

Nov. 8, 1960

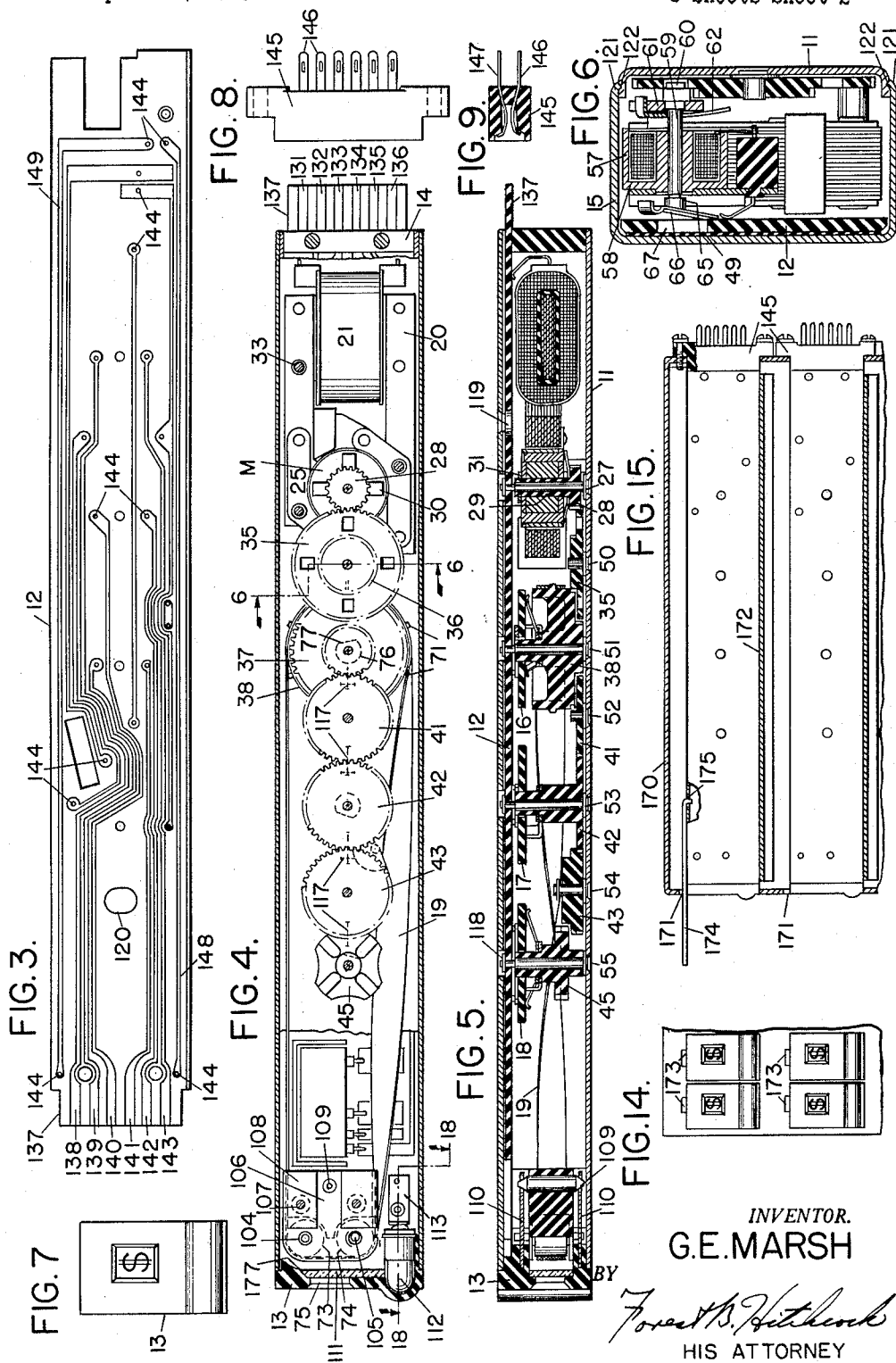
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2,959,773

DATA POSTING INDICATORS

Filed April 23, 1956

3 Sheets-Sheet 2



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FIG. 16.

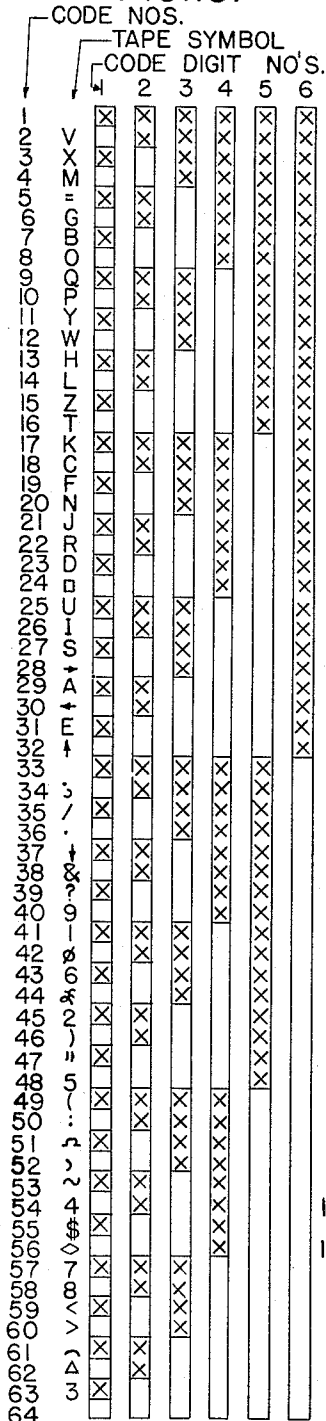
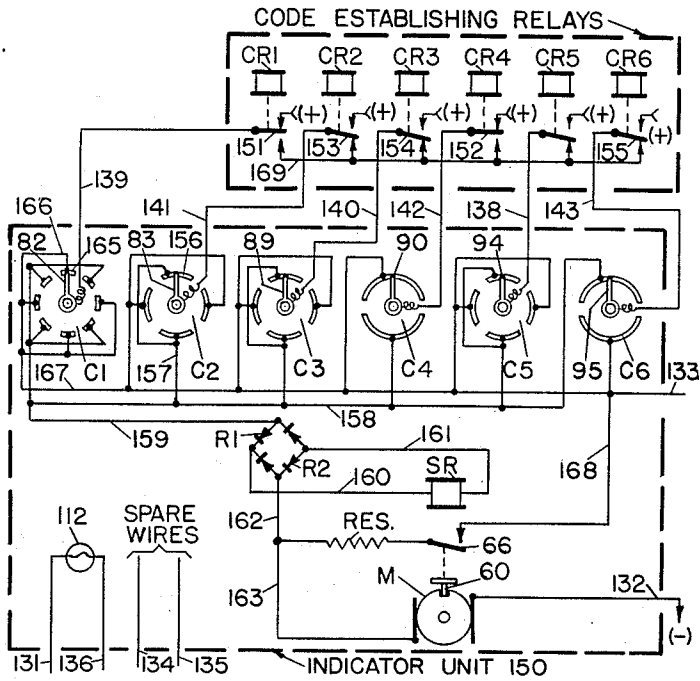
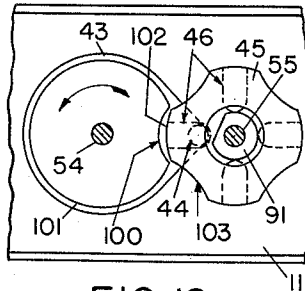
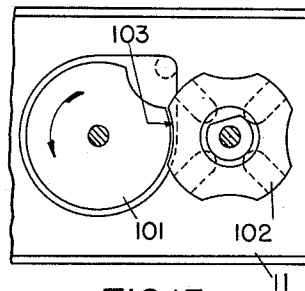
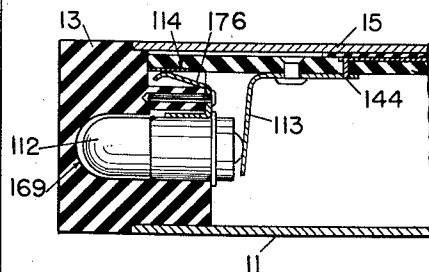


FIG. 17.



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2,959,773

DATA POSTING INDICATORS

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7 Claims. (Cl. 340—316)

This invention relates in general to data posting indicators of the digital type.

More particularly, this invention relates to an electro-mechanical indicating device which responds to a binary code for positioning a display tape for displaying different characters in a display window in accordance with the selected code.

In code communication systems, such as used in connection with railway signaling, teletype, airway control and various other control systems, it is desirable to make use of posting indicators to display different characters or symbols which correspond to the codes being transmitted. Such a posting indicator must of necessity be very reliable, economical, adapted to universal use, and capable of functioning under varying conditions wherein temperature changes effect the coefficient of expansion and contraction of working parts. Furthermore, such a posting indicator must be able to function in any position of mounting.

In general, the posting indicator of the present invention contemplates a device which is small in size to facilitate mounting in banks, and comprises working parts made of plastic nylon or the like for dimensional stability and mechanical strength. It has a panel forming one side which contains printed circuits on both sides and is adaptable for plug coupling. There are spring loaded contact wipers to cooperate with the commutator type printed code wires and control circuits. Also, the indicator includes a self encased motor and relay for individual operation. All these working parts are mounted on one base plate, the other sides and ends snapping into place and being held together as a unit by one covering piece. All metallic parts are made of rust resistant material such as aluminum, stainless steel, bronze, or the like.

More specifically, the posting indicator of the present invention comprises a metallic base plate to which are pin mounted the gear train, spring loaded contact wipers and their associated drivers, tape drums, motor, relay latching means and the like, this base plate forming one wall of the device. The opposite wall is of insulating material and contains printed electrical conducting circuits on both sides, certain of the circuits being interconnected by electrical conducting pins passing through the insulated wall from one printed circuit to the other. One end of this wall is formed so that the printed circuits are spaced in alignment to cooperate with a plug coupler for external connection to the various code wires and control circuits. One end piece forms a blank end wall; whereas, the other end piece is provided with a window opening for displaying the different characters on the movable tape which is lighted indirectly. The two end pieces are made of insulation and are positioned between the two side walls, being suitably fitted into recesses, whereupon a U-shaped metallic cover is snapped into place and forms a housing which holds all units together.

To operate the indicator unit, energy through the code wires is applied to the motor and the relay. The relay armature latching means is of the tractive armature type and when deenergized, it is spring biased to normally engage a motor operated latching gear. When energized, it disengages the latching gear and the motor will start the gear train and tape drum into operation. The gear train will operate the various contact wipe drivers causing the spring loaded contact wipers to rotate over the various commutator type printed circuits located on the inside sur-

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face of the panel wall. When the code has been satisfied, the relay and motor will be deenergized, the spring biased relay armature latching dog again engaging the latching gear which immediately stops the gear train and tape, the proper code character being displayed in the window opening. The motor overrun is brought to a final stop by a suitable spring type friction clutch.

The normal capacity of the posting indicator herein illustrated is such that it can have sixty-four different code positions with only six code wires. The tape has code characters on both sides and is spliced together with a 180° twist therein. It is proportioned so that it completes two revolutions for a complete cycle of the indication, the 180° twist exposing both sides of the tape during the cycle. Two of the code positions are unusable because with all six code wires being either energized or deenergized at the same time, the indicator would either run continuously or not run at all.

One object of the present invention is the provision of a posting indicator which may be mass produced and still be universal in use to the extent that it may be easily modified to change code capacity, code characters and display of code characters.

Another object of the present invention is the provision of a posting indicator which is made up of parts wherein the material is not subject to dimensional changes due to temperature variations, corrosion or varying weather conditions.

Another object of the present invention is the provision of a posting indicator having a minimum of working parts which can be assembled or modified with very little effort, the various parts being properly marked and designed so that the chances for error are at a minimum.

Another object of the present invention is the provision of a posting indicator which may be mounted in any position and still provide uniform operation, none of the parts or operating movements being affected by gravity bias or needing adjustment.

Another object of the present invention is the provision of a step-by-step movement for operation of the commutator contacts which are operated by the tail end of the gear train, the purpose of which is to provide amplified velocity during the movement of the contacts from one commutator segment to another.

Another object of the present invention is the provision of a display tape which is assembled with a 180° twist therein, has characters on both sides and is lighted indirectly so that only the characters on one side are visibly displayed, thus permitting use of a shorter tape.

A still further object of the present invention is the provision of a printed circuit panel arrangement whereby the posting indicators may function as a unit, or they may be coupled together by external circuitry to comprise an arrangement whereby codes may be transferred from one indicator to another for storage purposes.

A still further object of the present invention is the provision of a self-contained A.C. motor and D.C. relay-latch combination energized through a rectifier for latching and unlatching the gear train and an over-running clutch means to dissipate the stored motor momentum.

Other objects, purposes and characteristic features of the invention will be apparent as the detailed description progresses with reference to the accompanying drawings. In the drawings, like reference characters refer to like parts throughout the various views, in which:

Fig. 1 is a diagrammatic exploded view of the data posting indicator of the present invention, the parts being shown in perspective and partly broken away to facilitate explanation and understanding the disclosure;

Fig. 2 is a partial diagrammatic exploded view to further show one of the contacting elements of the data posting indicator;

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Fig. 3 is a plan view of the outside surface of the printed circuit panel which forms one wall of the data posting indicator and shows the circuit layout for receiving the six incoming code signals;

Fig. 4 is a side elevation view of the data posting indicator of the present invention with the front metallic wall cut away to show the organization of parts within the housing;

Fig. 5 is a top sectional view of the apparatus shown in Fig. 4, the section being taken substantially on a centerline through the gear train;

Fig. 6 is an end sectional view taken on the line 6—6 of Fig. 4 and shows the relay unit and its associated latching arrangement which cooperates with the gear train;

Fig. 7 is a front view of the data posting indicator of the present invention and shows the window through which the display tape characters are visible;

Fig. 8 is a side view of a plug coupler of the type which may be used in connection with the data posting indicator of the present invention;

Fig. 9 is a sectional view taken through one of the contact assemblies of the plug coupler shown in Fig. 8;

Fig. 10 is a side view of the inner side of the latching gear of the posting indicator and shows the relationship of the relay latching member with respect to the latching holes in the latching gear;

Fig. 11 is a sectional view taken on the line 11—11 of Fig. 10 and shows the latching member about to enter a hole in the latching gear;

Figs. 12 and 13 are side views as viewed from the inside to show two different operating positions of the two cooperating members of a so-called "Geneva" cam arrangement;

Fig. 14 is a front view of a typical arrangement showing a bank of data posting indicators of the present invention as they may be mounted for use in actual practice in a posting system;

Fig. 15 is a side sectional elevation of the apparatus of Fig. 14 showing the units mounted and plug coupled and how they may be extracted from a shelf type housing;

Fig. 16 is a showing of a typical code chart having 64 character spaces which may be used with a data posting indicator of the present invention;

Fig. 17 is a typical circuit organization for the operation of a single data posting indicator of the present invention; and

Fig. 18 is a top sectional view taken substantially on the line 18—18 of Fig. 4 and shows the lamp mounting and its cooperating contact springs.

Referring now more particularly to Figs. 1, 2, 4, 5 and 6, the posting indicator housing comprises a box-like structure having one metallic side wall 11 of aluminum, an opposite side wall 12 of insulation, a front end wall 13 of molded insulation, a rear wall 14 of insulation, and a U-shaped cover piece 15 of aluminum (see Fig. 6), all fastened together in a manner described hereinafter. The outer portions of the U-shaped cover 15 provide the top and bottom walls.

The metallic side wall 11 is a channel shaped structure and forms the mounting means for the operating mechanism which comprises in general a motor M, a tractive armature type relay SR which operates an associated latching means, and a gear train which drives contact drums 16, 17 and 18 and a display tape 19.

The motor M is of the A.C. shaded-pole, squirrel-cage type, and has a stator comprising a laminated core 20 and a coil 21 which is mounted on the core 20. The laminated core 20 terminates into two pole shoes 22 and 23 between which the rotor 24 is mounted. The structure is held together by means of side plates 25 on each side with rivets passing therethrough. The rotor mounting comprises a shouldered journal pin 27 which is suitably fastened into the metallic side wall 11 (see Fig.

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5). On this pin 27 is mounted a plastic nylon pinion gear 28 which is provided with a bushing type hub 29 that forms the mounting for the rotor 24. A spider type four pronged spring 30 is positioned on this bushing hub 29 between the rotor 24 and the pinion gear 28 whereupon the spring 30 is compressed and the rotor 24 is held in position by means of a horseshoe type spring washer 31 which is fitted into a groove in the bushing hub 29. The assembly provides a friction type drive for the pinion gear 28. The complete motor assembly is mounted on the side wall 11 by means of shouldered rivet pins 32, the shoulder portions 33 acting as spacers.

The gear train, which operates the various contact drums 16, 17 and 18 and display tape 19, includes the motor pinion gear 28, which we will assume has twenty-one teeth. These teeth mesh with a latching gear 35 having eighty-four teeth, which provides a four to one ratio. Integral with the latching gear 35 is a pinion gear 36 having forty teeth which mesh with an eighty tooth gear 37 to drive the display tape drum 38 and the contact drum 16 at a two to one ratio. Integral with the gear 37 is a pinion gear 40 having eighteen teeth which drives an idler gear 41 which in turn drives a thirty-six tooth gear 42 to operate the second contact drum 17 at a two to one ratio. The gear 42 meshes with another gear 43 of equal size which has attached thereto the drive pin 44 to form a part of a "Geneva" cam arrangement. The cam 45 of this "Geneva" cam arrangement is provided with four receiving slots 46 spaced 90° apart to receive the drive pin 44 which will rotate the cam 45 in steps at a four to one ratio. The cam 45 operates the third contact drum 18. The various gears, pinions, motor rotor and cam parts of the gear train just described are journaled on pins 27, 50, 51, 52, 53, 54, and 55 which are suitably fastened into the side wall 11 preferably by providing shoulders on the pins, countersinks in the plate and using the machine spinning process to flatten the pin heads (see Fig. 5).

Referring now to the latching gear 35 and its associated relay operated latch or plunger, a means has been provided whereby the gear train is rendered operative or inoperative in accordance with the energized or deenergized condition of the tractive armature type relay SR. The relay SR and its contact block 56 are mounted on the frame member 25 of the motor M. The relay itself (see Fig. 6) comprises an ironclad housing 57 which houses a coil 58. The iron housing 57 forms a part of the magnetic structure. An armature bearing pin 59 passes through the housing 57 and has both ends protruding therefrom. One end is provided with a squared tapered head 60 and an armature plate 61, all fastened together as a unit. A curved resilient spring plate 62 is inserted between the armature plate 61 and the pole ends of the iron housing 57. This spring 62 is preferably made of bronze material or the like and being non-magnetic it acts as a residual between the housing 57 and the armature plate 61 when the relay SR is energized and also provides an opposing spring bias for the armature plate 61 and pin 59.

The armature plate 61 has a slot 63 therein which fits over a guide pin 64 to prevent the armature and pin assembly from turning. The other end of the armature pin 59 bears against an insulation button 65 of suitable hard material which is mounted on a resilient contact spring 66. This contact spring 66 serves to bias the armature and pin assembly away from the pole ends of the housing 57. This contact spring 66 is mounted on the insulation side wall 12 directly over an opening 67 therein to permit flexibility when depressed. It also acts as a current carrying unit for the energization of the motor M as will be explained hereinafter.

The squared tapered head 60 of the armature pin 59 is positioned to coact with one of four squared tapered holes 68 located 90° apart in the latching gear 35, only when the relay SR is in a deenergized condition. Re-

ferring now to the operation of the motor M, the relay SR and its associated gear train and latching arrangement, the indicator as a whole is in its at-rest position when the squared head 60 of the armature pin 59 is in position in one of the squared holes 68 in the latching gear 35, the gear train being prevented from turning due to its latched condition.

Assume now that the motor M and the relay SR are energized simultaneously through a circuit to be described hereinafter. The energized coil 58 will cause flux to flow through the magnetic structure of the relay SR causing the pole ends of the housing to attract the armature plate 61 thereto. This movement of the armature plate 61 will withdraw the squared head 60 from the squared hole 68 to unlatch the latching gear 35 and at the same time will cause flexing of the contact spring 66 and the spring plate 62 in a direction opposite to their natural bias. The motor M also being energized, its rotor 24 revolves and drives the pinion gear 28 through its spring type clutch 30 and the gear train is put into operation. Any rotating motion of the motor rotor 24 prior to complete unlatching of the latching gear 35 will cause slippage between the rotor 24 and pinion gear 28 through the spring type clutch 30.

Upon deenergization of the motor M and the relay SR, the trapped spring pressure in the biased springs 66 and 62 will force the armature pin squared head 60 into one of the squared holes 68 and stop the gear train. In this connection, it should be stated that the squared head 60 will first bear against the side of the gear 35 while it is rotating and will then enter the next hole to appear in line (see Figs. 10 and 11). Each squared hole is provided with a beveled guide groove 69 leading thereto to facilitate easy entrance of the squared head 60 into the squared hole 68. As the squared head 60 enters the guide groove 69 under pressure, it will follow the base of the guide groove 69 toward the hole 68 until it strikes the shoulder formed by the far side of the hole 68 (as shown by dot and dash lines, Fig. 11), to bring the latching gear 35 to a stop instantly; whereupon the squared tapered head 60 will easily enter the squared tapered hole 68. With the latching gear in a stopped position, it follows that the motor pinion gear 28 is also stopped. As will be explained more in detail hereinafter in connection with the operation of the indicator unit, current is supplied to the motor by means of contact 66 until the squared head 60 is actually in the squared hole 68. This provides a means whereby the motor actually drives the gear 35 into a latched position, rather than having to depend on momentum of the motor to carry the operation through. The overrun of the motor rotor 24 is taken up by slippage through the spring clutch 30.

Referring now to the gear train and its associated driven parts, as previously stated the pinion gear 28 drives the latching gear 35 at one-quarter of the motor speed and the latching gear 35 through the medium of pinion gear 36 drives the gear 37 at one-half its speed or one-eighth of the motor speed. This gear 37 is integral with the display tape drum 38 which is in the form of a sprocket having eight teeth 71 around its periphery. These teeth 71 cooperate with holes 72 in the display tape 19. The other extremity of the display tape 19 is guided and rolls on a pair of rollers 73 and 74 spaced to position the characters on the tape one at a time in a display window 75 located in the front wall 13 of the indicator. There is one hole 72 for each of the thirty-two character spaces on one side of the display tape 19 so that the tape drum 38 completes four revolutions for one revolution of the tape 19. The tape 19 is spliced with a 180° twist therein with thirty-two character spaces on each side. In order to display all sixty-four spaces to complete a cycle of operation of the indicator, the tape 19 will have to revolve twice and the tape drum 38 will have to revolve eight times. As the motor rotates eight times for each revolution of the tape drum 38,

the ratio is one motor revolution for each tape character displayed in the window 75 during operation.

The combined part including the gears 37, 40 and the tape drum 38 is provided with a round hub 76 having a flat portion 77 thereon. This flat portion 77 is provided for the purpose of forming a driving connection for a driving arm 78 and a spider type three pronged spring 79 which are both mounted on the hub 76. Both the driving arm 78 and the spring 79 are provided with a hole therein which also has a flat portion to coincide with the periphery of the hub 76. Also mounted on the hub 76 is the contact drum 16 of insulating material. This contact drum is provided with a round hole so that it cannot be driven by the hub 76. The driving connection for the contact drum 16 is provided by means of the driving arm 78 which is formed with two right angle prongs 80 which coact with two notches 81 located in the periphery of the contact drum 16. These prongs 80 and notches 81 are of different sizes so that they can be assembled in one way only.

The spider type spring 79 is located between the driving arm 78 and the contact drum 16 and has its three prongs bent outward toward the contact drum so that when assembled, a natural spring bias is tending to force the contact drum 16 outward toward the commutator type printed circuits which are located in the insulation side wall 12. Contact strips or connectors 82 and 83 are mounted on the contact drum 16 by means of rivet pins 84. These pins 84 have extending portions 85 which actually contact certain of the commutator printed circuits formed in the wall portion 12 and complete an electrical bridge connection between certain ones as the contact drum 16 rotates.

The gear 42 is likewise provided with a hub 86 having a flat portion thereon to receive a driving arm 87 and a spider type spring 88. The driving arm 87 is connected to and drives the second contact drum 17 in a manner similar to that already described in connection with the first contact drum 16, the prongs 80 coacting with the notches 81. The contact drum 17 is provided with contact strips or connectors 89 and 90 which contact certain other commutator printed circuits in the wall portion 12.

The gear 43 with its associated driving pin 44 and the cam 45 form a driving means known as a "Geneva" cam arrangement, as previously mentioned. This type of driving means has been chosen to obtain a four to one reduction in speed between the movement of the contact drum 17 and the contact drum 18 in lieu of gear reduction because if gears were used, their size would be restricted due to the limitations in spacing between parts and this would enhance the tolerances permitted because of gear backlash and manufacturing clearances. It will readily be appreciated that such a gear movement of the contact drum 18 would provide continuous motion and result in poor accuracy at the crossover points between commutator segments whereas a "Geneva" cam arrangement provides amplified velocity during the movement from one commutator segment to another.

With reference to Fig. 12, the cam 45 is shown at a midpoint in one of its 90° movements, the gear 43 having its associated driving pin 44 fully within a slot 46 of the cam 45. In this position, a cut-out portion 100, which is provided in the gear hub 101, will be directly opposite one of the slotted portions 102 of the cam 45. This permits free turning of the cam 45 while it is being driven by the pin 44. However, when the movement reaches a point where the driving pin 44 is just leaving the confines of the slot 46, as shown in Fig. 13, the periphery of the gear hub 101 will lie within the confines of an arcuate portion 103 formed in the cam 45 between two of the slotted portions 102. This will prevent any further turning of the cam 45 until the gear 43 and its associated driving pin 44 complete another 270° of travel, whereupon the pin 44 will engage the next slot 46 and drive the cam through another 90° of movement.

The cam 45 is also provided with a hub 91 having a flat portion thereon to receive a driving arm 92 and a spider type spring 93. The driving arm 92 is connected to and drives the third contact drum 18 in the same manner as previously described, the prongs 80 of the driving arm 92 coacting with the notches 81 in the contact drum 18. This contact drum 18 is provided with contact strips or connectors 94 and 95 which contact certain other commutator printed circuits in the wall portion 12.

This contact wipe arrangement of commutator C5-6 may be more clearly seen and understood by referring to Fig. 2 of the drawings in which the parts have been further separated for clearness. It is also typical of commutators C3-4 and C1-2. The pins 84 serve to fasten the contact strips 94 and 95 to the insulated contact drum 18 whereas the extended portions 85 contact the metallic circuit portions or segments 96, 97, 98 and 99 which are actually the printed circuits imbedded in the insulation board which forms the wall portion 12. It can be seen that with the contact drum 18 in the position shown, the contact strip 94 is bridging the two metallic segments 96 and 99, the contact pins 85 bearing directly on the segments 96 and 99, the necessary contact pressure being present due to the action of the biased spring member 93. Likewise, in this position, the contact strip 95 is bridging the metallic segments 97 and 98. The design of these printed circuit commutator arrangements is such that one end of the contact strips 94 and 95 is always connected to a certain continuous metallic segment whereas the other end of the contact strips 94 and 95 will be connected to different metallic segment in accordance with the position of the contact drum 18 as it revolves.

Referring now to the guiding arrangement for the front end of the display tape 19, as previously mentioned, this tape 19 rolls on the rollers 73 and 74. These rollers 73 and 74 are mounted on pins 104 and 105 which are journaled in a molded nylon block 106. This block 106 is molded with hollowed out portions therein to provide space for the rollers 73 and 74 and also to provide a channel portion which acts as a track to guide the display tape 19. The block 106 is fastened to the side wall 11 by means of rivet pins 107, spacing pads 108 being provided on the block 106 to position its location. A pin 109 is molded into the block 106 at a location between the pads 108. The ends of the pin 109 protrude from the block and are pointed to receive two spring fingers 110 which are molded into the front end wall 13. Holes in the fingers 110 fit over the pointed ends of the pin 109 to provide a means for holding the front end wall in position.

The front end wall 13 is provided with a piece of transparent material 111 such as "Lucite" or the like to cover the window opening 75. This end wall 13 also provides a holding recess 169 for a lamp 112 and a mounting means for a contact spring 176 (see Fig. 18). This lamp 112 is positioned to directly illuminate the tape 19 (see Fig. 4), but due to its position, the lower portion in the tape in front of the window opening 75 receives the most of this direct illumination. In addition, the lamp 112 supplies light to the lower edge of the translucent piece 111 which light is transmitted through this piece to its upper edge 177 which is at an oblique angle substantially equal to the critical angle of reflection to cause the internally transmitted light to be reflected onto the upper portion of the tape 19. Thus, the outer surface of the opaque tape 19 is uniformly illuminated so that the symbols or characters located thereon are clearly visible from the outside.

The contact spring 176 is suitably fastened to the end wall 13 and provides a connecting means between the base of the lamp 112 and a metallic pad 114 located on the insulation side wall 12. Another contact spring 113 which is fastened to the side wall 12 provides a connection from the filament of the lamp 112 to a printed cir-

cuit on the insulation side wall 12. In assembly, the lamp 112 is placed in the recess 169, its base contacting the contact spring 176. The end wall piece 13 is then snapped into place, its two spring fingers 110 cooperating with the pointed ends of the pin 109. In this position, the filament contact of the lamp 112 will cooperate with the contact spring 113 and the contact spring 176 will cooperate with the metallic pad 114 on the insulation side wall 12, thus establishing a lighting circuit for the lamp 112 as described in detail hereinafter. The other end wall 14 is provided with pin type projections 115 which fit into holes 116 in the two side walls 11 and 12 when assembled.

From the description thus far given and with reference to the drawings, it can be seen that all of the moving parts are assembled to the metal side wall 11. The normal assembled position has been chosen as the position wherein the "\$" code mark on the display tape 19 will appear in the window opening 75. In this position, the markings 117 on the gears 36, 37, 40, 41, 42, 43 and cam 45 are all in alignment as shown in Fig. 4, thus assuring proper assembly. The complete indicator unit housing may now be assembled first by placing the two end walls 13 and 14 in position with respect to the side wall 11, the end wall 13 snapping into position wherein the spring fingers 110 coact with the pin 109 and the end wall 14 having its pins 115 in the holes 116. The wall portion 12 which is an insulation panel having the printed circuits therein is provided with clearance holes to receive the ends of the journal pins 27, 51, 53 and 55 as shown in Fig. 5. These four journal pins and the two pins 115 in the end wall 14 serve to position the wall portion 12 wherein it is held by means of horseshoe type spring washers 118 which fit into grooves provided in the ends of the journal pins 27, 51, 53 and 55. The U-shaped cover piece 15 is provided with clearance holes for the ends of the journal pins 27, 51, 53 and 55 and also a stud 119 which is positioned to cooperate with a hole 120 in the wall portion 12. This assures that the cover 15 may be assembled in one position only. This cover 15 is now snapped into position (see Fig. 6) over the channel shaped wall portion 11, the edges 121 fitting into grooves 122 provided in the wall portion 11. A strip of insulation 49 is inserted between the U-shaped cover 15 and the wall portion 12 during assembly to insulate the printed circuits from the indicator housing.

As previously mentioned, the wall portion 12 is made up of insulation material and has metallic printed circuits molded therein on both sides which terminate on one end to provide plug coupling means. As already described, the printed circuits on the inside face of the panel wall 12 constitute the commutator type circuit arrangements such as 96, 97, 98 and 99 which cooperate with the contact strips 94 and 95 on the contact drum 18. The same is true for the contact strips 89 and 90 of the contact drum 17 and the contact strips 82 and 83 of the contact drum 16. Also, as previously described, the inside face of the panel wall 12 carries the contact spring 113 and the metallic pad 114 which cooperate with the lamp 112 and the contact spring 66 which cooperates with the relay core 59. In addition to the above, there are two metallic pads 123 and 124 which cooperate with the two spring fingers 125 and 126 which are connected to the relay coil 58. Also, there are two metallic pads 127 and 138 which cooperate with two spring fingers 129 and 130 which are connected to the motor coil 21. All of these contact connections are made up when the indicator unit is in its assembled position and contact pressure is maintained due to the spring bias of the spring contact members involved. A four part rectifier unit R and a resistor unit RES are also soldered to appropriate metallic pads on the inside face of this panel wall 12. The circuits for these various metallic pads terminate in the leads 131 to 136 inclusive which are located in the end portion 137 of the panel wall 12.

The outside face of the panel wall 12 is also composed of various metallic printed circuits as shown in Fig. 3. These circuits primarily are for carrying the code signals to the various commutator type circuits on the reverse side of the panel wall 12 and terminate in the leads 138 to 143 inclusive which are also located in the end portion 137 of the panel wall 12. Certain of the circuits on both sides are interconnected by means whereby a hole is drilled through the panel including the metallic circuits and the hole is filled by means of electroplating, as indicated at various places by the character 144.

As an example, let us refer to the contact spring 113 and the metallic pad 114 which form part of the circuit used to energize the lamp 112. Assuming that energy is applied to the lead 136 (see Fig. 1), it will be carried through the connection 144 to the reverse side of the panel wall 12 to a metallic strip 148 (see Fig. 3). The metal strip 148 is connected to the contact spring 113 (see Fig. 1) by means of another connection 144. Current passes through the contact spring 113 to the filament of the lamp 112 and to the base of the lamp 112 which is connected to the metallic pad 114 by means of the contact spring 176. The common return is from the metallic pad 114, through a connection 144 to another metallic strip 149 (see Fig. 3) on the reverse side of the wall board 12. The metallic strip 149 in turn is connected by another connection 144 to the lead 131 (see Fig. 1) which in this case is connected to a common return source. Other circuits are completed in a similar fashion, the six leads 131 to 136 on the inside face of the panel wall 12 being used primarily for circuits connected to the lamp 112, the motor coil 21 and spare wires for any other use. The six leads 138 to 143 on the outside face of the panel board 12 are used primarily to carry the six different incoming code signals.

The end portion 137 of the panel wall 12 which carries the various circuit leads 131 to 136 inclusive and 138 to 143 inclusive protrudes from the indicator unit housing and is adapted to cooperate with a plug coupler unit 145 (see Figs. 8 and 9) which in turn is electrically connected to an external source. This plug coupler unit may be of any suitable make and primarily consists of two separate banks of spring contact fingers 146 and 147 which cooperate in a spring biased fashion with the circuit leads of the indicator unit.

Having already reviewed the operating characteristics of the motor M and the relay SR with its associated latching means for latching and unlatching the gear 35, we will now assume that the gear 35 is unlatched and is being driven by the motor M through its pinion gear 28. This obviously puts the whole gear train and its associated units into motion and the indicator will continue to run until the incoming code signal is satisfied. From the detailed description thus far given, it has been determined that the unit comprising the gear 37 and its associated tape drum 38, and contact drum 16 is turning at one-eighth of the motor speed and requires eight revolutions of motion to turn the tape 19 one revolution wherein all sixty-four characters are displayed, eight characters being displayed for each revolution of the tape drum 38, or one character for each revolution of the motor. As the gear 42 is turning at one-half the speed of gear 37, its associated contact drum 17 is also turning at one-half of the speed of the tape drum 38, thus requiring two revolutions of the tape drum 38 for each revolution of the contact drum 17. Also as the gear 43 only operates the "Geneva" cam arrangement 90° for each revolution, the contact drum 18 will be driven at one-quarter of the speed of contact drum 17 which is equivalent to one-eighth of the speed of the tape drum 38, thus requiring eight revolutions of the tape drum 38 for each revolution of the contact drum 18. In other words, the contact drum 16 completes eight revolutions for each revolution of the tape 19, the contact drum 17 completes four revolutions for each revolution of the tape 19, and the con-

tact drum 18 completes one revolution for each revolution of the tape 19.

Having now determined the speed ratios of the three contact drums 16, 17, 18, let us refer again to the commutator groups which are formed in the insulation wall 12 in the form of printed circuits as previously described. These commutator groups will be referred to as C1-2, C3-4, and C5-6 to indicate that C1-2 is connected to the first and second code wires, C3-4 is connected to the third and fourth code wires, whereas C5-6 is connected to the fifth and sixth code wires.

The commutator group C1-2 comprises four metallic rings which cooperate with the two contact strips 82 and 83 which are located on the contact drum 16 in a manner similar to that illustrated in Fig. 2. The outer ring is divided into eight segments which are connected together in two alternate groups, four in each group, the two groups being insulated from each other. These two groups are alternately connected one at a time to a continuous inner ring by means of the contact strip 82 as the contact drum 16 revolves. Thus, the energy coming in from the first code wire to the contact strip 82 is fed to the two groups of commutator segments in alternate fashion. This may be more clearly seen and understood by referring to the C1 commutator shown on the circuit diagram in Fig. 17 and by reference to the No. 1 code illustrated on the code chart shown in Fig. 16. As the tape drum 38 turns one revolution for every eight tape characters and the contact drum 16 turns at the same speed as the tape drum 38, this means that one tape character is displayed for each commutator segment contacted by the contact strip 82, every other segment supplying energy to the windings of the relay SR and the motor M as the contact drum 16 revolves.

The other outer ring is divided into four segments which are connected together in two alternate groups, two in each group, the two groups being insulated from each other. These two groups are likewise alternately connected one at a time to another continuous inner ring by means of the contact strip 83 as the contact drum 16 revolves. Thus, the energy coming in from the second code wire to the contact strip 83 is fed to the two groups of commutator segments in alternate fashion. In this instance, every other segment supplies energy to the relay SR and the motor M but each segment is equal to the space interval of two tape characters, as can be seen by reference to the No. 2 code and the commutator ring C2 in Figs. 16 and 17. Also, as can be seen in Fig. 17, one of the four segment groups of commutator C1 is connected to a certain one of the two segment groups of commutator C2 and the other four segment group is connected to the other two segment group.

The other two commutator groups C3-4 and C5-6 each comprise two separate segment groups as defined by the commutator rings C3, C4, C5 and C6 in Fig. 17 and the code Nos. 3, 4, 5, and 6 in the code chart, Fig. 16. However, these segment groups are broken up into different combinations and the speed of the contact drums 17 and 18 is different as already explained in order to provide a workable combination as illustrated in the code chart Fig. 16. Here it can be seen that the code pulse received from No. 1 code wire and being transmitted to the relay SR and the motor M is alternated by the commutator ring C1 sixty-four times, once for each character or space on a complete revolution of the tape 19. The code pulse received from No. 2 code wire is alternated by the commutator ring C2 thirty-two times, once for every two character spaces on the tape 19. The code pulse from No. 3 code wire is alternated sixteen times, once for every four character spaces on the tape 19 whereas the pulse from No. 4 code wire is alternated eight times, once for every eight character spaces. Likewise, the energy from No. 5 code wire is alternated four times, while the energy from the No. 6 wire is alternated two times, once for every thirty-two character spaces.

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As above mentioned each complete revolution of the tape includes sixty-four positions, and it was also pointed out above that the code Nos. 1 and 64 could not be used. However, since there are actual positions on the tape for the first and sixty-fourth positions, it is obvious that the commutators must have a structure corresponding to some code. For convenience in the disclosure of Figs. 1 and 2, the structure of commutator C5 is made to use the code No. 17 for the indicator position No. 1. This means that the tape will have a symbol K in two different positions. In other words, the indicator position No. 1 is not usable to display a distinctive symbol, but must include a duplicated character for operating purposes.

The structure of the commutator C5 shown in Figs. 1 and 2, is made to correspond to the code No. 64, even though the code itself cannot be used in connection with the different positions of the code establishing relays. Thus, any other code that is used will be effective to cause the indicator to move past this position No. 64 on the tape which tape has no symbol for that position.

It has also been pointed out that the code No. 33 is not used, so as to make it possible to easily modify the connections to the indicator to employ only five code buses. This is done by constructing the commutator C5 as shown in Figs. 1 and 2 to correspond in its position No. 33 to have a structure as used for position No. 1. This means that the structure for indicator position No. 33 then corresponds to the structure required for position No. 49. For this reason, the position No. 33 on the tape will then have a duplicate symbol "C." This causes the commutator C5 to be non-symmetrical as shown in Figs. 1 and 2.

Referring now to Fig. 17, there has been diagrammatically illustrated a simplified typical operating circuit for the indicator, all wiring being contained on the printed circuit panel 12 with the exception of the external code wires 138 to 143 inclusive and the other external control wires 131 to 136 inclusive, as indicated by the dotted line housing 150.

This simplified typical operating circuit shows the different commutators in a diagrammatic manner, no effort being made to illustrate their exact structure nor to show the different positions in which the commutator arms are located for the different positions for the indicator. For convenience in the understanding of the illustration, it should be appreciated that the commutator arms for C1-C2 make eight revolutions for each complete revolution of the tape having sixty-four positions. The commutator arms for C3-C4 make four revolutions for each complete revolution of the tape having sixty-four positions. The commutator arms C5-C6 make one revolution for each complete revolution of the tape having sixty-four positions.

As an example, the indicator unit has been illustrated as being in its original normal assembled position, that is, the "\$" character position as shown on the main drawings, Figs. 4, 5, 6 and 7. Assuming that the last code position called for had been the "\$" character code, the code establishing relays CR1 and CR4 were energized and the indicator unit was operated until the code was satisfied and the "\$" character was displayed in the window opening 75. In order for the code to have been satisfied, the various contact strips 82 etc. must have reached a position on the various commutator groups C1 etc. wherein no energy was supplied to the relay SR and the motor M. This is true as it can be seen that with the relays CR1 and CR4 energized, energy is supplied through their front contacts 151 and 152 to the contact strips 82 and 90 but it cannot get through the commutator segments to the relay and motor.

Assume now that the next incoming code is to be the "K" character code. In accordance with the code chart this would call for code Nos. 1, 2, 3, 4 and 6 and the code establishing relays CR1, CR2, CR3, CR4 and CR6 would be energized in response thereto, relay CR5 re-

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maining deenergized. Energy would immediately be available from the front contacts 153, 154 and 155 of the relays CR2, CR3 and CR6 to the commutator groups C2, C3 and C6 from where it would be relayed to the relay SR and the motor M. As an example, one of these circuits may be traced as follows: from the positive side (+) of the source of current, front contact 153 of the relay CR2, No. 2 code wire 141, contact strip 83 and commutator segment 156 of the commutator group C2, wire 157 to the bus 158, wire 159, rectifier R1, wire 160 to the winding of relay SR, wire 161, rectifier R2, wires 162 and 163 to the winding of the motor M, and wire 132 to the negative side (-) of the source of current.

With the windings of the relay SR and the motor M both energized, the relay armature 59 will operate and close the contact 66 and unlatch the latching dog 60 from the gear 35 and permit the motor to operate the gear train and its associated tape drum 38 and contact drums 16, 17 and 18. As the indicator unit is operating, many combinations of circuits are set up through the commutator groups, one of these being a so-called run-around circuit. This is a condition wherein energy may pass through a certain CR relay contact to a certain commutator group C and then to the bus 167, back through another commutator group C to a back contact of a relay CR, through the bus 169 to another back contact of a CR relay, then through another commutator group C to the bus 158 which is connected to the windings of the relay SR and the motor M as described above. The indicator unit will continue to operate so long as energy is being supplied to the windings of the relay SR and the motor M by any one or any combination of circuits through the commutator groups C1, C2, C3, C4 and C6. Also, so long as the contact 66 is closed, additional energizing circuits for the motor M only are established. One of these circuits may be traced as follows: from the positive side (+) of the source of current, front contact 151 of the relay CR1, No. 1 code wire 139, contact strip 82 and commutator segment 165 of the commutator group C1, wire 166, to the bus 167, wire 168, contact 66 of the relay SR, resistor RES, wire 163 to the winding of the motor M, and wire 132 to the negative side (-) of the source of current.

When the time occurs where all the indicator commutator groups are in correspondence with the contacts on the code establishing relays, the main current path to the windings of the relay SR and the motor M will be open circuited, but the auxiliary circuit through the relay contact 66 to the motor M will still be closed. This condition is brought about due to the fact that although the relay SR is deenergized, its spring biased armature 59 cannot move to its full open position until its latching dog 60 is entirely within one of the squared holes 68 in the gear 35, as shown in Figs. 10 and 11. If the latching dog 60 is bearing against the side of the gear 35, the relay contacts 66 is still closed and supplies energy to the motor which continues to drive the gear 35 until the latching dog is in position in one of the squared holes 68. When this occurs, the gear train is latched up and energy is cut off to the motor because the contact 66 is now open. The motor may now continue to rotate until it dissipates its kinetic energy through the slip clutch arrangement comprising the spider type spring 30 and the gear 28. With the indicator unit now fully stopped and latched up, the incoming "K" character code has been satisfied and the character "K" will be displayed in the window opening 75.

In Figs. 14 and 15 there has been shown one of several ways in which the posting indicator units of the invention may be assembled in a posting system where several units are required. These units may be assembled side by side and one over the other in a manner

whereby they simulate drawers in a cabinet 170. This cabinet 170 is provided with openings 171 in the front panel and plug coupler units 145 in the rear panel, also side rails 172 extending from front to back. The indicator units may be slid into the openings 171 where they will coact with the plug coupler units 145. Removal is facilitated by providing a slot 173 in the opening 171 above each unit to allow insertion of a flat hooked tool 174. The hook portion of this tool 174 hooks into a hole 175 in the indicator unit whereupon it may be withdrawn from the cabinet 170.

As previously mentioned, the normal capacity of the indicator is sixty-four code positions but it may be converted to thirty-two code capacity merely by splicing the tape without the 180° twist and leaving code wide No. 6 open circuited and operating with only five code wires. Either side of the tape may be exposed depending on the type of code characters preferred. The time of a complete cycle for a thirty-two code indicator is approximately one half of the sixty-four code cycle time. Here again, two of the codes are unusable for reasons stated above.

The indicator may also be converted to sixteen code capacity if necessary. This would require having code wires Nos. 5 and 6 open circuited and elimination of the third operating gear 43 of the gear train as well as its associated cam 45, contact driver 92, and contact drum 18. It would also require a new printed circuit panel and a tape with all sixteen characters repeated, the thirty-two character tape completing one half revolution to each cycle of indicator operation. Obviously, eight code capacity could also be arranged by having three code wires open circuited and repeating the eight code characters four times on the tape.

These indicators may also be supplied with special colored tapes or code characters to distinguish from each other, or they may be made to display different colors instead of code characters. Also, different colored translucent material may be used to cover the display window openings, if desired.

Where several posting indicators are used in a system and each are mounted in a panel casing in bank formation, it is rather apparent that there may be numbers of these indicator units operating at the same time or in overlapping relationships; but their effect on local radio reception, telephone equipment, and the like, is minimized by reason of the fact that the driving motors are of the squirrel-cage type without commutators, and the relay operation is of direct current type. The use of the alternating current for driving purposes also tends to minimize the arcing at the different commutator contact segments. Also, as previously explained, the motor current is finally cut off by the contact 66 and not at the different commutator contact segments. Current to the relay winding only is cut off at the commutator contact segments. This also tends to minimize the arcing and prolong the life of the commutator contact segments.

Referring to Fig. 17, the wiring diagram shows all of the wires leading out of the indicator unit 150. This includes not only the code wires 138, 139, 140, 141, 142 and 143 but also the control wires 132 and 133. The control wire 132 is related to the motor operation directly; whereas, the wire connection 133 is provided to provide circuit access to the code commutator contacts for any desired purpose. Also, these wire connections include wires 131 and 136 for control of the lamp 112 as above described. Two spare wires 134 and 135 are provided in the event that the particular use of the indicator unit requires additional controls for circuit access to the contacts or relay. This provision of adequate circuit access through the printed circuit leads forming a part of a plug connection, renders the indicator available for almost universal application in various types of systems.

Having shown and described one form which the indi-

cator unit of the present invention can assume and the mode of operation thereof, it should be understood that various adaptations and deviations in the structure could be made without departing from the spirit of the invention within the scope of the appending claims.

What I claim is:

1. A display indicator unit comprising, a gear train having a tape drum and contact drums operatively connected thereto, a display tape operatively connected to said tape drum, commutator segments cooperating with said contact drums, a motor operatively connected to said gear train by means of a slip friction clutch, a tractive type relay having a spring biased armature which latches said gear train when said relay is deenergized and unlatches said gear train when said relay is energized, a first energizing circuit through said commutator segments for energizing said relay and said motor to cause said relay to unlatch said gear train and permit said motor to drive said display tape to a given position wherein said circuit is cut off, a second energizing circuit through said commutator segments for energizing said motor to permit said motor to drive said gear train into a latched position wherein said motor is deenergized and dissipates its kinetic energy through said slip friction clutch, said display tape displaying a character indicating the existing position of said indicator unit.

2. In combination, a display indicator unit comprising, a housing having an insulation board side wall and a metallic side wall, said insulation board side wall having printed circuit type commutator segments molded therein, said metallic side wall having movable contact drums mounted thereon which are spring biased into cooperation with said commutator segment, a code character display tape, a gear train operating means for said contact drums and said code character display tape, an A.C. motor and a D.C. relay and rectifier combination connected in series for operating and latching said gear train operating means, certain of said commutator segments being connected together by printed circuits and having leads terminating outside of said housing where they may be intermittently connected to code signals by coding relay contact means, said relay having its armature spring biased in a manner to latch up said gear train when said relay is deenergized and unlatch said gear train and close a motor energizing contact when energized, said motor being connected to said gear train through a spring type slip friction clutch so that said gear train is driven by said motor normally by said series circuit and continues to drive said gear train after said relay is deenergized by means of an auxiliary circuit through said motor energizing contact until said gear train reaches a latching position, wherein said gear train is latched up and said motor dissipates its kinetic energy through said slip friction clutch.

3. In combination, a display indicator unit comprising, a housing having an insulation board side wall and a metallic side wall, said insulation board side wall having printed circuit type commutator segments molded therein, said metallic side wall having a gear train mounted thereon for operating an associated display tape and contact drums, said contact drums being spring biased into cooperation with said commutator segments on said insulation board wall, said display tape having sixty-four code character positions and adapted to display code characters one at a time in an indirect lighted window opening in said housing, a driving means for said gear train comprising a motor and a spring type slip friction clutch, a relay for operating a spring biased latching means to latch and unlatch said gear train, said commutator segments being divided into three groups, each group having its cooperating contact drum rotated at a different speed by said gear train, the speed ratio being at the rate of eight, four and one revolutions respectively to one revolution of said display tape, the last of said contact drums being rotary operated by a step-by-step

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cam arrangement which produces high velocity contact movement from one commutator segment to another.

4. In combination, a display indicator unit comprising, a housing having one insulation board side wall and one metallic side wall and a metallic biased snap-on cover unit for holding said housing together, said insulation board side wall having printed circuit type commutator groups and connectors molded therein, said metallic side wall having mounted thereon a motor-relay unit, a gear train and associated contact drums and display tape operated thereby, said motor-relay unit consisting of an A.C. shaded-pole squirrel-cage type motor and a D.C. tractive type relay connected in series through a rectifier unit, said motor being operatively connected to said gear train by means of a spring type slip friction clutch, said relay having a plate armature with a bearing pin which is provided at one end with an extended portion to cooperate with a resilient biased contact finger mounted on said insulation board side wall, said plate armature being provided at its other end with a biasing spring and a latching dog for cooperation with a latching gear member of said gear train, said latching gear member being provided with openings each having a bevelled cam surface leading thereto and adapted to receive said latching dog, a main energizing circuit through said commutator groups and said contact drums to said motor and said relay, an auxiliary energizing circuit through said commutator groups, said contact drums and said contact finger to said motor, whereby coded energy passing through said main energizing circuit will cause said relay to close said contact finger and disengage said locking dog from said latching gear member and permit said motor to operate said gear train and its associated contact drums and display tape to the position called for by the incoming code signal, whereupon the said main energizing circuit is broken to deenergize said relay and permit said contact finger and said biasing spring to position said locking dog against said latching gear, said auxiliary energizing circuit permitting said motor to drive said gear train until said latching gear bevelled cam and opening cooperate with said latching dog, in which position the spring bias of said contact finger will force said latching dog into said latching gear opening and open said auxiliary circuit to deenergize said motor, said motor dissipating its kinetic energy through said slip friction clutch.

5. A display indicator unit comprising, a housing having one metallic side wall, one insulation board side wall, two insulation block end walls and a metallic biased snap-on cover for holding said housing together, said metallic side wall providing the supporting means for a motor-relay unit, a gear train and a display tape roller guide, said insulation board side wall having printed circuits molded therein consisting of commutator groups, connectors and plug coupler leads, and having a relay operated contact finger mounted thereon, one of said end walls having a snap action mounting means and being provided with a taped display opening, a translucent window and a lamp positioned to produce indirect lighting; said motor-relay unit consisting of an AC shaded-pole squirrel-cage type motor and a D.C. tractive type relay connected in series through a rectifier unit, said motor being operatively connected to said gear train by means of a slip friction clutch, said relay having its armature provided with a spring biased latching means which latches said gear train when said relay is deenergized, said armature closing said contact finger and unlatching said gear train when said relay is energized, said gear train having three operating units, one operating unit comprising a sprocket type tape drum, a spring biased contact drum to coast with a first of said commutator groups and a driving means for said contact drum; a second operating unit comprising a spring biased contact drum to coast with a second of said commutator groups and a driving means for said contact drum; a

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third operating unit comprising a step by step cam movement, a spring biased contact drum to coast with a third of said commutator groups and a driving means for said contact drum, a display tape mounted on said tape drum and said roller guide in a manner to be driven by said tape drum and be visible through said translucent window opening, said printed circuit commutator groups and connector wires terminating into leads which are adaptable to plug coupling to external code signal wires, whereby; said code signal wires when energized will cause said relay to unlatch said gear train and permit said motor to operate said display indicator unit to a position corresponding to said incoming code signal, whereupon the main energizing circuit to said relay and motor will be cut off but an auxiliary circuit through said relay operated contact finger will permit said motor to drive said gear train into a latched position, wherein the code character on said tape which corresponds to said code signal is displayed in said translucent window opening, said auxiliary circuit is cut off and said motor dissipates its kinetic energy through said slip friction clutch.

6. In a display indicator, a housing having a window opening at one end, a display tape having symbols thereon and supported to have such symbols successively moved past said window opening, an electric motor within said housing, a gear train operatively connected through a slip friction clutch to said motor, and also connected to operatively drive said tape to its different positions, a mechanical latch for locking said gear train in different positions for the different symbols on said tape, circuit means including commutator means operated by said gear train for controlling said motor to operate said tape to its different positions in accordance with the desired position of said tape, a relay having a front contact and also directly connected to said latch for unlocking said gear train when said relay is energized, said connection being so constructed that said front contact remains closed even though said relay is deenergized until said latch has locked said gear train in a given position, circuit means controlled by said front contact of said relay for supplying energy to said motor until said gear train becomes locked in a given position, and circuit means for also energizing said relay and said motor through said commutator means in accordance with the desired position of said tape.

7. In a display indicator, a housing having an opening at one end and a plug coupling unit at the other end, a flat endless tape having symbols thereon and mounted to have such symbols successively moved past said opening, an electric motor within said housing, a gear train operatively connected through a friction slip clutch to said motor and also operatively connected to drive said tape to its different positions, a plurality of commutators respectively associated with different gears in said gear train except the last which is operated from said gear train through a Geneva cam movement, and circuit means including said commutators for controlling said motor to operate said tape to its different positions in accordance with the desired position of said tape, whereby said tape is moved to its different positions in a steady and smooth operation whereas the last of said commutators is intermittently moved to its different positions by said Geneva cam movement.

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