

Oct. 17, 1950

L. M. POTTS

2,525,941

MECHANICAL CIPHERING UNIT

Original Filed Oct. 10, 1946

2 Sheets-Sheet 1

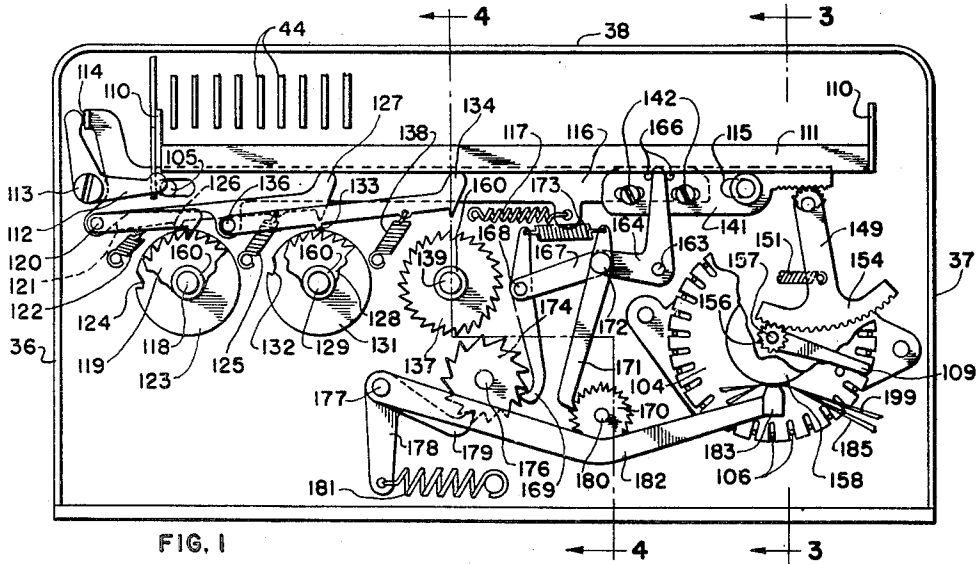


FIG. 1

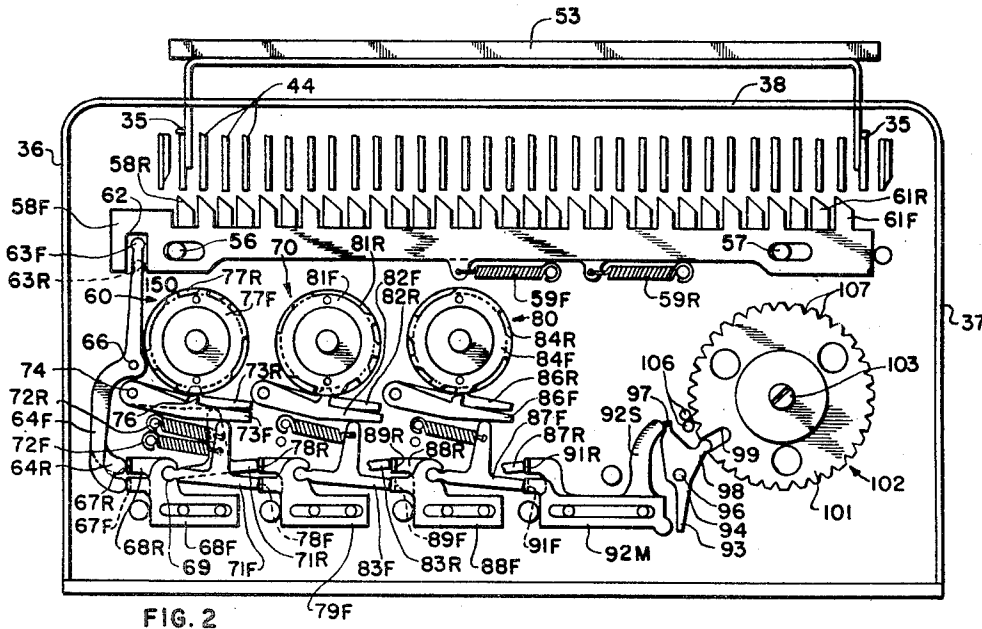


FIG. 2

Inventor

LOUIS M. POTTS, DECEASED
MARTHA W. C. POTTS, EXECUTRIX

By *Emery Robinson*
ATTORNEY

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2 Sheets-Sheet 2

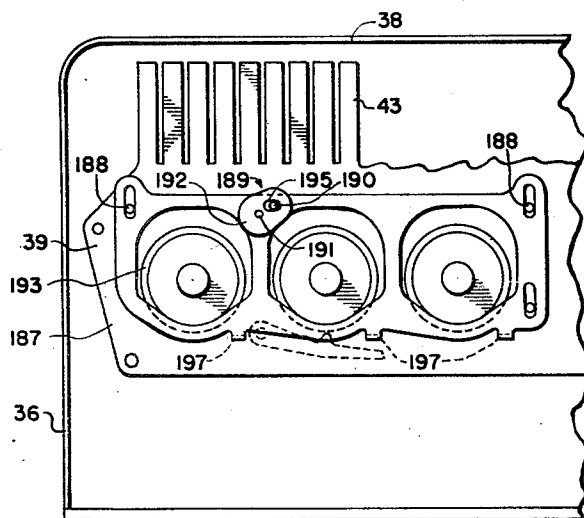
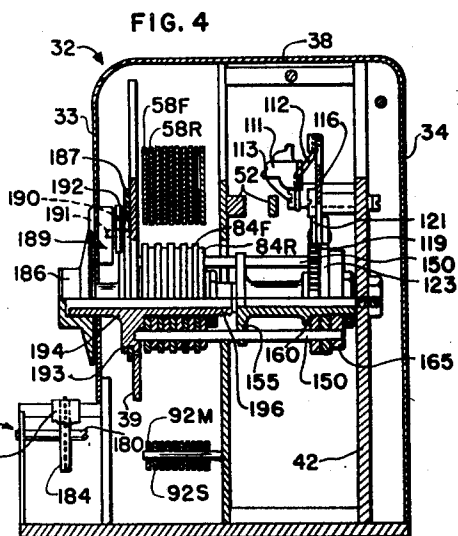
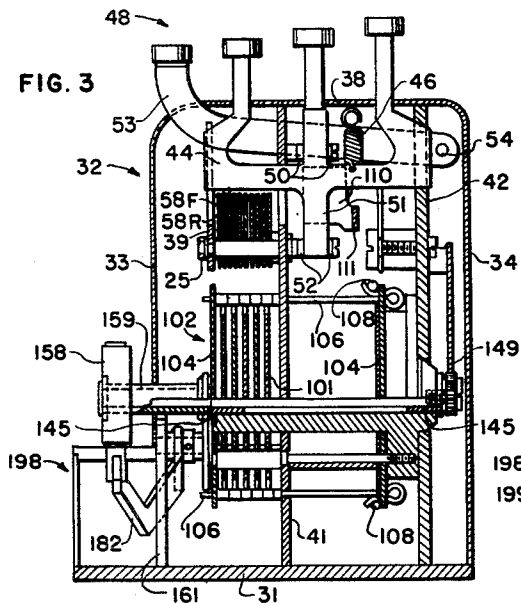


FIG. 5

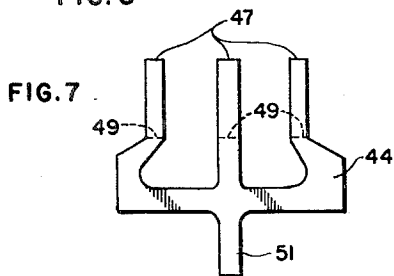


FIG. 7

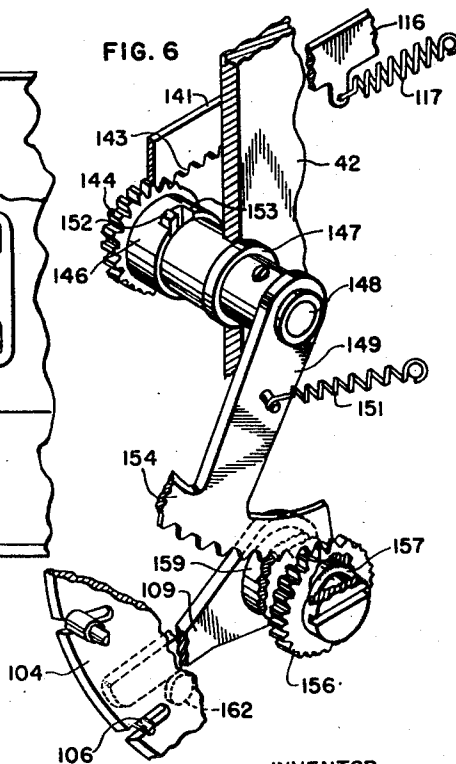


FIG. 6

INVENTOR

LOUIS M. POTTS, DECEASED
MARTHA W. C. POTTS, EXECUTRIX

BY

Emery Robinson
ATTORNEY

UNITED STATES PATENT OFFICE

2,525,941

MECHANICAL CIPHERING UNIT

Louis M. Potts, deceased, late of Evanston, Ill.,
by Martha W. C. Potts, executrix, Evanston,
Ill., assignor to Teletype Corporation, Chicago,
Ill., a corporation of Delaware

Original application October 10, 1946, Serial No.
702,429. Divided and this application September 27, 1947, Serial No. 776,526

5 Claims. (Cl. 197-4)

1

This invention relates to secret printing telegraph apparatus and particularly to mechanical ciphering units for enciphering and deciphering telegraph messages.

This application is a division of copending application Serial No. 702,429, filed October 10, 1946, matured into Patent No. 2,522,461.

The primary object of the invention is the provision of mechanical ciphering units for secret telegraph message communication.

Another object of the invention is to provide a mechanical ciphering unit including a mechanical chain linkage system in which variable paths of movement through the linkage are afforded for ciphering operations.

An additional object of the invention is the incorporation of a mechanical ciphering chain system in a type wheel printer.

A feature of the invention is to provide a ciphering type wheel printer which is all mechanical in operation and requires no motor, all power being furnished from the keyboard.

In general, it is proposed to provide, in combination with a five unit code selector which includes five mechanical selectable elements positionable to two different positions, a variable mechanical chain for each selectable element. The positions of certain component parts of the chains are varied so that motion transmitted through the individual chains follows a variable path which ultimately determines the positions occupied by the selectable elements. To achieve such a result each mechanical chain includes a plurality of pairs of slides which cooperate with a plurality of pairs of ciphering levers whose positions are determined by the setting of cam pairs of ciphering code drums which may be stepped to a number of different positions. The code drum cams are cut so that the high parts of one cam are opposite the low parts or notches of the companion member of the same pair of cams. This insures that the ciphering levers of any pair will always be oppositely positioned for operation to provide a continuous path of movement through the mechanical chains as will be more fully described later in the specification.

One embodiment of the invention utilizes mechanical ciphering chains in connection with a keyboard operated type wheel printer. The stopping position of the type wheel is determined by the selection of a stop pin, by means of a five unit code disc selector similar to the selector disclosed in the Morton et al. Patent No. 1,821,110. The positioning of the code discs is determined

2

by the operation of the mechanical ciphering chains, there being one chain for each element of the code. In this instance, an enciphered message can be typed on a tape and then sent by telegraph, courier, or other means to a predetermined destination. An attendant at this destination by employing an identical type wheel printer may retype the received message which will then be deciphered and printed in plain English. It is, of course, assumed that both type wheel printers would be provided with identically cut key code drums which will occupy the same relative positions during the enciphering and deciphering operation. An additional advantage of the type wheel printer herein disclosed is that its operation is all mechanically controlled from the keyboard and requires no motor.

A better understanding of the invention may be had by reference to the detailed description which follows when read with the accompanying drawings wherein:

Fig. 1 is a fragmentary front elevational view particularly illustrating the functional operations of the type wheel printer;

Fig. 2 is a fragmentary front elevational view particularly illustrating the operation of the selector mechanism of the type wheel printer;

Fig. 3 is an end view of the apparatus taken on the line 3-3 of Fig. 1;

Fig. 4 is an end view of the apparatus taken on the line 4-4 of Fig. 1;

Fig. 5 is a partial front view of the apparatus showing particularly the locking plate for the ciphering code drums;

Fig. 6 is an enlarged detailed perspective view of the mechanism for operating the type wheel; and

Fig. 7 is an enlarged detail view of a key slide blank.

Referring now to Figs. 1 to 7, inclusive, the embodiment of the invention which is devoted to the type wheel printer will now be described. Referring to the parts by reference numerals, 31 represents the base of the apparatus upon which is supported in any suitable manner a housing 32 composed of front and rear walls 33 and 34, respectively, end walls 36 and 37, and a top portion 38. Within the housing 32 are mounted a front supporting member 39, an intermediate supporting member 41 secured to member 39 by means of bolts 25, and a rear supporting member 42 integrally formed as part of the front supporting member 39 in a slotted guide 43 (Fig. 5). Similarly the rear supporting member 42 is provided with a slotted guide, not shown, and be-

tween it and the slotted guide 43 are mounted for slidable vertical movement a series of key slides 44 normally urged to an upward position by associated springs 46. All the key slides 44 may be cut from the same blank as shown in Fig. 7 by cutting off the undesired upward projections 47 according to the row of keyboard 48 in which it is desired to place the particular key slide. For example, if it were desired to make a particular key slide 44 operable from the front row of keyboard 48 the middle and rear upward projections 47 would be cut off at 49. The key slides 44 also include a centrally located and downwardly depending portion 51, designed to move in a lower guideway 52 which is suitably attached to the intermediate supporting member 41, while the middle upwardly extending projection 49 is designed to ride in the upper guideway 50 also mounted on member 41. Keyboard 48 is provided with the usual space bar 53 pivoted on each side at 54 and normally urged in an upward direction by springs, not shown.

Mounted below the key slides 44 for horizontal slidable movement on rods 56 and 57 are five pairs of permutation bars 58F, 58R. Each pair of permutation bars is composed of a front bar 58F and a rear bar 58R, the front bars 58F being normally urged to the right as viewed in Fig. 2 by means of springs 59F, while the rear bars 58R are similarly urged to the right by springs 59R. The permutation bars 58F, 58R are respectively provided with upwardly extending beveled cam projections 61F and 61R designed to be engaged by the lower edges of key slides 44 and are so arranged that for any given pair of bars 58F and 58R only one of the pair will move to the left when a key slide 44 is depressed. In other words, where there is a projection 61F on a bar 58F there will be no projection 61R at a similar point on bar 58R of the same pair and vice versa.

It will be understood that although the operation of only one mechanical chain will now be described there will be a similar chain for each element of the five unit code. Each of the permutation bars 58R, 58F is provided near its left end (as viewed in Fig. 2) with a notch 62, in which the upper arms 63F, 63R of a pair of operating levers 64F, 64R pivoted at 66 are nested. Operating lever 64F is designed to engage at its lower end a rearwardly extending lug 67F of slide 68F while operating lever 64R is designed to engage at its lower end a frontwardly extending lug 67R of slide 68R. Pivotaly mounted in socket 69 of slide 68F is a ciphering lever 71F which is urged in a counterclockwise or upward direction by means of its associated spring 72F. Ciphering lever 71R is similarly mounted on the slide 68R.

The positions of the pairs of ciphering levers 71F, 71R are determined by the positions of associated pairs of sensing levers 82F, 82R which are pivoted at 74 and which by means of projections 76 sense the periphery of associated cam pairs 77F, 77R of code drums 80. Cam pairs 77F, 77R are so notched that the high parts of cam 77F of one pair are directly opposite the low parts or notches of the other cam 77R of the same pair. The periphery of the cam pairs 77F, 77R may be cut in a fortuitous manner. The just described cutting of the cam pairs insures that ciphering levers 71F, 71R of any pair of ciphering levers will always be oppositely positioned. The free end of ciphering lever 71F or 71R is designed to engage either the rearwardly extending lug 78F of slide 79F or the frontwardly extending lug 78R of slide 79R, depending upon the notching

of the cam pairs 77F, 77R. Thus if ciphering levers 71F is down, as shown in Fig. 2, it will be in a position to engage a lug 78F of slide 79F. At this time ciphering lever 71R will be up or in a position to engage a lug 78R of slide 79R.

The second code drum 70 is composed of cam pairs 81F, 81R which by means of sensing levers 82F, 82R control the positions of ciphering levers 83F, 83R respectively mounted for pivotal movement on slides 79F, 79R. Likewise, a third code drum 80 composed of cam pairs 84F, 84R by means of sensing levers 86F, 86R, control the positions of ciphering levers 87F, 87R pivotally carried by their respective slides 88F, 88R. The free ends of ciphering levers 83F, 83R may engage either the rearwardly extending lug 89F of slide 88F or the frontwardly extending lug 89R of slide 88R. The free end of ciphering levers 87F, 87R may engage either the rearwardly extending lug 91F of marking slide 92M or the frontwardly extending lug 91R of spacing slide 92S. Marking slide 92M is designed to engage arm 93 of transfer lever 94 pivoted at 96, while spacing slide 92S is designed to engage arm 97 of transfer lever 94. Transfer lever 94 includes a rounded third arm 98, which is nested in notch 99 of an individual selector disc 101 of a five unit disc selector 102. Discs 101 are freely mounted on shaft 103. Movement of a marking slide 92M will, therefore, move an individual selector disc 101 to a marking position and movement of a spacing slide 92S will move an individual selector disc 101 to its spacing position.

At right angles to and equally placed along the circumference of the selector disc 101 and guided in guide plate 104 (Fig. 3) are the usual stop pins 106. This type of five unit selector is well known in the art and is fully described in the patent of Morton et al previously referred to above. When the V-shaped slots 107 of selector discs 101 adjacent a particular stop pin 106 are in alignment, this pin will pivot inwardly due to the force exerted by garter spring 108 and assume a position to stop movement of the type wheel stop arm 109 as will later appear.

It can now be readily seen that when a key slide 44 is depressed one of the operating levers 64F, 64R of each pair will pivot at 66 in a counterclockwise direction and at its lower end push against one of the slides 68F, 68R moving it to the right. The positions of ciphering levers 71F, 71R will determine which of the slides 79F, 79R will be operated, the positions of ciphering levers 83F, 83R will determine which of the slides 88F, 88R will be operated, and the positions of ciphering levers 87F, 87R will determine whether a marking slide 92M or a spacing slide 92S will be operated to position the individual selector discs 101 accordingly. Since the code drums 69, 70, 80 are stepped to different positions as will later be described it is obvious that the path of movement afforded for each mechanical chain will vary with the setting of the code drums.

Positioned below all the key slides 44 for engagement by any one of them, after selected permutation bars 58 have been moved to the left as previously explained, is a universal bar 111 (Fig. 1). The universal bar 111 is attached to end pieces 110 which are welded to the key slides 44 located at either end of the series of key slides. The key slides 44 which support the universal bar 111 will have all three upward projections 47 cut therefrom at 49 (Fig. 7) since in this case such projections are unnecessary. The universal bar 111 is normally held in an upward position by

5

springs 46 which are provided on all key slides 44.

As the universal bar 111 moves downward when engaged by a particular key slide 44 it strikes the laterally extending arm of a bell crank 112 which is pivoted at 113. This causes the engagement of the upwardly extending arm of bell crank 112 with a bent over flange 114 of main operating slide 116, causing the slide 116 to move to the right as viewed in Fig. 1 against the tension of a relatively strong spring 117. The slide 116 is mounted for horizontal movement by means of pin and slot connections 105, 115.

The stepping of the code drums 60, 70, and 80 through actuation of the main operating slide 116 will now be explained. It should be mentioned that it is proposed that each code drum may be stepped to twenty-six different positions. The first code drum 60 is carried by sleeve 196 which is rotatably supported on fixed shaft 118 suitably attached to the rear supporting member 42. Integral with sleeve 196 is a raised annular disc 194 in which are seated dowel pins 159 which extend through flange 155 of a second sleeve 160 mounted for rotation on fixed shaft 118, through ratchet 119, through disc 123 and spacer 165. Thus when ratchet 119 is rotated cam pairs 77F, 77R of code drum 60 will be rotated therewith. The dowel pins 159 are removable and provide means whereby adjustment of the cam pairs may be made. It is to be understood that code drums 70 and 80 will be respectively mounted in a similar manner on fixed shafts 129 and 139. Pawl 126 is urged into engagement with the teeth of ratchet 119 by means of a spring 122. Mounted adjacent to ratchet 119 for movement therewith is the disc 123 having a deep notch 124. As ratchet 119 is stepped by pawl 121 due to the reciprocation of slide 116 a position will be reached whereat lug 126 formed as an integral part of a stepping pawl 127 pivoted at 129 will enter the notch 124 of disc 123 allowing this pawl to step ratchet 123, thereby causing movement of sleeve 196 and the consequent stepping of the five pairs of cams 81F, 81R comprising code drum 70.

Secured on a sleeve 160 rotatable on fixed shaft 129 is a disc 131 having a notch 132 which at one position in its rotation will be engaged by a lug 133 integral with stepping pawl 134 pivoted at 136 to the main operating slide 116. Pawl 134 is urged into engagement with the teeth of ratchet 137 by means of a spring 138. Ratchet 137 is secured on a sleeve 160 rotatably mounted on fixed shaft 139 and drives the five pairs of cams 84F, 84R. The code drums may thus provide 17,576 (26 to the third power) key ciphering selections without repetition since there are 26 teeth in each of the ratchets 119, 128, and 137. Increasing the number of code drums and thus lengthening the chains would, of course, increase the number of key selections.

The operation of type wheel stop arm 109 will now be explained. The main operating slide 116 has secured thereto an adjustable plate 141 which is adjustable by means of screws 142. Formed as part of adjustable plate 141 is a rack portion 143 (Fig. 6) which is in engagement with a pinion 144 loosely mounted by means of a hub 146 to a shaft 148 suitably journaled on the supporting member 42 by bushing 147. Secured to shaft 148 is a gear segment 149 which is urged in a counterclockwise direction as viewed in Fig. 6 by means of a spring 151 which is weaker than the spring 117 that normally holds slide 116 to the right as viewed in

6

the same figure. Carried by shaft 148 is a lug 152 which engages in a notch 153 on hub 146 and due to the force exerted by spring 151 on shaft 148, lug 152 normally tends to follow the movement of pinion 144 by its engagement in notch 153.

Gear segment 149 engages at its toothed portion 154 a pinion 156 attached to shaft 157 which is mounted in bushings 145. Shaft 157 carries type wheel 158 and stop arm 109, each being connected to the shaft 157 by means of sleeve 159. It should be noted that normally the force exerted by spring 117 on operating slide 116 through rack 143, pinion 144, gear segment 149, and pinion 156 holds stop arm 109 against a fixed stop member 162. This gearing arrangement just described which drives stop arm 109 is of a very high ratio so that a small movement of slide 116 enables a relatively greater movement of the stop arm which is capable of movement until blocked by any selected pin 106 as will now be described. By means of adjustable plate 141 the operative position of rack 143 with respect to pinion 144 may be varied.

The play allowed between lug 152 of shaft 148 and notch 153 of hub 146 insures that the stop arm 109 may move to any of its positions according to the selection of a particular stop pin 106 and still allow further movement of the main operating slide 116 to complete other functions. Thus when a key slide 44 is depressed and slide 116 moves to the left as viewed in Fig. 6, rack 143 will rotate pinion 144 counterclockwise causing notch 153 to tend to move away from lug 152. However, the force of spring 151 acting on gear segment 149 attached to shaft 148 enables the lug 152 to follow notch 153 until stop arm 109 encounters the selected stop pin 106. It should be remembered that universal bar 111 is not operated until a selection is made as has already been pointed out, and therefore, a stop pin 106 will be selected prior to movement of stop arm 109. When the stop pin 106 is encountered by stop arm 109 further movement of slide 116 to the left is permitted due to the play between lug 152 and notch 153. The amount of additional movement of slide 116 after a pin 106 is encountered is determined, of course, by which pin is selected. If the nearest pin to the stop arm 109 is selected there will be a maximum of further movement of slide 116, whereas if the furthest pin 106 is selected there will be a minimum of additional movement.

A description of the printing and tape feeding tape operations will now be undertaken. Suitably pivoted at 163 to a fixed part of the apparatus is a bell crank 164 having an upstanding arm 165, the upper end of which rests between pins 196 attached to the main operating slide 116. To the laterally extending arm 167 of bell crank 164 is pivoted at 168 a pawl 169. Also carried by arm 167 of bell crank 164 is a tape stepping pawl 171 which is pivoted at 172. Pawls 169 and 171 are urged in opposite directions about their pivots by means of a connecting spring 173. Pawl 169 is provided for stepping ratchet 174 carried on the shaft 176. Attached to a suitably mounted rock shaft 177 is a bell crank 178 having an arm 179 which is urged into engagement with ratchet 174 by means of the spring 181. Also fixed to rock shaft 177 for movement therewith is the print hammer lever 182 carrying at its free extremity the usual printing element 183. Thus, as the main operating slide 116 moves to the right as viewed in Fig. 1 pins 166 carried

thereby will cause a clockwise pivotal movement of bell crank 164 which thereby operates pawl 169 to step the ratchet 174. At this time arm 179 of the bell crank 178 is cammed outwardly tensioning the spring 181. As bell crank 164 reaches its extreme clockwise position, arm 179 now moves over a tooth of the ratchet 174 enabling spring 181 to move the print hammer lever 182 in a counterclockwise direction causing a sharp operation of the printing element 183. Immediately thereafter pawl 171 which has moved away from the tape feeding ratchet 170 engages the next tooth of ratchet 170 to thereby step the tape forward one position for the next operation. Ratchet 170 is secured to a shaft 189 which at its other end carries the tape feed wheel 184.

For setting the code drums 60, 70, and 80 to prearranged positions each of the shafts 118, 129, and 139 are provided with dials 186. To prevent tampering with the code drums after they have been set, plate 187 (Fig. 5) is mounted for vertical movement on pins 188. This is accomplished by means of a standard cylinder lock 189 (Fig. 5) which, when operated by a key, moves shaft 191 and eccentric 192 welded thereto in a counterclockwise direction. This lifts the plate 187 upwardly by means of slot 195 engaging pin 190 carried by plate 187, so that it becomes locked in the grooves 193 of discs 194. Clearance, however, is provided so that discs 194 are free to rotate. Discs 194 are formed as integral parts of sleeves 196 which are rotatable on the shafts 118, 129, and 137 and carry respectively code drums 60, 70, and 80. Plate 187 includes bent over and rearwardly extending projections 197 which overlap the sensing levers 73, 82, and 86 and will disengage them from their respective code drums 77, 81, and 84 when the plate 187 is moved downward. This permits free access to and withdrawal of the code drums whenever necessary for adjustment or other purposes.

At the front of the housing 32 is mounted a compartment 198 (Figs. 3 and 4) which underlies the type wheel 152 and houses a tape feed wheel 184 and may include a tape guiding means (not shown) for tape 199. Means, not shown, will also be provided for feeding inking ribbon 185 in any conventional manner.

A brief résumé of the operation of the type wheel printer will now be given. Key slide 44 is depressed which through the five mechanical chains provided in the present invention results in the setting of the five individual selector discs 101 and the selection of a particular stop pin 106. The key slide 44 now engages universal bar 111 thereby operating bell crank 112 and moving the main operating slide 116 to the right as viewed in Fig. 1. This operates gear segment 149 causing rotation of stop arm 109 until it is stopped by a selected stop pin 106. Main operating slide 116 continues to move to the right, tensioning spring 181 of bell crank 178 and causing operation of print hammer lever 182 with a snapping action. As the main operating slide 116 returns to the left, pawl 171 operates tape feeding ratchet 170 to step tape 199 to its next position. At the same time pawl 169 assumes a position to engage the next tooth of ratchet 174.

Return movement of main operating slide 116 to the left causes pawl 121 to step ratchet 119 to its next position, and when the notch 124 of disc 123 is presented to lug 126 of pawl 127 this latter pawl will step ratchet 128 to its next position. Also when notch 132 of disc 131 is presented to lug 133 of pawl 134 this pawl will step ratchet

137 to its next position. Thus a continually changing path may be provided through the five mechanical chains to encipher or decipher each character of a message.

Space bar 53 is provided on either side with pins 35 which are each adapted to engage a key slide 44. Each of these latter key slides 44 will engage the same permutation bars 58F, 58R since the cam projections 61F, 61R carried thereby will be the same at these two points. A special code such as the "asterisk" character may be used to indicate spacing between words.

It is understood that various changes and modifications may be made in the present invention without departing from the spirit and scope thereof.

What is claimed is:

1. In a type wheel printer, a type wheel, a plurality of selectable elements for determining the stop position of said type wheel, a mechanical chain for each of said selectable elements including a series of pairs of movable members, mechanical means for variably selecting either one of each pair of movable members for movement, means for operating each of said chains to select said selectable elements, means for causing said type wheel to move to its selected stop position, printing means in operative relation with said type wheel, and means for operating said printing means after said type wheel has been positioned.

2. In a type wheel printer, a type wheel, a plurality of selectable elements for determining the stop position of said type wheel, a mechanical chain for each of said selectable elements having at least two parallelly arranged linkage systems each including variably positionable elements, means to vary the position of said variably positionable elements, means to operate each of said chains in accordance with the operation of said position varying means to thereby determine the selection of said selectable elements, means for causing said type wheel to move to its selected stop position, printing means in operative relation with said type wheel, and means for operating said printing means after said type wheel has been positioned.

3. In a type wheel printer, a type wheel, a plurality of selectable elements for determining the stop position of said type wheel, a mechanical chain for each of said selectable elements having at least two parallelly arranged linkage systems each including variably positionable elements, key operated means for varying the position of said variably positionable elements, means to operate each of said chains to provide a continuous path of movement through parts of at least two linkage systems of each of said chains or completely through one linkage system dependent on the operation of said key operated means to thereby control the selection of said selectable elements, means for causing said type wheel to move to its selected stop position, printing means in operative relation with said type wheel, and means for operating said printing means after said type wheel has been positioned.

4. In a printer, a plurality of character selecting elements, a mechanical chain for each of said elements having at least two parallelly arranged linkage systems each including variably positionable elements, means to vary the position of said variably positionable elements, means to operate each of said chains in accordance with the operation of said position varying means

9

to thereby determine the operation of said character selecting elements, and printing means for printing a character selected by said character selecting elements.

5. In a printer, a plurality of character selecting elements, a mechanical chain for each of said elements having at least two parallelly arranged linkage systems each including variably positionable elements, key operated means for varying the position of said variably positionable elements, means to operate each of said chains to provide a continuous path of movement through parts of at least two linkage systems of each of said chains or completely through one linkage system dependent on the operation of

10

said key operated means to thereby control the selection of said character selecting elements, and printing means for printing a character selected by said character selecting elements.

MARTHA W. C. POTTS,
Executrix Under the Last Will and Testament of Louis M. Potts, Deceased.

REFERENCES CITED

The following references are of record in the file of this patent:

FOREIGN PATENTS

Number	Country	Date
317,655	Italy	_____ of 1934