March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 1

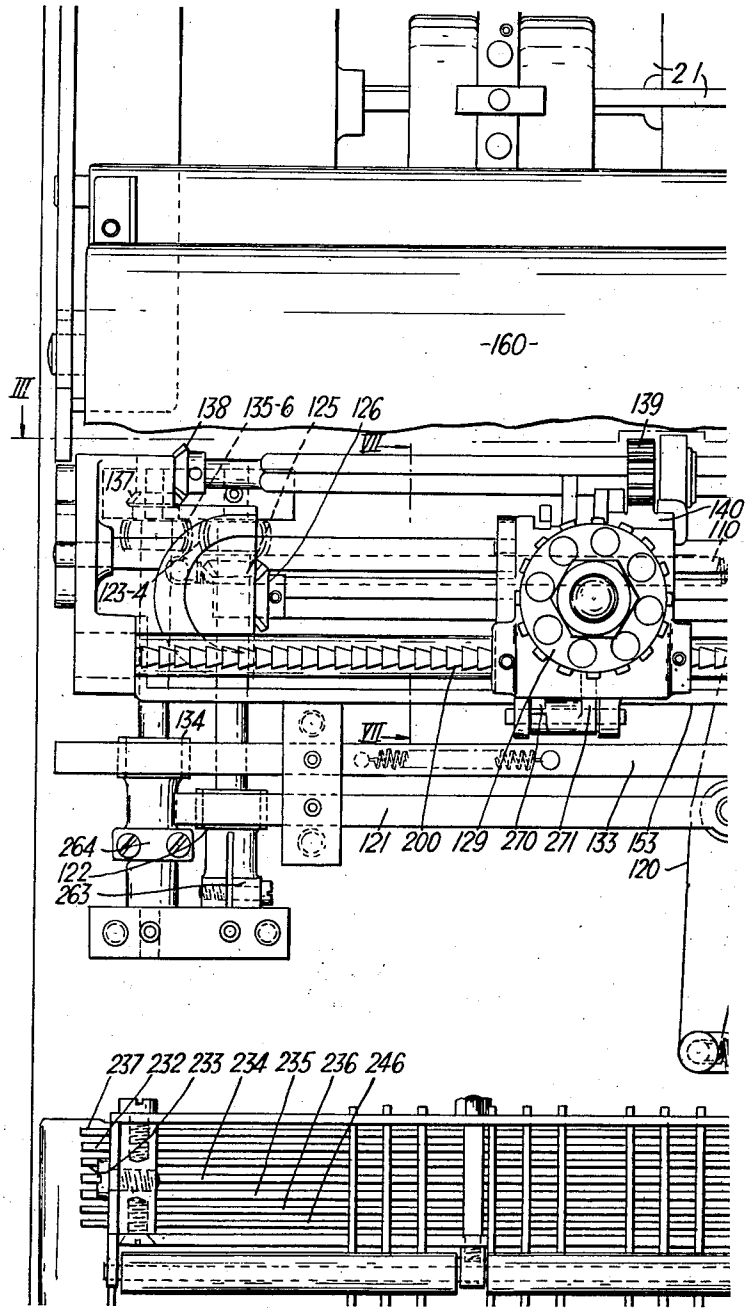


Fig. 1A.

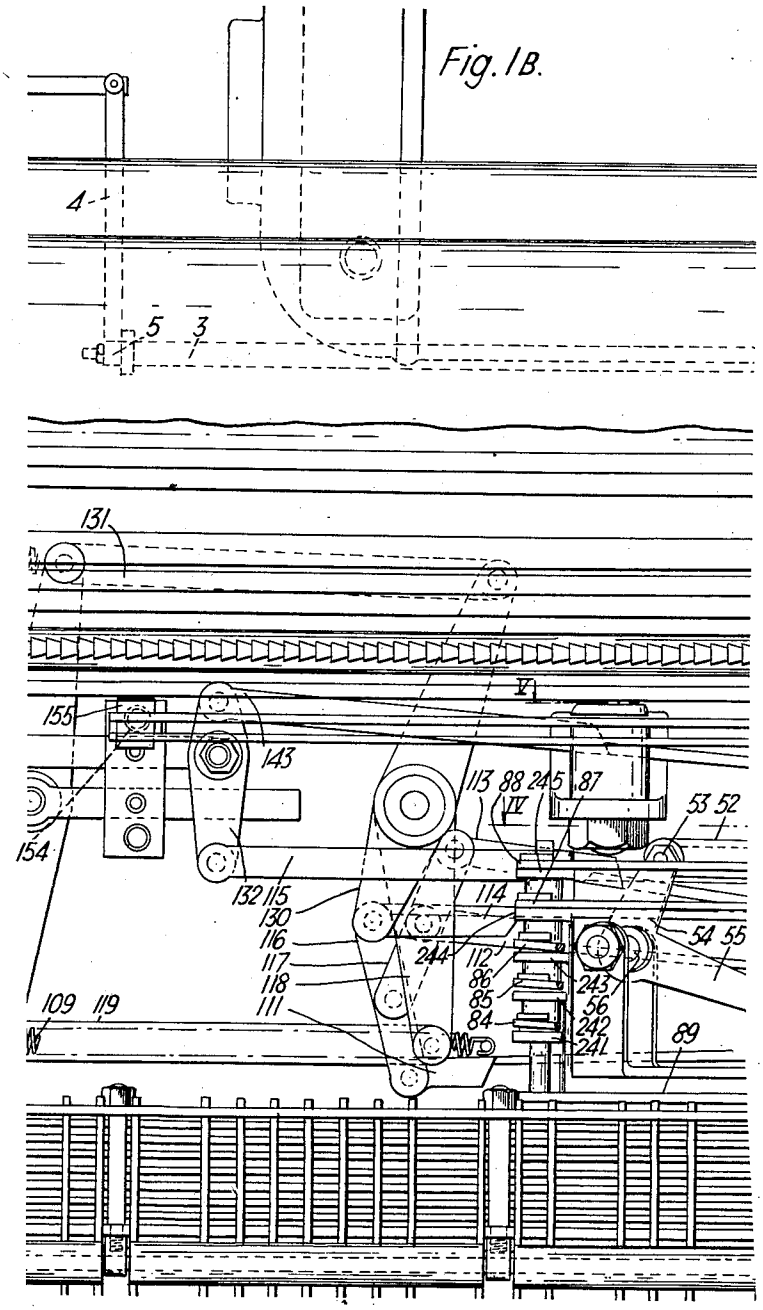
Inventor
J. HANDLEY
By R. P. Morris
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 2

Fig. 1B.



Inventor

J. HANDLEY

By R. P. Morris

Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 3

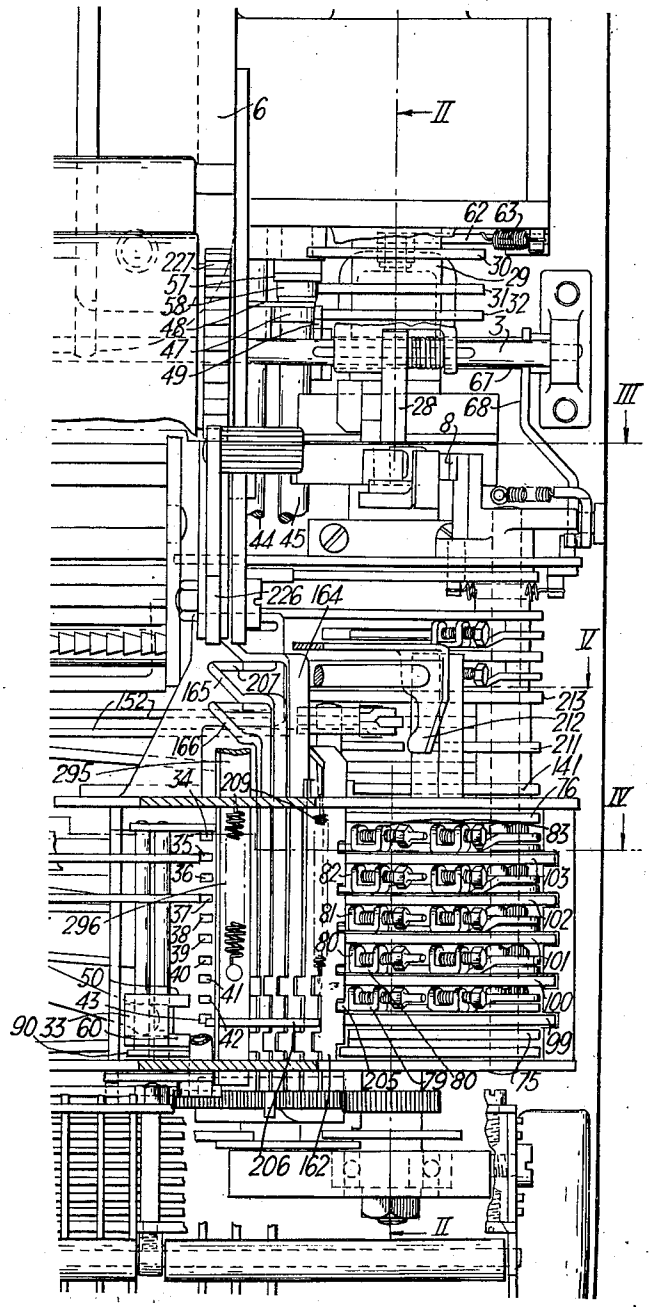


Fig. 1C.

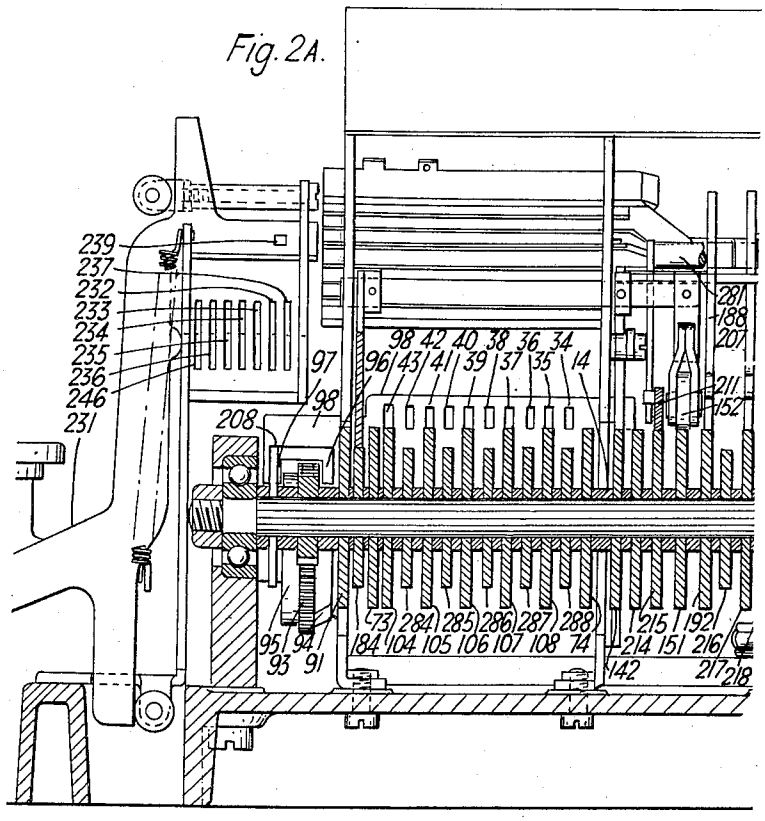
Inventor
J. HANDLEY
By R. P. Morris
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 4

Fig. 2A.



Inventor

J. HANDLEY

By R. P. Mowes

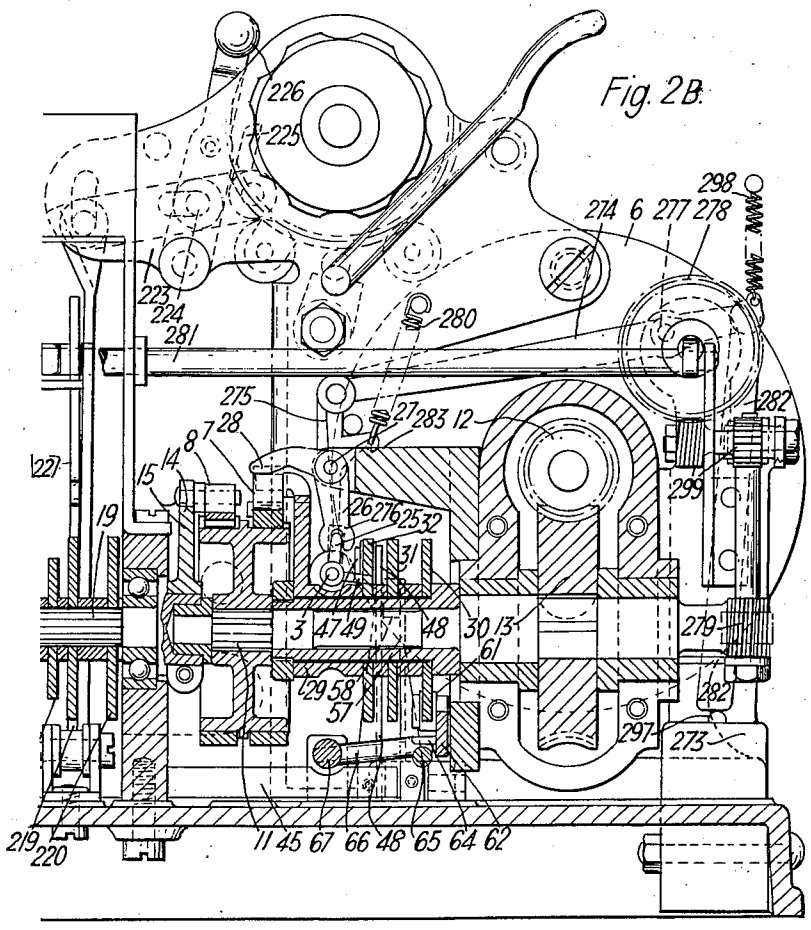
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 5

Fig. 2B.



Inventor

J. HANDLEY,

By R. P. Mowes

Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 6

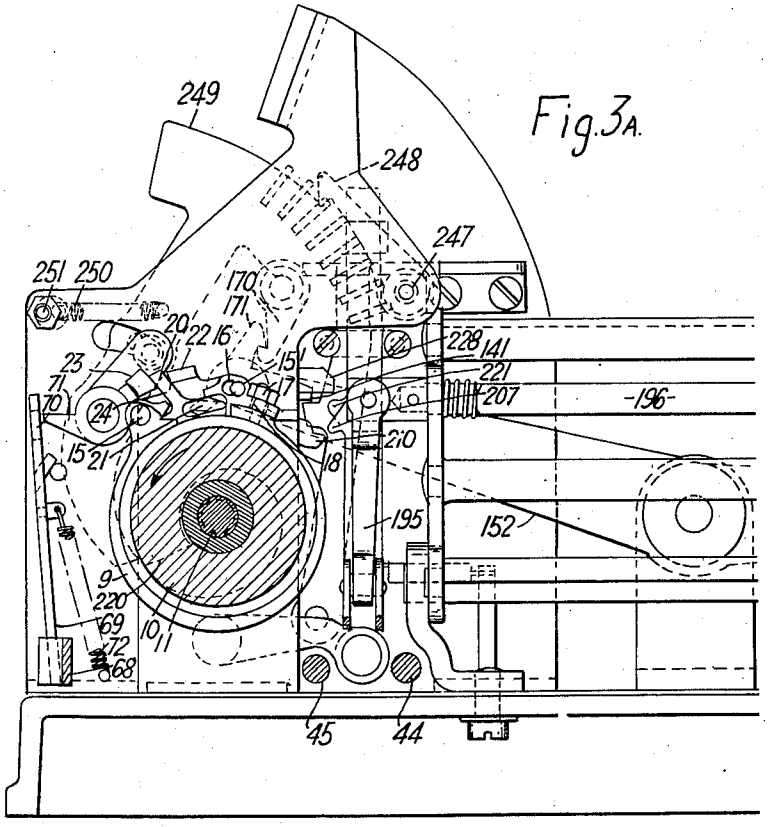


Fig. 3A.

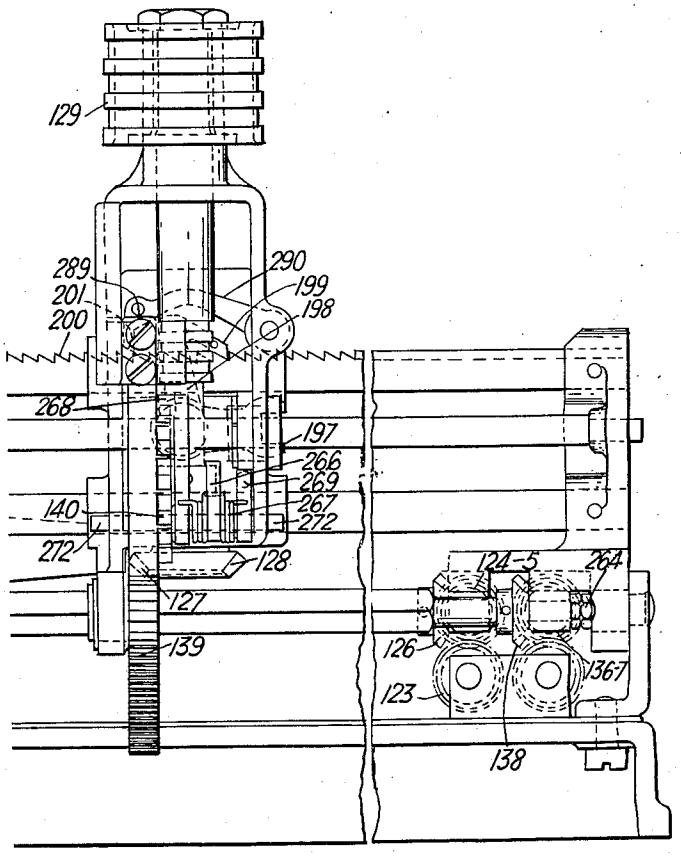
Inventor
J. HANDLEY
By R. P. Morris
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 7

Fig. 3B.



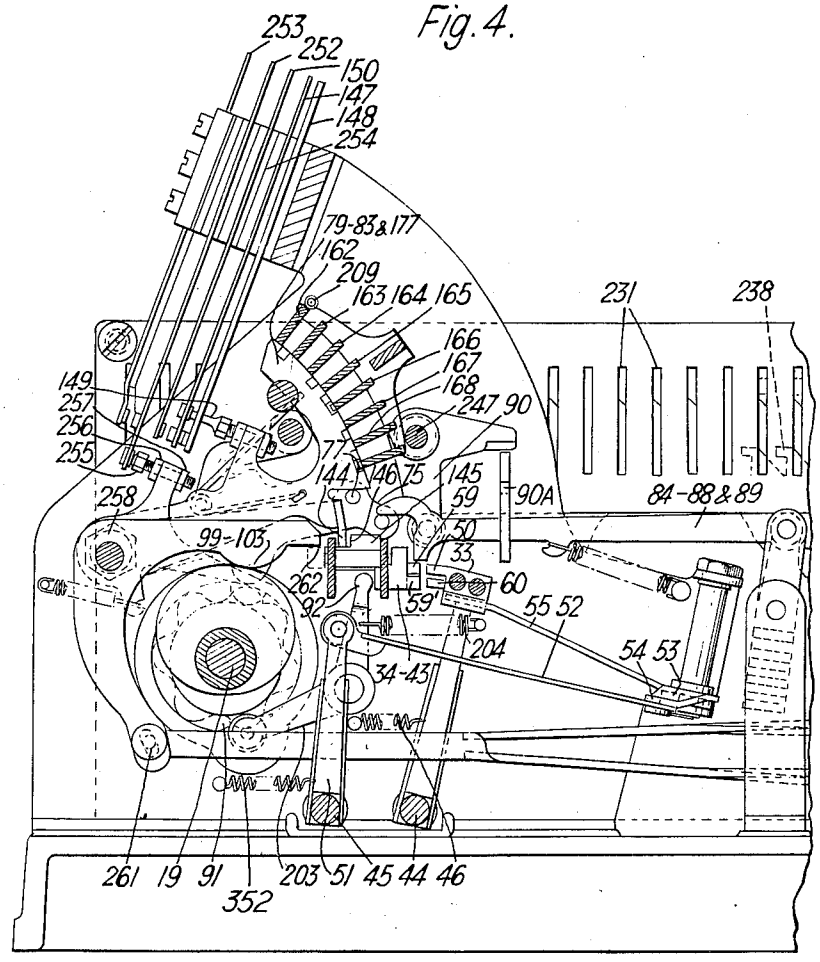
Inventor
J. HANDLEY
By R. P. Morris
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 8

Fig. 4.



Inventor

J. HANDLEY

By R. F. Morris

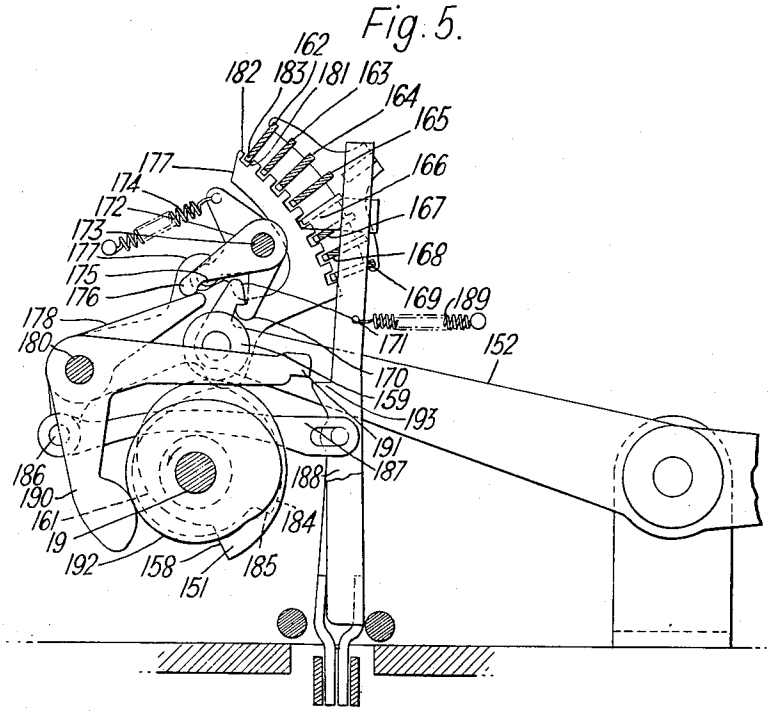
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 9

Fig. 5.



Inventor

J. HANDLEY

By R. P. Morris

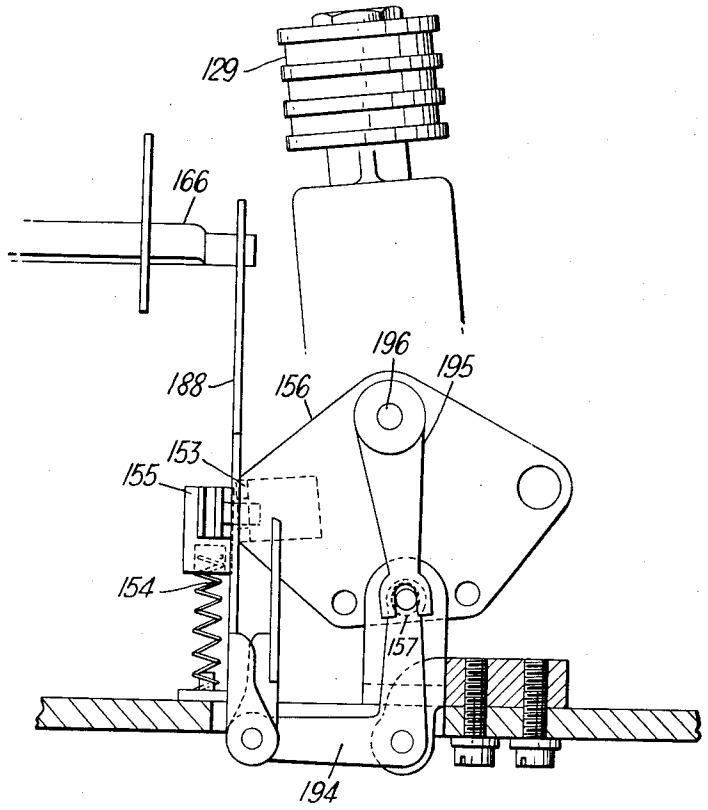
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 10

Fig. 6.



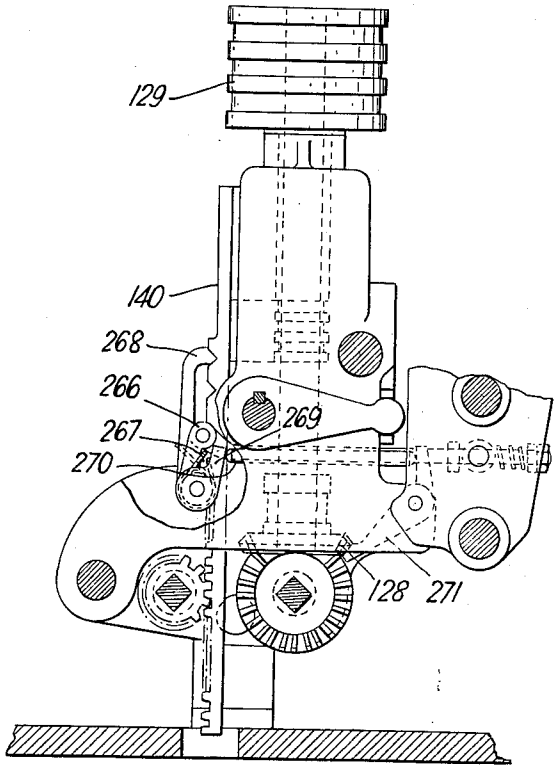
Inventor
J. HANDLEY
By R. P. Morris
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 11

Fig. 7.



Inventor

J. HANDLEY

By R. P. Mowes

Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 12

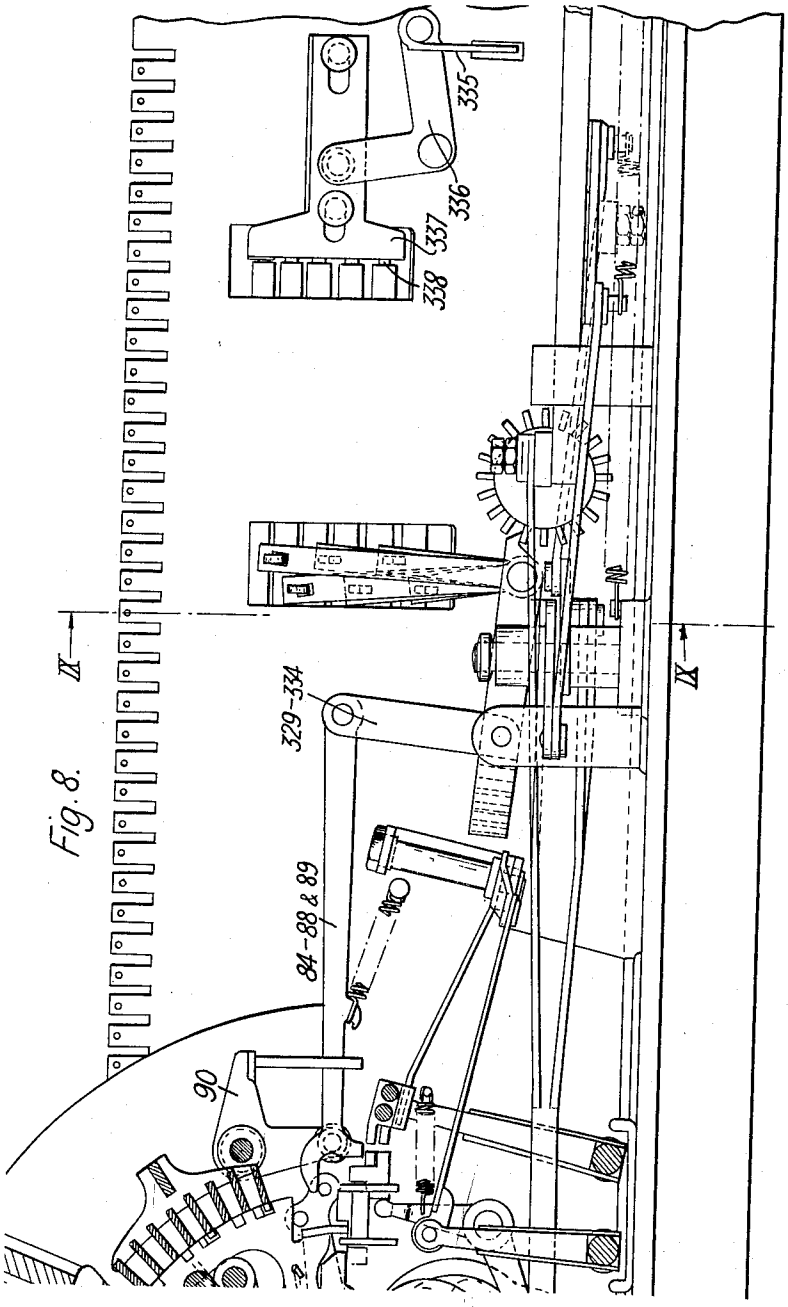


Fig. 8.

Inventor
J. HANDLEY
By R. F. Mains
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 13

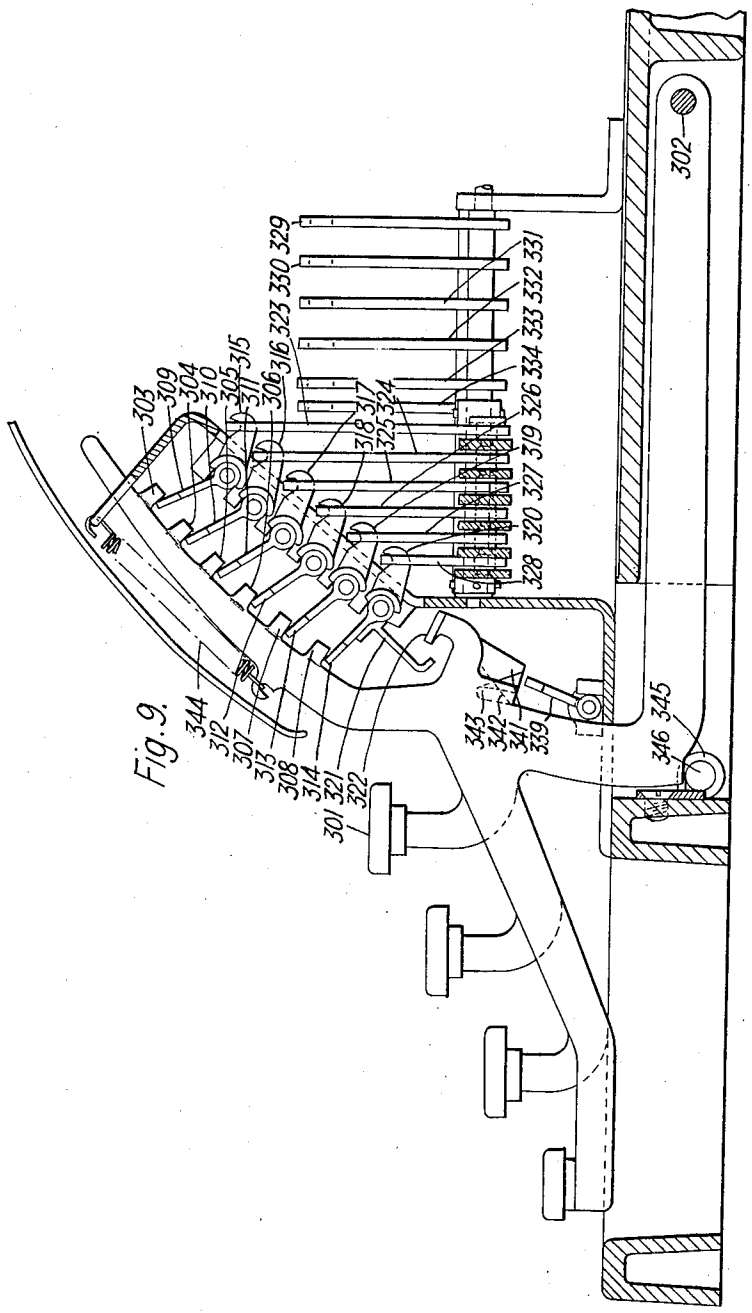


Fig. 9.

Inventor

J. HANDLEY

By R. P. Morris

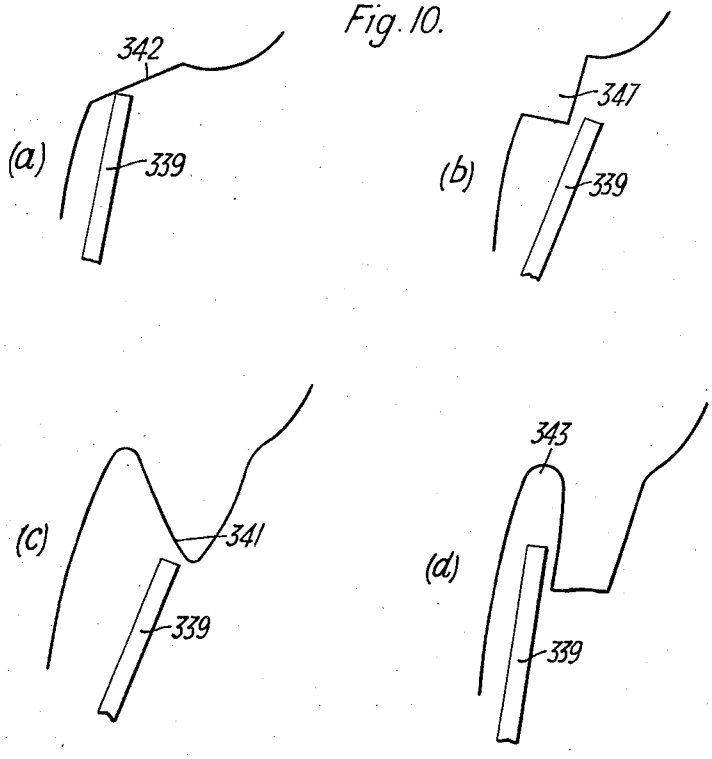
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 14

Fig. 10.



Inventor
J. HANDLEY
By R. F. Morris
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 15

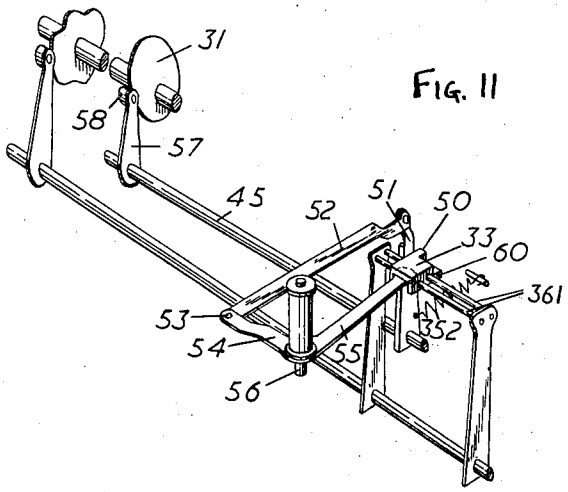
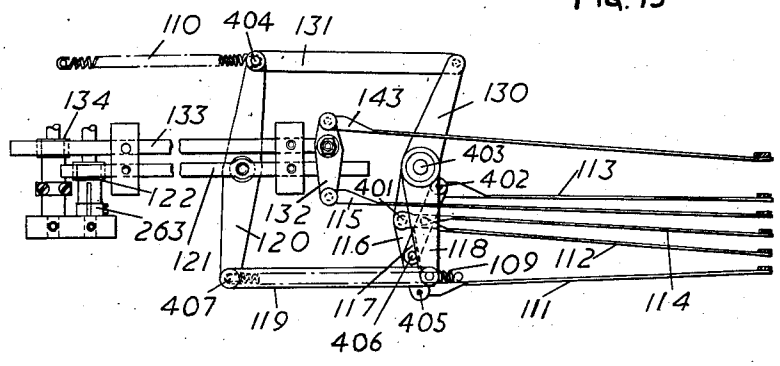


FIG. 11

FIG. 15



Inventor
J. HANDLEY
By Robert T. Handley Jr
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 16

FIG. 12

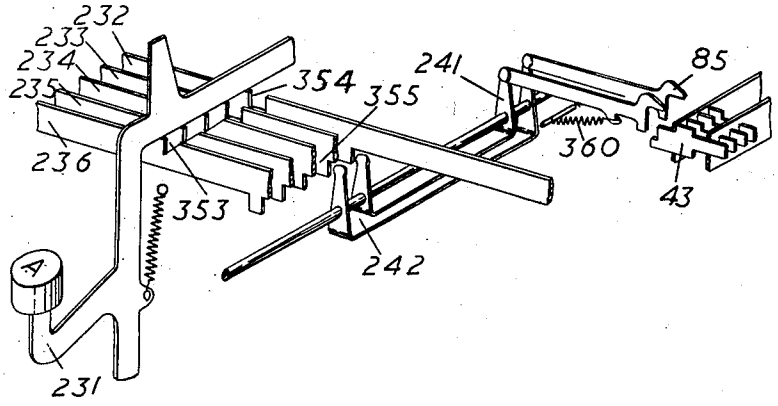
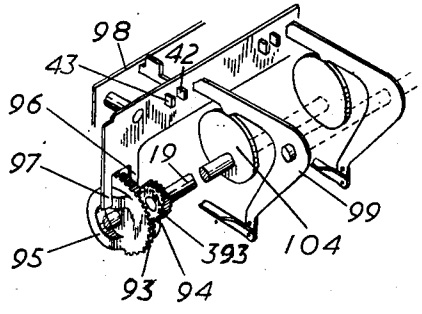


FIG. 14



Inventor
J. HANDLEY
By Robert Handley Jr
Attorney

March 7, 1961 J. HANDLEY 2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

Filed Jan. 21, 1955 17 Sheets-Sheet 17

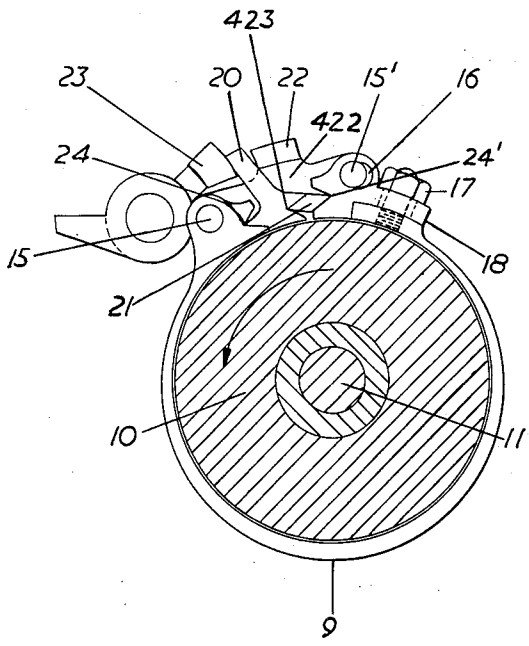


FIG. 13

Inventor

J. HANDLEY

By Robert P. Handley Jr.

Attorney

United States Patent Office 2,974,194 Patented Mar. 7, 1961

2,974,194

PRINTING TELEGRAPH SELECTOR APPARATUS

John Handley, Briar Hill, Purley, England, assignor to Creed & Company Limited, Croydon, England, a British company

Filed Jan. 21, 1955, Ser. No. 483,313
Claims priority, application Great Britain Jan. 25, 1954
6 Claims. (Cl. 178—27)

This invention relates to printing telegraph apparatus comprising a printing telegraph receiver and a keyboard transmitter.

The object of the present invention is to provide such apparatus in which the number of parts is reduced to a minimum and which is accordingly of light weight, without sacrificing speed of operation.

It has previously been proposed to cause a printed record of a transmitted signal combination to be made under mechanical control of the keyboard and thus to enable a character of a local record to be printed with the minimum of delay after actuation of a key. The purpose of such arrangement was to accustom an operator, used to the manipulation of a typewriter, to the manipulation of a teleprinter keyboard. The arrangement was, however, applied to a type bar printer and mechanism over and above that usually required in a keyboard controlled transmitter was required to achieve the object.

According to the present invention control members are provided which may be set either under control of the response of an electromagnet to received signals or by mechanical means under control of a keyboard and these control members determine in conjunction with a rotating cam sleeve, the selective positioning of a type carrier.

The main purpose of such an arrangement is the reduction in the number of parts that results therefrom.

The above mentioned control members may be divided into two sets, these sets being actuated alternately by successive signal combinations and one set being used to determine the position of the type carrier whilst the other set is being positioned by a signal combination.

A set of control members is actuated simultaneously by a key of the keyboard but the members are set successively by the elements of a received combination under control of a cam sleeve released for rotation by the response of the receiving magnet to the start element of a received code combination and under control of the response of that magnet to the successive elements of said combination.

Preferably an aggregate motion mechanism is used to position the type carrier. Many different forms of aggregate motion mechanism have previously been proposed for positioning a type wheel or other type carrier but the problem of backlash, which causes difficulties in accurate positioning of the type carrier, appears to have stood in the way of commercial production of such machines.

According to the present invention backlash has been reduced to negligible proportions by an aggregate motion mechanism the members of which are linked to respective cam followers, coacting with cams on a cam sleeve, and to a type carrier; spring means being provided constantly urging said cam followers into operative relation with their respective cams.

Embodiments of the invention will now be described with reference to the accompanying drawings in which:

Fig. 1 consisting of 1A, 1B and 1C is a plan view of a teleprinter according to the invention with certain parts thereof removed to show the operation of the mechanism; Fig. 1B being placed to the right of Fig. 1A and Fig. 1C being placed to the right of Fig. 1B,

Fig. 2 consisting of Figs. 2A and 2B is a section taken along the line II—II in Fig. 1; Fig. 2B being placed to the right of Fig. 2A,

Fig. 3 consisting of Figs. 3A and 3B is a section taken along the line III—III in Fig. 1; Fig. 3B being placed to the right of Fig. 3A,

Fig. 4 is a section taken along the line IV—IV in Fig. 1,

Fig. 5 is a part section taken along the line V—V in Fig. 1,

Fig. 6 shows diagrammatically the operation of the printing frame of Fig. 1,

Fig. 7 is a section taken along the line VII—VII of Fig. 1,

Fig. 8 is a part section of a teleprinter according to the invention but incorporating a modified form of keyboard, the section being taken along a line similar to that of Fig. 4,

Fig. 9 is a part section of the modified keyboard taken along the line IX—IX of Fig. 8, and

Fig. 10 shows in detail the underside of different keybars in the keyboard of Fig. 9.

Fig. 11 is a diagrammatic isometric view of the pecker traversing apparatus,

Fig. 12 is a detail of the apparatus used for the setting of the control members from the keyboard,

Fig. 13 is an end view partly in section of the clutch mechanism,

Fig. 14 is a detail of the apparatus which serves to transfer the position of the control plates from the position in which they are set up to the position in which they are sensed for printing, and

Fig. 15 is a detail of the aggregate motion mechanism.

In outline the operation of the machine is as follows: Control plates **34** to **43**, Figs. 1C and 2A, are set either by received signals or by the keyboard. There are ten such control plates, five being allotted to one signal combination and the other five to a succeeding signal combination, the two sets of five being interleaved. For setting control plates according to a received signal combination, a receiving cam unit **29**, set into rotation by the start element of a signal combination, causes a pecker **33** (Figs. 1C and 4) to be traversed along the line of control plates and the pecker strikes a control plate or is prevented from striking it according to the nature (space or mark) of a signal element. The pecker carries two projections **50** and **60**, Fig. 4, spaced apart so that they are opposite two successive control plates of one set. The control plates are provided with projections against which projections **50** and **60** may strike, but projection **60** is on a lower level than projection **50** so that during one traverse of the pecker **33** projection **50** is alone operative on the control plates, projection **60** passing below the corresponding projections on the control plates.

The first set of control plates may also be set by members **84** to **88** directly linked with code bars or code vanes actuated by a key of the keyboard.

A motor driven cam sleeve **14**, Fig. 2, is released for rotation either when a key of the keyboard is actuated or towards the close of rotation of the receiving cam unit **29** and the set of control plates is then moved along the array so that those plates positioned in accordance with a signal combination are able to exercise control of the operations of the machine such as positioning the type carrier or selection and operation of a function. The alternate series of control plates is now positioned to be acted upon by projection **60** of pecker **33** or by the keyboard.

The control plates that have been set are positioned so that they are beneath the ends of cam followers **99**—

103 or are clear of them. The cam sleeve allows such cam followers as are unobstructed to fall under spring pressure.

Each cam follower is linked to a lever of an aggregate motion mechanism for positioning the type carrier and springs operate through the pivoted levers of this mechanism on the cam followers. These springs act to take up any backlash in the aggregate motion mechanism.

The control plates, in addition to controlling cam followers to operate the aggregate motion mechanism, operate slotted change-over plates to select function bars for such functions as letters and figures, shift, carriage return and line feed etc.

These change-over plates also position contacts to control the transmission of a signal combination set up by the keyboard. The keyboard also operates a send-receive switch into the send position to cause these contacts to be effective in the transmission of signals.

Setting of control members by received signal

The operation of the mechanism will now be described in detail:

When a message is being received by the printer, the start (space) element moves the armature 1 of the electromagnet 2 from the backward or rest position, as shown in Fig. 1, to the forward position. This movement of the armature causes a rotary movement of the shaft 3, in an anti-clockwise direction as seen in Fig. 2, by means such as the links 4 and 5, which are shown in Fig. 1. This rotation of shaft 3 starts the motor 6 (if this is not already running), as will be described later, and also releases the receiving clutch 7.

The methods of operation of the receiving clutch 7 (Fig. 2) and the transmitting and printing clutch 8 (Figs. 2, 3 and 13) are similar and will be described with reference to the transmitting and printing clutch 8.

Construction of friction clutch

The clutch consists of an eccentric band 9 (Fig. 13) which naturally grips the drum 10 on shaft 11, which is driven by the motor 6 through the reduction gears 12 and 13. The band 9 is fastened to the transmitting and printing cam unit 14 by pins 15 and 15', the latter of which runs in a slot 16 in block 18. The pin 15 which is fixed to both the band 9 and the cam unit 14 is the driving pin, while pin 15' in conjunction with slot 16 guides the band 9 in its movements to and from the expanded position. The block 18 which carries the slot 16 is mounted on the band 9 by a screw and a nut 17. The clearance between the band 9 and the drum 10 may be adjusted by releasing the nut 17 and moving the block 18. Between the ends of the eccentric band 9 there is carried, by the band 9, a lever 20 which can pivot on a knife-edge 24, and a diamond-shaped piece 21 which can pivot on a corresponding knife-edge 24'. The lever 20 and diamond-shaped piece 21 cooperate to form a toggle arrangement as shown in Fig. 13. Also carried by band 9 is a support 422 from which a tongue 22 projects into a position behind the lever 20. When the clutch is engaged and the transmitting and printing shaft 19 and its associated cam unit 14 are being driven by it in the direction of the arrow, the toggle arrangement 20 and 21 and the tongue 22 on its support 422 all rotate with the band 9. The clutch is disengaged by moving a pawl 23 into the path of the lever 20 (as shown in Fig. 13), which impinges on the pawl 23 so that it is pushed back against tongue 22 and pivots about the knife edge 24 to force the diamond-shaped piece 21 downwards about its knife-edge 24 and backwards so that the point 423 is almost in a straight line with the edges 24 and 24' on which the respective toggle members pivot. As the diamond-shaped piece 21 is forced backwards it takes the block 18 with it thus expanding the band 9, which releases its grip on the drum 10. The tongue 22 is arranged so that the point 423 cannot lie exactly in a straight line with the edges 24 and 24' when the band is in the expanded position, as the lever and diamond must be able to release when the pawl 23 is removed from the path of the lever 20. However the point 423 is arranged to be almost in a straight line with the edges 24 and 24', in order to provide a very light release, i.e. the force exerted on pawl 23 by lever 20 is made as small as practicable.

Considering now the operation of the receiving clutch (in Fig. 2), when a start element is received the shaft 3 makes a rotary movement in an anticlockwise direction, as already described, and moves its arm 25 to the left. This arm 25 moves arm 26 of a two-armed member pivoted at 27, thus raising the second arm of the member on which there is a pawl 28, which serves a similar purpose in clutch 7 to that performed by pawl 23 in clutch 8. The receiving cam 29 then commences to rotate.

Operation of receiver cam unit

On the receiving cam unit 29 there are three cams 30, 31 and 32 (Figs. 1 and 2), which are respectively the second clutch release, traverse and striker cams. The traverse and striker cams operate a pecker 33 (Figs. 1 and 4) so that it sets up a combination on five of the control plates 34–43 (Figs. 1, 2 and 4) which corresponds with the combination of marks and spaces in the received signal.

The pecker 33 is mounted on a shaft 44 which is shown in Figs. 1, 3 and 4 and runs behind shaft 45 in Fig. 2 and parallel therewith. The pecker 33 is continuously urged towards the control plates 34–43 by the spring 46 (Fig. 4), but is only allowed to strike one of the plates when a roller 47 (Fig. 2) on a lever 48, which is also mounted on shaft 44, is allowed to fall into a recess on the striker cam 32.

The striker cam 32 has five recesses and these are arranged so that the roller 47 will fall into them, if it is allowed to, during each received signal element. Whether the roller 47 is allowed to fall into the recess or not will be determined by the position of a second arm 49 on the shaft 3 which makes rotary movements in accordance with the received signal. When a mark element is received the arm 49 is in the position shown in Fig. 2, and when a space element is received the arm 49 moves upwards from this position. With the arm 49 in the lower position, the roller 47 is prevented from falling into a recess on the striker cam 32, but, when the arm is in the upper position, roller 47 falls into a recess in the cam 32 and the pecker 33 strikes one of the control plates 34–43. A control plate is therefore struck in response to a received space element.

On pecker 33 there is a projecting 50 (Figs. 4 and 11) which strikes a control plate on the receipt of a space element. During each rotation of the receiving cam unit 29, the pecker 33 has to traverse the line of the control plates so that it strikes the control plate corresponding to the particular signal element being received at that instant. This traverse is effected by lever 51 which is spring-urged by spring 352 under the control of the traverse cam 31. A movement of lever 51 to the right in Fig. 11 (i.e. clockwise about shaft 45 on which it is mounted) will pull with it in that direction link 52 which is fastened by a pin 53 to an arm 54 (also shown in Figs. 1 and 4). The arm 54 is one arm of a bellcrank pivoted at 56, the other arm 55 of the bellcrank being the traversing member.

The way in which traverse cam 31 controls the movement of lever 51 is similar to the way in which the striking of the pecker is controlled from the striker cam. Mounted on the receiving cam end of the shaft 45 on which lever 51 is mounted is a lever 57 carrying a roller 58. The action of spring 352 on lever 51 ensures that the roller 58 is maintained in contact with the traverse cam 31 and follows the contour in that cam. Cam 31 is an eccentric cam which, in the rest position of receiving cam unit 29, has its minimum radius in contact with the

roller 58 on lever 57. As the unit 29 starts to rotate, the roller 58 follows the contour of cam 31 which on this part is a gradually increasing radius. Levers 57 and 51 are thus moved slowly to the left in Fig. 11 and the bellcrank consisting of arms 54 and 55 moves anti-clockwise about its pivot 56. Arm 55 which fits loosely in a slot in pecker 33 therefore causes the pecker to move along its rails 361 at such a speed that the projection 50 on pecker 33 will be opposite one of the control plates 42, 40, 38, 36, 34, at each of the instants when the striker cam 32 will cause the pecker to strike if an all-space signal is being received.

At the conclusion of the traverse, the contour of cam 31 decreases sharply in radius causing levers 57 and 51 to move to the right, as shown in Fig. 11, under the action of spring 352. Arm 55 of the bellcrank is thus caused to return the pecker 33 to the beginning of its traverse preparatory to the receipt of the next signal combination.

The control plates 34, 36, 38, 40, 42 have on them projections 59 (Fig. 4) on which projection 50 may act. The other project 60 on the pecker 33 is arranged two plates distant and at a lower level as shown in Figs. 1 and 4. Then, supposing that projection 50 of pecker 33 is in the position opposite control plate 38 during its traverse and that the pecker is allowed to strike, the projection 50 of pecker 33 will strike projection 59 on control plate 38, which will be operated, and projection 60 of pecker 33 will pass under projection 59 on control plate 40, which will remain in its unoperated position. The unoperated position of the control plates 34–43 is that shown in Fig. 4. The position which an operated control plate will take is shown dotted in Fig. 4 immediately beneath the end of rockers 99–103 at gap 262. As will be explained later, after a combination has been set up on a set of five control plates and before that combination is read for printing, the whole set of control plates 34–43 which are arranged in a single array are moved in the direction of the array a distance equal to the distance between centers of adjacent members in the array. Thus in the middle of the traverse for the character combination immediately succeeding that which has just been described, the projections 50 and 60 on pecker 33 will be opposite, for example, control plates 37 and 39. The odd-numbered control plates 35, 37, 39, 41, 43 have on them projections 59′ at a lower level than the projections 59 on the even-numbered plates already referred to. Thus, for the same traverse with the alternate combination, projection 60 will strike projections 59′ on, for example, control plate 39 for a space signal and projection 50 will pass over projection 59′ on the control plate two before the one actually being struck, i.e. plate 37 in the example quoted.

Release of printing cam unit from receiving cam unit

As the receiving cam unit completes its first revolution a signal combination has been set up on the control plates 34, 36, 38, 40 and 42. At this point it is necessary to operate clutch 8 and set the printing mechanism in motion. This is done by the second clutch release cam 30 and its associated mechanism. The second clutch release is prepared for operating when the receiving cam unit 29 starts to rotate. Roller 61 attached to arm 62 is forced out of the recess in cam 30, in which it is shown in Fig. 2, against the action of spring 63, shown in Fig. 1. This downward movement of arm 62 causes a projection 64 (Fig. 2) on it to engage with projection 65 on an arm 66 which is also forced downwards. The arm 66 is attached to a shaft 67 (Figs. 1 and 2) which performs a rotary movement in a clockwise direction as seen in Fig. 2. The shaft 67 also has attached to it an arm 68 (Fig. 1) which extends along the side of the machine until it is level with the transmitting and printing clutch 8 (Figs. 1 and 3). At this point, arm 68 carries a lifting release plate 69 which contains an aperture 70 to catch a latch 71 which when pulled downwards removes pawl 23 from the path of lever 20. Therefore, when the receiving cam 29 starts to rotate, shaft 67 performs a rotary movement and lifts arm 68 and release plate 69 against the action of spring 72 to engage latch 71 in aperture 70. This condition continues until the end of the revolution of receiving cam unit 29, by which time a set of control plates has been operated in accordance with the combination of elements received. Then, as the cam unit 29 completes its revolution, roller 61 falls back into the recess on cam 30 thus allowing release plate 69 to drop and release the printing clutch 8.

As cam unit 29 completes its revolution, a stop element received by the electromagnet 2 brings pawl 28 back into the path of the clutch lever on the receiving clutch 7 and brings the cam unit 29 to rest. In addition to performing the second clutch release as described above, the roller 61 as it falls back into the recess on cam 30 under the action of spring 63, ensures that the cam unit has sufficient power independent of its own inertia to operate the clutch toggle against substantial resistance to expand the clutch.

Reading control plates

Clutch 8 having been released, the printing shaft 19 now commences to rotate. At the beginning of the revolution of this shaft cams 73 and 74 (Fig. 2) lift the levers 75 and 76 (Figs. 1 and 4) to which the cross-pins 77 and 78 (Fig. 4) are fixed. As these pins 77 and 78 are lifted they lift the change-over plates 79–83 and the combination fingers 84–88 so that they are clear of the control plates 34–43, and the trip finger 89 (Fig. 1) so that it is clear of the trip lever 90 (Figs. 1 and 4). At the same time cam 91 (Figs. 2 and 4) operates control plate restoring levers 92 to the left in Fig. 4.

In the next few degrees of rotation of the shaft 19, the gear wheel 93 (Figs. 2 and 14) which is rotated therewith through gear wheel 393 on shaft 19 and which has face cams 94 and 95 one of which thrusts on one of the anvils 96, 97, is operative to move the single character storage unit 98 to the left or right, depending on which position the storage unit was previously in. Let it be supposed that the storage unit and control plates start in the position shown in Fig. 2 and that a combination has been set up on control plates 34, 36, 38, 40 and 42, then the storage unit is now moved to the left so that these plates are brought into position to be read by the cam followers 99–103 (Figs. 1 and 4) associated with printing cams 104–108 (Fig. 2). Cam followers 99–103 are hereinafter referred to as the type-setting rockers. In Fig. 14 the storage unit 98 and the control plates carried thereby are shown in the left hand position to which they have been moved by the cam face 95 thrusting on anvil 97. Gear wheel 93 is arranged to make only half a revolution during each complete revolution of gear 393 on shaft 19. It will thus be moved back to the right hand position at the corresponding time in the next revolution of shaft 19 by the cam face 94, which is on the opposite half of the opposite face of gear wheel 93 to the cam face 95, thrusting on anvil 96. By this time a signal combination will have been set up on control plates 35, 37, 39, 41, 43 and these plates will be in position to be read by type-setting rockers 99–103.

When the movement of the storage unit 98 is completed, the cams 73 and 74 lower the change-over plates 79–83 and fingers 84–88 and 89. The type-setting cams 104–108 then allow those of the type-setting rockers 99–103 which are not held up by operated control plates to move under the action of springs 109 and 110 (Figs. 1 and 15), through the various links and arms 111–121 and 130–133 thus allowing the type wheel to rotate and lift according to the rockers 99–103 which have been permitted to move.

Aggregate motion mechanism

Cam 104 allows rocker 99 to drop 3 units of length, and the 4:3 ratio which is introduced causes the consequential movement of link 111 to be 4 units, provided

that control bar 42 has not been operated. The other rockers 100-103, however, are allowed to drop 6 units by their respective cams 105 to 108, when no control bar is operated. Again a 4:3 ratio is introduced which makes the consequential movement permitted to their associated links 112–115 into 8 units each.

Links 111 and 112 are connected to each end of the first summation rocker 116. The centre of this rocker 116 and the end of link 113 are connected to the ends of the second summation rocker 117. The centre of the rocker 117 is pivoted midway between the centre and the end pivot of the arm 118, which is connected by link 119 to cross arm 120. The centre of cross-arm 120 is pivoted on the rack 121, and pulled by spring 109 under link 119.

Consider now that the rocker 99 is released allowing link 111 to move four units to the right in Fig. 15, all the other rockers 100–103 and links 112–115 retaining their unoperated positions. This movement of link 111 causes rocker 116 to pivot about point 401, so that the end of the rocker 116 attached to link 111 (i.e. point 405) will move four units, and the center of rocker 116 (i.e. point 406) will therefore move two units. Rocker 117 which is attached to the center of rocker 116, is therefore caused to pivot about point 402 and its center will move one unit. The center of rocker 117 is attached to the mid-point of arm 118 which is therefore caused to pivot about point 403 so that the end of arm 118 moves two units. This movement of two units is transferred through link 119 to the cross-arm 120 which pivots about point 404. The center of the cross-arm 120 therefore moves one unit, as does also the rack 121 to which it is attached. Rack 121, through gears 122, 123—124, 125—126, 127 and 128 (Figs. 1 and 3) turns the type wheel 129 (Figs. 1 and 3) (which is made of nylon) in an anti-clockwise direction one sixteenth of a revolution, i.e. one position.

Considering now the case in which rocker 100 alone is released, the link 112 will move 8 units as the cam permits twice as much movement as the first cam controlling rocker 99, but all the other rockers 99 and 101 to 103 and the links 111 and 113 to 115 will retain their unoperated positions. In this case rocker 116 is caused to pivot about point 405 and its center will move 4 units. This movement is twice that caused by the movement of link 111 in the case described above, and is transferred through the same mechanism as described there to rack 121 which is moved two units. The type wheel 129 is therefore caused to move two positions.

If rockers 99 and 100 are both released together the type wheel moves one plus two to position three i.e. three sixteenth of a revolution anti-clockwise.

If the rocker 101 is released alone, link 113 will move 8 units. Link 113 is attached to rocker 117 at point 402 and therefore causes rocker 117 to pivot about point 406. The center of rocker 117 will therefore move 4 units, and this movement is transferred through arm 118, link 119 and cross-arm 120 to rack 121 which also moves 4 units. The type wheel 129 is therefore moved four positions or one quarter of a revolution anticlockwise.

Then links 101 and 99 released together, four plus one, would move the type wheel 129 five positions, links 100 and 101, together, two plus four, would move it six positions, and if links 99, 100 and 101 are released together, one plus two plus four, the type wheel would turn seven sixteenths of a revolution anti-clockwise and move seven positions. Links 99, 100 and 101 thus give a choice of any one of eight positions, referred to as 0–7.

When rocker 102 alone is released, link 114 is allowed to move 8 units and links 111–113 and 115 remain in their unoperated positions. Link 114 is attached to the short end of rocker 130 at a point immediately beneath but quite independent of point 401. Rocker 130 pivots about point 403 and causes the end of its long arm to move 16 units in the opposite direction, i.e. to the left in Fig. 15. This movement is transferred through link 131 to cross-arm 120 which in this case will pivot about point 407, i.e. the junction between link 119 and cross-arm 120. The center of cross-arm 120 will therefore move 8 units in the opposite direction to the movements caused by links 111 to 113, and the type wheel 129 will be turned half a revolution in a clockwise direction.

Operation of the rockers 99 to 101 in conjunction with 102 subtract from this half revolution clockwise by their anti-clockwise movements to mark the intermediate positions between the eight mentioned above and sixteen. It will be seen that the clockwise movements are urged by spring 110 under link 131 in the opposite direction to link 119 and spring 109.

The fifth rocker 103 moves link 115 8 units, which operates a third summation 132 rocker to move rack 133. This rotates gears 134, 135, 136, 137, 138 and 139 (Figs. 1 and 3) lifting the vertical rack 140 (Figs. 1 and 3) and raising the type wheel 129 until the second level of the type is in position to print, thus presenting a second row of sixteen types for printing as selected by rockers 99 to 102.

When a figure shift signal is received it is necessary to lift the type wheel 129 to a third or fourth level of type. The figure shift signal, in a manner which will be described later, allows another type-setting rocker 141 (Fig. 1) to drop as it follows the contour of its associated cam 142 (Fig. 2). This operates link 143 (Fig. 1), which is connected to the other end of summation rocker 132. Link 143 moves rack 133 through twice the distance moved in response to movement of rocker 103 and brings the type wheel 129 up to print from the third level of type. When type-setting rockers 103 and 141 are operated together the type wheel 129 is lifted to bring the fourth level of type into printing position.

Operation of change-over plates

Thus at this point in the rotation of shaft 19, the type-setting rockers 99–103 which are not held up by any of the control plates 34–43 have been lowered to the roots of their respective cams 104–108. At this same point in the rotation of shaft 19, the change-over plates 79–83 (Fig. 4) have been lowered (as already described) and their projections 144 are either resting on the steps 145 of the control plates 34–43 or have dropped into cut-outs 146 on the control plates, as shown in Fig. 4.

A set of contacts 147, 148, 150 is provided for each change-over plate. Thus, when one of the change-over plates 79–83 is in the lower position, i.e. its projection 144 is resting in a cut-out 146 of an unoperated control plate, the signal feed contact 147 for that plate is "making" with contact 148 which is positive. Alternatively, if another change-over plate is resting on a step 145, the pin 149, which is mounted on that change-over plate and extends through an aperture in the support of its contact 148, forces contact 147 into the upper position where it "makes" with contact 150 which is negative. Thus the signal combination on the control plates is set up on the contacts 147, 148 and 150 during every rotation of shaft 19, but they are transmitting contacts and are only connected up when the teleprinter is used as a transmitter. It is, however, convenient to describe their operation here.

Printing

By the time the type-setting rockers 99–103 have reached the roots of their respective cams, the printing lift cam 151 (Figs. 2 and 5) has lifted one end of the printing lever 152 (Figs. 2, 3 and 5), pressing down the rear 153, Fig. 1, of the printing frame 156 against a spring 154 (Figs. 1 and 6), through the block 155 fixed to the other end of lever 152. This downward movement of the block 155 causes the whole printing frame 156, Fig. 6, to pivot about the point 157, thus rocking the

type wheel **129** slightly to the left in Fig. 6 as shown. The cam **151** then reaches the point in its rotation where the step **158** in it allows the roller **159** on the end of printing lever **152** to drop down the step **158** and the spring **154** forces the block **155** upwards beyond its normal rest position. This causes the frame **156** to pivot quickly in the other direction, and the type wheel **129** is moved sharply to the right in Fig. 6 so that it strikes the platen roller **160** (Fig. 1) and prints the character selected. Rollar **159** (Fig. 5) is then moved gradually upwards along the surface **161** of cam **151** until it is returned to its rest position where the printing frame **156** and type wheel **129** are again upright.

Prevention of printing

In addition to the operation of printing there are eight functions which are controlled by special signals, in response to which the five plates **79–83** permit function control bars **162–169** (Figs. 4 and 5) to move into series of aligned slots therein and initiate the required functions. When a function signal is received, no printing is required and an arrangement has to be provided whereby the natural movement of the printing frame **156** under the action of cam **151** is arrested.

Whether the machine is allowed to print or not is determined by the position of a pawl **170**, Fig. 5, at the actual moment of printing, i.e. when roller **159** drops down the step **158** in cam **151**. Pawl **170** is movable into and out of latch engagement with a corresponding pawl **171**, attached to the printing lever **152**. Pawls **170** and **171** can only engage when the printing lever is raised before the printing stroke. Pawl **170** is mounted on a frame **172** and this frame is pivoted at **173** and constrained to rotate about this point in an anti-clockwise direction (as seen in Fig. 5) under the action of spring **174**. The frame **172** carries two projections **175** and **176**, the first of which engages with a re-entrant in plate **177** and the second of which operates on an arm **178**. Plate **177** and arm **178** are pivoted at point **180** and plate **177** extends upwards parallel with and in a similar position to the change-over plates **79–83**.

The edge of plate **177** has eight cut-outs such as **181** and eight projections such as **182** alternately along it. At the beginning of each rotation of shaft **19**, plate **177** is in the position shown in Fig. 5, where each of its projections **182** is above the level of a corresponding one of the function bars **162–169**. Each function bar has on it a projection **183** which, in the unoperated condition of the function bar, remains behind the plate **177**. If plate **177** is then allowed to drop, it may do so unimpeded by any function bar, if the signal received is an ordinary letter signal. On the other hand, if a special signal which operates a function bar has been received, then the operated function bar, will move under the action of a spring such as **209** (Fig. 1) so that its projection **183** is brought into the downward path of one of the projections **182** (Fig. 5). The plate **177** will not drop then, even though it is allowed to do so by its cam **184**.

As the printing lever **152** is raised by its cam **151**, so is the plate **177** by its cam **184**. During this movement of the plate **177**, its re-entrant, which is always engaged with projection **175**, causes the frame **172** to rotate in a clockwise direction thus bringing pawl **170** into latch engagement with pawl **171**. If no function bar has been operated, the plate **177** will drop down the step **185**, and this movement will allow the frame **172** to move anti-clockwise under the action of spring **174**, thus disengaging pawl **170** from pawl **171**. In this case the printing action takes place. If a function bar has been operated, plate **177** will not drop down the step **185** and pawls **170** and **171** will remain latched and roller **159** cannot drop down the step **158** and so no printing takes place.

Character spacing

When frame **172** makes its anti-clockwise movement which allows the printing to take place, its other projection **176** impinges on the arm **178** causing this to make a clockwise movement about its pivot **180**. Attached to joint **186** on the part of arm **178** below its pivot is a link **187** which, under the clockwise movement referred to, draws a vertical link **188** to the left, as seen in Fig. 5, against the pull of a spring **189**. There is also provided a rocker **190** having a projection **191** as shown, this rocker **190** being operated by an eccentric cam **192**. With the vertical link **188** drawn to the left, projection **191** will engage with a corresponding projection **193** on the vertical link **188** and move it downwards. This downwards movement of link **188** initiates the letter feed, as will be described. If a function signal has been received there will have been no movement of link **188** to the left under the action of link **187** and projection **191** will fail to engage projection **193** and there will be no letter feed.

As vertical link **188** is forced downwards it causes rockers **194** and **195** (Fig. 6) to move, thereby turning the shaft **196** (Figs. 3 and 6). Associated with shaft **196** is a fork **197** (Fig. 3) which turns with it and pulls down a lever **198** and thrusts a pawl **199** against the teeth in the guide rail **200**. This thrust causes type wheel carriage to move along the guide rail and with it the locking projection **201** which engages with the next tooth in readiness for the printing of the next character.

Returning to shaft **19** (Fig. 4), further rotation of this shaft returns type setting rockers **99–103** to their original positions, and the clutch **8** is stopped by pawl **23** (Fig. 3). At this point the roller **202** on an arm **203** associated with the control plate restoring levers **92** falls back into a recess on its cam **91**, thus allowing levers **92** to move to the right (as shown in Fig. 4) under the action of their spring **204** and restore the control plates which have just been read (in this case **34**, **36**, **38**, **40** and **42**) to their unoperated condition. The spring-urged roller **202** ensures that the shaft **19** completes its revolution and operates toggle items **10** and **11** to expand the clutch band **9**.

While the reading of the control plates **34**, etc. has been going on, the next group of signals has been setting up control plates **35**, **37**, **39**, **41** and **43**. Projection **60** acts on lower projections on these plates, the other projection **50** passing above these plate projections and taking no part in this selling-up. When shaft **19** is started again into rotation, cam wheel **93** and its associated face cam will move the storage unit **98** to the right to bring control plates **35**, etc. into position to be read.

Function bars

The operations in response to the receipt of a function signal must now be considered.

The function bars **162–169** each have on them five slots **205**, each of which coincides with a respective one of the change-over plates as shown in Fig. 1. The change-over plates **79–83** have cut-outs arranged in such a way that, when one of the combinations used to denote one of the functions is received, the bar for the function in question has a slot in a change-over plate coinciding with each of its own five slots **205**. Then, when, the function bars are released by return bar **206**, this bar is able to move under the action of a spring such as **209** and initiate the desired function.

Return bar **206** is operated by rockers **211** and **212** in association with cam **215** (Figs. 1 and 2). At a point in the revolution of shaft **19** after the change-over plates **79–83** have been lowered, cam **215** allows rocker **211** to drop. This allows rocker **212** to drop as well and a link (not shown) attached to this rocker will allow the support bar **295** on which return bar **206** is mounted to move under the action of its spring **296**. Thus return

bar 206 moves, and any function bar for which a signal has been set up will move and initiate its function. Towards the end of the rotation of shaft 19, cam 215 will lift its rockers 211 and 212 and the link (not shown) will push the support bar 295 back against its spring 296. Return bar 206 thus moves back to its original position taking with it any function bar which may have been operated.

The functions which are initiated by these eight control bars are "Bell" 162, "Who are you" 163, "Line feed" 164, "Carriage return" 165, "Space" 166, "Figures" 167, "All space" 168, "Letters" 169. Each of the function bars has its end at an oblique angle, as shown for bars 165 and 166 in Fig. 1. Then the movement of the bar under the action of a spring such as 209 will cause the oblique end to push to one side a vertical link such as 207 or 188 (Figs. 1 and 5). This movement will initiate the function required.

The movement of the "Bell" function bar 162, causes a pair of contacts similar to 147, 150, to close and sound the alarm bell. The "Who are you" bar 163 will release a lever so that cam 208 can step round a rotor (not shown) which engages rockers 241 to 245 in well-known manner and signals the number of the machine back to the machine which is calling.

The third bar 164 is released when the "line feed" signals are set up and link 221 (Figs. 2 and 3) is moved over so that rocker 228 (Fig. 3) operated by cam 219 (Fig. 2) engages it. The engagement between 221 and 228 moves 221 downwards and with it link 222 (Fig. 2) which operates rocker 223 pivoted on pin 224, thus lifting pawl 225. Pawl 225 engages ratchet wheel 227 (Fig. 1) and rotates the platen roller 226 to feed the paper to the next line. Double spacing between lines can be obtained if desired by moving lever 226 to the left in Fig. 2. This causes pawl 225 to travel further and feed the platen roller round two teeth at a time.

When "carriage return" signals are set up, the fourth bar 165 (Figs. 1, 4 and 5) is released and this causes links 207 (Figs. 1, 2 and 3) to be moved into engagement with rocker 210 (Fig. 3). Rocker 210 is arranged to be raised by cam 217 and will lift link 207 with it. Link 207 is pivoted on the same shaft as link 188 (already referred to in connection with the letter feed) and the raising of link 207 causes rockers 194 and 195 (Fig. 6) to move thereby turning shaft 196. The turning of shaft 196 and the fork 197 (Fig. 3) associated with it is in the opposite direction to that in the letter feed operation and lever 198 is pushed up. This causes the projection 289 on the pawl 199 to lift the arm 290 associated with the locking projection 201 so that it is clear of the teeth on the guide rail 200. At the same time the pressure of the projection 289 on arm 290 keeps pawl 199 out of engagement with the teeth in the guide rail 200 and the carriage returns pulled by a spring box (not shown).

The fifth bar 166 is released when "space" signals are set up and its operation moves link 188 (Figs. 1 and 5) so that it can be operated on by projection 191 on rocker 190 (Fig. 5). The subsequent operations are as described for the letter feed, although in this case no character is printed and a space is provided between one word and the next.

The sixth bar 167 operates in response to "Figure shift" signals and shift lever 229 (Fig. 2) is thrown clear of rocker 141 (Fig. 1) so that link 143 operates rack 133. The type wheel 129 is thus lifted to print figures until the lever 229 is restored again.

When the "all space" signals are set up, the seventh bar 168 is released. This usually occurs when there is a failure in the line, and the operation of this bar prevents printing from taking place under this condition.

The eighth bar 169 is released when "letter shift" signals are set up and operates to push shift lever 229 back to prevent operation of rocker 141 so that link 143 does not operate the rack 133.

Setting of control members from the keyboard

When the teleprinter is operated from its own keyboard a key 231 (Figs. 2 and 12) is depressed and this engages saw teeth on a selection of the five code bars 232 to 236 (Figs. 1, 2 and 12). Teeth are provided on the code bars in accordance with the code elements for the key being struck, for instance for "A" the code is that the first two signals are marks and the last three are spaces; therefore when the key "A" is depressed the keybar engages with the inclined teeth 353 on bars 234, 235 and 236 and these bars are moved to the right as seen in Fig. 12. Bars 232 and 233, however, have no teeth under the keybar for "A" and have a rectangular cut-out 354 in which the keybar can move when the key is depressed without affecting the position of these bars.

Bars 234, 235 and 236, thus move to the right on depression of key "A" and their projections 355 move the upper portions of rockers similar to 241 and 242 with which they are in contact, and cause these rockers to pivot in a clockwise direction and push associated fingers such as 84, 85 to the right as seen in Fig. 12. The combination is thus set up on one of the sets of control plates, either plates 39, 37, 35 or plates 38, 36, 34 being operated depending on the position of the array of control plates when the key is depressed.

When the key is released it returns to its normal position under the action of its spring, and the operated fingers 84 etc. together with rockers 241 etc. and code bars 232 etc. are returned to their normal positions under the action of spring 360.

The trip and lock bar 237 is operated by any key and operates release rocker 90 (Figs. 1 and 4), through link 89 causing it to pivot in a clockwise direction as seen in Fig. 4. The movement of bar 237 to the left causes the nose on the tooth 238 which is on the bar 237 and adjacent to the depressed key to enter a hole 239 in that key, thus locking it down, and the other teeth 238 on the bar 237 prevent any other key from being depressed. When the operated key is released, the trip bar 237 moves back to its normal rest position under the action of its spring (not shown).

A check bar 246 may be provided to be operated by the figure shift and letter shift keys and in one position prevents certain keys being operated when the machine is printing figures, while in another position prevents other keys being operated when the machine is printing letters.

Release of transmitting and printing cam unit from keyboard

At the same time that a combination is set up on the control plates 34–43, rocker 90 is operated by bar 237 as described above and starts to turn shaft 247 (Figs. 3 and 4). Associated with shaft 247 is release pawl 248 (Fig. 3) and when this is moved the lag weight 249 is pulled outwards by spring 250, taking with it pawl 23 to release the transmitting and printing clutch 19 to print the character and also to signal it to a distant printer.

The lag weight 249 is used to give a pause after each rotation of shaft 19 to ensure that the receiver on the distant printer will keep in step with the transmitting printer. The time of delay given by the lag weight may be reasonably accurately adjusted to any requirement between ten and thirty milliseconds by increasing or decreasing the tension on spring 250 by rotating toggle 251.

As shaft 19 rotates, the letter or figure is printed in the manner already described for received signals. The setting up of contacts 147, 148 and 150 in accordance with the signal combination present on the control plates has also been described, and the method by which this combination is transmitted will now be described.

Transmitting

The operation of release pawl shaft **247** and lag weight **249** causes the send-receive contacts, which are not shown but are a set of contacts similar to **147**, **148** and **150**, to change-over so that the outgoing lead previously bringing in signals to the home receiving relay now sends out signals to the distant relay. The send-receive contacts are held in this condition until after both **247** and **249** are returned to their original positions.

A set of reading contacts **254** (Fig. 4) is provided for each set of contacts **147**, **148**, **150** and the contact **252** of each reading set **254** is electrically connected to its corresponding signal-feed contact **147**. Each of the other contacts **253** of the reading set is connected to the transmitting lead, as are also two other pairs of contacts (not shown). These last-mentioned contacts are operated by cams **216** and **218**, and send respectively a start signal and a stop signal.

Arranged to ride on cams **284–288** (Fig. 2) are five rockers such as **259** (Fig. 4), each of which carries a screw, such as **255**. When rocker **259** is raised by its associated cam **288**, screw **255** closes contacts **252** and **253**, and the signal on the corresponding contact **147** is sent to line. The duration of the signal is adjustable by screw **255** which is threaded into lugs **256** and **257**. These lugs are closed together slightly after tapping so that the screw **255** binds between the threads and is self-locking. An eccentric adjuster **258** is used to correct for any error in the radial position of the cam by advancing or retarding the signal.

Cams **284–288** (Fig. 2) raise their respective rockers sequentially so that the five signals are sent in the correct signal element periods between the start and stop signals. At the end of the rotation of shaft **19**, cam **220** (Figs. 2 and 3) returns the lag weight **249** and releases the trip and lock bar **237**.

Correction of type positions

The position of the type selected may not be quite correct owing to slight inconsistencies in the mechanism, and a number of correctors have to be provided to overcome these inconsistencies.

In the first place a slot **261** (Fig. 4) is provided in the end of the rocker arms **99–103**, and this allows for the lever to be lengthened or shortened to correct for differences in the individual travel of the type setting links which might result from varying clearances between the rocker and the control plate at gap **262**, or through the cams running slightly out of true. All backlash between the link and rocker bearings from the cams to cross-arm **120** is automatically taken up by springs **109** and **110**.

Adjusting nuts **263** and **264** are used to take up any play in the gears so that the links bring the type wheel to the correct position. The way in which the final correction for the height and radial position of the type wheel is made may be seen from the following description taken in conjunction with Fig. 7, where the correctors are shown in the engaged position.

As the type wheel rocks forward to print, pressure is put on lever **266** from a thrust rail, and this lever **266**, through spring **267**, forces another lever **268** into one of a number of recesses in the rack **140**. The fact that lever **268** is forced into a recess ensures that the type wheel is at the correct height as it prints. Lever **266**, again through spring **267**, also engages rocker **269** to operate push rod **270** so that rocker **271** is thrust between the teeth of the bevel gear **128**. This thrust of rocker **271** ensures that the correct radial position of type wheel **129** is obtained, i.e. that the character selected is brought exactly facing the platen roller **160**.

Ribbon feed

The ribbon feed for the type wheel is not shown, but is similar to that used in normal typewriter practice, where at the end of the spool a small lever operates a pawl to trip the reverse feed mechanism. In the present apparatus the ribbon spools are carried on a short horizontal spindle side by side behind the printing head, so that the spools traverse with the printing wheel. The ribbon jumper is operated by the forward movement of the printing head as it rocks forward to print, but the feed is operated by the return movement of the head after printing. The ribbon mechanism is pivoted on the two ends of the pin **272** (Fig. 3) on which the corrector lever **270** is pivoted.

Carriage return damper

The blow of the carriage return, i.e. the blow caused by the return of the printing head to start a new line, is damped by a plunger in a pot containing small steel shot. When the plunger strikes the shot a sudden blow it becomes displaced in all directions, but the friction between the particles of the shot wader pressure serves as a damping medium to absorb the blow and prevent rebound.

Motor start from received signals

The operation of the motor **6** (Fig. 2) from remote signals is accomplished by the use of a micro-switch **273**. At the end of a message the receiver is in a rest (marking) condition, the pin **276** in the relay shaft **3** being in the vertical position, as shown in Fig. 2. If the motor is still running, its shaft will operate the shaft gear **279** and, through worm reduction gears **299**, will turn gear **278** very slowly. Dogged into the driven gear **278** is a crank having a crank pin **277**, and as the gear **278** rotates the crank pin is pulled slowly downwards. The cantilever **274** is thus pulled down. One end of cantilever **274** has on it a link **275** which can move downwards only a limited amount because the pin **276**, in its vertical position, prevents it. The other end of cantilever **274** therefore has to move down against the action of a spring **298**, and does so until the switch link **282** presses down the switch contact spring **297** of the micro-switch **273** and stops the motor running.

When a start signal is received from a distant station, the relay shaft **3** performs an anti-clockwise movement as seen in Fig. 2 and as already described. The pin **276** on this shaft is thus moved out of the way of the link **275** which is moved downwards as the cantilever **274** rocks about pin **277** under the action of spring **298** and against spring **280**. This rocking movement lifts switch link **282**, releasing the switch contact spring **297** and allowing the micro-switch **273** to start the motor running. The start signal also releases the receiving cam unit **29** and this, at the end of its first revolution, releases the printing and transmitting shaft **19**. During its revolution shaft **19** operates the function restoring lever **211** and this rocks the release shaft **281** which pushes the crank out of engagement with gear **278** so that it springs back into a clear position.

At about one minute intervals whilst the motor is running the dog re-engages but it is immediately released by the lever **211** each time the printer operates so that after the first starting pulse there is no interference with the relay operation. When no signals have been received for some time, however, the clutch dogs in again and carries link **282** down to stop the motor again.

The timing of the striker pulses in relation to the start signal may be altered by rocking the member **283**, which carries the arm **26**, pawl **28** and lever **62**, in either direction.

Cam **214** (shown on Fig. 2) to which no reference has been made is a spare cam.

Modified keyboard

A modified form of keyboard which can be used in the machine is shown in Figs. 8 and 9. This keyboard

replaces in the combined machine the keyboard shown in Figs. 1 to 7.

The key-bars 301 are pivoted on a shaft 302 and by means of projections 303 to 308, provided in combinations appropriate to the signal combinations represented by the respective key-bars, depress when actuated a combination of rockers 309 to 313 and a universal rocker 314. These rockers are cut away opposite projections 303 to 307 so that only that combination of rockers representing a signal combination is operated by a key-bar individual to that combination. Levers 315 to 320 are welded or brazed to the rockers 309 to 314. A plate 321 is fixed to rocker 314 and when actuated by any key bar engages a projection 322 on each of the key bars, moving underneath unoperated key bars and above the projection on the operated bar.

The levers 315 to 320 engage links 323–328 which are connected to another set of rockers 329 to 334 which, in turn operate the fingers 84 to 88 and 89 to set up the control plates 34 to 43 and operate rocker 90 in the same manner as in the embodiment described with reference to Figs. 1 to 7.

The modified keyboard may have four rows of keys, similar to a typewriter, where some keys carry two characters in the figures class. In this case a shift key (not shown) is used so that the five code rockers 309–313 may be moved along, to provide any particular key 301 with access to two combinations of notches in the upper edges of the rockers. The lateral movement of the rockers 309–313 is effected by the operation of the shift key on link 335, rocker 336 and plate 337 (Fig. 8). Plate 337 engages the rockers 309–313 in grooves 338 and moves them to the left as seen in Fig. 8.

A check rocker 339 (Figs. 9 and 10) is provided to prevent the operation of letter keys after a figure shift signal and similarly of figure keys after a letter shift signal. The way in which the check rocker 339 performs these functions may readily be understood from a consideration of Fig. 10 where the shapes of the individual keys are separated out.

After some figure signals have been sent out the rocker 339 will be in the position shown in Fig. 10*a*. The underside of the letter shift key is shaped as shown in this figure, having an extension 342 which, on depression of the letter shift key, moves rocker 339 to the right so that it occupies the position shown in Fig. 10*b*. The letter keys are shaped as shown in Fig. 10*b* with a step 347 which misses the rocker 339 when it has been operated by the letter shift key, so that letter keys can be depressed. With 339 in the figure key position of Fig. 10*a*, the step 347 would impinge on 339, thus preventing the depression of a letter key.

The figure shift key has an extension 341 (Fig. 10*c*) which, on depression of this key, moves rocker 339 back to the left. Figure keys may then be depressed as the rocker 339 moves into the slot 343 (Fig. 10*d*) provided in the underside of all figure keys.

The shift key for selection of the second character in the figure class already referred to is shaped similarly to the figure keys as shown in Fig. 10*d*. It is thus only possible to move the code rockers 309–313 along to select a second combination for any one key when the figure shift signal has been sent out.

The keys are returned by springs 344 (Fig. 9) shown anchored to the rocker frame at the top. To vary the key tension, these springs may be anchored to an eccentric rod, which can be rotated thus increasing or decreasing the tension.

The operation of two keys together is prevented by the trough 345 which contains steel balls such as 346.

What I claim is:

1. Printing telegraph apparatus comprising an electromagnet adapted to operate in response to received signal combinations, a keyboard, a set of control members, means for setting successively said control members in accordance with the response of said electromagnet to received signal combinations, means for setting simultaneously said control members mechanically under control of a key of said keyboard in accordance with the elements of a signal combination represented by the controlling key, and means under control of said control members and a motor driven cam sleeve for selectively positioning a type carrier in accordance with the setting of said control members.

2. Printing telegraph apparatus comprising control members, equal in number to the elements of a signal combination, a first motor driven cam sleeve, a keyboard, mechanical means for setting respective ones of said control members in accordance with the elements of a signal combination represented by a key of said keyboard, means under control of said control members and said first cam sleeve for selectively positioning a type carrier in accordance with the setting of said control members, an electromagnet, a second cam sleeve, means for starting said second cam sleeve into rotation by the response of said electromagnet to the start element of a signal and means for setting said control members by the response of said electromagnet to a received signal combination under control of said first cam sleeve.

3. Printing telegraph apparatus as claimed in claim 2 comprising means operative on actuation of a key of said keyboard to cause rotation of said first cam sleeve, and means operative towards the end of a period of rotation of said second cam sleeve to cause rotation of said first cam sleeve.

4. Printing telegraph apparatus comprising an electromagnet, a keyboard, two sets of control members, each set containing one member for each element of a signal combination, means for setting said two sets alternately under control of successively actuated keys of said keyboard, means for setting said two sets alternately under control of the response of said electromagnet to successively received signal combinations and means for printing a character under control of one set of control members during the setting of the other set of control members.

5. Printing telegraph apparatus as claimed in claim 4 in which said two sets of control members are arranged at equal distances apart in a single array with the members of one set interleaved with those of the other and means operative upon completion of the setting of one set to move all the control members in the direction of the array a distance equal to the distance between centres of adjacent members in said array.

6. Printing telegraph apparatus according to claim 1 in which said means for selectively positioning a type carrier comprises an aggregate motion mechanism, having members linked to respective cam followers coacting with cams on said cam sleeve and with said type carrier, spring means constantly urging said members to cause said cam followers to follow said cams, and means for controlling the movement of said cam followers by said control members.

References Cited in the file of this patent

UNITED STATES PATENTS

1,847,554	Fawick	Mar. 1, 1932
1,936,656	Bell	Nov. 28, 1933
1,960,092	Taylor	May 22, 1934
2,230,463	Levin	Feb. 4, 1941
2,278,978	Doty	Apr. 7, 1942
2,329,652	Reiber	Sept. 14, 1943
2,376,136	Gerst	May 15, 1945
2,505,729	Zenner	Apr. 25, 1950
2,551,992	Aasted	May 8, 1951
2,574,775	Bechler	Nov. 13, 1951
2,684,745	Blodgett	July 27, 1954
2,708,218	Nilson	May 10, 1955