

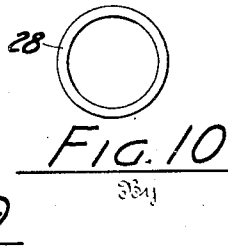
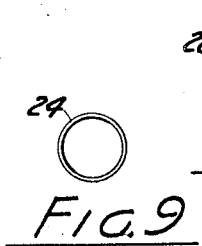
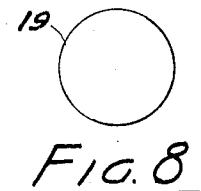
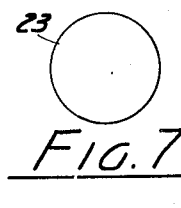
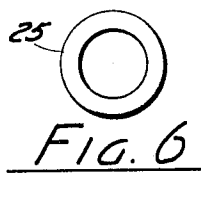
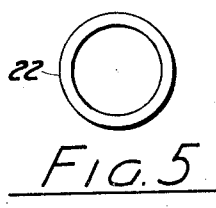
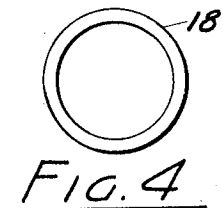
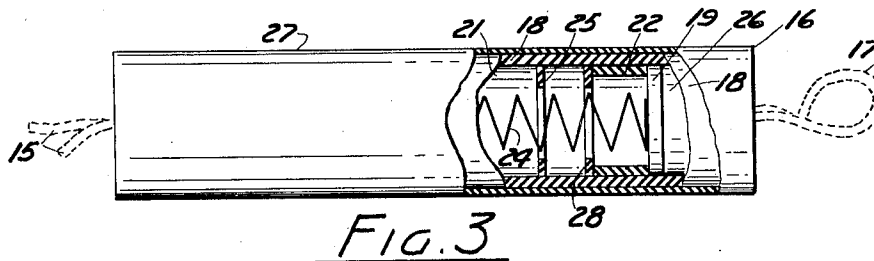
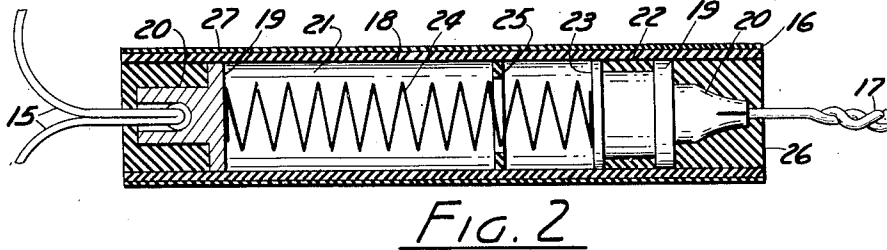
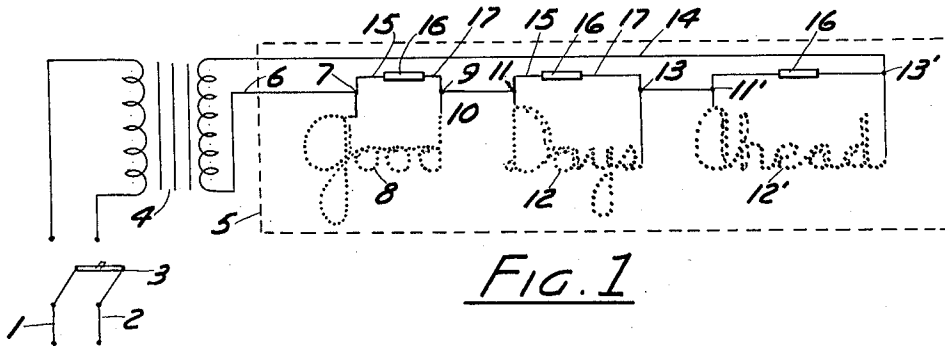
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2,474,600

SHUNT CONTROL UNIT

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SHUNT CONTROL UNIT

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4 Claims. (Cl. 200-118)

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This invention relates to residual circuit maintenance for luminous vapor tube sections in series. This circuit maintenance is effected thru automatic by-passing of a defective section.

This invention has utility when incorporated in fluorescent lighting equipment, more particularly vapor tube signs of the so-called neon type, wherein the voltage is usually in the range of seventy-five hundred to fifteen thousand and the amperage for the current consumption in the range of three milliamperes per section. With this equipment, a usual practice is for a step-up transformer in proximity thereto, and the cut-in switch therefor in the primary circuit to the transformer. Accordingly, upon failure of a section of the sign tubing, wherein the sections are in series, the secondary circuit from the transformer is open, with no load, notwithstanding sixty cycle alternating current supply be still surging as to the transformer core. The practice usually places the sign sections in ranges of twenty to thirty foot lengths for the tubing, and in series of two or more. The inventors herein have made provision for an automatic taking-on of a residual sign section or sections, at once upon the failure of a section in series therewith. Upon a sign section failure, the in-parallel thoroly insulating control unit herein, may by-pass the inert section, and the transformer secondary circuit is thereby closed.

Referring to the drawings:

Fig. 1 is a wiring diagram of an embodiment of the invention;

Fig. 2 is an enlarged view in longitudinal section of a unit;

Fig. 3 is a partially broken away unit at by-passing control;

Fig. 4 is an end elevation of the main housing insulation tube;

Fig. 5 is an end elevation of the spacer insulation tube;

Fig. 6 is a side elevation of spring centering insulation ring;

Fig. 7 is fusible insulation disk initially holding the spring;

Fig. 8 is a view of the spring facing end of a terminal;

Fig. 9 is an end view of the spring; and

Fig. 10 is a side elevation of the residual ring from which its central portion of Fig. 7 has been removed by the control operation.

In an electric sign installation, electric current supply may be from lines 1, 2, say as sixty cycle one hundred fifteen volts. While in some instances there may be clock, or photoelectric cell

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control, in other instances a manual switch 3 may cut in the power supply to a step-up transformer 4. This step up may be to seventy-five hundred volts, or to fifteen thousand volts, for a sign 5, with a line 6 to a high tension insulation terminal 7 for a neon tube section 8, say 23' long to a terminal 9. To connect in series therewith, a line 10 from the terminal 9 is to a terminal 11 where a second vapor tube, fluorescent light or neon sign section 12, of say 26' in length, is to a terminal 13, with a lead line 14 connected back therefrom in completing the secondary circuit from the transformer 4. Display sign operations have problems arising at times of tube section failures. These arise from various causes, such as tube fracture, terminal trouble, as well as vapor exhaustion. When these occur to cause darkening of such section of the sign, with the sections in series, the entire sign is out and the trouble is primarily diagnosed as the whole sign being wrong. Of course, the trouble shooter will come to check up, and may put in a bridging connection to by-pass the defective section, whether or not such be removed for curing.

Under the invention herein, the trouble-causing sign section is automatically by-passed, with the remaining sections functioning as normally. Accordingly, in setting up the display sign, at the terminal 7, conductor leads 15 extend to a control unit 16, with flexible conductor leads 17 therefrom to the terminal 9. While the unit 16 is in parallel with the sign section 8, in fact, it is non-current carrying. It may be termed an insulation link 16. The action is, that at once the section 8 be defective, whether during service, or upon cutting in of the sign, the transformer 4 has its full voltage secondary circuit completed thru operative sections of the sign. This protection for the transformer, and automatic disclosure of the extent of display usable sections for the sign, may be between each section terminals, as unit 16 between the terminals 11, 13, and section 12' between the terminals 11', 13'.

The unit 16 comprises a main tubular housing 18. The tube 18 has been up to $\frac{3}{8}$ " in outside diameter and about $1\frac{1}{2}$ " long, with thickness ranging close to $\frac{1}{2}$ ".

A terminal 19 may be of copper, and of general split rivet form having a sleeve portion 20 adapted to be crushed down into binding holding relation with the respective conductor leads 15, 17. The outside diameter of the terminal 19 has a sliding fit inside the housing 18. Upon introducing the terminals 19 into the housing 18 from opposite ends and slightly inward, there is formed an in-

intermediate chamber 21. In the chamber 21 adjacent one of the terminals 19 is an insulation sleeve or spacer 22 of somewhat lighter gage than the thickness of the housing 18.

Against this spacer 22 at the end thereof away from the terminal 19, is a thin wafer or fusible disk 23, as of combustible Celluloid. The film-like disk 23 may be in the range of .01" in thickness. However, it is sufficiently substantial to hold a compression helical spring 24 as abutting the other terminal 19. The coil spring 24 is in the range of $\frac{3}{8}$ " outside diameter. The spring 24 in the chamber 21 away from the disk 23, is poised centrally of the chamber 21 by an insulation guide ring 25. The end of the spring 24 which rests centrally on the disk 23, is so held, and therefore its thrust line of direction is coaxial with the spacer 22 with some inward clearance relatively thereto. The wire spring 24 is a good electrical conductor, and may be of steel, brass or copper. The wire 24 may be .018" diameter. The uncompressed length of the spring 24 may be as $\frac{3}{4}$ ", while at a set position therefor in the chamber 21, it may space the disk 23 from the terminal 19 by $\frac{1}{2}$ ". The flexible conductor leads 15, 17, may be 22 gage copper wire.

The assembly in the housing 18 is readily effected by shoving a terminal 19 into one end to have its portion 20 slightly inward. Sealing in this position may be had by cellulose adhesive, as by acetate plastic 26.

The extent of the housing 18 away from the sealed end exposes therein the sealed-in terminal 19, against which is thrust the spacer insulation sleeve 22, followed by the film disk 23, held in place by the spring 24 as maintained central in the chamber 21 by the ring 25 of insulation. The spring 24 is placed under compression, which may be in the range of 6 oz. The compression of the spring 24 is sufficient to have the second terminal 19 fully within the housing 18, to be there sealed with a second acetate adhesive bonding filler or agent 26. When the housing 18 is transparent, there may be concealment of the internal details, as well as protection of the housing from scratches, and making it more substantial by an opaque adhesive wrapper 27, as of paper. While of small dimension, the control unit is an effective device of no current carrying operation, so long as the neon sign section of say 23' of $1\frac{1}{4}$ " diameter glow vapor charge be functioning, say even on 15,000 volts, with the amperage in the range of 3 milliamperes.

The protective operation of the control unit occurs upon the failure or absence of the sign section in parallel therewith. The functioning of the transformer in the distorted wave form, in a fraction of a second develops such a surge as to jump the air gap in the spacer region 22 between the disk 23 and the terminal 19. The limited amount of air in the chamber 21 is just sufficient for the Celluloid wafer 23 to have its center flash out to leave a ring 28 thru which there is clearance for the spring 24 to lodge against the terminal 19 at the sleeve 22. The spring 24 has thus, at almost instantaneous automatic action, cut-in the residual sign section or sections, notwithstanding there be a section local to the unit 16 which is inoperative. The practice may be to discard the unit 16 and replace with one wherein the disk 23 still serves as a spacer. However, upon clearing the seal 26 for one of the terminals 19, the spring 24 may be reset by the assembly therewith of another disk 23.

The wave pattern herein developed is not a true sign curve. Assuming that the phase starts downward, there is the unevennesses of vibrations with slight advance, which merge out into a horizontal approaching line with slight downward deflection to an abrupt ascent to the zero line, and with hardly any advance or forward pitch. Upon crossing the zero line and upward, there is again marked vibrations in the ascent with somewhat more advance pitch, to leave as below a nearly horizontal but slight pitch away from the zero line for about three fourths of this phase lobe as above the line, then to a nearly straight drop to the line for crossing with the vibrations below in repeating the cycle. The general pattern of the cycle is retained for the sign, even with but two sections in or with the unit of control and one section. However in the latter instance, the amperage does not seem to be disturbed materially, but the voltage then shows a drop thru the two sections in series of 52 volts for a 7500 volt secondary, while for the control unit and one section the voltage drop showed 30 volts. In the instance of 15,000 volt secondary, the two sections in series as checked by a one megohm resistor shunt load of thirty megohms showed 51 volts; while for one control unit in series with one neon tube sign section taken across one megohm resistor of shunt load thirty megohms there was 30 volts. Here the indicated voltage across six megohms of shunt load was six volts as read on 1000 R per volt meter, as against 12 volts for the sections in series at 15,000 volts. For 7,500 volts to one unit and one section six megohms shunt load as read by 1000 R volt A. C. meter showed 7 volts, while for two sections in series the volts showed 14.

The effective sealing of the chamber 21, contacts so to limit the air volume that its oxygen content is so low that immediate quenching occurs for the wafer center to be fused instantaneously to convert the disk 23 to the ring 22.

The fused unit has resistance of from .62 to .4 ohms. Unfused capacity is less than 10 micro-microfarads. Ratio 5:3 on both 7,500 and 15,000 volt transformers is for the sign independent of the unit.

With the experience that the unit responds acceptably in sign circuits of sections in series, and with the voltage of the impressed secondary circuit ranging from 5,000 to above 15,000 volts, there seems to be an interacting relation between the neon tube sections and the protective units as for the respective sections. This prompts the conclusion that the effective resistance of a neon gas charged sign section of tubing is lower than that of the protective unit, in considering for the rupture or break-down for the unit to act as a by-pass.

A basis for interpretation can be that for 7,500 volts as impressed by the transformer secondary circuit in a three section sign, 2,500 volts may be taken as for each section. The three control units 16 as in parallel to by-pass the respective sections, and normally inert, automatically by-pass the section with which paired.

A neon vapor charged tube sign section may have in the range of 10,000 ohms resistance per foot, which at 15,000 volts from the transformer and at full load operation shows .030 milliamperes. The resistance of the unit 16 is understood to be in excess of 1,000 megohms. In practice, such ratio as this may be taken to establish, has come thru for uniform performance as herein disclosed.

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What is claimed and it is desired to secure by Letters Patent is:

1. A shunt control unit embodying an insulation housing, encased in the housing a pair of terminals having deformable stem extensions inward from the respective ends of the housing, a conductor press-anchored with each extension and protruding from the housing, insulation sealing means anchoring the terminals to provide air-tight closure for a chamber provided in the housing between the terminals, an insulation spacing ring adjacent one terminal, a fusible disk spaced from said one terminal by the ring, and a spring extending from the other terminal and under compression to hold the disk against the ring and toward the one terminal, said spring being an electrical conductor adapted to coact for flash-fusing of the disk and thereby directly connecting the terminals in converting the unit into a negligible resistance conductor.

2. A shunt control unit embodying a housing cylinder of insulation rigid body, a pair of disk terminals fitting the cylinder inner side and spaced inward from each end of the body to leave an intermediate chamber, flexible leads from the respective terminals, plastic sealing means bonding the terminals with the body and from which leads extend, whereby there is provided vapor tight anchorage for the terminals to the chamber, an insulation sleeve spacer against one terminal in the chamber, a compression helical spring against the other terminal and also in the chamber, a disk insulator in the chamber held by the spring against the spacer, and centering means exterior of the spring in the chamber for directing the spring centrally of the disk, said disk being susceptible for flash fusing breakdown from current surge with the flash forthwith quenched by oxygen exhaustion in the chamber with the spring in electric conductive relation to short circuit between the terminals.

3. A shunt control unit embodying a tubular insulation housing, a pair of terminals providing two conductor contacts exterior of and spaced apart by the housing, insulation sealing means anchoring the terminals to provide air-tight

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closure for a chamber provided in the housing between the terminals, an insulation spacing ring adjacent one terminal, a fusible disk spaced from said one terminal by the ring, and a spring extending from the other terminal and under compression in said insulation chamber to hold the disk against the ring and toward the one terminal, said spring being an electrical conductor adapted to coact for flash-fusing of the disk and thereby connecting the terminals in converting the unit into a negligible resistance conductor.

4. A shunt control unit embodying a housing cylinder of insulation rigid body, a pair of disk terminals fitting the cylinder inner side and spaced inward from each end of the body to leave an intermediate chamber, conductor contacts exterior of the body, one connected to each terminal, sealing means bonding the terminals with the body, whereby there is provided vapor tight anchorage for the terminals, an insulation sleeve spacer against one terminal in the chamber, a compression helical spring against the other terminal and also in the chamber, a disk insulator in the chamber held by the spring against the spacer, and centering means exterior of the spring in the chamber for directing the spring centrally of the disk, said disk being susceptible for flash fusing breakdown from current surge with the flash forthwith quenched by oxygen exhaustion in the chamber with the spring in electric conductive relation to short circuit between the terminals.

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