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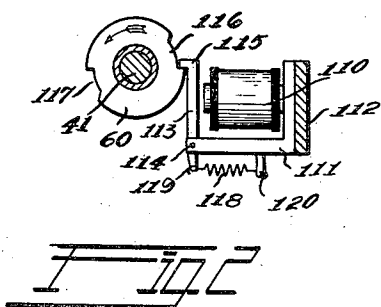
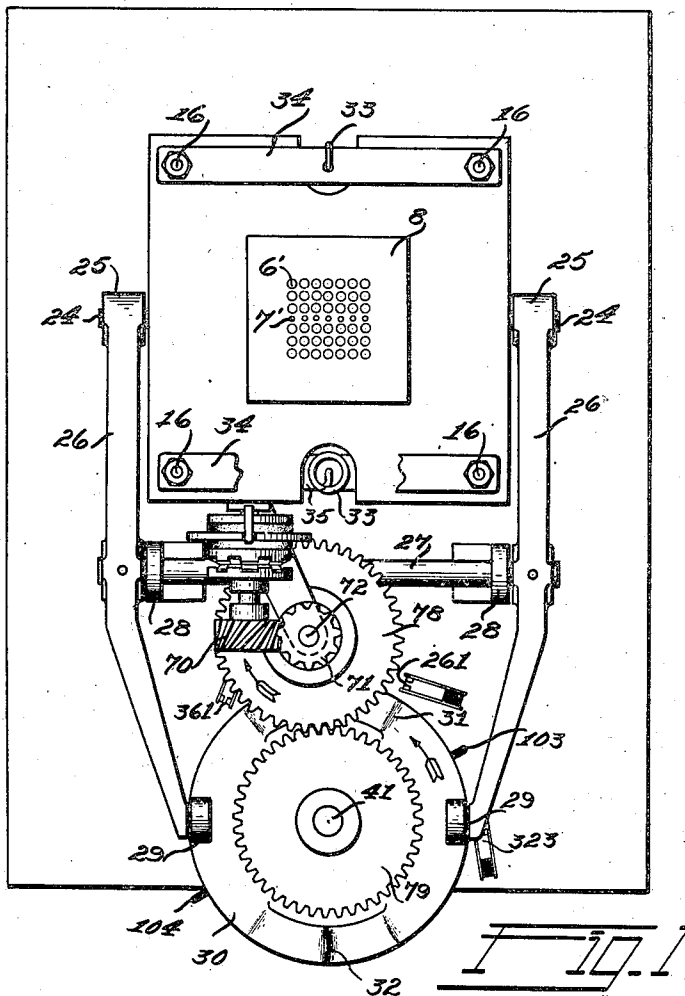
L. M. POTTS

2,085,120

SIGNALING TRANSMITTING METHOD AND APPARATUS

Filed May 10, 1930

7 Sheets-Sheet 1



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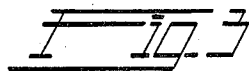
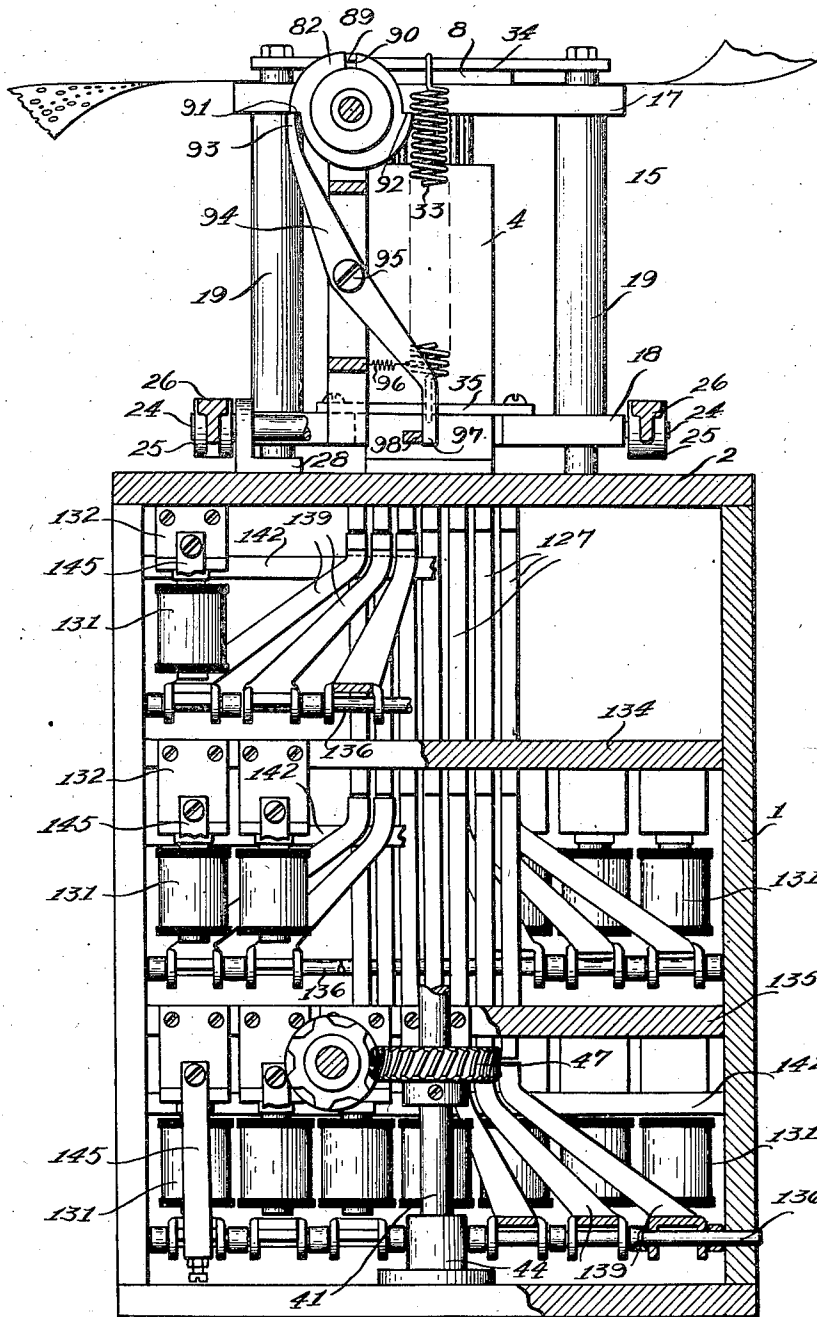
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SIGNALING TRANSMITTING METHOD AND APPARATUS

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7 Sheets-Sheet 2



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7 Sheets-Sheet 3

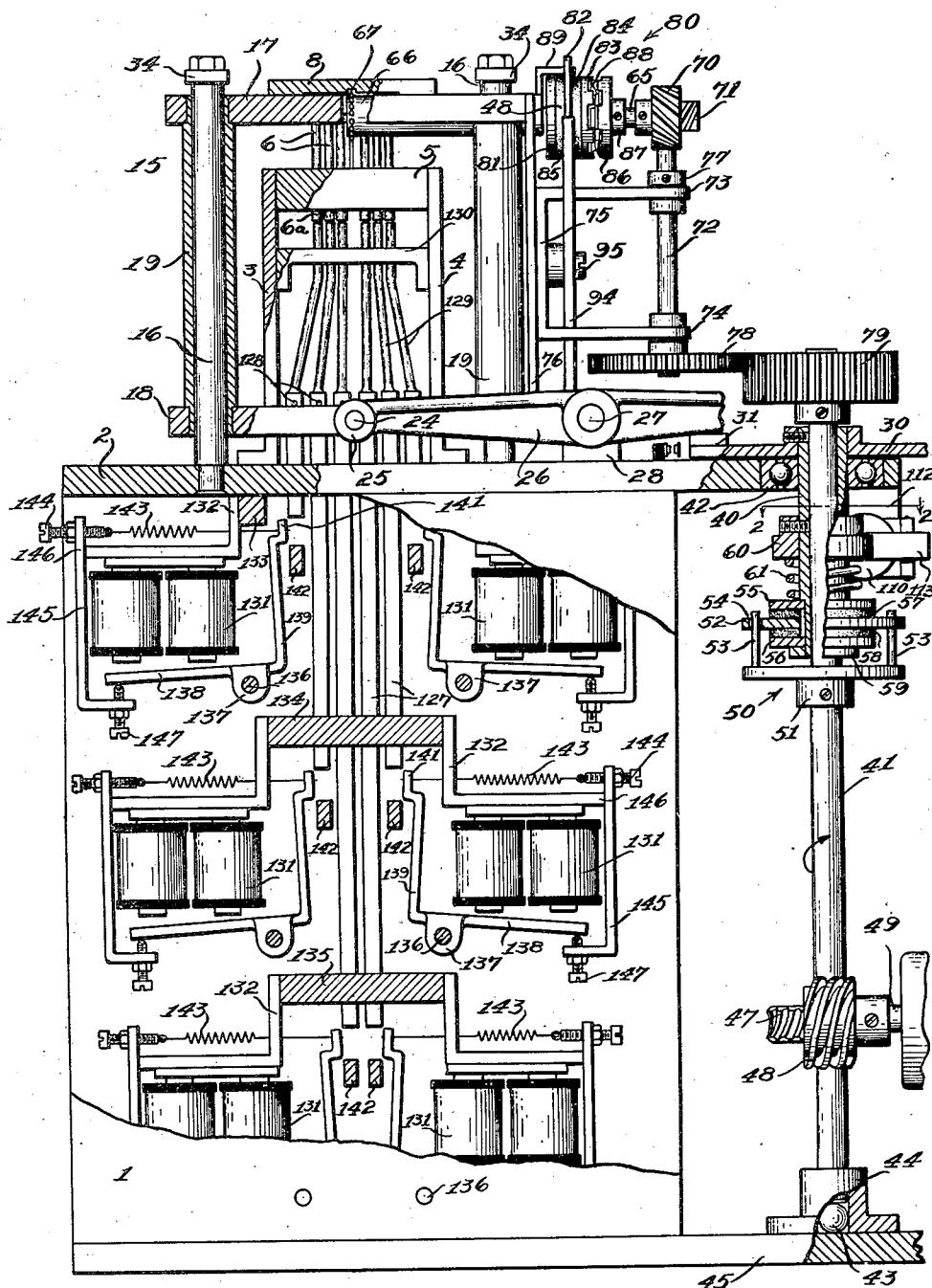


FIG. 4

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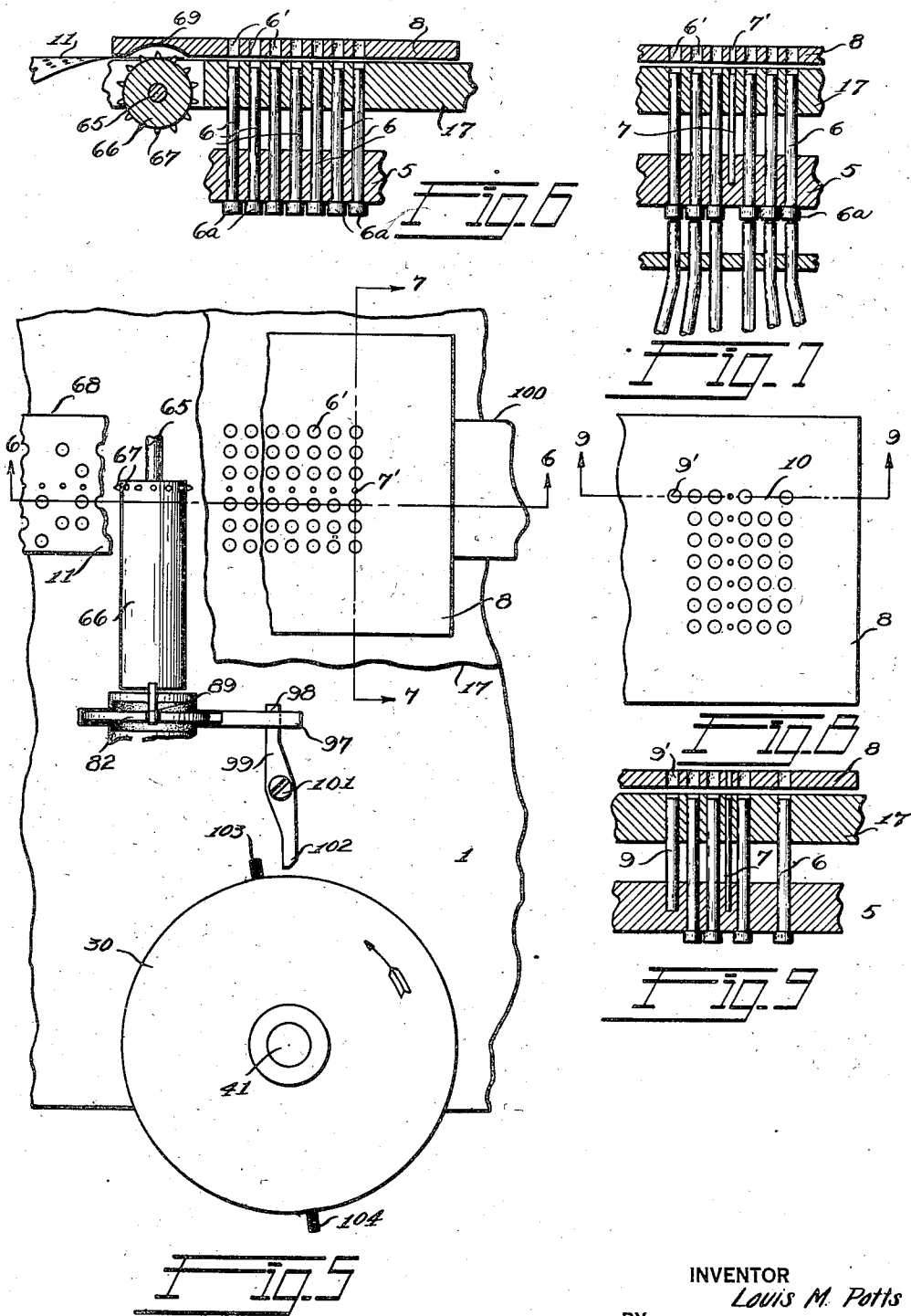
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SIGNALING TRANSMITTING METHOD AND APPARATUS

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7 Sheets-Sheet 4



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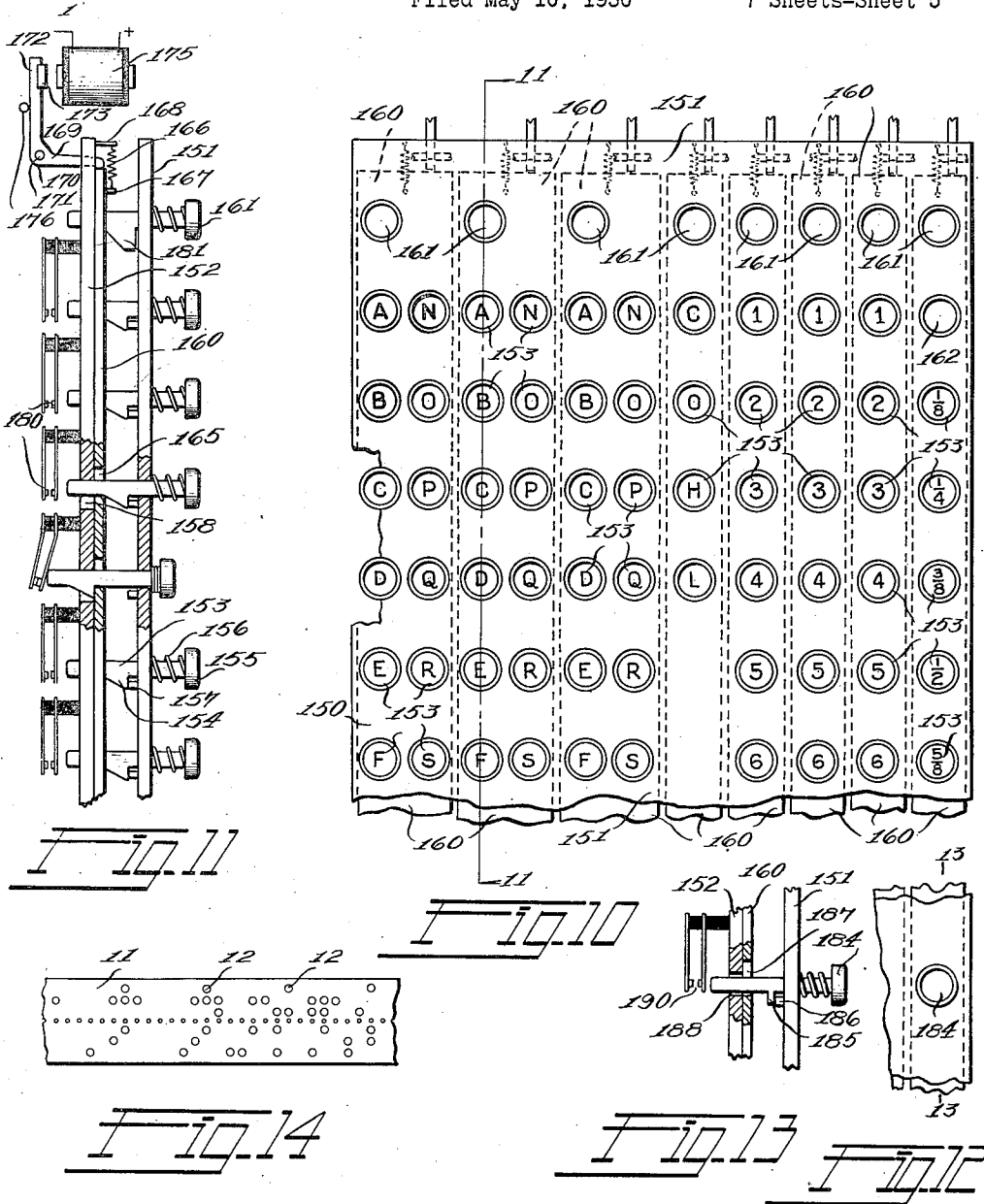
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SIGNALING TRANSMITTING METHOD AND APPARATUS

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7 Sheets-Sheet 5



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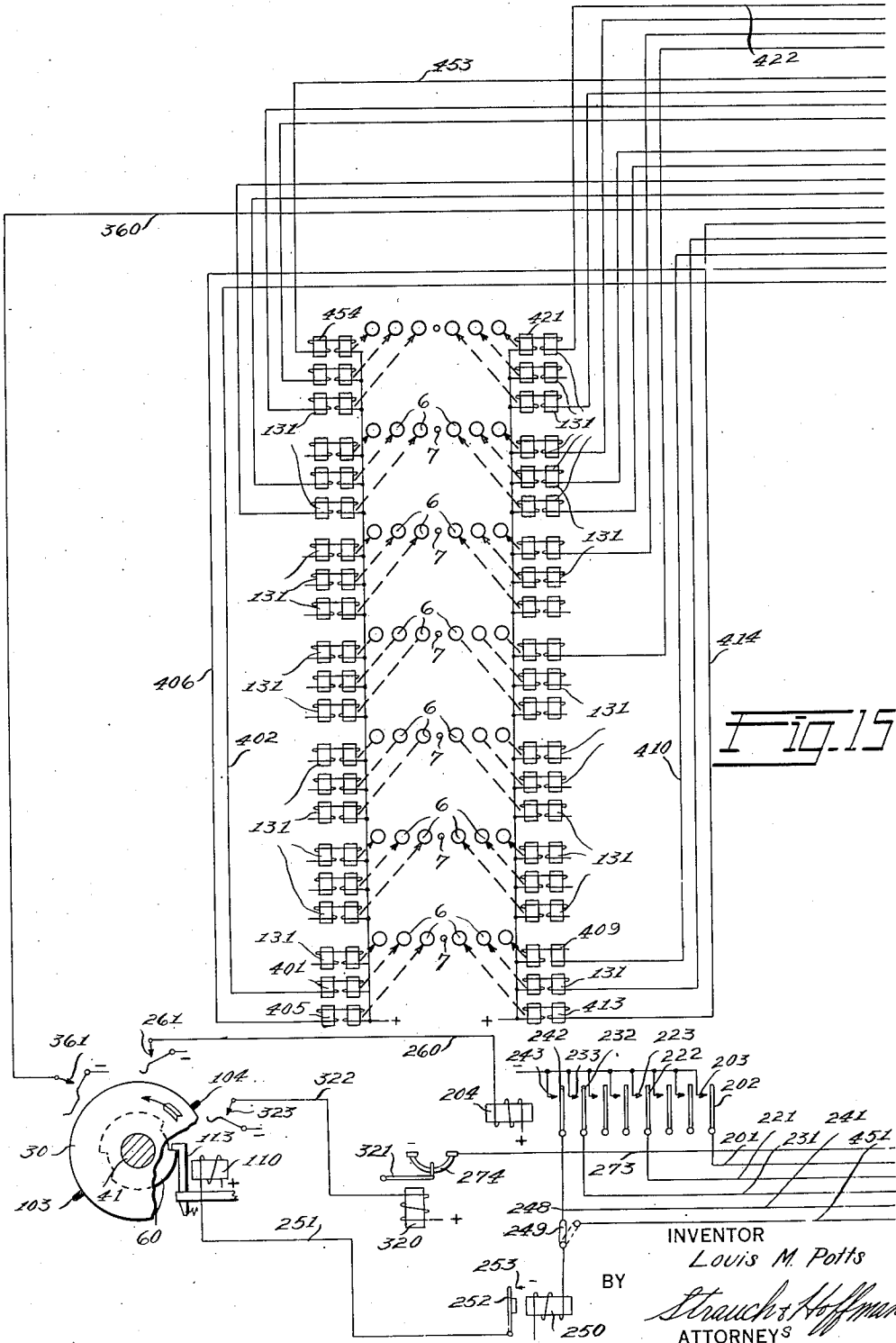
L. M. POTTS

2,085,120

SIGNALING TRANSMITTING METHOD AND APPARATUS

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7 Sheets-Sheet 6

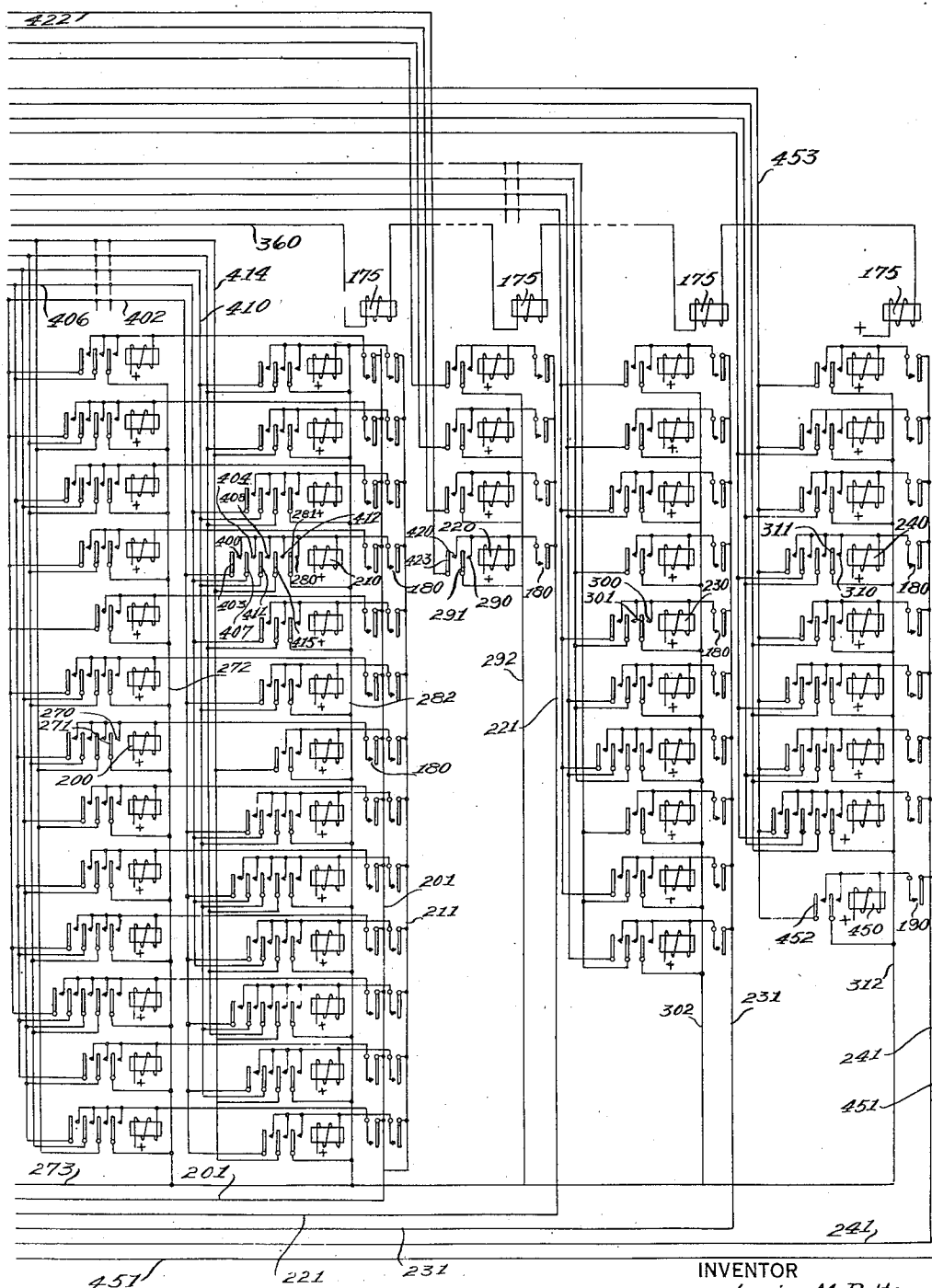


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SIGNALING TRANSMITTING METHOD AND APPARATUS

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7 Sheets-Sheet 7



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Fig. 16

UNITED STATES PATENT OFFICE

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SIGNALING TRANSMITTING METHOD AND APPARATUS

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Application May 10, 1930, Serial No. 451,493

61 Claims. (Cl. 164—113)

My present invention relates to signal transmitting methods and apparatus. More particularly, my invention relates to transmitting methods and apparatus in which a plurality of code signals may be set up prior to transmission, and then transmitted either to a transmitter control tape or a transmitting apparatus.

In ordinary automatic telegraph systems for the transmission of intelligence the messages are built up of code combinations of signaling conditions, and each code combination controls the complete selection of a character or performance of a definite operation at the receiving station. In such systems, therefore, transmitters, or tape perforators for the control of automatic transmitters have generally been arranged to set up the individual code combinations or character signals of a message in succession, so that an error in transmission or omission of a code signal resulted only in a single error.

In special signaling systems, as for example, commodity quotation distribution systems, recently developed, each message or quotation unit comprises a definite and predetermined number of code combinations transmitted successively in a fixed sequence and the messages or quotation units are usually all of the same length. Thus, in one modern form of stock quotation system, the first three code combinations in the transmitted message represent letters of the alphabet which constitute a code designation of the stock to be quoted and operate the receiver to select the recorder allotted to the selected stock. These three code combinations are invariably followed by four further code combinations which set the recorder to indicate the quotation of the stock selected by the three preceding code combinations. A further code combination, to be transmitted either simultaneously with the four last code combinations or immediately thereafter sets the recorder to indicate the nature of the quotation as high, low, last, or the like.

In such special systems, provisions must be made not only to insure synchronism during the transmission of each code combination of conditions, but also that proper "message synchronism" or phase relation is maintained between the transmitter and receiver with respect to successive code combinations, so that the receiver will be conditioned to receive the stock code combinations while the transmitter is transmitting same in succession, and will be in condition to receive the number code combinations while same are being transmitted.

Although the transmitters and perforators heretofore used for setting up the code combinations separately and in succession satisfied conditions met within the standard telegraph systems, such mechanisms are not best suited for stock quotation systems due to the fact that if one code combination of the message is omitted loss of "message synchronism" would occur. For example, if in setting up a quotation, the operator should overlook the setting up of the fraction code combination of one quotation, the next code combination transmitted, which would be the first letter of the next stock quotation, would be transmitted in a way that would cause a selection of a fraction quotation of the previously selected stock recorder. The transmitter and recorder would then be out of message phase and quotations would no longer be correctly quoted on the recorders in the system.

To obviate such a possibility of error in operation of automatic transmission for commodity quotation systems I have provided novel transmitting methods and apparatus to set up complete quotation message units before transmission of the message unit is initiated, each message unit being transmitted in succession instead of transmitting individual code combinations in succession as has heretofore been the practice. In this way errors are localized in the individual quotations and are not reflected throughout the succeeding quotations.

Accordingly, an object of my invention is to provide novel methods and apparatus for setting up complete message units prior to the initiation of transmission thereof.

Another object of my invention is to provide novel transmitting apparatus especially adapted to a system of telegraphic transmission in which a plurality of successive messages of equal length are to be transmitted which insures the correct length of every individual message by transmitting complete message units at a time, to insure proper message synchronism of the transmitting and receiving apparatus.

It is important that the equipment in stock quotation systems, particularly the transmitting equipment remain of simple design so that it can be operated at a high speed to meet the traffic requirements of stock quotation systems, and a further object of my invention is therefore, to provide simple, compact and efficient apparatus especially adapted for quotation transmission.

Another object of my invention is to provide a novel perforating mechanism electrically controlled from a remotely disposed control means.

A further object of my invention is to provide novel tape perforating mechanisms in which one group or series of perforations is being perforated in the tape while a succeeding group is being manually set up.

Other objects of the invention will appear in the following detailed description of preferred embodiments thereof and are defined by the scope of the appended claims.

In the accompanying drawings, in which:

Figure 1 is a top or plan view of a preferred embodiment of my improved perforator.

Figure 2 is a fragmentary cross-section immediately above the start-stop cam of the perforator shown in Figure 1, taken through line 2-2 of Figure 4.

Figure 3 is a vertical transverse cross-section of the perforator shown in Figure 1.

Figure 4 is an elevational cross-section of the preferred form of perforator.

Figure 5 is a fragmental top-view illustrating the feed operating mechanism of my improved perforator shown in Figure 1.

Figure 6 is a cross-section through line 6-6 in Figure 5.

Figure 7 is a fragmental cross-section through line 7-7 in Figure 5.

Figure 8 is a fragmental top view of a die or punch-plate showing a modified form of punch arrangement forming part of my invention.

Figure 9 is a cross-section on line 9-9 in Figure 8.

Figure 10 is a partial plan view of the preferred embodiment of keyboard forming part of my invention.

Figure 11 is a cross-section on line 11-11 in Figure 10 showing one of the keys depressed.

Figure 12 is a fragmental plan view of my improved keyboard showing the manual control key.

Figure 13 is a cross-sectional view on line 13-13 in Figure 12.

Figure 14 is a plan view of a preferred specimen of tape showing perforations therein made in accordance with my invention.

Figure 15 is an electrical wiring diagram showing the preferred circuits for my improved perforating mechanism.

Figure 16 is an electrical wiring diagram showing the circuits for the keyboard of my improved perforating mechanism.

In the accompanying drawings there is shown a perforating unit and a keyboard unit embodying my invention. The perforating unit comprises a main frame upon which is operably mounted means for perforating a large number of holes simultaneously and also punch selecting means which is under control of the keyboard. The main frame supports the punches, the selecting magnets and the driving mechanism. The keyboard outwardly has the appearance of the well known adding machine keyboard and controls the individual punches in the perforating unit in accordance with the keys which are depressed.

Punch mechanism

Mounted on the main frame 1, Figures 3 and 4, and fixed to the top plate 2 thereof are a pair of upright standards 3 and 4 which are bridged by a horizontally disposed punch guide plate 5. Mounted for vertical movement in the guide plate 5 are a plurality of code hole punches 6 which are provided at their lower ends, immediately adjacent to the guide plate 5, with enlarged stop portions 6a, adapted to engage the lower side of

guide plate 5 for limiting the upward movement of the punches.

The arrangement of the punches is best illustrated in Figures 1, 6 and 7. In addition to the code hole punches 6, there are a plurality of feed hole punches 7, one of which is shown in Figure 7. The feed hole punches 7 are not mounted for vertical movement in the guide plate 5, but are fixed to the guide plate as shown in Figure 7.

In accordance with my invention the punches to be operated are first positioned for operation and a female die plate or matrix is then moved with respect to the punches for performing the punching operation. The female die plate is referred to hereinafter as the punch plate and the mechanism which carries the female die plate is referred to hereinafter as the punch plate assembly.

The punch plate is designated in the drawings by the reference numeral 8. As clearly indicated in Figure 1, punch plate 8 is provided with a plurality of holes arranged in rows, there being seven rows of seven holes each. Holes 6' are the matrix holes for the code hole punches 6 and holes 7' are the matrix holes for the feed hole punches 7.

In the modified form of punch arrangement shown in Figures 8 and 9 only one punch 9 and its corresponding hole 9' are provided in the left hand row of the rows of punches and holes. Also it will be noted that the punch 9 is fixed to the guide plate 5. The purpose of this arrangement is to provide an index record for each perforation operation. In Figure 8 it will be noted that no hole is provided at the point 10. The reason for this omission is that in this modified form this perforation is never used in the code combination relating to fractions.

This is shown clearly in Figure 14 illustrating a specimen of tape 11, where it will be noted that the perforations 12 in the top row occur regularly every seventh code combination in the series of combinations, thereby providing a record on the tape of seven units of information by operating less than seven keys. In this view the large circles represent code perforations and the small circles represent feed perforations.

The punch plate assembly is designated as a whole by the reference numeral 15 (Figures 3 and 4) and is positioned for vertical reciprocal movement on guide columns 16 which are fixed to the top plate 2. The assembly 15 comprises, for the main part, a top plate 17 to which the punch plate 8 is fixed and a bottom plate 18. The plates 17 and 18 are held in spaced relation, in a well known manner, by guide sleeves 19 which are received by the guide columns 16. The top plate 17 is provided with suitable means for guiding the code hole punches and the feed hole punches.

Bottom plate 18 of the punch-plate-assembly 15, is provided with two oppositely disposed trunnions 24, 24 (Figures 1 and 4) to which are attached the ends, 25, 25 of a pair of levers 26, 26 respectively. Levers 26, 26 are fulcrumed on a shaft 27 which is journaled in brackets 28, 28 fixed to top plate 2. The opposite ends of the levers 26, 26 are provided with follower rollers 29, 29 which engage the top surface of an operating cam 30. Operating cam 30 is provided with a pair of raised cam portions 31 (see Fig. 4) and 32, which, upon rotation of said cam 30 in a manner hereinafter described, engage the follower rollers 29, 29 at predetermined intervals, imparting a reciprocal motion through operating

levers 26, 26 to the punch plate assembly 15. For returning the punch plate assembly 15 to normal, springs 33, 33 are provided. One end of each spring is attached to spring top anchor bars 34, 34 removably attached to the free ends of guide columns 16 and the other ends of the springs are secured to spring bottom anchor bars 35, 35.

The operating cam 30 is secured to a sleeve 40 through which extends the main driving shaft 41. The main driving shaft 41 is substantially vertical and is journaled through sleeve 40 to an anti-friction bearing 42 in the top plate 2 of the main frame. The bottom end of the main shaft 41 rests upon a steel ball bearing 43 held in a flanged sleeve 44 fixed to the bottom plate 45 of the main frame 1. The ball 43 thus sustains the entire weight of the main shaft 41 and its associated parts and constitutes an end thrust bearing for the shaft 41. The main shaft 41 is driven by a motor (not shown) through a gear 47 fixed to the main shaft 41 and a pinion gear 48 pinned or keyed to the motor shaft 49.

The sleeve 40 is driven by the main shaft 41 through a friction clutch mechanism 50. The friction clutch mechanism 50 comprises a driving member in the form of a flanged sleeve member 51 secured to the shaft 41 and a driven member in the form of a disk 52 loosely mounted on the sleeve 40. The driven disk 52 is driven through pins 53 which are secured to the driving member 51 and which extend into notches 54 in the disk 52. In addition, a pair of plates 55 and 56 are loosely mounted on the sleeve member 40. A friction disk 57, such as a felt washer, is placed between plate 55 and driven disk 52 and another friction disk 58 is placed between the driven disk 52 and plate 56. The plates 55 and 56, the driven disk 52 and the friction disks 57 and 58 are retained in position on the sleeve 40 by means of a lock nut 59 having threaded engagement with the sleeve 40.

The sleeve 40 has pinned to it intermediate its length a start-stop cam 60. Adjacent to cam 60 is a clutch spring 61 which normally bears against cam 60 and continually exerts pressure against the friction elements. It will be evident that, as long as the start-stop cam 60 is not restrained against motion, power will be transmitted from the main shaft 41, through the friction clutch elements, to the sleeve 40 and cam 30. When, however, the start-stop cam is restrained against motion, the sleeve 40 and operating cam 30 will remain stationary and the friction clutch will "slip". The means for controlling the start-stop cam will be described fully hereinafter.

Tape feeding

It is obvious that the tape must be advanced after the completion of each perforating operation to a position to clear the punches preparatory to performing the succeeding perforating operation. Accordingly I have provided a means for performing this function.

Journaled in brackets, not shown, but attached in an appropriate manner to top plate 17 of the punch-plate assembly 15 is the tape feed roll shaft 65 (Figures 3, 4, 5 and 6). Mounted on this shaft is a feed roll 66 in the form of a cylinder having feed pins 67 extending radially around the periphery thereof. Figures 5 and 6 show most clearly the relation of the feed roll 66 to the punch mechanism. There are in the present embodiment of my invention, fourteen

feed pins 67 equally spaced around the circumference of the feed roll 66 and in alignment with the feed hole punches 7. The feed pins 67 are spaced apart a distance between the centers of the feed hole punches 7. The feed pins 67 cooperate with the feed holes in the tape 11 for advancing the tape in accordance with the extent of rotation of the feed roll 66. The punch plate 8 is provided with a groove 69 to clear the feed pins 67 on the feed roll 66.

On the end of the shaft 65 opposite the feed roll 66 is keyed or pinned in a suitable manner a helical gear 70. Gear 70 intermeshes with a similar gear 71 keyed or pinned in an appropriate manner to one end of an auxiliary shaft 72 suitably journaled in bearings provided at the ends 73 and 74 of a substantially U-shaped bracket 75 secured to a supporting bar 76 fixed to the punch plate assembly 15.

Auxiliary shaft 72 (Figure 4) is positioned with respect to the U-shaped bracket 75 by means of a collar 77 pinned or otherwise suitably fixed to said shaft 72. To the opposite end of auxiliary shaft 72 is fixed a gear 78. It will now be apparent that shaft 72 is restrained from independent vertical movement with respect to the bracket 75, by the fixed collar 77 and fixed gear 78 acting on opposite sides of the bracket 75. It is also obvious that auxiliary shaft 72 and its associated parts are bodily movable with the punch-plate assembly 15.

Gear 78 on shaft 72 meshes with a gear 79 fixed to the end of the main shaft 41. While gear 79 possesses only a rotary motion, gear 78, with which gear 79 is enmeshed, is adapted to have imparted to it simultaneously a rotary motion through gear 79 and a vertical motion through punch-plate-assembly 15. In order to maintain the intermeshing engagement between gears 78 and 79 at all times, gear 79 is made considerably wider than gear 78.

The feed roll 66 is arranged to be driven from the shaft 65 through a friction clutch 80. The clutch 80 is an integral removable unit and comprises a flanged sleeve member 81 as one operating element and a drive disk 82 as the other operating element. The drive disk 82 is rotatably mounted upon the sleeve member 81. In addition, a plate 83 is loosely mounted on the sleeve member 81. A friction member 84, such as a felt washer, is placed between the plate 83 and drive disk 82 and a similar friction member 85 is placed between the disk 82 and the flange of the sleeve member 81. The friction members are confined upon the sleeve member 81 by an adjustable threaded member 86 and a lock nut 87. The friction members are pressed into engagement with the members 81, 82 and 83 by an annular member 88 comprising a spring with a plurality of radial wings turned alternately right and left. The wings engage corrugations in the threaded member 86 and the loose friction plate 83 and cause the friction plate 83 to turn at all times with the principal operating member 81 while at the same time pressing the friction elements together. The tension of the clutch is adjustable by means of the threaded member 86 and its lock nut 87.

The connection for driving the feed roll 66 from the disk 82 comprises an arm 89 fixed to the feed roll 66 and extending into a slot 90 in the disk 82, as shown in Figures 3 and 4. When the disk 82 is not restrained it drives the feed roll 66 through this slot and arm connection. However, during predetermined periods in

the operation, the disk 82 is restrained against rotation and the feed roll 66 is therefore held stationary. For this purpose, the drive disk 82 has formed on its periphery two diametrically disposed radial stop portions 91 and 92 (Figure 3) either of which is adapted to be engaged by one end 93 of a lever 94 at a certain interval in the cycle of operation of the perforator, as will be fully described hereinafter. The lever 94 is pivoted intermediate its ends on a pin 95 and its end 93 is continually biased into engagement with the disk 82 by means of a spring 96. The lower end 97 of the lever 94 has co-operative relationship with one end 98 of a trip lever 99 (Figure 5) which is pivoted intermediate its end on a pin 101. The other end 102 of the trip lever 99 is disposed in the path of movement of a pair of studs 103 and 104 which extend radially from the periphery of the operating cam 30.

At predetermined intervals in the operation of the apparatus, the stud 103, or the stud 104, engages the end 102 of the trip lever 99 rocking this lever in a clockwise direction, as viewed in Figure 5. In this rocking movement the end 98 of lever 99 is forced against the end 97 of the lever 94 rocking the lever 94 counter-clockwise, as viewed in Figure 3, about its pivot 95 against the action of spring 96. This movement disengages end 93 of lever 94 from the notch 91 of disk 82 thereby initiating rotation of the shaft 65. After the tripping action of lever 99, lever 94 is immediately returned to its normal position, under the influence of spring 96, in time to permit end 93 of the lever 94 to engage notch 92 of disk 82, thereby restricting the rotation of shaft 65 to only one-half revolution.

It will be noted by reference to Figure 6 that there are twice as many feed pins 67 on feed roll 66 as there are feed hole punches 7. Inasmuch as the pitch distance between each feed pin is equivalent to the pitch distance between the punches 7 it is obvious that each one-half revolution of feed roll 66, controlled by drive disk 82 in the manner hereinbefore described, will cause the tape to advance seven units and therefore clear the group of punches in preparation for the succeeding perforating operation. This advance is of such distance as to maintain a uniform pitch or spacing between the successive feed holes in the tape.

Start-stop mechanism.

The starting and stopping of the punching and tape feeding mechanism is controlled by a magnet 110 (Figures 2 and 4). The magnet 110 is secured to a bracket 111 which in turn is secured by a bracket 112 to main-frame-top-plate 2. As more clearly shown in Figure 2, magnet 110 is provided with an armature lever 113 pivoted at 114 to bracket 111. One end of armature lever 113 is provided with a hook or latch 115 which engages one of two peripheral notches 116 and 117 on start-stop cam 60. A spring 118 having one of its ends connected at 119 to armature lever 113 and its other end connected to spring post 120 fixed to bracket 111 normally tends to revolve lever 113 in a counter-clockwise direction about pivot 114 thereby holding lever 113 away from or out of contact with magnet 110 when said magnet is deenergized; and holding the hook 115 of the lever 113 in engagement with peripheral notch 116 or 117, as the case may be, in start-stop-cam 60.

Now, when magnet 110 is energized it attracts armature lever 113 causing said lever to revolve

about pivot 114 in a clockwise direction against the action of spring 118 and thereby disengaging latched end 115 of lever 113 from notch 116 or 117 in start-stop cam 60, allowing said cam to rotate under the influence of the friction clutch mechanism 50. As the cam 60 rotates, the sleeve 40 and the operating cam 30 also rotate. The punching and feeding operations are then performed under the control of the cam 30 as described above. As will appear hereinafter, the rotation of the operating cam 30 is limited to one-half revolution.

Selector mechanism

Referring to Figure 4, immediately below the punches 6 and having abutting relation therewith are a plurality of punch interference bars 127 (Figures 3 and 4), one of such interference bars being provided for each punch 6. The interference bars 127 are supported on bottom plate 18 of reciprocating punch plate assembly 15 by means of trunnion like pins or projections 128. To compensate for the compactness of the group of punches 6 and the necessary spread of bars 127, the latter are provided with integrally formed compensating arms 129. This spread of the bars 127 is necessary to provide sufficient room for mounting the selector magnets hereinafter referred to. The compensating arms 129 are suitably guided in a guide plate 130 located below guide plate 5 and secured to the standards 3 and 4.

Suitably positioned in main-frame 1 are a plurality of selector magnets 131 (Figures 3 and 4), one such magnet being provided for each of the punch interference bars 127. Magnets 131 are secured to supporting brackets 132 which in turn are fixed to supporting bars 133, 134 and 135. Associated with each magnet 131 and pivotally mounted on an appropriately located shaft 136 is a bell crank lever 137, each lever comprising an armature arm 138 and a punch blocking arm 139. Each arm 139 is bent at its end 141 so as to form a blocking means for obstructing the movement of the particular punch interference bar 127 associated therewith. Backing up the ends 141 are arrestor bars or punch abutments 142, suitably fixed at their ends to the selector casing walls.

Each bell crank lever 137 has associated therewith a spring 143 one end of which is secured to the end 141 of the blocking arm 139 and the other end to an adjusting screw 144, suitably mounted on one end of a bracket 145 fixed to the end 146 of bracket 132. Appropriately mounted to the other end of each bracket 145 and adjacent to the free end of the armature arm 138 of lever 137 is an adjusting screw 147.

When the magnets 131 are in their normal condition, that is, deenergized, the springs 143 rotate the bell crank levers 137 about shafts 136 until the armature arms 138 engage the adjusting screws 147. When a magnet 131 is energized, it attracts the armature arm 138 of the associated bell crank lever 137 causing said lever to rotate about shaft 136, in the opposite direction against the action of spring 143, thereby causing the blocking end 141 to be introduced between the end of punch interference bar 127 and punch abutment 142. The magnets 131 are selectively controlled by operation of the keys on a keyboard.

Keyboard

The keyboard 150 (Figures 10 and 11) comprises a top plate 151 and a bottom plate 152, held in spaced relation with respect to each other

in any suitable manner, and a series of rows of keys 153.

The keys 153 are suitably supported for axial movement in the keyboard top and bottom plates 151 and 152, respectively, and each key is provided with a latch 154 formed integrally therewith and a key top 155 on which is appropriately indicated the letter or figure designating the individual key. Enveloping the shank of each key and confined between the top plate 151 and key top 155 is a helical spring 156, normally maintaining key top 155 in spaced relation with respect to top plate 151. This spaced relation is limited by the cooperation of the latches 154 with suitable stops 157 which may be fixed to, or formed integrally with, the top plate 151. The openings 158 in the bottom plate 152 are elongated to permit the reception of the latches 154 of the keys.

Positioned between plates 151 and 152 and having slidable abutting relation with bottom plate 152 are a plurality of slide members 160. In the particular form of keyboard herein disclosed there are provided eight slide members 160 and eleven vertical rows of keys. Each of the three left hand slide members cooperates with a pair of vertical rows of keys. Each row of said pairs of vertical rows consists of thirteen keys, partly shown in Figure 10, and each pair of vertical rows represents the letters of the alphabet preferably disposed so that each row contains one-half of the alphabet consecutively arranged from top to bottom, the left hand row of each of said pairs embodying the first half of the alphabet and the right hand row embodying the last half of the alphabet. The seventh to the eleventh rows, inclusive, have one slide member each. The seventh row contains four keys, the key tops of which are labeled, C, O, H, L designating the words, "Close", "Open", "High", "Low", respectively. The eighth, ninth and tenth rows contain the numerals 1 to 9 inclusive and 0. The eleventh or extreme right hand row contains the fractions $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$ and also three blank keys. The top blank keys 161 are release or unlatching keys, hereinafter described, there being one such key for each slide member 160. The depression of any key in the right hand or fraction row of keys except the aforementioned top blank key, will initiate the operation of the perforator as will hereinafter appear. The blank key 162 in the right hand row of keys is provided for the purpose of initiating the operation of the perforator in the event the message to be perforated does not contain a fraction.

The slide members 160 are provided with elongated holes 165 through which the keys 153 extend, as shown in Figure 11. The slide members 160 are normally held in the position shown in Figure 11 by means of springs 166, each of which has one end secured to a stud 167 on the slide member 160 and the other end secured to a stud 168 fixed to the bottom plate 152. Each spring 166 normally pulls its slide member 160 into engagement with the associated keys 153 and against the stop arm 169 of a bell crank lever 170. It will be understood that there is an individual bell crank lever for each slide member.

Each bell crank lever 170 is pivoted at 171 and comprises the aforementioned stop arm 169 and an armature arm 172 to the free end of which is secured a pole piece 173. Associated with each lever 170 and adjacent to pole piece 173 and in spaced relation therewith is a release magnet 175 the function of which is to effect the release of any depressed or operated key 153, preparatory to

making a succeeding selection of combinations. This release operation will be fully described hereinafter.

When any one of the keys 153 is depressed sufficiently, the inclined edge of its latch 154 urges the associated slide member 160 away from its normal position against the action of spring 166 until the latch has cleared the opposite side of the slide member whereupon the slide member returns to its normal position under the influence of spring 166 and locks the depressed key in its depressed position, preventing the return or release of said depressed key until released by operation of the release magnet 175 or by operation of the proper release key 161, as will be described.

When a release magnet 175 is energized it attracts the pole piece 173 on armature arm 172 causing the bell-crank lever 170 to rock about its pivot 171 in a clockwise direction, as viewed in Figure 11, so that arm 169 urges slide member 160 to move against the action of spring 166 sufficiently to permit the disengagement of the depressed key 153. When magnet 175 is deenergized, lever 170 is free to rock in a counterclockwise direction under the influence of spring 166 acting through slide member 160 and arm 169 until the arm 172 strikes an appropriately located stop 176. It is obvious that movement of all the slide members 160 may be effected by means of one magnet 175 and lever 170 of proportionate dimensions. The manner in which the magnets 175 are controlled will be fully described hereinafter.

Appropriately positioned on bottom plate 152 and secured thereto on the side opposite to that on which the slide members are disposed are a plurality of contacts 180 of any well known construction, one such contact being associated with each key 153. The depression of any key 153 closes its associated contacts 180 which is thereby instrumental in completing a circuit hereinafter to be described.

As hereinbefore stated, each slide member 160 is provided with a slide release or unlatching key 161 the purpose of which is to effect the manual release or unlatching of the depressed or operated keys 153. It is quite probable that the operator in making a selection might strike or operate the wrong key. In such event the keys 161 afford a means whereby the error may be corrected. These keys 161 also afford a means of erasing a complete message which has been set up on the keyboard.

Keys 161 are similar in construction to keys 153 except that their latches 181 (Figure 11) are purposely made larger than latches 154 and are so fashioned as to throw or urge the slide members, the elongated holes in which are substantially uniform, a greater distance than do latches 154, thereby allowing any latch engaging a slide member 160 to become unlatched or disengaged therefrom and returning the corresponding key to its normal position under the influence of the associated spring 156.

A key 184 (Figures 12 and 13) the purpose and operation of which will be hereinafter fully described, is provided preferably, though not necessarily, in the fraction row of keys. This key is similar in construction to the keys 153 and 161 with the exception that key 184 is not provided with a latch. In place of a latch the key 184 is provided with a stop portion 185 which bears against a stop 186 to limit the movement of said key. Of course the slide member 160 is

provided with a slot 187 for key 184 but only for the purpose of providing clearance or play in case other keys in the same row with key 184 are operated. The hole 188 in plate 152 need not be elongated as in the case of the other keys since there is no latch on key 184. Contacts 190 are arranged to be operated by the key 184.

Electrical circuits

For a proper understanding of the electrical circuits, Figures 15 and 16 should be read together.

The selector magnets 131 which, as hereinbefore described, are suitably positioned in the main frame 1 to effect the selection and storage of the desired combinations of punches are shown diagrammatically in Figure 15. These magnets 131 are electrically connected to selector relays which are associated with the keyboard. The latter may form a unit distinctly apart from the perforating unit and isolated therefrom, if desired. The selector relays, diagrammatically shown in Figure 16, are shown arranged in rows similarly to the keys on the keyboard.

The selector relays which are controlled by the letter keys will be referred to hereinafter as the letter relays, the selector relays which are controlled by the figure keys will be referred to as the figure relays, the selector relays which are controlled by the C, O, H, L keys will be referred to as the designation relays and the selector relays which are controlled by the fraction keys will be referred to as the fraction relays. To avoid repetition, I have shown in Figure 16 only two rows of letter relays and only one row of figure relays. I have, of course, shown the designation relays and the row of fraction relays. Accordingly, in Figure 16 the first and second rows comprise letter relays, the third row comprises designation relays, the fourth row comprises figure relays and the last row comprises fraction relays.

Each of the letter relays as, for example, relay 200 is provided with an energizing circuit which extends from positive battery through the winding of the relay, over the key-controlled contacts 180, common conductor 201, armature 202 and contact 203 of relay 204 to negative battery. The function of relay 204 will be fully explained hereinafter.

Each of the letter relays as, for example, relay 210 is provided with an energizing circuit which extends from positive battery through the winding of the relay, over the key-controlled contacts 180, common conductor 211, conductor 201, armature 202 and contact 203 of relay 204 to negative battery.

Each of the designation relays as, for example, relay 220 is provided with an energizing circuit which extends from positive battery through the winding of the relay over the key-controlled contacts 180, common conductor 221, armature 222 and contact 223 of relay 204 to negative battery.

Each of the figure relays as, for example, relay 230 is provided with an energizing circuit which extends from positive battery through the winding of the relay and over the key-controlled contacts 180, common conductor 231, armature 232 and contact 233 of relay 204 to negative battery.

Each of the fraction relays as, for example, relay 240 is provided with an energizing circuit which extends from positive battery through the winding of the relay, over the key-controlled

contacts 180, common conductor 241, armature 242 and contact 243 of relay 204 to negative battery. As shown in Figure 15, the energizing circuit for the fraction relays divides at the point 248 and extends over a switch 249 through the winding of a relay 250 to negative battery. The relay 250 is the start-stop relay and controls the operation of the start-stop magnet 110 over a circuit which extends from positive battery through the winding of the start-stop magnet 110, conductor 251, armature 252 and contact 253 of start-stop relay 250 to negative battery.

The relay 204 which controls the armatures 202, 222, 232 and 242 is provided with an energizing circuit which extends from positive battery through the winding of the relay 204, conductor 260 and contacts 261 to negative battery. The contacts 261 are arranged to be engaged by the lugs 103 and 104 on the operating cam 30 as the operating cam 30 rotates.

In addition to each of the energizing circuits, each of the selector relays such as relays 200, 210, 220, 230 and 240 is provided with a locking circuit as will now be described.

The locking circuit for each of the letter relays such as relay 200 extends from positive battery through the winding of the relay, back contact 270, armature 271, common conductor 272, conductor 273 and over circuit breaker 274 to negative battery.

The locking circuit for each of the letter relays such as relay 210 extends from positive battery through the winding of the relay, back contact 280, armature 281, common conductor 282, common conductor 273 and over circuit breaker 274 to negative battery.

The locking circuit for each of the designation relays such as relay 220 extends from positive battery through the winding of the relay, back contact 290, armature 291, common conductor 292, common conductor 273 and over circuit breaker 274 to negative battery.

The locking circuit for each of the figure relays such as relay 230 extends from positive battery through the winding of the relay over back contact 300, armature 301, common conductor 302, common conductor 273 and over the circuit breaker 274 to negative battery.

The locking circuit for each of the fraction relays such as relay 240 extends from positive battery through the winding of the relay, over back contact 310, armature 311, common conductor 312, common conductor 273 and over the circuit breaker 274 to negative battery.

It will be noted from the above description that the locking circuit of every selector relay includes the circuit breaker 274. Obviously therefore, opening the circuit breaker 274 will have the effect of breaking any locking circuit which happens to be closed. The circuit breaker 274 is normally maintained closed and is arranged to be opened at a predetermined time in the cycle of operations by means of a relay 320 which has its armature 321 secured to the circuit breaker 274 for this purpose. The energizing circuit for the relay 320 extends from positive battery through the winding of the relay and over conductor 322 and contacts 323 to negative battery. The contacts 323 are arranged to be engaged by lug 103 or lug 104 on the operating cam 30 as will be described hereinafter.

In addition to the locking circuit control armature and contact each individual relay in each row is provided with one or more armatures 75.

and contacts for controlling one or more of the punch selector magnets 131 (Figure 15). The number of such armatures and contacts associated with any particular relay depends upon the code combination corresponding to the letter or figure which that relay represents.

The release magnets 175, although associated with the keyboard unit, are in no way directly electrically connected therewith. These magnets are connected in series with each other over a conductor 360 to contacts 361 (Figure 15) which are arranged to be engaged by lug 103 or lug 104 on the operating cam as will be described hereinafter.

Operation

It will be assumed that the motor is running and that a tape to be perforated has been introduced between punch plate 8 and top plate 17 in the usual and well known manner. The motor drives the shafts 49, 41, 72 and 65 and the parts are now ready for operation.

Referring to Figure 10 it will be assumed that the Q-key of the first set of letter keys is to be depressed followed by a depression of the L-key of the row of designation keys, the 5-key of the first row of figures keys and the $\frac{3}{8}$ -key of the row of fraction keys, in the order named. It is of course to be understood that since the depression of a fraction key initiates the operation of the perforator it must be the last key to be depressed in each message.

It will be assumed that switch 249 is positioned as shown in Figure 15 to effect the automatic operation of the apparatus. It may, however, as will hereinafter appear, be shifted to the dotted position to dispense with the automatic operation.

The depression of the Q, L and 5 keys closes the contacts 180 in the energizing circuits of the relays 210, 220 and 230 respectively, of Figure 16. As hereinbefore described, the energizing circuit for each of these relays includes an armature and a contact of the relay 204, Figure 15. Inasmuch as this relay 204 is at this time de-energized, its contacts 203, 223, 233 and 243 are open and consequently depression of the aforementioned keys does not complete the energizing circuits for the relays but merely prepares such energizing circuits. It will be recalled that the keys, when depressed, are latched in their depressed position by the slide members 160. Accordingly, the contacts 180 operated by the depressed keys are maintained closed until released by automatic operation of the release magnets 175 or by manual operation of the release keys 161.

When the $\frac{3}{8}$ key is depressed it closes its contacts 180 and prepares an energizing circuit for the relay 240, Figure 16, and simultaneously completes an energizing circuit for the start-stop relay 250. The latter circuit extends from positive battery through the winding of the relay 240, contacts 180, conductor 241, switch 249, and through the winding of the start-stop relay 250 to negative battery. The start-stop relay 250 energizes and establishes an energizing circuit for the start magnet 110, this circuit extending from positive battery through the winding of the start magnet 110 and over conductor 251, armature 252 and contact 253 to negative battery.

Start magnet 110 energizes, moving its armature 113 out of engagement with the start-stop cam 60 thereby initiating rotation of the cam 60 and operating cam 30. These cams rotate in a counterclockwise direction as viewed in Figure 15. Immediately after the initiation of rotation, the

peripheral stud 104 on the operating cam 30 closes contacts 261 thereby establishing an energizing circuit for the relay 204, this circuit extending from positive battery through the winding of relay 204 and over conductor 260 and contacts 261 to negative battery.

Relay 204 energizes and closes its contacts 203, 223, 233 and 243, thereby completing the previously prepared circuits through the winding of relays 210, 220, 230 and 240 and energizing these relays. Each of the relays 210, 220, 230 and 240 upon being energized closes a locking circuit for itself and in addition each of these relays establishes an energizing circuit for one or more punch selector magnets 131.

Thus, relay 210 establishes at its back contact 400 an energizing circuit for the punch selector magnet 401, Figure 15, this circuit extending from positive battery, through the winding of the punch selector magnet 401, over conductor 402, armature 403 in engagement with back contact 400, contacts 180, conductor 211, conductor 201, armature 202 and contact 203 of relay 204 to negative battery. At contact 404, relay 210 establishes an energizing circuit for the punch selector magnet 405, this circuit extending from positive battery through the winding of the punch selector magnet 405, over conductor 406, armature 407, contact 404, contacts 180, conductor 211, conductor 201, armature 202 and contact 203 of relay 204 to negative battery. At contact 408, the relay 210 establishes an energizing circuit for the punch selector magnet 409, this circuit extending from positive battery through the winding of punch selector magnet 409, over conductor 410, armature 411, contact 408, contacts 180, conductor 211, conductor 201 and armature 202, and contact 203 of relay 204 to negative battery. At contact 412, the relay 210 establishes an energizing circuit for the punch selector magnet 413 this circuit extending from positive battery through the winding of punch selector magnet 413, over conductor 414, armature 415, contact 412, contacts 180, conductor 211, conductor 201, armature 202 and contact 203 of relay 204 to negative battery.

Relay 220, at its contact 420, establishes an energizing circuit for the punch selector magnet 421, this circuit extending from positive battery, through the winding of the punch selector magnet 421, over conductor 422, armature 423, contact 420, contacts 180, conductor 221, armature 222 and contact 223 of relay 204 to negative battery. Referring to Fig. 16 there is disclosed a series of designation relays 220 (four in the present instance) each of which is electrically connected, similarly as just described, to corresponding ones of the upper four groups of punch electromagnets 131 shown in Figure 15. As is well known in the art, permutations of four elements comprising two signaling conditions supply a sufficient number of combinations to take care of ten digits, viz. 0 to 9. Consequently, the right hand punches in the upper four rows of punches 6 (Fig. 15) are not used for price indication purposes. Thus, it is a feature of the present invention to utilize these right hand punches for stock designation purposes.

In a similar manner, relays 230 and 240 complete energizing circuits for certain of the punch selector magnets.

The selected punch selector magnets 401, 405, 409, 413, etc., upon being energized, attract the armature arms 136 of bell-crank lever 137 rocking these levers about their respective pivots 136, 75

moving blocking portions 141 of said levers 137 into the path of punch interference bars 127 thereby setting up a punch arrangement corresponding to the series of code combinations of the message to be perforated, preparatory to performing the perforating operation. A short time after the punch arrangement has been set up the portions 31 and 32 of cam 30 engage the follower rollers 29, 29 of operating levers 26, 26 rocking these levers about fulcrum 32 and thereby imparting a reciprocating motion to the punch plate assembly 15, to produce a perforated message in tape 11.

After the raised cam portions 31 and 32 have passed under the follower rollers 29, 29 the punch plate assembly 15 is restored to its normal position by the return springs 33. Thereafter the stud 104 on cam 30 engages the trip lever 99 (Figure 5) causing the latter to trip the lever 94 and release the drive disk 82. The latter rotates one-half a revolution in the manner hereinbefore described and operates the feed roll 66 to advance the tape 11 a distance corresponding to seven units.

As the operating cam 30 continues to rotate, the stud 104 engages and closes the contacts 361, establishing a circuit from positive battery through the windings of all of the release magnets 175 (Figure 16) in series and then over wire 360, through contacts 361 to negative battery, thereby energizing all of said release magnets 175 and operating all the slide members 160, as hereinbefore described, to effect the restoration of the depressed keys to their respective normal positions.

It will be evident from the preceding description that operation of the relay 204 transferred the setting of the keys to the selector relays and that the relays locked themselves to maintain their setting. Accordingly, as soon as the release magnets 175 have restored the depressed keys to their respective normal positions the operator may proceed to set up on the keyboard the succeeding message to be perforated. In other words the succeeding message may be set up while the preceding message is being perforated. Thus an "overlap" is provided whereby rapid operation is facilitated.

Following this last mentioned operation in the cycle, the peripheral stud 103 on the operating cam 30 engages and closes the contacts 323, thereby establishing an energizing circuit for the release relay 320, this circuit extending from positive battery through the winding of release relay 320, wire 322, contacts 323, to negative battery. The release relay 320 energizes and operates its armature 321 to open the circuit breaker 274, thereby breaking the circuits which extend through the windings of the operated selector relays and the windings of the operated punch selector magnets. The operated selector relays and punch selector magnets are thus deenergized.

It will be noted that the locking circuit through the selector relays maintain those relays energized and their associated contacts closed until the circuit breaker 274 is opened in the aforementioned manner. It is obvious that the use of the circuit breaker 274 in this manner will preserve the relay contact points of the keyboard unit and thereby simplify and reduce the maintenance of said relay assembly. Circuit breaker 274 is constructed so as to be adapted to resist deterioration by sparking.

Also it will be noted that the period during which the punching operation and the tape feed-

ing operation may take place, extends from the time that the lug 104 on the operating cam 30 closes the contacts 261 until the lug 103 on the operating cam 30 closes the contacts 323.

Non-automatic operation

It may be desirable to dispense temporarily with the automatic operation of the keyboard, and to this end, manually operated switch 249 (Figure 15) and key 184 (Figures 12 and 13) are utilized. Should it be desired to dispense with the automatic operation, switch 249 (Figure 15) is moved to the dotted line position, thereby preventing the completion of a circuit through the start-stop relay 250 by the mere operation of a fraction key and necessitating the further operation or depression of key 184 (Figures 12 and 13) to close contacts 190 (see Figure 16) and allow current to flow from positive battery through winding of relay 450, contacts 190, wire 451, switch 249, winding of relay 250 to negative battery, energizing relay 250 and thereby initiating the operation of the perforator. In this way the depression of a fraction key will not initiate the operation of the apparatus, but will further require the depression of key 184 to start said operation.

Armature 452 of relay 450 (Figure 16) is connected over a conductor 453 to punch selector magnet 454 (Figure 15) in case its associated punch is to be selectively operated instead of being permanently fixed as illustrated by punch 9 in Figures 8 and 9. In either case the operation or depression of key 184 (shown in Figures 12 and 13), and consequent closing of contacts 190 will initiate the operation of the perforator to produce a punched record whether or not any of the other keys have been operated.

The purpose of this sixth punch 9 (Figures 8 and 9) in every seventh code combination is to insert a guide record for each perforation operation, that is to say, whenever key 162 or key 184 is depressed alone a perforating operation will result, in which only one punched hole other than feed holes, will appear in the tape, it being that pierced by punch 9, which may have been either slidably mounted in or permanently fixed to punch guide plate 5, as the case may be. This guide hole separates messages and may be used to control operations peculiar to the end or beginning of a message.

It will be noted that as soon as the last key has been depressed the operation of the perforator is initiated and the operator is free to proceed in setting up on the keyboard the succeeding message to be perforated, while the preceding operation is taking place. This, as is readily discernible, provides an overlap in the operation of my apparatus whereby its rapid operation is facilitated.

It will also be noted from the foregoing description that the perforator consists of two parts namely the main-frame which embodies the punches and selector-magnets, and the reciprocating-punch-plate assembly in which the latter is of the lighter construction and therefore is made the movable unit, thereby also enhancing the rapid operation of the machine.

It is obvious that numerous changes may be made in the details set forth without departure from the essentials of the invention as defined in the claims. Thus, although the invention has been described in a specific form particularly adaptable to the perforation of a tape for the transmission of signals for stock and commodity

quotation board operation it is obvious that the the invention is not limited to such use. Furthermore, while the perforating mechanism is herein shown as controlled by a keyboard it will be understood that it can be equally well controlled in many other ways.

Furthermore, my invention may be used for controlling a transmitter directly, instead of perforating a tape, by arranging the distributing mechanism to successively transmit code combinations of impulse conditions over a signaling line in accordance with the operation of the perforating magnets. Such an arrangement would provide sufficient overlaps in the transmitting circuit to permit direct transmission of the prepared code combinations without the use of an intermediary tape as has heretofore been found necessary.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What I claim and desire to secure by U. S. Letters Patent is:—

1. The method of perforating a tape which comprises the steps of conditioning a plurality of punches in accordance with corresponding code combinations of signaling conditions to be perforated, perforating all of said conditioned code combinations simultaneously, and further conditioning during said perforating operation said plurality of punches in accordance with a succeeding code combination of signaling conditions to be perforated.

2. In a perforating device, punching mechanism comprising a plurality of groups of punches, selecting mechanism comprising a plurality of groups of keys for selecting the punches to be operated, certain of said groups of keys corresponding to certain of said groups of punches, each of said keys adapted to simultaneously control one or more punches in its corresponding group of punches, and means controlled by certain of said groups of keys for initiating the operation of said punching mechanism.

3. In combination, a plurality of groups of perforating members, a plurality of groups of keys, each group of keys being individual to one of said groups of perforating members, said keys being arranged so that only one key in each group is operated at any one time for selecting one or more perforating members in the group thereof corresponding to each key, and means operative following the operation of said keys for simultaneously operating all selected perforating members.

4. In combination, a plurality of groups of perforators, a plurality of groups of keys, each group of keys being individual to one of said groups of perforators, said keys being arranged so that only one key in each group is operated at any one time for selecting corresponding perforators, means operative following the operation of said keys for simultaneously operating all selected perforators, and means whereby said keys are operable for setting up a new selective combination of said perforators while said per-

forators are being operated in accordance with the previous setting.

5. In a perforating device, punching mechanism comprising a plurality of punches, selector mechanism comprising a plurality of keys for selecting the punches to be operated, said keys being arranged in groups, the keys in any of said groups controlling the selection of said punches permutably and the keys in one of said groups controlling the initiation of operation of said punching mechanism.

6. In a perforating device, punching mechanism comprising a plurality of groups of punches, selecting mechanism comprising a plurality of keys for selecting the punches to be operated, each of said keys adapted to control one of said groups of punches in varying combinations, means controlled by certain of said keys for initiating the operation of said punching mechanism, and means whereby errors in the selecting operation may be corrected prior to the punching operation.

7. In a device for perforating a tape, a plurality of punches arranged in rows, the punches in each row being adapted to perforate in said tape a code combination of holes representing a character, means for selecting punches in one or more of said rows, means for transferring said selection simultaneously from said means to said punches, and means for operating all of said selected punches simultaneously, whereby holes representing a plurality of characters are produced in a single perforating operation.

8. In a device for perforating a tape, a plurality of punches arranged in rows, the punches in each row being adapted to perforate in said tape a code combination of holes representing a character, means for selecting punches in one or more of said rows, means for operating all of said selected punches simultaneously, and a punch for perforating in said tape at each perforating operation a hole to indicate the beginning of a series of characters.

9. In a perforating device, a plurality of groups of punches, selector mechanism comprising a plurality of keys for invariably selecting the punches of a group for operation in permuted combinations which represent different characters, a punch plate assembly including a female die plate, power driven means for reciprocating said punch plate assembly with respect to said punches, and key-controlled means for initiating the operation of said power driven means.

10. In a perforating device, a plurality of groups of punches, a selector mechanism comprising a plurality of keys for invariably selecting the punches of a group for operation in permuted combinations which represent different characters, a punch plate assembly including a female die plate, power driven means comprising an operating cam for reciprocating said punch plate assembly with respect to said punches, and key-controlled means for initiating the operation of said operating cam.

11. In a device for perforating a tape, a plurality of transverse rows of punches, selector mechanism comprising a plurality of keys for selecting the punches to be operated in each transverse row simultaneously in permuted combinations, a punch plate assembly including a female die plate, an operating cam for reciprocating said punch plate assembly with respect to said punches, key-controlled means for initiating the operation of said operating cam, and

means controlled by said operating cam for feeding the tape.

12. In a device for perforating a tape, a plurality of transverse rows of punches, a punch plate assembly comprising a female die plate, a tape feeding means, an operating cam, selector mechanism comprising a plurality of keys for selecting the punches to be operated in each transverse row simultaneously in permuted combinations, means controlled by certain of said keys for initiating operation of said operating cam, and means whereby said operating cam when started into operation first effects a reciprocation of said punch plate assembly to bring said female die plate into co-operation with the selected punches and thereafter effects an operation of said tape feeding means.

13. In a device for perforating a tape, a plurality of punches, a punch plate assembly comprising a female die plate, a tape feeding means, a power driven shaft, a friction clutch mechanism including a start-stop cam associated with said shaft, an operating cam controlled by said start-stop cam, selector mechanism comprising a plurality of keys for selecting the punches to be operated, means controlled by certain of said keys for releasing said start-stop cam whereby said operating cam is released for operation by said power driven shaft through said friction clutch mechanism, and means whereby said operating cam when started into operation first effects a reciprocation of said punch plate assembly to bring said female die plate into cooperation with the selected punches and thereafter effects an operation of said tape feeding means.

14. In a device for perforating a tape, a plurality of punches, a punch plate assembly comprising a female die plate, a tape feeding means, a power driven shaft, a friction clutch mechanism comprising a start-stop cam associated with said shaft, an operating cam controlled by said start-stop cam selector mechanism comprising a plurality of keys for selecting the punches to be operated, electromagnetic means controlled by certain of said keys for releasing said start-stop cam whereby said operating cam is driven by said power shaft through said friction clutch mechanism, and means whereby said operating cam first effects a reciprocation of said punch plate assembly to bring said female die plate into co-operation with the selected punches and thereafter effects operation of said tape feeding means.

15. In a perforating device, a punching mechanism comprising a plurality of punches, power driven means for operating said punching mechanism, selector mechanism for said punches comprising relays and key-controlled switches for controlling said relays, means controlled by certain of said key-controlled switches for initiating operation of said power driven means, and means including a special key for rendering said last mentioned means non-responsive to operation of said certain key-controlled switches and responsive only to said special key.

16. In a perforating device, punching mechanism comprising a plurality of punches, power driven means for operating said punching mechanism, selector mechanism for said punches comprising selector magnets, selector relays for controlling said magnets and key-controlled switches for preparing energizing circuits for said relays, means responsive to operation of certain of said switches for initiating the operation of said power

driven means, means controlled by said power driven means for completing the prepared energizing circuits of said relays, locking circuits for said relays, and means controlled by said operating cam for opening said locking circuits.

17. In a perforating device, punching mechanism comprising a plurality of punches, power driven means for operating said punching mechanism, selector mechanism for said punches comprising selector magnets, selector relays for controlling said magnets, key-controlled switches for preparing energizing circuits for said relays, means for locking said key-controlled switches in their operated positions, means responsive to operation of certain of said switches for initiating the operation of said power driven means, means controlled by said power driven means for completing the prepared energizing circuit for said relays, locking circuits for said relays, means controlled by said power driven means for releasing the locking means of said switches, and means controlled by said power driven means for opening said locking circuits.

18. In a perforating device, punching mechanism comprising a plurality of punches, power driven means for operating said punching mechanism, said power driven means including an operating cam; selector mechanism for said punches comprising selector magnets, selector relays for controlling said magnets and key-controlled switches for preparing energizing circuits for said relays, means responsive to operation of certain of said switches for initiating the operation of said operating cam, means controlled by said operating cam for completing the prepared energizing circuit, of said relays, locking circuits for said relays, and means controlled by said operating cam for opening said locking circuits.

19. In a perforating device, punching mechanism comprising a plurality of punches, power driven means for operating said punching mechanism, said power driven means including an operating cam, selector mechanism for said punches comprising selector magnets, selector relays for controlling said magnets, key-controlled switches for preparing energizing circuits for said relays, means for locking said key-controlled switches in their operated positions, means responsive to operation of certain of said switches for initiating the operation of said operating cam, means controlled by said operating cam for completing the prepared energizing circuit for said relays, locking circuits for said relays, means controlled by said operating cam for releasing the locking means of said switches, and means controlled by said operating cam for opening said locking circuits.

20. In a perforating device, a punch mechanism comprising a plurality of punches arranged in rows, the punches in each row being adapted to perforate in a strip a code combination of holes representing a character, a punch plate assembly including a female die plate and power driven means for reciprocating said punch plate assembly with respect to said punches, selector mechanism comprising key controlled electromagnetic means for selecting the punches to be operated, means for effecting the transfer of the selection of said punches simultaneously from said selector mechanism to said electromagnetic means, and key controlled electromagnetic means for initiating the operation of said power driven means.

21. In a perforating device, a punching mechanism comprising a plurality of punches arranged in rows, the punches in each row being adapted to

perforate in a strip a code combination of holes representing a character, a punch plate assembly including a female die plate and power driven means comprising an operating cam for reciprocating said punch plate assembly with respect to said punches, means for effecting the transfer of the selection of said punches simultaneously from said selector mechanism to said electromagnetic means, and key controlled electromagnetic means for initiating the operation of said operating cam.

22. In a device for perforating a tape, a plurality of punches arranged in transverse rows, selector mechanism comprising key controlled electromagnetic means for selecting the punches to be operated in each row simultaneously in permuted combinations, a punch plate assembly including a female die plate, an operating cam for reciprocating said punch plate assembly with respect to said punches, key controlled electromagnetic means for initiating the operation of said operating cam, and means controlled by said operating cam for feeding the tape.

23. In a device for perforating a tape, a plurality of punches, a punch plate assembly comprising a female die plate, said punch plate assembly being mounted for reciprocatory movement with respect to said punches, a tape feeding means secured to said punch plate assembly and adapted to reciprocate therewith, an operating cam, selector mechanism comprising a plurality of keys for selecting the punches to be operated, means controlled by certain of said keys for initiating operation of said operating cam, and means whereby said operating cam when started into operation first effects a reciprocation of said punch plate assembly to bring said female die plate into cooperation with the selected punches and thereafter effects an operation of said tape feeding means.

24. In a device for perforating a tape, a plurality of punches, a punch plate assembly comprising a female die plate, said punch plate assembly being mounted for reciprocatory movement with respect to said punches, a tape feeding mechanism secured to said punch plate assembly and adapted to reciprocate with said punch plate assembly, power driven means for reciprocating said punch plate assembly and said paper feeding means, and means for transmitting power from said power driven means to said tape feeding mechanism while permitting reciprocating movement of said tape feeding means.

25. In combination, electromagnetically operated punch selecting mechanism, manually controlled means for variably operating said punch selecting mechanism, and overlap means interposed between said manually controlled operating means and said punch selecting mechanism whereby said punch selecting mechanism may be operated in accordance with said manually controlled operating means while said manually controlled operating means are being reoperated to selectively reoperate said punch selecting mechanism.

26. In combination, a plurality of punches, means for operating said punches, manually controlled means for selectively operating said punch operating means, and means interposed between said manually controlled means and said punch operating means and operated in accordance with the operation of said manually controlled means for variably operating said punch operating means while said manually controlled means are being reoperated for setting up a new selection without disturbing the other selection.

27. In combination, a plurality of punches, electro-magnetic means for selectively controlling said punches, manually controlled means for variably operating said electro-magnetic means, and means whereby said electro-magnetic means, when operated, are maintained in operated position independently of said manually controlled means until said punches have been operated, whereby said manually controlled means may be reoperated while said punches are operated.

28. In combination, a plurality of punches, electro-magnetic means for selectively controlling said punches, manually controlled means for variably operating said electro-magnetic means, means whereby said electro-magnetic means when operated are maintained in operated position independent of said manually controlled means until said punches have been operated, whereby said manually controlled means may be reoperated while said punches are operated, and means whereby said electro-magnetic means are restored to normal and operated in accordance with the reoperation of said manually controlled means following the complete operation of said punches.

29. In combination, a plurality of punches, electro-magnetic means for selectively controlling said punches, manually controlled means for variably operating said electro-magnetic means, means whereby said electro-magnetic means when operated are maintained in operated position independent of said manually controlled means until said punches have been operated, whereby said manually controlled means may be reoperated while said punches are operated, and means whereby said manually controlled means do not attain control of said electro-magnetic means until said punches have completely operated in accordance with the preceding operation.

30. In combination, a plurality of groups of electro-magnetic devices, each for preparing code combinations of impulse conditions for transmission, a single keyboard comprising a corresponding plurality of groups of keys individual to each of said groups of electro-magnetic devices, means whereby electro-magnetic devices in each group are operated simultaneously in accordance with the keys operated in its associated group, means whereby the operated groups of keys on said single keyboard may be reoperated in accordance with other code combinations of signaling conditions to be transmitted while said electro-magnetic devices are operating in accordance with the preceding keys operated, and means to make a record in accordance with the keys depressed.

31. In a perforating device, a plurality of groups of selectable punches, means for selecting the punches in said groups simultaneously in varying combinations, and means whereby the selected ones of said punches may be operated simultaneously with the reconditioning of said selecting means for a succeeding punch selecting operation.

32. In a perforating device, a plurality of groups of selectable punches, electro-magnetic means adapted to select the punches in said groups simultaneously in varying combinations, and motor driven means to operate the selected ones of said punches.

33. In a device for producing perforated strips, a series of selectable punches, means to select simultaneously the punches to be operated in permuted combinations, and automatic means to

move said strip toward said punches to cause perforation thereof.

34. The method of perforating which comprises the steps of operating one or more of a plurality of keys to establish certain conditions, storing said conditions, utilizing the stored conditions for effecting perforation, and establishing of other conditions prior to the perforating operation of the prior established conditions.

35. In a key controlled perforator, a selecting device, perforating mechanism, a bank of keys, means to operate and lock a plurality of said keys, means acting subsequent to the operation of the last of said keys to transfer the setting of said keys to said selecting device, means acting subsequent to said transfer to release the keys for reoperation, means to operate the perforating mechanism under the control of the selecting device, and means to operate the keys and set up a new code while the perforating device is operating.

36. In a perforator comprising a plurality of keys, electromagnetic means individual to said keys, and perforating mechanism arranged to be selectively controlled by said electro-magnetic means, said keys adapted to be operated successively, means for transferring the key records simultaneously to said electro-magnetic means to prepare selectively said perforating mechanism for operation, means for restoring said keys to normal, means for operating the punches, and means for restoring the electro-magnetic means to normal for reoperation in accordance with new operations of said keys while the perforating device is operating.

37. In a signaling system, a first storage device, a second storage device, a recording device, a bank of keys, means to operate a series of said keys and store in said first storage device a plurality of code signals corresponding to the keys depressed, means to transfer the stored signal to the second storage device, means to operate the recording device according to the last mentioned stored signals, and means to operate said keys for a new message while the previous message is being recorded.

38. In a signaling system, a plurality of keys, a first plurality of elements, a second plurality of elements, means to set certain of said first plurality of elements according to a succession of operated keys, means to set the second plurality of elements according to the first setting, and means to make a record according to the setting of the second plurality of elements while said first plurality of elements is being reset in accordance with a succeeding operation of said keys.

39. In a perforator, a plurality of punches arranged in a plurality of rows, means to select the punches in said rows simultaneously in permuted combinations each row representing a different character of a message, and means for operating all of said selected punches simultaneously.

40. In a perforator, a plurality of rows of punches, each row of punches representative of a different character of a prearranged group of characters in a definite order, means for selecting the punches in the respective rows in permuted combinations representative of the several characters allotted to each row, means actuated following the selection of punches in each row for effecting the transfer of said selection simultaneously from said selecting means to said punches and means for operating all of the selected punches simultaneously.

41. In a perforator, a plurality of rows of

punches, each row of punches representative of a different character of a prearranged group of characters in a definite order, means for simultaneously selecting the punches in permuted combinations representative of the several characters allotted to each row, and means actuated following the selection of punches for operating all of the selected punches simultaneously.

42. In a perforator, a plurality of rows of punches, each row of punches representative of a different character of a prearranged group of characters in a definite order, means for selecting the punches in the respective rows in permuted combinations representative of the several characters allotted to each row, means actuated following the selection of punches in each row for operating all of the selected punches simultaneously, and means to make a perforation which invariably appears in one of the groups of perforations.

43. In a device for perforating sections of a strip, a punching mechanism, a plurality of means for setting up and retaining the data to be punched, mechanism for causing the selective conditioning of said data setting means according to a code, and means for transferring the data simultaneously from said setting means to said punching mechanism.

44. In a perforator, a plurality of groups of keys, each group representative of a different character of a prearranged group of characters in a definite order, a plurality of rows of punches less in number than said groups of keys, and means whereby all the information conveyed by said groups of keys is incorporated in said rows of punches.

45. In a perforator, a plurality of groups of keys, a plurality of rows of punches less in number than said groups of keys, means operable by said keys for setting up data to be punched, and means whereby all of the data set up is subsequently incorporated in said rows of punches.

46. In a device for perforating sections of a strip, a punching mechanism, a plurality of means for setting up the data to be punched, said mechanism comprising a plurality of rows of punches less in number than said plurality of setting means, and means whereby all of the data set up is subsequently incorporated in said rows of punches.

47. In a perforator, a plurality of groups of keys, each group representative of a different character of a group of characters prearranged in a definite order, and means for producing in a single operation a perforated coded record in accordance with the operation of said keys, said means including means whereby the codes corresponding to certain of said characters are added to the codes corresponding to others of the characters.

48. In combination, a plurality of groups of electromagnetic devices, each for preparing code combinations of impulse conditions for transmission, a corresponding plurality of means for setting up data to be transmitted, an additional data-setting means, and means for incorporating in said groups of electromagnetic devices the data set up by said additional setting means.

49. In a device for perforating strips, a plurality of means for setting up data to be perforated, an additional data setting means, means for producing a series of code combinations of perforations representative of the data set up by said plurality of setting means, and means to associate with certain ones of said combinations an

additional perforation representative of the data set up by said additional setting means.

50. In a device for perforating strips, a plurality of rows of punches for producing a series of code combinations of perforations, a corresponding plurality of means for setting up data to be perforated, each of said rows of punches adapted to be controlled invariably by the same setting means, an additional setting means, and means for incorporating in said series of perforations the data corresponding to said additional setting means.

51. In a device for perforating strips, a plurality of rows of punches for producing a series of code combinations of perforations, a corresponding plurality of means for setting up data to be perforated, said means adapted to selectively control said punches, an additional data setting means, and means to incorporate in said series of perforations the data corresponding to said additional setting means.

52. In a perforator, a plurality of means for setting up data to be perforated, a corresponding plurality of groups of punches to produce a series of code combinations of perforations representative of the data set up by said plurality of setting means, an additional data setting means, and means to add to certain of said code combinations of perforations a perforation representative of data corresponding to said additional setting means.

53. In a perforator, a plurality of setting means, a corresponding plurality of rows of punches adapted to be conditioned in code by said means, an additional setting means, and means to introduce in certain of said rows of punches a condition determined by said additional setting means.

54. In a perforator, a plurality of rows of punches, a corresponding plurality of data setting means adapted to condition said punches to correspond to the data set up, an additional setting means, and means to condition an additional punch in certain of said rows in accordance with the operation of said additional setting means whereby said certain rows will be conditioned to correspond to two kinds of data.

55. A recorder comprising a plurality of groups of recorder-control elements, a series of actuators, one individual to each element, means associated with said actuators to condition said elements for operation, and other means associated with one of said actuators for rendering the conditioned elements effective simultaneously to control recording operations.

56. A mechanism comprising a plurality of groups of elements, an individual conditioning element for each element of the group of ele-

ments, a corresponding plurality of groups of keys, means operated by a key for controlling the conditioning elements for a group of elements for operation, and means operated by a second key for controlling the conditioning elements for a second group of elements for operation and adapted upon operation to render both said conditioned groups of elements effective simultaneously to cause the operations corresponding to the operated keys.

57. A recorder comprising a plurality of groups of recorder-control elements, a corresponding series of actuators, one individual to each element, means associated with each actuator to condition the corresponding element for operation, and other means associated with one of said actuators for rendering the conditioned elements effective simultaneously to control recording operations.

58. A recorder comprising a plurality of groups of recorder-control elements, a corresponding series of groups of actuators, one actuator individual to each element, means associated with each actuator to condition the corresponding element for operation, and other means associated with one of said actuators for rendering both conditioned elements effective simultaneously to control recording operations.

59. A mechanism comprising a plurality of groups of elements, a corresponding series of groups of actuators, one actuator individual to each element, means associated with each actuator to condition the corresponding element for operation, other means associated with one of said actuators for rendering the conditioned element effective, and means for unconditioning the first conditioned element after it has been conditioned and prior to the operation of the second actuator.

60. A mechanism comprising a plurality of groups of elements, a corresponding series of groups of keys, means operated by the keys for conditioning a group of said elements for operation in varying combinations, and means operated by the last key in the series for rendering the conditioning effective for the operation of all the selected elements simultaneously in corresponding varying combinations.

61. In combination, a plurality of recording elements, a corresponding plurality of electromagnets, means to condition one of said electromagnets for operation, means to condition another of said electromagnets for operation, means associated with said second mentioned means to cause the conditioned electromagnets to operate simultaneously, and means to make a record in accordance with the electromagnets operated.

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