

June 26, 1951

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2,558,412

MULTIPLE CONTACT SWITCH CONSTRUCTION

Filed Oct. 22, 1948

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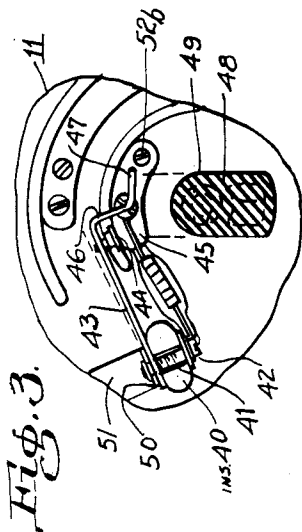
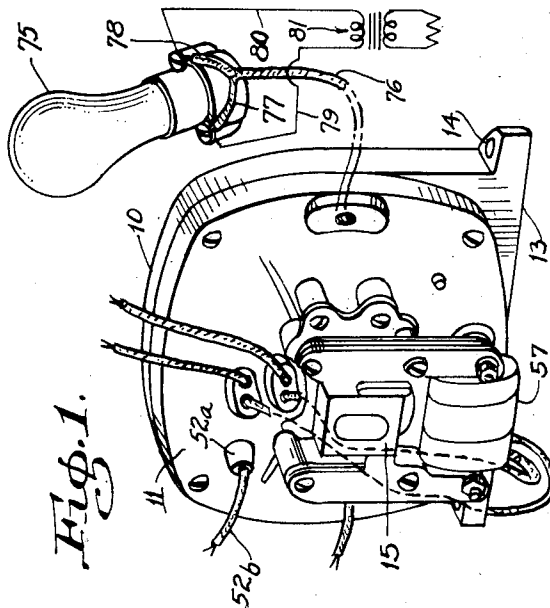
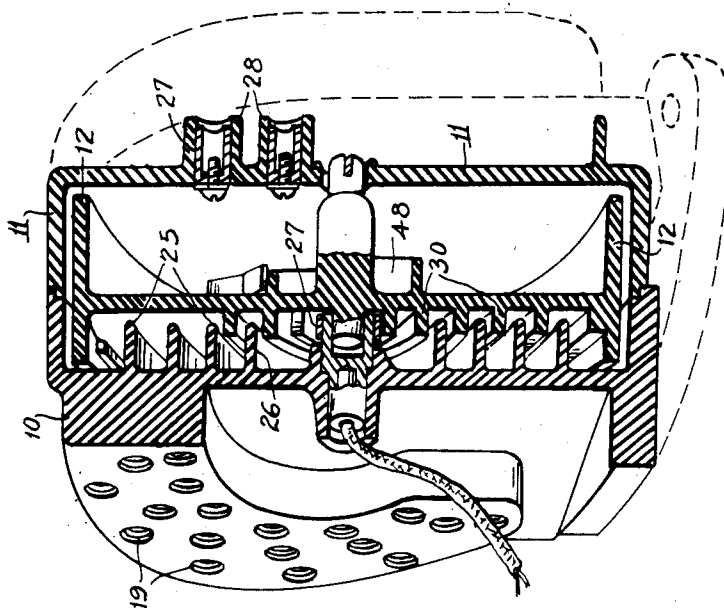


Fig. 2.



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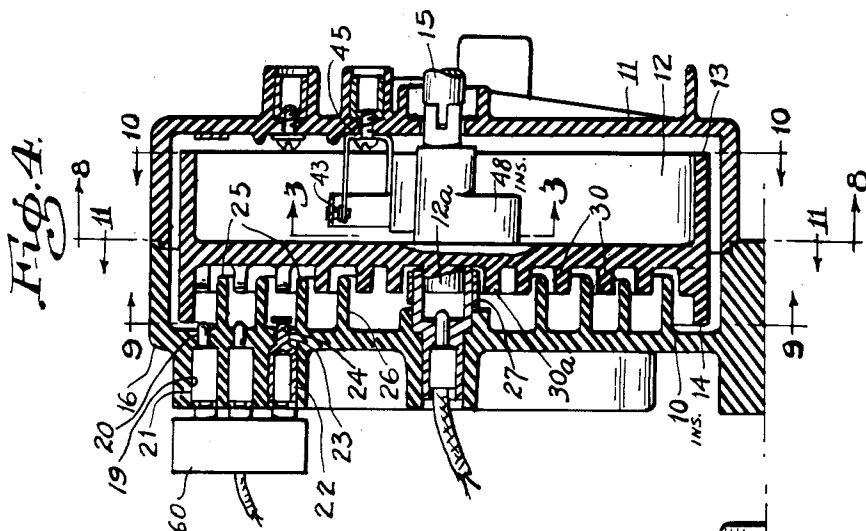
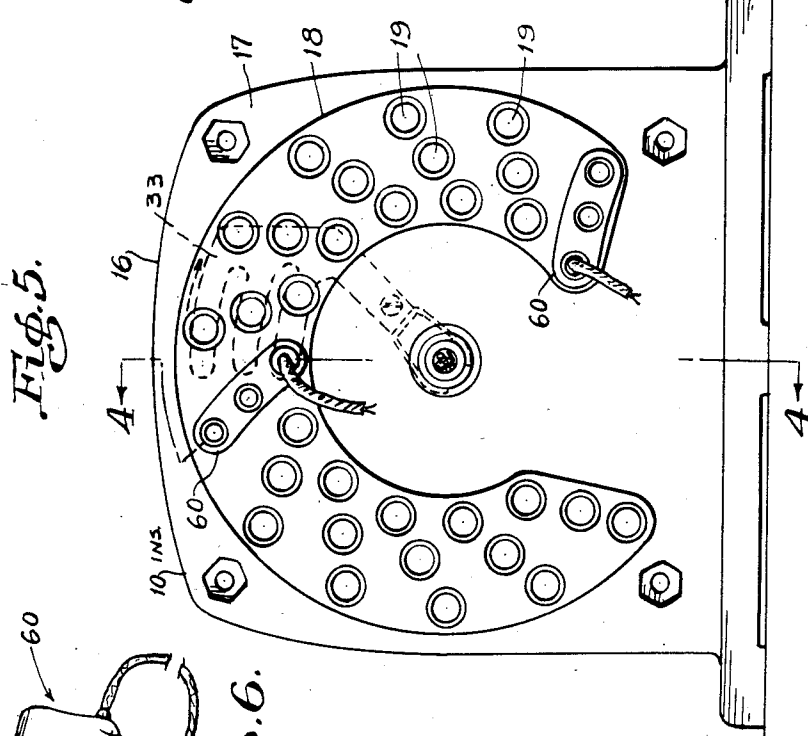
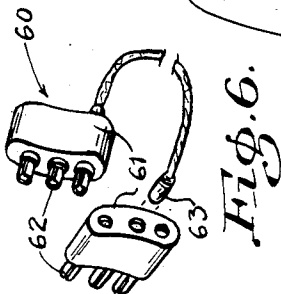
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4 Sheets-Sheet 2



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MULTIPLE CONTACT SWITCH CONSTRUCTION

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Fig. 8.

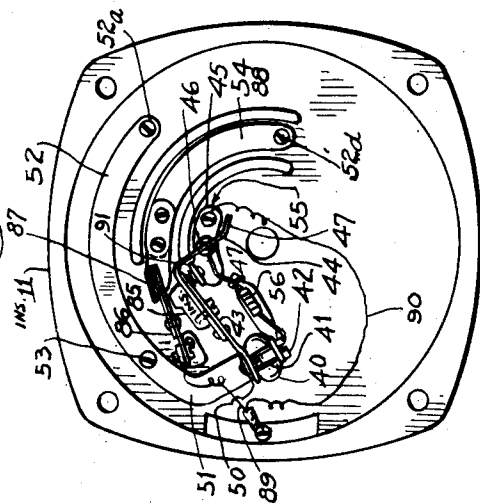


Fig. 7.

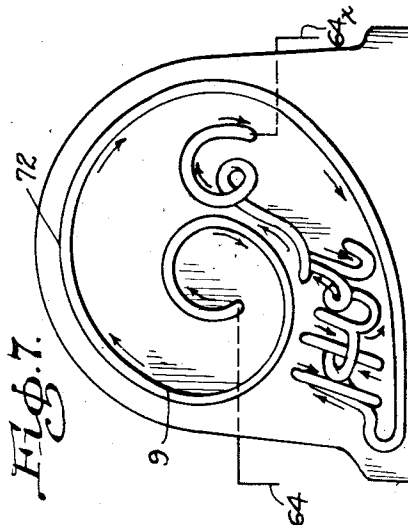


Fig. 9.

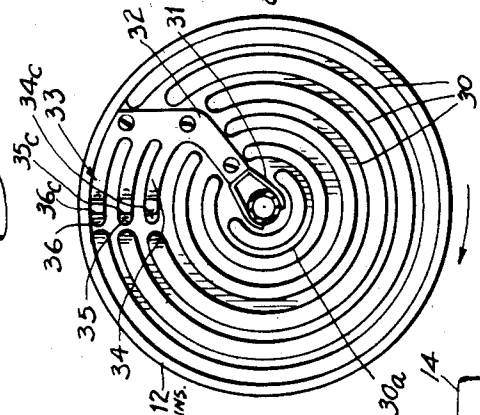


Fig. 10.

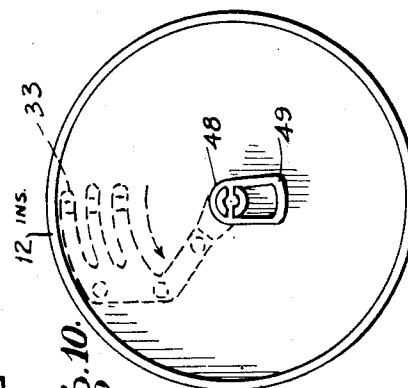


Fig. 11.

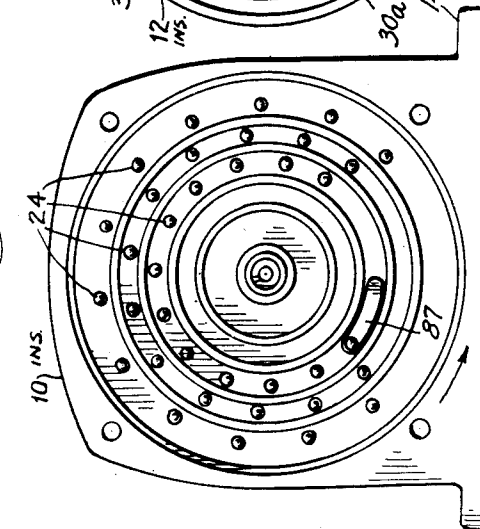
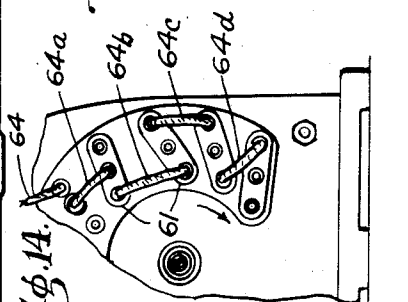


Fig. 14.



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Fig. 12.

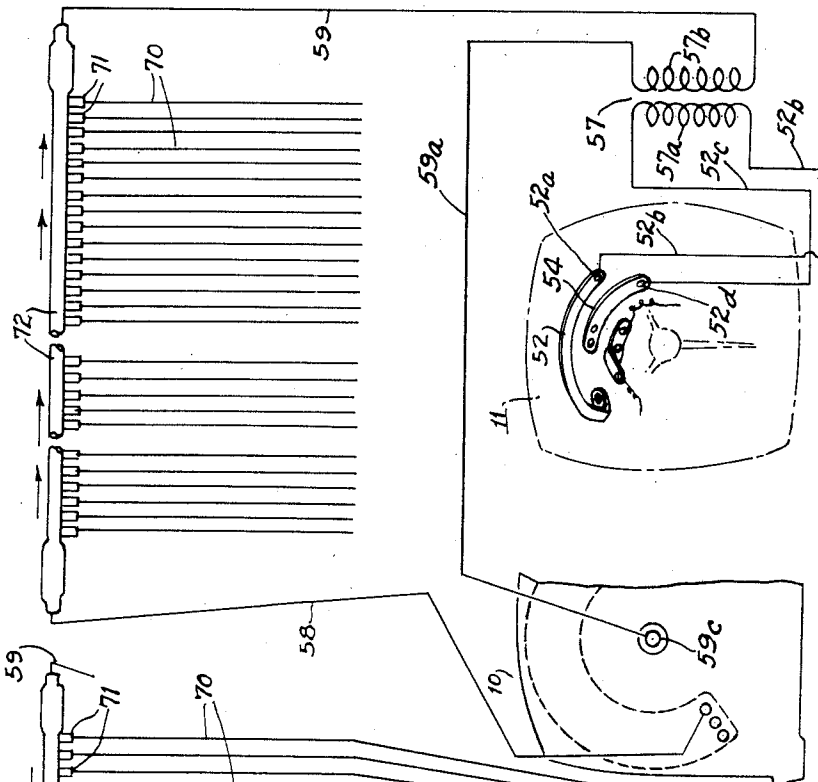
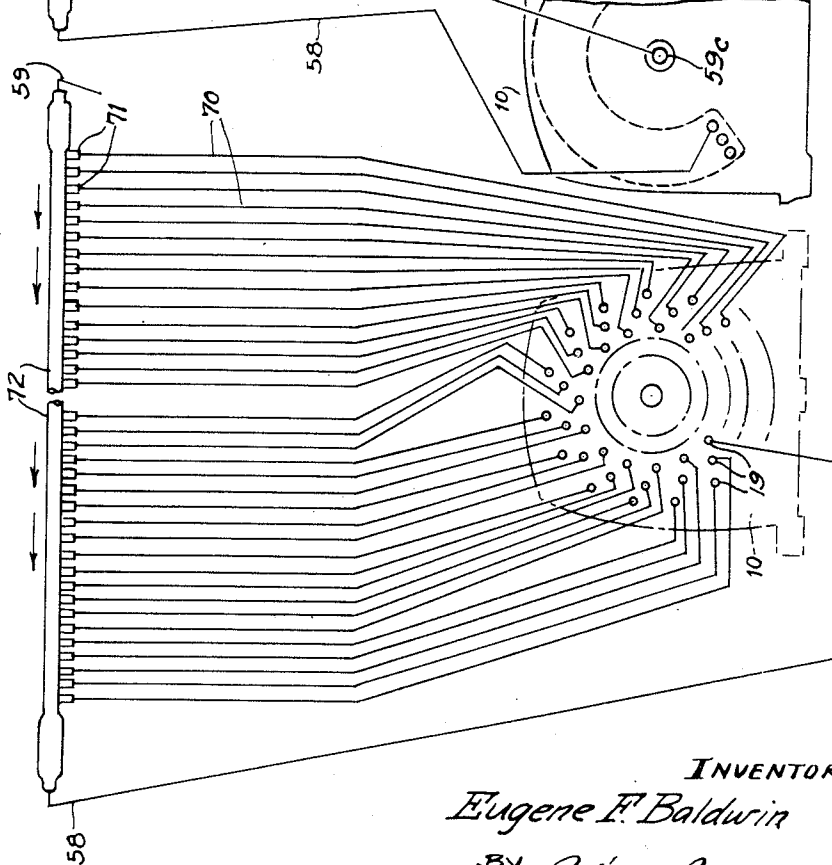


Fig. 13.



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MULTIPLE CONTACT SWITCH
CONSTRUCTION

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5 Claims. (Cl. 200—11)

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This invention relates to a multiple circuit and multiple contact, high and low tension electrical switch assembly.

This invention is particularly well adapted for use to provide for and automatically control the progressive illumination of neon signs, whether this involves "spelling" the words of a sign or the progressive illumination of pictorial matter.

Accordingly, it is an object of this invention to simplify a multiple contact switch construction so that it constitutes an electro-mechanical device easy to install and constructed efficiently to serve the purpose intended, and a device that will readily lend itself to large scale, low cost manufacture when embodied in a high dielectric plastic or insulating molded material, so that the device can be rapidly produced on a large scale.

It is a further object of the invention to construct an electric device of the above stated character in a more compact manner, making the size thereof smaller than has hitherto been deemed necessary, thus well adapting the device for more convenient installation in portable plug-in types of signs as well as for installation in connection with larger outdoor types of signs, in each instance adequate high voltage capacity being combined with a sufficient number of plug-ins leading to different points along the tubing of the sign to secure commercially adequate illuminated effects from each cycle of a single rotor brush structure which is provided to serve the complete apparatus.

Among other objects of the present invention are: to provide a sign illuminating means of the above stated character wherein only a single transformer will be required to perform the work for which a considerable number of transformers has hitherto been required; to provide a simplified mode of assembly for the apparatus; to provide a simplified, more compactly constructed housing structure and mounting means for the electrical means and motor, and its adjuncts.

A composite result of these advantages has been accomplished by producing a device which has no exposed exterior electrical conductors, all metal electrical parts being enclosed within a housing structure provided for them; and the rotor within the completed structure being so designed as to serve a dual purpose, namely, functioning as an insulative shield between the low and high tension circuits; together with providing means for opening and closing the primary circuits on one side and for the application and handling of the high tension circuit from the opposite side. This latter feature safeguards

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against too close electric potentials and on the secondary side telescopic intervening ridges are provided to prevent arcing from contacts to center main line secondary feeder current if the apparatus is operated under an excessively high tension load resistance.

Still another object of the invention is to provide a multiple contact switch for the purpose stated which will more effectively prevent the nuisance of line feed-back or electrical radiation that will produce radio interference noises, or one in which, if such noises are not entirely suppressed, that they may easily be remedied by the use of simple low-cost standard equipment designed for the purpose.

In addition to the foregoing objects and advantages, it remains to be pointed out that this device is equipped with a commercially feasible switch made more valuable by reason of being adjustable to a wide range of undertermined specific applications. With a view to putting into effect this last improved feature, an effective and simply applied "bridging" arrangement is provided which is applied to the exterior of the apparatus when required to hold the circuit or illumination on if the secondary connections to the unit are not all used up; or, for holding on of preceding illuminated tube sections to emphasize the message before proceeding to additional progressively illuminated tube sections; and, which is also essential to prevent arcing which would otherwise occur if tubing has insufficient intermediate electrodes. These bridges are designed to fit the unused rows of unused contacts, and are simply blocked in the conform with whatever effect is desired, or to meet an otherwise inoperable condition. If more than one bridge is desired or required, they are serially connected to each other by means of flexible plug-in jumpers.

Fig. 1 is a rear-primary exterior perspective view of a preferred form of switch casing which houses an internal rotor and affords a mounting means for the multiple primary contacts of the apparatus, the casing of the motor, which operates the selector mechanism, being included in the view and appearing in the portion thereof nearest to the observer.

Fig. 2 is a partly sectional and partly secondary exterior perspective view of the structure shown in Fig. 1, except that the motor and its adjuncts are omitted. The scale is enlarged and the plane of section is vertical and through the central portion of the structure.

Fig. 3 is a modified sectional detail, reproducing on an enlarged scale the means shown in Fig. 8

for dual action open-close (break-make) arrangement when the primary circuit is opened and sign is dark, the auxiliary "make" circuit is utilized as in Fig. 1.

Fig. 4 is a vertical midsection on section-indicating line 4—4 of Fig. 5.

Fig. 5 is a front face view of the device illustrating the use of a contact-bridging device.

Fig. 6 is a perspective view of one of the bridge members.

Fig. 7 is a detail of a neon electrode sign as connected to my device, said sign being exemplary of many different forms thereof.

Fig. 8 is an inner face view of the rear cover (directed toward the observer in Fig. 1) of the casing, showing the modified detail referred to in Fig. 3.

Fig. 9 is a face view of the secondary side of the interior rotor, looking at said rotor from the plane indicated by line 9—9 on Fig. 4. The triple finger secondary brush appears in this view.

Fig. 10 is a view of the rotor shown in Fig. 9 viewing said rotor from the opposite side, the phantom secondary brush being shown by broken lines.

Fig. 11 is an inside face view of the secondary cover section of the casing as suggested by line 1 of Fig. 4, the elements shown in Figs. 9 and 10 being omitted.

Figs. 12 and 13 are wiring diagrams.

Fig. 14 is a view of a modification of Fig. 5, showing bridge connecting means.

The multiple contact, high tension switch structure disclosed in the drawings electrically connected with the sign tube 9, is shown mounted upon and within a casing or housing made of insulating or dielectric material and which comprises a front section 10 and rear section 11, each of these sections being interiorly recessed in relation to the other, so that space is provided between them in which is mounted a circular dielectric rotor 12. Said front section 10 has a downwardly directed basal portion 13 provided with a foot flange 14 suitably apertured at each end to receive bolts or other attaching means for securing the device to a suitable support. Said rotor is driven by an electric motor 15, mounted upon the rear side of the housing structure.

A multiplicity of circular recesses or receptacles designated 19 (or 19 plus a lower case letter) are arranged in arcuate rows in the boss 18 of front section 10 and extend through the thickness of said boss. In axial alinement with each of said receptacles 19, a diametrically reduced circular hole 20 leads through the remainder of the thickness of the aforesaid housing section 10 and opens into the space defined by the housing sections. A hollow metallic secondary conduit or tap-off socket member 21 occupies each of said receptacles and alined holes 20, said tap-off socket members each having a tubular end portion 22 which fits within the recesses and diametrically reduced solid end portions 23 which fit closely into the accompanying holes 20. The latter are provided with rounded, projecting contact ends 24. In this way there is formed a multiplicity of female plug-in terminals arranged throughout an approximate horseshoe-shaped raised area. The terminals are arranged in sets of three of which there is one in each arcuate row immediately adjacent to a terminal in the next row, the sets of terminals being arranged along lines that are tangent to a circle concentric to the axis of rotor 12. On the opposite or inner face of said housing section 10 is provided a series of concentric circular

ribs 25 which separate from each other the aforesaid partly circular rows of conducting elements 22 and 23. In addition to these ribs, shown as three in number, an inner concentric rib 26 is provided, centrally of which is located a hollow current-supplying terminal 27, which also functions as a bearing member for a rotor 12, as will presently be explained.

Said rotor 12 is so constructed and positioned as to cooperate functionally with the structure which has just been described. Accordingly one side of said rotor is provided with a central stud 12a which has rotational fit the aforesaid hollow terminal 27, thus affording a bearing for one side of said rotor. As an additional safeguard against arcing, that face of said rotor which carries said stud 12a is provided with a concentric series of ribs 30, there being one of these ribs between each of the adjacent aforesaid ribs 25 and 26 of the housing member 10. The inner one of these ribs, designated 30a, is made semicircular so as to provide, at one side, room for a two-armed leaf spring contact 31 the arms of which continuously conductively grip between them the aforesaid terminal 27. Said contact 31 is integral with an arm 32 of a brush 33 having three spring arms 34, 35 and 36 that are radially arranged, respectively carrying contacts 34c, 35c and 36c. Segments of said ribs 30 are shown cut away in order to provide room for the different parts of said contact brush 33.

The free end portions of said contact arms 34, 35 and 36 spring out into continuous contact with a plurality of the aforementioned rounded ends 24 of the stationary contacts 23 during all the time it is desired to illuminate the sign. It is desirable, however, that a dark period (as to exterior illumination of the sign) occur between each cycle of progressive sign illumination, and the means for causing this to occur will next be described.

Looking at the interior of the front housing section 10 (Fig. 8) there is seen a mounting stud 40 of insulating material having a slot 41 across its upper end to receive a screw 42. Said screw serves to secure, to one side of said stud, a resilient switch arm 43, said spring arm being so tensioned that, adjacent to its free end, it normally engages the outer end portion of a contact finger 44 upstanding from the inner face of the housing member 10, said finger having a foot portion 45 attached to said housing member by screws or otherwise.

Said switch arm 43 has an angularly bent free end portion 46 which terminates in a deflected lip 47 positioned to be acted upon, at each revolution of the rotor 12, by a cam arm 48 carried by the rotor near its center. Said cam arm is a lateral extension of the foot portion of a control stud 49, said stud projecting centrally from that face of the rotor which is directed toward the front housing section 10.

The aforesaid resilient switch arm 43 is electrically continuous with the upstanding arm 50 of an L-shaped metallic strip having a foot portion 51 provided with an arcuate tail 52 which is shown attached by screws 53 to the inner face of the rear housing section 11. With said tail 52 cooperate an intermediate arcuate conducting strip 54 and an inner short conducting strip 55 (see Fig. 8). From the outer end of said tail 52 leads an electrical connection 52a, through the wall of the rear housing section 11, thence through wire 52b to the primary coil 57a of a transformer 57. From the opposite end of said

coil 57a the current passes through a wire 52c to an electrical connection 52d in circuit with the aforesaid short conducting strip 54. When the resilient switch arm 43 is open, the current is shunted through a resistance 56 and so reduced in the primary coil 57a of the transformer that nominal induction to the secondary coil 57b exists and is of inadequate voltage to illuminate the tubing of a sign. The secondary coil 57b of the transformer has one end connected at 59 to one end of tubing 72 of a neon sign and its opposite end connected by a wire 59a to the circuit-completing terminal 59c.

The shunted resistance 56 cushions the full load impact (make and break) of the circuit to the transformer primary coil making for longer life.

If the shunted resistance extends with leads to the outside and consists of incandescent light bulbs, the energy thereby shunted may be utilized in form of glow-light or other signal effects while tubing on sign is at "dark" period. The capacity of the shunt resistance should not exceed approximately 15 per cent of the primary coil capacity of transformer.

In Fig. 6 is shown a typical jumper bridge 60, one or more of which may be used to increase the range of illuminated sign effects when a sign does not contain sufficient letters or tubing electrodes to require using the entire number of socket terminal plug-in points 22. In such cases these triple inlet-outlet bridges 60 are used in order to complete the necessary internal secondary circuit. A typical bridge member 60 consists of paired twin bridge members 61 and is provided with three plug-in projections or fingers 62, each said finger being shown as a longitudinally split prong. Said bridge members 61 are united by means of a flexible detachable connector 63.

As many of the aforesaid bridges are used as are required to complete the unused secondary tap-off secondary socket terminal groups on the control assembly. When more than one bridge is required, each bridge is then series connected to the next succeeding bridge by means of the flexible detachable connector 63 furnished with each, until the last bridge is plugged in. Thus the illumination of the tube or sign is held on until the rotor 12 has reached the final stage of each cycle.

The flexible terminal lead of the last bridge, if not used, is pulled out inasmuch as this last bridge has completed the circuit to the end of the cycle resulting from a complete rotation of said rotor.

Use of these bridges provides a wide, flexible range of illuminated tube effects, by applying them where desired (always to the last master electrode of a tube section) to prolong preceding illumination, then straight socket terminal wiring to additional tubing (an aforesaid detachable connector being tied to the preceding tube section) for additional pick-up illumination and again holding to the end.

Fig. 14 illustrates the use of a connected series of the aforesaid bridges, such as is required when the apparatus is hooked up to a sign a good deal shorter than is required to use up all the terminals of the horseshoe-shaped arrangement shown in Fig. 11, and it is desired to illuminate such a sign without any long dark period occurring between cycles. To accomplish this when the contact supplied by the lead 64 of Fig. 14, supplies the terminal part 64x of the short sign

shown in Fig. 7, the current is passed through the series of leads 64a, 64b, 64c and 64d, which connect the already described bridges 61 (see Fig. 6). When the gap in the horseshoe shaped arrangement of the contacts is first reached by the three-armed brush 33 (see Fig. 9), the current will pass through all the leads and bridges shown in Fig. 14, and will then progressively pass through a lesser number of the leads until finally it will pass through only the lead 64d.

In the wiring diagram shown in Fig. 13 an assembly of current output wires 70 is shown, one end of each wire being plugged into its proper secondary socket of the series 19 shown in Fig. 5, the opposite end of each wire being connected with the proper terminal of the row of terminals 71 of the sign or tube 72. These wires are all connected up in a proper sequence at both ends, so that, under the automatic control of the revolving rotor 12, they progressively spell out words, letter by letter, from one end of the sign to its opposite end; or else, progressively illuminate the sign tube in other ways, according to the structure of the sign. A conventional number in small type should be inscribed next to each contact socket 19 of Fig. 5 and a corresponding number inscribed next to the tube terminals 71, to aid the operator in making the hook-up with the sign.

By comparing Figs. 5 and 13 it will be seen that the plug-in receptacles 19 for the wires 70 are arranged in rows of three, said rows extending transversely of the horseshoe shaped raised area which they occupy and each row being inclined rather than radial, in relation to the length of said horseshoe shaped area. This arrangement of the plug-receiving receptacles is provided in order that the radially aligned switch contacts 34c, 35c and 36c may engage the stationary contacts 24, with which they cooperate, in a proper sequence. This part of the device is so constructed that current will be continuously supplied to the sign resulting in a continuous illumination of the latter, until the moving switch contact arms reach the gap represented by the space between the outer ends of the limbs of the horseshoe shaped contact carrying area. Thus continuous illumination of the sign during the travel of the triple contact brush 33 over the stationary contacts 24 carried by the horseshoe-shaped area, results from the fact that the outermost of the three fingers of the brush will have advanced to the next stationary contact before the middle finger of the brush has left the contact with which it is in engagement.

During the illumination of the sign by the secondary electric current, the current is supplied to the sign with sufficient voltage to cause the gas in each increment of the sign tubing between terminals 71 to ionize with resultant radiant illumination. As the rotor continues to turn and the three-armed secondary brush is advanced thereby, the three fingers of said brush flex slightly upon touching and leaving the raised contacts with which they cooperate, the flexion of said fingers being only enough to allow for sufficient electrical circuit conduction. This flexion is so small that only a slight power is required to produce it, said brush fingers being so designed and positioned in relation to the raised contacts with which they cooperate that they sweep over said contacts with only a minute flexion action, and are not permitted to touch or scrape the insulating material. Otherwise metallic deposits would accumulate upon said insulating material

and develop into electrical conductors which would cause short circuits together with deterioration of the insulating material.

In the wiring diagram of Fig. 12 is shown the means for automatically eliminating the preceding progressively illuminated tubing on the sign and means for utilizing primary circuit energy for auxiliary illumination of the sign at what would otherwise be a "dark" period, that is to say, during the gap between the output of the secondary outlets, indicated by the gap shown between out-put terminals in the lower portion of Fig. 13. When the three-armed brush 33 reaches the aforementioned gap at the open side of the horseshoe-shaped area, the resilient switch arm 43 (see Fig. 8) is acted upon by the cam 49 (see Fig. 10) thus shunting the transformer primary circuit through an incandescent light resistance 75 (Fig. 1) externally substituted for resistance 56 (Fig. 8) with conductor leads secured to 42 and 55 and thereby causing the tubing 72 to be unilluminated but glow-light radiation from the conventional electric lamp may be thrown upon the sign from any vantage point desired. Also, it may be desired, throughout this same "glow" or "dark" period, to have full supply line potential electrical energy available for maximum lamp globe light radiation or for other electric power purposes supplied through cord 76 containing the two leads 77 and 78, these leads respectively passing the current through the leads 79 and 80 of a transformer 81 or to such other devices for which full load energy is desired.

The switch mechanism whereby the rotor 12 controls the illumination of the aforesaid lamp 75, will now be described. Regarding Figs. 3 and 8, the structure shown in the former view is a modification, but has been described first because of being simpler than that shown on the latter view. The structure shown in Fig. 8 contains parts which are duplicated in Fig. 3, and which are, therefore lettered the same in both these views. In addition, in Fig. 8 a piece of insulating material 85 is shown attached to the back side of the primary switch arm 43 to engage a secondary resilient switch arm 86 and cause the latter arm, when closed, to engage a contact post 87 carried by and in electrical connection with arcuate conducting plate 54, current being conducted to the opposite end of said arm 86 by a wire 89, which is continuous with one of the wires of the lamp cord 76 of Fig. 1. On the opposite side of this circuit is a wire 90 which is continuous with the other wire of said lamp cord 76. Said wire 90 leads from said lamp cord to the short conducting plate 55 of Fig. 8, said plate 55, in turn, being electrically continuous with an upstanding contact post 91 which is electrically contacted by the aforesaid resilient switch arm 43, except when the lip 47 of said arm is being acted upon by the cam 48 (see Fig. 4), carried by the rotor.

By the foregoing arrangement, means is provided for using the light of a conventional lamp globe for illumination on the sign at the otherwise "dark" period. Also, it is desirable to provide for use of the electric lamp, as aforesaid, in order to safeguard against the sign remaining permanently dark in event the electric circuit to the gaseous tubing, or the tubing itself on the sign becoming accidentally broken.

In Fig. 11 the final extended segmental contact of the inner row of contacts 24 is shown provided with an extension 87 positioned to prolong the current cycle (illumination in tubing) for a

period after complete illumination of the sign, it being understood that during this prolonged period the transformer 57 reduces the voltage, so that when the inner finger 34c of the switch arm 32 leaves said extension 87, no injurious arcing results.

I claim:

1. A switch unit comprising a two-section hollow dielectric housing having a substantially circular interior space, a dielectric rotor in said space and having a transverse wall dividing said space into two parts, one housing section having a wall provided with an outwardly extending horseshoe-shaped boss, a plural series of arcuately arranged contacts extending through said boss, a current-conducting brush mounted to rotate with the rotor and having a spring arm for successive electrical engagement with the contacts of each respective series thereof, circular ribs on the housing section having the boss and concentrically arranged about the center of rotation of the rotor and brush and extending into the space part that is defined between said one housing section and the transverse wall of the rotor, said ribs constituting barriers preventing arcing between the contacts of one series and those of an adjacent series, and circular concentric ribs on the transverse wall of the rotor and extending into interlacing relationship with the ribs on the housing section, the ribs on the rotor being interrupted to provide a space in which the brush resides.

2. A switch unit according to claim 1: the plural series of contacts being arranged in sets in which one contact of each series is immediately adjacent to a contact in the next series, said sets of contacts being arranged along lines tangent to a circle concentric to the axis of the rotor, the contact-engaging portions of the spring arms of the brush being arranged radial to said axis.

3. The combination with a switch unit according to claim 1, of jumper bridge means to electrically connect at least one contact of each series of contacts of said unit, said jumper bridge means comprising electrically connected prongs engageable with said contacts from the outside of the housing section mounting said contacts.

4. A switch unit comprising a two-section hollow dielectric housing having a substantially circular interior space, a dielectric rotor in said space and having a transverse wall dividing said space into two parts, one housing section having a wall provided with an outwardly extending horseshoe-shaped boss, a plural series of arcuately arranged contacts extending through said boss, a current-conducting brush mounted to rotate with the rotor and having a spring arm for successive electrical engagement with the contacts of each respective series thereof, circular ribs on the housing section having the boss and concentrically arranged about the center of rotation of the rotor and brush and extending into the space part that is defined between said one housing section and the transverse wall of the rotor, said ribs constituting barriers preventing arcing between the contacts of one series and those of an adjacent series, circular concentric ribs on the transverse wall of the rotor and extending into interlacing relationship with the ribs on the housing section, the ribs on the rotor being interrupted to provide a space in which the brush resides, said series of contacts and brush constituting a secondary high tension circuit means, and primary circuit make and break

elements carried by the other housing section in the other space part, said rotor embodying a cam to control the operation of the primary circuit elements, the mentioned transverse wall of the rotor constituting a dielectric barrier isolating the primary and secondary circuits of said switch unit.

5. In a multiple contact switch structure of the kind described, a housing of insulating material comprising a front section and a rear section, each of said sections being internally recessed in relation to the other so that a space is provided between them, a dielectric rotor mounted within said space, the front housing section having a front wall provided with a plurality of passages therethrough, said passages being in concentric rows which are distributed throughout a horse-shoe-shaped area of said front wall thus providing a space at one side of such area which is free of passages, a contact in each passage, a resilient switch arm mounted upon the front face of said

rotor, said switch arm having a circumferentially elongated contact finger for each row of contacts, each of said fingers carrying a contact part at its free end arranged successively to engage the contacts of the aforementioned rows of contacts, and jumper bridge contact means comprising electrically connected prongs for short-circuiting certain of the contacts of the several rows thereof, as desired, said prongs being connectable to the contacts from the outside of the housing.

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The following references are of record in the file of this patent:

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