Aug. 1, 1939. F. B. HALE 2,167,750

PERIODIC ROTARY SWITCH

Filed Oct. 28, 1936

FIG. 1.

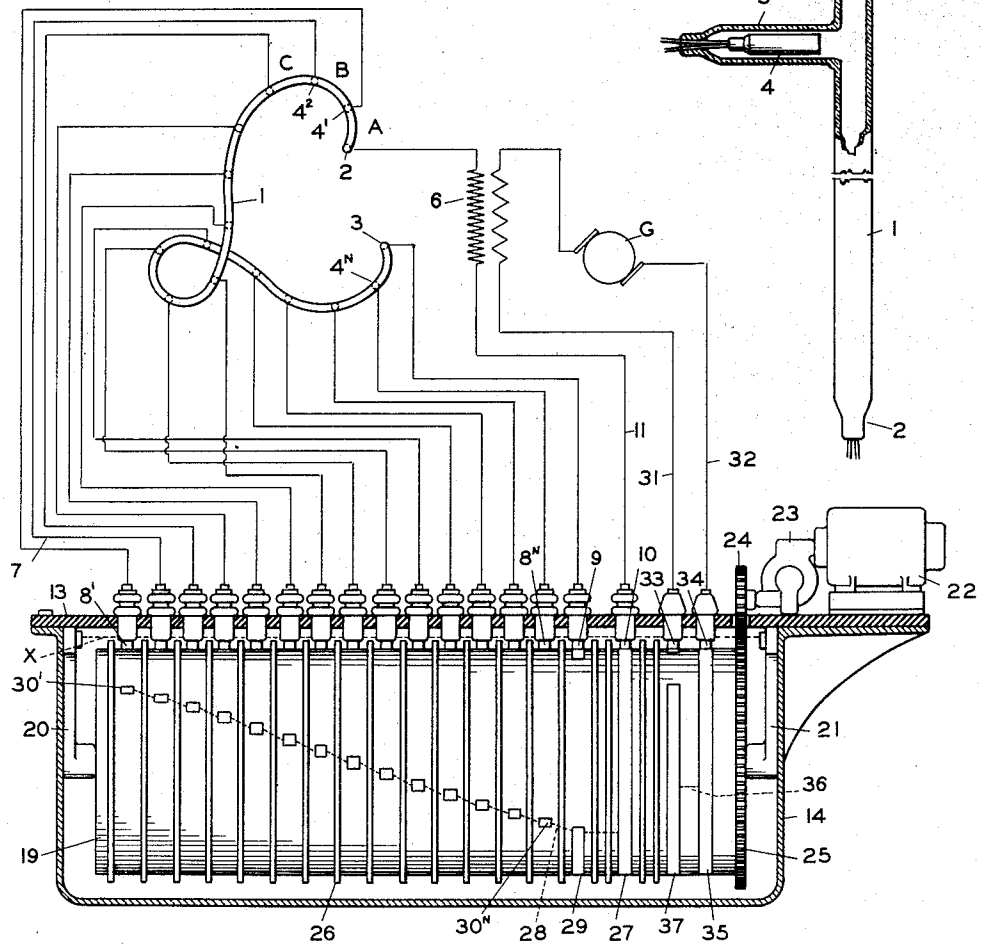


FIG. 2.

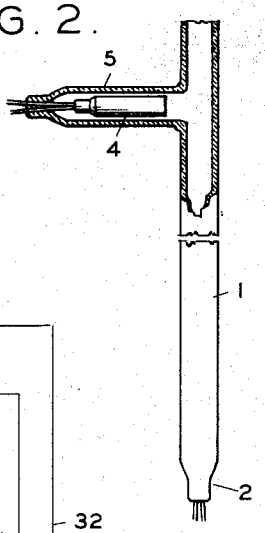


FIG. 4.

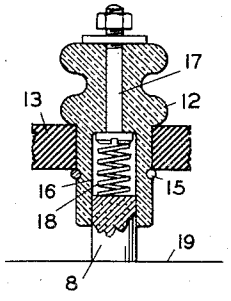
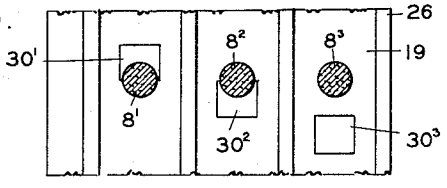


FIG. 3.



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Patented Aug. 1, 1939 2,167,750

UNITED STATES PATENT OFFICE

2,167,750

PERIODIC ROTARY SWITCH

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Application October 28, 1936, Serial No. 108,027

3 Claims. (Cl. 200—24)

This invention relates to improvements in periodic rotary switches and more particularly to means and methods for controlling animated signs of the luminescent type.

Among the objects of the invention is to restrict luminescence to a small segment of the length of the tube and then to progressively extend the luminescence throughout the length of the tube. This enables many novel and striking effects to be attained including the illusion of the act of writing.

Another object is to enable selective control of various portions of luminescent signs without requiring the function and expense of a separate transformer for each part which is separately controlled.

Another object is to directly control high voltage circuits without at any time breaking contacts carrying current at high potential. This enables ordinary low voltage switching equipment to be used since it is not required to guard against arcing.

Other objects and advantages appear as this description progresses.

In this specification and the accompanying drawing the invention is disclosed in its preferred form. It is to be understood, however, that the invention may be embodied in other forms without departing from the spirit of the invention as defined in the claims following the description.

In the one sheet of drawings:

Fig. 1 is a schematic diagram of a luminescent sign and its control circuits, the switching apparatus being shown in vertical section.

Fig. 2 is a fragmentary detail view partly in vertical section showing the arrangement of the electrodes in the luminescent tube.

Fig. 3 is a fragmentary horizontal section showing the operating sequence of the commutator segments.

Fig. 4 is a detail view in vertical section of one of the commutator brushes and its mounting.

In detail the construction illustrated in the drawing comprises the modified luminescent tube 1 filled with a fluorescing gas such as neon. The tube has the conventional terminal electrodes 2 and 3. This conventional glass tube is modified by a series of intermediate electrodes 4^1, 4^2 . . . 4^n arranged at spaced intervals and mounted as shown in Fig. 2. The protuberance 5 is fused on to the body of the tube 1 to form a recess for the electrode 4 which is adapted to discharge into the tube. The protuberance 5 should be placed on the back side of the tube 1 for concealment.

The terminal electrode 2 is connected to the secondary of the high potential transformer 6. The intermediate electrodes 4^1 . . . 4^n and the opposite terminal electrode 3 are connected by the conductors 7 to the brushes 8^1 . . . 8^n and 9. The opposite side of the secondary of the transformer 6 is connected to the brush 10 by the conductor 11.

The brushes 8^1 . . . 8^n, 9 and 10 are contained in the insulators 12, see Fig. 4 which extend through the non-conducting cover 13 of the switch box 14. The insulators are fixed in the cover 12 by the encircling spring clip 15. The brushes are slidable in the central recesses 16 in the insulators 12. The binding posts 17 extend from the recesses 16 through the tops of the insulators. The springs 18 electrically connect the brushes to the binding posts 17 and urge the brushes outward into yielding contact with the commutator 19.

The commutator is rotatably mounted within the box 13 in the bearings 20 and 21. It is driven at predetermined speed by the electric motor 22 through the reduction gear unit 23 and the spur gears 24 and 25. The surface of the commutator is of non-conducting material. It has the series of insulating flanges 26 which project between the brushes 8^1 . . . 8^n, 9 and 10.

The brush 10 is in continuous contact with the ring 27 which is connected by the conductor 28 to the segment 29 cooperating with the brush 9. The conductor 28 also interconnects the short segments 30^1, 30^2 . . . 30^n which are arranged on the commutator in staggered relation.

The low voltage primary of the transformer 6 is connected in series by the conductors 31, 32 to the brushes 33, 34 which engage the commutator 19. The brush 34 bears against the continuous ring 35 which is connected by the conductor 36 to the segment 37 cooperating with the brush 33.

The switch box 13 may be filled with switch oil up to the level x if desired but this is not essential.

The invention operates substantially as follows: The primary of the transformer 6 is energized when the rotation of the commutator 19 brings the beginning of the segment 37 into contact with the brush 33. This completes a circuit through the conductor 31, the primary of the transformer 6, the source G of low voltage current, and back through the conductor 32 to the brush 34. At substantially the same time, the

short segment 30^2 is brought into contact with the brush 8^1. This completes a circuit through the conductor 7, the electrodes 4^1, 2, the secondary of the transformer 6, the conductor 11, the brush 10, the ring 27 and the interconnecting conductor 28. The discharge between the electrodes 4^1, 2 produces luminescence in the segment A of the tube 1.

Before the segment 30^1 passes from contact with the brush 8^1, the segment 30^2 is brought into contact with the brush 8^2, see Fig. 3. A circuit similar to that through the electrode 4^1 is then completed through the electrode 4^2. However, current does not commence to flow because of the higher resistance.

When the segment 30^1 passes from contact with the brush 8^1, the circuit through the electrode 4^1 is interrupted and the current forced to take the longer circuit through the brush 8^2. A discharge takes place between the electrodes 4^2 and 2 causing the segment AB of the tube 1 to luminesce. The current flowing through the circuit is in the order of a few milliamperes so that the iR drop in the short distance between the electrodes 4^1 and 4^2 is very low. The potential difference in the mesh including the brush 8^2, the electrode 4^2, and the terminal electrode 2 is very little higher than the potential difference in the mesh including the 8^1 and the electrodes 4^1, 2. The transfer of the current to the mesh including the electrode 4^2 by the breaking of the contact between the brush 8^1 and the segment 30^1 thus does not involve the material raising of the potential of the current flowing through the network. For this reason arcing is negligible.

The commutator next brings the segment 30^3 into contact with the brush 8^3, the segment 30^2 then passing out of contact with its cooperating brush. The continued rotation of the commutator 19 brings the segments 30^n seriatim into contact with their respective brushes 8^n and thus progressively extending the luminescent area of the tube 1. This produces a striking simulation of the progressive act of writing, the luminescent area seeming to flow from an invisible pen. Finally the segment 29 contacts its brush 9 and the whole tube is rendered luminescent between the electrodes 2 and 3. The segment 29 is relatively long so as to continue the luminescence of the tube for as long a period as desired.

The discharge in the tube 1 is discontinued when the end of the segment 37 passes from contact with the brush 33. This interrupts the circuit through the primary of the transformer 6. This accomplishes cessation of the flow of current without physical breaking of the high potential circuit.

A succeeding cycle of operation is initiated when the beginning of the segment 37 is again brought into contact with the brush 33.

The mode of operation for progressively lighting consecutive segments of the luminescent tube has been described in detail above. The invention is not limited to this particular order in lighting the tube. The segment first rendered luminescent may be in the center of the tube and the area of luminescence extended from each side thereof by suitable arrangement of the segments on the commutator 19. Various artistic effects may also be secured by beginning the luminescence at several points in the tube by selectively illuminating separated segments thereof. Breaking of the secondary circuit is avoided by shunting the current to other electrodes when it is desired to discontinue the discharge between two given electrodes.

The length of the tube is limited only by the maximum wattage of the transformer. An entire sign may be operated by a single transformer of adequate size with animation effects controlled by the present means.

Having thus described this invention, what is claimed and desired to secure by Letters Patent is as follows:

1. In a multiple rotary switch, a revolvable drum, a primary contact band arranged peripherally thereon and a plurality of secondary contacts arranged spirally on the drum, the first one of the secondary contacts being alined with the beginning of the primary contact band and the last one of the secondary contacts extending peripherally beyond the primary contact band.

2. In a multiple rotary switch, a revolvable drum, a primary contact band arranged peripherally thereon, and a plurality of secondary contacts arranged spirally on the drum and forming a part of a secondary circuit, and an alined series of stationary contacts arranged for coaction with the primary and secondary contacts, the peripheral spacing between the secondary contacts being less than the thickness of the stationary contacts, thus causing the secondary circuit to remain closed during shifting from one contact to another.

3. In a multiple rotary switch, a revolvable drum, a primary contact band arranged peripherally thereon, and a plurality of secondary contacts arranged spirally on the drum and forming a part of a secondary circuit, and an alined series of stationary contacts arranged for coaction with the primary and secondary contacts, the peripheral spacing between the secondary contacts being less than the thickness of the stationary contacts, thus causing the secondary circuit to remain closed during shifting from one contact to another, and the last secondary contact extending around the drum further than the primary band, whereby a primary circuit which includes the primary contact band is made to open in advance of the secondary circuit for eliminating arcing.

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