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Colin Hinson
In the village of Blunham, Bedfordshire, UK.

INSTRUCTION BOOKLET No. 38

THE TELEPRINTER

MODEL 3A

(COMBINED TRANSMITTER—PRINTER.)

CREED

CREED & COMPANY LIMITED,
Telegraph Engineers,
CROYDON ——— SURREY.

THE CREED TYPEWRITING BY TELEGRAPH SERVICE.

THE TELEPRINTER

3A

(COMBINED TRANSMITTER PRINTER.)

INSTRUCTION BOOKLET

No. 38.

(SECOND EDITION)

CREED & COMPANY LIMITED,
Telegraph Engineers,
CROYDON——————SURREY.

Telegrams : "CREDO, PHONE, CROYDON."
Cables : "CREDO, CROYDON."
Telephone : CROYDON 2121 (4 lines).

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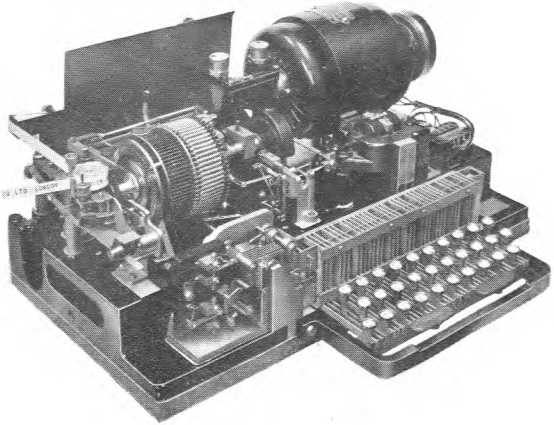
THE TELEPRINTER 3A

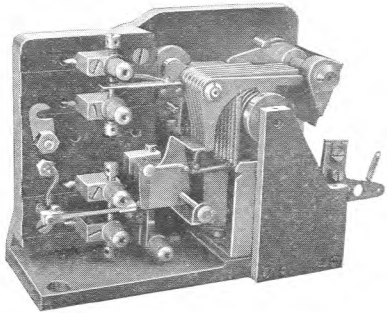


COVER OFF.

COMPLETE MACHINE.

Fig. 1A.

THE TELEPRINTER 5A



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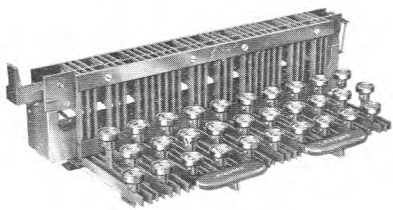

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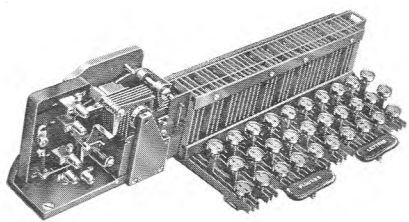


KEYBOARD AND TRANSMITTER SECTIONS COMPLETE.

Fig. 1B.

TELEPRINTER MODEL 3A

This booklet describes the operation of, and adjustments necessary for, the combined transmitter and printer, MODEL 3A.

This apparatus uses the 5-unit code, each letter of which is formed by a combination of five signals of equal length, which may be differentiated either by reversals of polarity, or by a rise from Zero to Positive or Negative. Each combination of signals is preceded by a " Start " and followed by a " Stop " signal, these signals being necessary to operate the Printer, which starts and stops for each letter printed, and for this reason comes under the heading of " Start-Stop " Printers.

Since there are only thirty-two possible combinations of the 5-unit code, the numerals and other special signals are operated by the same combination as that employed for letters, the change being accomplished by a signal called the " Figure Shift." The change from figures to letters is accomplished by a signal called the " Letter Shift." These shift signals are sent by means of spacing keys on the Keyboard, and alter the combination arrangement of the Printer so that the desired character is printed.

SPEED OF WORKING.

Teleprinters are usually set to work at a speed of 66 words per minute which corresponds to about 25 cycles per second on the line. The keyboard can be operated up to this speed. In practice, it is found that a skilful operator can transmit for long periods at a speed of 50 to 60 words per minute ; an average operator can easily maintain 40 to 50 words per minute.

TYPES.

Two type faces are available, and special characters can be fitted to the keys and typehead to suit individual customers.

CURRENT CONSUMPTION.

The driving motor consumes about 70 watts, i.e., it will run for about 14 hours per B. of T. Unit. An automatic starting and stopping device is fitted which stops the motor should no signals be received during a period of about a minute.

LINE CURRENT.

The Teleprinter can be worked with double or single current, simplex or duplex, on any wire with earth return or copper loop.

The polarised Power Relay on the instrument requires about 25 milliamperes to operate it, and has been found satisfactory for working direct on lines up to 100 miles in length. For longer lines the Creed 27 Model Line Relay ($25^{v}-25^{v}$) can be inserted, and the instrument connected in the local circuit.

The line current may be taken from an ordinary earthed battery, or Post Office power leads. The resistance of the Teleprinter Relay coils is 50 ohms, and the inductance about 2 henries.

SYNCHRONISM.

Synchronism between the instruments at each station is not essential. The term "Start-Stop" is descriptive of the principle of the apparatus. Unison of speeds between the transmitting and receiving instruments is maintained by starting the mechanism of each machine at the beginning of each group of signals and stopping it at the end of the same; thus, any difference in speed between the two machines is corrected after every revolution of the cam, i.e., once for each letter, and cannot accumulate.

The instruments are driven by electric motors fitted with speed governors. Usually they are supplied for 110v. or 220v. direct current, but motors can be supplied for practically any electric supply.

TAPE.

The Teleprinter prints on a paper tape which may be $\frac{1}{2}''$ or $\frac{3}{8}''$ wide as desired, and provision is made for using either width of tape. A reel of tape will be sufficient for printing about 16,000 words. Tape from the machine, after printing, is gummed or pasted on a form. If desired, tape already gummed on the back, may be used. Small instruments for moistening the tape or applying gum, can be supplied.

INK.

Ink is applied to the types by means of a small Blick pattern ink roller. These are supplied in sealed bottles containing 100, and can be had in black, purple, or purple copying. The ink roller lasts approximately 12 hours.

LUBRICATION.

The machine should be kept well oiled with a good quality medium oil. We recommend Wakefield's Castrol A.A. Fill the large lubricators at least once a day, at the same time apply a small amount of oil to those parts which have oil holes drilled in them, and to those smaller bearings not necessarily provided with oil holes, as on the trip shaft bearings and the feed pawl pin which pivots in the feed lever. A small quantity of oil should also be applied to the cam surfaces and rollers.

Keep oil away from the type-head, otherwise it will cause bad printing. The motor has ballraces which are packed with grease, and should not require attention for at least twelve months, when the bearings may be cleaned out and repacked with a good quality grease.

SPACE.

The space occupied by the machine is about 20″ long 18″ wide, height 10″. It is fitted with a solid cover which makes it practically noiseless. This cover is made to hinge backwards, but should this be inconvenient from the point of view of other apparatus at the back of the machine, provision has been made whereby the cover can be lifted off vertically.

The instrument does not require fixing to, and there is no need for cutting the tables. Connections are made by means of a plug and socket or terminal strip, as desired.

PACKING.

For safety in transport the driving motors are removed from the instruments. They are labelled to correspond with the machines on which they have been tested, and if the correct motor is replaced there should be no need for any adiustment.

TO ASSEMBLE THE DRIVING MOTOR.

Hold the motor with both hands, with the holding-down bolt pointing downwards, and lower it into position carefully on to the four adjusting pillars, so that the coupling on the end of the motor spindle is in line with the coupling on the machine. Between the two couplings a leather disc is inserted.

The nut must then be placed on the holding-down bolt. This can be done by holding the motor in position with the left hand, raising the base of the machine and then placing the nut in position. Alternatively, the machine can be slid over the edge of the table while this is being done. Clamp the nut with a spanner lightly, and then ascertain that the couplings are approximately in line and the motor free to revolve. Should this be the case the nut can be tightened permanently.

Should the couplings not align well, alter the position of the motor by means of the adjusting pillars until the alignment is correct.

SPEED.

The speed of the machine is controlled by a Governor on the end of the motor spindle. The speed of this Governor is accurately set before the machine leaves our Works, and it is recommended that no attempt should be made to alter it in any way. On one of the gear wheels will be found a white spot. A stroboscope or vibrating reed is supplied, the reed being fixed to the inside of a tube, and made to vibrate by a touch of the finger. The speed of the instruments may be observed by looking through the slit in the stroboscope at the white spot on the above-mentioned disc. When the white spot appears to be stationary, the speed is correct. If the spot seems to move in a clockwise direction, the machine is going too fast. When it moves in the opposite direction, the speed of the machine is too slow. (See notes under " Governor "). If the stroboscope is held in the hand it will be found that the longest vibration of the reed is obtained if the tube is grasped near the top.

STARTING.

The standard machine is fitted with a starting and stopping device, i.e., an Automatic Switch, which starts the motor on

receipt of the first signal and stops it if no signals are received or transmitted for a space of from half to three-quarters of a minute.

To start the machine the switch on the left-hand side of the base should be pressed down and on receipt of signals from the distant Transmitter, the machine will start up of its own accord.

To start the machine for transmitting purposes, press down the switch as mentioned above, and then depress any key. This operates the starting device, causing the motor to start up.

It should be noted that if a starting device is fitted, care should be taken that the switch is in the "off" position while the mechanism of the Printer is being handled, as otherwise injury to the fingers may result through the machine being accidentally started.

TO FEED THE TAPE.

Place the roll of tape on the wheel so that it will unwind in an anti-clockwise direction, looking from the front. Then take it through the guide and over the roller on the side of the tape wheel support, and thence through the tape guide (C) of the Printing Carriage, Fig. 2, round the Platen (P) and under the Roller (W), see also Fig. 3.

An elevation of the carriage is shown in Fig. 2. The paper tape is threaded through the guide pillar (C) and around the Platen (P), and then between the Platen and the Pressure Wheel (W). The Platen is revolved by means of the Feed Pawl (F.P.) working in the Ratchet Wheel (R). Each movement of the printer cam operates the feed pawl, drawing one tooth of the ratchet wheel forward, this being equivalent to one letter space.

The carriage may be moved out of the way of the type-head by depressing the Lever (S.B.), and pulling it forward. The Lever (S.B.) lies in a slot in the screw (S). By turning this screw the carriage may be moved in or out so as to alter the distance between the face of the Platen (P.) and the Printer type-head. It should be set so that there is about 1/32" clearance between the paper and the type.

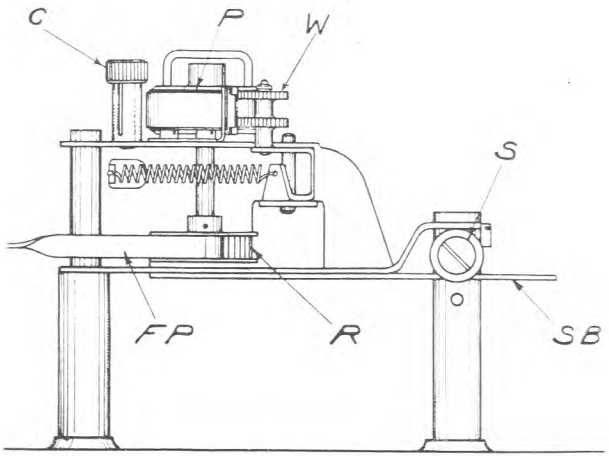


Fig. 2.

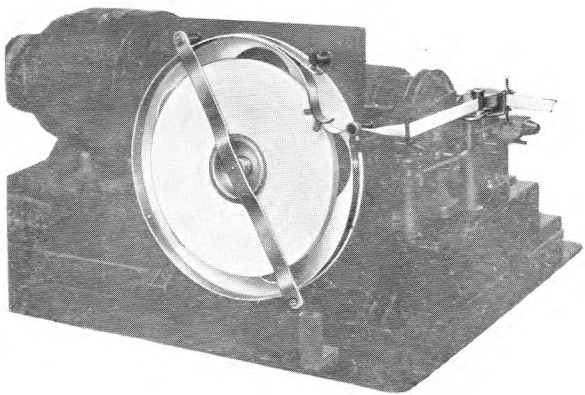


Fig. 3.

ARRANGEMENT OF TAPE FEED.

The guide pillar (C.) has a knurled top which may be removed ; it is spring-tight, and should be set the exact width of the paper, so as to keep the latter from rising.

The inking of the types is carried out by means of small ink rollers which are supplied in bottles ready for use. To place the ink roller in position it is only necessary to swing open the printing carriage by means of the Lever (S.B., Fig. 2). Use tweezers to transfer ink rollers from bottle in which they are supplied to pin in front of type-head which acts as pivot upon which roller revolves.

Provision is made for using two ink rollers, which give a better impression, but the machine will work satisfactorily with one only. Replace the printing carriage after changing ink roller.

CONNECTIONS.

The standard machine is fitted with a plug and socket, the cord of which terminates with a connection strip. Fig. 4 shows the external connections to be made from this connection strip to suit different purposes.

The internal connections of the machine are shown in Figs. 5 and 6.

Provision is made for connecting either 110v. or 220v. D.C. shunt motors without alteration to the wiring of the base. The leads from each motor terminate in a connection strip having four projecting pins to engage with a similar connection strip on the base of the machine. By changing the position of the pins, as indicated in the diagram, the correct resistance for the voltage in use is inserted in series with the field of the motor and shunted by the Governor.

The P.O. pattern machine is not provided with a plug and socket, but has a connection strip fitted to the base of the machine. The internal connections are shown in Fig 7 in which the motor connections are for a 220v. motor. Fig. 8 shows the connections for a 110v. motor.

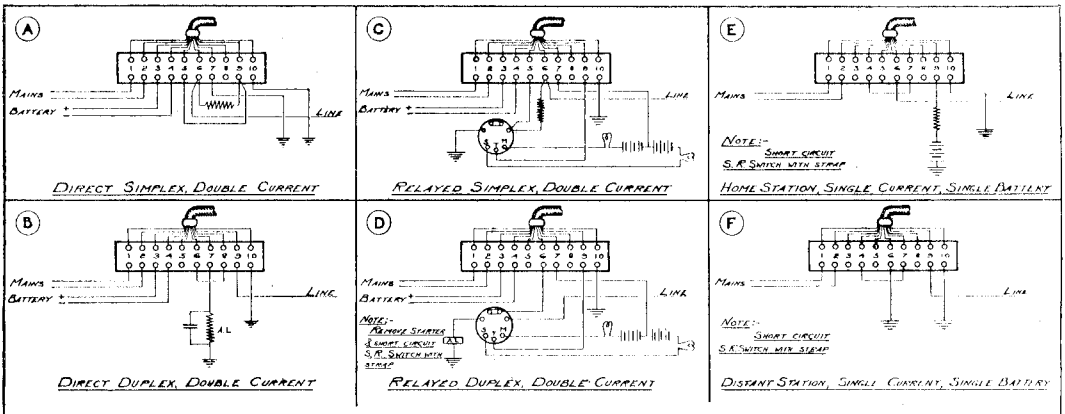


Fig. 4. External Connections for Standard Machines.

A. Direct Simplex Double Current.

B. Direct Duplex Double Current.

C. Relayed Simplex Double Current.

D. Relayed Duplex Double Current.

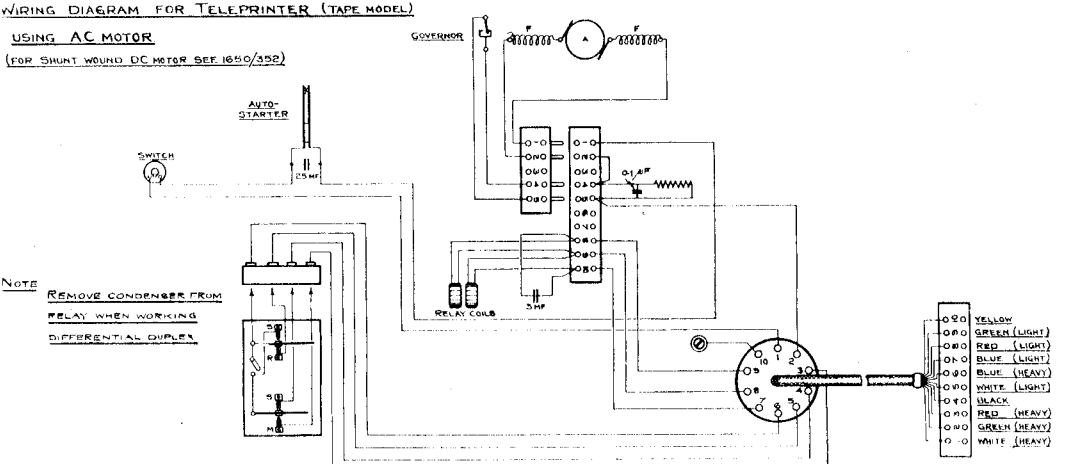
E. Home Station. Single Current Single Battery.

F. Distant Station Single Current Single Battery.

WIRING DIAGRAM FOR TELEPRINTER (TAPE MODEL)

USING AC MOTOR

(FOR SHUNT WOUND DC MOTOR SEE 1650/352)



NOTE REMOVE CONDENSER FROM RELAY WHEN WORKING DIFFERENTIAL DUPLEX

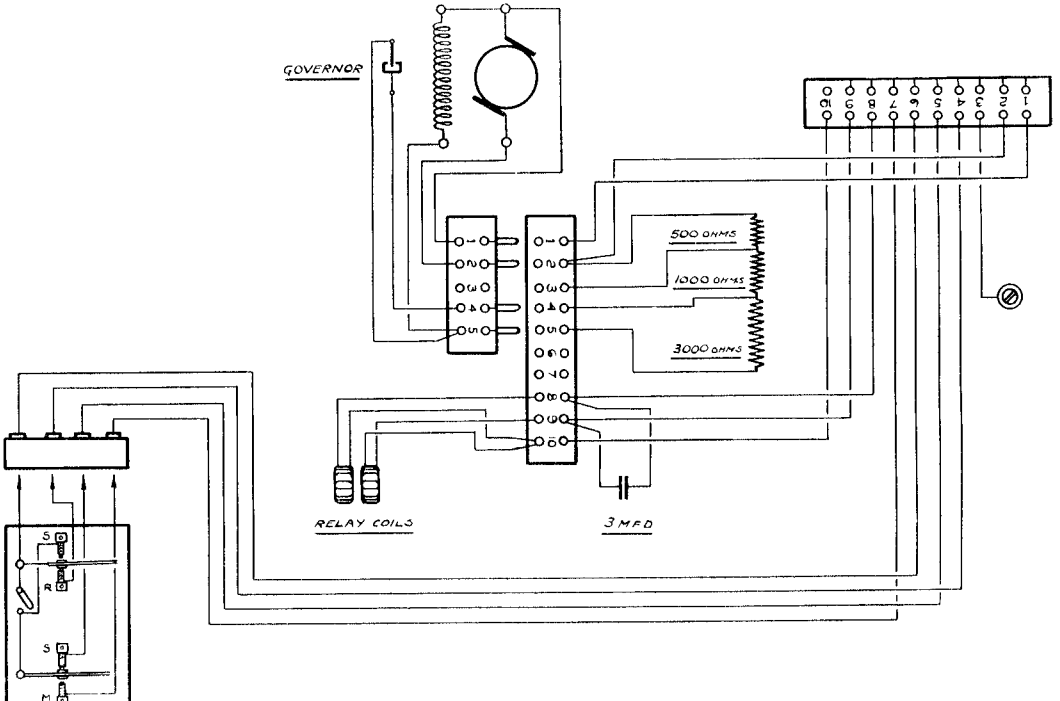


Fig. 6. Internal Connection of P.O. Machine with 220V Shunt Motor.

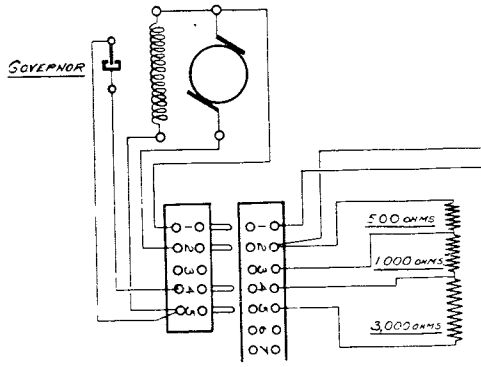


Fig. 7.

CONNECTIONS OF 220V. SHUNT MOTOR FOR STANDARD AND P O. MACHINE.

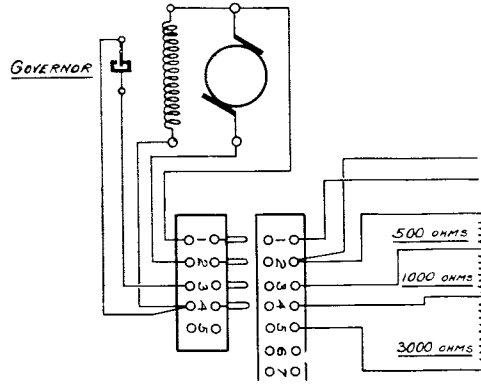


Fig. 8.

CONNECTIONS OF 110V. SHUNT MOTOR FOR STANDARD AND P.O. MACHINE.

NOTE.—For voltages below 110V. and 220V. it is desirable to br erminals 2 and 3 on the 10-way connection strip on top of the bas he machine.

OPERATION.

Both transmitter and printer mechanism are mounted on the same base, and driven by the same motor. This motor drives through gearing one spindle and clutch to operate the printer, and another spindle and clutch to operate the transmitter.

TRANSMITTER.

The operations are carried out by a cam under the control of the key bars. This cam is operated by means of a single revolution clutch, a diagrammatic view of which is shown in Fig. 9.

The cam is supported on a spindle on which are cut ratchet teeth (R.) Attached to the cam are two pawls (P.). These pawls are normally held out of engagement by the pawl abutment (P.A.). When the trip lever (T.L.) is raised, it will engage the pawl abutment (P.A.) and withdraw it from engagement with the Pawls (P.). When this occurs, the pawl spring forces the pawls into engagement with the ratchet teeth (R.), and the cam will then revolve with the spindle. As the cam revolves, an eccentric path on its circumference pushes out the lever (T.L.) until it is out of engagement with the pawl abutment (P.A.). This latter will then be returned to its original position by its spring and be ready to intercept the pawls at the end of one revolution.

The pawl extremities striking the pawl abutment will withdraw them from the ratchet teeth and the cam will remain stationary until the trip lever (which the eccentric portion of the cam has allowed to return to its normal position) is again operated.

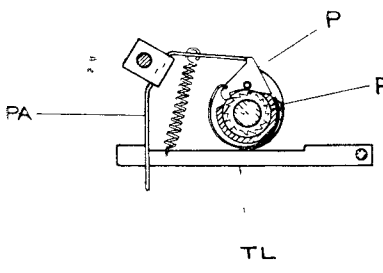


Fig. 9.

It may be noted that the cam is retained in its stationery position by a retaining lever (not shown), which is held in a notch in the periphery of the cam by means of a spring. This is sufficient to hold the cam steady but allows it to revolve when the pawls are engaged.

Referring to Fig. 12, all the keys as at (K.B.), are held in racks, and immediately under them are the combination bars as at (C.B.). A projection of each key rests on a trip bar (T.B.) which runs the whole length of the keyboard and engages a lever (L.) which has its other end attached to the cam trip lever. The Lever (L.), Fig. 11, is attached to the Lever (T.L.) in Fig. 9. Whenever a key is depressed it will press down the trip bar (T.B.) and raise the trip lever (T.L.) and cause the cam to make one revolution.

The combination bars (C.B.) have springs attached to them tending to pull them to the right, but are normally held with their slots under the keybars (K.B.) by means of a lever (R.B.) operated by the cam. When a keybar is depressed it will enter one of the slots formed in the combination bars, and at the same time depress the trip bar (T.B.) causing the cam to revolve. The combination bars are cut with slots (or have projections left on them) according to the code. When a key is depressed it will prevent any bar, which has a projection on it corresponding to that keybar, from being pulled to the right.

The cam has six tracks, and above lie the ends of six selecting levers. Fig. 10 is a diagram showing the action. The selecting levers (S.L.) lie over the cam (C.) which, as it revolves, will allow the levers (S.L.) to drop for a period equal to the duration of a signal. The ends of the levers (S.L.) lie over the ends of the Combination Bars (C.B.) so that when a key is depressed it will prevent its corresponding selecting lever from dropping when the cam revolves.

The other ends of the selecting levers (S.L.) lie in front of one end of the contact lever (C.L.). The other end of this lever is slotted and the contact blade (T.) lies in this slot. Normally the lever (C.L.) is held by a spring so that the contact blade (T.) is held against the top contact screw ; when however, a selecting lever is allowed to drop it will strike the contact lever and force the contact blade against the lower contact.

It will be seen that as the cam revolves certain selecting levers will be allowed to drop, according to the position of the combination bars (C.B.) ; these selecting levers will in turn strike the contact lever (C.L.) and operate the contact blade which is connected to the line, and thus transmit signals corresponding to those set up by the combination bars (C.B.).

It should be noted that there are five combination bars but there are six selecting levers. The reason for this is

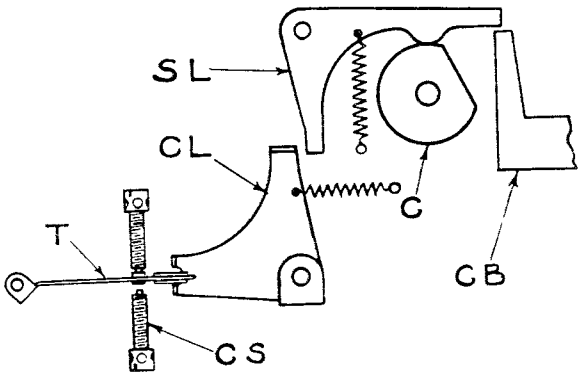


Fig. 10.

that in addition to the five signals of the 5-unit code, a starting signal is always transmitted. This is done automatically by the cam and selecting lever, which has no combination bar to control it.

The operation of the transmitter is as follows :—

When a keybar (K.B.) is depressed, it enters into the slot formed in the combination bars (C.B.), depresses the trip bar (T.B.), and releases the cam pawl (P.), Fig. 9. The cam commences to revolve, and releases the combination bars (C.B.), Fig. 12, according to the signal selected by the keybar. One or more of these bars may be pulled to the right so that they do not obstruct the selecting levers (S.L.), but other bars, which have projections, will rest against the keybar instead of moving.

As the cam continues to revolve it will allow the first selecting lever to rise, in turn moving the contact lever (C.L.) and forcing the contact blade against the upper contact screw. The cam allows the contact lever to hold the blade in position for the correct time and then returns it to its normal position.

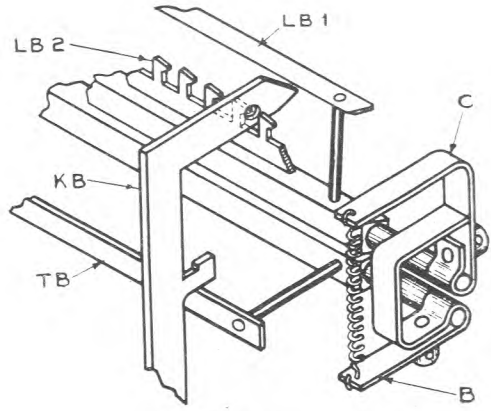


Fig. 11.

KEYBAR LOCKING DEVICE.

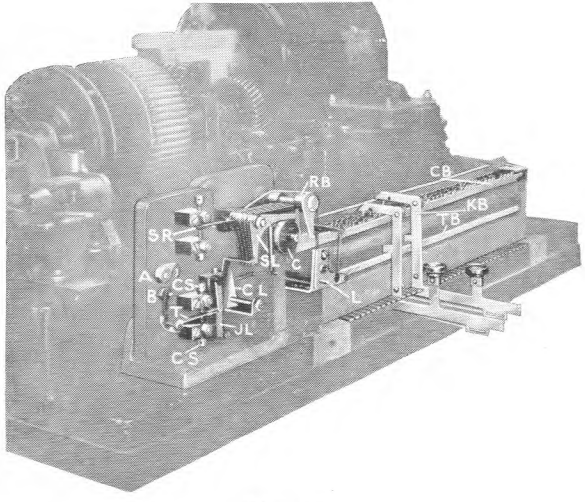


Fig. 12.

KEYS, COMB BARS AND TRANSMITTER.

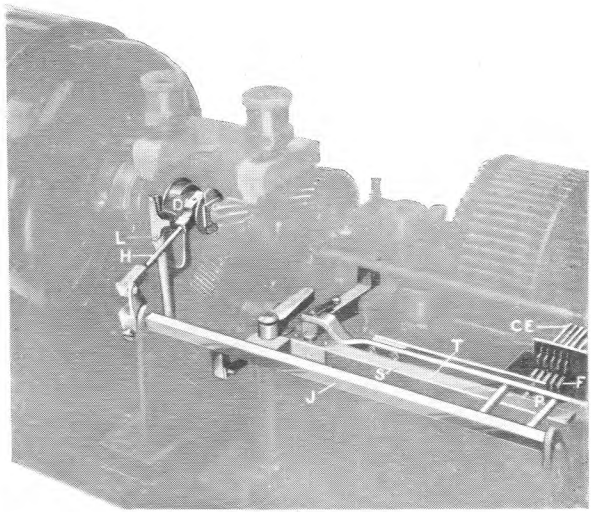


Fig. 13.

MECHANICAL RELAY AND SELECTING MECHANISM.

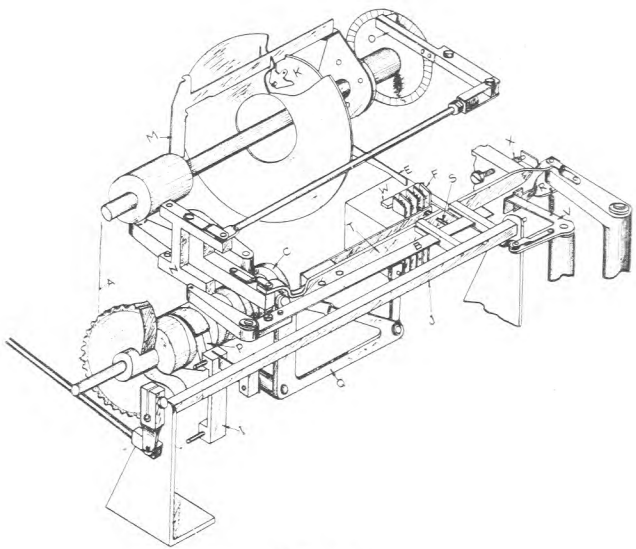


Fig. 14.

The cam then allows the second selecting lever to drop, and so on for the five levers, which in turn will operate the contact lever as required, then it will return the combination bars to their normal position, and the pawl abutment (P.A.), Fig. 9, having then moved into position, as previously described, withdraws the pawls from the ratchet teeth, and the cam comes to rest. It should be noted that this occurs even if the keybar is kept depressed, as the pawl abutment is moved into position by the cam

In the foregoing description we have neglected to mention, for the sake of clearness, the keyboard locking device. This locking device is fitted to prevent (a) another key being depressed after one is down, and (b) to prevent the key rising after depression until the signal has been transmitted. The general arrangement is shown in Fig. 11, the locking being effected by means of the two bars (L.B.1) and (L.B.2).

(L.B.) is situated behind the keybars and is operated by the trip bar (T.B.) Fig. 11, through the medium of a spring. Whenever the trip bar is depressed by a key it will carry with it the Lever B. thus permitting the locking bar (L.B.1) to come forward under the influence of the spring, operating through lever (C) which is attached to the shaft of (L.B.1). In its forward position the edge of (L.B.1) lies under the ends of all the keybars which have not been depressed, and prevents their depression until the release of the key originally depressed.

The second locking bar is similar to the combination bars (C.B.), but instead of having a combination of projections it has a whole series corresponding to the number of keybars. These projections terminate in a right angled point somewhat similar to an inverted L. and each keybar has a hole in which this right angled projection can engage.

When the cam commences to revolve and the combination bars are released, this locking bar will also be released and be pulled to the right by its spring : the point of one of these projections engaging in the hole of the depressed keybar and preventing it rising until the cam has completed its revolution.

Although the functions of the two locking bars are similar at first sight, it should be noted that the first bar (L.B.1) is

operated by the trip bar and released by it, so that it only prevents another key being depressed whilst the finger is retained on the depressed key. The second bar (L.B.2) is cam-controlled and carries on the "locking" from the first bar until the end of the signal, irrespective of the time the finger remains on the key.

PRINTER OPERATION.

The line signals are received by a polarised Power Relay mounted on the base of the machine, and this relay controls, by means of a link, a device called the Mechanical Relay. The purpose of this mechanical relay is to operate the selecting blade and clutch mechanism, which requires rather more power than is obtainable from the relay, unless a heavy line current is used.

Referring to Fig. 13. Carried on a spindle driven by the electric motor is a detent piece (D.) frictionally held by a spring against the face of a revolving drum ; this detent would normally revolve, but is held in one of two positions by the lever (L). This lever is controlled by the link of the line relay, and thus forms an escapement, allowing the detent piece to revolve half a revolution corresponding to each movement of the relay.

Attached to the detent is an eccentric portion which controls a rod (H.) directly coupled to the selecting mechanism and clutch, so that a movement of the relay will operate the lever (L.), and allow the detent (D.) to make half a revolution, and thus operate the rod (H.) which in turn operates the mechanism of the printer.

Fig. 14 is a diagramatic view of the Printer mechanism. There are combination combs (K.) having extension pieces (E.), and immediately in front of these extension pieces are selecting fingers (F.).

Fig. 16 shows the Combination Combs and Extension pieces, and these latter together with the Fingers (F.) may be seen again in Fig. 13.

There are five Combination discs or combs and five fingers. Each finger can operate a Comb, and the five Combs are mounted side by side on a drum, or body, upon which they

The cam then allows the second selecting lever to drop, and so on for the five levers, which in turn will operate the contact lever as required, then it will return the combination bars to their normal position, and the pawl abutment (P.A.), Fig. 9, having then moved into position, as previously described, withdraws the pawls from the ratchet teeth, and the cam comes to rest. It should be noted that this occurs even if the keybar is kept depressed, as the pawl abutment is moved into position by the cam

In the foregoing description we have neglected to mention, for the sake of clearness, the keyboard locking device. This locking device is fitted to prevent (a) another key being depressed after one is down, and (b) to prevent the key rising after depression until the signal has been transmitted. The general arrangement is shown in Fig. 11, the locking being effected by means of the two bars (L.B.1) and (L.B.2).

(L.B.) is situated behind the keybars and is operated by the trip bar (T.B.) Fig. 11, through the medium of a spring. Whenever the trip bar is depressed by a key it will carry with it the Lever B. thus permitting the locking bar (L.B.1) to come forward under the influence of the spring, operating through lever (C) which is attached to the shaft of (L.B.1). In its forward position the edge of (L.B.1) lies under the ends of all the keybars which have not been depressed, and prevents their depression until the release of the key originally depressed.

The second locking bar is similar to the combination bars (C.B.), but instead of having a combination of projections it has a whole series corresponding to the number of keybars. These projections terminate in a right angled point somewhat similar to an inverted L. and each keybar has a hole in which this right angled projection can engage.

When the cam commences to revolve and the combination bars are released, this locking bar will also be released and be pulled to the right by its spring : the point of one of these projections engaging in the hole of the depressed keybar and preventing it rising until the cam has completed its revolution.

Although the functions of the two locking bars are similar at first sight, it should be noted that the first bar (L.B.1) is

operated by the trip bar and released by it, so that it only prevents another key being depressed whilst the finger is retained on the depressed key. The second bar (L.B.2) is cam-controlled and carries on the "locking" from the first bar until the end of the signal, irrespective of the time the finger remains on the key.

PRINTER OPERATION.

The line signals are received by a polarised Power Relay mounted on the base of the machine, and this relay controls, by means of a link, a device called the Mechanical Relay. The purpose of this mechanical relay is to operate the selecting blade and clutch mechanism, which requires rather more power than is obtainable from the relay, unless a heavy line current is used.

Referring to Fig. 13. Carried on a spindle driven by the electric motor is a detent piece (D.) frictionally held by a spring against the face of a revolving drum ; this detent would normally revolve, but is held in one of two positions by the lever (L). This lever is controlled by the link of the line relay, and thus forms an escapement, allowing the detent piece to revolve half a revolution corresponding to each movement of the relay.

Attached to the detent is an eccentric portion which controls a rod (H.) directly coupled to the selecting mechanism and clutch, so that a movement of the relay will operate the lever (L.), and allow the detent (D.) to make half a revolution, and thus operate the rod (H.) which in turn operates the mechanism of the printer.

Fig. 14 is a diagramatic view of the Printer mechanism. There are combination combs (K.) having extension pieces (E.), and immediately in front of these extension pieces are selecting fingers (F.).

Fig. 16 shows the Combination Combs and Extension pieces, and these latter together with the Fingers (F.) may be seen again in Fig. 13.

There are five Combination discs or combs and five fingers. Each finger can operate a Comb, and the five Combs are mounted side by side on a drum, or body, upon which they

are permitted to turn a fraction of an inch. Each of these Combination Combs is slotted on its edge with a different arrangement of slots, and can be made to occupy one of two positions, one of which, in Combination with other selected Combs, opens two longitudinal slots in the whole series of five Combs.

As there are only 32 possible Combinations of the 5-unit code the numerals and other special characters are operated by the same Combination as that employed for the letters, the change being accomplished by a signal called the "Figure Shift." The change from figures to letters is accomplished by a signal called the "Letter Shift." In addition to the five combs on the body of the Printer there is a sixth comb called the shift comb. This comb is actuated by two bellcranks corresponding to the shifts, which move it into one of two possible positions so as to close one set of slots and open another; thus when the signal corresponding to the letter E is set up on the combs two adjacent avenues are opened, one corresponding to the letter E and the other to the figure 3, which is the secondary character on the E key. The position of the shift comb determines which of these shall function.

Passing through the axis of the drum is a spindle which continually rotates the type-head and stop through a friction clutch. When the selected Combs open a longitudinal slot and admit a bellcrank, the outer end of the latter is projected in the path of the type-head stop, thus momentarily arresting the rotating type-head, and causing the clutch to slip. A hammer actuated when the type-head ceases to revolve, strikes the back of the type directly opposite the paper and records the impression.

Opposite the Selector Fingers is the Striker Pin (S.) which is carried in a Traversing Link (T.), operated by the Cam (C). The Striker Pin can be pushed forward by the Striker Blade (B.)

The operations of the Printer are performed by the Cam (C.). This Cam has five Tracks, and is operated by a Single revolution Clutch. It is supported on a Spindle in which are cut ratchet teeth, as shown in the sectional diagram Fig. 15.

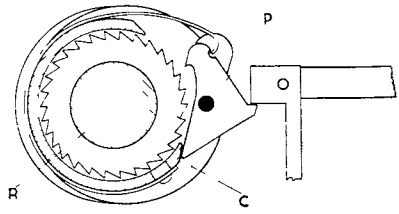


Fig. 15.

Attached to the Cam are two Pawls (P.) normally held out of engagement by the Pawl Abutment (I) Fig. 14. If the Trip Lever is withdrawn the Pawl Spring forces the Pawls into engagement with the ratchet teeth and the Cam will then revolve. If the abutment is then replaced before the end of the revolution the Pawl extremities will strike the abutment and withdraw them from the ratchet teeth. This Pawl abutment is operated by the Trip Shaft (J).

Referring to the Cam, Track 1 operates the lever (Q) which lifts the selector fingers up at the required time and then returns them to their zero position. Track 2 operates the Bellcrank which lifts the bellcranks and permits the 'reshuffle' of the Combs. Track 3 controls the Traversing Bar (T.) which carries the Striker Pin. The normal position for this Pin is opposite the middle Selecting Finger.

When the Cam revolves, the Traversing Bar carries the Selecting Pin first to the left until it is opposite the first Selecting Finger, then to the right until the last Selecting Finger is reached, and finally returns it to the zero or central position. Track 4 operates, by means of the lever (N.), Type hammer (O.) which prints the selected character. Track 5 controls the Striker Blade (B.). It is cut with five steps which cause the Blade to make five forward movements, and is so timed that these movements take place at the time that the Striker Pin is opposite each successive Selector Finger. At the end of the Cam is a Retaining Notch into which the end of a Retaining Lever drops. This is so arranged that at the end of a revolution when the Abutment (I.) withdraws the Pawls from engagement

with the ratchet teeth the Retaining Lever drops into this Notch and prevents the Cam moving forward under the thrust of the pawl springs.

The Finger Resetting Mechanism is controlled by the Traversing Bar. Its normal position is shown in Fig. 14 with the end of the Resetting Link Lever (V.) in engagement with the end of the Resetting Bellcrank (R.). As the Traversing Link moves to the left Lever (R) will push against the end of

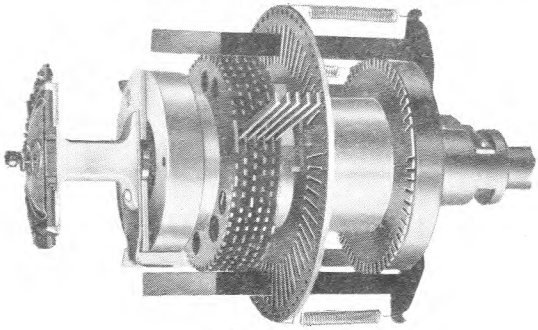


Fig. 16.

COMBINATION COMBS AND BELLCRANKS.
TYPE-HEAD SHOWN IN SECTION.

Lever (V.) moving it to such an extent that the Resetting Link (W.) carries the Selector Fingers out of engagement with the Combination Comb Extensions. Before the Traversing Bar reaches the end of its stroke however, the other extremity of Lever (R.) strikes the Abutment Screw (X.), which throws the end of the Lever (R.) out of engagement with that of (V.). Lever (V.), having no support, is carried to the right by the spring, and thrusts the Resetting Link (W.) in a backward direction so as to leave the Selector Fingers clear for the combination to be set. As the Traversing Bar moves to the right, Lever (R.) is carried with it so that eventually its extremity falls behind Lever (V.) again.

Seven impulses are employed ; the first is always a negative impulse and its function is to operate the Pawl Abutment and

start the Cam revolving. The last Unit is always Positive and its function is to return the Abutment and withdraw the Pawls out of engagement with the ratchet, thus arresting the Cam. The intermediate five impulses may be positive or negative. If Positive, the Striker Blade will be in its upper position in line with the Striker Pin. If Negative, it will be in its lower position and will pass under the Pin.

The operation of the machines is as follows : Assume the letter Y is being transmitted, then the combination is :— negative (Start) positive, negative, positive, negative, positive, positive (Stop). The first negative impulse moves the Relay Armature towards the right. This by means of the link moves the Detent Lever (L.) to the right thus releasing the Detent Piece which, driven by the Friction Clutch, will make half a revolution and be arrested on the other side of Lever (L.). In making this half revolution the eccentric on the Detent Spindle will operate Lever (H.) causing the Trip Shaft to withdraw (by means of the link) the abutment out of engagement with the pawls. Owing to the pressure of the Pawl Spring, one of these pawls will immediately engage with one of the Ratchet Teeth on the spindle and the Cam will commence to revolve. The Traversing Bar (T.) carrying the striker Pin will immediately move to the left and arrive opposite the first selector finger at the time the second impulse is received. The second impulse which is a positive one will move the Relay armature, returning it to its positive position, and this through the clutch and detent will set the striker bar in its upper position, where, as it is in line with the pin, it will strike forward the selector finger as it is moved by the cam.

The next impulse is negative. The relay armature will move over to the right. This will release the Detent again and set the striker bar in its lower position. The Striker Pin will now be opposite the second finger, but as the Striker Bar is in its lower position, when it is moved forward it will miss the striker pin causing no movement to the Selector Finger. The next impulse, a positive one, will cause the striker pin to push forward the third Selector Finger (C.) and so on until the Combination has been set up on the selector fingers. Cam Track No. 1 then operates Lever (Q.) which lifts the selected

combs to their upper positions, the Bellcranks having first been raised to permit this movement, and then dropped to pick up the new selection. The last impulse, always a positive, places the pawl abutment (I.) in its normal position, the Pawls are withdrawn and the Cam comes to rest.

There will be one clear "avenue" across the Combs corresponding to the letter set up, and this will allow the corresponding Bellcrank to drop lower than any of the others. This Bellcrank also acts as a Locking Bar for the Combs. The selected letter is not printed until the next revolution of the Cam, i.e., it is printed while the next letter is being set up on the Selector Fingers.

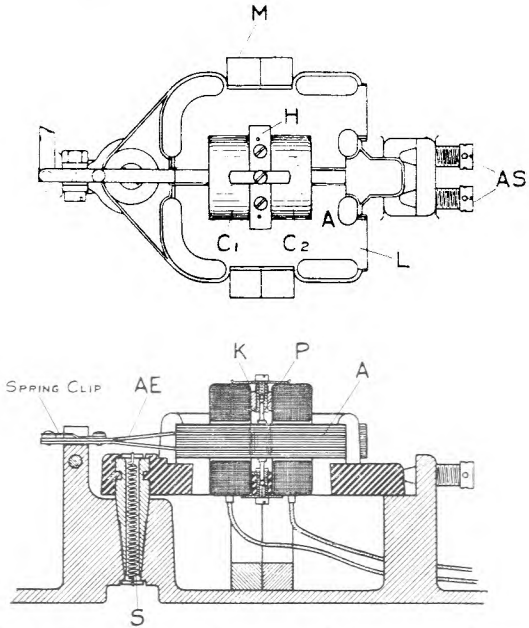


Fig. 17. PLAN AND SECTIONAL ELEVATION OF RELAY.

RELAY.

Referring to Fig. 17, the Relay consists of two laminated Pole pieces (L.) supported between the poles of two permanent magnets (M.). The Armature (A.) is pivoted in the centre of the pole pieces, as at (P.) and surrounding it are two coils (C.1) and (C.2). The Relay is attached to the base of the machine by a conical pivot held down by a spiral spring (S.). At the opposite end are the adjusting screws (A.S.).

The Pivot bearings have a small oil well which contains sufficient oil to lubricate the Pivot for about 12 months, but the top Pivot bearing is more liable to lose its oil than the lower one. Lubrication of the top Pivot can be effected by removing the screw which holds clip (K.) in position. Only fine clock oil should be used.

The Armature coils can be removed easily by first removing the Armature Pivot housing (H.). The Armature and coils will then slide out. If it should be necessary to disconnect the coils it should be noted that one end of each coil is clamped under a common screw on the terminal block, and it is advisable to label the wires before disconnecting so that they are not mixed on assembly.

SEND-RECEIVE SWITCH.

This is an automatic switch arranged so that the Line, which normally is connected to the Relay, is automatically connected to the Transmitter contact tongue during the transmission of a signal. It can be seen in Fig. 12 at (S.R.) and consists of a contact blade, operated by the Cam, moving between two contact screws. When the Transmitter is at rest, the blade lies against the lower contact screw and connects the line to the Printer Relay but immediately the Transmitting Cam commences to revolve, the contact blade is moved upwards against the top contact screw and connects the Line to the Transmitter tongue.

For Duplex working it is necessary to short circuit this device and for this purpose a small brass strap is provided to connect terminals (A.) and (B.) Fig. 12.

GREASE FOR TYPE-HEAD CLUTCH.

The Creed Type-head Clutch requires grease at intervals and the grease gun supplied with the machine enables this operation to be done easily without dismantling the clutch.

One of the screw holes on the Clutch body is marked with a line or dot. Removal of the screw from this hole uncovers a channel which leads into the clutch chamber. In order to fill the gun the plunger should be withdrawn and the barrel half-filled with grease, then insert the plunger and push it in until the shoulder is flush with the top end of gun ; wipe off surplus grease from end of gun, and the amount left in the barrel will then be a suitable charge for the clutch.

Hold the gun by the knurled portion between finger and thumb, press the nozzle into the hole in the Clutch body from which the screw was removed, holding it at a slight angle so as not to damage the types. Then press the plunger down as far as it will go.

If the Printer is working continuously, the clutch will require charging with grease about once per month.

We recommend " Grimsengere " supplied by the British Oil & Turpentine Corporation.

Suitable grease can be supplied by Creed & Co., Ltd.

GOVERNOR FOR DIRECT CURRENT MOTORS.

This is of the centrifugal type and is shown in Fig. 18. (S.) is a Spiral Spring secured at one end to an Anchor (B.) and attached at the other end to a movable Arm (A.) carrying a weight which is pivotted at (P.). The Arm (A.) has a Contact at one end which is arranged to play between the Contact (C.) and stop (D.).

The Spring (S.) and Weight Arm (A.) are calibrated to such values that at a pre-determined speed the centrifugal force acting on the Weight Arm will overcome the spring and allow the Arm to move outwards.

For governing shunt wound D.C. Motors, the contacts should be open until the governing speed is reached.

A resistance is inserted in series with the Shunt Coil of the Motor which will cause it to run faster than its normal speed.

The governor is arranged to short-circuit this Resistance, thus causing the motor to run at its normal speed.

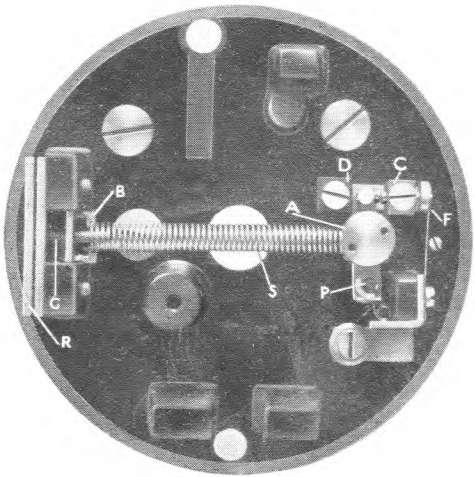


Fig. 18.

GOVERNOR FOR DIRECT CURRENT MOTORS.

When the motor is at rest the Weight Arm (A.) is held against the Stop (D.). Immediately it starts to revolve and the desired speed is reached the Arm (A.) will fly outwards and strike the Contact (C.). This will short-circuit the Resistance in the Field circuit and cause the speed to drop. Immediately this happens the Arm (A.) will be pulled back by the spring, thus opening the contacts and causing the resistance to be re-inserted in the Field circuit and the speed once more to rise. This action takes place very rapidly and an average speed will be maintained corresponding to the setting of the spring and weight arm.

A Contact mounted on a spring arm is arranged as shown at (F.). The purpose of this is to short-circuit the governing resistance at the moment of starting, so that the motor will start on its full field current. Immediately the motor commences to pick up speed this arm will fly off by centrifugal force and allow the governing resistance to come into play.

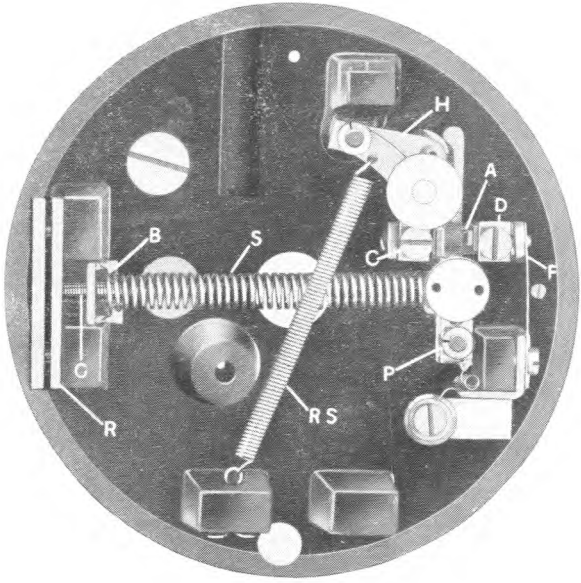


Fig. 19.

GOVERNOR FOR ALTERNATING CURRENT MOTORS.

GOVERNOR FOR ALTERNATING CURRENT MOTORS.

This is similar to the Governor for Direct Current Motors but the stop (D.) and contact (C.) are reversed.

(S.) is a spiral spring secured at one end to an anchor (B.) and attached at the other end to a movable arm (A.) carrying a weight. This arm is pivotted at (P.) and has a contact which is arranged to play between the contacts (C.) and stop (D.).

The spring (S.) and weight arm (A.) are calibrated to such values that at a predetermined speed the centrifugal force acting on the weight arm (A.) will overcome the spring and allow the arm to move outwards.

A resistance is connected in series with the motor and the contacts of the governor arranged to short-circuit this. When the motor is at rest the weight arm (A.) is held against the contact (C.), but when the motor revolves and the desired speed is reached, the arm (A.) will fly outwards, until it reaches stop (D.). This will allow the series resistance to become effective and cause the speed to drop. Immediately this happens Arm (A.) will be pulled back by the spring (S.), short circuiting the resistance and causing the speed to rise again. This action takes place very rapidly and an average speed will be maintained corresponding to the setting of spring (S.) and Arm (A.).

A weight Arm (H.) controlled by the retaining spring (R.S.) is so arranged that when the motor commences to pick up speed it will move outwards and in doing so strike an extension of the Arm (A.), opening the contact as it does so. The object of this is to positively open the contacts before governing speed is reached to remove any stickiness due to partial welding together caused by a heavy starting current.

A contact mounted on a spring arm is arranged as shown at (F.). The purpose of this is to short circuit the governing resistance during the period that the contacts are forcibly opened by Arm (H.). The weight is such that it will fly open after arm (H.) has moved out and before governing speed is reached.

The Governor (A.C. or D.C.) is secured to the Motor Spindle by means of a Grub Screw and if this is unscrewed the Governor will slide off the shaft.

The Connections to the Governor are made by means of Carbon Brushes rubbing on slip rings. There is no need to have a heavy spring pressure on these Brushes, only just sufficient to carry the small current used. Should the spring pressure be very strong unnecessary heat will be generated.

The Governor is calibrated for speed at our Works and should not require any attention beyond burnishing the contacts occasionally.

ADJUSTMENTS.

GENERAL.

All parts of the machine are easily accessible for removal. Levers are held in place either by Spring Retaining Catches or by Split Spring Collars. These latter may be easily removed with a pair of pliers or by levering them with a screw-driver. To replace, hold them over the top of the Pin and give them a light tap with the end of a wooden handle of a screw-driver; afterwards, tap them down as far as they will go, taking care not to bind the lever.

TRANSMITTER PAWL ABUTMENT.

The amount of "lift" of the Pawl Abutment is adjusted by means of an eccentric headed screw on lever (L.,) Fig. 12. It should be adjusted so that it rises not more than 1/32" above the tips of the pawls, when a Key is depressed.

LOCKING BAR AND TRIP BAR.

One Locking Bar, situated behind the Keybars, is adjustable as follows :—Slack the clamping screws of levers (B.) and (C.), Fig. 11, so that they can be moved on their shafts but are tight enough to stay in position.

Place the thumb of the left hand under lever (L.), Fig. 12, holding it up as high as it will go, and then with the right hand press lever (B.) hard against lever (C.), Fig. 11, so that the latter is pressed against its back stop pin, and clamp lever (B.1 in this position.

Now set the Locking Bar (L.B.1) in relation to lever (C.) so that when a key is depressed and (L.B.1) comes forward, it just clears the top of the depressed keybar and takes up a position just under the ends of the other keybars. Clamp lever (C.) in this position. Note that if this adjustment is correctly carried out there should be no back-lash between any keybar and the trip bar (T.B.).

SEND-RECEIVE SWITCH.

Slack back the lower contact screw until it does not touch the contact blade, then slowly advance the contact screw until it just touches the contact blade, and give it half a turn more to ensure good contact. Then set the top contact screw until there is a contact gap of about .010".

TRANSMITTER CONTACTS.

To adjust the transmitter contact screws, depress the erase key, and turn the instrument by hand until the contact lever (C.L.), Fig. 12, is in its mid-way position. This position is attained when one of the selecting levers (S.L.) is half-way up and the next lever is half-way down, and may be found as follows : Turn the instrument until No. 1 lever rises, and then a little more until No. 2 tends to rise. Then turn the machine slightly until both levers are just touching the contact lever (C.L.). This is the mid-way position, and it is now necessary to adjust the contacts so that there will be an equal movement on either side. The pressure of the bias lever is adjusted by means of a screw acting on the end of the lever (J.L.). By turning the screw, tension can be removed from the jockey lever so that the contact lever will move freely. Now slack back the contact screws (C.S.) until the tongue (T.) lies on either side of the slot in the contact lever (C.L.). Move the tongue by hand to one side or the other and advance each contact screw (C.S.) until a gap of about .008" exists ; each screw will require from half to three-quarters of a turn.

JOCKEY LEVER.

The adjustment of the jockey lever (J.L.) is best made by sending signals by the transmitter and adjusting the screw bearing on the end of the jockey lever, until it presses so hard on the contact tongue (T.) that it prevents it working. Then gradually slack off the pressure until it just works and the tension is correct. The position of the jockey roller can be ascertained correctly by feeling if the contact blade has an equal pressure against each contact ; the position of the roller is adjusted by means of its pivot screw which is made slightly eccentric, and is fitted with a small wire lever so that it may be

urned by hand and will alter the position of the jockey roller n relation to the contact tongue.

STRIKER BLADE.

This should cause the striker pin to strike the third finger slightly to the left and allow it to come quite central when the finger is pushed right forward. It should normally hit the striker pin so that there is about .005" between the top edge of the blade and the top edge of the pin.

COMB FINGERS.

These should lift the comb extensions to within about .005 of the top of the comb rack. The striker blade should be adjusted so that the fingers are moved to within 1/32" of the comb rack by means of the tommy screw in the boss. The comb finger resetting link should be adjusted so that it is released when the fingers just touch the back guide plate.

BELLCRANKS.

The lift of the bellcranks when correctly set should be approximately .010" above the surface of the combs. This last fault may cause apparent wrong selections by preventing some of the combs from returning to their original position if the bellcranks do not lift sufficiently. The effect will be that the combs are being set when not selected.

RELAY.

This should be absolutely neutral, i.e., when the line current is off the armature should bear with equal force against each side of its stop, when moved from side to side by hand If it is biassed to one side, correct by means of the adjusting screws (A.S.), Fig. 17.

PRINTING HAMMER.

Swing back the retaining catch on the type hammer cam lever, lift the type hammer link off its bearing pin, and screw it in or out to adjust the pressure of the spiral spring. To

adjust the distance between the hammer and the back of the types, the two lock nuts on the type hammer link should be screwed backwards or forwards until there is a clearance between the backs of the types and the face of the hammer equal to about .010".

TO REMOVE THE TRAVERSING BAR.

Swing back the spring retaining catch at either end and lift the traversing bar up. When replacing, make certain that the finger returning bellcrank is on the same side of the traversing bar as the fingers.

POSSIBLE FAULTS AND RECTIFICATIONS.

It should be noted that when the machine is freshly connected to the line the polarity must be correct or the signals will be reversed.

Should faults occur, first check the speed with the aid of the stroboscope to see if the speed is correct. Should the white spot appear to be moving in either direction attention should be given to the governor contacts ; a burnisher rubbed between them will frequently put matters right.

In tracing faults it is first of all necessary to determine if the mistakes are due to the Printer or Transmitter. If the distant station reports mistakes, it can be ascertained by means of the local machine, whether these mistakes are common to both machines. If so it would point to transmitter trouble, but if one record is correct, then it may be assumed that the other printer is out of adjustment, or that there is line or battery trouble.

In the case of wrong letters or signs being printed persistently, attention should be given to the combination bars in the transmitter, to make sure that these are not held up or sluggish.

Wrong letters being printed occasionally may be due to misadjustment of the transmitter contact blade or jockey lever, and this can be easily proved by running the machine locally and adjusting the transmitter.

In cases where it is determined that the faults are due to the printer, i.e., wrong letters appearing intermittently, such are due to selection trouble, and attention should be paid to the adjustment of the relay striker blade and comb fingers.

If a space or smudge is printed instead of a letter, then the trouble lies in the combination head, and is probably due to the bellcranks failing to drop. This may be due to dust

odging round the bellcranks, and can be remedied by a horough clean and lubrication with very thin oil. Alternatively fter the machine has been working some while, it may be lue to the comb setting lever (1300/24) failing to lift the electors sufficiently. This lever has a small corrugation in t, and by increasing or decreasing this slightly the lift given o the selectors can be adjusted.

If the selection is set up correctly and figures and signs re printed instead of the corresponding letters, or vice versa, t possible cause of the trouble is the shift comb. The hift comb jockey arm spring may be bent or the shift comb ever pivot pin broken.

The shift comb, however, seldom requires attention, and t is more probable that the trouble can be attributed to in- ufficient lift of the combs. To ascertain that this is the ause, depress any key and rotate motor in working direction ntil combs are at maximum lift. The bellcranks should now ie in a central position over both slot and pip of combs. If hey are not central they can be corrected by setting the comb etting lever (1300/24) as mentioned above.

If an irregular noise is heard from the pawls, investigation hould be made at once, as unless the pawls are very much worn he noise would indicate that some part of the machine is orking stiffly and overloading the clutch.

AUTO-STARTER.

This device is arranged to start the motor of the machine on the receipt of the first signal, and to stop it again should no signals be received for a lapse of time of about 30 seconds.

Referring to Fig. 20 a small gear and worm (E.) continuously drive the worm wheel (F.). This is arranged to run at a comparatively slow speed, and is drilled with two holes. Running through the centre bearing of wheel (F.) is a crook-shaped piece of wire (D.), having a boss (H.) at one end which is pulled outwards by a spring so that its short end lies against the face of the wheel (F.). This is known as the trip pin. As the wheel revolves a hole will eventually come opposite the end of the trip pin into which it will drop, and so be carried round the wheel.

The contact blades (A.) and (B.) are arranged as shown so that as the trip pin (D.) is carried round with the wheel an insulated sleeve will be pressed against the lever (C.) and throw it out of engagement with the contact spring (A.) which will in turn immediately fly open, thus breaking the motor circuit.

When the signals have stopped and the trip pin (D.) has been carried round by the wheel, and broken the motor circuit, it will be seen that a slight push on the boss (H.) will throw it out of engagement with the wheel. There are two springs acting on the boss (H.) tending to pull the trip pin back to its original position.

Lever (G.) is connected to the armature of the line relay, and when this relay moves in response to a received signal, the end of lever (G.) will strike against the boss (H.) on the end of trip pin (D.), and throw it out of engagement with the wheel (F.) Trip pin (D.) will then be rotated back by the two springs, and strike the contact lever (A.) with sufficient force to close the contacts and allow lever (C.) to fall into place, thus securing the contacts.

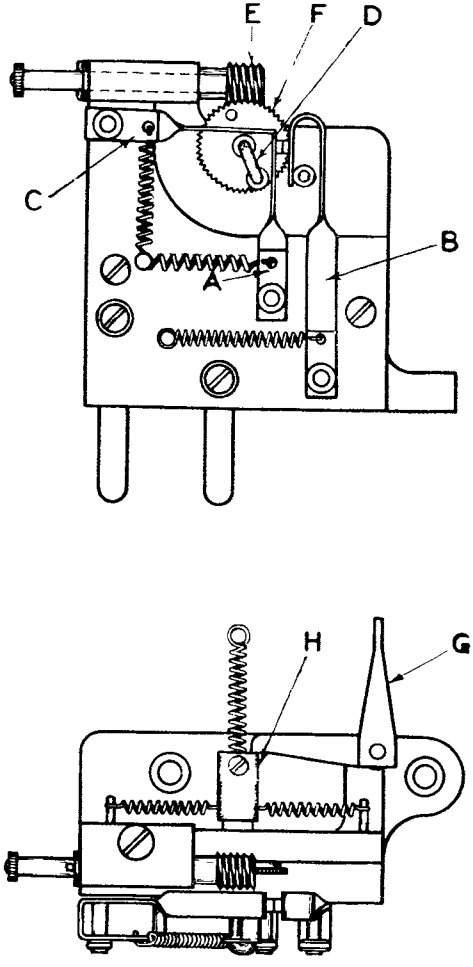


Fig. 20.

TELEPRINTER AUTO STARTER.

It will be seen that all the time signals are being received, lever (G.) will be operating and tending to push trip pin (D.) away from the wheel (F.). Actually the boss (H.) is cut away so that while the trip pin is in the position shown, lever (G.) will fail to act on it. Instead, a link is attached between the trip pin and the bellcrank lifting lever, which is operated every revolution by the cam, and this pulls (D.) away from the wheel (F.). Thus the line relay only has to perform this work on the receipt of the starting signal.

ADJUSTMENT.

See that the trip pin will drop easily into the hole in the worm wheel.

The link should not lift the trip pin more than .020 of an inch from the face of the worm wheel when the machine is printing.

The trip pin spring boss is held by a clamp screw to the trip pin. It should be set so that when the machine is printing, the trip lever (G.) just misses that portion of the boss which is not cut away. It will then be found that when the machine stops the trip lever will be in the correct position to restart the machine when the relay operates again.

N.B.—There should only be about .022 of an inch clearance between the trip lever and trip pin boss in this position.