

June 8, 1937.

W. G. H. FINCH

2,083,160

TELEGRAPH PRINTER SYSTEM

Filed April 10, 1936

4 Sheets-Sheet 1

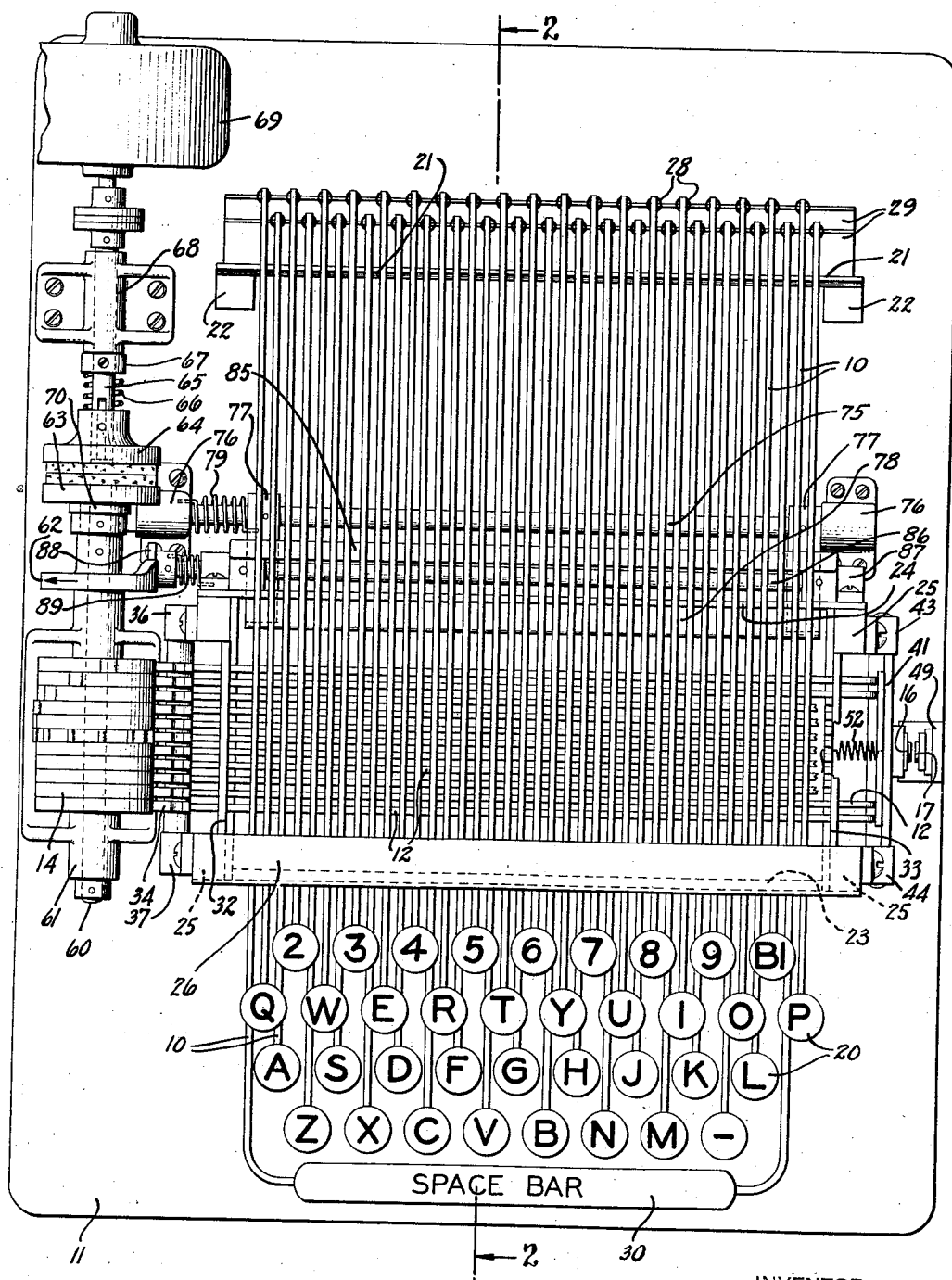


Fig. 1.

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4 Sheets-Sheet 2

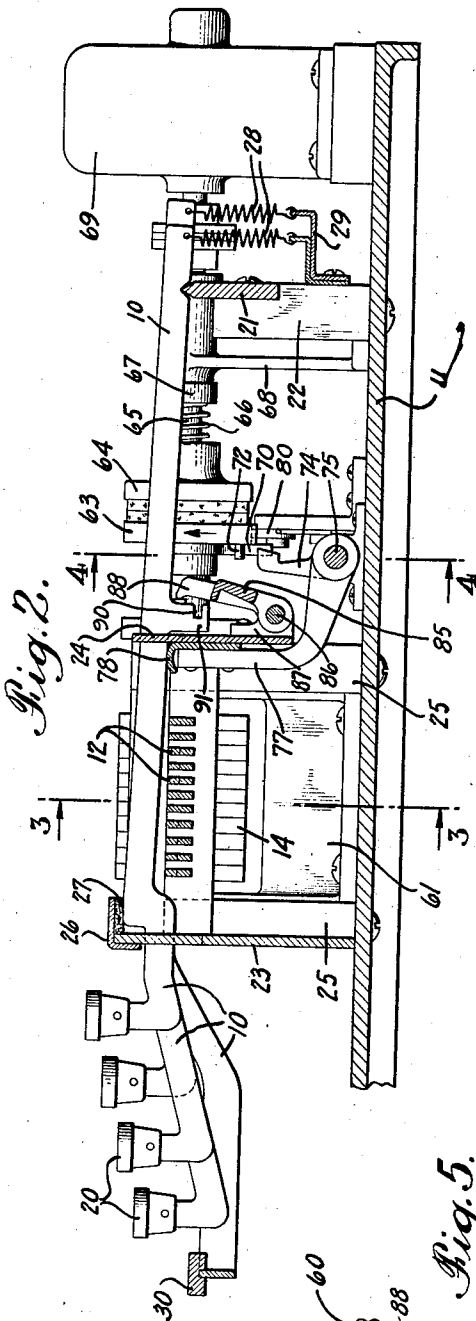


Fig. 2.

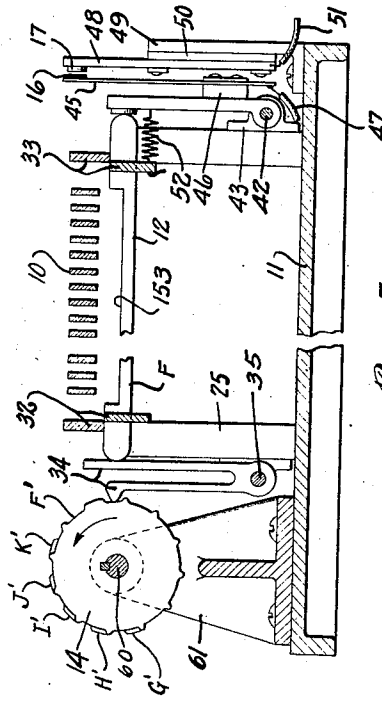


Fig. 3.

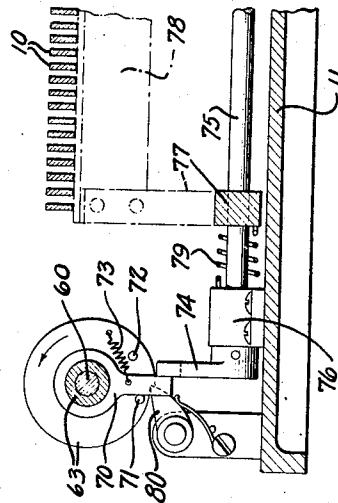


Fig. 4.

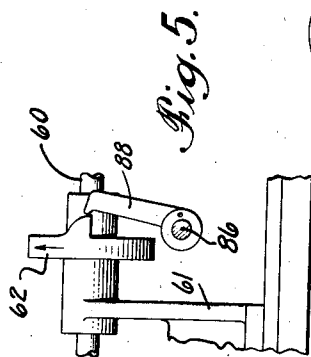


Fig. 5.

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TELEGRAPH PRINTER SYSTEM

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4 Sheets-Sheet 3

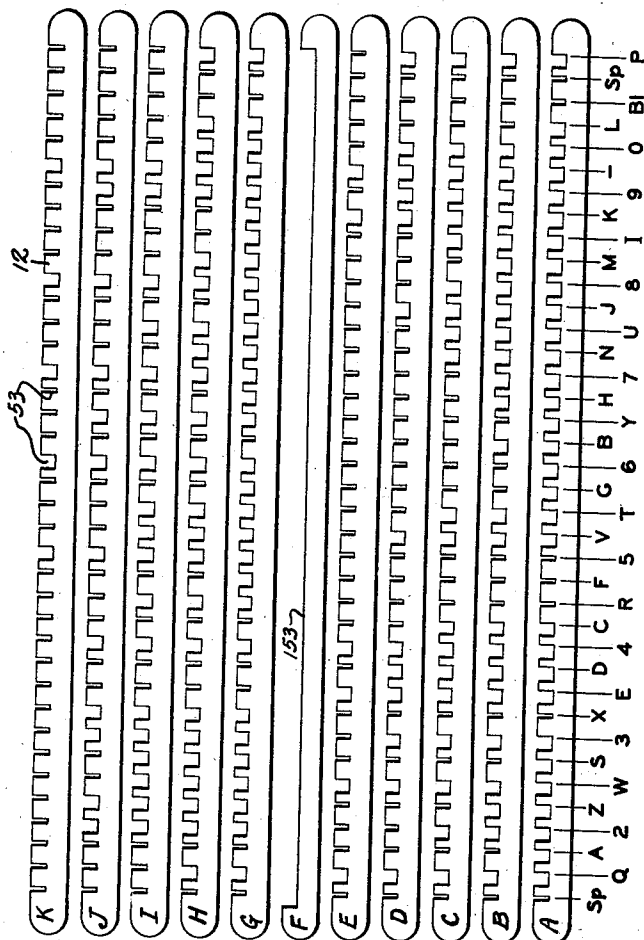


Fig. 7.

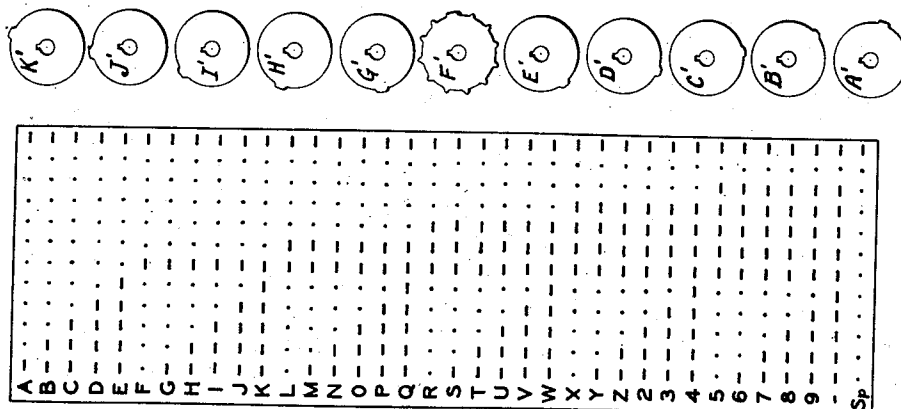


Fig. 8.

Fig. 6.

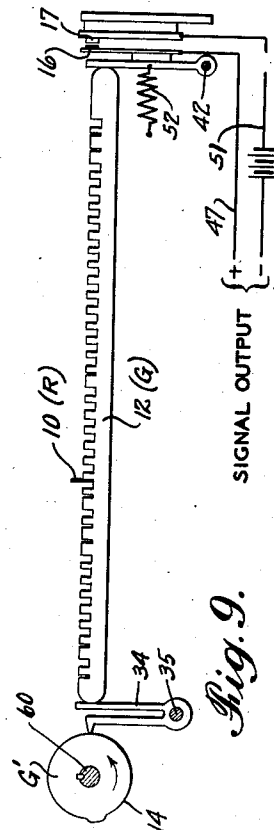


Fig. 9.

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TELEGRAPH PRINTER SYSTEM

Filed April 10, 1936

4 Sheets-Sheet 4

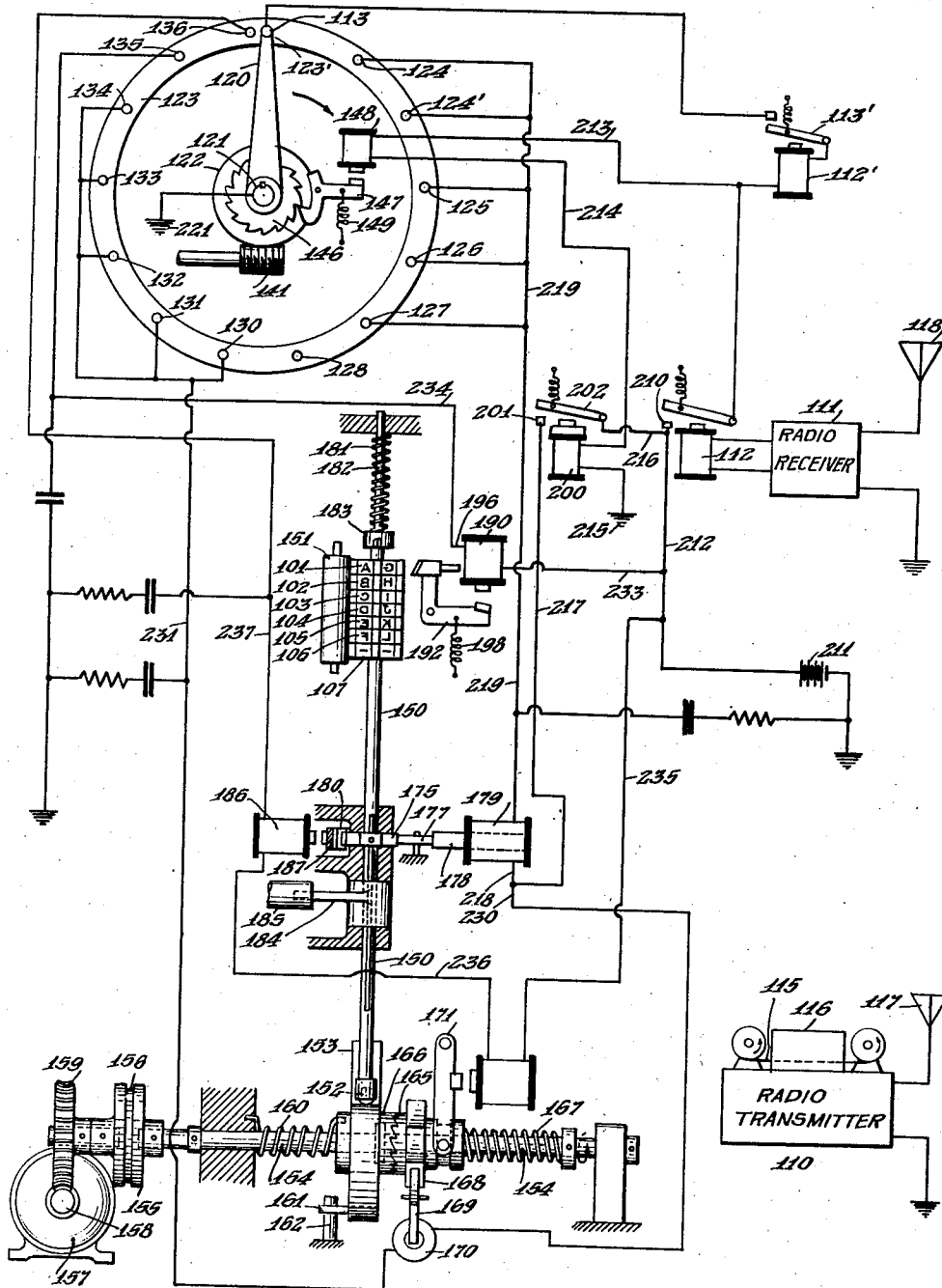


Fig. 10.

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UNITED STATES PATENT OFFICE

2,083,160

TELEGRAPH PRINTER SYSTEM

William G. H. Finch, New York, N. Y.

Application April 10, 1936, Serial No. 73,783

18 Claims. (Cl. 178—79)

My invention relates to novel apparatus for and methods of generating code combinations of signals and more particularly relates to a novel portable telegraph code transmitter.

5 In my Patent No. 2,008,389, issued July 16, 1935, I disclose a portable telegraph receiver operating on a long and short or dot-dash code as distinguished from the uniform Baudot code.

10 Although practical transmitters have been developed for generating Baudot code signals, this being a relatively simple problem because of the uniform character of the impulses or signal conditions, the transmitters heretofore developed for transmitting long and short impulse codes
15 have involved complicated, heavy and costly mechanisms.

The transmitter required to operate the printer described in my patent above to be useful as a portable unit has to be light, inexpensive and
20 relatively simple to operate.

The inventive concept of my transmitter, accordingly, embodies a novel single-contact all-mechanical transmitter for generating code combinations of long and short impulse conditions.

25 Accordingly, an object of my invention is to provide a novel inexpensive transmitter for generating long and short impulse signal conditions. A further object of my invention is to provide a novel single-contact long and short impulse
30 code transmitter.

Still another object of my invention is to provide a novel portable transmitter.

A further object of my invention is to provide a novel all-mechanical transmitter.

35 There are other objects of my invention which, together with the foregoing, will appear in the detailed description which is to follow in connection with the drawings, in which:

40 Figure 1 is a plan view of an apparatus for mechanically converting a code system into corresponding electrical impulses.

Figure 2 is a section taken on the line 2—2 of Figure 1.

45 Figure 3 is a section taken on the line 3—3 of Figure 2 but with certain parts left off for the sake of clearness.

Figure 4 is a fragmentary section taken on the line 4—4 of Figure 2 and showing the cam shaft stop mechanism.

50 Figure 5 is a fragmentary side view of the key locking cam and cam finger.

Figure 6 is a diagram of the dot and dash code system which the illustrated apparatus is adapted to transmit.

55 Figure 7 is a diagram of the group of code bars

arranged in the order in which they are placed in the machine.

Figure 8 is a diagram of the various code bar operating cams in their relative positions as placed in the machine.

Figure 9 is a diagram of one set of elements which cooperate to produce one impulse in a plurality of impulses comprising a specific signal.

Figure 10 is a diagrammatic view of the circuits and printer which operate in response to the codes generated by my novel transmitter.

Referring to the drawings, the apparatus consists broadly of a bank of selector key bars 10 (Figures 1 and 2) mounted upon a base plate 11 and arranged to be operated manually similarly to a typewriter; a group of code or permutation bars 12 mounted in operative relation beneath the key levers and at right angles thereto; a series of code bar cams 14 (Figures 3, 8 and 9) placed at one end of the code bars and adapted to actuate certain bars as determined by a depressed key bar so as to make and break an electrical circuit through contacts 16 and 17 placed at the opposite end of the code bars.

Each of the selector key bars 10 is equipped with a button 20 which is marked with a letter, number or other character and so arranged as to form a keyboard similar to that of a standard typewriter. The key bars 10 are mounted within suitable guide members so as to have a short vertical movement about a pivot and as embodied this comprises a knife-edge fulcrum bar 21 supported at each end on posts 22 and placed at right angles to and near the rear end of the key bars, all of which are pivoted thereon by means of a V-shaped notch on their lower edges.

The central and forward ends of the key bars are slidably supported in spaced relation by comb-plates 23 and 24, the spaces of which are sufficiently deep to allow the desired vertical movement of the key bars about their fulcrum. The comb-plates 23, 24 are supported upon the base 11 by four corner posts 25.

Secured on the upper edge of the comb-plate 23 and extending between the two front corner posts is an angle strip 26 carrying a strip of felt or other shock absorbing material 27 on its underside and so positioned as to limit the upward movement of all the key bars. The front ends of the key bars are resiliently held in their upper or normal non-operating position by means of tension springs 28 fastened to their rear ends and to anchor strips 29 secured to and extending between rear posts 22.

Two of the key bars 10, one on each side of the

bank, are connected together by a finger bar 30 so as to act as a unit or single bar and do not differ from the other bars, being similarly adapted to select and transmit their own code signal representing a "space" just as each of the other bars select their individual code signal to represent a letter or a number.

The group of code bars 12 which cooperate with the key bars to produce a desired signal are supported in guide members 32, 33 in close parallel relation to each other and beneath and at right angles to the key bars. The guide members 32, 33 which are mounted on corner posts 25, allow only an end-wise reciprocation of the code bars 12.

The number of code bars necessary in the machine is related to the type of code used. In the illustrated form, eleven code bars are provided as being the proper number to transmit a code system wherein each signal comprises twelve impulses of both long and short duration (the so-called dot and dash type) grouped in different orders individual to each of thirty-six characters. The first ten impulses of the signal may be employed to select the different characters while the last two may perform functions in the mechanism common to all the characters such as resetting the receiving mechanism after each character signal has been received and recorded. These last two impulses, a short and a long one, are produced by the code bar F (see Figure 7). The other code bars are restricted to character representation impulses only.

As shown in Figure 1, the middle code bar 12 is the "space" signal and non-character signal bar F but its central position in the group of bars is arbitrary and immaterial to its operation.

Referring now to Figures 1 and 3, the means for reciprocating the code bars, at their left end, Figure 1, is a series of U-shaped spring levers 34 pivoted on a common pivot pin 35 carried in brackets 36, 37 on the left corner posts 25. One leg of each lever 34 bears against the left end of each code bar 12 while the other leg of the U rides on the periphery of one of the eleven cam disks 14. At the right end of the code bars and in contact therewith is a bridge plate 41, pivoted on pin 42 which is carried in brackets 43, 44 fastened on right corner posts 25.

The bridge plate 41 is the base member upon which is mounted the contact 16 which, with contact 17, forms the circuit maker in the signal impulse circuit. Contact 16 is formed on the upper end of a spring conductor strip 45 which is secured to and insulated from the bridge plate 41 by a block of fiber or similar material 46. The conductor 47 is attached to the lower end of spring strip 45. Contact 17 is formed on the upper end of a rigid conductor strip 48 which is secured to and insulated from a bracket 49 on the base 11 by a block 50. Conductor 51 may be connected to the lower end of conductor strip 48. A spring 52 with one end attached to bridge plate 41 and the other end anchored to the code bar guide member 33, serves to move all the code bars to the left, Figure 1, against their respective spring levers 34 and the latter, in turn, are held against their respective cams 14.

The manner in which the code bars 12 are constructed so as to cooperate with the key bars 10 will now be described. Each code bar consists of a plurality of vertical slots 53 so arranged as to allow any key bar to enter when it is depressed. Certain of the slots 53 are of the same width as the thickness of the key bars while

others are twice as wide in such wise that the additional width is provided on the left side of the slot, see Figure 7. Thus, when a key bar is depressed it will enter one of the slots 53 and if it is a wide slot, the code bar can be moved to the right under the action of its cam 14 to complete a circuit through the contacts 16, 17 or to maintain said circuit if the bridge plate 41 had previously been moved to contact making position by other code bars. If the slot 53 entered by the key bar is a narrow one, the code bar is prevented from moving laterally and the motion produced by the high spot on the associated cam is absorbed in the U-shaped spring lever 34. The wide and narrow slots 53 in the code bars A, B, C, D, E, G, H, I, J, K, in their relation to each other and to the position of the key bars 10 serve to determine the proper order and sequence of the dot and dash electrical impulses to transmit a selected code signal.

In Figure 7, the code bars 12, A to K, and their slots 53 are shown diagrammatically. The "Space" code bar F in the mechanism illustrated has a long cut-out 153 to receive all the key bars but not be held against lateral movement thereby.

Each group of signal impulses which represents a character or "space" consists of a combination of twelve long and short electrical contacts in a certain order as, for instance, an A is one long or dash and ten short or dots and another long or dash series of impulses; and an H consists of two dashes, three dots, one dash, five dots and one dash. The "space" signal is eleven dots and one dash. In each case there are twelve impulses. Figure 6 is an illustration of the code which may be employed.

The cam disks are all keyed to a common shaft 60, act as a unit and are provided with cams equally angularly spaced throughout 360° so that in one revolution they cause twelve electrical contacts to be made. The order and time duration of each contact is controlled by a depressed key bar and its relation to a wide or narrow slot in each of the eleven code bars.

In Figure 8, the cams 14, A' to K' are shown in their relation to each other in the machine in their position of rest. Cam F' acts as the primary cam and actuates code bar F, which is always free to move, to produce eleven short impulses and one long one. If the space bar 30 is depressed all of the code bars except F are locked against movement and a "space" signal is produced, but if any other key bar, say R, is depressed, the eleven dots and one dash signal is modified by certain code bars which are free to move. Code bars G, H and I are free to move in the selected example, R, and cams G', H' and I', which actuate these bars are provided with a "long" high spot in such relative position as to convert the sixth, seventh and eighth dots produced by cam F' to dashes, this modified signal then consisting of five dots, three dashes, three dots and one dash which represents the letter R in the code. Each key bar when depressed thus locks its own characteristic combination of code bars, the remaining free ones then modifying the primary or basic signal of eleven dots and one dash to a signal representing the letter of that key bar.

Referring now to the operation of the cam shaft 60, a journal bracket 61 (Figure 1) is provided to support the shaft and its cams 14. On the rearwardly projecting cam shaft 60 is pinned a key bar locking cam 62 and a one-revolution clutch member 63. Cooperating with clutch

member 63 is a similar clutch disk 64 slidably keyed on the end of motor driven shaft 65 and held in continuous frictional engagement with member 63 by a spring 66 which encircles shaft 65 and abuts on a collar 67 secured thereon. Shaft 65 is journaled in a bearing block 68 and is driven by a motor 69 mounted on the base plate 11. The motor 69 runs continuously during the operation of the machine.

Since the transmission of a signal is instituted by depressing a key bar, the latter is utilized to control the operation of the one-revolution clutch member 63. As constructed-member 63 has rotatably mounted on its hub a stop arm 70 (Figures 2 and 4) which is limited in its rotation about the member by two stop pins 71 and 72, and is urged towards pin 72 by a tension spring 73. A stop finger 74, secured on the end of rod 75, is positioned in the path of travel of the stop arm 70 and thus normally prevents the rotation of clutch member 63. The rod 75 is rotatably mounted on the base 11 by means of bearing blocks 76. The rod 75, which extends the entire width of the machine, has mounted thereon an actuating ball comprising a pair of arms 77 and a cross bar 78 which normally rests against the front of comb-plate 24 and beneath all the key bars 10. It is spring held in that position by a torsion spring 79 coiled about rod 75 adjacent one of the arms 77 and bearing block 76.

Thus it will be seen that when any one of the key bars 10 is depressed, the stop finger 74 will move out of the path of stop arm 70 and the clutch member 63 will then rotate with its mate 64, causing cams 14 to start their cycle of signal contacts as determined by the depressed key bar. When the key bar is released finger 74 again enters the path of stop arm 70 and stops clutch member 63 from further rotation.

The tension spring 73 on stop arm 70 serves merely to eliminate the shock of a sudden stop of clutch 63. A pawl 80 cooperating with a tooth on the periphery of clutch member 63 insures the maintenance of the cam shaft position of rest when the motor 69 is not running.

It is essential in the operation of this machine that a complete revolution of the cam shaft 60 take place before a second key bar is operated and further that any other key bar cannot be depressed until the signal cycle of the cams 14 has been substantially completed. To this end, there is provided a lock bar 85 rotatably mounted on the back of combplate 24 by means of rocker rod 86 and bearing blocks 87. The left end, Figure 1, of the rod 86 is extended and carries a cam finger 88 which bears against the face of key bar locking cam 62 due to a spring 89 coiled about the rod adjacent to finger. The hooked end of lock bar 85 is adapted to enter a notch 90 in a depending lug 91 on each key bar when it is depressed, or, if not depressed, to pass directly beneath lug 91 and prevent the bar from being depressed. Thus, the first movement of cam shaft 60, which was started by the depression of a certain key bar, serves to lock that particular bar in the down position and all the other bars in the up position until the locking cam 62 make almost a complete revolution when the depressed bar is released in time to allow finger 74 to stop the clutch 63 but after the last signal contacts have been made. Due to this construction, it is obvious that the operator of the keyboard cannot depress the various keys at a speed faster than the machine can transmit each signal.

Although my novel transmitter may be em-

ployed for generating long and short impulses of any code type such, for example, as the Morse code or others, I have here illustrated it for producing long and short impulses comprising signals to operate a printer such as disclosed in my Patent No. 2,008,389 and as illustrated by the circuit and apparatus shown in Figure 10. This mechanism comprises a receiving device 111, a receiver controlled relay 112 for repeating the received code, combinations of impulses to the selecting and recording system, a controlling device 113 responsive to the short and long impulses of the received code and a printing mechanism which is selectively actuated to progressively print upon a movable tape 114 a letter or character corresponding to the transmitted code combination of short and long electrical impulses assigned to represent that character.

In response to the starting impulse, relay 112 which is a slow acting relay is energized.

Normally relay 112' whose winding is of a lower resistance than the series windings of magnet 148 and relay 200, provides a by-pass circuit for the current from battery 211 over contact 123' and brush 120 to ground at 221. Relay 112', however, upon being energized over this circuit, opens the circuit at its armature 213' which disengages its back contact.

Thereafter upon receipt of the first signal impulse, the circuit completed extends over conductor 213 as will be explained hereinafter, since relay 112' being slow to release is not deenergized during the no-impulse period.

If, therefore, the synchronizing impulse is received while brush 120 is on contact 123', normal operations proceed as will be described.

If, on the other hand, no impulse is received when brush 120 is on contact 123', no operation can occur. For reasons that will appear hereinafter, brush 120 will remain on contact 123' until the synchronizing impulse showing that the transmitter and receiver are in synchronism is received.

The resetting impulse is much longer than even the long impulse of the code to be described in order to energize extra slow relay 112'. As soon as relay 112' is energized, stepping magnet 148 is energized over a circuit to be described in connection with the code signals. Brush 120 is moved from contact 123'. At the end of the synchronizing impulse, magnet 148 is deenergized, stepping the brush a further distance and the apparatus is ready for the first signalling impulse.

In response to the first signal impulse energizing relay 112, an energization circuit is completed from the battery 211 front contact and armature 210 and conductor 213 through the magnet 148, conductor 214 and relay 200 to ground at 215.

Magnet 148 is a stepping magnet controlling the operation of the distributor device 113 which controls the switching of the oncoming impulse to mechanisms, to be described, responsive to the two-unit code and controlling the final printing and restoration of the printer.

This switching is effected by the brush or contact arm 120 which is mounted on, and locked by a key to one end of a rotatable shaft 121, the other end of which carries a friction plate 122. Shaft 121, is driven by a motor 140 (Figure 2) through worm 141 mounted on a shaft of the motor and meshing with a worm wheel 142 secured to and driving shaft 143. Secured to for

rotation with shaft 143 is the friction disc 144 including plates 122 and 145.

As motor 140 rotates, shaft 121 carrying distributor arm 120, tends to rotate with it, but is normally prevented from rotating by the pawl 147 in engagement with one tooth of the ratchet 146, secured to the shaft 121. One end of the pawl 147 consists of an armature controlled by a magnet 148 to which the armature is attracted when that magnet is energized. Normally, however, the pawl 147 is held against its backstop as shown in Figure 1 by a spring 149 one end of which is secured to the pawl 147 and the other to the frame work.

When magnet 148 is energized in the manner described above, it attracts pawl 147 which rocks about its pivot withdrawing the lower tooth of pawl 147 from the ratchet wheel 146 and moving its upper tooth in the path of the ratchet wheel permitting a rotation of the shaft 121 with arm 120 through an angle equal to one-half the pitch of the teeth of ratchet wheel 146.

The distributor arm 120 is moved successively into engagement with a series of contacts 124 to 136 consisting of contacting points mounted on an insulating ring 113. Each of the contacts 124 to 128 is common to a character on each disk wheel, five contacts being shown here for purposes of illustration of a printer in which there are five characters on each disk wheel to be described. Each of the contacts 129 to 134 is individual to a type wheel disk of a printer consisting of a plurality of such disks. Contact 135 controls a printing operation and contact 136 a restoring operation all of which will be described in more detail hereinafter. The pitch of the teeth of ratchet 146 is equal to the angular displacement between successive contacts, so that when magnet 148 is energized to permit the escapement mechanism 146 and 147 to operate, the distributor arm 120 is rotated either from a contact to a point intermediate the contact and a successive contact or from an intermediate point to a succeeding contact. With brush 120 therefore in the normal position shown, the receipt of the first code impulse energizing relay 112 which in turn energizes the escapement magnet 148 will permit rotation of brush 120 in the direction of the arrow shown to the first contact 124. It will be recalled that the escapement magnet 148 was energized in a series circuit with relay 200.

Relay 200 is a slow-to-energize relay constructed so that it will not respond to the short impulse of the code but is only responsive to the long impulse. If, however, the first impulse received is a long impulse, relay 200 will energize after an interval of time and an energizing circuit will thereupon be completed from ground at 221 over distributor brush 120, contact 124, conductors 220 and 219, through the selector relay 179, conductors 218 and 217, front contact 201 and armature 202, conductors 216 and 212 and through battery 211 to ground. The effect of the energization of relay 179 will be described hereinafter.

Upon the completion of the first code impulse, relay 112 is deenergized, opening the energizing series circuit for the magnet 148 and relay 200. Upon the deenergization of relay 148, pawl 147 is restored to the position shown permitting rotation of shaft 121 for a distance equal to half the pitch of the ratchet 146. Brush 120 rotates from contact 124 to a point intermediate contacts 124 and 125. Selecting relay 179 is deenergized and

the apparatus is back in normal condition in preparation for the next impulse.

The same cycle of operations is now repeated, brush 120 moving into engagement with contacts 125 and 128 successively in response to each impulse received and in turn controlling the selective energization of relay 179 in accordance with whether the received impulse is long or short.

The first unit selection is completed when the brush 120 leaves contact 128 and the second unit selection begins when the brush engages contact 129. If a long impulse is received at this time, relay 200 is energized, and a circuit is completed from ground at 221, brush 120, contact 129, conductor 232 and 231, through the magnet 170, conductor 230 and thereafter over conductor 217 to battery 211 and ground as described hereinbefore.

Relay 170 is a second selection relay which is energized in response to long impulses in the second unit of the code for selecting the particular type wheel disk. Relay 179 having previously selected a particular column of characters, a final selection is thus completed as will be described in more detail hereinafter. The selection having been completed, the printer is now in position for operation and on receipt of the next impulse which is the printing impulse, brush 120 engages contact 135 to extend the energizing circuit from ground at 221 over conductor 234 to the printing magnet 190 and conductor 233 to battery 211 and ground. Upon the energization of the printing magnet, the printing operation of the selected character is completed. Brush 120 is now moved to contact 136 to complete an energizing circuit over conductor 237 for the restoring magnets 186 and 172 in series over conductors 235 and 237. Magnets 186 and 172 upon energization restore the apparatus to normal. Following the restoration of the apparatus brush 120 moves to its normal position shown in synchronizing contact 123'.

It will be noted that contact 123' is spaced one-half a tooth pitch from contact 136 and one and one-half a tooth pitch from contact 124. At the end of the last signal, relay 112 is deenergized to move brush 120 to contact 123'.

Upon receipt of the synchronizing impulse, relay 112 is energized to energize relay 112' if the impulse is long enough. Magnet 148 is energized as soon as relay 112' is energized to move brush 120 off of contact 123'. Thereupon magnet 148 is deenergized at the end of the synchronizing impulse and brush 120 moves to one-half a pitch distance from contact 124 in preparation for the first signaling impulse.

If during the signaling period an impulse is lost and distributor brush 120 so falls out of synchronism with the transmitter, brush 120 will continue to be stepped until it reaches synchronizing contact 123'. It will then be held at this position because of the deenergized condition of relay 112' providing a bypass around magnet 148 until a synchronizing impulse energizes the relay 112'. This insures distributor brush 120 always starting out in synchronism.

I claim:

1. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; and further means, controlled by said selector bars, operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals.

2. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of dot signals; and further means, controlled by said selector bars, operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of marking and spacing signals.

3. In a telegraph transmitter, a plurality of selector bars; a contactor comprising a bar; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; and further means, controlled by said selector bars, operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals.

4. In a telegraph transmitter, a plurality of selector bars; a contactor comprising a bar having a single elongated slot and having a normal and a longitudinally spaced operated position in which it operates said contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; and further means, controlled by said selector bars, operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals.

5. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; and further means comprising a plurality of permutation bars, controlled by said selector bars, operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals.

6. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; and further means comprising a plurality of permutation bars having notches, controlled by said selector bars, operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals.

7. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; and further means comprising a plurality of permutation bars having notches mounted in operative relation beneath said selector bars and at right angles thereto, controlled by said selector bars, operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals.

8. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; and further means comprising a plurality of permutation bars having notches mounted in operative relation beneath said selector bars and at right angles thereto, controlled by said selector bars; means for selectively operating said selector bars into predetermined notches of said permutation bars for limiting an endwise movement of predetermined permutation bars; and means including circuit connec-

tions for operating on said contactor in response to variable arrangements of said permutation bars for modifying the generated signals of said first means into the generation of code combinations of correspondingly variable signals.

9. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; and means comprising a plurality of permutation bars, said permutation bars having a normal position and a longitudinally spaced operated position, controlled by said selector bars, for operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals.

10. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; means comprising a plurality of permutation bars, said permutation bars having a normal position and a longitudinally spaced operated position, controlled by said selector bars, for operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals; and a plurality of code bar cams, one for each of said permutation bars, each cam being located at one end of its associated permutation bar and arranged to move its associated permutation bar endwise.

11. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals comprising a bar having a single elongated slot and having a normal and a longitudinally spaced operated position in which it operates said contactor; a cam adjacent one end of said last bar for moving said last bar longitudinally periodically during each complete revolution thereof; means comprising a plurality of permutation bars, controlled by said selector bars, for operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals; a plurality of code bar cams, one for each of said permutation bars, each cam being located at one end of its associated permutation bar and arranged to move its associated permutation bar endwise; and a shaft carrying all of said cams.

12. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; means comprising a plurality of permutation bars, said permutation bars having a normal position and a longitudinally spaced operated position, controlled by said selector bars, for operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals; a plurality of code bar cams, one for each of said permutation bars, each cam being located at one end of its associated permutation bar and arranged to move its associated permutation bar endwise; and a shaft carrying all of said cams.

13. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; means comprising a plurality of permu-

tation bars, said permutation bars having a normal position and a longitudinally spaced operated position, controlled by said selector bars, for operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals; a plurality of code bar cams, one for each of said permutation bars, each cam being located at one end of its associated permutation bars and arranged to move its associated permutation bar endwise; a shaft carrying all of said cams; and a power drive for said shaft including a clutch.

14. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; means comprising a plurality of permutation bars, said permutation bars having a normal position and a longitudinally spaced operated position, controlled by said selector bars, for operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals; a plurality of code bar cams, one for each of said permutation bars, each cam being located at one end of its associated permutation bar and arranged to move its associated permutation bar endwise; a shaft carrying all of said cams; a power drive for said shaft including a clutch; and means operated simultaneously with the depression of a selector bar for operating said clutch to connect the power drive for rotating said cams.

15. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; means comprising a plurality of permutation bars, said permutation bars having a normal position and a longitudinally spaced operated position, controlled by said selector bars, for operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals; a plurality of code bar cams, one for each of said permutation bars, each cam being located at one end of its associated permutation bar and arranged to move its associated permutation bar endwise; a shaft carrying all of said cams; a power drive for said shaft including a clutch; means operated simultaneously with the depression of a selector bar for operating said clutch to connect the power drive for rotating said cams; and means whereby said clutch disconnects said cams at the end of each revolution.

16. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals; means comprising a plurality of permutation bars, said permutation bars having a normal position and a longitudinally spaced operated position, controlled by said selector bars, for operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals; a plurality of code bar cams, one for each of said permutation bars, each cam being located

at one end of its associated permutation bar and arranged to move its associated permutation bar endwise; a shaft carrying all of said cams; a power drive for said shaft including a clutch; means operated simultaneously with the depression of a selector bar for operating said clutch to connect said power drive for rotating said cams; means whereby said clutch disconnects said cams at the end of each revolution; and means operative following the depression of a selector bar for preventing the depression of a second selector bar until the completion of a cycle of operations.

17. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals comprising a bar having a single elongated slot and having a normal and a longitudinally spaced operated position in which it operates said contactor; a cam adjacent one end of said last bar for moving said last bar longitudinally periodically during each complete revolution thereof; means comprising a plurality of permutation bars, said permutation bars having a normal position and a longitudinally spaced operated position, controlled by said selector bars, for operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals; a plurality of code bar cams, one for each of said permutation bars, each cam being located at one end of its associated permutation bar and arranged to move its associated permutation bar endwise.

18. In a telegraph transmitter, a plurality of selector bars; a contactor; means, controlled by said selector bars, operating on said contactor for generating a predetermined number of like signals comprising a bar having a single elongated slot and having a normal and a longitudinally spaced operated position in which it operates said contactor; a cam adjacent one end of said last bar for moving said last bar longitudinally periodically during each complete revolution thereof; means comprising a plurality of permutation bars, said permutation bars having a normal position and a longitudinally spaced operated position, controlled by said selector bars, for operating on said contactor for modifying the generated signals of said first means into the generation of code combinations of variable signals; a plurality of code bar cams, one for each of said permutation bars, each cam being located at one end of its associated permutation bar and arranged to move its associated permutation bar endwise; a shaft carrying all of said cams; a power drive for said shaft including a clutch; means operated simultaneously with the depression of a selector bar for operating said clutch to connect said power drive for rotating said cams; means whereby said clutch disconnects said cams at the end of each revolution; and means operative following the depression of a selector bar for preventing the depression of a second selector bar until the completion of a cycle of operations.

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