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Creed

No. 47
TAPE MODEL TELEPRINTER

Description and Principle of Operation

Printing Telegraph Apparatus

Creed

No. 47 TAPE MODEL TELEPRINTER

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KEYBOARD

RECEIVER

No. 47 TELEPRINTER
COMPLETE WITH COVER
FIGURE 1

THE No. 47
TAPE MODEL TELEPRINTER

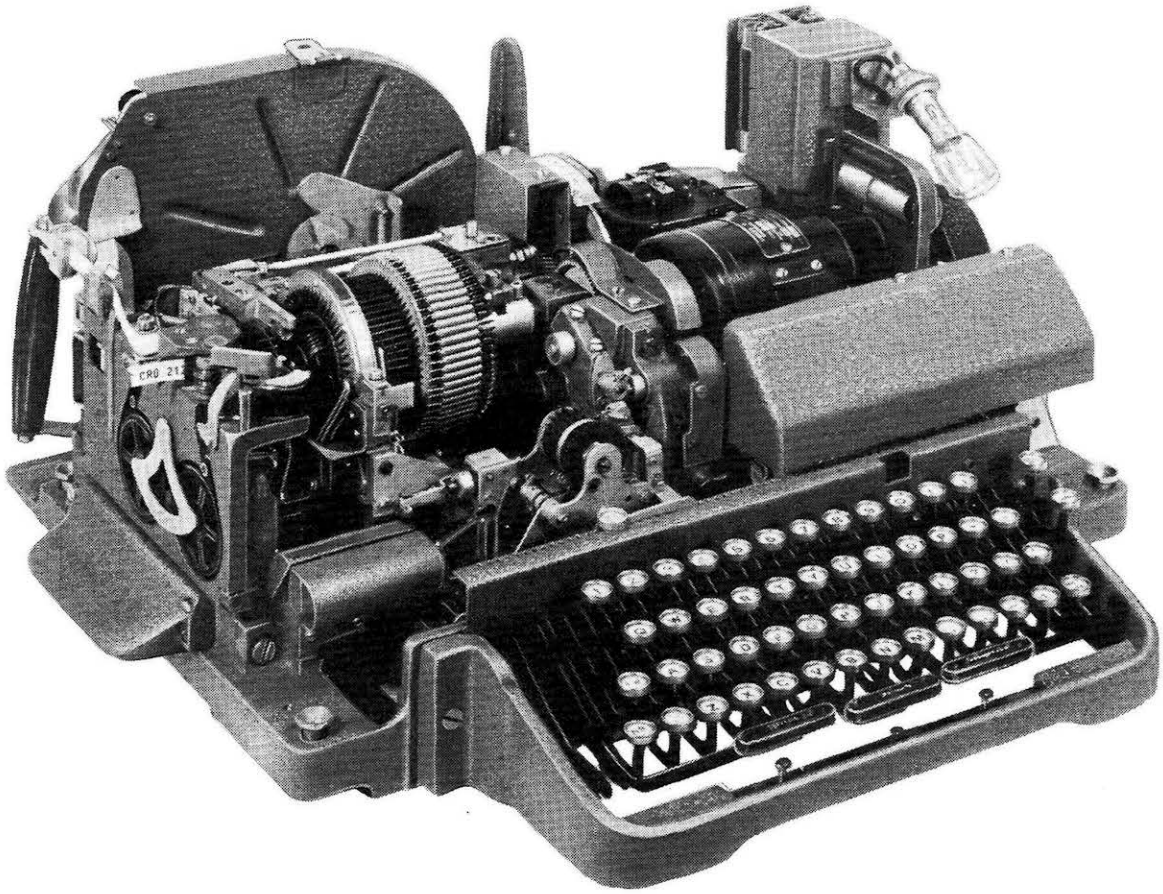
The No. 47 Tape Model Teleprinter is designed primarily for the transmission of public telegraph traffic over nation-wide automatic teleprinter switching systems.

The basic principles of operation and unit construction employed in the No. 7 Teleprinter are retained, new mechanisms being added to furnish facilities not hitherto provided. Many improvements also are introduced in order to facilitate operation, to simplify maintenance, to achieve a much higher standard of performance and to reduce noise to a minimum.

Operating facilities include: provision for rapidly fitting a new roll of paper tape or typewriter ribbon without removing the printer cover; an automatic tape-feed failure alarm; a tape tear-off position conveniently placed on the left-hand side of the machine close to the printing point; and a shift-lock facility on the keyboard.

Maintenance is facilitated by the provision of an orientation device and the extensive use of oil-impregnated bearings; also, an improved typehead clutch of much simpler design is employed.

This teleprinter is required for heavy duty and also operation on "unattended" circuits. The highest degree of accuracy and dependability has, therefore, been the aim in the design and construction, laboratory tests showing that this aim has been fully attained.



No. 47 TELEPRINTER
WITH COVER OFF SHOWING PRINTING POINT
FIGURE 2

OPERATING FACILITIES

Keyboards

Three different types of keyboard, providing a variety of facilities, may be used :

(a) a 4-row non-storage keyboard with shift-lock facility ;
(b) a 3-row non-storage keyboard ; and
(c) a Commercial Typewriter Keyboard.

The Shift-Lock Keyboard can be provided either with single-character keys or with a layout almost identical with that of any standard typewriter. In both kinds of layout, case-shift keys are included for changing the printing from letters to figures and vice versa, but provision is made for the depression of either case-shift key to lock automatically all keys in the opposite case. This prevents the inadvertent transmission of characters in the wrong case, an important safeguard on "blind duplex" circuits.

The 3-row keyboard is similar to the 4-row model, but lacks the shift-lock facility, having both the letters and the corresponding figures on the same keys.

The Commercial Typewriter Keyboard (fully described in Bulletin No. 2), has four rows of keys and character storage. It has no shift keys, the change from figures to letters and vice versa being made automatically by the keyboard mechanism.

Automatic Tape-Feed Failure Alarm.

To ensure absolute security of reception on unattended circuits, a tape-feed failure alarm is provided which gives instant warning of the failure of the paper tape to feed forward, whether caused by breakage, jamming, or need for replenishment. Any such failure results in the closure of two contacts which may be utilised to give a local or a remote warning.

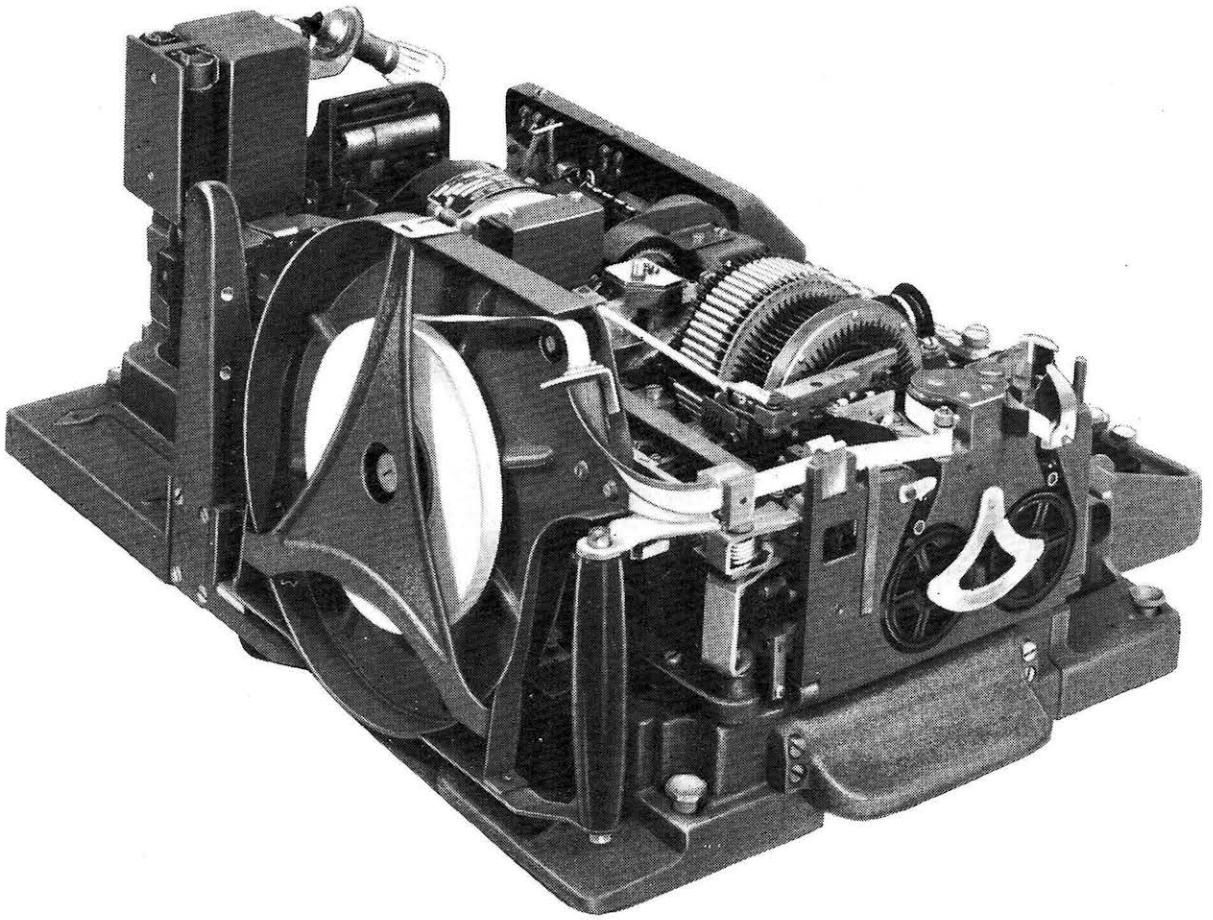
Tape Tear-Off Position.

The tape tear-off position is close to the printing point on the left-hand side of the machine, and is ideally located for good visibility, affording economy in the use of paper, and making for speed in the handling of incoming traffic.

The "Answer-back" or "Here is" signal is immediately visible without feeding the tape forward by hand.

Answer-Back Device.

This unit is of the single-revolution type, ensuring only one transmission of the answer-back signal, even if the "Who-are-you ?" signal remains set up on the receiving mechanism.



No. 47 TELEPRINTER
SIDE VIEW SHOWING TAPE ROLL HOLDER
FIGURE 3

"Here is" Key.

Keyboards are normally fitted with a "Here is" key which provides for transmission of the answer-back signal by the calling operator, thus giving the identity of the calling station to the called station.

Tape Roll Holder.

The tape roll holder is located at the rear of the machine and can be instantly removed by the operator for the rapid replenishment of tape without removing the printer cover.

Motor Control.

The motor is started automatically on receipt of the first signal. In addition, press buttons are provided for starting and stopping the motor manually.

The teleprinter is driven by a fractional horse-power commutator type motor, the speed of which is controlled by a centrifugal governor of special design which requires no operating adjustments.

Radio Interference Suppression.

Filters are normally incorporated in the teleprinter for reducing interference to neighbouring radio receivers to a low level over medium frequency wave bands.

Bell Signal.

Contacts are provided in the printer to enable a calling bell to be operated. These contacts are closed when the "Bell" signal is received and may be used to light a lamp or ring a bell at any distance from the printer.

Speed of Operation.

The speed is normally set for 50 bauds, either at 428 characters per minute with 7-unit operation, or at 400 characters per minute with $7\frac{1}{2}$-unit operation, but it may, if desired, be operated at higher speeds with a good margin of safety.

Message Tray with Station Indicator.

This is an optional attachment to the printer cover, providing a convenient means for separating incoming and outgoing traffic and thus making for its speedy handling.

End-of-Line Indicator.

This unit is fitted to the keyboard when operating to a page teleprinter. A red warning lamp glows fifteen characters before the end of a line is reached on the distant page teleprinter and is automatically extinguished on depression by the transmitting operator of his carriage-return key.

No. 47 TELEPRINTER
COMPLETE WITH COVER AND MESSAGE TRAY
FIGURE 4

MAINTENANCE

Special attention has been paid to ensuring simplicity of maintenance.

Orientation Device.

This device provides a means of adjusting the time intervals between the start transit of the receiving magnet and the instants of selection. The adjustment is effected by means of a lever movable across a graduated scale.

In association with the high-grade signals from the striker transmitter, the orientation device provides the mechanic with a ready means of testing the operating margin of the teleprinter.

Oil-Impregnated Bearings.

The extensive use of oil-impregnated bearings has enabled a continuous operation period of 300 hours to be achieved without re-lubrication.

Typehead Clutch.

A new and simpler design of typehead clutch and stop has given this vital apparatus increased efficiency and a long life.

Printing Unit.

A hinged printing unit is used which provides immediate access to the ink ribbon mechanism, tape feed alarm and printing types without the removal of the teleprinter cover.

Receiving Electromagnet.

An improved high-grade electromagnet is used.

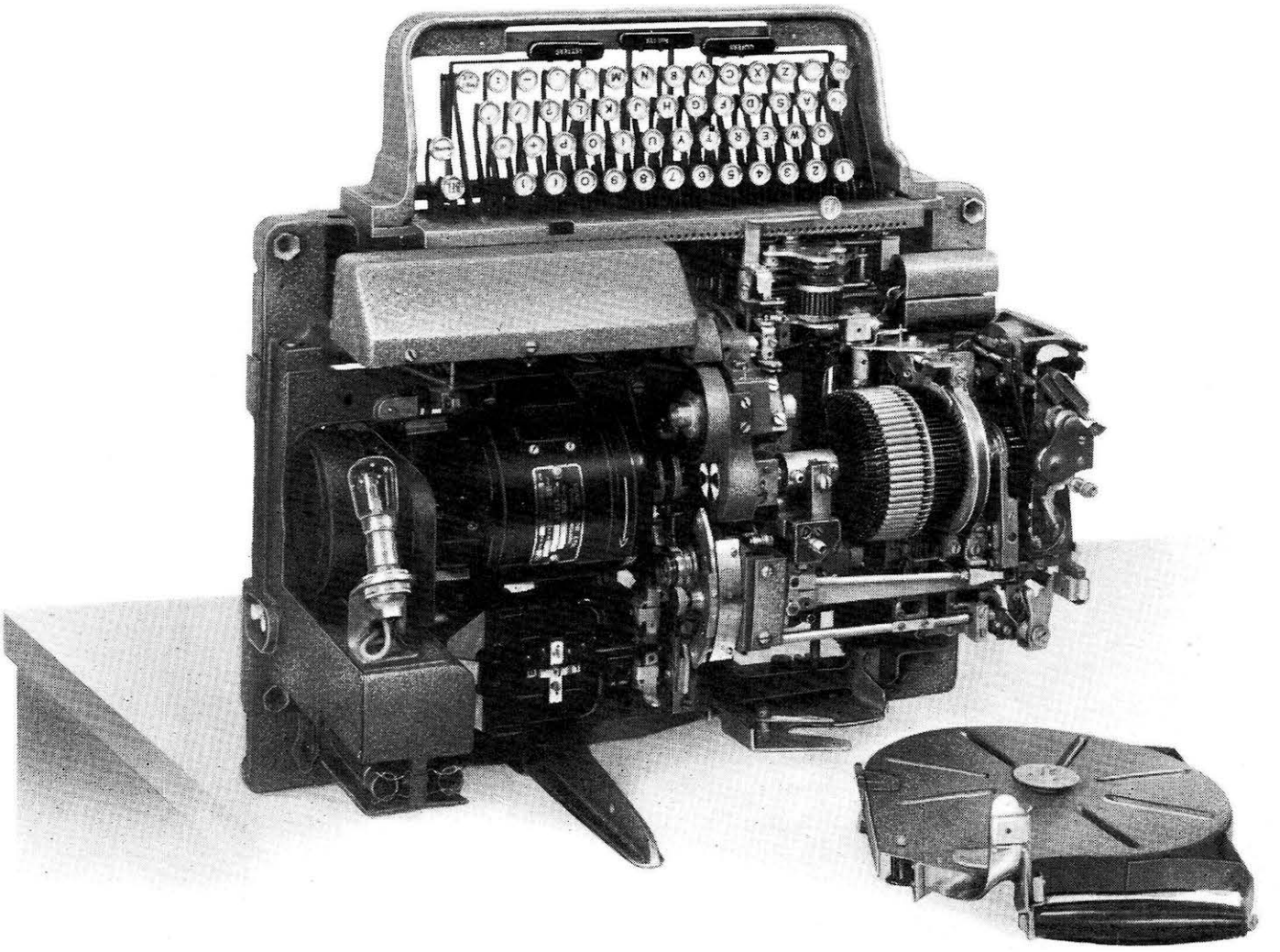
Protective Supports.

A rigid support enables the teleprinter to be safely upturned upon its back, thus facilitating access to the underbase wiring and contacts, with no risk of damage to the mechanism.

The main base is extended to ensure protection of the mechanism against damage during transport on maintenance trolleys.

Transmitting Unit.

All keyboards fitted to this teleprinter, whether of the shift-lock, commercial typewriter, or 3-row type, are fitted with a single transmitting armature. This, in combination with other features of construction, ensures transmission with a distortion considerably less than the plus or minus 5% stipulated by the C.C.I.T., without the need for critical adjustment.



No. 47 TELEPRINTER
PLAN VIEW SHOWING MACHINE RESTING ON SUPPORT
WITH TAPE ROLL HOLDER DETACHED
FIGURE 5

Spare Parts.

The No. 47 Teleprinter incorporates certain spare parts identical with those used in the No. 7 Teleprinter.

Modern methods of manufacture ensure a high degree of interchangeability of spare parts and units.

CONSTRUCTION

The unit construction principle of the No. 7 Teleprinter has been retained, all main apparatus units being interchangeable and readily taken apart and re-assembled.

Low Noise Level.

Special attention has been given to the design of the main base, the mounting of the motor and the arrangement of all gearing to reduce noise to a minimum.

Mounting.

The teleprinter may be mounted on any table, as it requires no screws to fix it in position and it is not necessary to cut the table in any way. A metal dust cover is normally provided.

Metal tables for mounting individual teleprinters and accessory equipments can be supplied on request.

Tropical Finish.

Components are tropically rated and finished to ensure efficient operation under all climatic conditions.

Measurements and Weights.

	Dimensions	Weights Unpacked
Model 47/N3	19in. × 17in. × 9½in.	67lbs.
	48 × 43 × 24cm.	30.4kg.
Model 47/N4	19in. × 18in. × 9½in.	68lbs.
	48 × 45.7 × 24cm.	30.9kg.
Model 47/R	19in. × 10½in. × 9½in.	53lbs.
	48 × 26.7 × 24cm.	24.1kg.

KEYBOARD

Introduction

The simplest type of keyboard for a teleprinter employing the 5-unit code is the 3-row type, in which most of the keys bear two characters each, one of which is in the "letters" case and the other in the "figures" case. Two keys are set aside for the transmission of the case-shift combinations. With this type of keyboard, any omission by the operator to depress the case-shift key, when necessary, results in the receiver printing a character in the wrong case.

The 4-row shift-lock keyboard with single-character keys overcomes this difficulty. Separate keys are provided for each character in the letters and figures cases, and the keyboard is so arranged that when the letter case-shift key has been depressed (and the receiver thereby conditioned to print in the letters case only), all keys bearing characters in the figure case are locked; similarly, when the figure case-shift key is depressed, all keys bearing characters in the letter case are locked. By this means any omission to send the appropriate case-shift signal before shifting from one case to another is immediately made evident and printing of the wrong character (*i.e.* the character in the wrong case) is prevented.

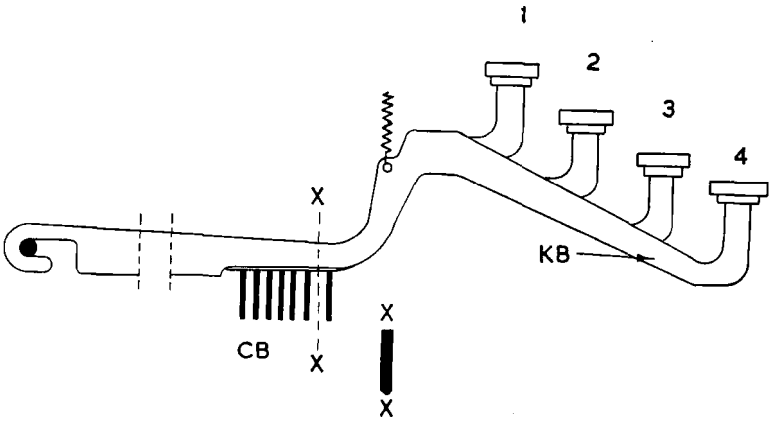
This method, however, demands one key for each character, which results in a somewhat longer keyboard. To overcome this further difficulty the 4-row shift-lock keyboard, with typewriter layout, has been developed. In this keyboard each of the keys in the top row bears two characters in the same case, and therefore with different code combinations. This is accomplished by the provision of two sets of combination bars, a "code-change" key being used to determine which of the two combinations set up by any key is actually transmitted. This key is labelled "Shift" and occupies approximately the same position, and in effect serves the same purpose as the shift key on a typewriter. The shift-lock feature can be retained on this keyboard as no key bears characters in opposite cases.

An alternative but less efficient way of compressing the layout with single-character keys is to have a number of keys bearing two characters in opposite cases. With this layout a lock may be applied to the single-character keys only, the resulting keyboard being a 4-row partial shift-lock keyboard.

THE KEYBOARD ASSEMBLY

The keybars for a 4-row keyboard layout with single-character keys are shown in Fig. 6. They are supported by a common bar at the rear of the machine base, and are held in their normal positions by helical springs. The

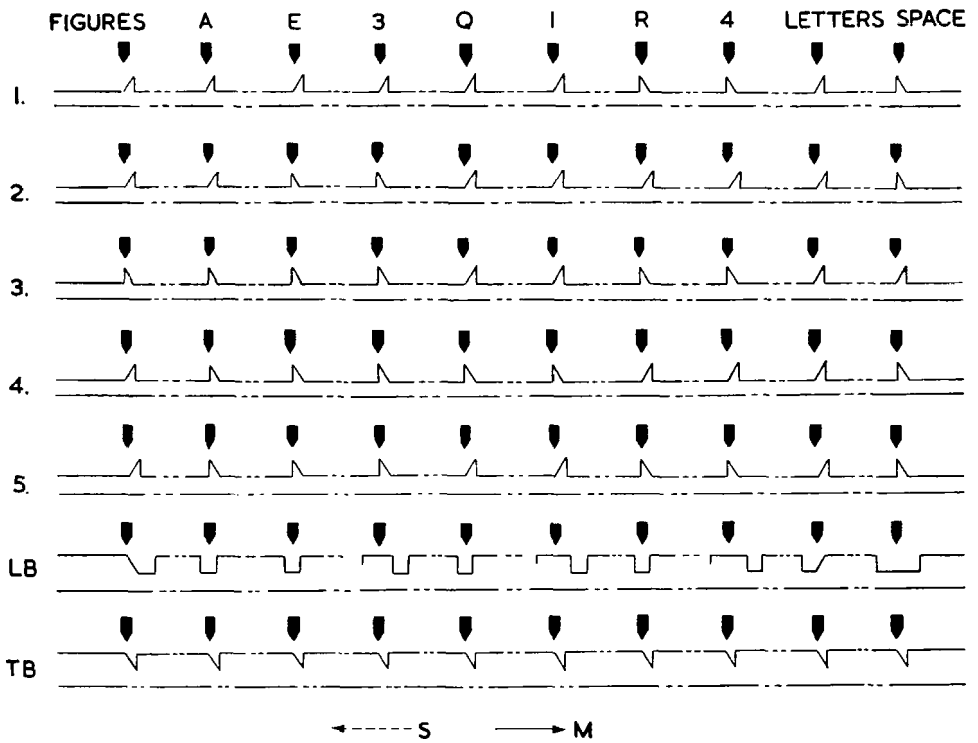
underneath edge of each keybar is chamfered for part of its length, so that when a keybar is operated, this chamfered edge presses down upon five combination bars and two function bars.



KEYBARS
FIGURE 6

The combination bars 1—5, Fig. 7, are provided with teeth, so that the downward pressure of the chamfered edge shifts these bars to the right or left, depending upon the direction of slope of the engaging teeth. Bars which are moved to the right determine the transmission of marking impulses ; those to the left, spacing impulses.

Fig. 7 illustrates a few of the teeth on each of the combination and function bars. The combination bars are all shown in their right-hand positions, *i.e.* in the positions they would occupy if the "letters" case-shift key had been operated, since the combination for the "letters" case-shift signal is MMMMM.



COMBINATION AND FUNCTION BARS
FIGURE 7

A further effect of operating the "letters" case-shift key is that the shift-lock bar LB is moved to the right, and in this position permits the operation of keybars A, E, Q, R and SPACE, whilst blocking the operation of the figures keybars 3, 1 and 4. Thus, until the operator depresses the "figures" case-shift key, none of the figures keys can be operated. Similarly, when the "figures" case-shift key is operated, the shift-lock bar LB is moved to the left and the keys in the "letters" case are all blocked against operation while keybars 3, 1, 4 and SPACE are free.

If, when the combination bars and the shift-lock bar are all to the right after the operation of the "letters" key, the "A" key is depressed, then the combination bars 1 and 2 remain on the right and 3, 4 and 5 are moved to the left. This setting determines the transmission of the code signal MMSSS by the transmitting mechanism.

The trip bar TB operates on the depression of any key, its function being to trip the transmitting cam shaft.

For 4-row shift-lock keyboards with typewriter layout, each of the keys in the top row bears two characters in the "figures" case. This necessitates two sets of combination bars, each set consisting of five bars, so that the depression of any key in the top row sets up the two combinations corresponding to the two "figures" characters simultaneously on the two sets of bars. If the operator desires to transmit the combination for the "upper" character only, a special "Shift" key is depressed. The operation of this key disengages the combination bars corresponding to the "lower" character from the transmitting mechanism, and engages those corresponding to the "upper" character. If the "Shift" key is not depressed, then the lower character is transmitted.

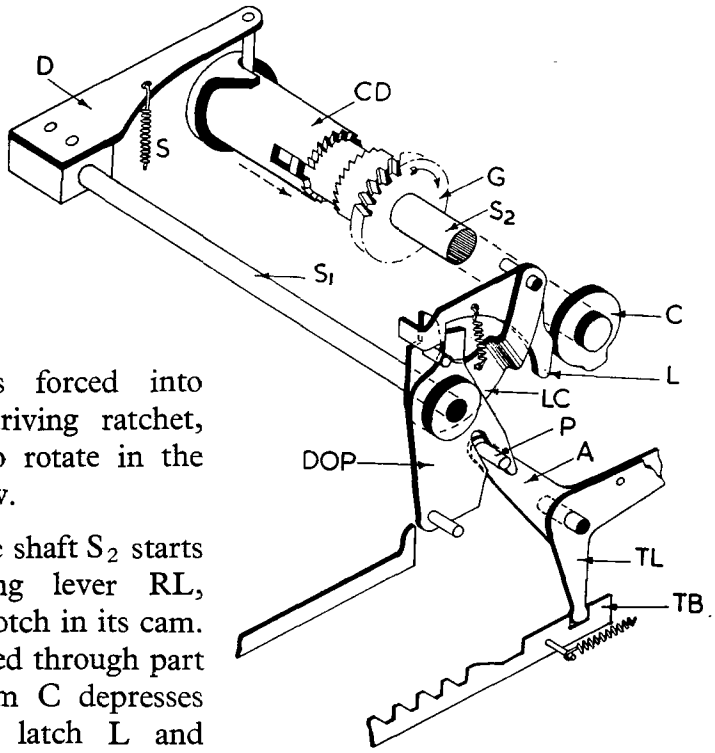
CAM CONTROL

The mechanism for effecting a single revolution of the transmitting cam every time a key is depressed is shown in Fig. 8.

The trip bar TB is normally held to the right against a stop by a tension spring. The depression of any keybar causes the trip bar to move to the left, rotating the trip lever TL about its pivot in a clockwise direction. This motion is communicated to lever A, which is secured to trip lever TL by a screw. Pin P, rigidly fixed in the upper arm of lever A, engages with a forked extension of the detent operating lever DOP. This is free to rotate about the shaft S_1 and is, therefore, turned in an anti-clockwise direction.

The latch carrier LC is pinned to the shaft S_1 and carries on its right-hand extremity the pivoted latch L. A step on the underside of this latch lies in the path of the upper arm of lever DOP. The anti-clockwise movement of DOP is, therefore, communicated to the shaft S_1 via latch L and latch carrier LC.

The detent D is rigidly fixed to the shaft S_1 and is normally urged in a clockwise direction by spring S. A cylindrical projection on its end engages with a vertical cam surface on the clutch ratchet CD, holding the latter out of engagement with the driving ratchet. This second ratchet is positively fixed to the gear G which is free to rotate on the shaft S_2 and is driven continuously in a clockwise direction by the motor. When the detent D is raised, the clutch ratchet CD is forced into engagement with the driving ratchet, causing the shaft S_2 to rotate in the direction of the full arrow.



TRANSMITTER TRIP MECHANISM
FIGURE 8

Immediately after the shaft S_2 starts to rotate, the retaining lever RL, Fig. 9, rises out of the notch in its cam. When shaft S_2 has rotated through part of its revolution, the cam C depresses the right-hand end of latch L and disengages the step on the underside of L from the detent operating lever DOP. The latch carrier LC is then free to rotate clockwise under the impulse of the spring S acting through detent D and shaft S_1. The vertical portion at the end of D is, therefore, allowed to fall into the path of the vertical cam surface on the clutch ratchet CD, so that it is in a position to withdraw the latter at the end of the revolution, even if the keybar is held down indefinitely. The clutch ratchet CD is then cammed out of engagement with the driving ratchet, and the cam shaft continues to rotate for a small fraction of a revolution until it is arrested by the retaining lever RL, Fig. 9, dropping into the notch in its cam.

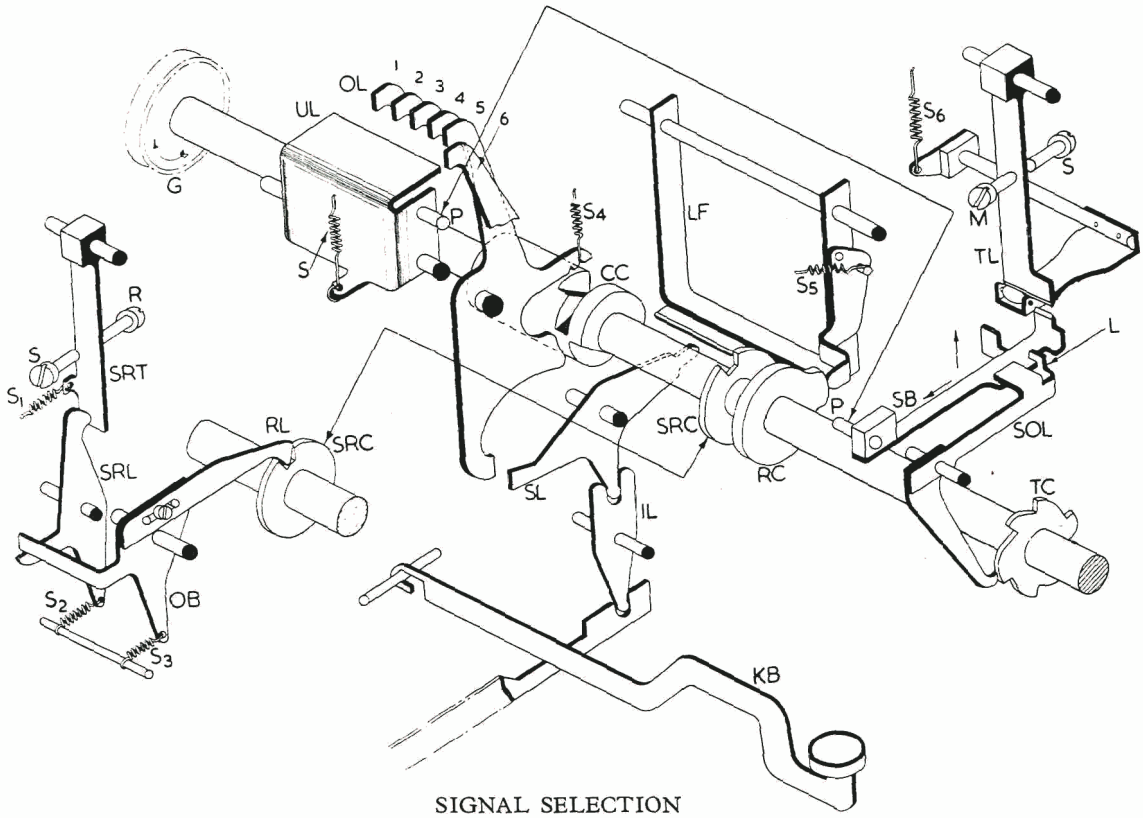
Upon the release of the key, the trip bar TB is restored to its normal right-hand position by its tension spring, and the trip lever TL rotates in an anticlockwise direction. The detent operating lever DOP is thereby rotated clockwise until the vertical arm of the lever is again caught by the latch L.

In order to provide the facility of transmitting one combination continuously, a special "run-out" key is used, which imparts more movement to the trip bar TB than that given by the character keys by engaging on a long tooth cut in the

trip bar. This has the effect of rotating the latch carrier LC and detent D through a greater angle. When the latch L is disengaged from the detent operating lever DOP by cam C, the latch carrier LC is prevented from returning to its normal position by a pin riveted to LC engaging with the edge of the lever DOP. The detent D will therefore be held away from the ratchet CD so long as the "run-out" key is depressed.

SIGNAL SELECTION

It has been seen that the depression of a character key sets up a code combination on five bars and also causes the transmitting cam shaft to make one complete revolution. Fig. 9 shows the mechanism for converting this code setting into a sequence of accurately timed electrical impulses.



SIGNAL SELECTION
FIGURE 9

(1) Construction.

Each combination bar is connected to a lever IL which is, in turn, connected to a selector SL. The depression of a key has the effect of setting the five selectors SL so that the left-hand ends of marking selectors lie in the path of the lower extensions of the operating levers OL, and the ends of the spacing selectors lie below them. The knife edges on the right-hand ends of the selectors are positioned above or below a knife edge on the pivoted locking frame LF.

The five operating levers OL have two other arms, the right-hand one of which lies on the periphery of the cam CC, the other being positioned in operative alignment with the upper edge of the common lever UL. A sixth operating lever is mounted in front of and on the same pivot as the five code operating levers. Vertical springs hold the six operating levers against the cam.

The cam CC has six slots, arranged sequentially, so that the six operating levers are caused to oscillate once, one after the other, as the cam revolves. The common operating lever UL is held to the right by spring S, but is prevented from touching the vertical arms of the operating levers OL, when those are in their normal or right-hand position, by the left-hand side of a slot in striker SB resting against a vertical stop on lever SOL.

In the rest position of the cam, the sixth lever is half-way to the bottom of its slot, its upper arm touching but not operating the common lever UL, which is, therefore, held towards the right by the spring S. The upper arms of all the other operating levers are held to the right by the cam.

The striker SB is pivoted on the common lever, and its right-hand end, provided with an upturned knife edge, is slidably mounted on the upper arm of the lever SOL.

(2) Operation.

Immediately the cam commences to rotate, following the depression of a key, the retaining lever RL rises out of the notch in its cam, in turn rotating the operating bracket OB, Fig. 9, about its pivot. The left-hand extension of OB presses down upon the Send and Receive lever SRL, thereby withdrawing the bakelite nose piece of this lever from the Send-Receive tongue SRT. A spring S_1, thereupon moves the tongue from the Receive to the Send Contact.

The sixth operating lever then falls to the bottom of its slot in cam CC, and forces the upper edge of the common lever UL to the left. Simultaneously, the locking frame LF is permitted by cam RC to rotate about its pivot in a clockwise direction under the action of a tension spring, until the knife edge has locked the selectors SL in their selected positions.

At appropriate intervals thereafter, the five code operating levers are released for anti-clockwise movement unless prevented by the corresponding selectors SL. During the rotation of the cam, therefore, the knife edge on the striker SB is rocked from side to side in a sequence determined by the setting of the selectors.

The lower arm of the lever SOL is held by a spring in engagement with the cam TC. This cam has seven "falls", angularly spaced with extreme accuracy, and their function is to time the upward striking movement of the knife edge

on striker SB. When the striker is fully positioned by the common operating lever UL, after the commencement of the rotation of the cam CC, the knife edge on the striker is struck upwards, forcing the contact armature TL, which normally rests on the left-hand or Marking contact M, over to the right-hand or Spacing contact S, thus initiating the "Start" impulse. The armature is held in this position by a jockey roller.

The horizontal position of the striker is subsequently determined by the combination being transmitted, and the armature is moved by the striker only if there is a change in the latter's position. After the five selecting impulses have been transmitted, the final "strike" initiates the "Stop" impulse, by retaining the armature on, or moving it to, the Marking contact M. The sixth selecting lever partially re-enters its slot towards the end of the cam revolution, but insufficiently to interfere with the transmission of the "Stop" impulse.

By connecting a suitable signalling supply to the Mark and Space contacts, the selected signals are transmitted to the distant station.

20-CHARACTER ANSWER-BACK UNIT

The answer-back unit is operated either by the depression of the "Here is" key, or by the receiver on receipt of the "Who-are-you ?" signal.

The "Here is" key is used by the calling operator to transmit the identity of his station to the receiving end. In effect, the answer-back unit is required to simulate the effect of the depression of the character keys corresponding to the answer-back signal, *i.e.* it is required to set the combination bars in accordance with a pre-arranged sequence of characters on the answer-back drum, and to trip the transmitting shaft at the proper times to allow these combinations to be transmitted to line.

Reception of the "Who-are-you ?" signal by the receiver results in the dropping of a bellcrank on the combination head. This action causes the release of the answer-back unit, a sequence of links and bellcranks being employed to communicate the motion of the operated bellcrank to the trip lever on the answer-back unit.

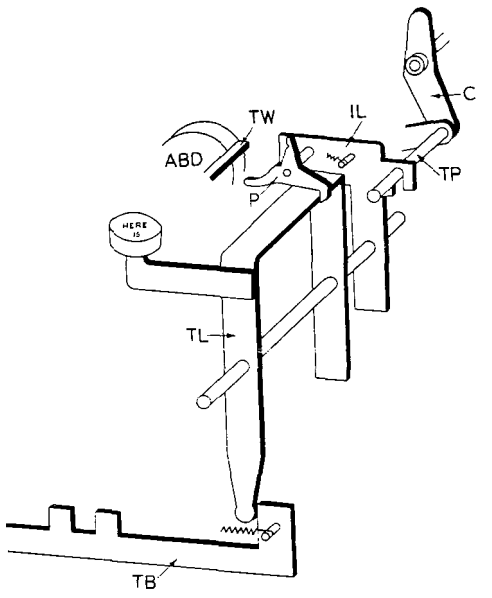
To obviate the possibility of the answer-back transmission from the distant machine commencing before the send-receive switch on the enquiring machine has returned to the receive side, and in certain cases, to give time for the operation of echo-suppressors, a delay period occurs before the commencement of the answer-back transmission. During this delay, which is approximately 164 milliseconds in duration, cams prevent the answer-back operating levers from exercising any control over the combination bars and the transmitter is not released.

(1) Single-Revolution Feature.

If the "Here is" key is depressed for a longer period than the time taken for one complete revolution of the answer-back drum, the latter will make a second revolution unless a means is provided to prevent it. Similarly, if the answer-back bellcrank on the combination head of the receiver is not reset, then the answer-back drum will continue to revolve unless prevented from doing so.

When the answer-back unit is used in circuits providing a local record, the bellcrank in the combination head is reset by the subsequent combinations of the answer-back signal. When, however, the unit is used in circuits not providing a local record, the bellcrank remains operated, and, unless some means is provided to prevent it, the answer-back drum continues to revolve, rendering further transmission impossible.

Fig. 10 shows the mechanism for starting the answer-back unit and for stopping it after it has completed a single revolution, whether the answer-back bellcrank remains operated or not.



SINGLE-REVOLUTION TRIP MECHANISM
FIGURE 10

The dropping of the answer-back bellcrank results in the movement of a pin TP to the left. This pin engages in a hooked extension of the latch support arm IL, and therefore moves the upper part of this arm to the left. The latch P, which is free to rotate about a pin riveted to IL, normally occupies a position in which a claw on the right-hand end of the latch clips over the top of the trip lever TL. As P moves to the left, the claw on P turns the trip lever in an anticlockwise direction about its pivot. The lower end of TL, which engages with the trip bar TB, moves the latter to the right and releases the answer-back drum.

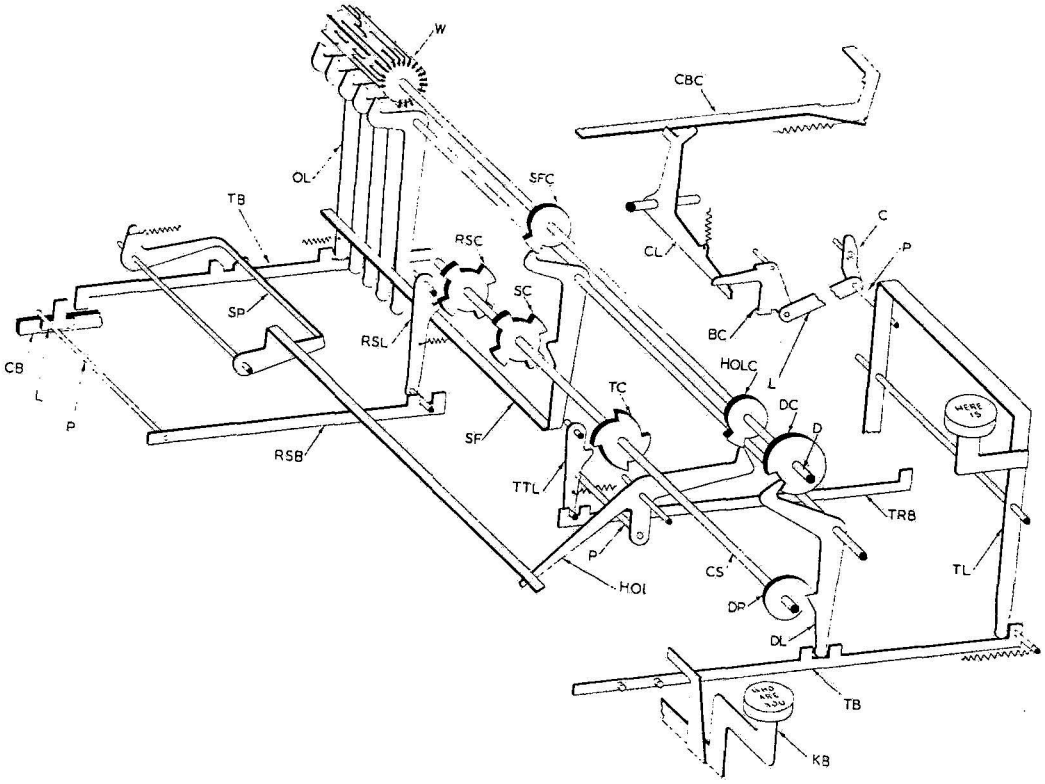
When the drum is approximately in the middle of its revolution, the figure shift ward approaches a shoulder of latch P. This ward is longer than the others, having an extension which overlaps the milled clamping plate. As the drum rotates, the extension of the ward presses down upon the latch shoulder, rotating it in an anticlockwise direction and disengaging the claw on the other end of the latch from the trip lever TL. The returning spring on the trip bar TB then resets TB and TL, so that the claw on latch P rides on the upper horizontal face of the trip lever TL. Thus, the trip bar TB is reset, although

the answer-back bellcrank on the combination head of the receiver remains operated, and the drum is accordingly arrested at the end of one complete revolution.

When a message is transmitted, the answer-back bellcrank is reset, causing the pin TP to move to the right. The latch support arm IL and latch P are also moved to the right, the claw on latch P again clipping over the lever TL, urged by a spring attached to a vertical extension of the latch. The trip mechanism is thereby made ready to respond to another answer-back signal.

(2) **Operation of the Answer-Back Mechanism,** see Fig. 11.

The operation of the trip lever TL, either by the depression of the "Here is" key, or by the receiver in response to a "Who-are-you ?" signal, moves the trip bar TB to the right. Two projections on the trip bar engage with an



ANSWER-BACK UNIT
FIGURE 11

extension of the detent lever DL. This lever is therefore turned about its pivot in an anticlockwise direction, disengaging its claw from the detent plate DP and releasing the control shaft CS, which being frictionally driven, commences to revolve. Thus, the detent plate DP, the transmitter trip cam TC, the setting cam SC and the resetting cam RSC, which are carried by the control shaft, are caused to revolve in a clockwise direction.

A second shaft D, which is gear-driven by the control shaft CS, starts to revolve at the same time as CS but at one-sixth of the speed. Shaft D carries the drum assembly consisting of the detent control cam DC, the hold-out lever cam HOLC, the setting frame cam SFC, and the answer-back drum, the latter being mounted above the operating levers OL.

The answer-back drum makes a complete revolution, carrying a number of wards, cut in accordance with the combinations to be transmitted, at a uniform speed past the ends of the five operating levers OL. These levers control the position of the combination bars of the keyboard. As each ward passes in front of the operating levers OL, an auxiliary cam SC permits the levers OL to press against the ward, and so arrange the combination bars in accordance with the signal to be transmitted. As this action is taking place, the cam TC causes the transmitting cam on the transmitting unit to be released and to make one complete revolution, during which the combination set up by the wards is transmitted to line. When transmission is completed, the levers OL are reset by a third auxiliary cam RSC in readiness for the same cycle of operations to be repeated for the next ward.

The control shaft CS completes six revolutions during a single revolution of the answer-back drum. The cams TC, SC and RSC on the control shaft each has four notches, and, in consequence, the operation of the answer-back mechanism may be divided into twenty-four cycles.

(3) **Sequence of Operations,** see Fig. 11.

(a) The Rest Position.

The setting frame SF is prevented from engaging with a notch of the setting cam SC by the hold-out cam SFC. Similarly, the transmitter trip lever TTL is held away from a hollow on the cam TC by means of a pin fixed to the hold-out lever HOL.

(b) First Quarter-Revolution of the Control Shaft.

The detent control cam DC on shaft D holds the detent lever DL in an anticlockwise direction and retains it in that position clear of the detent plate until the end of the revolution of the answer-back drum.

The hold-out cams SFC and HOLC withdraw their rises from the setting frame SF and the lever HOL. The latter thereupon removes a pin from in front of the transmitter trip lever TTL to allow this lever to be operated by the cam TC when the next hollow is presented to it. The lever HOL also moves its left-hand end away from the stop frame SP, permitting the right-hand edge of the frame to fall between projections on the transfer bars, the movements of which are thus limited.

The resetting lever RSL operates. The resetting bar RSB is moved to the right, a pin P riveted to RSB, thereby resetting any displaced combination bars CB and transfer bars TB, prior to the setting up of a new combination.

The setting frame nose is allowed to fall into a notch of the setting cam SC. Those operating levers OL which are not arrested by projections on the first ward rotate about their common pivot in a clockwise direction, their lower ends setting the transfer bars TB in accordance with the character cut on the ward.

The nose of the transmitter trip lever TTL enters a hollow in the cam TC. The lower extension of TTL then moves the transmitter release bar TRB to the right. This connects via an intermediate release bar with a pin on the detent operating lever DOP, Fig. 8, and therefore releases the transmitter cam shaft to transmit the character set up on the transfer bars by the ward.

At the end of the first quarter-revolution of the control shaft, the transmission of the "Start" signal is not quite complete.

(c) Second Quarter-Revolution.

The remainder of the "Start" signal, the five code elements, the "Stop" signal and a part of the next "Start" signal are transmitted.

During the transmission of the first three code elements the operating levers OL are moved out of the path of the wards as the nose of the setting frame rises from the notch in cam SC.

After the fifth code element has been transmitted, the setting frame SF permits the transfer bars TB and the combination bars CB to be reset, the transmitter trip lever is again actuated, and the transmitter cam again released.

The cycle of operations performed in the second quarter-revolution is repeated twenty times.

(d) Twenty-First Quarter-Revolution.

During this cycle of operations, the last answer-back character is transmitted.

The hold-out cams SFC and HOLC present their rises to the noses of the setting frame SF and lever HOL respectively. The setting frame SF and the transmitter trip lever TTL are thereby prevented from being operated by their cams throughout the twenty-second, twenty-third and twenty-fourth quarter-revolutions.

The hold-out lever HOL also raises the right-hand edge of the stop frame SF from between the projections on the transfer bars.

(e) Twenty-Second to Twenty-Fourth Quarter-Revolutions.

The resetting lever RSL continues to operate but the operation of the setting frame SF and the lever TTL is suppressed by the hold-out cams.

At the end of the revolution of the answer-back drum, the nose of the detent lever DL falls into a notch in the detent control cam DC, and the detent plate DP is arrested by the claw on the detent lever DL.

END-OF-LINE INDICATOR

The End-of-Line Indicator is used when transmitting to a page teleprinter to provide a visual warning to the sending operator that the page attachment on the distant teleprinter is approaching the end of a line and that he must therefore depress his Carriage-Return Key.

The mechanism is essentially a counting device to record the number of key-depressions after each operation of the Carriage-Return Key. When fifty-five depresssions have been recorded, the device closes a pair of contacts and lights a warning lamp on the Mains R.I.S. unit. The ensuing operation of the Carriage-Return Key resets the mechanism.

(a) Counting Operation.

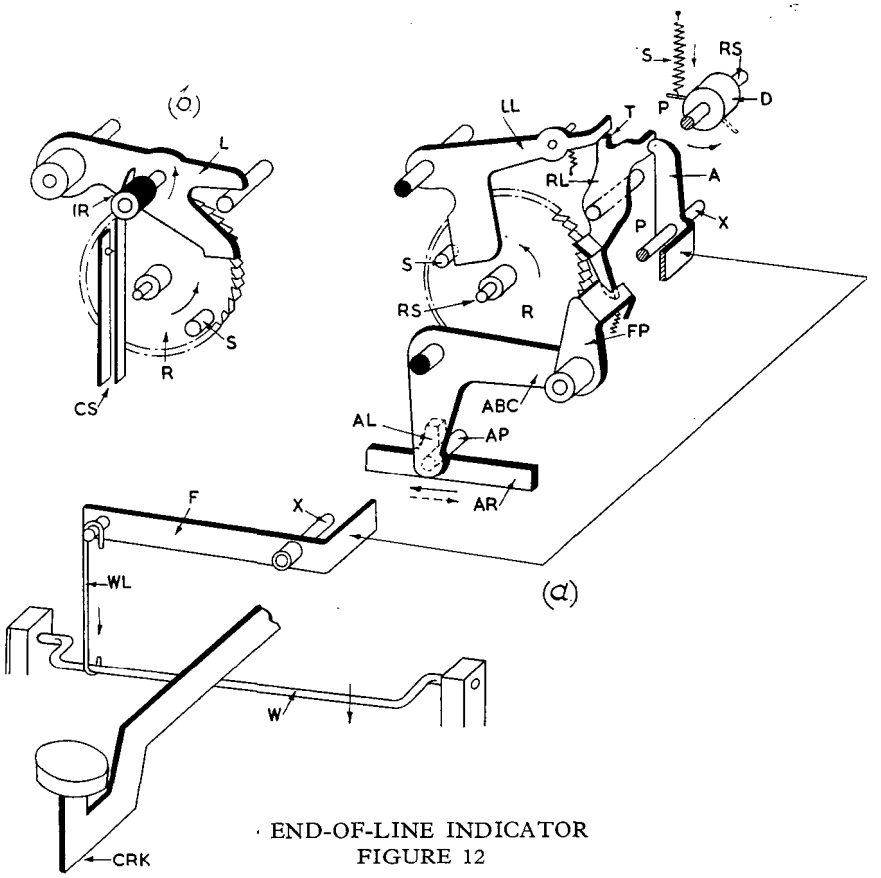
The drive for operating the indicator is obtained from a cam on the transmitting cam shaft. A lever working off the cam engages a pin in a claw formed at the right-hand end of the trip release bar AR, Fig. 12. Once during each revolution of the transmitting cam shaft the lever AR moves to the right, a lug on AR engaging with a pin AP on the feed lever ABC and rotating it in an anticlockwise direction. The other arm of ABC carries the feed pawl FP. This pawl therefore feeds the ratchet wheel R by one tooth, the retention pawl RL and its spring holding the ratchet in the fed position.

Every time the trip release bar AR moves to the right, the foregoing sequence of operations is repeated. As the ratchet wheel R rotates about its spindle RS it stretches a spring S (shown in the upper part of the figure) and partially winds this round the small drum D fixed to the spindle RS.

After the ratchet has been stepped round fifty-three teeth, the stud S presses against the lower limb of contact operating lever L, Fig. 12b, causing the contact roller IR to press the contact blade to the left. The action is completed and the contacts made after fifty-five teeth have been fed, a blank on the periphery of the ratchet wheel preventing further feeding.

(b) Resetting the Counter Unit.

Depression of the Carriage-Return key rotates the cranked trip rod W, which is connected by means of the indicator resetting link WL to the resetting lever (F and A). Lever A therefore strikes inwards at the retaining pawl RL, disengaging it from the ratchet wheel. The other extension of RL lifts the feed pawl FP clear of the ratchet immediately afterwards. A bent lug on the end of the lever LL holds the retaining pawl RL in its disengaged position by locking over the tooth T.



END-OF-LINE INDICATOR
FIGURE 12

Thus, freed from restraint, the ratchet wheel, under the tension of spring S, spins round rapidly in a clockwise direction. The pressure on L is relieved, allowing the contacts CS to break and the lamp to be extinguished.

At the end of the movement of the ratchet wheel, the stud S strikes the lower extension of lever LL. This lever is rotated in an anticlockwise direction, the movement being damped and arrested by a damping buffer and stop plate (not shown). The bent lug on the horizontal arm of LL is accordingly moved clear of the step T on RL. Hence, the retaining and feed pawls are allowed, under the action of their springs, to re-engage with the teeth of the ratchet, and the End-of-Line Indicator is thereby reset for the next counting operation.

THE RECEIVER

Introduction.

The signal impulses transmitted by the keyboard are received by a polarised electromagnet, the windings and electrical connections being so arranged that the armature rotates clockwise and anticlockwise for spacing and marking impulses respectively. These movements of the electromagnet armature control the selecting mechanism which reproduces the code on five vertical fingers.

The start transit of the armature releases an orientation cam. When this has been allowed to rotate by an amount which may be preset by the manual adjustment of a lever on a graduated scale, it releases the receiving cam. The rest position of the latter is so chosen that the variable time-delay in the release of the cam inserted by the adjustable orientation mechanism constitutes a means of advancing or delaying the selecting periods with respect to the start transit of the electromagnet armature. (The "selecting periods" are those five periods during the revolution of the receiving cam throughout which the receiving cam must remain against the appropriate Marking or Spacing stop for correct selection of the code to take place).

The orientation device is provided as a ready means of centralising the margin and checking the overall adjustment of the machine. Signals from a standard source of high-grade signals or from a striker transmitter are fed into the receiver, and the orientation lever is moved across the scale until the two positions at which the receiver fails to select are determined. Special combinations are sent for the shortest time sufficient to determine the minimum orientation range over which the receiver selects correctly. For correct overall adjustment of the teleprinter this range should not be less than the amount stipulated in the adjustment booklet. The lever is then set in the middle of the determined range.

The code setting on the five vertical fingers determines, through the agency of the translating mechanism, the fall of a bellcrank on the combination head. Operated bellcranks arrest and hold the typehead in the correct printing position, or, in the case of a non-printing combination, with a blank opposite the printing hammer.

The functions of feeding the tape and ribbon and providing an alarm for tape feed failure are derived from the same link that carries the finger setting pin. Levers are also included for operation by the functional bellcranks in order to prevent the tape from feeding on the All Spacing combination, and on Letters and Figures case-shift combinations.

ORIENTATION DEVICE

The principle of the orientation device involves :

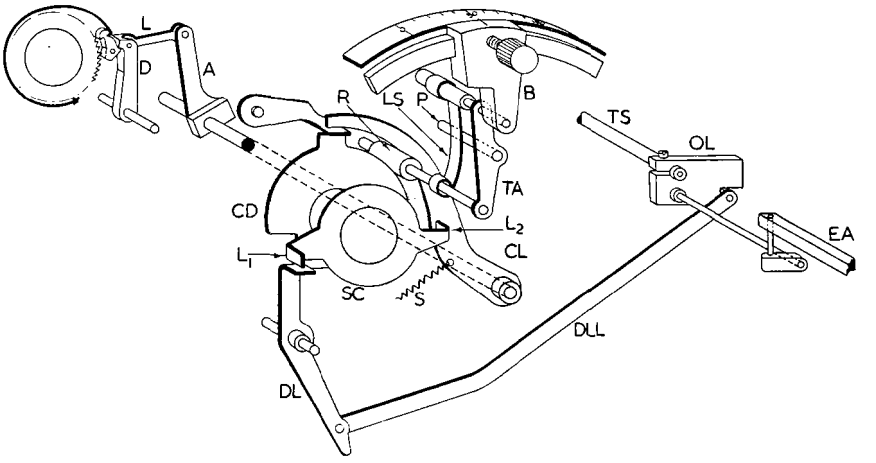
(a) a mechanism for inserting a variable time-delay between the start transit of the electromagnet armature and the moment of release of the receiving cam ; and

(b) the advance of the rest position of the receiving cam by 60 degrees from the position it occupies on the No. 7B Teleprinter (when this is not fitted with the orientation device), *i.e.* on the orientation cam unit the timing of the selecting levers is advanced with respect to the moment of release of the receiving cam sleeve.

Consequently, if the delay in (a) is greater than the advance in (b), then the net result is a delay in the selecting periods with respect to the start transit of the electromagnet armature. If the delay in (a) is less than the advance in (b), then the net result is an advance in the selecting periods.

The mechanism for delaying the release of the receiving cam is illustrated in Fig. 13.

An auxiliary pilot cam SC, possessing two lugs L_1 and L_2, is coupled to the main receive cam spindle by a friction clutch. In the rest position, cam SC is prevented from rotation by lug L_1, which abuts on a stop latch formed on the upper end of the pilot cam detent DL.



ORIENTATION DEVICE
FIGURE 13

When the start impulse is received, the movement of the electromagnet armature EA rotates the trip shaft operating lever OL in an anticlockwise direction. This moves the detent lever link DLL to the right, thereby rotating the detent about its pivot, removing the stop latch from the path of the lug L_1 and allowing the pilot cam SC to rotate.

B is a sliding frame which may be set and clamped in position on a circular scale graduated from 0—100. Hanging from B is a link TA which carries a roller R, the latter being supported by a fixed circular disc CD behind the friction clutch. The lower end of the orientation link spring LS projects into the circular path of lug L_2. The orientation link TA may, therefore, be set manually so that its lower end occupies any position in a limited portion of a circular path concentric with the spindle.

After the pilot cam has rotated an adjustable distance, therefore, lug L_2 comes into contact with the lower projecting end of spring LS. This presses against the pin P and moves the orientation link outwards, in turn rotating the cam release lever CL about its pivot. The link spring LS serves, by storing energy derived from the clutch and transferring it to the orientation link and release lever, to prevent the clutch from slipping, which would result from a direct impact. The cam release lever is connected to the detent D via levers A and L and therefore withdraws the detent from the receive cam pawls.

At the end of the revolution of the pilot cam SC, the latch on the vertical arm of pilot cam detent DL is again in position to abut against lug L_1 and hence to stop the cam from further revolution.

SELECTION

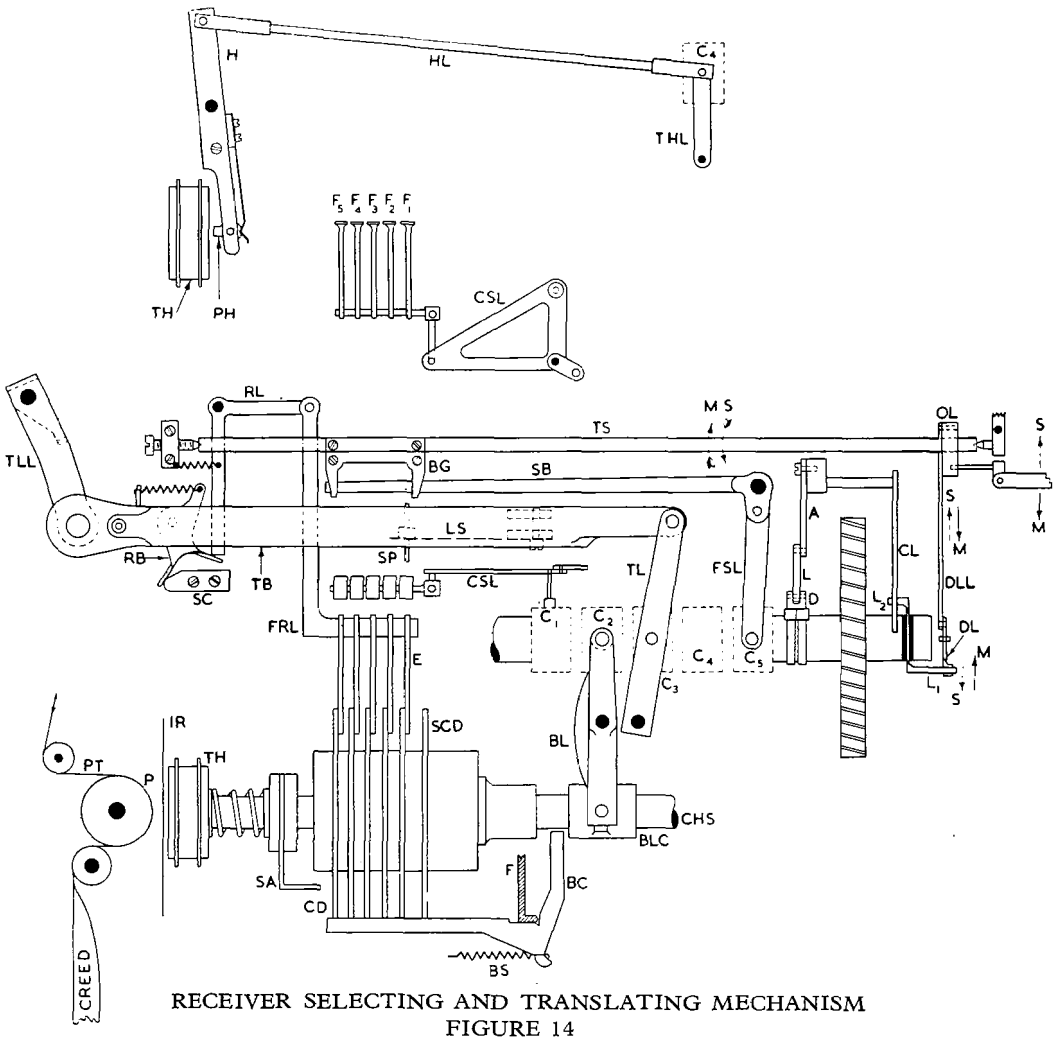
The selecting mechanism converts the movements of the electromagnet armature into a code setting on five vertical fingers, F_1—F_5, Fig. 14.

The receiving cam sleeve carries five cam tracks, in each of which there runs a roller controlling the movement of a lever. Two of these, the traversing lever TL and the finger setting lever FSL, are relevant to the process of selection.

The finger setting lever FSL has attached to it a flexible blade SB, which is free to move in slots formed by two blade guides BG. These are rigidly attached to the trip shaft TS. A rotation of the trip shaft, therefore, has the effect of raising or lowering the end of the blade SB.

The traversing lever TL is connected to a link TB which carries the finger setting pin SP. This is supported at one end by a spring LS, the rear portion of the pin passing through a hole in the link.

In the rest position of the cam the setting pin is opposite the first finger. Immediately after the cam sleeve starts to rotate, the traversing link remains stationary for a few milliseconds and then takes the pin steadily past the five fingers. During this motion the finger setting lever FSL causes the blade SB to strike inwards at the pin SP in timed relation to its movement past the fingers, so that, when the blade is in its fully forward positions, the pin is approximately central with each of the five fingers in turn.



RECEIVER SELECTING AND TRANSLATING MECHANISM
FIGURE 14

Whether the blade strikes the pin or misses it is determined by the position of the guides BG and hence of the trip shaft TS. A spacing condition of the trip shaft (*i.e.* rotated in the direction of the dotted arrow) depresses the blade SB and causes it to pass underneath the pin. A marking condition of the trip shaft allows the pin to be struck inwards against the tension of the spring LS. The code combination which was registered by the electromagnet armature is reproduced in this way on the five fingers, marking fingers being pushed back under the comb extensions E.

The fingers are pivoted at their lower ends on a spindle and are supported in guide slots in a block, each slot being fitted with damping springs to ensure the retention of the finger in its correct position.

On the return journey of the traversing link TB from the fifth to the first finger, the fingers are reset. The resetting bellcrank RB turns the resetting link lever RL about its pivot, causing the resetting link FRL to draw back all the fingers. The plate SC is so adjusted that the bellcrank RB is tripped out of engagement with the lever RL just before the fingers reach the fronts of their slots.

TRANSLATION.

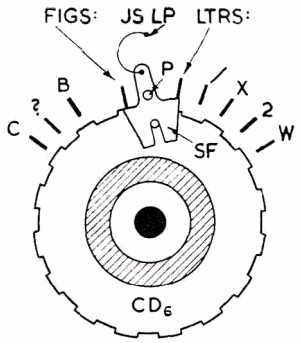
The comb setting lever CSL and the bellcrank lifting lever BL translate the code set up on the fingers into the fall of a bellcrank on the combination head.

After the fifth finger is set the bellcrank lifting lever BL presses its collar BLC against the tails of the bellcranks BC. These are pivoted on an annular fulcrum F, about which they are turned against the tensions of their springs BS, freeing the five combination combs CD and a sixth comb SCD. The combs are mounted on a stationery hollow cylinder with the combination head spindle CHS passing through its centre. Freed from the pressure of the bellcranks, they are enabled to move about their bearing under the action of their springs, the extensions E being thereby caused to fall.

Immediately after the bellcrank lifting lever has operated, the comb setting lever raises the five fingers. The roller of this lever works off the side of its cam track, the lever itself being connected to the spindle upon which the lower ends of the fingers are pivoted. The marking fingers of the code which were set prior to the operation of the comb setting lever, meet and raise the dropping comb extensions E, causing those combs to be rotated. Whilst the comb setting lever holds the fingers in their upper position, the bellcrank lifting lever allows the bellcrank to fall on to the combs. After the bellcranks have fallen the fingers are lowered.

A series of notches is cut round the periphery of each of the combination combs in such a manner that, for every combination into which the combs are moved, an unobstructed slot is opened up by all five combs beneath a pair of adjacent bellcranks. Each of these pairs of bellcranks consists of one bellcrank corresponding to a character in the "Letters" case, and one in the "Figures" case. Which bellcrank of the pair is permitted to drop is determined by the position of the shift comb SCD.

This comb has a serrated edge, the pitch of the teeth being equal to double the pitch of the bellcranks. It is free to turn about the same bearing as the combination combs and its permissible movement is equal to one bellcrank pitch. Thus, in its change from one position to the other, it prevents one bellcrank in each pair from moving, but places the other under the control of the combination discs. Generally, one combination, therefore, results in the operation of one bellcrank only, the position of the shift comb determining whether this bellcrank is in the "Figures" or the "Letters" group. In a few cases such as the Carriage-Return, Line Feed and Space bellcranks, which have to operate in both shifts, two adjacent bellcranks fall. Only one is effective, however, as the second has part of its end cut away and therefore cannot arrest the typehead.



SHIFT COMB
FIGURE 15

The movement of the shift comb is effected by two special bellcranks, Fig. 15. When a letter case-shift combination is received, the combination combs are turned and present five spaces under the letters bellcrank. The entire pressure of this bellcrank and its associated spring is brought to bear on a shoulder of the shift lever SF, thus turning the lever about its pivot P and moving the shift comb into the letters position. When the figures case-shift combination is received, the reverse operation takes place.

The spring JS replaces the jockey roller which is usually fitted to this type of movement, and retains the shift comb in the position to which it was last moved. The pin LP is attached to the frame of the machine, the spring being compressed when it is placed in position.

THE TYPEHEAD AND CLUTCH.

The typehead consists of an assembly of type pads, one for each character, arranged radially in a circular rack supported on a boss mounted on the typewheel spindle.

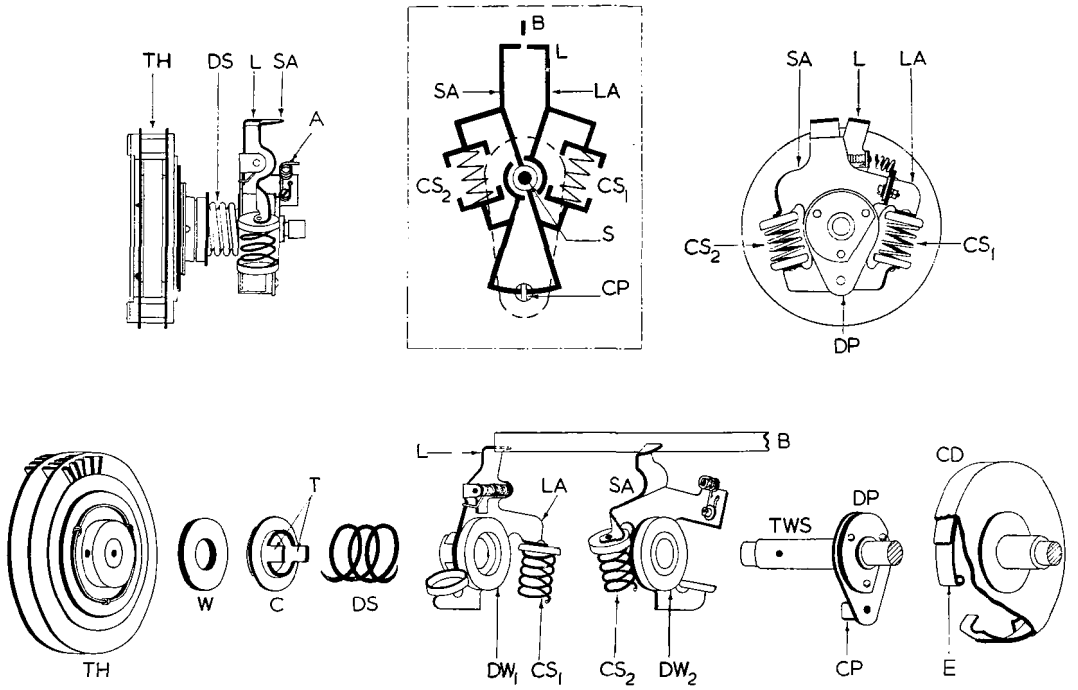
When the bellcrank lifting collar spreads the bellcranks on the combination head, the typehead is allowed to rotate, driven by the combination head spindle via a friction clutch. Mechanism is provided to stop the typehead against the dropped bellcrank and to absorb its energy, so that it may be at rest and correctly positioned when the printing hammer strikes forward.

Construction.

Fig. 16 represents the typehead with its parts drawn in the order in which they are assembled on the spindle TWS, the typehead boss and rack holding the assembly together by being pinned to the spindle. Threaded over TWS and located next to TH are the thrust washer W and thrust collar C, the latter being keyed by the diametrically opposite tongues T to a boss on the latch arm LA. The stop arm SA is assembled between the latch arm LA and the driving plate CD.

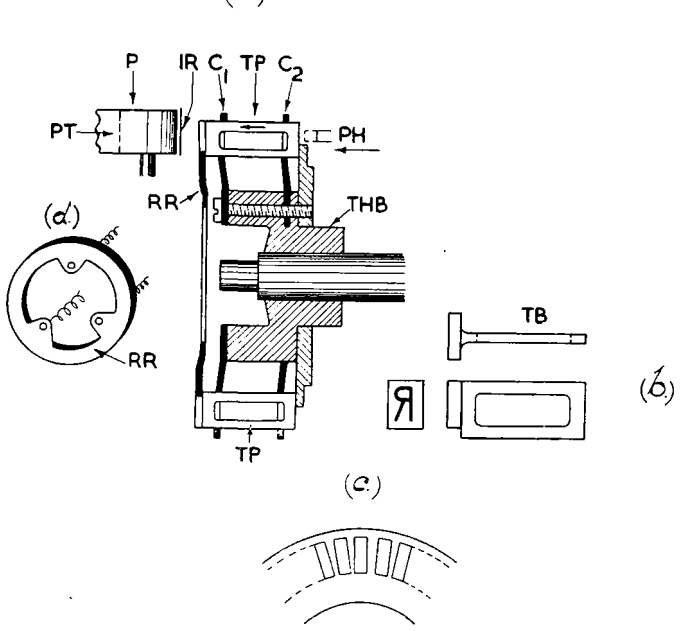
Between LA and SA, and again between SA and CD, are two oilite damping washers, DW_1 and DW_2. The damping spring DS, which surrounds the tongue T on C and the key slots in LA, thrusts the latch arm, the stop arm and the two damping washers towards DP, so that any movements of the latch arm and the stop arm are heavily damped.

A centralising pin CP is riveted to the driving plate DP. The springs CS_1 and CS_2 apply a clockwise torque to SA and an anticlockwise torque to LA, so that two straight edges on these arms are normally thrust against the centralising pin.



TYPEHEAD AND CLUTCH
FIGURE 16

The construction of the type rack and boss is shown in greater detail in Fig. 17. The outer edge of the retaining ring RR fits against the shoulders formed beneath the faces of the type pads. This ring is held against the types by three helical springs, Fig. 17d, and yields when the printing hammer strikes the back of a type pad.



TYPE RACK
FIGURE 17

Operation.

The action of stopping the typehead and positioning it for printing may be understood from the schematic inset at the top of Fig. 16. This shows the typehead arresting mechanism viewed from the combination head. The rotation of this mechanism, before the typehead is stopped by

an operated bellcrank, is in a clockwise direction about the spindle S, and it is driven by the typehead driving spring A which engages with an eye formed by one end of the clutch band E.

After a bellcrank drops the typehead continues to rotate until the stop arm SA approaches the fallen bellcrank. The latch L on LA first engages the bellcrank and is pressed back against the tension of its spring. When the stop arm SA meets the bellcrank, the latch arm passes beyond it, and, jumping forward again under the action of its spring, latches on its other side.

The inertia of the typehead now causes it to go on rotating. Thus, the centralising pin CP, which is solidly connected to the typehead, continues to move in a clockwise direction, thrusting against the bottom of LA and therefore compressing both CS_1 and CS_2. During this motion some of the energy of the typehead is dissipated in the damping washers DW_1 and DW_2, the rest being stored in CS_1 and CS_2. CP now reverses, being pushed back in an anticlockwise direction by the springs CS_1 and CS_2 until it makes contact with the bottom of SA. CP then thrusts against SA, which again compresses CS_1 and CS_2, although not to such an extent as the compression of these springs by the movement of LA, since more of the energy of the typehead has been dissipated in the damping washers.

Thus, the typehead executes a rapidly damped oscillatory movement, coming to rest opposite the appropriate type pad, its final position being determined by the fact that SA and L are at rest against each side of the bellcrank, and the pin CP, firmly held between SA and LA, is solidly connected to the typehead.

The type pad is then struck by the printing hammer PH, Fig. 17. The interval of time between the release of the typehead by the bellcrank lifting collar and the moment when the typehead is at rest and ready for printing is with the single cam arrangement on this teleprinter, too great to allow the printing of a character to take place during the same revolution of the cam which effected its selection.

In order to give the maximum time for the revolving typehead to stop and to be in position for printing, the hammer head strikes just before the fifth code element of the following character is fully selected. It moves smartly forward and strikes the paper tape PT, Fig. 17, which is supported by the platen P. An ink ribbon IR is interposed and in this way a record of the selected type pad is secured.

TAPE FEED MECHANISMS

The tape is fed forward step by step, a feed operation taking place, unless interruption occurs, during the motion of the setting pin from the first to the fifth finger.

Provision is made to sense the passage of the tape continuously and to give an indication

(a) if there is no tape in the machine ;
(b) if the tape has broken ; and
(c) if it has jammed and is not being fed by the tape feed roller.

This indication is accomplished by the closure of two contacts, which may be used to complete a local alarm circuit or, alternatively, to provide a warning of tape feed failure to the transmitting operator.

This tape feed failure alarm device is essential on "unattended" circuits, particularly if they are associated with a switching system. On such circuits, operation of the answer-back unit automatically advises the transmitting operator that the distant machine has received and translated the incoming signals correctly. It is safe to accept this as an acknowledgment that the message has been received, provided that there is tape in the machine and that it has been properly fed.

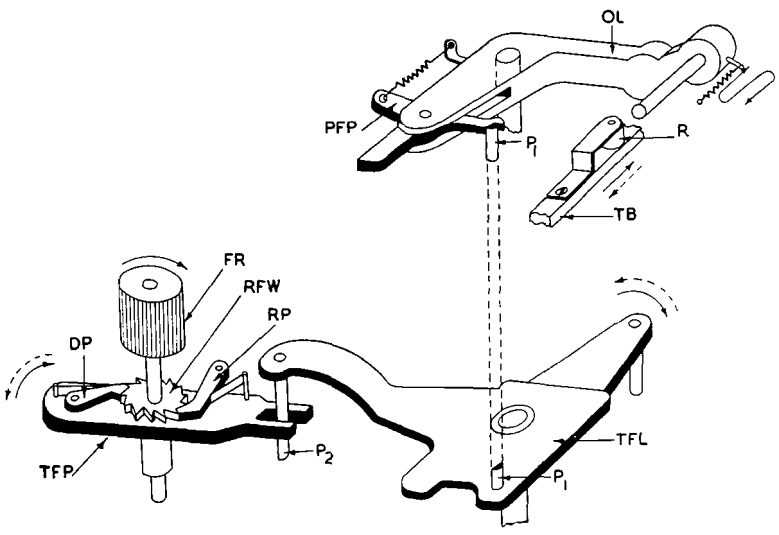
Deliberate interruption of the tape feed is effected for certain functional combinations (*i.e.* All Spacing, Letters and Figures), and when the tape has jammed.

Normal Feeding Operation.

As the traversing link TB, Fig. 18, moves in the direction of the full arrow, carrying the setting pin (not shown) towards the fifth finger, roller R on the rear of the link engages with a stud on the operating lever OL and rotates this lever in an anticlockwise direction about its pivot.

Attached to the other arm of OL is a permissive feed pawl PFP, which is caused to engage with a projection P_1 on the tape feed lever TFL, and thereby rotate this lever in turn.

A pin P_2 on an arm of the lever TFL engages in a slot in the plate TFP, thus feeding the tape feed roller FR by means of a pawl and ratchet mechanism consisting of the ratchet wheel RFW, driving pawl DP and retention pawl RP.

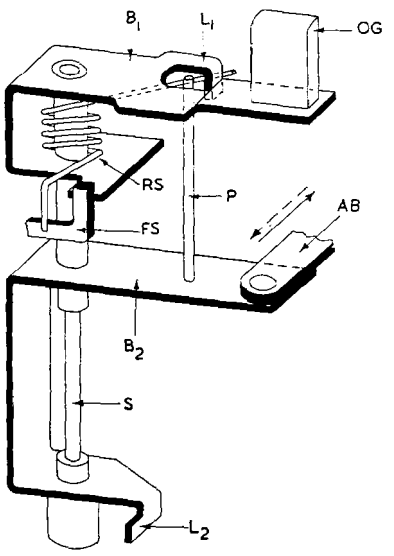


TAPE FEED MECHANISM
FIGURE 18

Tape Feed Failure Alarm.

A further function of the traversing link during its movement forward is to rotate the traversing lever link B_2, Fig. 19, in a clockwise direction about the spindle S.

When the setting pin is opposite the first finger and the traversing link is therefore fully withdrawn in the direction of the full arrow, Fig. 19, the pin P holds one end of the tape gripper spring RS clear of the lug L_1 on the tape gripper lever B_1. As the traversing link moves forward in the direction of the dotted arrow, the pin P relaxes the tension in spring RS, allowing the latter to engage with lug L_1 and rotate lever B_1 in a clockwise direction. The gripper OG is thereby brought in tight against the fixed gripper FG, Fig. 20, and the tape is held fast between the two grippers.



TAPE GRIPPER
FIGURE 19

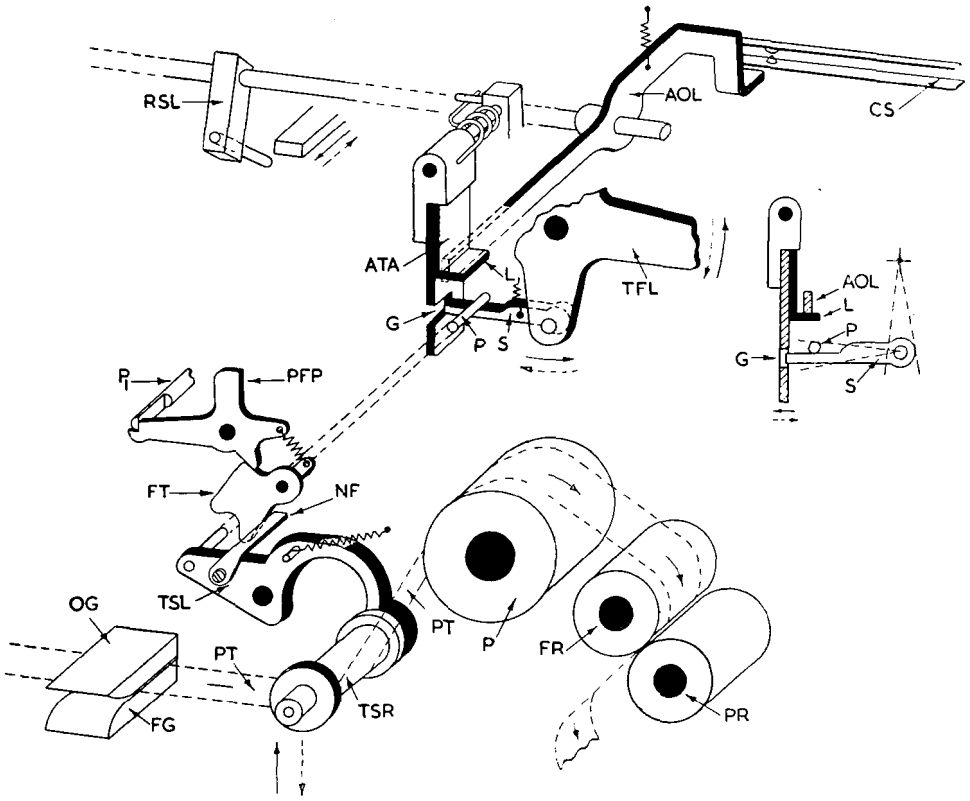
This gripping action occurs during every forward movement of the traversing link. Conversely, every return movement of the traversing link releases the tape. Pin P removes the spring RS from lug L_1, freeing the tape gripper lever B_1 and allowing fresh tape to be drawn through.

The effect of feeding the tape at the feed roller while it is held fast by the tape grippers is to shorten the length of tape between these two points. In addition to passing in front of the platen the tape passes round a sensing roller TSR on the end of the curved arm of the seeker operating lever TSL. The shortening of the tape, therefore, applies a force to the sensing roller, and causes the lever TSL to rotate against the tension of its returning spring. The amount of rotation of this lever for the normal feeding case, in which no alarm condition is set up, is sufficient for seeker operating pin P to position the seeker S in front of its gate G, so that, on the return of the traversing link, and hence on the resetting of lever TFL, the seeker may pass through the gate.

(a) "No Tape" and "Broken Tape" Conditions.

If there is no tape in the machine, or if the tape is broken, the sensing roller is free from pressure, and the seeker operating lever TSL occupies a maximum clockwise position.

During the return movement of the traversing link the tape feed lever TFL returns the seeker towards the alarm trip arm ATA. The position of the lever TSL, and therefore of the pin P, causes the seeker to engage on the



TAPE FEED FAILURE ALARM
FIGURE 20

alarm trip arm ATA on the upper side, on Fig. 20, of the gate. A lug L on ATA disengages from the end of the alarm operating lever AOL. The latter is free to move since lug L_2, Fig. 19, on the traversing lever link B_2 is clear of the pin on the resetting lever RSL, Fig. 20. The spring attached to AOL rotates the lever about its pivot, enabling it to close the alarm contacts CS. The closure of these contacts may be utilised to complete a local warning circuit or to send a warning signal back to the transmitting operator.

When fresh tape is placed in the machine the resetting of the mechanism takes place automatically. When the lever TSL, and therefore the seeker S, are properly positioned for normal operation, the resetting action of lever RSL allows the lug L on the alarm trip arm ATA to clip under AOL, since the arm ATA is spring-tensioned. The lever AOL is thus held in the unoperated condition until the next failure.

(b) "Jammed Tape" Condition.

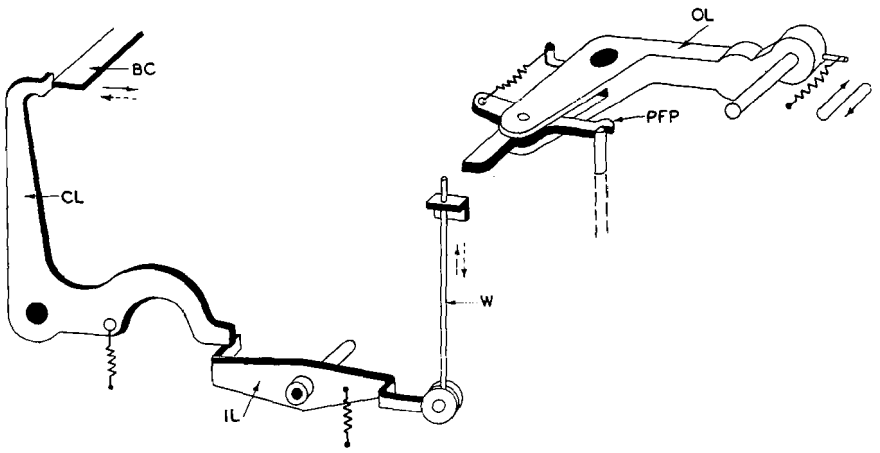
A single shortening of the length of tape between the tape grippers and the tape feed roller is sufficient to ensure non-fail operation, *i.e.* by allowing the seeker to return through its gate. If the paper jams, however, further shortenings of the length of tape between the two points will take place, and the seeker

will eventually engage with the alarm trip arm ATA on the under, on Fig. 20, side of the gate. Hence, ATA will be tripped and the lever AOL will close the alarm contacts in the manner already described.

In order to prevent the milled edge of the feed roller FR, Fig. 18, from wearing through the paper when the tape has jammed, the tape feed operation is stopped. A non-feed lever NF, Fig. 20, which is attached by a screw to the seeker operating lever TSL, rotates the feed throw-out lever FT in a clockwise direction. This presses on a shoulder of the permissive feed pawl PFP, in turn rotating the pawl in an anticlockwise direction, so that the feeding arm disengages from the pin P_1, and therefore prevents the tape feed lever TFL, Fig. 18, from operating.

Tape Feed Throw-Out.

Resting against the All-Spacing, Letters and Figures bellcranks are pivoted control levers CL, of which one only is shown in Fig. 21. Their other ends rest upon an extension of the selector lever IL.



TAPE FEED THROW-OUT
FIGURE 21

When one of the bellcranks drops, the corresponding control lever is rotated about its pivot by the downward pull of a spring, thereby also turning selector control lever IL about its pivot and raising the selector W.

This action occurs immediately after the operation of the bellcrank lifting lever. During the remainder of the revolution of the receiving cam sleeve, the traversing link carries the setting pin from the fifth to the first finger. The operating lever is permitted to rotate in a clockwise direction under the action of its spring. During this return movement of OL an arm of the permissive feed pawl PFP backs against the top of the feed pawl selector W, rotating PFP anticlockwise and moving the driving extension of PFP clear of the projection P_1, Fig. 18, on the tape feed lever TFL.

Repeated motions of TFL, therefore, cause the ratchet R_2 to rotate in a clockwise direction. The right-hand ribbon spool is rotated by R_2, winding on ribbon from the other spool attached to R_1.

Ribbon Reversal.

The automatic reversing action of the ribbon feed mechanism depends upon the presence of a small button or eyelet a few inches from each end of the ink ribbon. The ribbon, assumed to be unwinding from the left-hand spool, passes through two narrow slots S_1 and S_2 in the ribbon reversing lever RRL. Thus, the ribbon leaves the left-hand bobbin, passes through the left-hand slot S_1 in the lever RRL, is guided between the printing hammer and the paper tape, enters the right-hand slot S_2 in RRL, and is finally wound on the right-hand bobbin.

As the left-hand spool nears exhaustion, an eyelet E on the ribbon tries to pass through the left-hand slot of RRL. The eyelet being too large to pass through, RRL is caused to rotate about its pivot in a clockwise direction (see positions a and b in inset chain-dotted diagram), the change jockey lever CJ retaining it in its new position. The next operation of RFL brings an extension L_1 of the feed pawl FP (position b on inset diagram) into contact with the left-hand bottom edge of the newly positioned lever RRL. As RFL continues to rotate in a clockwise direction and FP continues to rise, the latter changes over to the left-hand side (position c), the pin P now engaging with the ratchet R_1. FP is held in its new position by the spring JS. The retaining pawl RP is rotated by the pin P in an anticlockwise direction so that RP_2 now engages as a retaining pin with R_1. The pawl RP is held over to the left by jockey lever JL, the pin LP on pawl RP being held down by the lower horizontal face of JL.

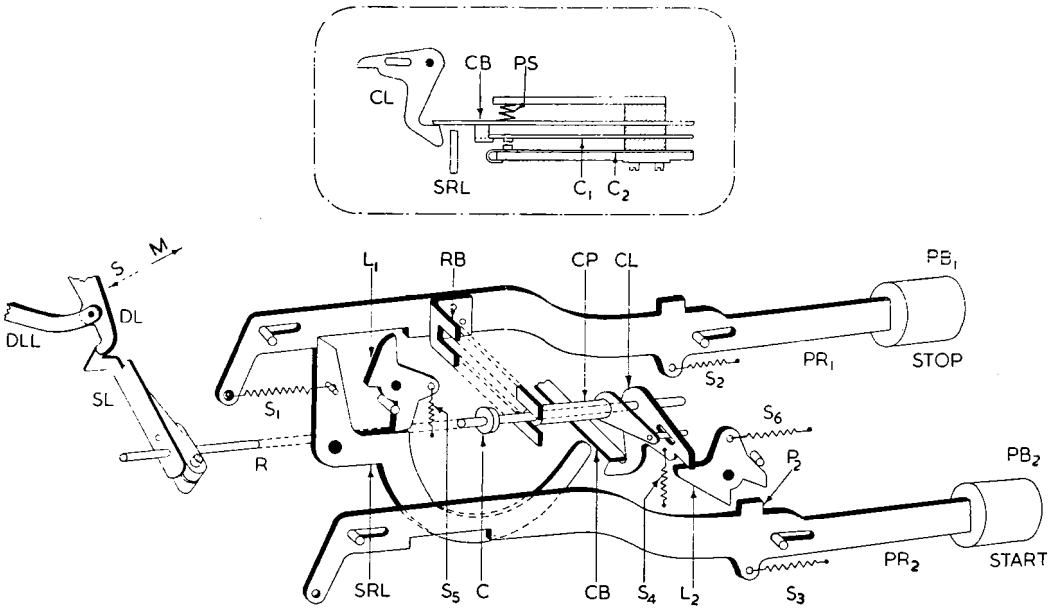
Hence, the left-hand ratchet wheel is now fed round in an anticlockwise direction, the ribbon unwinding from the right-hand spool. When the latter spool nears exhaustion the other eyelet rotates the lever RRL in an anticlockwise direction (position d), L_2 engages with the bottom of RRL, and pin P is swung over to the right, carrying RP with it (position a again) and once more reversing the feed of the ribbon.

STARTER SWITCH UNIT

The starter switch unit provides facilities for starting and stopping the motor by means of separate push-buttons, and for starting the motor automatically by means of an incoming spacing impulse. Provision is also made for operation of the "Stop" button to stop the motor during the receipt of a long spacing signal.

(a) Manual Starting.

Fig. 23 depicts the starter switch unit from a point below the machine base. Pressing the lower start push-button PB_2 causes the push rod PR_2 to slide to the left against the tension of the returning spring S_3. A projection P_2 on PR_2 engages latch L_2 and causes it to rotate in a clockwise direction. The extension of the contact latch CL which rests on a shoulder of latch L_2 is thus



STARTER SWITCH UNIT
FIGURE 23

raised against the pull of the spring S_4 and the contact latch rotates about its pivot. The other arm of CL bears the latch face which, in the stop position, holds up the contact operating bar CB of the starter switch against the pressure of the spring PS. The rotation of the contact latch CL removes this face from under the bar CB and allows the latter to be pushed downwards by the spring PS, thereby carrying the motor contact blade C_1 towards the contact blade C_2. The contacts therefore make and complete the motor circuit. Removal of the finger from the start button PB_2 allows the push rod to return to the right under the action of spring S_3, the lower end of the contact lever falling against the end of the operating bar CB through the tension of the spring S_4.

(b) Manual Stopping (Electromagnet Marking).

Pressing the upper "stop" button PB_1 causes the push rod PR_1 to slide to the left. A spring S_1 on its left-hand extremity is attached to the vertical arm of the switch return lever SRL, and therefore, for the first part of the movement of the push rod, the lever SRL rotates in an anticlockwise direction. It is then arrested by the underside of the latch L_1, the continuing movement of PR_1 tensioning the spring S_1. Towards the end of the movement of the push rod,

a step on the underside of the rod comes into contact with a vertical extension of the latch L_1, and moves the latter in an anticlockwise direction, removing the obstruction to the further movement of the switch lever SRL.

Owing to the tension of spring S_1, the switch lever operates suddenly, moving the operating bar CB upwards with a decisive action and breaking the motor circuit. The operating bar CB is retained in its upward position by the contact latch CL, which is caused to rotate about its pivot by the spring S_4 and to position its latching face under the operating bar.

Removal of the finger from the stop button PB_1 allows the push rod PR_1 to slide back to the right. Towards the end of its movement the rod resets the switch lever SRL in a clockwise direction. The latch L_1 is then reset by means of the spring S_5.

(c) **Automatic Starting.**

The arrival of a starting impulse at the receiving electromagnet trips the pilot cam detent DL, see Fig. 12, the lower end of which operates starting lever SL, Fig. 23. With the motor stopped and the electromagnet armature in the marking position, the lower extension of the pilot cam detent rests against the starting lever. Hence, the movement of the electromagnet armature to space moves the detent downwards, on Fig. 23, and rotates the contact latch CL via the rockshaft R and the coupling CP. The latch releases the operating bar CB and allows the blades C_1 and C_2 to make contact. The contact latch then returns and rests against the end of the operating bar CB, holding the starting lever clear of the detent extension.

(d) **Manual Stopping** (Electromagnet Spacing).

In order that the motor may be stopped manually while the electromagnet armature is spacing, the starting lever SL is made in the form of a light spring and has a slot in its upper end slightly wider than the lower extension of the pilot cam detent DL.

When the "Stop" button is operated, the two claws of the rockshaft bracket RB push the rockshaft R to the left by pressing against the collar C. The starting lever SL, therefore, also moves to the left, positioning the slot in the lever opposite the detent DL. When the operating bar CB is struck upwards by the switch return lever SRL, the spring S_4 rotates the contact latch CL about its pivot until it latches under the operating bar and retains it in an upward position. This movement is made possible by the slot in the starting lever SL, which allows the lever to move upwards to the latching position.

When the finger is removed from the "Stop" button PB_1, the push rod PR_1 returns to the right and the claws on the rockshaft bracket RB press against the coupling CP, thereby pushing the rockshaft R in the same direction.

The starting lever SL, which is held by the detent DL at its upper end, flexes as its lower end follows the motion of the rockshaft.

MOTOR UNIT.

The standard motor for this teleprinter is a single voltage AC/DC motor. This is available for any nominal voltage between 85 and 250 in steps of 5 volts, when the AC frequency is 50 cycles per second. For frequencies above and below 50 cycles per second this range is modified according to frequency.

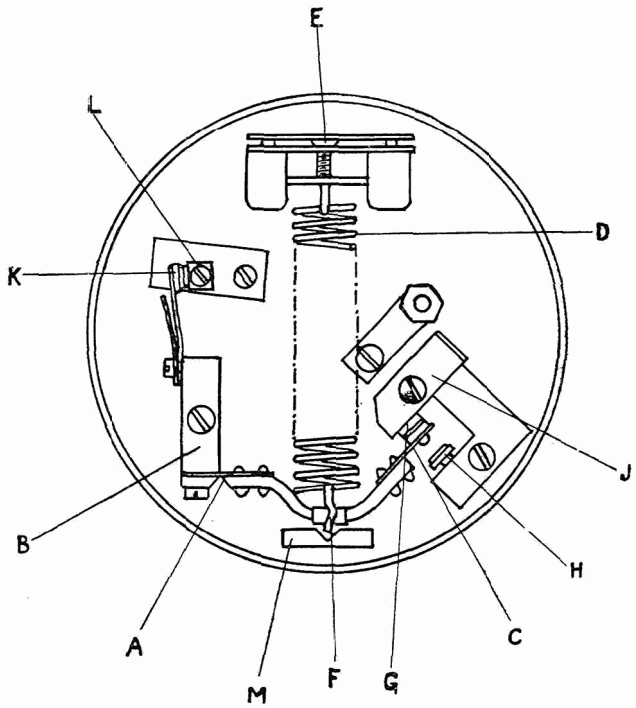
The standard motor may be used where variations from the nominal voltage for which the motor is supplied do not exceed ±10 per cent. Straps are provided for connecting the field coils in parallel for use with A.C. and in series for D.C. supplies.

When a motor is required for a D.C. supply of less than 50 volts, series governing is undesirable because of the consequent heavy currents in the armature. In such cases, a shunt-wound motor is used and shunt governing employed ; that is, the armature and field coils are arranged in parallel, the governing resistance being in series with the field coils. A shunt type governor S.1933 must be employed with this motor.

Noise from the motor is virtually eliminated by the use of "Silentbloc" bonded-rubber mountings and a bonded-rubber coupling, electrical contact between the motor and the base terminal blocks being effected by means of two wire leads.

MOTOR GOVERNOR

Between the Motor Unit and Governor Unit on this teleprinter, a Motor Connection Panel is inserted in order to hold the governor R.I.S. resistor and capacitor, and two adjustable governor brushes. These brushes make contact with the slip rings on opposite sides of the motor shaft in order to provide independent adjustments for them. This enables new brushes to be fitted and set so that their entire contact faces press against the slip rings.



GOVERNOR
FIGURE 24

Fig. 24 shows the governor used with this teleprinter. The contact arm A consists of a central portion of bent steel with a spring extension affixed to each end. The spring on the left-hand end is used to anchor the contact arm to the contact arm block B and also serves as a pivot for it. The spring C on the right-hand end is set at an angle to the anchor spring and carries the governing contact, which, to facilitate replacement, is fixed to the arm by a screw.

The governing spring D is fixed at its top end to an adjustable anchorage E, its lower end being fitted with a loop F which embraces the contact arm.

When the motor is at rest the contact arm is pulled towards the centre, and the governing contact is held against the fixed contact G with sufficient force to flex the contact spring slightly.

As the motor speed increases towards the governed speed the centrifugal force acting against the governor spring force increases, and the contact arm continues to move outwards. During the first part of its movement the contact spring unflexes, sliding the moving contact across the face of the fixed contact, resulting in a self-cleaning effect.

As the contact arm continues to move outwards, the contacts separate and a resistance is thereby inserted in series with the armature. This causes the motor speed to fall, leading to a reduction in the centrifugal force and an inward motion of the contact arm. As soon as the contacts touch each other the resistance is short-circuited. Owing to the inertia of the armature, the speed is not immediately affected by the increase in voltage across it; the contact arm continues to move inward, thereby flexing the contact spring and wiping the contact faces together.

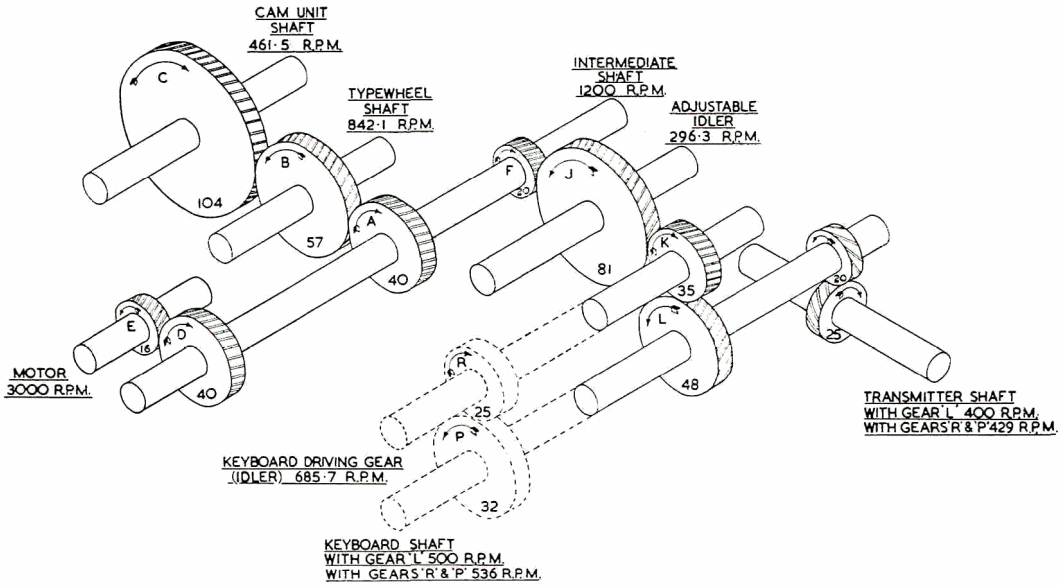
After a short interval, the speed again increases to a value sufficient to cause the contact arm to move outwards, repeating the wiping action and again inserting the resistance in series with the armature. This cycle of operations continues, whilst the motor is running, at a frequency of approximately 50 per second. The self-cleaning action provided by this design prevents contact pitting and considerably increases the life of the contacts.

The contacts H, K and L are not provided on standard governors, but can be added when the governor is required to control a shunt-wound motor by controlling the field current. When the motor is at rest the contacts K and L are closed, short-circuiting the governing resistance on starting. Contact G is replaced by an insulating stud and contact C is reversed to operate in conjunction with contact H in short-circuiting a resistance in series with the field when the motor speed rises beyond its correct value.

This governor holds the speed constant within ± 0.5 per cent. with voltage variations of ± 10 per cent. from the normal.

SHAFT SPEEDS

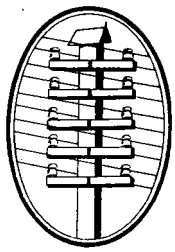
Fig. 25 illustrates the gear train employed in the No. 47 Teleprinter and gives the names and speeds of the shafts.



SHAFT SPEEDS
FIGURE 25

For $7\frac{1}{2}$-unit transmission, gear K is coupled to L to provide the required speed of 400 r.p.m. for the transmitter shaft. For 7-unit transmission, gear L is replaced by two gears R and P (shown dotted), the transmitter shaft speed being thereby increased to 429 r.p.m.

The $6\frac{1}{2}$-divide receiving cam employed in both cases is driven at 461.5 r.p.m.



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