

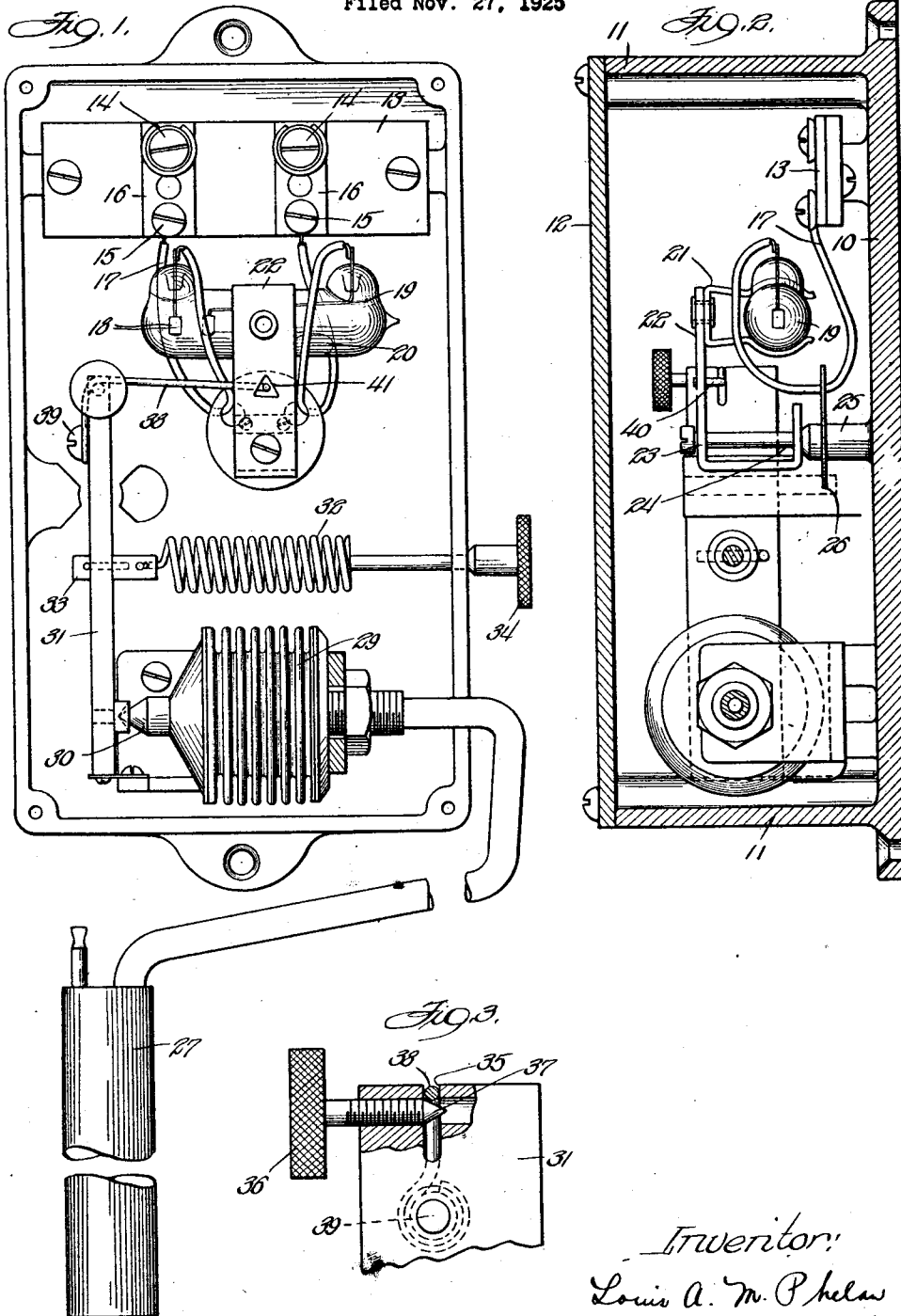
Dec. 6, 1927.

1,651,629

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TILTABLE SWITCH ADJUSTING MEANS

Filed Nov. 27, 1925



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## UNITED STATES PATENT OFFICE.

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## TILTABLE-SWITCH-ADJUSTING MEANS.

Application filed November 27, 1925. Serial No. 71,858.

My invention relates to tiltable switches and more particularly to novel means for adjusting the time of actuation of such switches.

I will hereinafter describe my invention as used in connection with a tiltable mercury tube contactor switch of the type wherein said contactor is tiltable from side to side to make and break contact between two electrodes sealed therein, such circuit making and breaking being effected by the movement of a meniscus of mercury from one end of the tube to the other, said mercury in one position of the tube bridging the afore-

said electrodes. In a switch of this character it is particularly desirable to obtain a very close control of the actuation thereof, and moreover, to be able to adjust this control very accurately.

In such a switch it is also highly desirable to provide means whereby the strain on the lead wires, which are attached to the contactor tube, is reduced to a minimum when said contactor is tilted from side to side. As will hereinafter be more apparent when my invention is described in detail, the lead wires of such a contactor switch are, of course, moved each time the switch itself is tilted from side to side, and I have found that a marked increase in the durability of the lead wires may be obtained by associating therewith means in accordance with my invention, which comprises in part bringing said lead wires substantially to the center of tilt of the switch tube.

Again the bringing of the lead wires to the center of rotation of the switch, which is one of the particular features of this phase of my invention, insures the movement of the switch tube without any drag being imposed upon said movement by the flexible lead wires attached to the contactor.

A better understanding of my invention may be had from the accompanying drawing, in which:

Figure 1 is a front, elevational view of a mercury tube switch and casing embodying my invention;

Fig. 2 is a side elevational view partially in section of said switch; and

Fig. 3 is an elevational sectional view of a detail of my invention.

Referring now more particularly to the drawings, my switch comprises a base member 10, which has wall portions 11 upstanding therefrom forming a box-like container in which the operating elements of my switch may be disposed, the same being closed by a lid 12.

A terminal board 13 is positioned within the switch container and has mounted thereupon binding posts 14—14 to which the wires leading from the device to be controlled are attached. Similar binding posts 15—15 are connected to said posts 14—14 through contact strips 16—16, and from these posts 15—15 lead wires 17—17 are taken off.

The other ends of these wires are connected to electrodes 18—18 positioned in an evacuated sealed mercury container tube 16 in which a mass of mercury 20 is positioned and is adapted to be moved from one end to the other of said tube to bridge said electrodes 18. The said contactor tube 19 is rigidly secured in a clip 21, which latter clip is fixed to a tiltable supporting member 22.

This tiltable member 22 is substantially L-shaped when viewed from the side whereby two bearing portions 23 and 24 are provided through which a shaft 25 protrudes, providing thereby a pivotal mounting for said member 22 about said shaft 25. An insulating washer-like member 26 floats on said shaft 25 and has perforations therein through which said lead wires 17—17 are loosely passed. It will be observed, therefore, that the lead wires are brought as close as practicable to the center of tilt of said contactor 19, thereby minimizing to a marked degree the strain which would otherwise be placed upon said lead wires, and moreover, insuring that no drag or other obstruction will affect the free movement of said tiltable tube.

I have illustrated my invention as used in connection with a pressure responsive device, and for this purpose have shown, as illustrative only, a container 27 in which the pressure varies, the fluid under pressure being conducted through a conduit 28 to an expansible and contractible casing 29, which latter is provided at its lefthand side with

a knife edge or other like bearing device 30. A member 31 is pivotally mounted on the base, or other fixed portion of the switch, and is adapted to be moved in response to  
 5 said pressure changes by reason of the pressing thereagainst of the knife edge 30, and it will be observed that, upon the movement of said member to the left, said member 31 is swung to the left.

10 An adjustable spring 32 has its lefthand end connected to a slotted portion 33 surrounding member 31 whereby, when said member 29 contracts, the member 31 is constantly kept in contact with the actuating  
 15 knife edge or point 30, the aforesaid spring 32 being capable of adjustment through the thumb screw 34. A slot 35 is cut in the upper end of the member 31 and extends across the top of said member. An adjustable screw  
 20 member 36 is adapted to be moved normally to the front surface of member 31 and has an inner tapering end 37, which end is movable normally to the walls of the slot 35 (as best shown in Fig. 3).

25 A phosphorus bronze wire, or like spring member, 38 has one of its ends securely fastened to the lefthand side of member 31 by a screw 39. This spring wire is biased in a downward direction and passes through  
 30 the slot 35, being so confined by the walls of said slot that it may move only in a vertical direction. By reference to Fig. 3, it will be seen that this spring or wire is biased in such a direction that it constantly presses  
 35 downward against the tapering end of the screw 36. The other end of said wire 40 is bent at right angles and extends through a triangular opening 41 in the member 22, said opening being above the pivotal point  
 40 about which said member 22 is adapted to be swung.

By referring to the drawing, it will be seen that when the screw 36 is adjusted so that the tapering end thereof moves normally to  
 45 the walls of the slot 35, the spring 38 will be raised or lowered, whereupon the outer end of the wire 40 will travel in an arc. Movement of said wire end 40 from the base of the triangular opening 41 to the apex of the  
 50 latter provides a marked range of adjustment whereby the tilting time of the contactor tube may be controlled.

In other words, when said wire end 40 is near the lower end of its permissible arc of  
 55 travel, said end must move from one side or lower corner of the triangular opening to the other corner thereof, and it has, therefore, a maximum movement prior to contacting with the sides of the opening and thereafter  
 60 moving said tiltable switch.

If on the other hand, said end 40 is raised by manipulation of the screw 36, until it is positioned substantially in the upper apex of the triangular opening, then said contactor  
 65 tube will instantly respond to pressure

changes, there being no lost motion between said end 40 and the sides of the opening 41. Any desirable adjustment between these two extremes may be provided for by means of  
 70 my novel arrangement through movement of the knurled portion 36 and the raising or lowering of the spring 38 by the tapering end 37 of the screw.

Moreover, the above described adjusting means eventuates a very close control of the  
 75 tilting time of the switch, and is particularly desirable in that the operator of the switch may at all times have a visual indication of just how he has changed the adjustment control.

80 While I have described but one embodiment of my invention, it is obvious that many modifications of this type of projecting end and triangular opening structure may be proposed without departing from  
 85 the inventive concept above described, and I desire, therefore, that my invention be limited only by the scope of the appended claims or by the prior art.

Having described my invention, what I  
 90 claim as new and desire to secure by Letters Patent of the United States is:

1. In a tiltable switch, a pivotally mounted tilting member having an opening of  
 95 varying width formed therein, an actuating element loosely connected to said member by having one of its ends project through said opening, and means for moving said projecting end longitudinally of said opening to  
 100 vary the times between contact with the opposed sides of said opening.

2. In a tiltable switch, a pivotally mounted tilting member having an opening of  
 105 varying width formed therein, an actuating element loosely connected to said member by having one of its ends project through said opening, the other end of said element being adjustably secured and the element being  
 110 movable as a whole to effect movement of said switch, and means for raising the projecting end of said element to move the same longitudinally of said opening.

3. In a tiltable switch, a pivotally mounted tilting member having an opening of  
 115 varying width formed therein, an actuating element loosely connected to said member by having one of its ends project through said opening, another member responsive to predetermined changes, the other end of said  
 120 element being adjustably secured to the latter member and movable as a whole thereby to actuate said tilting member through contact with the sides of said opening.

4. In a tiltable switch, a pivotally mounted tilting member having an opening of  
 125 varying width formed therein, an actuating element loosely connected to said member by having one of its ends project through said opening, another member responsive to predetermined changes, the other end of  
 130

said element being adjustably secured to the latter member and movable as a whole thereby to actuate said tilting member through contact with the sides of said opening, and means associated with said responsive member for moving the projecting end of said element in said opening.

5. In a tiltable switch, a pivotally mounted tiltable member having a triangular opening therein, an actuating element having one end projecting through said opening to effect a loose connection at substantially all times between said element and said tiltable member, another member responsive to predetermined conditions, the other end of said element being connected to said latter member, and means for moving the projecting end of said element from the base to the apex of said opening to vary the tilting action of said switch.

6. In a tiltable switch, a pivotally mounted tiltable member having a triangular opening therein, an actuating element comprising a spring member having one end projecting through said opening to effect a loose connection at substantially all times between said element and said tiltable member, another member responsive to predetermined conditions, the other end of said spring element being connected to said latter member, and means for moving the projecting end of said element from the base to the apex of said opening to vary the tilting action of said switch comprising a member on said responsive member which may be moved to raise said spring and thereby move its free end.

7. In a tiltable switch, a pivotally mounted tiltable member, a mercury tube contactor mounted on said member, lead wires attached to said contactor, and means for minimizing the movement of said lead wires when said contactor is tilted comprising a movable pivoted member having perforations therein through which said wires are passed.

8. In a tiltable switch, a pivotally mounted tiltable member, a mercury tube contactor mounted on said member, lead wires attached to said contactor, and means for minimizing the movement of said lead wires when said contactor is tilted comprising a movable pivoted member having perforations therein through which said wires are passed, said member being mounted substantially coaxially of said tiltable member.

9. In a tiltable switch, a tiltable member, a shaft on which said member is mounted, a mercury tube contactor supported on said member, lead wires attached to said contacts, and means for minimizing the movement of said wires when said contactor is tilted comprising a member floating on said shaft and having perforations therein through which said wires loosely pass.

10. In a tiltable switch, a tiltable mercury tube contactor switching element, lead wires attached to said contactor, and means for reducing to a minimum the strain of said lead wires comprising a member having perforations therein through which said wires are loosely passed, which member is disposed substantially at the center of tilting movement of said contactor and is free to move in any direction.

11. In a tiltable switch, a tiltable mercury tube contactor switching element, lead wires attached to said contactor, and means for reducing to a minimum the strain of said lead wires comprising an insulating washer through which said wires are loosely passed and which is adapted to move longitudinally of the axis about which said contactor tilts and also to have a rotary movement thereabout.

12. In a tiltable switch, a pivotally mounted tiltable member having a triangular opening therein, an actuating element comprising a spring member having one end thereof projecting through said opening and adapted to contact with the sides of the latter and thereby move said tiltable member, another member movable in response to predetermined conditions, the other end of said spring being attached to said latter member, and means comprising a movable tapering member over which said spring rides for varying the position of said projecting end of said opening.

13. In a tiltable switch, a pivotally mounted tiltable member having a triangular opening therein, an actuating element comprising a spring member having one end thereof projecting through said opening and adapted to contact with the sides of the latter and thereby move said tiltable member, another member movable in response to predetermined conditions, and having a slot in the upper end thereof, said spring passing through the slot and having its other end secured to the far side of said responsive member, and a tapering element movable normally to the walls of said slot and upon which said spring rides whereby movement of said tapering element lifts the end of the spring projecting through said opening, and varies the distance which said actuating element may travel before contacting with the side walls of said opening.

14. In a tiltable switch, a pivotally mounted tiltable member having a triangular opening therein, a mercury tube contactor mounted thereupon, an actuating element having one end projecting through said opening, another pivotally mounted member adapted to be moved in response to predetermined conditions, the other end of said actuating element being adjustably secured to said latter member, pressure responsive means for moving said latter mem-

ber, and means for varying the position of said projecting end in said opening, said means comprising a tapering member adjustably threaded in said responsive member and bearing against said actuating member.

15. In a device of the class described, a supporting member having a slot in its end, a spring member biased toward said supporting member and confined by the walls of the slot, a member having a tapering end movable normally to the walls of said slot and over which said spring rides whereby the movement of said tapered end member raises and lowers said spring member.

16. In a tiltable switch, a pivotally mounted tiltable member, an actuating member, a mercury tube contactor mounted on said tiltable member, lead wires connected to the same, means for varying the relative position of said tiltable member and said actuator, and means for minimizing the strain on said lead wires comprising a floating member positioned at substantially the center of tilt of said contactor and through which the wires are passed.

17. In an electric switch, a base, a shaft fixed thereto, a supporting member pivotally mounted on said shaft, a mercury tube contactor fixed on said supporting member, lead wires connected from said base to said contactor, means for minimizing the strain on said wires when said contactor is tilted comprising an insulating washer floating on said shaft through which said wires are loosely passed, another member mounted on said base and movable in response to pressure changes, the latter member having a slot in its upper end, a spring wire-like member secured to said pressure-responsive member and passing through said slot, being confined by the walls of the latter so that it may move vertically only, said supporting member having a triangular opening therein through which the free end of said spring projects, and an adjustable screw passing through said pressure-responsive member and having an inner tapered end movable normally to the walls of said slot, said spring pressing against said tapered member whereby an in-and-out movement of said screw raises and lowers said spring to vary the position of its free end in said opening whereby an accurate adjustment of the tilting time of said switch is obtained.

18. In an electric switch, a base, a shaft fixed thereto, a supporting member pivotally mounted on said shaft, a mercury tube contactor fixed on said supporting member, another member mounted on said base and movable in response to pressure changes, the latter member having a slot in its upper end,

a spring wire-like member secured to said pressure responsive member and passing through said slot, being confined by the walls of the latter so that it may move vertically only, said supporting member having a triangular opening therein through which the free end of said spring projects, and an adjustable screw passing through said pressure responsive member and having an inner tapered end movable normally to the walls of said slot, said spring pressing against said tapered member whereby an in-and-out movement of said screw raises and lowers said spring to vary the position of its free end in said opening whereby an accurate adjustment of the tilting time of said switch is obtained.

19. In a tiltable switch, a pivotally mounted tilting member having an opening therein, means having a projection thereon for actuating said tilting member, said member and said means being adjustably connected by means of said projection engaging said opening.

20. In a tiltable switch, a pivotally mounted tilting member having a triangular opening therein, means having a projection thereon for actuating said tilting member, said member and said means being adjustably connected by means of said projection engaging said opening.

21. In a tiltable switch, a pivotally mounted tilting member, means having a projection thereon for actuating said tilting member, said member having an opening formed therein for receiving said projection, said opening being of such shape that adjustment of said projection therein varies the time of response of said tiltable member.

22. In a tiltable switch, a pivotally mounted tilting member, means having a projection thereon for actuating said tilting member, said member having an opening of progressively decreasing width formed therein for receiving said projection, and means for moving said projection to vary the time at which said projection contacts with the sides of said opening to actuate said tiltable member.

23. In a device of the class described, a supporting member having a slot in its end, an actuating member secured to said supporting member and confined by the walls of said slot, and means for moving said actuating member comprising a tapering element over which said actuating means rides and which is movable normally thereto to raise and lower the same.

In witness whereof, I have hereunto subscribed my name.

LOUIS A. M. PHELAN.