Jan. 18, 1955 L. E. DILTS 2,700,154

MOUNT INSPECTING DEVICE

Filed Oct. 9, 1953

Fig. 2.

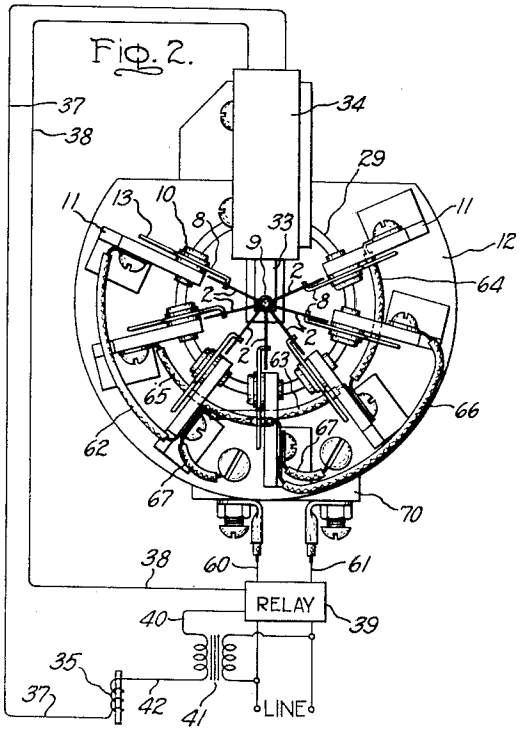


Fig. 1.

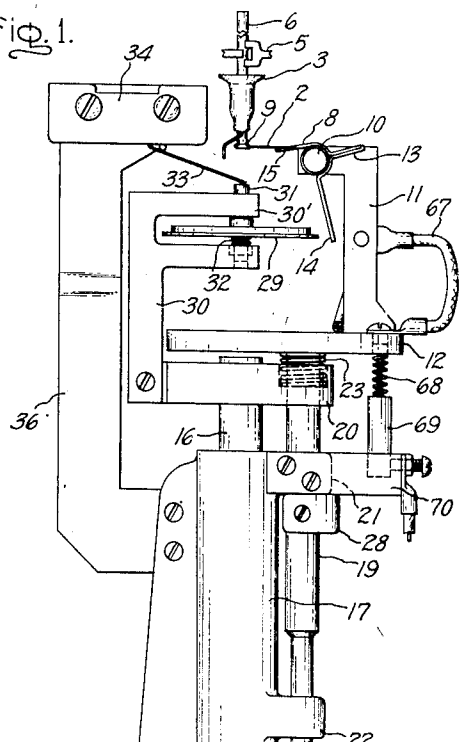
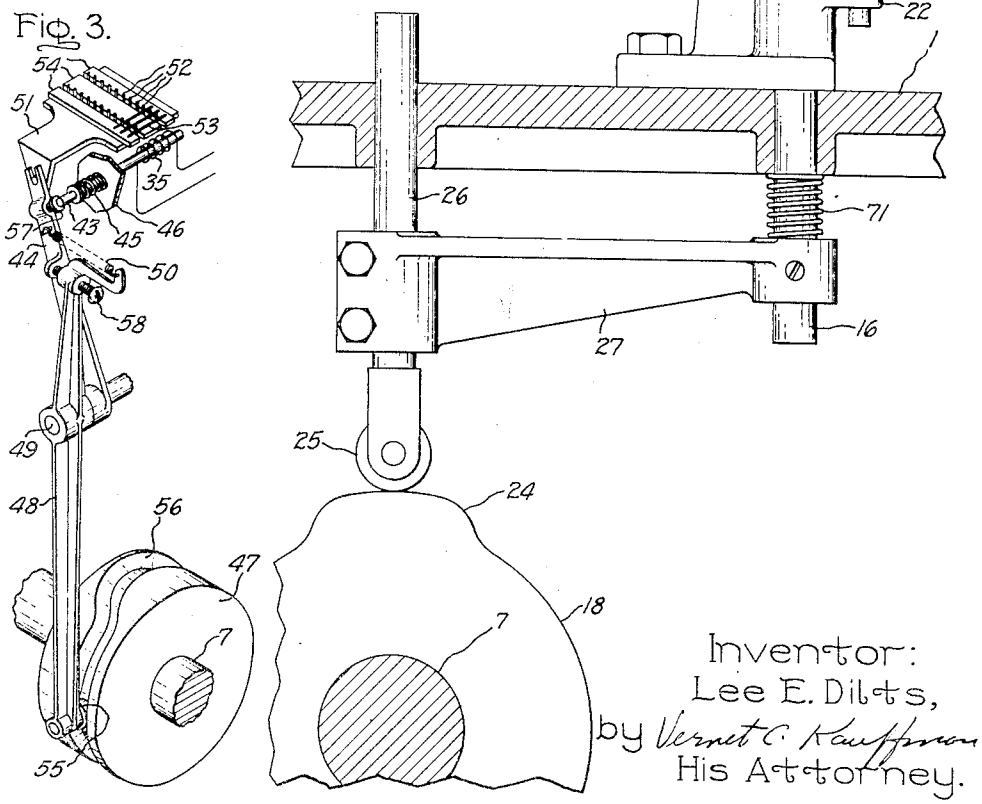


Fig. 3.



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MOUNT INSPECTING DEVICE

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2 Claims. (Cl. 340—259)

My invention relates to apparatus for manufacturing incandescent lamps and discharge devices, and more particularly to apparatus for examining the "spider" portions of mount assemblies for incandescent lamps and discharge devices to determine the presence of each of the fine wires of said spider in proper insulated relationship.

Inspection apparatus of the type disclosed herein is desirable in automatic machines to provide a constant check over the operation thereof and to enable an operator or mechanic to readily track down and correct improper operation. Mount making machines for incandescent lamps and discharge devices, for instance, include means for assembling a spider by inserting fine filament supporting wires into the vitreous button of a stem, and means for then properly shaping the wires and mounting a filament thereon. Occasionally, the fine wires are improperly inserted or become bent, and two or more of the wires may make electrical contact within the button, resulting in defective spiders and finished mounts. The discovery of spiders made defectively by such improper conditions permits the machine to be shut down before excessive jamming of loose wire and other destructive conditions occur in the mount making machine, and prevents considerable loss from the manufacture of defective completed mounts from such defective spiders.

This loss is greatly aggravated by the fact that mount making machines operate at very high speeds so that a considerable number of defective mounts are made if the condition of defective operation is not corrected immediately. Such machines are so large as to make it impractical to delay detection of the defect to inspection of the end product thereof (finished mount) since as many as fifty mounts are being processed at a given moment, so that a like number of mounts would accordingly be made improperly before the defect would appear in the end product.

One object of my invention is to provide apparatus for detecting defective mount spiders formed from fine and easily bent wires extending from a stem arbor of a mount. In a physical embodiment of apparatus fulfilling this object I provide means which makes physical contact with the extending free ends of the support wires and which determines said wires to be present at proper relative positions in the mount when contact is made therewith and to be electrically insulated from each other when electric current cannot flow between adjacent wires.

Another object of my invention is to provide rapidly operable apparatus suitable for use in combination with high speed mount making machines for detecting the presence and proper electrical insulated relationship of a group of fine and easily displaced support wires radiating from the vitreous arbor button of a stem. The apparatus is an improvement of the general type of detecting device disclosed in U. S. Patent 2,053,137, Donovan et al., dated September 1, 1936, and assigned to the assignee of the present invention, and contributes to the satisfactory operation of the mount making machine as a whole by inspecting the support wire group both physically and electrically at one work station thereabout and without interference with the operations thereof.

The support wire detecting device comprising the invention is particularly applicable to more recently developed mount making machines for the manufacture of a complex type of mount and spider having a considerable number of support wires extending from a single arbor button. The detecting device in such instances must effect engagement with from five to eight very fine support

wires radiating from a relatively small vitreous arbor button in a single plane and, without increasing the very limited permissible pressure of engagement, it must effect control over electrical means which, in turn, controls a portion of the mount making machine. Also incorporated in the detecting device are means for applying a sensing electrical potential to each of the support wire engaging means, and means for providing an overriding control over the electrical control circuit should current flow because said wires contact each other within the arbor button.

Further objects and advantages of my invention will appear from the following detailed description of a species thereof and from the drawing.

In the drawing, Fig. 1 is a side elevation of a support wire detecting and inspection device comprising my invention and shown at operative relation to a mount, said view being modified by having only one of the seven duplicate support wire engaging means in place therein.

Fig. 2 is a plan view of the support wire detecting and inspection device with a schematic wiring diagram of the electrical apparatus and the control means thereof.

Fig. 3 is a diagrammatic perspective view of filament feeding means controlled by the detecting and inspection device.

The detecting and inspection device shown in the drawing is constructed to be mounted upon the stationary work table 1 of a mount making machine and to be arranged on said table 1 in operative relation to the support wires 2 of a stem 3 advanced to one work station of said mount making machine in the course of the regular operations thereof. The general type of mount making machine with which the illustrated form of the detecting and inspection device is particularly suited to operate is that disclosed in Flaws Patent 1,907,532, dated May 9, 1933, and assigned to the assignee of the present invention. The detecting and inspection device, at the moment the stem 3 is advanced thereto, is retracted below the horizontal path of movement of the stem, and in its operative cycle moves up to and then downwardly away from the stem 3, which remains stationary at said work station for an interval. Regularly repeated indexing movements of the carrier, or turret, of the mount making machine, herein repersented by the jaws 5 gripping the exhaust tube 6 of the stem 3, provide for the presentation of a succession of stems 3 at regular intervals at the work station shown. The detecting and inspection device is operated in synchronization with the presentation of the stems 3 through its engagement with a cam on the shaft 7 of the mount making machine, said device being constructed so as to complete one cycle of operation during one revolution of the cam shaft 7.

The cycle of operation of the detecting and inspection device is initiated by a combined positioning and sensing movement thereof in which wire feelers 8 (Figs. 1 and 2) thereof are carried upward against the support wires 2 of the stem 3 and in which sufficient movement of said feelers 8 occurs to cause them to be turned out of position by engagement with said support wires 2. The feelers 8, as shown in Fig. 2, are arranged about the axis of the stem 3 in the same general arrangement as the support wires 2 which radiate horizontally from the button at the lower end of the vitreous stem arbor 9. In the present instance the support wires and feelers are seven in number. Each feeler 8 is pivoted upon a pin 10 extending from the side of a standard 11 mounted upon the circular carriage plate 12 and is so counterbalanced by the weight of the laterally extending portion 13 that the lower control portion 14 normally swings to a vertical position directly below the pivot pin 10 whereas a sensing portion 15 extends horizontally to one side of said pivot pin 10. The upward movement of the feelers 8 carries the sensing portions 15 thereof through the normal positions of end portions of the support wires 2 and, if all support wires 2 are present, results in said feelers 8 being turned about the pivot pins 10 to the positions shown in Fig. 1. The comparatively slight mass of the fingers 8 and their pivotal mounting allows them to be displaced without causing the very fine support wires 2 to be bent out of place.

The upward movement of the carriage 12 is brought

about by actuating means comprising push rod 16 and associated means in common with the main support standard 17 of the device and other means located below said standard and engaging the cam 18 on the cam shaft 7 of the mount making machine. The carriage 12, which is fixed to the upper end of a rod 19, is guided in its movements by said rod 19, which is slidable within the platform 20 and the upper and lower ears 21 and 22 on the support standard 17 and takes the motion of the push rod 16 inasmuch as it rests upon the upper end of a helical compression spring 23, in turn, resting upon the platform 20 on the upper end of the push rod 16. The spring 23 is located about an upper portion of the guide rod 19 and is partly contained in a well in the platform 20. The motion of the push rod 16 occurs when the hump 24 on the edge of the cam 18 engages the roller 25 on the lower end of the operating rod 26, the operating rod being coupled to the push rod through a connecting arm 27. The limit of the positioning and sensing operation is reached when the fixed stop 28 on the guide rod 19 comes to bear against the ear 20 on the body 17.

The next occurring operations of the detecting and inspection device relate to the control means thereof and are brought about by acceptable or defective conditions found by the feelers 8 in the group of support wires 2 on the stem 3. One step in the operation of the control is dependent upon whether all the feelers 8 have been turned properly by engagement with the support wires 2. In normal periods of operation when all of the support wires 2 are in place on the stem 3 and are not bent out of position, the feelers 8 are turned as shown in Fig. 1 and the disc-like control member 29, which continues to move upward, passes alongside of the control portions 14 of the feelers 8 as shown. In other instances, however, a missing or bent support wire 2 may not have caused a feeler 8 to be turned sufficiently to clear the path of motion of the rim of the disc 29 and said disc 29 will be blocked from further movement. The upward pressure of the disc 29 is not capable of turning the feelers 8 out of position as the control portions 14 thereof are then located almost directly vertically below the pivot pins 10 and practically the full pressure exerted by the disc 29 is directed against the pins 10.

The upward motion of the control disc 29 occurs during the continued upward motion of the push rod 16, which follows after the carriage 12 has stopped moving, and is imparted thereto by the support bracket 30 which is attached to the platform 20 and which engages the center spindle 31 on said disc 29. At that time, the disc 29 and spindle 31 are retained at positions wherein the center portion or hub of the disc 29 seats against the upper leg 30' of the support bracket 30 and wherein the spindle 31 projects some distance above said upper bracket leg, since the pressure of a helical spring 32 about the lower end of the spindle 31 forces said spindle 31 upward. The upward motion of the support bracket 30 is normally sufficient to carry the top end of the spindle 31 against the actuating arm 33 of the switch 34 should the control disc 29 be uninterrupted in its motion; however, any one of the feelers 8 can block the full movement of the disc 29 and cause it and the spindle 31 to be displaced within the bracket 30 so that the switch 34 is not operated.

This function of the switch 34 is the means of effecting one end result of the detector device in that it is normally open and, when operated, completes an operating circuit to the control solenoid 35 associated with the filament feeding means (Fig. 3) of the mount making machine. The switch 34, which is mounted upon the upper portion of a bracket 36 extending from the main support standard 17, completes the circuit between the leads 37 and 38 of a circuit including the normally closed relay 39, the lead 40, the secondary of the transformer 41 and the lead 42, and by so doing applies the low voltage current from said secondary to the control solenoid 35. Accordingly, the solenoid 35 is operated each time a mount 3 having the proper arrangement of support wires 3 is inspected and is adaptable to a release function, an operation which it performs, in the arrangement herein shown, by withdrawing the stop-pin 43 from the path of travel of the operating lever 44 of filament feeding means. A helical spring 45 located about one end of the stop-pin 43 between a collar thereon and a portion of the standard 46 of the feeding means resists the action of the solenoid 35 and normally keeps the stop-pin 43 in the advanced position.

The filament feeding means, which is disclosed in greater detail in patent 1,907,532, hereinbefore referred to, is located opposite another work station along the path of movement of the mount 3; however, it has such a relation to the inspection device that the filament released in the presently described period of operation will be attached to the mount 3 currently engaged by the inspection device.

The cycle of operation for the filament feeding means provides for the cam 47 to oscillate the follower lever 48 about the stationary pin 49 during each feeding interval and the interconnecting spring 50 to cause these motions to be transferred to the operating lever 44, so that the plate 51 is advanced horizontally in a manner for the pins 52 therein to advance the filaments 53 across the slats 54 of a table (not shown). Although the follower lever 48 is required to oscillate in every cycle because the roller 55 thereon always remains in the track 56 of the cam 47, the operating lever 44 may not make a corresponding motion unless the stop-pin 43 is pulled back by the control solenoid 35. When the mount 3 is defective, the motion of the operating lever 44 immediately brings the head of a pressure pin 57 against the stop-pin 43 whereupon the motion is interrupted and the motion of follower lever 48 is absorbed in stretching the spring 50. This independent motion of the follower lever 48 unseats the positioning screw 58 from the pad on the operating lever 44.

Another inspection function of the detecting and inspection device is also initiated by upward movement of the feelers 8 and is actually maintained during the entire period the feelers 8 are in contact relation to the support wires 2. At that time test circuits between adjacent feelers 8 cause them to inspect for a mutual insulated relationship between the support wires 2 and to determine whether said support wires 2 are properly insulated from each other within the vitreous arbor 9. This type of test is highly desirable for many mount constructions having a multiplicity of support wires extending from a single arbor button, in that a slightly misplaced or bent support wire may easily contact an adjoining support wire when it is inserted in the arbor.

The test circuits are established in the feelers 8 by connecting alternate feelers 8 to one or the other of the leads 60 and 61 of a sensitive vacuum tube relay 39 and by insulating the feelers 8 and the supports 11 from the supporting and actuating portions of the device. The insulated state of the feelers 8 is created by making the carriage 12 and the disc 29 of insulating materials. As shown in Fig. 2, the endmost and two intermediate feelers 8 of the group are connected together by the wires 62, 63 and 64, and the alternate feelers 8 are connected together by the wires 65 and 66. Two duplicate connecting devices comprised of a lead 67 from one of the standards 11 associated with each group of feelers 8, a fine coil 68 of wire and a metal thimble 69 provide electrical connection from the movable portion of the device to the leads 60 and 61 on the stationary terminal block 70 of insulating material. Because of these connections, contact between any adjacent pair of support wires 2 will complete the circuit to the vacuum tube relay 39 and will result in said relay 39 breaking the low voltage circuit from the transformer 41 to the control solenoid 35 of the auxiliary control means.

The final operations of the detecting and inspection device in each cycle provide for the feelers 8 to be retracted from contact with the support wires 2 by the return downward movement of the push rod 16 under control of the cam 18. The roller 25 and the interconnected operating means including the push rod 16 having a motion conforming to the variation in the cam 18 as a compression spring 71 located about a lower portion of the push rod 16 between the table 1 and the connecting arm 27 causes the roller 25 to bear against the edge of the cam 18 at all times.

While the above-described embodiment of my invention represents a preferred form thereof, I do not wish to be limited to the exact structure thereof as it will be understood that many modifications of the precise manner by which the invention is carried into effect may be made without departing from the scope of the appended claims.

What I cliaim as new and desire to secure by Letters Patent of the United States is:

1. In combination with means for supporting a vitreous stem having support wires extending therefrom, a detect-

ing and inspection device comprising a plurality of feelers, support means mounting said feelers for independent movement thereon and for engagement with end portions of the support wires, means for moving said support means toward the stem supporting means to advance portions of the feelers through the positions normally occupied by the support wires in order to cause the feelers to be displaced in their support means upon engagement by said wires, a member mounted for movement through the positions occupied by undisplaced feelers at their advanced position and arranged to be arrested in such movement upon engagement by an undisplaced feeler, an electrical control circuit comprising switch means positioned for actuation by said member upon full movement thereof occasioned by displacement of all said feelers, and support wire insulation testing means inculding connections to said feelers to control energization of said control circuit upon finding circuit continuity between an adjacent pair of support wires engaged by said feelers.

2. In combination with means for supporting a vitreous stem having support wires extending therefrom, a detecting and inspection device comprising support means, a plurality of feeler wires pivotally mounted on said support means, each feeler wire having a projecting portion disposed to engage an end portion of a support wire and a portion normally depending below the pivot point,

means for moving said support means toward the stem supporting means to advance said projecting portions of the feelers through the positions normally occupied by the end portions of the support wires in order to cause the feelers to be turned about their pivot points in the event of engagement by said support wires, a member mounted for movement through the positions occupied by the dependeing portions of undisplaced feelers and arranged to be arrested in such movement upon engagement by an undisplaced feeler, electrical control means, and an electrical circuit including switch means controlling said electrical control means, said switch means being positioned for actuation by said member upon full movement thereof occasioned by displacement of all said feeler wires, said circuit further including relay means having connections to said feelers and arranged to control energization of said electrical control means upon finding circuit continuity between an adjacent pair of support wires engaged by said feeler wires.

References Cited in the file of this patent

UNITED STATES PATENTS

2,053,137	Donovan et al.	Sept. 1, 1936
2,549,296	Dilts	Apr. 17, 1951
2,671,139	Dilts	Mar. 2, 1954