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PW—B5

Post Office Engineering Department

TECHNICAL PAMPHLETS FOR WORKMEN

Subject

Hughes Type-printing Telegraph

ENGINEER-IN-CHIEF'S OFFICE
1919

LONDON

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LIST OF Technical Pamphlets for Workmen

GROUP A.

1. Magnetism and Electricity.
2. Primary Batteries.
3. Technical Terms.
4. Test Boards.
5. Protective Fittings.
6. Measuring and Testing Instruments.
7. Sensitivity of Apparatus.
8. Standard List of Terms and Definitions used in Telegraphy and Telephony. (*Not on sale.*)
9. Standard Graphical Symbols for Telegraphy, Telephony and Radio Communication. (*Not on sale.*)

GROUP B.

1. Elementary Principles of Telegraphy and Systems up to Morse Duplex.
2. Telegraph Concentrators.
3. Wheatstone System. Morse Keyboard Perforators.
4. Quadruplex, Quadruplex Repeated Circuits and Telegraph Repeaters, Simplex and Duplex.
5. Hughes Type-printing Telegraph.
6. Baudot Multiplex Type-printing System.
7. Western Electric Duplex Multiplex. Murray Duplex Multiplex. Siemens and Halske Automatic Type-printing System.
8. Fire Alarm Systems.

GROUP C.

1. Wireless Transmission and Reception.
2. Interference with Reception of Broadcasting.

GROUP D.

1. Elementary Principles of Telephony.
2. Telephone Transmission. "Loading." Telephone Repeaters and Thermionic Valves.
3. Principles of Telephone Exchange Signalling.
4. Magneto Exchanges—Non-Multiple Type.
5. Magneto Exchanges—Multiple Type.
6. C.B.S. No. 1 Exchanges—Non-Multiple Type.
7. C.B.S. Exchanges—Multiple Type.
8. C.B. Exchanges—No. 9 Type.
9. C.B. Exchanges—No. 10 Type.
10. C.B. Exchanges—No. 12 Type.
11. C.B. Exchanges—22 Volts.
12. C.B. Exchanges—40 Volts.
13. Trunk Telephone Exchanges.
14. Maintenance of Manual Telephone Exchanges.
15. Telephone Testing Equipment.
16. Routine Testing for Manual Telephone Exchanges.
17. Internal Cabling and Wiring.

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CORRECTION SLIP TABLE

The month and year of issue is printed at the end of each amendment in the Correction Slips, and the number of the slip in which any particular amendment is issued can, therefore, be traced from the date. In the case of short corrections made in manuscript, the date of issue of the slip should be noted against the correction.

The Summary portions of the Correction Slips should be completed and affixed below in numerical order.

CORRECTION SLIP TABLE—(contd.)

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THE HUGHES TYPE-PRINTING TELEGRAPH

(B 5.)

The following pamphlets in this series are of kindred interest :

- B 1. Elementary Principles of Telegraphy and Systems up to Morse Duplex.
- B 6. Baudot Multiplex Type-printing System.
- B 7. Western Electric Duplex Multiplex. Murray Duplex Multiplex. Siemens and Halske Automatic Type-printing System.

ADVANCED TELEGRAPHS

THE HUGHES TYPE-PRINTING TELEGRAPH

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THE HUGHES TYPE-PRINTING TELEGRAPH.

1.—GENERAL DESCRIPTION

The Hughes instrument is one of the earliest forms of printing telegraphs which use a separate key for each letter of the alphabet. The depression of any one key causes a short current of electricity to pass out to line and to actuate the printing mechanism at the other end of the line, recording in Roman characters, on a paper strip, the particular letter or figure which has been signalled.

A general view of the instrument is given in Fig. 1, from which it will be seen that the keys are of the pianoforte type. The printing is produced from a type-wheel as the result of the mechanism being actuated by the incoming signal passing through the polarised electro-magnet on the left-hand side.

It can be worked under duplex conditions with a separate instrument for reception, and can be worked either by the single current or double current method.

2.—KEYBOARD

The keyboard (Fig. 2) consists of 28 keys arranged in two rows of black and white keys, similar in appearance to the keys of a piano, except that the 14 black keys are regularly spaced between the 14 white keys. Each key is given a letter, commencing with A on the first black key on the left, and with O on the first white key on the right. The last white key on the left is blank, and is known as the "letter blank" key. It is used for giving a spacing signal between words. There is another blank white key between the keys lettered V and W, which is known as the "figure blank" key. This is used for spacing between groups of figures.

It will be seen from the illustration that every key except the blanks has two signals, viz., a letter and a figure or symbol. Letters are printed after the "letter blank" key has been used, while figures are printed after the "figure blank" key has been used. This is arranged for by shifting the type-wheel forward or backward 1-56th of a revolution.

The keys actuate pins arranged in a circle in the centre of the instrument. Over the tops and clear of the pins a rotating arm travels continuously, and when one of the pins is raised into the path of the arm, a short current is sent to the line to actuate the instrument at the other end. At the same time the movement of the arm, in passing over the pin, mechanically releases the printing mechanism at the sending end to make a home record of the outgoing signal.

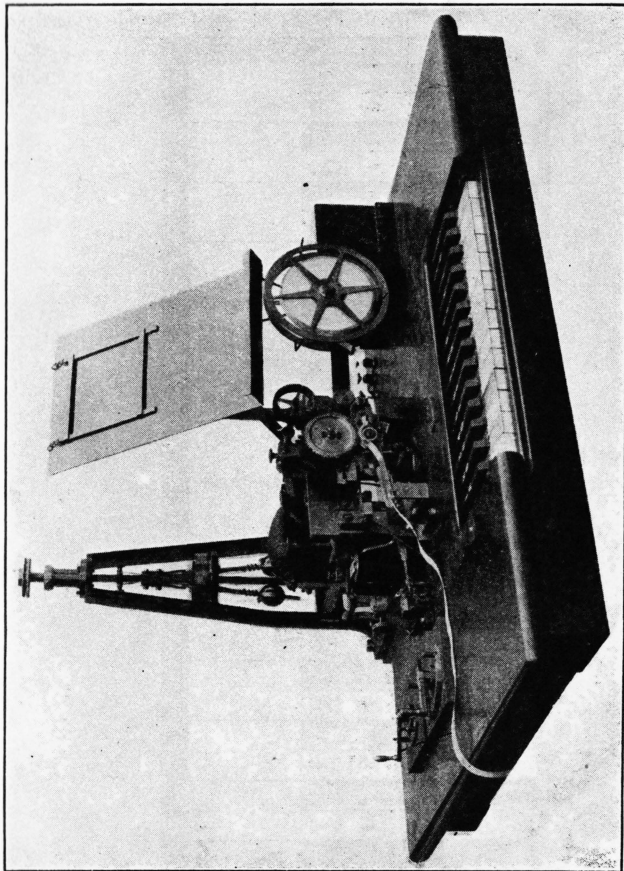


Fig 1.

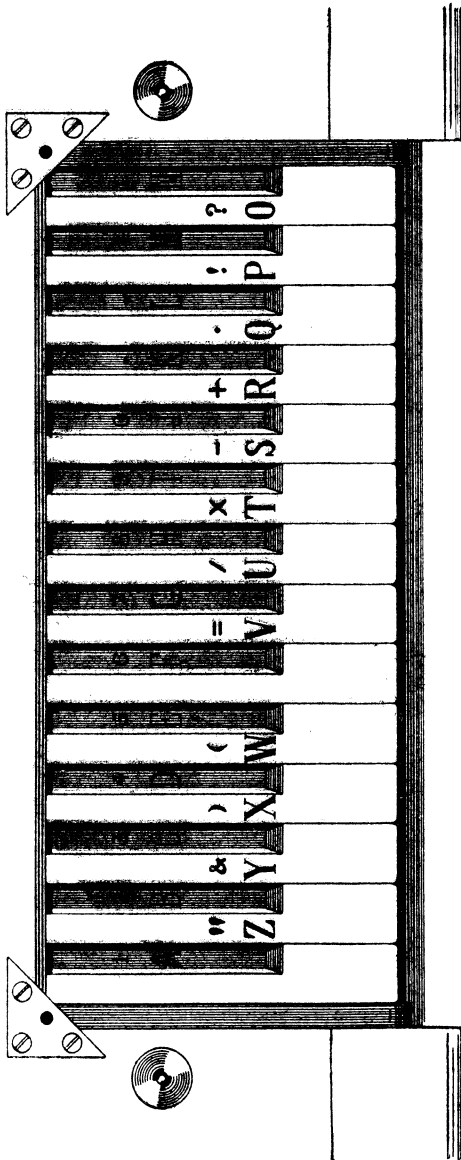


Fig. 2.

3.—PRINTING MECHANISM

The printing mechanism consists of a type-wheel carrying all the letters and signals designated on the keys, and when printing is going on, this wheel rotates in unison with the rotating arm of the sending instrument.

Ink is supplied to the rim of the type-wheel from an ink-roller, and the letters or figures are printed on a blue paper band, which is fed forward the space of one letter for each received signal. This is arranged for by the incoming signal releasing the armature of an electro-magnet, which, in turn, releases the cam of what is termed the printing axle. This latter drops into gear with the motor spindle, makes one revolution, and throws itself out of gear to be ready for the next incoming signal. In its one revolution it performs the following actions by means of various cams that it carries :—

- (1) Replaces the armature of the electro-magnet.
- (2) Prints the signal by lifting the paper against the type-wheel.
- (3) Feeds forward the paper tape while printing so as not to blur the impression.
- (4) Corrects, when necessary, the position of the type-wheel for printing.
- (5) Throws itself out of gear and comes to rest.

The printing axle movement is, therefore, one of the most important parts of the working, and as it must make one complete revolution from start to rest for each signal, it has to be capable of doing this 780 times per minute for a speed of 120 revolutions per minute of the type-wheel. The strain is therefore very heavy, resulting in considerable wear on certain portions of the mechanism, even though the best material is used.

4.—SPEED REGULATION

The rotation of the mechanism is obtained from a small electric motor driven from a 40 volt battery, and the speed of the instrument is regulated and controlled by a 2-ball friction governor at the back of the instrument. The normal speed ranges from about 110 to 122, but can be taken as high as 160 revolutions per minute. It is essential that the machines shall run at approximately the same speed, and that the type-wheels shall start from zero at the commencement of working. The former requirement is met by sending one letter, such as "A," continuously while the receiving instrument coils are cut out for 10 revolutions. If, at the end of 10 revolutions, the signal "A" is still printed, then the speed is sufficiently close, otherwise the governor must be regulated until this requirement is obtained.

5.—UNISON OF TYPE-WHEELS

The zero-starting is arranged for by the depression of a zero-setting lever at each end. This action throws out of gear the type-wheels, but does not otherwise interfere with the movement of

other portions of the mechanism. Now, if the letter-blank key be depressed at one end, the resulting signal will start both wheels rotating in proper phase, so that any subsequent letter will be recorded correctly at both ends.

6.—ADJUSTING THE ELECTRO-MAGNET

The next step after obtaining the correct speed is to adjust the sensitivity of the electro-magnet and printing mechanism. This is done by sending continuously the letter blank signal and the letters I, N, T. This gives four signals per revolution, and when they, or their equivalent, are correctly received, first by one station and then by the other, working may be commenced.

7.—OUTPUT

The output speed of working is not great, because, although the printing speed is about one word per revolution, the incidence of letters in words will not admit of more than an average of about 1·5 letters being sent per revolution. This gives an average output of about 30 words per minute for a speed of 120 revolutions per minute.

The instrument is particularly useful for figure and code messages, as the figure signals are no longer than letter signals, and there is no skilled reception. It is on this account that the instrument has found such favour on the continent of Europe and in communication between England and various continental Administrations. Owing to its low average output, the instrument is being rapidly replaced by the Baudot Duplex and its modifications, the Western Electric and Murray Duplex multiplex systems.

It did good work on the long underground cable circuits between London, Liverpool, Manchester and Glasgow as a duplex installation when it was not possible to obtain sufficient Baudot apparatus, while Morse quadruplex entailed the provision of costly repeaters, but after some 10 years' useful work on inland circuits they have all been replaced by systems of larger output.

The instruments are costly, being approximately £80 each, and for expert operating require some three months fairly concentrated practice. It needs skilled mechanical attention to regulate the various "cams," etc., but the electrical portion is exceedingly simple.

For duplex working the sending mechanism is not required on the receiving instrument. This has permitted the construction of a very portable and compact arrangement of the printing mechanism.

Owing to there being only one electric impulse per letter, the system will work either simplex or duplex on fairly long and difficult circuits, but because the printing mechanism is released on the rise of current, the duplex balance for this system requires great accuracy, otherwise wrong letters are printed.

LIST OF Technical Pamphlets for Workmen

(Continued.)

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18. Distribution Cases, M.D.F. and I.D.F.
19. Cord Repairs.
20. Superposed Circuits. Transformers. Bridging Coils and Retardation Coils.
21. Call Offices.
22. Units, Amplifying. (*Not on sale.*)

GROUP E.

1. Automatic Telephony: Step by Step Systems.
2. Automatic Telephony: Coded Call Indicator (C.C.I.) Working.
3. Automatic Telephony: Keysending "B" Positions.

GROUP F.

1. Subscribers' Apparatus. Common Battery System.
2. Subscribers' Apparatus, C.B.S. Part I—C.B.S. No. 1 System.
3. Subscribers' Apparatus. Magneto.
4. Private Branch Exchanges—Common Battery System.
5. Private Branch Exchanges—C.B. Multiple No. 9
6. Private Branch Exchanges—Magneto.
7. House Telephone Systems.
8. Wiring of Subscribers' Premises.

GROUP G.

1. Maintenance of Secondary Cells.
2. Power Plant for Telegraph and Telephone Purposes.
3. Maintenance of Power Plant for Telegraph and Telephone Purposes.
4. Telegraph Battery Power Distribution Boards.

GROUP H.

1. Open Line Construction, Part I.
2. Open Line Construction, Part II.
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4. Underground Construction, Part I—Conduits.
5. Underground Construction, Part II—Cables.
6. Underground Maintenance.
7. Cable Balancing.
8. Power Circuit Guarding.
9. Electrolytic Action on Cable Sheaths, etc.
10. Constants of Conductors used for Telegraph and Telephone Purposes.

GROUP I.

1. Submarine Cables.

GROUP K.

1. Electric Lighting.
2. Lifts.
3. Heating Systems.
4. Pneumatic Tube Systems.
5. Gas and Petrol Engines.