P.W. - B.6

Post Office Engineering Department

TECHNICAL PAMPHLETS FOR WORKMEN

Subject :

Baudot Multiplex Type-printing System

ENGINEER-IN-CHIEF'S OFFICE.

1919.

(Reprinted March. 1934, inluding Correction Slips to date)

LONDON

PUBLISHED BY HIS MAJESTY'S STATIONERY OFPICE.

To be purchased directly from H.M. STATIONERY OFFICE at the following addresses :

Adastral House, Kingsway, London, W.C.2; 120, George Sreet Edinburgh 2
York Street, Manchester 1; St. Andrew's Crescent, Cardiff
80 Chichester Street, Belfast or through any Bookseller

1934

Price 6d. Net

3-9999

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),*

GROUP B.

1. Elementary Principles of Telegraphy and Syst ems 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.
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.

|*Continued on page iii of Cover.*

BAUDOT MULTIPLEX TYPE-PRINTING SYSTEM (B.6).

The following pamphlets in this series are of kindred interest:

B.1. Elementary Principles of Telegraphy and Systems up to Morse Duplex.

B.4. Quadruplex, Quadruplex Repeated Circuits and Telegraph Repeaters, Simplex and Duplex.

B.5. Hughes' Type-printing Telegraph.

B.7. Western Electric Duplex Multiplex. Murray Duplex Multiplex. Siemens and Halske Automatic Type-printing System.

ADVANCED TELEGRAPHS.

BAUDOT TYPE-PRINTING SYSTEM.

TABLE OF CONTENTS.

ADVANCED TELEGRAPHS.

THE BAUDOT SYSTEM.

1. - INTRODUCTION.

The Baudot is a Multiplex Type-Printing Telegraph System based upon the use of a 5-unit code for the Alphabet. The signals representing a letter are sent to the line by means of a keyboard working in conjunction with a Distributor, which latter consists of a number of concentric metal rings, traversed by rotating brushes. At the Distant Station the line

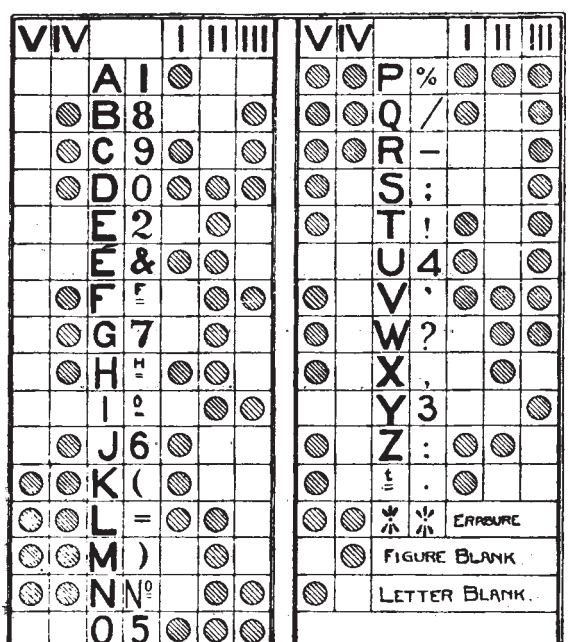


Fig 1.

currents operate a polarised relay. This relay delivers, through the medium of a second Distributor, the current impulses to the receiver, which translates them and prints the message in block letter capitals upon a blue slip practically the same as a Morse slip.

2. - BAUDOT CODE.

As already mentioned above, a 5-unit code is used for the Alphabet. In this code the signals sent to line, repre- senting the various letters of the Alphabet, are made up of combinations of positive and negative current impulses.

Each letter consists of a different combination. For instance, A is represented by - + + + +, that is, a marking impulse followed by four spacing impulses; T is represented by - + - + -, that is, alternations of marking and spacing current impulses. Similarly for the other, letters of the Alphabet. It should be noted that, although the combinations representing the letters vary according to the letter, each combination consists of 5 impulses. It is for this reason that the arrangement is known as a 5-unit code. The complete Baudot Code for Foreign circuits is given in Fig. 1, the shaded circles indicating which keys are to be depressed. For Inland Working a number of different characters is used as indicated in Fig. 1A. (See Fig. 6 for Keyboard and position of hands.)

FOREIGN	INLAND
&	½
F	5/
H	1
9	3/
Nº	£
: ;	7/
!	2
,	9/
t	—
É	/

Fig 1A

3. - MULTIPLEX PRINCIPLE.

Distributors are employed, one at each end of the line, to allow the use of the Multiplex Principle, which gives a number of operators in succession the exclusive use of the telegraph line for a short time during recurring periods. The elementary principle underlying Multiplex operation is shown diagrammatically in Fig. 2.

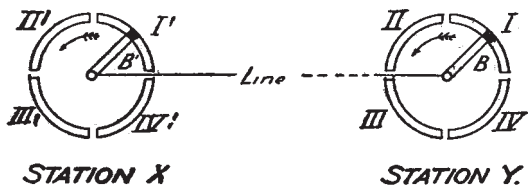


Fig 2

Referring to Fig. 2, the distributors at the Stations X and Y are represented by metal rings divided into 4 Quadrants, I, II, III, IV at Y, and I', II', III', IV' at X. B and B' are rotating brush arms connected to the line as shown. It is clear that if the brush arms start from the same relative positions (for instance, B from the beginning of Quadrant I, and B' from the beginning of Quadrant I'), and move over the rings at the same uniform rate, then Quadrant I will be connected through the line with Quadrant I', Quadrant II with Quadrant II', III with III', and IV with IV' once per revolution of the brush arms. If we assume that a signal consists of simply one impulse of current, it would be possible to transmit one signal per quadrant per revolution.

Now, in the Baudot system a signal consists of 5 current impulses, so that if, instead of having continuous quadrants, we divide each quadrant into 5 segments, it will be possible to transmit 5 current impulses, representing a letter in the Baudot Code, per quadrant per revolution.

In Fig. 3 the quadrants are shown subdivided into the 5 segments, but for the sake of simplicity, 2 quadrants only at each end are shown. The segments are insulated from one another and from the rest of the ring. At the Sending Station Y, the segments of one quadrant are shown connected to a set of 5 keys, which comprises the keyboard of one operator. At the Receiving Station X the segments are connected to a set of 5 electromagnets, which form the essential part of the translating arrangement of the receiver. The other quadrants are similarly connected. The continuous ring at Y is connected directly to the line, but at the Receiving Station X a polarised relay is introduced, and the continuous ring is connected to its tongue. The reason why a polarised relay must be used, and the con-

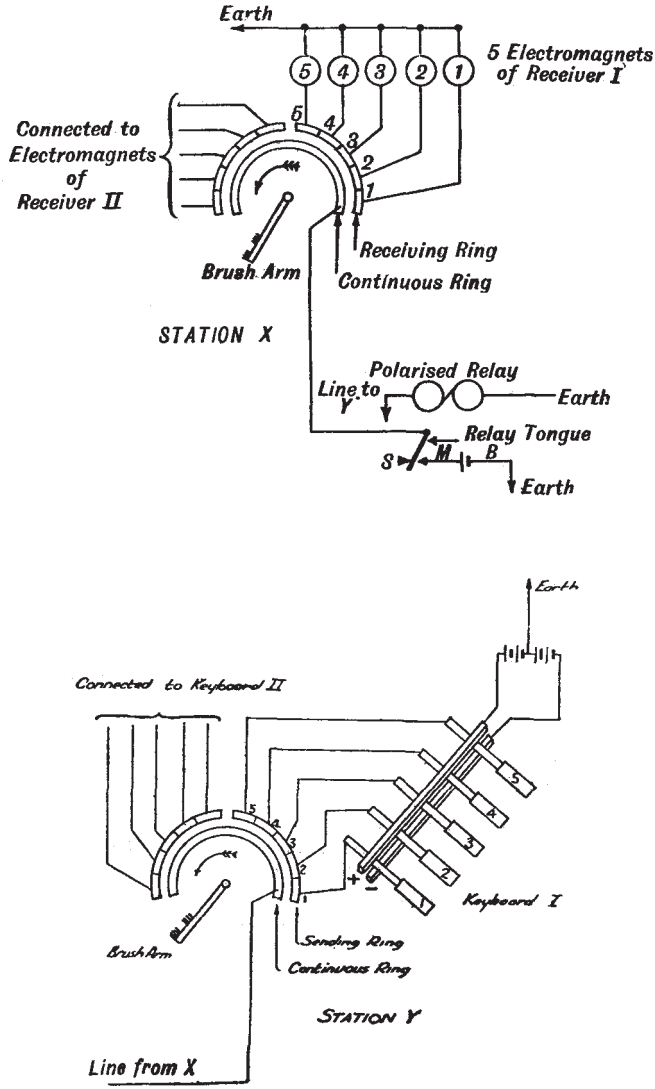

Earth
5 Electromagnets of Receiver I
Connected to Electromagnets of Receiver II
Brush Arm
Receiving Ring
Continuous Ring
STATION X
Polarised Relay
Line to Y
Earth
Relay Tongue
S
M
B
Earth
Earth
Connected to Keyboard II
Keyboard I
Brush Arm
Sending Ring
Continuous Ring
STATION Y
Line from X

Fig 3.

tinuous ring at X cannot be directly connected to the line, is because the combination of impulses representing a letter flowing over the fine consists, as already explained, of positive and negative currents. Now the electromagnets of a receiver are non-polarised - that is to say, they would be operated by both positive and negative currents - so that it would be impossible to operate them selectively if they were connected directly to the line. By connecting up, as shown, to the tongue of the polarised relay, it will be seen that, as the latter only moves over to the marking contact M when a negative current passes through it from the line, it is on such occasions only that an electromagnet of the receiver is operated, and then by means of the local battery B.

It is essential, of course, in such a system that the two brush arms at X and Y respectively should revolve in phase - that is, they should revolve at the same uniform rate, and occupy the same relative positions. For instance, if brush arm at Y is on Segment 1, which is connected to Key 1 of Keyboard 1, then the brush arm at X should be on Segment 1, which is connected to Electromagnet 1 of Receiver 1, and similarly for the other segments. This phase relationship, as it is called, should be maintained for successive revolutions. The manner in which this is brought about will be described later.

The depression of one of the keys of the keyboard simply connects the corresponding segment to the negative or marking source of current which is supplied by the split battery at Station Y. Thus, if keys 2 and 5 be depressed, then at station Y Segment 1 will be connected to positive or spacing, Segment 2 will be connected to negative or marking, Segment 3 will be connected to positive or spacing, Segment 4 will be connected to positive or spacing, Segment 5 will be connected to negative or marking.

As the brush sweeps over the segments successively, negative and positive current impulses are sent to line in the above order. At Station X the relay tongue moves to marking in response to negative currents from 2 and 5, and to spacing in response to positive currents from 1, 3 and 4. Now, as the brush at X is on the successive segments at the correct moment, the electromagnets on Segments 2 and 5 only will be actuated by the currents sent from the relay tongue.

The 5 keys and 5 electromagnets represent one arm or channel only.

It is necessary, of course, that a sending operator should know the exact moment when to depress the keys of a keyboard-that is, just before the distributor brush reaches the segments allocated to the particular keyboard. For this reason a “Cadence” signal is provided in order to warn the operator. In the older form of instruments this was a telephone receiver placed on a movable bracket near to the operator's ear. This has

now been replaced in modem instruments by an electromagnet inside the keyboard. itself. The armature of this electromagnet when operated produces a tap, which warns the operator to depress the keys. To guard against the operator allowing the keys to rise too early - namely, before the distributor brush has passed over the last of the five segments-a mechanical locking device which holds the keys down when they are depressed is provided. The keys are released automatically, by means of the "Cadence" signal, in time for the next signalling operation.

4. - MAINTAINING UNISON.

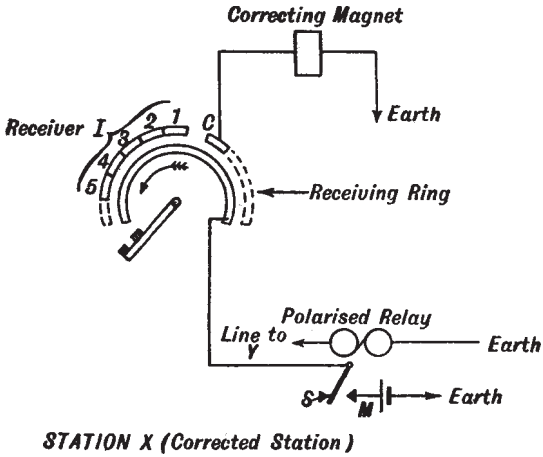
In order that the two sets of brushes may be made to rotate in unison, the first essential is that the brush arms should be driven by an arrangement which will maintain a practically constant rate of rotation. The methods of driving the brush arms will be described later. At this stage it will be assumed that the brush arms are revolving at constant rates. This being so, the method of maintaining unison is as follows:-

Fig. 4 refers.

Two segments on the sending ring at Station Y (which is called the Correcting Station) are allocated for the purpose of sending a correcting current to the Distant Station X (which is called the corrected station), one segment is connected to the positive side of the signalling battery and the other to the negative side. On the receiving ring at the corrected station a special movable segment is set aside for the reception of the correcting current.

The brush arm at the Corrected Station X is arranged to run slightly faster than the brush arm at the Correcting Station Y. The relative positions of the + and - correcting segments at Y and the correcting segment C at X are such that if the brush at Y is on the + segment and that at X is on C, then the two brushes are in phase. If, however, the brush at Y is on the negative segment when that at X is on C, then the brush arm at X is in advance of that at Y.

Now if both brush arms arrive simultaneously at + and C, the correcting magnet at X will not be operated, because the polarised relay at X only moves to marking when a negative current flows through the line from Y. After one or two revolutions the distributor brush at X will have gained on Y to such, an extent that it will pass over C while the brush arm at Y is on the negative segment. When such is the case owing to the fact


Correcting Magnet
Earth
Receiver I
3
2
1
C
4
5
Receiving Ring
Polarised Relay
Line to Y
Earth
S
M
Earth
STATION X (Corrected Station)

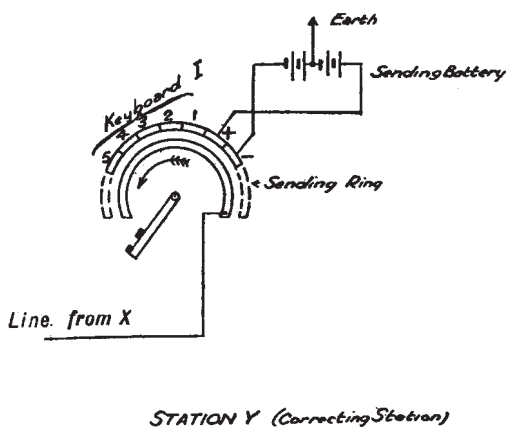

Earth
Sending Battery
1
Keyboard
4
3
2
1
+
−
5
Sending Ring
Line. from X
STATION Y (Correcting Station)

Fig 4.

that the negative, current in the line has moved the tongue of the relay to the marking stop, the correcting magnet, which is .connected to Segment C, will be operated. The armature of the correcting magnet, when operated, acts on the driving mechanism of the distributor brushes, and momentarily uncouples the brushes from the driving mechanism, so that the phase relationship of the brushes is restored.

The armature of the correcting magnet is restored to its normal position mechanically by means of a cam on the spindle carrying the brush arm.

Turning, now, to the apparatus in detail, there are three principal parts - namely, the distributor, the keyboard, and the receiver. These are briefly described below :

5. - THE DISTRIBUTOR.

There are two kinds of distributor in use for correcting and corrected stations. Distributors are also distinguished from each other by their driving mechanism. In the older form the motive power is supplied by a descending weight acting through a system of pulleys and gear wheels. The instrument is in two parts, known as the base and the top. The base contains the weight-driving gear, and the top the metal rings which are traversed by the brushes and also the correcting mechanism. Theoretically the weight-drive should give a constant distributor speed. In practice, however, owing to the variable nature of the friction encountered in the driving mechanism, the tendency towards variation of speed would be so great as to render multiplex working very unsatisfactory unless some means were taken to prevent it. The trouble is overcome by fixing a centrifugal governor on the fastest running axle of the distributor (where its governing effect is at a maximum). The governor acts by increasing or decreasing the frictional resistances of the driving mechanism, as the speed tends to rise or fall through any cause. By so doing the net amount of energy available for driving the rotating masses of the distributor is kept constant, and the speed variation is consequently kept within very small limits.

An alternative method of driving Baudot distributors is the Phonic wheel drive. It has proved to be so steady that there is no need for any governing device to ensure uniformity in the speed of running. In the Phonic wheel distributor the base containing the weight-drive and governor is not required, but the top, with its mechanism slightly modified, is the same. The Phonic wheel itself consists simply of a toothed iron wheel, which is kept in rotation by the magnetic attractions of electromagnets. The diagrammatic connections of the Phonic wheel motor and its auxiliaries are shown in Fig. 5.

The vibrating reed acts upon the principle of the trembler bell. The vibration of the reed energises the Phonic wheel magnets A and B alter-

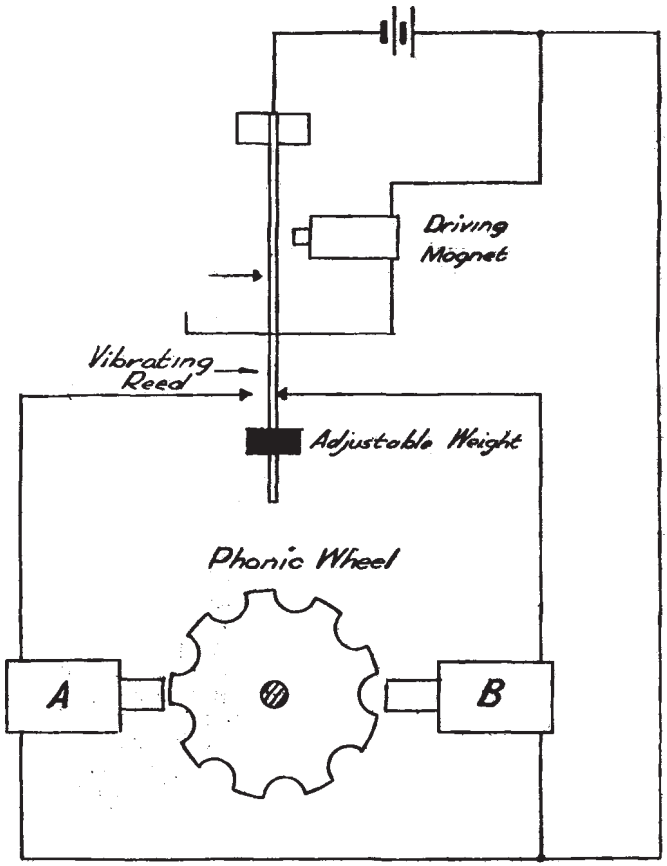


Fig 5.

nately, and keeps the wheel moving steadily once it has been set in motion by hand. The axle of the Phonic wheel. is directly connected to the axle of the distributor, which carries the brush arms.

The speed of the Phonic wheel motor depends solely upon the rate of vibration of the reed which drives it, and so long as the current impulses passing through the magnets A and B are sufficiently strong, small variations in the strength of the impulses will have practically no effect upon the speed.

The rate of vibration of the reed may be controlled, however, by means of adjustable weights.

In both forms of distributor the top is equipped with two ebonite discs, one on the front and- one on the back. Each of these discs or plates carries six contact rings, some of which are continuous, and others are cut up into segments. The electrical connections are made by means of brass screws, which pass through the 'back of the ebonite discs into the various segments or rings, and cables are led therefrom to a connection case on the desk, where they may be connected with other cables going to the various keyboards, receivers, etc. A spindle passes through the centre: of both discs and supports at each end brush carrying arms, which are fitted with silver solder with a steel stiffener lightly touching the metal rings. There are three pairs' of brushes for each plate. In each case one pair of brushes connects rings 1 and 4, another, 2 and 5, and the third, 3 and 6.

The rings on each plate are uniformly numbered from 1 to 6; 1 is the outer and 6 the innermost ring, -adjacent to the driving axle.

The distributor brushes at the correcting station are generally arranged to- run at 180 revolutions per minute, whilst those at the corrected station run at 180½ to 181 revolutions per minute: The above speed is equivalent to 30 words per minute per arm or channel.

The actual segments on the receiving ring of the distributor are shortened to half the length of the sending segments in order to render the system less subject to the effect of inductive disturbances. The whole of the receiving and sending plates are mounted in such a manner. that they may be rotated independently of each other. This allows of the receiving plate, for instance, being "orientated" - that is, rotated clockwise, or anticlockwise - in 'order to get the receiving segments (Ring 1) into the best position for reception.

A new type of Distributor known as Distributor, Baudot, No. 4 is now being introduced, and will eventually replace the whole of the Distributors previously described.

Distributor, Baudot, No. 4. - The Train and Base are in two parts, the upper portion, known as the Distributor Train Baudot, is similar in all respects to that used with the weight-driven distributor including the mechanical correction mechanism and the correcting coils. The lower portion, known as the Distributor Base, for_ Distributor, Baudot, No. 4, consists of an iron framework C, Fig. 5A, carrying the electric motor. M and the cylindrical brass frame enclosing the mechanism of the combined clutch and governor.

The Motor M, develops 1/20 H.P., at 3,500 revolutions, and is supplied with current at 110 volts. It drives the pulley P, by means of a twisted cotton-tape belt, at a speed always greater than that required for the axle A.

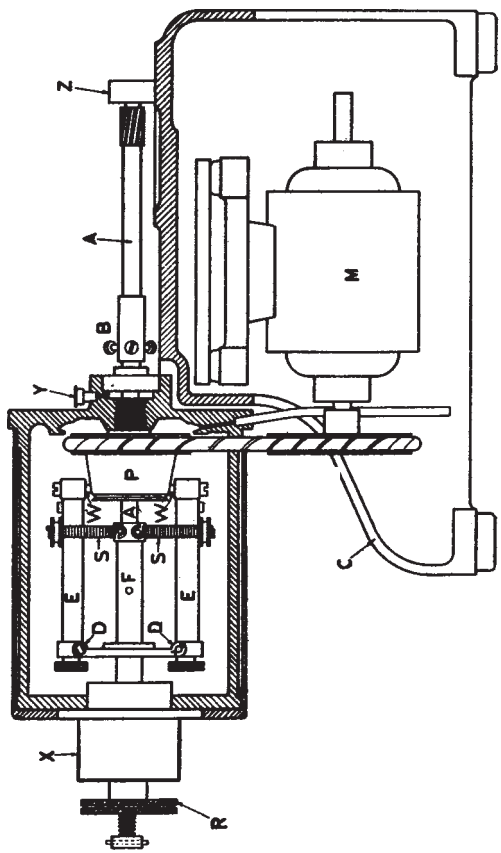


FIG. 5A.—Distributor, Baudot, No. 4. Base.

The Clutch, which is the means for transmitting the rotation of the pulley P to the axle A, consists of the conical extension forming part of the pulley P, the thin steel conical sleeve covering the extension, and the two small wooden blocks W, which are pressed against the highly polished surface of the conical sleeve.

The Pulley P, with its conical extension, is mounted upon ball bearings. and has no direct driving connection with the axle A.

The Governor consists of the two weighted arms E, supported at the two pivots D of the cross-arm portion of the sleeve F. Two friction blocks or rubbers W, fitted one at each free end of the two arms. E, are pressed against the conical extension of the pulley P, by the tension in the spiral springs S. The sleeve F is capable of sliding lengthwise on the axle A, but is keyed to turn with it. Thus, the rotation of the pulley p is imparted to the arms E, thence to the sleeve F, and to the axle A, which passes freely through the pulley P to the coupling B, where it is extended by the rear portion carrying the helical pinion for gearing with the distributor train.

The principle of the Governor is based upon the provision of a means for partially freeing the distributor mechanism from the driving motor, by allowing slip to take place at. the critical speed required for the correct working of the distributor train. Hence the speed of the motor is arranged to be always .somewhat faster than that needed, and it may then vary to some extent without disturbing the correct speed of the distributor. This factor allows for some variation in the power supply to the motor, as well as in the friction of the motor brushes or in the bearings. Upon starting the motor, the governor turns at the same speed as the pulley P, because there is then no slipping at the rubbers W. As the speed of the pulley increases, the tendency of the levers E to fly outwards also increases until the springs S begin to extend, and the friction of the rubbers W on the conical surface is lessened, thereby allowing the pulley P to run more or less freely. No further driving force can then be imparted, until the speed of the axle A has fallen sufficiently to allow the rubbers W to increase their pressure on the conical surface. The rate of rotation at which slipping occurs is sufficiently critical to enable a constant speed to be maintained on the distributor train. The speed of the pulley P must not be allowed to fall below the required speed of the axle A, as the governor only corrects for excessive speed. The critical speed at which slipping occurs may be varied, while the instrument is running, by turning the regulating screw R. The range of variation thus obtainable is about 30 revolutions of the brush-arms, e.g., 165 to 195, or 200 to 230 revolutions, according to the required speed. Further changes may be obtained by suitably readjusting the tension of the spiral springs S, and by turning the milled screws at the pivoted ends of the arms E : this latter action shifts the positions of the sliding weights fitted inside the arms. Both

these adjustments alter the speed" at which slipping occurs, while the final adjustment is made by shifting the position of the rubbers on the conical surface by turning the adjusting screw R. The position of the rubbers W is arranged to be approximately at the middle of the face o£ the cone.

6. - THE KEYBOARD.

This consists of 5 keys somewhat similar in appearance to the keys of a piano. Each key has a vertical flat spring fitted to it, which normally makes contact with the spacing side of the battery. When a key is depressed contact is made with the marking side of the battery. Each vertical spring is connected to its particular segment of the sending ring of the distributor. To form the Baudot Alphabet, one or more keys are depressed, the combination thus formed providing a letter or figure. Fig. 6 shows the

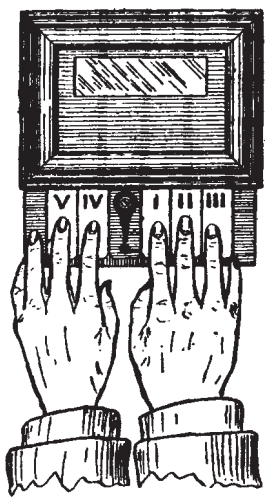


Fig 6.

manner in which the keyboard is manipulated by the fingers of both hands. In the latest type of keyboard the 5 keys when depressed are held down mechanically by 5 separate hooks. The keys are released by the passage of the cadence current through the cadence electromagnet. The keys are restored to their normal positions by means of helical springs.

NOTE.-The flat fingered method of sending shown Fig. 6 is not now favoured; a more free style is adopted.

Fig. 7 shows the manner in which a depressed key is held down by hook B. The passage of the cadence current through the magnet M attracts the armature R. R strikes stop P, giving warning signal to the opera-

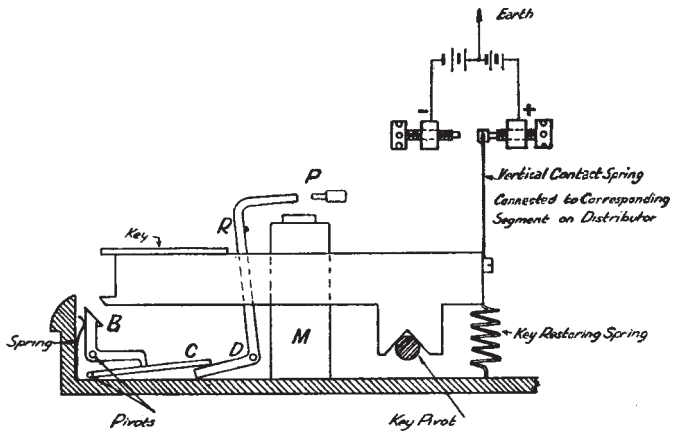


Fig 7.

tor; at the same time the extension D of R rises and lifts the pivoted lever C. When C rises it throws back the hook B and allows key to rise.

7. - THE RECEIVER.

The present form of Baudot receiver is motor driven, and consists of two parts -.

(a) The base containing the driving motor, a slide resistance for varying its speed within small limits, a starting switch, a flywheel, a friction brake operated by an electromagnet, and a friction governor for controlling the speed of the receiver.

The latest form of Baudot receiver is not fitted with a slide resistance or tumbler switch in the base. The motor switch. is fitted on the instrument table. The top is fixed permanently to the base and the electrical connections for the various electromagnets are carried through a cord to a plug which fits into a Jack No. 28 on the table.

(b) The top containing the five electromagnets, selecting mechanism, and the printing gear.

In the new instruments these two parts will be made as one.

The top is mechanically coupled with the electric motor by means of a belt drive, and gears with the mechanism of the base when it. is placed in position. At the same time, the electrical connections for the various electromagnets are made automatically by brass connecting strips, which make a pressure contact with the metal pins passing through the ebonite strip on the left-hand side of the receiver base.

Unless some means are taken to control the speed of the receiver, and bring it into some definite phase relationship with regard to the distributor, wrong letters are liable to be printed on the former. Fig. 8 illustrates the method adopted to ensure synchronism between the receiver and distributor.

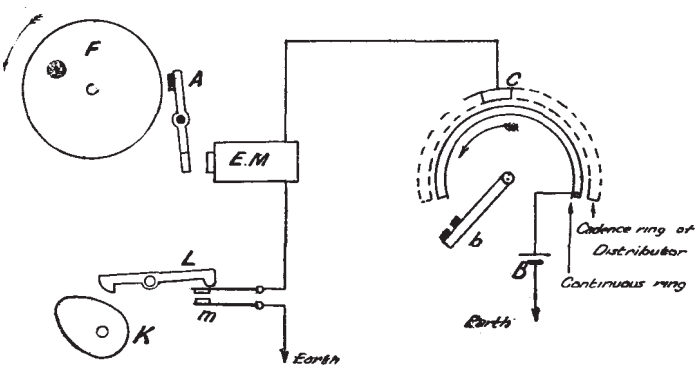


Fig 8.

The shaft of the receiver carries a cam K, which, by operating the pivoted lever L, closes the contact springs m once in a revolution. When this coincides with the passage of the brushes b over the brake segment C, a circuit is completed through the brake electromagnet EM, from the battery B. The electromagnet EM attracts its armature, and applies a cork brake block to the rim of the flywheel F, the axle of which gears with the mechanism of the receiver; the speed of the receiver is thus reduced. The receiver is set to run about 3 revolutions per minute faster than the distributor. It is clear that the receiver at first gains on the distributor, but quickly reaches a stage where it can advance no further owing to the brake coming into action. It therefore runs at approximately the same speed as the distributor. In order to secure that the printer shall run at the same speed whether it is printing or running free (when the resistance to its motion is less), a friction governor, sometimes called the moderator, is

fixed to the axle of the flywheel. It is similar in appearance to the distributor regulator, and its principle is the same. A stiff brake pad is fixed to its revolving weight, and rubs against a fixed, shallow, concave disc surrounding the axle. If the speed tends to increase, the weight flies outwards and increases the friction on the disc; if the speed decreases, as when printing takes place, the weight moves inwards, and the friction on the disc is reduced,

On the same axle as the type wheel of the receiver are fixed two discs, the rims of which contain notches. These notches or hollows are arranged in accordance with the Baudot Code, the front disc containing notches corresponding to marking units and the back disc notches corresponding to spacing units. For instance, for letter A the notches on that particular part of the discs set aside for its translation are arranged as in Fig. 9.

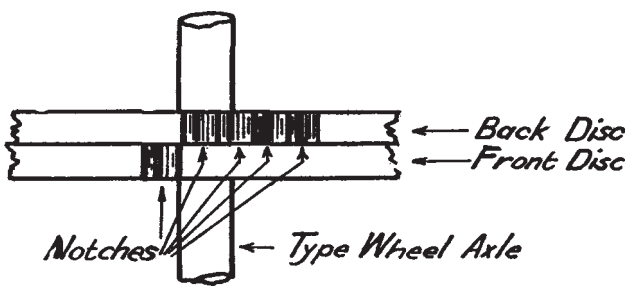


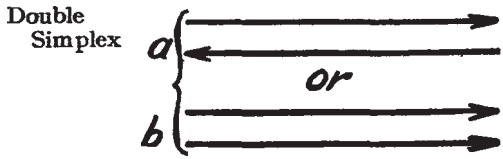
Fig 9.

The 5 electromagnets of the receiver, according to whether they are operated or not, cause the ends of selecting levers to fall into the rims of the front or back discs respectively. At a particular part of the revolution of the discs (and type wheel) the ends of the levers fall into the corresponding combination of notches, they are immediately jerked out again by the unevenness of the succeeding portions of the discs. This jerk has the effect of releasing the gear for printing the letter, the type wheel being so arranged that the letter selected is in the correct position for printing at the right moment. The printing gear and the various levers associated with the selection are all restored mechanically.

On the type wheel letters and figures are arranged alternately, and the wheel is changed from letters to figures and back again by means of special signals in a manner similar to that adopted in the Hughes instrument.

8. - TYPES OF BAUDOT INSTALLATIONS.

Figs. 10, 11 and 12 illustrate the different types.



(b) Necessitates reversing at intervals.

Fig 10.

On the Continent the Baudot has been worked mainly as a simplex system, giving one or more channels in each direction on one wire. The majority of the busy lines are equipped as Quadruple Simplex, but there are two cases of Sextuple Simplex on two wires, giving 6 channels all in one direction on each wire.

Fig 11.

The second channel is used in either direction, according to requirements.

Quadruple Simplex.

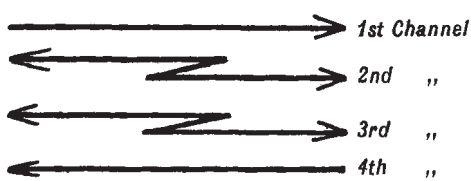


Fig 12.

The 2nd and 3rd channels are worked according to traffic requirements. This set can therefore give 2 channels in each direction, or 3 in one direction and 1 in the other.

For British Post Office work the Simplex Baudot is used on Continental circuits only, whilst on Inland circuits all Baudot sets are worked under duplex conditions, giving the following channels

Double Duplex (2 channels in each direction). Triple Duplex (3 channels in each direction). Quadruple Duplex (4 channels in each direction). Quintuple Duplex (5 channels in each direction). Sextuple Duplex (6 channels' in each direction).

The system is well suited for omnibus working-that is, for providing direct communication between a number of towns on one line. For in-

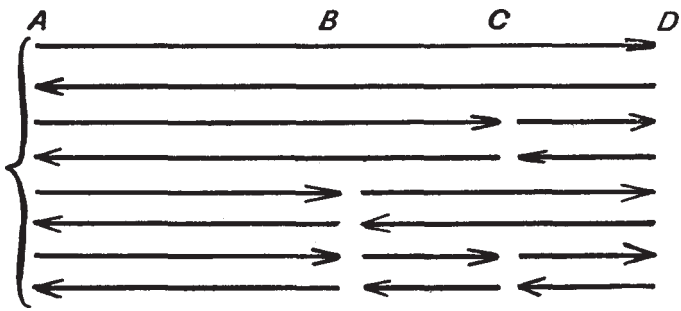


Fig 13.

stance, one Quadruple Duplex would provide the channels shown in Fig. 13.

A-D	...	...	2 channels
A-C	...	...	2 "
C-D	..	...	4 "
A-B	...	...	4 "
B-C	...	...	2 "
B-D	...	...	2 "

Similarly Quintuple Duplex and Sextuple Duplex apparatus may be used to provide for more than 4 stations on one line.

The omnibus method of working has been brought into use in the British Post Office by what is known as the "Three Station Baudot." Communication is maintained between 3 stations A, B and C, the signals between the terminal stations A and C being repeated by means of re-transmitters at Station B.

9. - HOW TO LEARN BAUDOT OPERATING.

Baudot operating can be learned in a fraction of the time required to learn Morse working. There is no skilled reception, such as sounder or

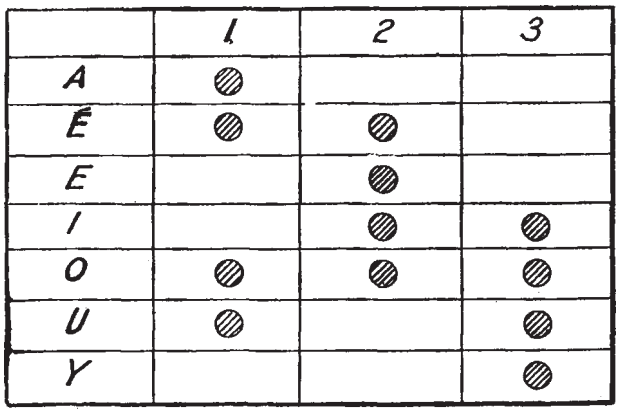


Fig 14.

slip reading, as in Morse. There are no long and short signals to be made accurately. Only two things are necessary :- (1) the correct selection of the fingers, (2) the correct timing of the depression of the keys.

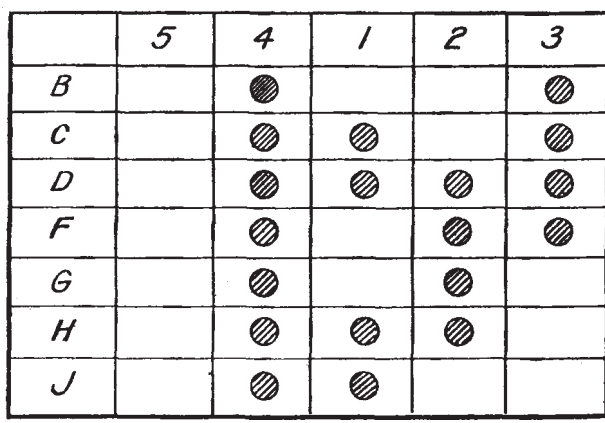


Fig 15.

For practice purposes it is not necessary to have a keyboard. Five pieces of paper on a wooden block are quite sufficient. The next step is to

learn the vowels, which are formed by the 3 fingers of the right hand, as shown in Fig. 14. These can be memorised- in a few minutes.

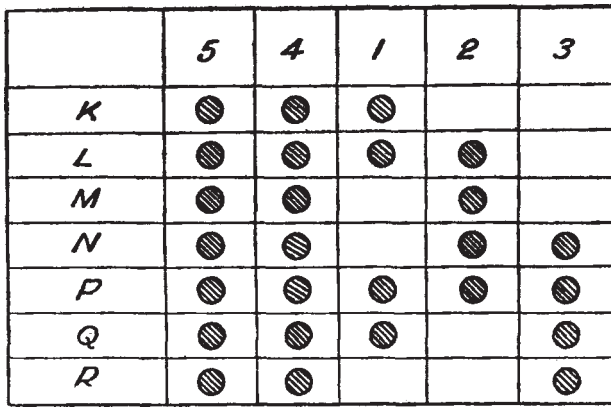


Fig 15.

The first 7 consonants are formed by key 4, operated by the first finger of the left hand, added to the vowels, but commencing with "Y" (Fig. 15). The next 7 consonants are formed by keys 4 and 5, added to the

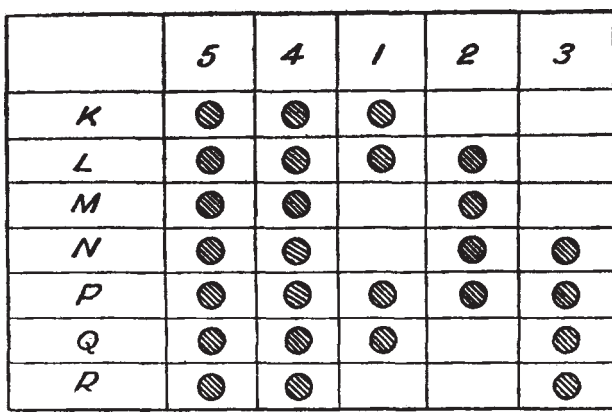


Fig 16.

vowels in Fig. 14 in a descending order, as in Fig. 16; and the last 7 consonants are formed by the use of key 5, added to the vowels in Fig. 14 in an upward direction, as in Fig. 17.

It has been said that the whole code has been learned in 5 minutes and correct operating in 30 minutes by following the simple procedure outlined above.

At the beginning the fingers should be made to select the required keys quite slowly and quite independently of any cadence, but correctly, and after a little practice from a newspaper it will be found that the speed of selecting rapidly increases. With continued practice this speed very soon exceeds the required working speed of 3 letters per second, or 180 per minute. When this speed has been exceeded, then, and then only, should a trial be made on an actual keyboard with the cadence, and it will be found that the operator almost immediately reduces his speed to the cadence, and sends correctly without difficulty:

Should a keyboard not be available, a metronome, or clock, can be utilised to give the speed for practice purposes.

Many operators have taught themselves to send correctly at the required speed without the use of a Baudot keyboard.

10. - AUTOMATIC BAUDOT.

Automatic Baudot working has been introduced on a number of foreign and inland circuits, and its use is likely to be extended. This arrangement allows the speed of the distributor to be increased from 180 to 210 or more revolutions a minute, to give a working speed of 35 words, or more, a minute on each channel.

For transmission the keyboard is replaced by an automatic transmitter (Transmitter Multiplex No. 1, B.N.) the signals from which are controlled by a perforated tape prepared by means of a keyboard perforator.

Reception is carried out under the same conditions as in manual working, and the only necessary alteration to the Receiver is the adjustment of the moderator to suit the increased speed of working.

Printed under the authority of His Majesty's Stationery Office
By Eyre and Spottiswoode Limited, East Harding Street, E C. 4,
Printers to the King's most Excellent Majesty.
Digital recreation by Sam Hallas June 2008
from an original provided by Bob Fastner

24z (318)7896 Wt 1930-599 2125 3/34

LIST OF
Technical Pamphlets for Workmen.
(Continued)

GROUP E.

1. Automatic Telephony: Step by Step Systems.
2. Automatic Telephony-: Coder 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 1-C.B.S. No. I 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 Telephones.
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 1.
2. Open Line Construction, Part II.
3. Open Line Maintenance.
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.