Jan. 9, 1962 A. M. HAILEY ET AL 3,016,526

ELECTRICALLY-OPERATED CHANGING DISPLAY INDICATORS

Filed Nov. 18, 1958

FIG.1.

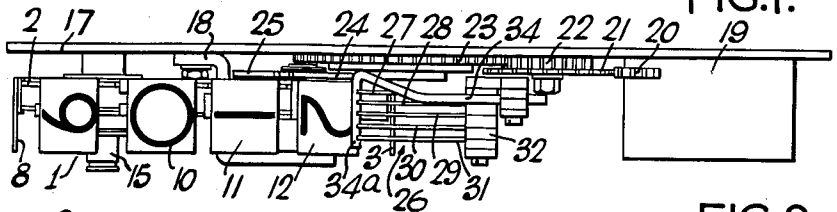


FIG.2.

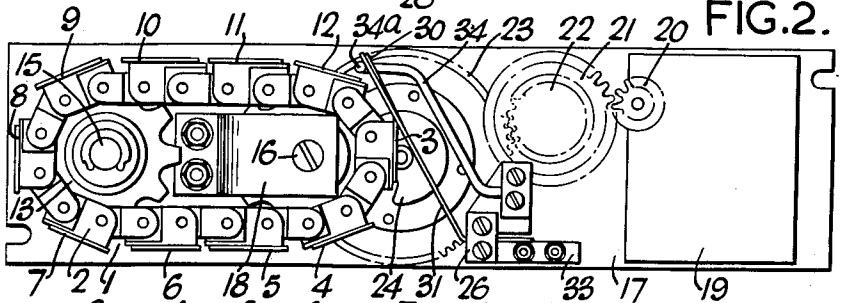


FIG.3.

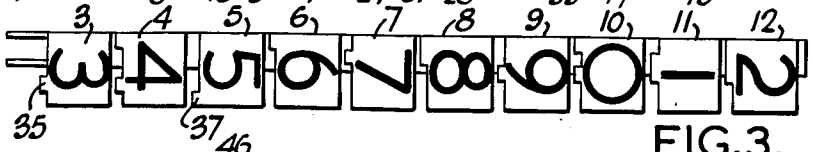


FIG.4.

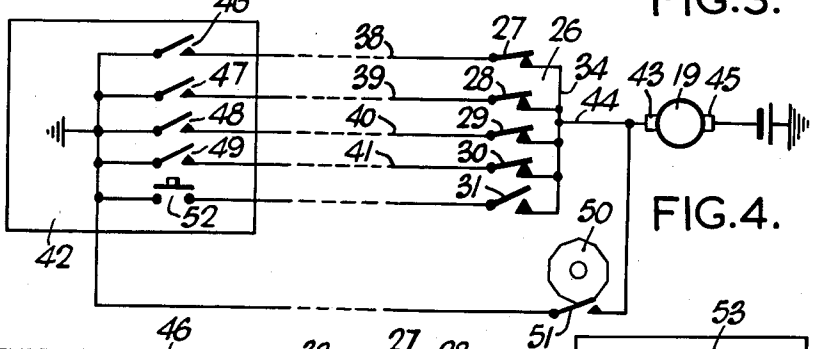
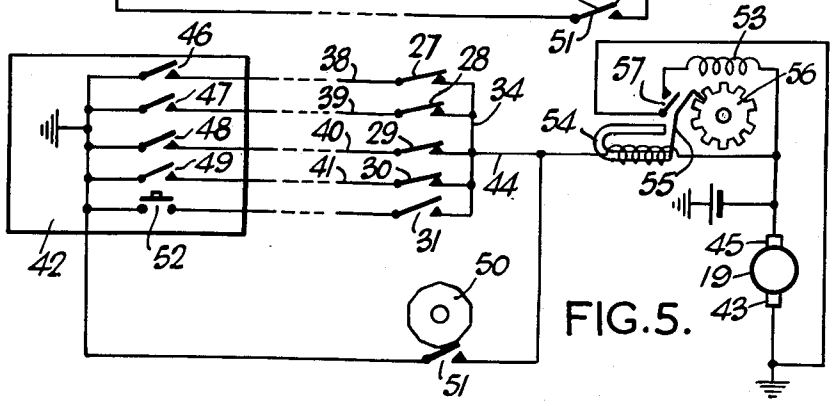


FIG.5.



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3,016,526 ELECTRICALLY-OPERATED CHANGING DISPLAY INDICATORS

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8 Claims. (Cl. 340—324)

This invention relates to electrically-operated changing display indicators arranged to display information (for example figures or letters or numbers or words) signified by code signals.

The invention is particularly concerned with such display indicators of the kind described in prior Patent No. 2,723,391, that is to say indicators comprising a driven member having a normal position and a plurality of stopping positions at which different display surfaces are displayed and wherein a code switching device provides in effect a controlling switch in each code branch of a control circuit which has a code branch individual to each code element of the code employed and which controls the setting of the driven member from the normal position to any particular stopping position as signified by a code signal. As regards each particular control circuit code branch, the code switching device operates to cause the branch to be open whilst the driven member is at one or more stopping positions and to be closed whilst the driven member is at the remaining stopping position or positions. Also as regards each particular control circuit code branch, when it is required to set the driven member from a normal position to a stopping position signified by a code signal the branch is not connected to render it effective, subject to the switching performed by the code switching device, unless the signal element to which the branch pertains is, in the case of the particular code signal concerned, of a particular character (for example is a "mark" as opposed to a "space"). During the setting of the driven member from a normal position to a stopping position signified by a code signal, at any stopping position reached before the requisite stopping position is reached the condition obtains that one or more control circuit code branches are effective to cause the driving of the driven member to continue. At the requisite stopping position, the condition obtains that no control circuit code branch is effective to cause the driving of the driven member to continue, so that the driven member is stopped in this stopping position.

One suitable form of code switching device is described in the previously referred to specification and comprises a rotor, driven by the driven member of the indicator and constituted by a plurality of code discs in permanent electrical contact with each other, and a plurality of fixed wipers, arranged to make electrical contact with the respective code discs and connected in the respective code branches of the control circuit previously referred to, the code discs having portions thereof cut away so that a through connection between a disc and its associated fixed wiper exists only when the rotor is occupying certain positions.

The present invention is directed to the provision of a changing display indicator of the kind hereinbefore set forth comprising an improved code switching device.

In accordance with the present invention there is provided an electrically-operated changing display indicator of the kind specified in which the code switching device is constituted by a fixed assembly of deflectable electric contact members respectively connected in the code branches of the indicator control circuit and co-operating with at least one fixed electric contact member connected in said control circuit and by a plurality of differently indented code edges movable in response to movement of the driven member so that at each stopping position of said driven member a different code edge operatively engages said assembly of deflectable electric contact members and deflects one or more of said members thereby modifying the code branch connections, said connections being so modified when any stopping position of said driven member corresponds to the requisite stopping position of said driven member that none of the code branches is effective to cause driving of the driven member to continue, which member accordingly stops in said requisite stopping position.

The deflectable members are preferably biased towards the fixed contact member so that they are deflectable out of engagement with the fixed contact member by the respective code edges which are preferably provided on the driven member of the indicator.

In carrying the invention into effect the driven member preferably takes the form of an endless chain or the equivalent carrying a series of display slats which provide the display surfaces. With a driven member of this form the code edges may conveniently be provided by suitably indented slat edges disposed transversely with respect to the direction of movement of the chain or its equivalent.

The driving control arrangements for the driven member of the indicator may be of the kind described in Patent No. 2,723,391, that is to say, the control circuit is arranged to control the driving of the driven member through the agency of a latch electromagnet provided with an armature which in its unoperated position permits a latch to enter a notch in a notched wheel coupled to the driven member and bring the driven member to rest at a stopping position and which in its operated position both holds the latch out of engagement with the notches in the notched wheel and closes a contact controlling the energisation of an electromagnetic clutch which serves for coupling the driven member to continuously rotating driving means, such as an electromotor. Such driving and control arrangements are especially advantageous where a number of changing display indicators co-operate to provide a complex changing display system since the driven members of the display indicators may be coupled up or uncoupled from common driving means by controlling the energisation of the respective clutches. Alternatively, the driving and control arrangements for the driven member may be of the kind in which the driven member is permanently coupled through suitable gearing to an electric motor such as an electromotor individual to the indicator and arranged to be energised through the control circuit when it is required to drive the driven member from its normal position to a stopping position signified by a code signal applied to the code branches of the control circuit. Driving and control arrangements of this kind are described in co-pending application Serial No. 642,423.

By way of example specific embodiments of the invention will now be described with reference to the accompanying drawings in which:

FIGS. 1 and 2 are plan and side elevational views respectively of the mechanism of an electrically-operated changing display indicator according to the invention;

FIG. 3 shows in developed form the driven member of the indicator mechanism illustrated in FIGS. 1 and 2;

FIG. 4 shows an electrical circuit diagram of an indicator embodying the mechanism according to FIGS. 1 and 2; and

FIG. 5 shows an electrical circuit diagram of an indicator embodying a modification of the indicator mechanism illustrated in FIGS. 1 and 2.

Referring to FIGS. 1 to 3 of the drawings, an electrically-operated changing display indicator of the kind

hereinbefore specified comprises a driven member 1 which in the present embodiment has a normal position and nine different stopping positions. The driven member 1 is constituted by an endless chain 2 which carries a series of display slats 3 to 12 inclusive to be displayed one at a time at a display position corresponding to the position occupied by slat 8 in FIGS. 1 and 2, and which passes around a pair of sprocket wheels 13 and 14 rotatably mounted respectively on axles 15 and 16 secured to a side mounting plate 17 and bracket means 18, respectively. The sprocket wheel 14 is permanently coupled with the rotor shaft (not shown) of a D.C. electromotor 19 carried by the mounting plate 17 through a gear train preferably comprising gear wheels 20, 21, 22 and 23, and a pin wheel 24 co-operating with a Geneva gear 25 secured to or otherwise fixed in relation to the sprocket wheel 14 but the Geneva gear and pin wheel may, if desired, be replaced by a suitable spur gear. The electromotor 19 which is preferably of the unwound rotor type such as is commonly employed in motor-driven uniselectors is effective to drive the driven member 1 in a counterclockwise direction as viewed in FIG. 2.

Adjacent the right-hand end of the driven member 1 in FIGS. 1 and 2 and secured to the side mounting plate 17 by bracket means 33 is a code switching device 26 which comprises an assembly of deflectable contact fingers 27, 28, 29, 30 and 31 clamped together in spaced apart relationship near one end by electrically insulating clamping means 32 with short end portions of said members being exposed for making electrical connections thereto, and biased towards a rigid fixed contact member 34 having a portion 34*a* thereof disposed transversely relatively to the deflectable contact fingers and the direction of movement of the driven member 1.

As can best be seen from FIG. 2 of the drawings, a transverse edge of each display slat will operatively engage with the assembly of deflectable contact fingers as said slat assumes a vertical position at the right-hand end of the driven member 1 (i.e. that position occupied by slat 3 in the figure) in response to rotation of the driven member. These slat edges are differently indented as indicated in FIG. 3 so that as the respective slats are driven in turn to the position at the right-hand end of the driven member 1 the upstanding part or parts of the slats between or adjacent indentations deflect the contact finger or fingers in alignment therewith in the direction of movement of the driven member out of engagement with the fixed contact member 34. The differently indented edges of the slats each represent a code which, as will hereinafter be apparent, identifies the particular slat in display when the indented edge is in operative engagement with the assembly 26. In the present embodiment where the display slats bear numerals (e.g. 0 to 9 inclusive) the indented slat edges are conveniently coded on a binary basis, the upstanding parts of the indented slat edges in alignment with the deflectable contact fingers 27, 28 29 and 30 signifying the numbers 1, 2, 4 and 8, respectively. By way of illustration, FIG. 3 indicates that the display slat 3 bearing the numeral 3 has a single upstanding part 35 which will be in alignment with the contact finger 30 and which therefore signifies the numeral 8. The numeral 8 is borne by slat 8 which, by referring to FIGS. 1 and 2, will be seen to be in the display position when the indented code edge of slat 3 is in operative engagement with the contact finger assembly 26.

Taking a further example, the indented code edge of slat 12 bearing numeral 2 is formed with a single upstanding part 36 which is in alignment with the contact fingers 27, 28 and 29 and therefore represents the numbers 1, 2 and 4 the sum of which is 7 i.e. the numeral borne by slat 7 which will be in display when the code edge of slat 12 is operatively engaging the assembly 26. The only slat not having an upstanding part in alignment with any of the contact fingers 27, 28, 29 and 30 is slat 5 bearing numeral 5 and it will moreover be observed that the latter is the only slat provided with an upstanding part 37 in alignment with the contact finger 31. From a consideration of the drawings it will be noted that the numeral 0 will be located in the display position (i.e. with the driven member 1 in the aforesaid normal position) when the indented edge of slat 5 is in operative engagement with the assembly 26, the contact finger 31 being deflected by the part 37 out of engagement with the fixed contact member to interrupt a re-setting drive circuit for the driven member when the latter is in its normal position.

Referring now to FIG. 4 of the drawings, in which the assembly 26 is shown as being in its normal condition (i.e. when the numeral 0 is being displayed by the indicator), it will be observed that the deflectable contact fingers 27, 28, 29 and 30 are respectively connected in code branches 38, 39, 40 and 41 of a control circuit, one code branch being provided in respect of each code element of binary code signals to be applied to the indicator from a control station 42 which may be remote from the indicator mechanism, while the co-operating fixed contact member 34 is electrically connected to one input terminal 43 of the electromotor 19 through a control lead 44, the other input terminal 45 of the electromotor being connected to negative battery as indicated. The code branches 38 to 41 are respectively connectable to earth potential at the control station through contacts 46 to 49 of code relays (not shown) which are operable in predetermined sequences to apply the requisite binary code signals to the indicator control circuit.

In order to bring a particular display slat to the display position of the indicator the code relays just above referred to will be operated in a predetermined sequence appropriately to the slat to be displayed so as to apply earth potential through the relay contacts to one or more of the code branches 38 to 41. With the slat to be displayed occupying its normal position, the indented code edge of the slat situated at the end of the driven member 1 remote from the display position operatively engages the assembly 26 so as to provide at least one through connection between the earthed code branch or branches and the control lead 44 to the electromotor 19 to energise the latter and effect driving of the driven member 1. If, at the first stopping position of the driven member 1, the slat to be displayed does not occupy the display position then the drive circuit for the electromotor 19 will be maintained through the assembly 26 which is now acted upon by the indented code edge of a different display slat. The driven member 1 will continue to be driven from one stopping position to another by the non-interruption of the electromotor drive circuit through the co-operating contact members of the assembly 26 until such time as the code branch or branches to which earth potential is applied is or are disconnected from the control lead 44 by the deflection of the appertaining deflectable contact finger or fingers out of engagement with the fixed contact member 34 by the indented code edge of the display slat situated at the end of the driven member 1 remote from the display position. When this condition obtains the display slat to be displayed will in fact be located at the display position of the indicator. The Geneva gear 25 and the co-operating pin wheel 24 of the indicator mechanism are arranged to de-couple the electromotor 19 and the gear wheels 20 to 23 from the driven member 1 immediately the latter reaches any stopping position and in this way avoids the possibility, more especially when the driven member 1 has been driven through a number of stopping positions to reach the requisite stopping position, of the combined momentum of the motor and gear wheels carrying the driven member 1 slightly beyond said requisite stopping position so that the slat in the display position becomes badly presented (i.e. inclined to the vertical).

By way of example let it be assumed that it is required to display the numeral 2 (i.e. the numeral borne by slat 12), then earth potential will be applied to code branch

39 only by the closure of code relay contact 47 at the control station 42. An energising circuit for electromotor 19 is thus completed and after a short interval the driven member 1 moves into its first stopping position as the Geneva gear 25 (FIG. 1) is stepped through a predetermined angle of rotation by the pin wheel 24 (FIG. 1). At the first stopping position of the driven member 1 the indented code edge of display slat 6 engages the assembly 26 thereby deflecting contact finger 27 out of engagement with contact member 34 but leaving the drive circuit for the electromotor 19 uninterrupted. The driven member is thus stepped from its first stopping position to its second stopping position by the Geneva gear arrangement, whereat the indented code edge of slat 7 deflects contact finger 28 to remove the earth potential from the motor circuit and so stop the driven member 1 with slat 12 bearing the numeral 2 located in the display position.

When the display slats are just moving into or away from the position remote from the display position the tilting of slats may cause the deflectable contact fingers 27 to 30 to be deflected out of engagement with the fixed contact member 34 thus interrupting the driving control circuit for the electromotor 19. This does not present any difficulty where the coupling between driven member 1 and the electromotor 19 is effected through the agency of a Geneva gear since the latter causes the driven member to move very rapidly from one stopping position to the next at appropriate intervals in response to continuous rotation of the electromotor 19, but where a spur gear is employed an alternative drive circuit for the electromotor must be provided during the time the driven member 1 is moving between stopping positions. To this end a multi-faced cam or the like 50, having ten faces in the present example, may be directly coupled to the sprocket wheel 13 and arranged to operate a make spring contact unit 51 so as to apply earth potential from the control station to the electromotor 19 whenever the driven member 1 is moving between stopping positions.

At any of the stopping positions of the driven member 1 the deflectable contact finger 31 will engage with the fixed contact member 34 so that when it is required to reset the driven member 1 to its normal position from a stopping position a resetting switch 52 may be operated so as to apply earth potential to the electromotor 19 and thereby re-establish a drive circuit for the latter. The driven member will be driven from one stopping position to another until it reaches its normal position whereat the motor drive circuit will be interrupted as a result of the separation of contact finger 31 and fixed contact member 34 by the upstanding part 37 (FIG. 3) of slat 5.

In FIG. 5 of the drawings there is shown a modification of the indicator just above described with reference to FIGS. 1 to 4, in which the electromotor 19, instead of being energised under the control of the code switching device, is permanently energised from a D.C. supply as indicated and is arranged to be coupled to the driven member 1 of the indicator by an electro-magnetically operated clutch having an energising winding 53 operable in response to the energisation of a latch electro-magnet 54, the latter having an armature 55, which, in the de-energised condition of the electro-magnet, engages a notched wheel 56 which may be rigidly coupled to one of the sprocket wheels 13 and 14 (FIGS. 1 and 2) to prevent movement of the driven member 1, and which, in the energised condition of the latch electro-magnet disengages the notched wheel 56 and closes make contacts 57 for the operation of the electro-magnetically operated clutch to couple the driven member 1 to the electromotor 19. With driving control arrangements of the latter kind the continuously rotating electro-motor 19 may serve as common driving means for a number of separate indicators.

Other modifications of the embodiments described are also contemplated in which the driven member of the indicator takes the form of a multi-faced drum which may be coupled up to an electromotor such as 19 through suitable gearing, the code indentations being provided along the edges between adjacent faces of the drum.

What we claim is:

1. An electrically-operated changing display indicator for displaying information signified by code signals, comprising a member and driving means therefor, said member having a normal position and a plurality of discrete stopping positions, different display surfaces arranged to be displayed respectively at said stopping positions of the driven member, a control circuit including a plurality of code branches, means for applying code signals to said code branches, and a code switching device associated with said control circuit for controlling driving of said driven member, said code switching device comprising a fixed assembly of deflectable electric contact members respectively connected in said code branches and a fixed contact member spaced away from said driven member and co-operating with said deflectable contact members and also connected in said control circuit and a plurality of rigidly mounted, differently indented code edges on said driven member extending transversely to the direction of movement of said driven member and operatively engageable with said fixed assembly of deflectable electric contact members at each of said stopping positions of the driven member to deflect at least one of said deflectable members whereby to modify the code branch connections, said connections being so modified when any stopping position of said member corresponds to the requisite stopping position as signified by a particular code signal applied to said code branches that none of said code branches is effective to cause driving of the driven member to continue, which member accordingly stops in said requisite stopping position.

2. An electrically-operated changing display indicator as claimed in claim 1, in which the deflectable electric contact members are biased towards the fixed contact member and deflectable out of engagement with said fixed contact member by the respective differently indented code edges.

3. An electrically-driven changing display indicator for displaying information signified by code signals, comprising an endless member and driving means therefor, said member having a normal position and a plurality of discrete stopping positions, a plurality of slats carried by said endless member and providing display surfaces arranged to be displayed respectively at the respective stopping positions of said endless member, a control circuit including a plurality of code branches, means for applying code signals to said branches and a code switching device associated with said control circuit for controlling driving of said endless member, said code switching device comprising a fixed assembly of deflectable electric contact members respectively connected in said code branches and a fixed contact member spaced away from the endless member and slats, said deflectable contact members being biased towards said fixed contact member, said fixed contact member being connected in said control circuit, and a plurality of rigidly mounted, differently indented code edges constituted by suitably deformed edges of said slats disposed transversely to the direction of movement of said endless member and operatively engageable with the assembly of deflectable contact members at each of said stopping positions of the endless member to deflect at least one of said deflectable members out of engagement with said fixed contact member whereby to modify the code branch connections, said connections being so modified when any stopping position of said endless member corresponds to the requisite stopping position as signified by a particular code signal applied to said code branches that none of said code branches is effective to cause driving of the endless member to continue, which member accordingly stops in said requisite stopping position.

4. An electrically-operated changing display indicator as claimed in claim 3, comprising a latch electromagnet arranged to be energised through the control circuit under the control of the code switching device, an armature arranged to be actuated by said electromagnet, a latch coupled to said armature and a notched wheel rotatable in response to movement of the endless member, said armature in its unactuated condition allowing said latch to enter a notch in said notched wheel at each stopping position of the endless member to arrest the latter and said armature in its actuated condition holding said latch out of engagement with the notched wheel and closing a circuit controlling the energisation of an electro-magnetic clutch device which serves for coupling the endless member to a continuously rotating electric motor.

5. An electrically-operated changing display indicator as claimed in claim 3, comprising an electric motor as driving means for the endless member and suitable gearing coupling said motor to the endless member, said motor being energised through the control circuit under the control of the code switching device when it is required to drive said endless member from its normal position to a stopping position signified by a code signal applied to the code branches of said control circuit.

6. An electrically-operated changing display indicator as claimed in claim 5, comprising a D.C. electro-motor as driving means for the endless member.

7. An electrically-operated changing display indicator as claimed in claim 1, comprising a code switching device having an additional deflectable contact member co-operating with the fixed contact member and actuated to prepare a circuit effective to cause driving of the driven member at each of the stopping positions of said driven member, and reset switching means operable to complete said circuit when it is required to return the driven member to its normal position from a stopping position, said circuit being disconnected by the separation of said additional deflectable member from the fixed contact member when said driven member reaches its normal position.

8. An electrically-operated changing display indicator for displaying information signified by code signals, comprising an electric motor, an endless member and gearing coupling said motor to said endless member, the latter having a normal position and a plurality of discrete stopping positions, a plurality of display slats carried by said endless member and providing different display surfaces arranged to be displayed respectively in said stopping positions of said endless member, a control circuit including a plurality of code branches, relay means operable in predetermined sequences to apply code signals to said branches and a code switching device associated with said control circuit for controlling the energisation of said electric motor, said code switching device comprising a fixed assembly of deflectable electric contact members respectively connected in said code branches a fixed contact member spaced from said endless member and slats and towards which said deflectable contact members are biased and which is connected in said control circuit and a plurality of rigidly mounted, differently indented code edges formed along edges of said display slats disposed transversely to the direction of movement of said endless member and operatively engageable with the assembly of deflectable contact members at each of said stopping positions of the endless member to deflect at least one of the deflectable contact members out of engagement with the fixed contact member whereby to modify the code branch connections, said connections being so modified when any stopping position of said endless member corresponds to the requisite stopping position as signified by a code signal applied to said code branches that none of said code branches is effective to cause driving of said endless member to continue, which member accordingly stops in said requisite stopping position, an additional deflectable contact member co-operating with said fixed contact member and acted on by the transverse slat edges to prepare an energising circuit for the electric motor at each stopping position of the endless member, reset switching means operable to complete said circuit when it is required to return the endless member to its normal position from a stopping position, said circuit being disconnected by the separation of said additional deflectable contact member from the fixed contact member when said endless member reaches its normal position, a multi-faced rotary cam coupled to the endless member and contacts actuated by said cam as said endless member is moving from one position thereof to the next position to complete an energising circuit for the electric motor independently of said code switching device.

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