all the floors of the buildings.

(*b*) The materials of which the buildings are constructed and the thickness of the walls.

(*c*) The heights of all the rooms (figured in circles).

(*d*) On the *ground* floor plan, illuminant and water mains, surface and foul drainage systems (giving dimensions, depths, and falls of pipes), manholes, and levels of inverts. All roads, paths, pavements, surface channels and trees.

(*e*) A table showing the floor space and cubic space per head, the net glass area per 100 cub. ft. of room space, the number of men, horses, etc., for which accommodation is provided, the date of commencement and completion of the work, and the estimated and actual cost.

Means of defence and the names of buildings used as magazines are to be omitted. Roof plans, sections, and elevations, are not required. When a skeleton record plan is forwarded for the first time to the W.O. an estimate of the probable number of copies required for local use in 3 years will be sent with it.

32. Para. 25 gives the procedure required to keep record plans amended to date.

Rifle Ranges.

33. No record plans for Rifle Ranges are required at the W.O. other than the copy of the 6-in. map submitted with proposals to construct or alter the range (*see* Musketry Regulations, Part 2). A set of the working drawings is, however, to be retained locally and amended annually as is done for W.D. buildings.

Machinery.

34. A set of the working drawings of all machinery is to be kept locally, and at the W.O., as a record plan (*see* para. 25 and Sec. I, para. 38). The position of machinery generally is also shown on the skeleton record plan referred to in para. 31.

5.—Plans connected with Lands.

General.

35. Plans connected with lands are to be prepared on Ordnance Survey Sheets (thick paper) of the latest edition. Usually the $\frac{1}{2500}$ scale will be most suitable, but for extensive areas the 6-in. scale, and for small plots the $\frac{1}{500}$ scale, maps are to be used. If necessary, a small scale key plan is to be inset to show the locality of the plot.

Duplicates of all plans sent to the W.O. other than those illustrating draft legal documents are to be kept by the C.R.E.

Law Plans.

36. Complete and accurate draft plans are to be annexed to all draft deeds and other legal documents relating to lands. They must fully illustrate the text of the document. The plans to be retained with the deeds will be prepared at the W.O. from the draft plans in the case of English and Irish purchases, or sales and hirings on lease. In other cases they will be prepared locally.

37. Draft deed plans are to show :—

(*a*) The exact limits of the property dealt with (shown by colour wash or verge).
(*b*) The nature and when possible the ownership of external boundary walls.
(*c*) The names of the adjoining owners.
(*d*) The adjacent W.D. boundary (if any).
(*e*) Any buildings on the property (to be distinguished by black hatching).

Record Plans of Lands.

38. Record plans of lands, clearance or other rights acquired by the W.D. for periods exceeding 21 years are to be forwarded to the W.O. for approval as soon after the acquisition as possible.

39. Each acquisition is to be indicated by a distinctive colour and the following particulars shown :—exact limits of the property ; boundary stones ; names of adjoining owners ; nature and ownership (usually indicated by a T) of external boundary walls or fences, A reference table giving name of vendor, date of deed, acreage, purchase money, nature of tenure, and reference to W.O. papers, is to be inserted.

40. In the case of clearance rights the plans are to show the positions, materials, height and character of all buildings, walls, fences, hedges, woods, etc., existing on the clearance area, and should be supplemented, if necessary, by photographs.

41. Record plans when first submitted are to be accompanied by a tracing (in outline only) showing proposals for siting, numbering and inscribing the necessary boundary stones, and an estimate of their cost. After approval, and the execution of the service, the positions of, and marking on, the stones as actually fixed will be added to the record plan.

After a copy has been made for local use it will then be returned to the W.O.

42. When lands are relinquished the deed plan, if accurate, should usually suffice for record purposes ; record plans will not be prepared unless the W.D. continues to own land immediately adjoining that sold, and only then if special circumstances (*e.g.*, inaccuracy or small scale of deed plan) renders the preparation of a record plan desirable.

43. Proposed alterations to printed plans of W.D. lands will be submitted to the W.O. for verification and approval.

Property Statement Plans.

44. The plans or maps required to illustrate the Terrier are to measure $3' \times 2'$ or be arranged to fold to that size. The W.O. and C.R.E. respectively will prepare such copies of plans as are necessary to keep the statement revised to date.

45. Each acquisition is to be distinguished by a colour wash, and a letter or number; a corresponding letter or number being used in Column 1 of the statement opposite the entry recording the acquisition.

46. If the area acquired falls on an existing property statement plan it is usually preferable to insert the new acquisition rather than to prepare a separate plan. In some cases (*e.g.*, purchases at foreign stations where no Ordnance Survey maps exist) it may be desirable to use the *record plan* of the acquisition to illustrate the property statement.

Perambulation Plans.

47. Perambulation plans will be retained at the station; no copy will be forwarded to the W.O. They will show the extent of the W.D. property (by a colour wash or verge); the position of all W.D. boundary stones; the nature and ownership of boundary walls and fences.

They are to be mounted on linen.

Public roads and public rights of way over W.D. property are to be clearly distinguished by colour.

Roads or paths, which are used by the public by permission of the W.D. and not as of right, are also to be shown by a distinct colour; the points at which they are closed at the annual perambulation being marked by a red cross in a circle, and a list of these points given in writing on the plan.

Letting Plans.

48. Plans to illustrate the register of lettings will be prepared, the various lettings being distinguished by separate colours and the W.D. boundaries by a red verge. Letting numbers are to be shown in red, and encroachments and their numbers in blue.

SECTION III.—PROTECTION FROM LIGHTNING.

(*Referred to in R.E.S., Part* 1, *para.* 128.)

1.—General Principles.

1. A thunder-cloud is a mass of vapour charged with electricity at a pressure or potential differing considerably from that of the land or water beneath, or of the clouds near it. The origin of this charge has been variously ascribed to evaporation, to friction of air currents, as well as to all the changes in the physical condition of the earth's surface which are incessantly occurring.

2. A thunder-cloud acts by induction on the land or water beneath, or on clouds near it, and tends to draw a charge of electricity of opposite kind to that part of their surface nearest to itself. The land, water, or neighbouring cloud react upon the thunder-cloud in a similar manner, thereby forming a huge electrical condenser.

3. When the difference of electrical pressure between the oppositely electrified cloud and earth, or cloud and cloud, is sufficiently great, an electric discharge of a disruptive nature with consequent disengagement of heat takes place across the air space which separates them. Clouds are imperfect conductors and therefore do not part with all their charge at once. Hence a single discharge does not necessarily deprive a cloud of the whole of its charge; there may be several successive discharges. Damage to buildings, etc., may arise from either the disruptive violence or the heating effect of a discharge.

4. The ease with which a lightning discharge can pass by any path depends not merely on the electrical conductivity of the materials composing that path, but also in a highly complicated manner on other considerations, such as the exact shape of the path, etc.

Impedance is the name given to that which tends to hinder the passage of a discharge.

Good conductors, *cæteris paribus*, offer less impedance than inferior conductors; and good conductors led as straight as possible will afford a path of the least possible impedance between two points.

5. A lightning discharge does not always follow a single path; it frequently divides between several. The extent to which it passes by any path depends upon the impedance of that path, being greatest where the impedance is least.

6. When a discharge finds several paths open to it, the impedance of some of which is practically infinitely great compared with that of the remainder, the whole of the discharge will pass by the paths whose impedance is small.

Thus in its passage to earth a discharge passing by a path composed of good conductors will not leave this path for one composed of very inferior conductors, unless from some cause, such as by being bent abruptly into a loop, the good conductors are made to offer a relatively high impedance. Where a good conductor is bent abruptly into a loop a considerable part of a discharge passing along the conductor may bridge the air space between the nearest portions of the conductor, a disruptive discharge taking place at the bend. The straighter the run, the better is the conductor.

7. When a disruptive discharge takes place with very great rapidity, very complicated secondary actions follow, which often leads to secondary discharges of a disruptive nature. Hence arises great practical difficulty in ensuring *complete* protection; for attempts to avoid these secondary discharges by increasing the impedance of the path of the primary discharge, with a view to reducing the rate of the primary discharge, are liable to result in damage from the primary discharge.

8. The rules hitherto followed for W.D. buildings, which are reproduced with but trifling alterations in the succeeding paragraphs, have proved reasonably satisfactory. They were designed mainly to guard against injury from primary discharges, but embody clauses intended to reduce the risk of damage from disruptive secondary discharges.

9. The surface of the earth is formed of fairly good conducting media, but there are some portions, such as sandy deserts and chalk downs, which, after long drought, form non-conducting areas. Lightning is least to be feared in such situations, the induced charge not being so easily drawn to the surface.

Objects which project above the general level, inasmuch as they generally offer far less impedance than the alternative path through air, are, *cæteris paribus*, most liable to be struck.

In connection with this question of liability to be struck, it should be borne in mind that, while dry, cool air is practically a non-conductor of electricity, moist or hot air has a certain amount of conductivity. Rain or hail, and columns of rising smoke or steam, sometimes determine the direction of the discharge. Metals are the best conductors of electricity, and hence, *cæteris paribus*, will offer the smallest impedance.

10. A lightning-rod is a pointed conductor in intimate connection with the earth, fixed on a salient feature of a structure with the object of protecting it from the destructive action of lightning. It fulfils two functions:—

1st. A lightning-rod tends to *prevent* a disruptive discharge occurring by silently* neutralizing the conditions which determine the formation of an induced charge in its neighbourhood.

2nd. It *protects* the structure to which it is attached by offering a path of relatively low impedance by which the discharge may be carried off harmlessly to earth.

It will be seen from the description that follows that these actions are largely dependent on time being allowed for them to take effect. In the case of very sudden disruptive discharges the chance of damage is consequently much greater.

11. The *preventive* action of a lightning-rod arises from the action of its pointed end. A thunder-cloud gradually approaching the vicinity of a structure draws inductively a charge of electricity to the surface of the earth in that neighbourhood. In the case of a structure provided with a lightning-rod, this charge will escape as fast as it is induced if the lightning-rod provides a sufficient number of sharp points all well connected with the earth. This tendency of points to dissipate a charge is due to the mutual repulsion of bodies charged with electricity of the same kind, and to the law of distribution of electricity on a surface that the density is greatest at points or on portions of the surface of greatest curvature. The particles of the atmosphere consequently can carry off a charge with some rapidity from sharp points. It is essential, therefore, to foster this gradual or brush discharge by providing a sufficient number of sharp points on lightning-rods in intimate connection with the earth by means of continuous metallic conductors, so as to collect or tap the induced charge, and facilitate its escape from the points.

Further, the flow of electricity from the points being directed towards the discharged cloud, some of the inducing charge may thereby become neutralized. Hence not only does a lightning-rod tend to prevent the accumulation of electricity on the surface of the earth within its sphere of action, but it also tends to restore the clouds to their normal state, both of which actions assist in preventing lightning discharges.

12. Should the brush discharge of electricity from the points of the lightning-rods be insufficient to prevent the gradual accumulation of a charge, and a disruptive lighting discharge take place, it would pass to the points, the previous action having prepared this path for it The discharge in this case would, in all probability, be greatly modified by the previous escape of electricity from the points, and being conveyed to the earth by the excellent path provided by the

* The word "silent" is the conventional term used to describe a continuous brush discharge which generally is not audible. The brush discharge when very rapid is accompanied by considerable noise, and is frequently visible at night.

lightning-rod, would leave no trace of its passage. This may be termed the *protective* function of a lightning-rod.

In the case of a disruptive discharge occurring very suddenly, so that the points have not had time to act, the protective action of the rod arises solely from its affording a path to the discharge alternative to the building it protects and of far lower impedance.

13. A lightning-rod in imperfect connection with the earth, due either to insufficient surface of conductor buried in the ground, or to defective joints, although it may save a building from actual damage by determining the path of the electric discharge to earth, is generally regarded as a source of danger, inasmuch as the sudden and disruptive discharge would be liable to fuse or scatter some portion of the conductor in its passage, and so leave the building unprotected from further strokes. Again, the resistance offered at the defective portions of the conductor may cause a portion of the discharge to seek another path disruptively through the building. A faulty lightning-conductor may thus prove worse than useless.

14. The upper end of a lightning-rod should be designed so as to combine, as far as possible, both its preventive and protective action (*see* para. 10). The requirements are somewhat antagonistic, because the sharper the point the greater the tendency towards brush discharge, but at the same time the more liable is it to be fused should a heavy disruptive discharge fall upon it. Attempts have been made to obtain an infusible point by the use of platinum tips, and silver or other alloys, but they enormously increase the cost, and have not proved reliable. The system which has been adopted is to separate the double function of a lightning-rod by prolonging the upper terminal, and bevelling it off to a blunt right-angled cone of the effective section of metal capable of safely carrying off any disruptive discharge, and with a view to facilitate as much as possible the brush discharge, to add three or four very sharp-tapered points projecting upwards from a ring fixed about a foot below the top of the lightning-rod.

15. As regards the earth connections, it is most important that the electrical resistance which they offer shall be very much less than that offered by any alternative route in the line of probable discharge, such as the rain water or gas pipes outside a building. The earth connection should be the best which the nature of the soil will admit of, and all available means which will assist in tapping a large extent of moist earth in the immediate vicinity of the building should be utilized; *e.g.*, rain water pipes may be made to discharge over the buried earth.

This is the sole and sufficient answer to the question often asked as to how much resistance is permissible in a lightning-rod's earth connections.

16. Except where the permanent water level is very near the surface, both deep and shallow earth connections are required,

because after a long period of dry weather the induced charge may be collected on a damp substratum, while after rain it may be collected on the surface. The deep earths should be carried down to water-bearing strata or to permanently moist soil, and the shallow earths should be arranged so as to offer a considerable surface of connection with the soil around the building.

17. Earth connections should be buried throughout in small coke, or preferably charcoal, both of which are fairly good conductors of electricity, readily absorbing and retaining moisture. The contact services between the metal conductor and the soil in which it is laid are thereby much increased, and the tapping of any induced charge or the transmission of any discharge to earth facilitated.

18. The metals employed in lightning-rod construction are iron, plain or galvanized, and copper. Roughly speaking, they cost the same for equal conductivity, but conductors made of iron are stronger, less easily fused, and less liable to be stolen. Copper conductors on the other hand have the advantage of being far more durable; and, being smaller and lighter, they interfere less with architectural features, and are much cheaper and easier to erect. Copper tape of high conductivity, which is now manufactured in long lengths, thereby obviating the necessity of numerous joints, has been adopted for all conductors on W.D. buildings.

19. Considerations of strength, durability, and surface for making good connections regulate the size of conductors rather than the electrical resistance per foot run, for these considerations dictate a size of conductor larger than that required for lightning-rods calculated from recorded instances of metal bars and rods that have been fused. The Lightning-Rod Conference of 1881 recommended the following as the *minimum* sizes of conductors to be employed :—

Material.	Section.	Area, sq. in.	Weight per ft.
Copper tape	$\frac{3}{4}'' \times \frac{1}{2}''$	0·09	5·76 oz.
,, rope	$\frac{1}{2}''$ diameter	0·10	6·18 ,,
,, rod	$\frac{5}{8}''$,,	0·11	6·80 ,,
Iron rod	$\frac{9}{16}''$,,	0·25	13·25 ,,

It will be seen in the rules that follow that it has been decided that the smallest size of copper tape to be used for the main conductors on W.D. structures is $1'' \times \frac{1}{8}''$. For other constructional stores required *see* the W.D. pattern book.

20. It has been asserted that a lightning-rod will protect a space included in a cone having the point for its apex, and a base whose radius equals the height from the ground. This statement is not now generally accepted as true. Buildings protected on this principle would require very lofty lightning-rods. It is considered

that a number of smaller rods, well connected together by conductors, carried along the salient features of a building, provide a more reliable protection than an equal amount of metal in higher rods spaced at greater intervals, and this is the system which has been adopted for the protection of all W.D. structures.

2.—Rules.

I. Lightning conductors are usually provided only for main magazines and buildings, the explosion of the contents of which might involve serious danger to life or property, and for the cases mentioned in Rules IV and V.

II. Should such a magazine or building be underground, although less exposed to lightning than overground buildings, it should nevertheless be provided with conductors. Explosives are now so frequently kept in metal cases that a path of less impedance than through the surrounding earth might be offered to the lightning through the body of the magazine or building.

III. Cartridge and shell stores and expense magazines need not be fitted with lightning-conductors, except in cases where they occupy very exposed sites, or have much metal connected with them.

IV. Barrack buildings are only to be provided with lightning-rods when experience has shown that the locality is very liable to lightning. In such cases the probability of their being authorized would be greater when any considerable mass of metal entered into their construction.

V. It is advisable to fix a lightning-rod on any flagstaff that may be near a magazine, and also on all high chimney shafts.

VI. Whenever lightning conductors are to be erected or reconstructed on any W.D. magazine or building the G.O. i/c Adm. is to forward to the W.O. a report, accompanied by descriptive drawings, in order that the detail and general arrangements may be approved, before any steps are taken to carry out the work. In cases where a doubt may exist as to the necessity of erecting or retaining lightning-rods, *see* Rules III and IV, a report is to be made specifying any peculiarities of the site; its height as compared with the neighbouring ground; liability of locality to thunder storms; nature of soil and substrata, and depth of permanent water level; full particulars of the building, and of all masses of metal entering into its construction or placed near it.

VII. The angles and prominent features of a building being the most liable to be struck, lightning-rods should be fixed on gable ends, chimneys, turrets, etc., and they should be connected together by continuous conductors along the ridges; if more than one vertical conductor is used, all of them should also be connected by a horizontal ring conductor at or near the ground line.

VIII. Lightning-rods should be about 4 ft. high and spaced at

intervals not exceeding 50 ft., so that no point on the building is more than 25 ft. horizontally distant from a lightning rod.

IX. The material to be exclusively employed for the construction of new lightning-conductors is copper tape. It is manufactured in lengths of 300 ft. and upwards. A conductivity of at least 95 per cent. of that of pure copper should be specified, and the tape should be soft and flexible, so as to admit of its following closely the outlines of a building. Copper tape $1'' \times \frac{1}{8}''$, weighing about $\frac{1}{2}$ lb. per foot, is the most suitable size for all ordinary conductors. $1\frac{1}{2}'' \times \frac{3}{16}''$ may be used for very high chimney shafts; but it is preferable in such cases to lead copper tape $1'' \times \frac{1}{8}''$ up one side, over the top, and down the other side, connecting the tape round the base as in Rule XI.

X. In situations where copper tape is liable to be stolen, it may be let into the walls of the building and cemented over or otherwise concealed where it is accessible. The practice of protecting the lower portion of copper conductors on buildings by enclosing them in iron pipes at the base of the building is of doubtful utility.

XI. In order to guard against those accidental defects and disarrangements to which conductors are liable, structures provided with lightning-conductors should have, as a rule, at least two earth connections, the conductors leading to them being connected at the base of the structure, above the ground line. Where deep earth connection is a necessity, two deep earths, independent of one another, should be provided, in addition to* at least two shallow earths, independent of one another. *Each lightning-rod is to be connected direct to earth by the shortest path outside the structure;* it is well to carry the conductor down the face of the structure which is most exposed to prevailing wet. In the case of gabled buildings, the conductors should be taken down the barge-courses in preference to the gable, so as to protect the angle of the building and at the same time secure the advantage of the additional moisture in the ground near the rain-water down-pipes, and facilitate their connection thereto.

XII. When the level of water or permanently wet soil lies within a few feet of the surface, the conductors should terminate in earths offering each about 18 sq. ft. of external surface. These may consist of copper plates about $3' \times 3' \times \frac{1}{16}''$, riveted to the ends of the conductors, and buried in water or wet soil from 15 to 52 ft. from the structure. A better plan, however, is, at this distance from the structure, to coil the end of the conductor spirally on a wooden frame, the external diameter of the coil being 4 ft., with 6-in. intervals between the turns, the inner (or free) end being led above

* Sometimes the deep earths are necessarily so led that they form shallow earths also, but unless this is the case separate shallow earths must be provided. A deep earth must never be diverted from its most direct path merely with a view to making it serve as a shallow earth also

ground again, and clamped to the conductor running round the base of the structure. About 33 ft. of tape are required for this earth connection, in addition to a length equal to twice the distance from the conductor running round the base of the structure to the coil when buried. This obviates the necessity of any underground joint, taps a larger surface of earth, and, the tape being twice the thickness of the plate, it is more durable, besides being a cheaper arrangement.

XIII. When the permanent water level is deep, it may be necessary to sink special wells for the earth plates, which should be the same size as those specified in the previous paragraph. The wells should be carried down several feet below the water level in the driest seasons, and the lower portions of the wells should be built without mortar.

If coils of copper tape are employed for earths, special wells are not necessary, because, there being no joints underground, the same necessity for periodical examination no longer exists. In this case the earth coils may be buried at the bottom of a pit sunk below the level of permanently wet soil, the inner (or free) end being led above ground again, and clamped to the conductor running round the base of the structure.

Where the depth is considerable, two or more conductors may be connected to the same earth-plate or coil of tape. In such cases the size of earths should be made proportionately larger.

XIV. When the permanent water level is deep, in addition to these deep earths, it is necessary to provide shallow "earths," laid in trenches, led away from the structure, from 1 ft. deep in clay soils to 2 ft. deep in sand or shingle, through which the rain percolates more freely.

These shallow earths need not be connected to the conductor running round the base of the structure. The length of each shallow earth-trench may be from 25 ft. in ordinary soil to 50 ft. in dry soil, and the width at bottom should be about 9 in. A few inches of powdered coke should be spread both above and below the conductor, and the trench filled in with light soil. The rain-water down-pipes from the roofs may with advantage be led into these trenches.

XV. In the case of forts and magazines near the sea, good earths can be obtained by laying a length of tape so that at least 5 sq. ft. of it shall always be under water, or a coil of tape may be buried in permanently wet sand.

When the distance to the sea is considerable, these earths should be supplemented by shallow earths round the building, so as to efficiently tap any induced charge in its vicinity.

XVI. Iron water mains form good earth connections. Soft metal pipes and gas mains should not be used, but when they run close to the conductors from a building, which is undesirable, they should be connected to the lightning-conductor system. There are many

recorded instances of both water and gas-pipes having sustained damage by lightning, owing to proximity to conductors, where damage might have been obviated had they been connected thereto (*see* General Principle 7).

XVII. In extremely dry or rocky situations it is often impossible to obtain good earth connections, except at a great distance. In such cases the best plan to adopt is to bury several hundredweight of old iron at the foot of the earth coil or plate in a mass of coke, leading the rain-water pipes so as to discharge into it.

XVIII. Coke, which is suitable for improving the earth connections of lightning-rods (*see* General Principle 17), is procurable as a waste product of gasworks. Clean smiths' ashes or charcoal may also be used. A layer of about 3 in. should be spread both below and above the conductors in the trenches, and also round the earth plates or coils.

XIX. The earth connections of flagstaffs near magazines should be led in a direction away from the building.

This rule is also applicable to shafts of powder mills, etc.

XX. The rain-water pipes and gutters should never be utilized as a portion of the system of lightning-conductors, to which, however, they should be connected.

All external masses of metal, such as copper sheeting on magazine doors and ventilators, and all metal on the roof, *e.g.*, flashing, etc., should also be connected to the nearest conductors by lengths of copper tape.

XXI. Lines of rail near buildings protected by lightning-rods should be connected to earth direct on both sides of the building; when the line is carried inside the building it should be connected also to the system of lightning-conductors. Iron railings round magazines should be connected direct to earth at intervals of about 50 ft.

XXII. All large and long masses of metal, such as beams, girders, pipes, hot-water systems, and large ventilators fixed in the interior of buildings, should be electrically connected with the earth as well as with the conductor.

Disused telegraph, telephone, etc., wires, entering a building, whether the building be provided with lightning-conductors or not, should either be removed, or earthed where they enter.

XXIII. Lightning conductors should not be insulated from the buildings to which they are attached. The copper tape should be laid on the ridges and walls, and secured by suitable fastenings screwed or nailed to the building. The holdfasts should be of gun-metal, fixed by nails of hard copper, and they should allow free expansion or contraction, at the same time preventing all the weight falling on any one bearing.

XXIV. Powder mills, etc., with zinc or galvanized roofs should be protected by copper conductors laid over them, but protected from actual contact by strips of wood, paint or tarred felt. The

zinc roof itself should be treated like any other external mass of metal, and should be thoroughly well connected to the conductors in several places. The system sometimes adopted of having sheet zinc lightning-rods and copper tape from the eaves of the roof to earth is very unreliable, because the lightning-rods are of inaffective section, the zinc sheets are insulated from one another by a layer of oxide, and the joint between the zinc and copper is liable to failure.

XXV. Chimney shafts should be protected by a ring of copper tape $1\frac{1}{2}'' \times \frac{3}{16}''$ placed round the outside of the top of the cap and a few inches below it, having stout copper points projecting 1 ft. above the top of the shaft at intervals of 3 or 4 ft. all round. A copper tape should be carried diametrically across the top of the chimney and down on opposite sides of the shaft to earth from the ring, and these conductors should be connected at the base, a test clamp being added to enable the continuity of the conductors and the state of the earth connections to be ascertained when necessary.

XXVI. An inspection pit with flush cover should be provided in cases of underground joints. Metallic continuity should be ensured at the joints of all conductors. Solder alone should never be relied upon where closely-fitting riveted or screwed joints can also be used. The solder is seldom properly sweated through the joint, and often consists of an imperfectly adhering mass of metal hiding up badly-fitting and dirty surfaces. Solder tends to set up galvanic action, which after a time will destroy the connection. In the case of copper conductors its use is objectionable, because it interposes an alloy of high resistance and low melting point in the joint, which would necessitate excessive joint surface for safety. Soldering conductors in the vicinity of magazines and powder factories is attended with so many restrictions and precautions, that it is unsuited for W.D. requirements. For these reasons it is considered better to ensure a perfect metallic contact between copper tapes by drawing the surfaces together by close riveting or by screw clamps and to exclude damp from the joint by paint or other means.

In riveting copper tapes five rivets should be used and the holes should be bored, not punched. The "arris" being removed, and the surfaces brightened with emery, the joint should be brought together with a hollow punch before riveting.

XXVII. The connection between the lightning-rod and the conductor is made by means of a slotted clamp similar in design to those employed for test or other joints. The lightning-rod terminates at its lower extremity in a $\frac{3}{4}$-in. bolt, which is screwed into the clamp, thereby making firm contact with one or more tapes inside it. This joint admits of visual inspection.

XXVIII. For the repair of old lighting-conductors it is sometimes necessary to use solder. The solder usually employed for copper consists of equal parts of tin and lead which has a resistance

nearly 10 times that of copper. The surface of the joint should be not less than $1\frac{1}{4}$ sq. ins.

Molten zinc should be used for soldering iron conductors. Being nearly twice as conductive as iron the surface of the joint need not necessarily exceed that of the cross section of the conductor.

In both cases the joint should be put together previously by screws or rivets, and the soldered joint, especially in underground work, should be carefully protected from galvanic action by tarred tape.

XXIX. Existing iron wire rope conductors may be connected to copper tapes in the following manner:—Take a piece of sheet copper $4\frac{1}{2}'' \times 4'' \times \frac{1}{8}''$, and cut it down at one end to the size of the tape for a length of $1\frac{1}{2}$ in., and rivet the tape to the sheet at this part. Then bend the remainder of the sheet round the end of the rope, which has been previously frapped with fine wire, thus forming a tube which should be previously tinned inside. Sweat up the joint with zinc solder, and protect it by tarred tape bound tightly over it.

XXX. Copper tape conductors may be connected to iron water mains by filing about a foot of the top of the pipe bright, binding the tape on it with a wire, and soldering it with zinc. Or a short length of iron bar, $2'' \times \frac{1}{2}''$, may be riveted and soldered to the copper tape, and then secured to the pipe by $\frac{1}{2}$-in. screw studs.

XXXI. The greatest care must in all cases be taken to protect the joint from galvanic action by layers of tarred tape, or by imbedding the main at the joint in cement.

XXXII. Metal surfaces on which the rays of the sun fall are exposed to a maximum range of temperature of about 144° Fahr. This range of temperature produces an expansion and contraction in copper conductors of about 1 in. in 60 ft., which should be provided for by forming small loops near the base of the lightning-rods, and by allowing the conductor free play through the holdfasts employed to fix it on the building. Conductors should never be screwed or nailed down. Vertical conductors on shafts, flagstaffs, and high walls should have small loops above every second or third holdfast to take the weight of the conductor, while still allowing for expansion and contraction. The holdfasts should in this case be 4 ft. apart.

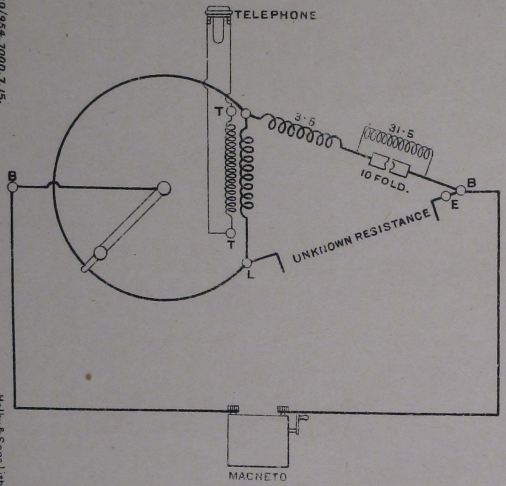
XXXIII. Artizans, and especially painters employed on W.D. Works, should be cautioned never on any pretence to disconnect, move or tamper with any portion of a lightning-conductor without first obtaining the written authority of the superintending officer.

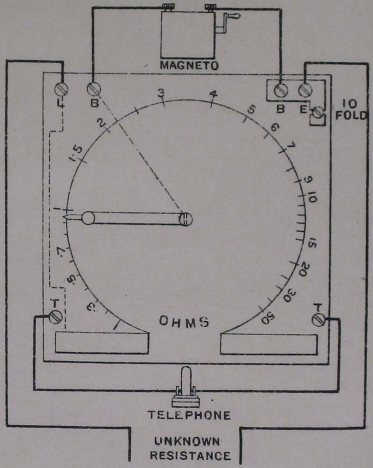
XXXIV. The D.O. is responsible that all lightning-conductors in his division are inspected biennially, preferably in the dry season.

The C.R.E. may, however, prefer to detail a R.E. Officer to carry out the inspection of all the conductors in his district. (*See* R.E.S., Part 1, para. 128.)

XXXV. To assist the inspecting officer, the C.R.E. will keep in his office:—

APPARATUS, TESTING LIGHTNING CONDUCTORS.





398/.12280/954. 7000.7.15.

Malby & Sons, Lith

To face Page 34

Apparatus, Testing Lightning Conductors.

To face page 35.

3981/1228/6s4.7000.7/15.

FIG. 1.
CLAMP, CONNECTING LARGE.

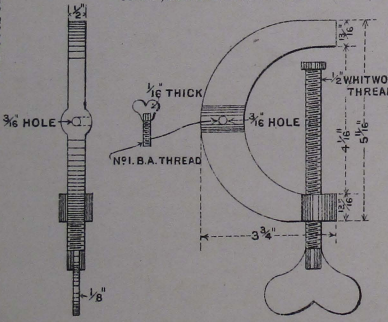


FIG. 2.
CLAMP, CONNECTING, SMALL.

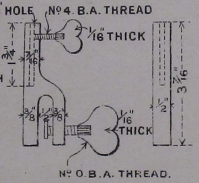


FIG. 3.
CONNECTOR BRASS

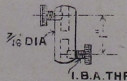


FIG. 4.
DRUM FOR 120 YDS. C.B. WIRE

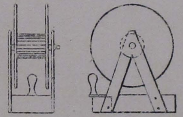
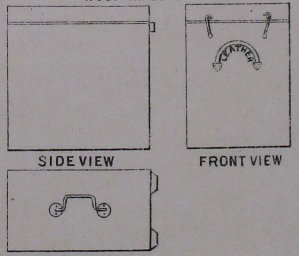
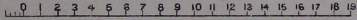


FIG. 5.

FIG. 6.
WOOD CHEST WITH TRAY



SCALE FOR FIG. 5.



SCALE FOR FIGS 1, 2 AND 3.

SCALE FOR FIGS 4 AND 6.

Malby & Sons Lith.

(*a*) Outline copies or tracings of such plans as may be required to show the positions of the buildings protected, the rods, earth connections and general course of the conductors. Copper conductors will be shown by red, and iron by blue, lines. The rods will be numbered 1, 2, 3, &c.; the conductors, *a*, *b*, *c*, &c.; and the earths E 1, E 2, E 3, &c., to correspond with the descriptive record (*see* (*c*) below).

(*b*) Drawings of such details as may be of service at inspections or when repairs become necessary.

(*c*) A descriptive record containing as many of the following particulars as possible:—

(1) Date of erection or reconstruction of lightning-rods.
(2) Character of soil and substrata, and depth of permanent water level or wet soil.
(3) Full particulars of lightning rods, conductors, and earth connections, nature of joints, connections, &c.
(4) Details of all external or internal masses of metal entering into construction of building, and how connected to conductors.
(5) Position of test joints, if any. Nearest earth available for testing, &c.
(6) Quantity of powder, &c., kept in store.
(7) Details of last inspection and précis of former tests, suggestions, &c., of inspecting officer.
(8) To whom notice of inspection should be sent so that ladders may be ready for getting on the roofs, &c.

XXXVI. If any conductors require repair or reconstruction, the inspecting officer will submit a report, accompanied by hand sketches showing the existing systems of conductors, detailing the various defects either in design or construction, and giving his suggestions and proposals for their improvement. (*See* Rule VI.)

XXXVII. The object of electrical tests of lightning-conductors is to determine the resistance of the earth connections, and to localize the position of any defective joints or connections in the conductors. The resistance of the conductor itself is quite inappreciable (less than $\frac{1}{4}$ ohm per 1,000 yards for copper tape $1'' \times \frac{1}{8}''$), and could not be detected by the portable testing apparatus employed. The resistance of the earth depends on the nature of the soil, and its state of moisture at the time of the test. As a rough guide it may be mentioned that the joint resistance of two earths, such as those described in Rule XII, 30 yards apart in damp soil, will not exceed 2 ohms.

XXXVIII. To facilitate the making of tests, test-joints should be made in the conductor running round the base of the structure and elsewhere as may be required.

When the system of conductors is to be tested, the resistance of two test earths, placed not less than 20 yards apart in water or moist soil, or of any two convenient earths unconnected with the system of lightning-rods, or with one another, is first ascertained. Then the sum of the resistance of each test earth in succession, and the earths of the lightning system is ascertained, and the joint resistance of the latter calculated from the resulting three equations. Thus :—

Let L = conductivity resistance of the leads,
Then the resistance of leads and test earths... $= L + e_1 + e_2 = A$
Resistance of leads, one test earth, and the earths of lightning-conductors ... ... $= L + e_1 + E = B$
Resistance of leads, other test earth, and earths of lightning-conductors ... ... $= L + e_2 + E = C$

Then $E = \frac{1}{2}(B + C - A - L)$ (1)

$e_1 = \frac{1}{2}(A + B - C - L)$ (2)

$e_2 = \frac{1}{2}(A + C - B - L)$ (3)

These resistances may be measured with the ordinary Wheatstone Bridge testing instrument, in which case very short contacts should be made with the battery key in order to reduce, as far as possible, polarization of the test plates ; or the special apparatus designed for testing lightning-conductors, and described hereafter, may be employed.

If the resistance is very unequal, the results obtained from these equations may not be very accurate. The results entered should be to the nearest ohm, decimals being omitted.

XXXIX. The resistance of the conductors from each lightning-rod point to that part of the conductor from which the resistance of the earth connections was ascertained is then found. As the resistance of the conductor should be practically nil, any resistance in excess of that of the leads must be due to defective joints, and the faults should be localized and marked for repair.

3.—Instructions for the use of the W.D. Lightning-Conductor Testing Apparatus.

The object of this apparatus is for use in testing the electrical resistance of various parts of a lightning-conductor circuit from the points of the rods to earth.

For this purpose the apparatus is connected up as shown in the diagram (Plate I). The magneto is placed at as great a distance from the tester as the flexible cords permit, and, if possible, to leeward and round a corner, in order that the noise made in turning the handle may not interfere with the use of the telephone in testing.

The portion of the circuit under test is connected, by means of the covered wire and connectors supplied, between the points L and

E of the bridge. The magneto is connected to the points BB. The telephone receiver is connected to the points TT, and the circuit is only completed when the movable arm is pressed. This arm should be kept lifted during traversing to avoid wearing the German silver wire. When it is pressed, and the handle of the magneto is being turned, a buzz is audible in the receiver, except when the movable arm of the bridge is in the position of balance, *i.e.*, when the reading on the scale agrees with the resistance of the circuit under test, added to that of the leads employed. Having obtained this reading, the ends of the leads used should be connected together, and a similar test taken, which will give the resistance of the leads. This must be subtracted from the previous result, and the remainder will be the resistance of that portion of the circuit tested.

The large part of the covered wire supplied is coiled double on the drum, so that it can be paid out from a central position in the two directions it is desired to connect.

The reason of this is that the effect of induction on an alternating current is very readily perceptible in the telephone, and is largely obviated by this method of coiling. The wire should be recoiled after use in the same manner. When using any of the shorter wires supplied rolled up, care should be taken to straighten them out, and not leave part of the coil intact. Unless this is done the test will be erroneous.

All ends of leads should be scraped bright with a knife before connecting. The surfaces of copper tape should be rubbed with emery cloth, and iron flanges filed bright. The bearing surfaces of connectors may be rubbed with emery cloth as required.

Four-inch clamps are used to connect the leads to pipe, and smaller clamps to connect to copper tape. Connectors are also supplied for joining leads together (Plate II).

The movable arm should only be handled by the insulating knob, or the tester's body will prove a source of error.

The scale round the German silver wire is in ohms and decimals of an ohm, if the 10-fold screw is in its place. If this be removed, an extra resistance is introduced, which renders it necessary to multiply the readings by 10. The dial then reads from 1 to 500 ohms.

The principles of this test are clearly shown in the accompanying theoretical diagram (Plate I), and will be seen to be the same as in the ordinary Wheatstone Bridge method, a magneto being substituted for the battery, and a telephone receiver for the galvanometer usually employed.

In some cases it may be found impossible to obtain absolute silence in the telephone receiver when making the test. This may be due to—

(*a*) Induction in the testing circuit.

(*b*) Leakage in the apparatus, probably due to dampness.

(*c*) A faulty (*i.e.*, leaky) telephone receiver.

Defect (*a*) may be removed or lessened by attending to the instructions already given regarding coiling of test wires, etc.

Defect (*b*) is due to dampness, may be prevented by keeping the apparatus in a dry place and exposing it to the weather as little as possible.

Defect (*c*) may be remedied temporarily by insulating the handle of the telephone receiver with india-rubber tape.

When it is found impossible to obtain complete silence, the reading must be taken in that position of the movable contact arm which produces least sound in the telephone receiver.

List of Vocabulary Stores Required for Testing Lightning Conductors.

Figures on Plate II.	Articles.	Number.
Fig. 6	Chest, wood, with handle, lock and key fitted, to contain	1
	Apparatus, testing, lightning-conductors with flexible leads...	1
	Chisel, hand, cold, 1″ × 7½″	1
	Cloth, emery, fine ... ... quires	½
Fig. 1	Clamps, connecting, 4″	2
Fig. 2	,, ,, ½″	3
Fig. 3	Connectors, small	6
	Driver, screw, G.S. 6″	1
Figs. 4 and 5	Drum, cable, 8½″ × 3½″, iron, on stand, with handle	1
	File, second cut, half round, 8″ handled	1
	Hammer, handled, riveting, 12-oz.	1
	Knife, clasp, with marline spike	1
	Plates, earth, copper, small...	2
	Pliers, side cutting, 7″ ... . pairs	1
	Spanner, McMahon, 12″	1
	Telephone, Ader, receiver, with flexible cords ...	1
	Wire, covered (E.1.) for drum ... yards	120
	,, ,, in 25 feet lengths ... pieces	4

SECTION IV.—CHEMICAL EXAMINATION OF BUILDING MATERIALS.

1. It is necessary sometimes to have certain building materials chemically examined, in order that the D.O. may be enabled to satisfy himself that they are of specified quality (*see* R.E.S., Part 1, para. 677 (*a*)).

2. The following list gives the materials commonly in use which require chemical examination. It also shows the quantity of each description of material which is required as a sample :—

Asphalte	2 lbs.
Cement	7 lbs.
Colours, dry	2 ozs.
Fire clay	2 lbs.
Galvanized steel	1 sq. ft.
Lime	4 lbs.
Metals, other than steel or iron (preferably in solid form) ...	4 ozs.
Oil, colza	1 quart.
Oil, fuel, for oil engines	1 pint.
Oil, fuel, for steam engines ...	1 pint.
Oil, lubricating	1 pint.
Oil, linseed, raw	½ pint.
Oil, linseed, boiled	½ pint.
Paints ground in oil	¼ lb.
Plaster of Paris	1 lb.
Steel and iron (preferably in the form of turnings or borings)	3 ozs.
Turpentine	½ pint.
Varnish	½ pint.
*Water	1 gallon.
White lead	¼ lb.
Building stone	A 6-in. cube.

3. The following instructions are to be observed by D.Os. in preparing samples :—

(*a*) They must fairly represent the bulk of supply. To ensure this, the sample should be made up, when practicable, from several packages.

(*b*) Paints are to be well strained before samples are taken.

---

* This only refers to such examination as may be needed for building purposes. As regards the examination of drinking water, &c., see Regulations for the Army Medical Service.

(*c*) Each sample is to be securely packed in a bottle or tin that is *perfectly dry and clean.*

(*d*) Each sample is to be labelled.

4. The D.O. will send the samples direct to the "Chief Inspector, Royal Arsenal, Woolwich." A list of the samples (on A.F. K 1312) is to be enclosed in the box, and a separate copy despatched to him by post. Chemical examination of petroleum spirit, etc., supplied by the A.S.C. will be dealt with by that department.

A.O. 163. 1914.

SECTION V.—ADMINISTRATION OF W.D. ESTATE.

Instructions for W.D. Land Agents.

(*Referred to in R.E.S., Part I, para.* 136.)

1. Before the Agent enters on his duties he will receive from the C.E. a list showing the names of all the tenants in his Agency, together with the amount of their rents, and the dates of their agreements for tenancy; details of any arrears of rent, and the particulars of the premises they occupy by reference to a plan or plans.

2. The agreement forms generally in use for lettings are specified in R.E.S., Part I, para. 175; special forms have also been approved for use at certain stations.

3. The duties of the Land Agent may be summarised as follows:—

(*a*) To collect the rents of lettings and encroachments.
(*b*) To ascertain that each tenant fulfils the terms and conditions of his agreement.
(*c*) To render a monthly account to the C.P. of his receipts and disbursements.
(*d*) To give notices to quit to the tenants as and when so instructed by the C.E.
(*e*) To make all arrangements on change of tenancy or resumption of lands and buildings.
(*f*) To obtain tenants for W.D. property and to arrange for re-letting on instructions from the C.E.
(*g*) To keep the tenancy agreements in his custody.
(*h*) To advise the C.E. generally on questions affecting the general management of W.D. lettings.
(*i*) To inspect all lettings in his care at least once annually.
(*j*) To furnish annually to the C.E. a general report on the property in his collection.

4. The payment of rates and taxes (except in the case of cottage properties), the sale of W.D. land, and the purchase of land for the purposes of the W.D., will not form part of the Agent's duties.

5. The rents from yearly tenancies are to be collected within 40 days, and from other tenancies within seven days, after becoming due. Any rents which become two quarters in arrear are to be brought to the notice of the C.E. (*see* R.E.S., Part I, para. 177).

6. Allowances for improvements or substantial repairs, previously sanctioned by the W.D., are to be deducted out of the rent, and the vouchers sent in by the Agent with the rent account.

The Agent is to state the reason for every allowance and is not to make any exceeding 5 per cent. on the rent, or to pay any claims for compensation, without the previous sanction of the C.E.

7. The Agent will render to the C.P., not later than the 10th of each month, a monthly account (on A.F. P 1952) of his receipts and disbursements, supported by a Statement (on A.F. P 1952a) of the sum received for rents, etc., during the month ; he will at the same time forward to the C.P. the balance of the account.

8. The Agent will make all the arrangements devolving on the landlord upon a change of tenancy, and for the resumption of lands or buildings required for the public service, including any valuations under the Agricultural Holdings Act.

9. When premises become untenanted or lands are acquired not needed exclusively for military purposes, the Agent shall let them, on instructions from the C.E.

The ordinary method of letting W.D. lands and buildings is by public competition evidenced by written tenders, but if in any particular instance the Agent is of opinion that better results would accrue from negotiation with prospective tenants he will so advise the C.E.

Tenders will be issued by the Agent, and will be addressed to the C.E. The Agent will advise the C.E. as to the competency of the persons tendering.

The Agent will at all times submit to the C.E. any offers received for hiring W.D. properties.

10. Agreements for tenancies will be retained by the Agent.

11. Whenever an opportunity offers the Agent will advise the C.E. whether premises may be advantageously re-allotted with lettings other than those which have heretofore been held with them.

The Agent will at once bring to the notice of the C.E. any facts which may affect the financial status of W.D. tenants.

12. On the 1st November the Land Agent will submit to the C.E. for transmission to the W.O. a report stating :—

(*a*) The gross and net rental of each letting.

(*b*) The amount of any arrears and any steps which have been taken in reference thereto.

(*c*) The condition of the letting and information as to cultivation, repair and the manner in which the tenant is keeping his covenants.

(*d*) Suggestions for increasing the income from the W.D. Estate.

(*e*) Proposals for arrangements more conducive to the mutual interest of landlord and tenant than those existing.

13. The Agent's commission will be calculated on the actual amount of the sums received, except that in the case of compensation allowed for disturbance or repairs the commission may be charged upon the gross amount of rent due.

2.—Colonial Military Land Circulars.

(*Referred to in R.E.S., Part 1, paras.* 140 *and* 203.)

No. 1.

(Circular.)

Colonial Office, Downing Street,
9th June, 1890.

Sir,

I have the honour to transmit to you, for your information and guidance, unless you have any serious objection of principle to urge against the proposal, a memorandum agreed upon by the War Office, the Treasury, and the Colonial Office, with regard to the disposal whenever occasion may arise of Colonial military Crown lands and buildings no longer required for defence purposes.

KNUTSFORD.

To Officers Administrating.

Enclosure in No. 1.

Disposal of Colonial Military Lands and Buildings.

1. With regard to the general question of Colonial military lands and buildings, it is assumed that all such lands and buildings are held by the Secretary of State for War for purposes connected with Colonial defence, and that the Secretary of State represents the Crown in all matters pertaining to their military administration.

2. The military authorities, acting on behalf of the Secretary of State, should, therefore, in communication with Colonial Governments, deal with Colonial military lands and buildings in such manner as may best secure—

(1) The efficient execution of the special service to which the land and buildings are devoted.

(2) The general interests of the Colony.

3. On account of the changing conditions of warfare, it not unfrequently occurs that Colonial lands and buildings set apart for military purposes cease to be necessary or suitable to their purpose, while, at the same time, or subsequently, other lands and buildings have to be acquired to meet the necessities of the garrison.

4. It is therefore considered that all such military properties and their values should be treated as part of a capital sum devoted to defensive purposes, and that when they are disposed of by sale or by transfer to the Civil Government, their realized or estimated values should, as hereinafter detailed, be retained by the Colonial Governments, and be held by them available towards the provision of such other lands and buildings as it may subsequently be necessary to acquire for defensive purposes.

5. In Colonies garrisoned by Imperial troops, when military lands or buildings, other than such as may have been purchased and paid for by the Imperial Government, are no longer required for military service, either immediately or prospectively, it is recommended that they should be surrendered to the Colonial Government, subject to the following conditions :—

(1) If the Colony wishes to retain them for civil purposes, their value should be settled by agreement between the local civil and military authorities, or by competent surveyors, as may be considered most desirable.

When other lands or buildings for the garrison have to be provided, the agreed value of the surrendered lands or buildings should be contributed by the Colony towards the cost of providing the new lands or buildings.

If no such new lands or buildings are required at the time, the value of the surrendered lands or buildings should be retained by the Colonial Government until other lands or buildings are required for the garrison, when the value of the surrendered lands and buildings should be contributed by the Colony towards their cost.

(2) If the Colony does not wish to retain the lands or buildings, they should be surrendered by the military authorities to the Colonial Government for sale, the proceeds of the sale being dealt with in the same manner as provided for in the case of the value of lands retained by the Colony, *i.e.*, if other lands or buildings are being provided for military purposes, the sums realized should be taken in aid of their cost, and if no such lands or buildings are required at the time, the sums realized should be retained by the Colonial Government, and be available at any subsequent period, when other lands or buildings may be required for military purposes.

6. If some such course as this be not adopted, it is evident that whenever, owing to local conditions, a change of barracks or sites in a colony became necessary, the Colony would gratuitously acquire valuable properties, while the Imperial Government would have imposed upon it the entire cost of replacing them.

7. An alternative policy might be adopted by the free surrender to Colonies of all lands and buildings no longer required for military service, on the understanding that they should provide all necessary lands and buildings for their garrisons. This course, however, might occasionally entail upon a Colony an expenditure disproportionate to its means. It would seem preferable, therefore, while ensuring that the value of surrendered lands and buildings shall be made available towards the cost of replacing them, to leave the question of the division between Imperial and Colonial revenues, of the excess cost, of new over surrendered

properties, to be adjusted in each case either upon its merits, or under any general or special agreement which may exist at the time between the Colonial and Imperial authorities.

8. When lands or buildings in a Colony have been purchased and paid for by the Imperial Government, their value, when sold or transferred, should be credited to Imperial revenues.

No. 2.

Colonial Office, Downing Street,

Sir, 30th December, 1894.

From correspondence which has taken place respecting Colonial military lands and buildings—that is to say, lands the fee simple of which is vested in the Crown, represented by the Colonial Government, but of which the War Department has a right of perpetual user for purposes of defence, and the buildings on such lands, in certain colonies—since my predecessor's circular despatch of the 9th June, 1890, it appears that the exact meaning of the proposals enclosed in the circular as to the mode of dealing with such lands, when no longer required for military purposes, has not been clearly understood.

2. Her Majesty's Government have carefully reconsidered the question, and have decided to adhere to the proposals adopted by their predecessors, and communicated to the Colonial Governments in Lord Knutsford's circular despatch, and with the view of removing any misunderstanding they have thought it desirable to formulate their proposals in the following terms, viz. :—

"The free surrender to the Colony of all Colonial military lands and buildings no longer required by Her Majesty's Government on the engagement by the Colony that, in the event of lands and buildings being required then or in the future for the defence of the Colony, the Colony shall provide an equivalent for the lands and buildings so surrendered towards the satisfaction of the above-mentioned requirements, and to that intent the value of the lands and buildings surrendered shall be ascertained and recorded, and any lands and buildings provided out of that value shall be held by Her Majesty's Government on the same tenure as those surrendered."

3. This proposal is based upon the assumption that the Colonial military lands in question constitute a permanent defence fund of the Colony, the integrity of which ought to be preserved, in kind

or value, even though the original lands themselves may be diverted to civil purposes. Accordingly, whenever such lands which have been set apart for defensive purposes have, from change of circumstances, or from an altered scheme of defence, or from any other reason, ceased to answer the purposes for which they were set apart, and are in consequence surrendered by the military authorities, their value should be treated as forming a capital applicable either immediately, or from time to time, so far as it will extend, to providing other lands or buildings which may be required in the Colony for such purposes.

4. Effect would be given to the above proposal in the following manner :—

If the Colonial Government should not desire to retain the lands and buildings to be surrendered, they will be sold in the open market, and the proceeds paid into the Colonial Treasury, when the amount would be entered in a special account to the debit of the Colonial Government. In the event of any new lands or buildings being immediately required for the defensive purposes of the Colony, the amount of the above-mentioned proceeds, or a sufficient portion of them, would be paid out as required for the purchase of the new sites, and for the construction of the new buildings ; the amounts so paid out being entered in the special account to the credit of the Colonial Government. Should the new sites, instead of being purchased from private owners, be located on Crown lands in the possession of the Colonial Government, the necessary lands would be given over to the military authorities, and credit taken in the special accounts for the market value of the fee simple of the Crown lands so given over.

5. Should new lands or buildings not be immediately required for defensive purposes, the above-mentioned proceeds would stand in the special account to the debit of the Colonial Government to be paid out in the same way, in the event of funds being ever required in the future for providing lands or buildings for defensive purposes.

6. Whenever the Colony desires to retain any lands which the military authorities give up, such lands, instead of being offered for sale, would be valued, and the market value of their fee simple at date of surrender would be entered in the special account to debit of the Colonial Government, together with the fair selling value at that date of any buildings which might be upon that land. In the event of the surrender of any buildings now existing, which in the past were erected at Colonial cost, it would only be necessary to record the value of the site. The amounts so entered would be paid out as required for the provision of the lands or buildings for the defensive purposes of the Colony, and the amounts, as in the case of sale, credited to the Colonial Government, the like credit being given in the event of new sites being provided on Crown lands. Should no new lands or buildings be immediately required

the amounts entered would remain to the debit of the Colonial Government until such time, if ever, as lands or buildings should become necessary for defensive purposes.

7. Valuation of lands or buildings, when required under the circumstances above-mentioned, should be made by the Colonial and military authorities conjointly, or in the event of their disagreeing, by an independent and competent surveyor, to be chosen by agreement between the Home and Colonial Governments, whose report should be final. The cost of employing such surveyor would be borne by the Colonial Government, but should be placed to its credit in the special account.

8. Any lands and buildings provided hereafter for defensive purposes under this arrangement, including land required for rifle ranges or other purposes conducing to the efficiency of the garrison, would be occupied by the military upon a right of perpetual user only, the fee simple of the land remaining in the Crown represented by the Colonial Government. In the event of any such lands being at any time surrendered by the military authorities they would be dealt with in the manner above detailed.

9. Before any buildings are commenced, the cost of which will be chargeable to the special account, the Governor will be informed of the nature and estimated cost of the proposed buildings in order that any observations that he may wish to offer upon them may be duly considered by Her Majesty's Government.

10. It is not proposed to re-open any transactions already closed, and lands which have already passed out of military occupation will remain the property of the Colony, subject of course to any conditions which may have been attached to them at the time when they came into the possession of the Colonial Government.

11. The foregoing proposal relates solely to the terms on which Colonial military lands, in the hands of the War Department, should be surrendered to a Colonial Government. It does not affect the obligation of a Colony to provide other lands required within its borders for military purposes, whether under some special agreement or under the general obligation that rests on every Colony to contribute, according to its means, towards its own defence. Whatever the circumstances of a Colony may be, it is obviously within its means to maintain its Colonial military lands intact, in money or kind, for defensive purposes.

12. I request that you will lay this despatch before the Legislative Council and House of Assembly, and convey to them my earnest hope that the proposals of Her Majesty's Government will be accepted as a fair and equitable solution, to the advantage alike of the Mother Country and of the Colony, of a question which has in some Colonies been the subject of considerable and prolonged controversy.

RIPON.

No. 3.

Downing Street,
May, 1903.

Sir,

I have the honour to acquaint you that I have been in communication with the Secretary of State for War with regard to the method of recording transfers or exchanges of land effected between the War Department and a Colonial Government, and with a view to dispensing as far as possible with the legal charges involved on the execution of a formal deed of conveyance, an arrangement has been agreed to under which such a deed will not be necessary so long as the terms of the arrangements in connection with the transfer are clearly recorded in a formal memoradnum, accompanied by a plan of the lands in question and signed in duplicate by the Governor and the Officer Commanding the Troops in the Colony after being approved by the Secretaries of State for the Colonies and for War.

2. I have therefore to request that whenever in future it may be necessary to effect a transfer or exchange of land with the War Department you will have a memorandum prepared embodying the terms of transfer, and forward it, accompanied by the necessary plan, for approval.

J. CHAMBERLAIN.

3.—Instructions Regarding Tenders for Lettings and for Sales of Produce.

1. The procedure as regards calling for tenders is laid down in R.E.S., Part I, paras. 183 and 199.

2. The procedure to be followed as regards receiving and opening tenders is laid down in the Regulations for Supply, Transport and Barrack Services (modified by R.E.S., Part I, para. 315 and para. 6 below).

3. All tenders for lettings are to be referred to the G.O. i/c Adm. They may require reference to the W.O. (*See* R.E.S., Part I, paras. 179, 180 and 189.)

4. Tenders for sales of produce not exceeding £25 in estimate value may be accepted by the C.R.E. If exceeding that amount, they are to be submitted to the G.O. i/c Adm. If they exceed £100 they are to be referred to the W.O. before acceptance.

5. When forwarding a schedule of tenders for acceptance the C.R.E. and G.O. i/c Adm. will endorse on it their recommendations.

6. The highest tender is to be accepted provided the tenderer is competent and that the prices quoted are not unreasonable.

The regulations governing Sales, given in the Regulations for Supply, Transport and Barrack Services, indicate generally the particulars to be given in the tender forms.

(As to prices in brackets, see top of page 2.)

KING'S REGULATIONS AND ORDERS FOR THE ARMY. 1912. (Reprinted, with Amendments published in Army Orders up to Aug. 1, 1914). 1*s.* (1*s.*)

KIT PLATES :—

Artillery. Royal—

1. Horse and Field. Kit in Barrack Room. 1912. 2*d.* (2*d.*)
2. Ditto. Kit laid out for Inspection. 1903. 2*d.* (2*d.*)
6. Garrison. Kit laid out for Inspection. 1909. 2*d.* (2*d.*)
10. Ditto. Kit in Barrack Room. 1909. 2*d.* (2*d.*)

Cavalry. 1891. 1*d.* (1*d.*)

Engineers. Royal—

1. Dismounted. Detail of Shelf and Bedding, with Marching Order ready to put on. Detail of Shelf and Bedding, with Drill Order ready to put on. 1914. 1*d.* (1*d.*)
2. Dismounted. Full Kit laid out for Inspection in Barrack Room. 1914. 1*d.* (1*d.*)
4. Mounted N.C.O. or Driver and Field Troop Sapper. Full Kit laid out for Inspection in Barrack Room. 1910. 1*d.* (1*d.*)
5. Mounted. Detail of Shelf and Bedding. 1910. 1*d.* (1*d.*)
6. Driver, with pair of Horses. Field Kit laid out for Inspection on Parade, including Articles carried in Valise on Baggage Wagon. 1899. 1*d.* (1*d.*)

Infantry—

1. Kit in Barrack Room. 1905. 2*d.* (2*d.*)
2. Kit laid out for inspection. 1905. 2*d.* (2*d.*)

Highland. 1884. 1*d.* (1*d.*)

Medical Corps. Royal Army. Kit in Barrack Room. 1912. 2*d.* (2*d.*)

Ordnance Corps. Army. For guidance at Marching Order and Kit Inspections. 2*d.* (2*d.*)

LARGE FORMATIONS. The Operations of. (Conduite des Grandes Unités). Translated from the Field Service Regulations of the French Army, dated Oct. 28, 1913. 6*d.* (5*d.*)

LAW. Military. Manual of. 1914. 2*s.* (1*s.* 9*d.*)

LAW FOR THE RESERVE FORCES AND MILITIA. Manual of. 1886. 1*s.* 6*d.* (1*s.* 2*d.*)

MACHINE-GUN. Tests of Elementary Training. 1*d.* (1*d.*)

MACHINE GUNS AND SMALL ARMS, 303-inch. Nomenclature of Parts, Stripping, Assembling, Action, Jams, Misfires, Failures, and Inspection of. Revised Edition. 1915. 3*d.* (3*d.*)

MAGAZINES AND CARE OF WAR MATERIEL. Regulations for. 1913. 9*d.* (9*d.*); Amendments, July 1914, June 1915. Each 1*d.* (1*d.*)

MAP READING AND FIELD SKETCHING. Manual. 1912. (Reprinted, with Additions, 1914). 1*s.* (11*d.*) (*And see* Schools, Army.)

MECHANISM AS APPLIED TO ARTILLERY. Notes on. Second edition. 1902. 1*s.* (11*d.*)

MEDICAL CORPS. Royal Army (*and see* Territorial Force):—

Admission to. Regulations for. Jan. 1912. 1*d.* (1*d.*)

Standing Orders. 1914. 1*s.* (10*d.*)

Training. 1911. 9*d.* (9*d.*)

MEDICAL DEPARTMENT. Army. Index to Appendices of Reports from 1859 to 1896. 3*d.* (3*d.*)

MEDICAL SERVICE. Army. Regulations. 1906. (Reprinted, with Amendments up to Sept. 1914). 4*d.* (5*d.*)

MEDICAL SERVICE. Strategical and Tactical Employment of the, as carried out in an Army Corps; with a series of Problems. Translated from the Austrian. 4*s.* 6*d.* (3*s.* 4*d.*)

(As to prices in brackets, see top of page 2.)

MEDICAL SERVICES. Army. Advisory Board for. The Treatment of Venereal Disease and Scabies. First Report. 1904. 1*s.* 6*d.* (1*s.* 3*d.*); Second Report. 1905. 2*s.* (1*s.* 6*d.*); Third Report. 1905. 1*s.* (10*d.*); Final Report. 1906. 6*d.* (5*d.*)

MEDICAL SERVICES OF FOREIGN ARMIES. Handbook of. Part I. FRANCE. 6*d.* (5*d.*) (*Under revision*); Part II. GERMANY. 6*d.* (5*d.*); Part III. AUSTRIA-HUNGARY. 6*d.* (5*d.*); Part IV. RUSSIA. 6*d.* (5*d.*); Part V. ITALY. 6*d.* (5*d.*); Part VI. THE NETHERLANDS AND BELGIUM. 1911. 6*d.* (5*d.*)

MEKOMETER Handbook. 1911. 6*d.* (6*d.*)

MOUNTED TROOPS (DIVISIONAL) TRAINING. Provisional. June 1915. 1*d.* (1*d.*)

MUSKETRY REGULATIONS:—

Part I. 1909. (Reprinted, with Amendments, 1914). 6*d.* (7*d.*)

Part II. Rifle Ranges and Musketry Appliances. 1910. (Reprinted, with Amendments to Oct. 31, 1914). 4*d.* (4*d.*)

NIGHT OPERATIONS. Elementary Training in. 1911. 1*d.* (1*d.*)

NUMBER OF TROOPS TO THE YARD in the Principal Battles since 1850. Memo. on. With opinions of Modern Authorities on limits of extension at the present day. 1884. 9*d.* (7*d.*)

NURSING IN THE ARMY. Queen Alexandra's Imperial Military Nursing Service. Reprinted from "The British Medical Journal." 1905. 1*d.* (1*d.*)

NURSING SERVICE. Queen Alexandra's Imperial Military. Regulations for Admission to the. 1914. 1*d.* (1*d.*)

OFFICERS TRAINING CORPS:—

Regulations. 1912. 2*d.* (2*d.*) (*Under revision*)

Ditto. (Inns of Court). 1*d.* (1*d.*)

Special A.O., March 16, 1908. 1*d.* (1*d.*)

Junior Division. Instruction for the Annual Camps. 1913. 2*d.* (2*d.*)

OPERATION ORDERS. A Technical Study by Hans von Kiesling. Translated from the German. 1*s.* 6*d.* (1*s.* 3*d.*)

OPTICAL MANUAL or Handbook of Instructions for the guidance of Surgeons. Third edition. 1885. 1*s.* 6*d.* (1*s.* 3*d.*)

OPTICS. Notes on. 6*d.* (5*d.*)

ORANGE FREE STATE. Topographical Survey of the, 1905-1911. Report on the. 10*s.* (7*s.*)

ORDNANCE COLLEGE (*and see* Artillery College):—

Advanced Classes. Reports on (up to the 33rd). Each 1*s.* (9*d.*)

Ditto. 34th. 6*d.* (5*d.*)

Dynamics. Notes on. Second edition. 3*s.* (2*s.* 5*s.*)

Officers' Mess (Royal Artillery) Management and First Principles of Bookkeeping. 3*d.* (3*d.*)

Ordnance Courses. Reports on. Each 1*s.* (9*d.*)

Regulations. 1907. 2*d.* (2*d.*)

ORDNANCE CORPS. Army. Standing Orders. 1912. (Reprinted, with Amendments to June 30, 1914). 6*d.* (6*d.*)

ORDNANCE MANUAL (WAR). 1914. 6*d.* (5*d.*)

ORDNANCE SERVICE. Treatise on. Seventh edition. 1908. With volume of plates. 7*s.* 6*d.* (5*s.* 6*d.*); Amendments. June 1909, Dec. 1910, Dec. 1912. Each 1*d.* (1*d.*); Ditto. Dec. 1909, Dec. 1911. Each 2*d.* (2*d.*)

ORDNANCE SERVICES. ARMY. Regulations:—

Part I. 1912. (Reprinted, with Amendments published in Army Orders up to Oct. 1, 1914). 6*d.* (6*d.*)

Part II. 1914. Instructions for Laboratories and Laboratory Operations, Examination of Explosives and Ordnance. 1*s.* (11*d.*)

Ditto. Amendments, June 1915.

PATHOLOGICAL SPECIMENS in the Museum of the Army Medical Department, Netley. Descriptive Catalogue of. Third edition. Vol. I. By Sir W. Aitken, M.D. 1892. 5*s.* (3*s.* 8*d.*)

(As to prices in brackets, see top of page 2.)

PAY DUTIES of Officers Commanding Squadrons, Batteries, Companies, &c. Instructions. (Revised for the period of the War). I. Home and Colonies. II. In the Field. May 1915. 1*d.* (1*d.*)

PHYSICAL TRAINING. Manual of. (Reprint 1908 with Amendments published in Army Orders to Dec. 1, 1914). 9*d.* (9*d.*)

PLACE-NAMES OCCURRING ON FOREIGN MAPS. Rules for the Transliteration of. 1906. 1*s.* (9*d.*)

PORTABLE SUB-TARGET (Mark I.), and How to Use it. 1911. (Reprinted, with Amendments, 1914.) 1*d.* (1*d.*)

POSTAL SERVICES. ARMY. WAR. Manual of. 1913. 3*d* (3*d.*)

PROJECTION, &c. Linear Perspective. A Text-Book for use of the R.M. Academy. Part I.—Text. Part II.—Plates. 1904. 6*s.* (4*s.* 5*d.*)

PUBLICATIONS (RECENT) OF MILITARY INTEREST. List of, Quarterly. Nos. 1 to 8. 2*d.* (2*d.*) each; Nos. 9 to 17. 4*d.* (4*d.*) each. (*Continued by* THE ARMY REVIEW).

RAILWAY DISTANCES. Ireland. Handbook of. Third edition. 1884. 7*s.* 6*d.* (5*s.* 3*d.*)

RAILWAY MANUAL (WAR). 1911. (Reprinted, with Amendments, 1914). 6*d.* (5*d.*)

RAILWAYS. MILITARY. RECONNAISSANCE AND SURVEY (F. Notes on, for Officers of R.E. Railway Companies. 1910. 2*s.* 3*d.* (1*s.* 8*d.*)

RANGE-FINDER. Handbooks:—

Infantry, No. 1. (Marindin). 1913. 3*d.* (3*d.*)

Infantry, No. 2. (Barr and Stroud). 31·5-inches base. 1913. 1*s.* (10*d.*)

Ditto. Addendum. 1*d.* (1*d.*)

Watkin. Regulations for instruction in, and practice with. 1882. 1*s.* (9*d.*)

RANGE FINDING. COAST DEFENCE. Manual of. Part I. 9*d.* (8*d.*)

Ditto. Amendments, June 30, 1914. 1*d.* (1*d.*)

RANGES, MINIATURE CARTRIDGE. (*Reprinted from* THE ARMY REVIEW, January 1914). 3*d.* (3*d.*)

RANGETAKERS. Instructions for the Training of, with the Range-finder Artillery. 1*d.* (1*d.*)

RANGING. Examples of. (*See* Artillery, Training; Field.)

RECRUITING FOR THE REGULAR ARMY AND THE SPECIAL RESERVE. Regulations. 1912. (Reprinted, with Amendments to Aug. 31, 1914). 3*d.* (3*d.*)

REMOUNT MANUAL (WAR). 1913. 2*d.* (2*d.*)

REMOUNT REGULATIONS. 1913. 3*d.* (3*d.*)

REQUISITIONING OF SUPPLIES, TRANSPORT, STORES, ANIMALS, LABOUR, &c., IN THE FIELD. Instructions for the. 1907. 1*d* (1*d.*)

RESERVE (*and see* Motor Reserve; Special Reserve):—

Army Reserve. Class I. Regulations. 1911. 1*d.* (1*d.*)

Ditto. Amendments, June 1913. 1*d.* (1*d.*)

National Reserve. Regulations. 1913. 1*d.* (1*d.*)

RIFLE RANGES. Care and Construction of. Instructions for. 1908. 3*d.* (3*d.*)

RIFLE RANGES, TRAINING GROUND, AND MUSKETRY CAMP, PENALLY. (Western Coast Defences.) Standing Orders. 1910. 2*d.* (2*d.*)

RIFLES, &c. Cleaning of. Notes on the. 1911. 25 for 6*d.* (7*d.*)

RIFLES, SHORT AND CHARGER-LOADING, MAGAZINE, LEE-ENFIELD. Handbook for Serjeant-Instructors of Special Reserve, Officers Training Corps, and Territorial Force in regard to the Care, Inspection, &c., of. 3*d.* (3*d.*)

RUSSIAN MILITARY AND NAVAL TERMS. Dictionary of. 1906. 3*s.* 6*d.* (2*s.* 6*d.*)

RUSSO-JAPANESE WAR:—

Medical and Sanitary Reports from Officers attached to the Japanese and Russian Forces in the Field. 1908. 5*s.* (3*s.* 10*d.*)

(As to prices in brackets, see top of page 2.)

Russo-Japanese War—*continued.*

Official History. Part I. Causes of the War. Opening Events up to and including the Battle of the Ya-lu. Second edition. 1909. **1s. 6d.** (*1s. 3d.*); Part II. From the Battle of the Ya-lu to Liao-yang, exclusive. 1908. *5s.* (*3s. 8d.*); Part III. The Siege of Port Arthur. 1909. *4s. 6d.* (*3s. 4d.*); Part IV. Liao-yang. 1910. *4s.* (*3s.*); Part V. Sha Ho. 1911. *4s. 6d.* (*3s. 5d.*)

Official History (Naval and Military). Vol. I. To August 24, 1904. With case of Maps. 1910. *15s.* (*10s. 7d.*); Vol. II. Liao-yang, the Sha-ho, Port Arthur. With case of Maps. 1912. *15s.* (*10s. 10d.*)

Reports from British Officers attached to the Japanese and Russian Forces in the Field. In three vols., with two cases of Maps (*not sold separately*). *21s.* (*15s.*)

SALISBURY PLAIN. SOUTHERN COMMAND. Standing Orders applicable to all Troops Encamped on Salisbury Plain, and applicable generally to Troops Quartered at Bulford and Tidworth. 1913. (Reprinted, with Amendments, 1915). *3d.* (*3d.*)

"SAM-BROWNE" BELT, SCABBARD, AND SWORD KNOT. Specification and Drawings. 1899 *1d.* (*1d.*)

SCHOOLS. Army:—

Annual Reports on. 1911–12; 1912–13. Each *1s.* (*9d.*)

Map Reading. Notes on. 1915. *3d.* (*3d.*)

(*And see* Map Reading and Field Sketching.)

Military and other Terms, and Words which Occur in Orders. Lists of. 1914. *2d.* (*2d.*)

Physiology. Elementary. Handbook. 1901. *1d.* (*1d.*)

Regulations. 1911. *4d.* (*4d.*)

School Hygiene. Handbook of. For Teachers. *6d.* (*6d.*)

Singing in. Regns. for Teaching. 1911. *1d.* (*1d.*)

Standing Orders for Inspectors, Examiners, and Teachers. 1910. *6d.* (*5d.*)

Type Exercises of Extracts from Regimental Orders for the use of Candidates for Third-class Certificates of Education. 1912. *3d.* (*3d.*)

SCOUTS. Training and Use of. Lecture by Col. F. C. Carter. 1905. *2d.* (*2d.*)

SCREWS. Standard Leading. Provision of, for Screw-cutting Lathes. Report of Committee. 1905. *1s.* (*10d.*)

SEVASTOPOL. Siege of. 1854–55. 3 vols., with Case of Maps and Plans. Half Mor., *£5 4s.* Cloth, *£4 4s.*

Or separately:—Vol. I. Engineer Operations. *£1 6s.*; Vol. II. Ditto. With Case of Maps and Plans. *£2 10s.*; Vol. III. Artillery Operations. *10s.*

SEWAGE. Practical Treatment of. The latest development of. 1903. *6d.* (*5d.*)

SHOEBURYNESS GARRISON. Standing Orders. 1913. *1s. 6d.* (*1s. 1d.*)

SIEGE OPERATIONS in the Campaign against France, 1870–71. (*Von Tiedemann.*) Translated. *4s. 6d.* (*3s. 3d.*)

SIGNALLING. Training Manual. 1907. (Reprinted, with Amendments to May 1, 1911). (*Under revision*); Amendments. Nov. 1912, May 1913, April and Aug. 1914 (in one), April 1915. Each *1d.* (*1d.*); Appendix IV. Despatch Riding. *1d.* (*1d.*)

SIGNALLING. Training Manual. Part II. For the use of the Divisional Signal Companies and Intercommunication Personnel of Units in Divisions, other than 1st to 8th Divisions, of the Intercommunication Personnel of Units of the Territorial Force other than Signal Units and R.G.A. Coast Defence Companies, and of Signallers of King Edward's Horse. 1914. *6d.* (*5d.*) (*Under revision*)

Ditto. Appendix I. Telephone Cable Drill. Artillery. *1d.* (*1d.*)

Ditto. Appendix II. Telegraph Cable Drill. *2d.* (*2d.*)

Ditto. Appendix III. Telephone Equipment: Artillery Batteries and Infantry Battalions. *1d.* (*1d.*)

Ditto. Amendments. April 1915. *1d.* (*1d.*)

(As to prices in brackets, see top of page 2.)

SIGNALLING DISC. Directions for Use. 1911. 1*d.* (1*d.*)

SIGNAL SERVICE. THE ARMY. 1*d.* (1*d.*)

SIGNAL SERVICE. ARMY. Manual of—WAR. Provisional. 1914. 2*d.* (2*d.*)

SMALL ARMS Text Book. 1909. With Tables. 2*s.* 6*d.* (2*s.* 1*d.*)

SMALL WARS. Their Principles and Practice. Third Edition. 1906. (*Reprinted* 1909.) 4*s.* (3*s.*)

SOMALILAND:—

Military Report on. 1907. Vol. I. Geographical, Descriptive, and Historical. 2*s.* (1*s.* 7*d.*)

Operations in, 1901-04. Official History. Vol. I. 3*s.* (2*s.* 4*d.*); Vol. II. 4*s.* (3*s.*)

SOUTH AFRICAN WAR, 1899-1902:—

Medical Arrangements. 7*s.* 6*d.* (5*s.* 6*d.*)

Medical History. An Epidemiological Essay. [Reprinted from "The Journal of the Royal Army Medical Corps."] 3*s.* 9*d.* (2*s.* 9*d.*)

Railways. 4*s.* (3*s.*)

Surgical Cases Noted. 7*s.* 6*d.* (5*s.* 6*d.*)

Telegraph Operations. 10*s.* (7*s.* 1*d.*)

Voluntary Organizations in aid of the Sick and Wounded. Report of the Central British Red Cross Committee on. 1902. 3*s.* (2*s.* 5*d.*)

SPECIAL RESERVE:—

Commission in the Special Reserve of Officers. Short Guide to obtaining a; &c. 1*d.* (1*d.*)

Regulations for Officers of the Special Reserve of Officers, and for the Special Reserve. 1911. 4*d.* (5*d.*)

Scheme for the Provision, Organization, and Training of the Special Reserve required to supplement the Regular Army, and the Application of the Scheme to the existing Militia. (Special A.O., Dec. 23, 1907.) 2*d.* (2*d.*)

Scheme for the Provision, Organization, and Training of that portion which will be drawn from the Territorial Force to supplement the Regular Army on Mobilization being ordered. (Special A.O., Nov. 20, 1908.) 2*d.* (2*d.*)

STAFF COLLEGE Regulations (Camberley). 1905. Reprinted with Amendments up to Nov. 30, 1910. 1*d.* (1*d.*)

STAFF. General. Duties of. (*Von Schellendorff.*) Fourth Edition. 1905. (*Out of print*)

STATIONS OF UNITS OF THE REGULAR FORCES, MILITIA, SPECIAL RESERVE, AND TERRITORIAL FORCE. Quarterly up to No. 45, July 1914. Each 2*d.* (2*d.*) (*Publication suspended*).

STATUTES relating to the War Office and to the Army. 1880. 5*s.* (3*s.* 9*d.*)

STATUTORY POWERS of the Secretary of State, Ordnance Branch. 1879. 5*s.* (3*s.* 9*d.*)

STEAM ENGINES AND BOILERS AND GAS AND OIL ENGINES. Management of. Notes and Memoranda. 1911. 1*d.* (1*d.*)

SUDAN ALMANAC. 1915. Compiled in the Intelligence Department, Cairo. 1*s.* (9*d.*)

SUDAN. BRITISH FORCE IN THE. Standing Orders. 1914. 9*d.* (7*d.*)

SUDAN. The Anglo-Egyptian. A Compendium prepared by Officers of the Sudan Government:—

Vol. I. Geographical, Descriptive, and Historical (*with Eighty-two Illustrations*). 10*s.* (7*s.* 4*d.*)

Vol. II. Routes. 7*s.* 6*d.* (5*s.* 5*d.*) (*Not containing Chapter VII., Supplement (A).*)

(As to prices in brackets, see top of page 2.)

SUDAN. The Anglo-Egyptian—*continued.*

Vol. II. Routes. In Separate Chapters. 1*s.* (10*d.*) each:—
I. and II., *Nil.* III. North-Eastern Sudan. IV. Eastern Sudan. V. Central Sudan. VI. South-Eastern Sudan. VII. Bahr-el-Ghazal. VIII. Kordofan. IX. North-Western Sudan.
Ditto. Chapter VII. Supplement (A). Bahr-el-Ghazal. Additional Routes. 1*s.* (10*d.*)

SUDAN CAMPAIGN. History of the. Two parts, and Maps. 1890. 15*s.* (10*s.* 11*d.*)

SUPPLY MANUAL (WAR). 1909. 6*d.* (6*d.*)

SUPPLY, REORGANIZED SYSTEMS OF, and of Ammunition Supply of the Expeditionary Force in War, consequent on the Introduction of Mechanical Transport. Memorandum explaining the. Feb. 1912. 1*d.* (1*d.*)

SUPPLY, TRANSPORT, AND BARRACK SERVICES. Regulations. 1908. 9*d.* (8*d.*) (*Under revision*)

SURVEYING. Topographical and Geographical. Text Book of. Second edition. 1913. 7*s.* 6*d.* (5*s.* 6*d.*)
Ditto. 1905. Appendix XI. Tables for the Projection of Graticules for squares on 1° side on scale of 1:250,000, and for squares on 3° side on scale of 1:125,000; with other Tables used in Projecting Maps. 4*d.* (4*d.*)
Ditto. 1905. Appendix XII. Tables for the Projection of Graticules for Maps on the scale of 1:1,000,000. 1910. 2*d.* (2*d.*)

TACTICAL RIDES AND TOURS ON THE GROUND. The Preparation and Conduct of. Translated from the German. 1*s.* 3*d.* (1*s.* 1*d.*)

TELEGRAPHY AND TELEPHONY. Army. Instruction in:—
Vol. I. Instruments. (Reprinted, with Corrections, 1914). 1*s.* 6*d.* (1*s.* 4*d.*)
Vol. II. Lines. 1909. (Reprinted, with Corrections, 1914) 1*s.* (11*d.*)

TELESCOPIC SIGHTS. Handbook. Land Service. 1904. 4*d.* (4*d.*)

TERRITORIAL FORCE. (*And see* Equipment; Establishments):—
Cadet Units in the British Isles. Regulations governing the Formation, Organization, and Administration of. 1914. (Reprinted, with Amendments in Army Orders to Dec. 1, 1914). 1*d.* (1*d.*)
Field Kits. Officers and Men. 1*d.* (1*d.*)
Hospitals, General, of the. Regulations for. 1912. 2*d.* (2*d.*)
Medical Corps. Royal Army. Syllabus of Training. 1914. 1*d.* (1*d.*)
Mobilization of a Territorial Infantry Battalion. (*Reprinted from* THE ARMY REVIEW, July 1913.) 3*d.* (3*d.*)
Nursing Service. Standing Orders. 1912. (Reprinted, with Amendments, 1914). 1*d.* (1*d.*)
Pay Duties during Embodiment. Instructions in. 2*d.* (2*d.*)
Regulations for the (including the Territorial Force Reserve), and for County Associations. 1912. (Reprinted, with Amendments published in Army Orders to Dec. 1, 1914). 6*d.* (7*d.*)
Voluntary Aid:—
Scheme for the Organization of, in England and Wales. Dec. 1910. (*Out of print*)
Ditto. Ditto. Amendments. 1*d.* (1*d.*)
Ditto, in Scotland. Oct. 1911. 2*d.* (2*d.*)
Ditto. Ditto. Amendments. 1*d.* (1*d.*)
Training. (Extracts from "Medical Corps. Royal Army. Training. 1911.") 6*d.* (7*d.*)

(As to prices in brackets, see top of page 2.)

TRACTOR TRIALS held by the Experimental Sub-Committee of the Mechanical Transport Committee at Aldershot, Sept. and Oct. 1903. Report on. 6*d.* (5*d.*)

TRAINING AND MANŒUVRE REGULATIONS. 1913. 4*d.* (5*d.*)

TRANSPORT MANUAL. Field Service. 1905. Part I. Provisional. 4*d.* (4*d.*)

TRANSPORT. MECHANICAL:—
Heavy Pontoon Bridge for use by. Provisional. 1914. 2*d.* (2*d.*)
Regulations for the Appointment of Inspectors of. 1*d.* (1*d.*)

TRANSPORT. PACK. Notes on. 1*d.* (1*d.*)

TRUMPET AND BUGLE SOUNDS for the Army. With Instructions for the Training of Trumpeters and Buglers. 1914. 9*d.* (8*d.*)

TYPHOID (ANTI-) COMMITTEE. Report. 1912. 2*s.* 6*d.* (1*s.* 11*d.*)

TYPHOID (ANTI-) INOCULATION COMMITTEE. Report on Blood Changes following Typhoid Inoculation. 1905. 1*s.* 6*d.* (1*s.* 2*d.*)

URDU-ENGLISH PRIMER. For the use of Colonial Artillery. 1899. 15*s.* (10*s.* 2*d.*)

VALISE EQUIPMENT. Instructions for Fitting:—
Pattern 1888 with pattern 1894 Pouch opening outwards. 1895. 1*d.* (1*d.*)
Bandolier pattern. 1903. 2*d.* (2*d.*)

VALPARAISO. The Capture of, in 1891. 1*s.* (10*d.*)

VENEREAL DISEASE. *See* Medical Services.

VETERINARY CORPS. Army:—
Regulations for Admission. 1910. 2*d.* (2*d.*)
Standing Orders. 1906. 4*d.* (4*d.*)

VETERINARY MANUAL (WAR). 1915. 1*d.* (1*d.*)

VETERINARY SERVICES. Army. Regulations. 1906. (Reprinted, with Amendments to Dec. 1, 1914). 3*d.* (3*d.*)

VOLUNTARY AID. *See* Territorial Force.

WAR OFFICE LIST, AND ADMINISTRATIVE DIRECTORY FOR THE BRITISH ARMY. 1914. *Sold by Harrison & Sons* 45, *Pall Mall.* 5*s. net.* (*Under revision*)

WARFARE. *See* LAND WARFARE

WATER SUPPLY MANUAL. 1*s.* 6*d.* (1*s.* 4*d.*)

WORKS MANUAL. (WAR.) 1913. 4*d.* (4*d.*); Corrections (*In the press*)

X-RAY APPARATUS. Hints regarding the Management and use of. 3*d.* (3*d.*)

YEOMANRY AND MOUNTED RIFLE TRAINING. Parts I. and II 1912. (Reprinted, with Amendments, 1915). 6*d.* (6*d.*)

ZULU WAR OF 1879. Narrative of the Field Operations connected with the. 1881. (*Reprinted* 1907.) 3*s.* (2*s.* 4*d.*)