A. DEMPSTER.

ATTACHMENT FOR VAPOR LAMPS.

APPLICATION FILED NOV. 9, 1905. RENEWED APR. 4, 1908.

1,006,729. **Patented Oct. 24, 1911.**

2 SHEETS—SHEET 1.

Fig. 1

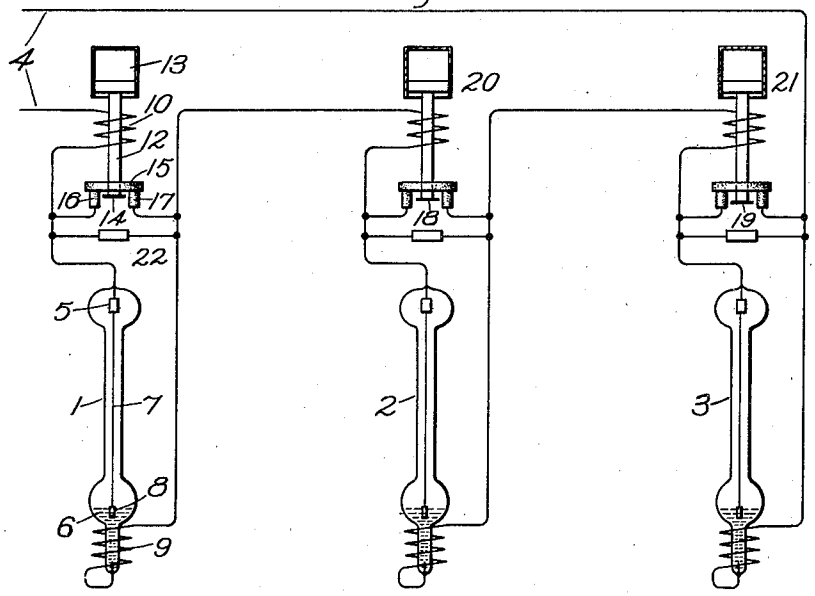
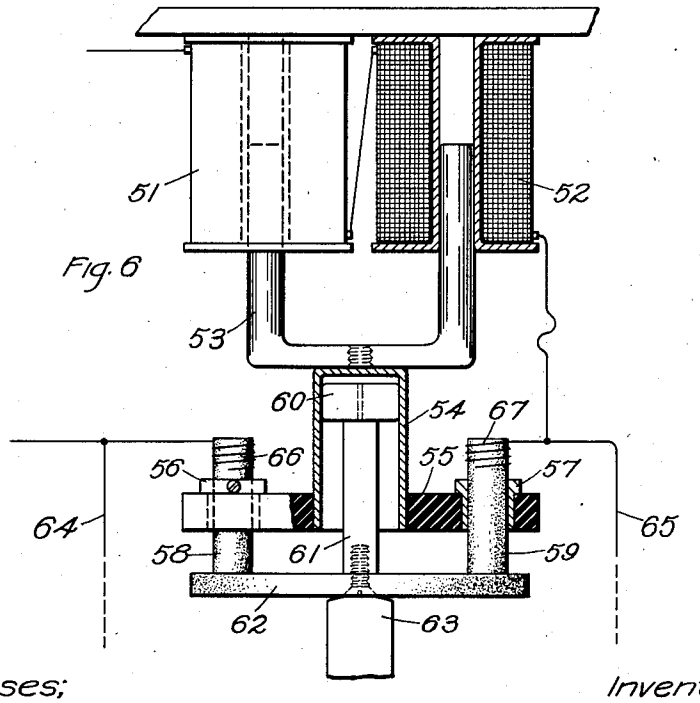


Fig. 6



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2 SHEETS—SHEET 2.

Fig. 2

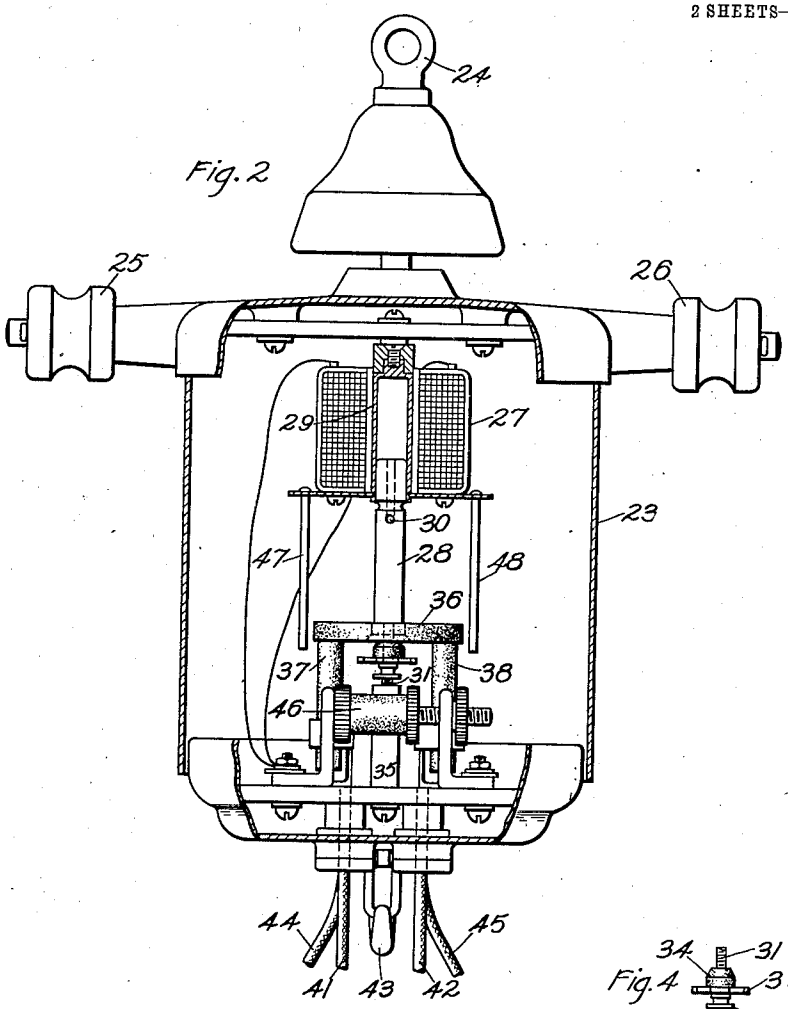

Fig. 4

Fig. 3

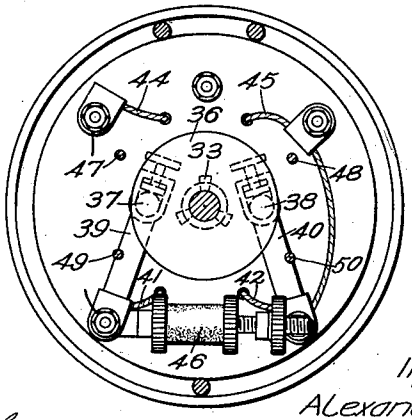

Fig. 5

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UNITED STATES PATENT OFFICE.

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ATTACHMENT FOR VAPOR-LAMPS.

1,006,729. Specification of Letters Patent. Patented Oct. 24, 1911.

Application filed November 9, 1905, Serial No. 286,514. Renewed April 4, 1908. Serial No. 425,166.

To all whom it may concern:

Be it known that I, ALEXANDER DEMPSTER, a subject of the King of Great Britain, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Attachments for Vapor-Lamps, of which the following is a specification.

This invention relates to an improved form of cut-in device for lamps and similar apparatus and to an improved arrangement of vapor lamps whereby the novel features of my improved form of cut-in device are utilized to advantage.

While my improved cut-in device may be used in connection with various forms of translating devices, it possesses certain features which make it of special value when used in conjunction with vapor apparatus, such as mercury vapor lamps.

The details of my invention will be better understood by reference to the following description taken in connection with the drawing forming part of this specification.

Figure 1 is a diagrammatic representation of a series circuit supplying current to three mercury lamps, each of which is provided with a cut-in device of my improved form; Fig. 2 is an elevation partly in section of one modification of my improved cut-in device; Fig. 3 is a plan view of the same; Figs. 4 and 5 are details; and Fig. 6 shows a second modification with certain of the elements represented diagrammatically.

The system shown in Fig. 1 includes three mercury lamps 1, 2 and 3, of a type now well known in the art, connected in series and receiving energy from the distribution circuit 4. Lamp 1 is provided with a graphite anode 5, a mercury cathode 6, a high resistance filament 7, and an iron plunger 8 floating in the mercury cathode and carrying in its top a cup-shaped depression filled with mercury and arranged to make contact with the lower end of filament 7. Plungers of this type are well known to persons skilled in the art and are shown for instance in United States Patent #850,270, Steinmetz, April 6, 1907. Surrounding the mercury cathode is a solenoid 9 so disposed that when energized by current it will draw down the mercury plunger 8 in the manner and for the purpose hereinafter described. When potential is impressed on the lamp, current will flow from anode 5 through filament 7 and plunger 8 to the mercury cathode 6, and then through solenoid 9 back to the source. This current through the solenoid draws down plunger 8 until it breaks contact with filament 7, thereby producing a spark or arc at the end of the filament. This initial spark or arc starts the lamp into operation as will be readily understood by persons skilled in the art. The filament 7 is ordinarily of such high resistance that when the tube is operating under normal conditions very little of the current passing through the tube flows through the filament; therefore, it follows that when several of these lamps are connected in series the resistance of the circuit before the lamps start is much higher than the normal running resistance of the circuit. It has been found that when a brush generator is used to energize such a circuit difficulty is sometimes experienced in making the generator build up to normal current because of this initial high resistance. With my improved form of cut-in device arranged as shown in Fig. 1, each of the lamps is short-circuited at starting so that the initial resistance of the circuit is considerably lower than the normal operating resistance; consequently no difficulty is experienced in starting up the generator.

Another difficulty that has been encountered in operating several vapor lamps in series arises from the disturbing action of one lamp on another during the starting operation; due no doubt to the considerable variation in resistance when the lamps start or fail to start on the initial current. I therefore, find it desirable to provide means for starting one lamp after another instead of allowing the lamps to start simultaneously the instant pressure is impressed on the distribution circuit: The means for effecting this result are hereinafter described.

When using lamps of the type above described there is a certain inertia of the movable parts of the lamp, so that an appreciable time elapses between the first flow of current through the filament and normal flow through the mercury vapor of the lamp. Because of this I find it desirable in starting to bring up the pressure across each lamp gradually so that the moving parts may have sufficient time to operate to best advantage.

One form of cut-in device which I have found to meet the above recited conditions

is shown in Fig. 1 as comprising a solenoid 10, an armature 12 therefor carrying a dash pot 13 and provided at its lower end with a stop 14 capable of engagement with the lower surface of the contact disk 15 of carbon which at starting rests on two carbon rods 16 and 17, and thereby shunts the lamp 1. The other lamps of the circuit are similarly equipped except that the stops 18 and 19 of the cut-in devices 20 and 21 are set at different distances below their corresponding disks, so that the three disks will not be lifted simultaneously. This gives a different time constant for each lamp. If desired a self-reducing resistance 22 may be connected directly across the lamp to act as a safety device and cut the lamp permanently out of circuit in case of emergency.

The details of my device are shown in Fig. 2. A water proof case 23 of sheet steel or other suitable material is provided with a supporting eye 24, and a cross bar carrying insulators 25 and 26 for convenience in connecting the lamp to a commercial circuit. A solenoid 27 is suspended from the top of the sheet iron casing 23 and is provided with a movable armature 28, the upper end of which fits snugly within a brass sleeve 29, and acts as a dash pot when the armature is drawn upward into the coil. A suitable vent 30 is provided in the plunger of the dash pot. Armature 28 carries at its lower end a threaded rod 31 on which is mounted a thumb screw 32, a lead grid 33 and a carbon bushing 34. When the electromagnet is unexcited the lower end of rod 31 rests on a fiber post 35. When current is admitted to the electromagnet or solenoid 27 armature 28 is drawn up, thus causing an engagement of the web 33 with the lower surface of the carbon disk 36, thereby lifting the disk away from the two carbon rods 37 and 38. These carbon rods correspond to the contacts 16 and 17 of Fig. 1 and together with disk 36 form a low resistance shunt path around the lamp before starting. When the disk is lifted an arc is drawn from each of the carbon rods so that the lamp is then shunted by a circuit containing two carbon arcs in series. The upward movement of armature 28 and the supported disk 36 is relatively slow owing to the retarding action of the dash pot, so that the length of these carbon arcs increases gradually. This gives a gradual increase of voltage across the mercury lamp, and allows ample time for movement of the plunger 28 or other starting mechanism. In order that the lamps may not all start at once, I adjust the cut-in devices with different time constants. This may be done by varying the fit of the dash pots to give a different speed of motion for the armatures, or it may be done by adjustment of the web 33 which engages with the carbon disk. This latter adjustment may be effected by raising or lowering the thumb screw 32 to increase or decrease the distance through which the armature must travel before the carbon disk begins to lift. As shown in Figs. 2 and 3 the carbon rods 37 and 38 are rigidly clamped to the upwardly bent ends of brass plates 39 and 40. These plates are connected directly across the mercury lamp by means of conductors 41 and 42. The lamp itself may be supported below the cut-in by means of a hook 43, and may be connected to the series circuit by conductors 44 and 45. A magnetite or other self-reducing resistance 46 is connected directly across the lamp and operates to short-circuit the lamp and permanently cut it out of circuit in case of emergency. If for any reason the arcs between the movable disk and the contact rods are drawn out and continue to burn, as might occur in case of a defect in the apparatus, the heating action of the arcs melts off the arms of the lead grid 33 and permits the disk 36 to drop back on the contact rods and thus short-circuit the lamp. Four brass guide rods 47, 48, 49 and 50 insure a proper seating of this disk on the top of the rods when it falls.

Fig. 6 shows a modified form comprising two electromagnets 51 and 52 connected in series and operable on a U-shaped armature 53 which carries a dash pot cylinder 54, and a cross bar 55 of insulating material. This cross bar is provided with holes in which fit two brass sleeves 56 and 57. Carbon rods 58 and 59 are rigidly clamped in these brass sleeves and project a short distance below the insulating bar. Within the dash pot 54 fits a plunger 60 rigidly secured to the rod 61 on which is a carbon disk 62. A fiber stop 63 serves to limit the downward motion of the dash pot plunger and its carbon disk. When the apparatus is in the starting position the two carbon rods 58 and 59 rest on the carbon disk 62, and thus short-circuit the lamp which is connected to conductors 64 and 65, but when current is passed through the series distribution circuit the solenoids 51 and 52 are energized and the armature and its attached dash pot cylinder 54 are drawn upward. This tends to separate the carbon rods from the carbon disk, but the suction of the dash pot draws the disk upward with the rods so that the upward movement of the armature does not start the carbon arcs, but only lifts the rods and disk to a distance corresponding to the distance of travel of the armature. The slow leakage in the dash pot soon equalizes the pressure on the two sides of the dash pot plunger and the carbon disk then sinks slowly away from the rods and thus draws two carbon arcs to increase the voltage across the mercury lamp. The rate of travel of the carbon disk is dependent on the leak-

age or adjustment of the dash pot so that different dash pots may be arranged with different time constants. The brass sleeves 56 and 57 furnish another means of adjustment, for by changing the setting on the carbon rods the collars can be so adjusted that when the armature is in its lowest position, with the carbon rods seated on the carbon disk, the shoulders on the brass collars will be a slight distance above the upper surface of the insulating bar. When so arranged a downward motion of the carbon disk does not start the carbon arcs until the disk has dropped far enough to seat the brass collars on the insulating bar and thereby check the downward motion of the carbon rods. Flexible connections 66 and 67 are provided between the carbon rods and the electrical conductors 64 and 65, so that the rods are free to move upward and downward with the armature.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. The combination of a vapor lamp, a conducting path in shunt with said lamp, and means for producing a plurality of sustained arcs in said shunt path to gradually increase the voltage on said vapor electric apparatus.

2. The combination of a vapor lamp, arcing contacts connected to the terminals of said lamp, a contact plate for connecting said contacts, and automatic means for gradually moving said plate from said contacts to start said lamp.

3. The combination of a vapor lamp, arcing contacts connected to the terminals of said lamp, a conducting plate for connecting said contacts, automatic means for moving said plate from said contacts to gradually increase the voltage on said lamp, and a retarding device operatively connected to said conducting plate.

4. The combination of a vapor lamp, means for shunting said lamp with a plurality of sustained arcs and for gradually increasing the length of said arcs, and a retarding means to govern the speed of said increase in length.

5. The combination of a series consumption circuit, a plurality of vapor lamps connected thereto, means for shunting each of said lamps with a plurality of sustained arcs, means for increasing the voltage drop across said arcs to start said lamps, and means for preventing the simultaneous starting of said lamps.

6. A cut-in device comprising an electromagnet, a movable armature therefor, a plate carried by said armature, arcing contacts initially bridged by said plate, and a retarding device for regulating the rate of movement of said armature.

7. A cut-in device comprising an electromagnet, a movable armature therefor, contacts to be separated by movement of said armature to form a sustained arc, and an adjustable connection between said armature and one of said contacts to permit a variation of the length of travel of said armature before separating said contacts thereby varying the time interval elapsing between the energizing of said electromagnet and the formation of said sustained arc.

8. The combination of a vapor lamp, a conducting path in shunt with said lamp, means for increasing the resistance of said shunt path to start the lamp, and fusible means coacting with said means for effecting a decrease in the resistance of said path if the vapor lamp fails to start.

9. A cut-in device having a plurality of rods, a plate initially bridging said rods, an armature for lifting said plate, and a fusible connection between said armature and plate.

In witness whereof, I have hereunto set my hand this 8th day of November, 1905.

ALEXANDER DEMPSTER.

Witnesses:
BENJAMIN B. HULL,
MARGARET E. WOOLLEY.