

June 9, 1936.

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2,043,441

DOUBLE ADJUSTMENT CONTROL

Filed Feb. 8, 1935

4 Sheets-Sheet 1

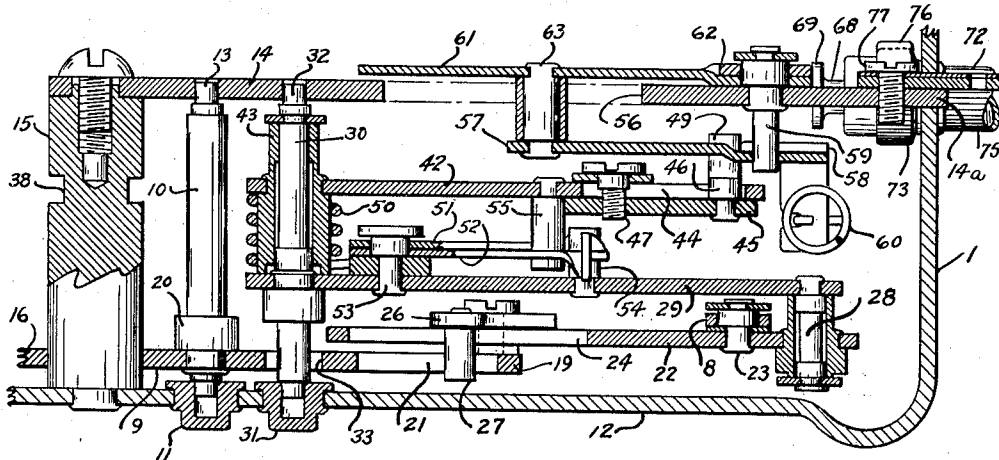


Fig. 2

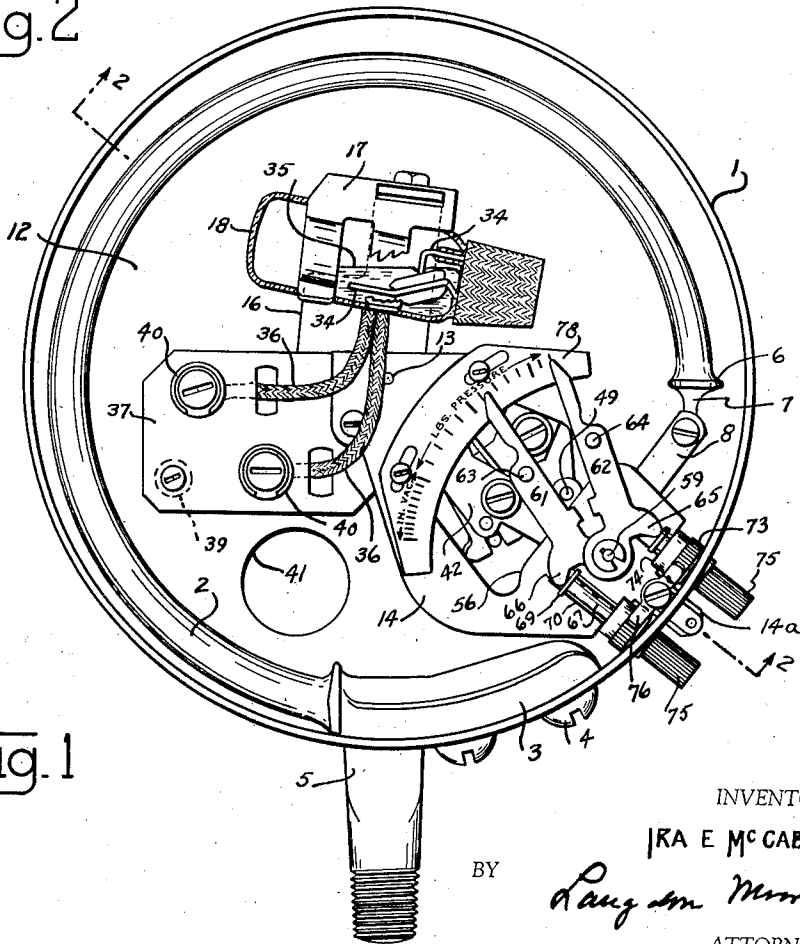


Fig. 1

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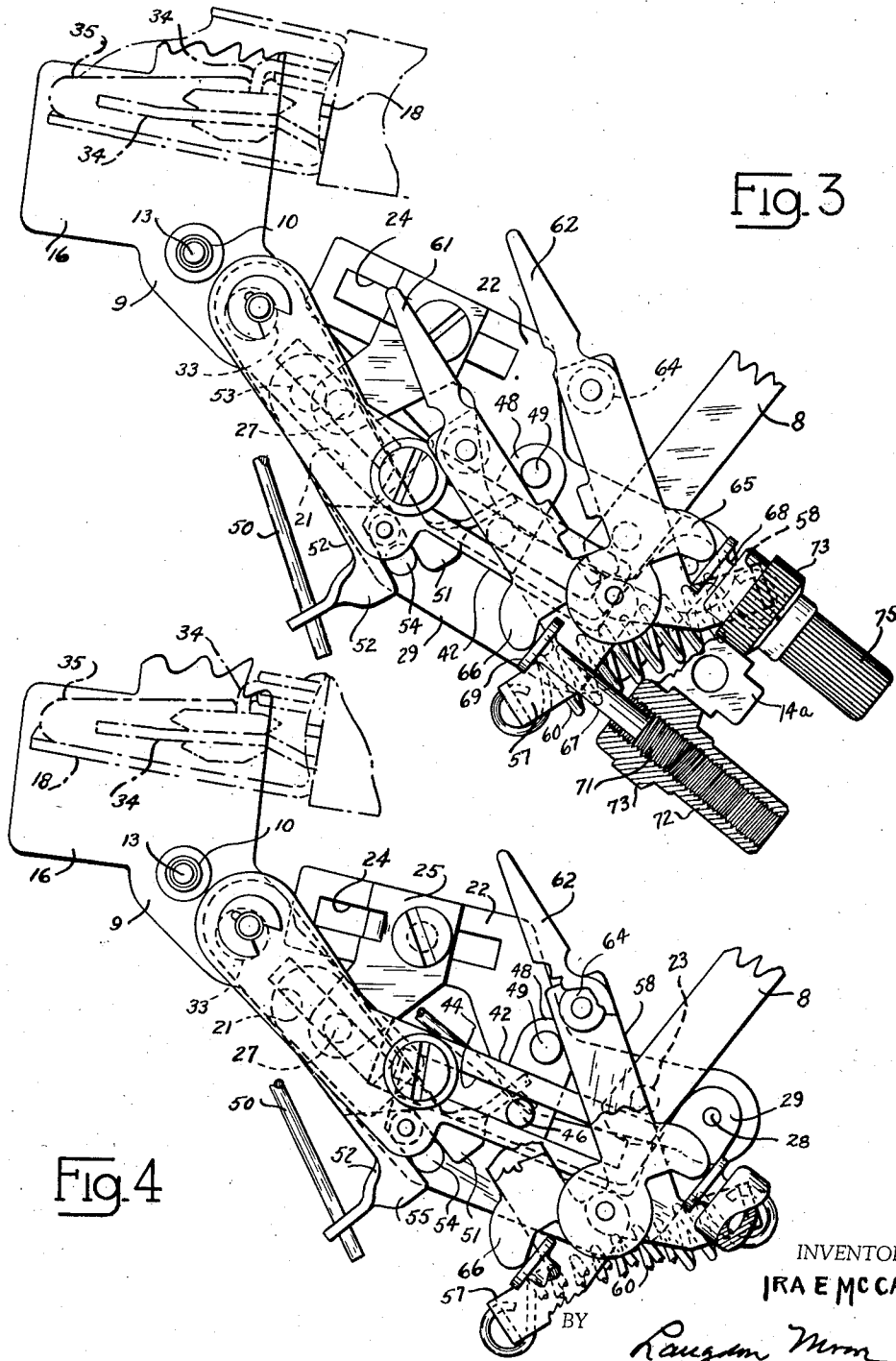
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4 Sheets-Sheet 2



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4 Sheets-Sheet 3

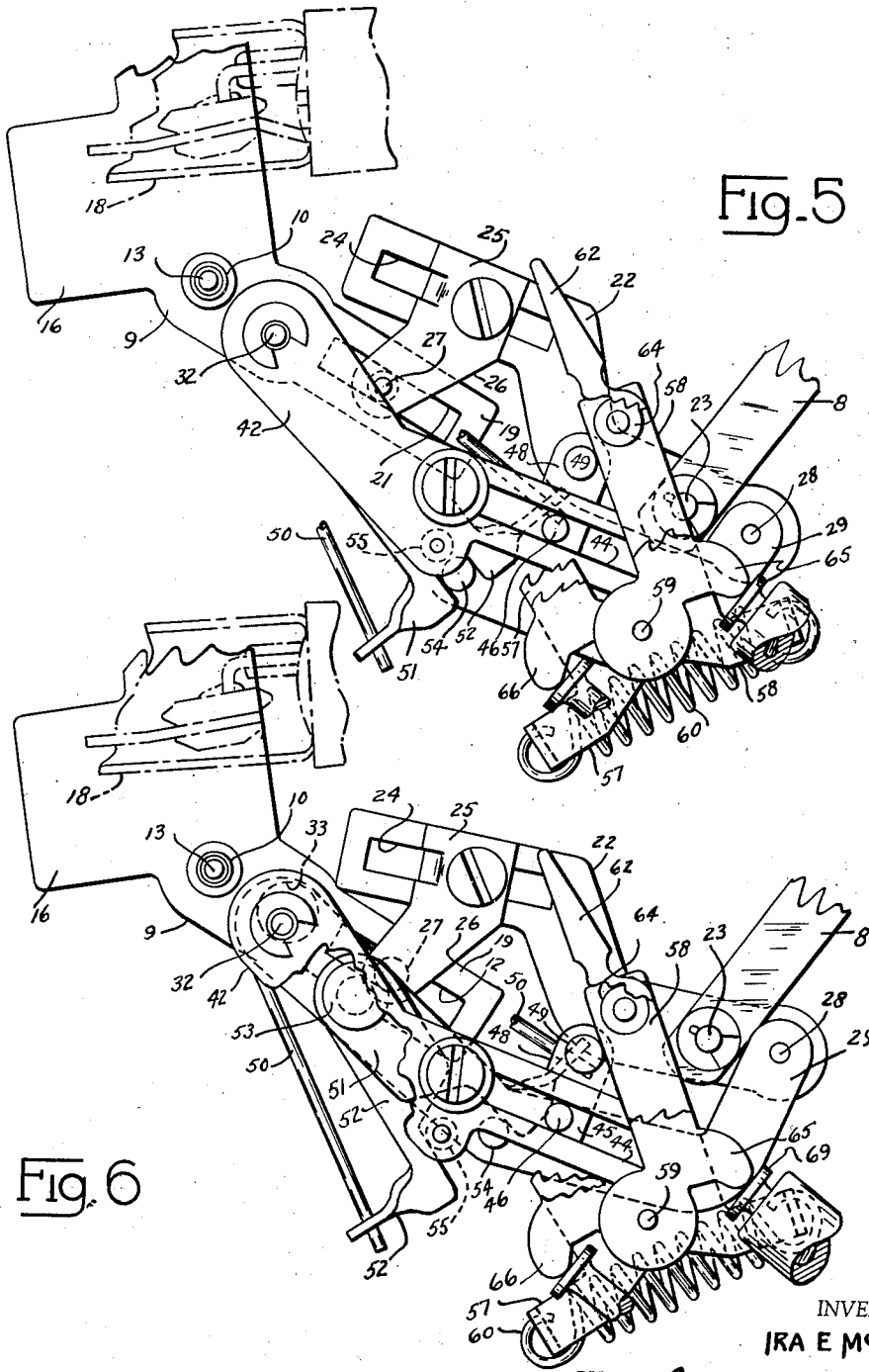


Fig. 5

Fig. 6

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4 Sheets-Sheet 4

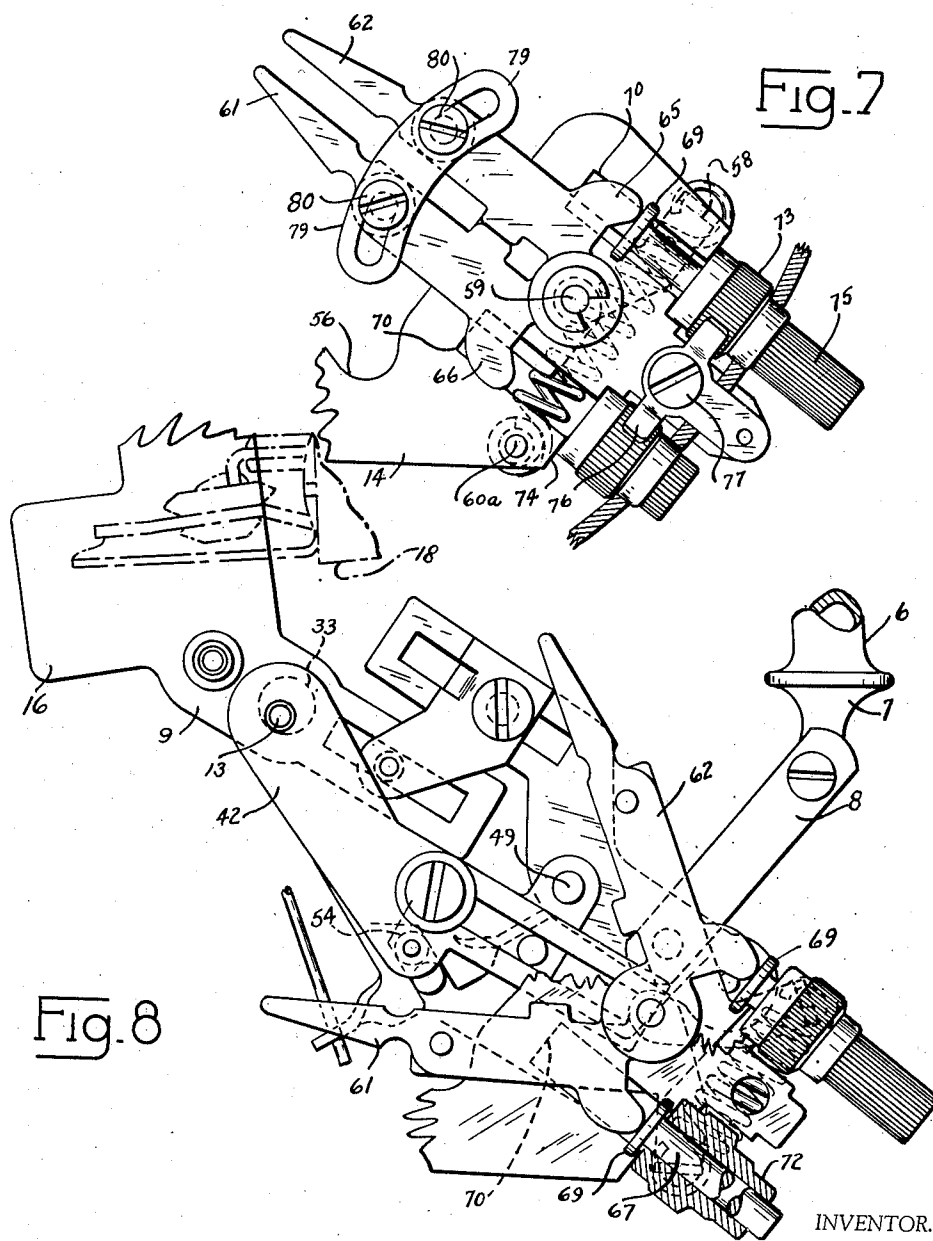


Fig. 8

Fig. 7

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UNITED STATES PATENT OFFICE

2,043,441

DOUBLE ADJUSTMENT CONTROL

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Application February 8, 1935, Serial No. 5,613

8 Claims. (Cl. 200—81)

This invention relates to improvements in double adjustment controls, and more particularly to a pressure actuated circuit control having a double adjustment.

5 This invention is a further development of this applicant's pressure actuated circuit controls such as disclosed in his prior patents Nos. 1,662,122 granted March 13, 1928, and 1,734,015 and 1,734,016 both granted October 29, 1929. It is an object of this invention to construct a control of this character with a visible indicator, or pointer, in connection with a calibrated scale which may be adjusted to operate the control in one direction at a predetermined pressure indicated on the scale by the pointer and in the opposite direction indicated by another pointer at the pressure indicated upon the scale.

15 With these and other objects in view, reference is made to the accompanying sheets of drawings which illustrate preferred embodiments of this invention with the understanding that minor changes may be made without departing from the scope thereof.

In the drawings—

25 Figure 1 is a view in front elevation of a control constructed in accordance with this invention mounted within a cylindrical casing from which the front cover has been removed, with the switch shown in section.

30 Figure 2 is an enlarged, fragmentary, detailed view in transverse vertical section, taken upon the line 2—2 of Figure 1, with parts thereof shown in elevation.

35 Figure 3 is an enlarged, fragmentary, detailed view of the switch operating and adjusting means showing the parts in the position assumed when the switch has been closed.

40 Figure 4 is a similar view showing the positions assumed by the operating parts as the increasing pressure has moved the said parts in the direction for opening the switch.

Figure 5 is a similar view illustrating the position assumed by the parts when the increasing pressure has opened the switch.

45 Figure 6 is a view similar to Figure 5, illustrating the over travel position of the parts when the switch has been opened and the pressure has increased beyond that necessary to open the switch.

50 Figure 7 is a fragmentary, detailed view of a modified construction employed when a single adjustment is desired.

55 Figure 8 is a view similar to Figure 1, illustrating a modification of the adjusting means whereby the device is semi-automatic, and is provided with a hand reset.

As illustrated in Figure 1, the operating parts of this control are contained within a cylindrical casing 1, and include a Bourdon tube 2 fixed at one closed end 3 to the casing wall by screws 4 which end communicates with a stem 5 adapted to be connected with the source of pressure and the free closed end 6 is provided with a bracket 7 secured thereto for pivotally mounting one end of a switch actuating link 8.

A switch carrier 9 is mounted upon a pivoted column 10, one end of which preferably is shouldered and received within a bearing member, or cap, 11 secured to the bottom 12 of the casing in line with the vertical axis of the stem 5 with the opposite end of the column 10 shouldered and received within a bearing 13 provided in a face plate 14. The face plate extends parallel to the bottom 12 of the casing and is mounted upon the end of a stud 15 secured at the opposite end to the bottom 12 preferably to the left and below the column 10 having portion 14^a of the face plate passed through and engaging the side wall of the casing 1, as shown in Figures 1 and 2.

The switch carrier 9 is in the form of a plate having a portion 16 extending upward and to the left of the pivotal column 10, the upper end of which supports a clip 17 carrying one or more mercury tube switches 18 and provided with a portion 19 extending downwardly and to the right of said pivotal column, as shown in Figures 5 and 6. As shown in Figure 2, the carrier 9 is securely fixed upon the column 10 against a shouldered portion 20 thereon and the portion 19 is provided with a longitudinal rectangular slot 21 the longitudinal center line of which passes through the center of the column 10.

The end of the switch actuating link 8 opposite its pivotal connection to the Bourdon tube 2 is pivotally connected adjacent one end of a switch operator plate 22 by the pivot 23, as best shown in Figures 2, 5 and 6. The other end of the switch operator is provided with an elongated rectangular slot 24. The slotted end of the operator 22 mounts an adjustable plate 25 having a sliding connection within the slot 24 and an arm 26 adapted to extend over the portion 19 of the switch carrier to mount a stud 27 upon the under side thereof adapted to travel within the slot 21 of the switch carrier and impart motion thereto. The opposite end of the operator plate beyond the pivotal connection 23 of the switch operator 22 is pivoted by the pivot 28 to the short end of an L-shaped plate 29, the opposite end of which is mounted upon a pivoted column 30 parallel to the column 10 arranged below and to

the right thereof and mounted in bearings 31 and 32 in the bottom 12 of the casing in the front plate 14 in a manner similar to the column 10. The column 30 passing through a circular aperture 33 provided therefor in the portion 19 of the switch carrier acts to limit the rotation of the switch carrier 9.

The mercury tube switch 18, shown in Figure 1, is of a commercial type and in the position illustrated, the electrodes 34 are submerged in the body of mercury 35 thereby completing the circuit through the switch. The lead wires 36 from the switch are preferably passed through a plate of insulating material 37 spaced apart from the front plate 14 and the base 12 having one edge engaged in the notch 38 of the stud 15 with the opposite edge mounted upon a stud 39 supported upon the base 12 of the casing with the ends of the lead wires 36 connected to binding posts 40 extending through from the upper side of the plate 37. The base 12 of the casing is provided with an aperture 41 through which the current carrying wires may be passed and connected to said binding posts.

The mercury tube switch 18 is shown partly in section in Figure 1, and is indicated in dot and dash lines upon Figures 3, 4, 5 and 6. The relation of the Bourdon tube and connections to the switch carrier are such that when there is no pressure within the Bourdon tube, the switch assumes the closed position, as shown in Figures 1 and 3, and when pressure begins to expand the Bourdon tube, the link 8 will impart rotation to the L-shaped plate 29 through plate 22 and pivot 28 and also cause the switch operator plate 22 to rotate about the stud 27 engaged in the slot 21 of the portion 19 of the switch carrier without imparting any movement to the switch carrier. It is therefore necessary to provide a stop to limit the rotation of the plate 29 before the plate 22 will be caused to rotate about its pivot 28 to impart a rotative movement to the switch carrier. To accomplish this end a limiting plate 42 is mounted in spaced apart parallel relation to the L-shaped plate 29 with one end secured to a bushing 43 mounted upon the column 30 which also supports the corresponding end of the L-shaped plate 29, and adapted to be rotated thereabout. The opposite end of the plate 42 is provided with a longitudinal slot 44 mounting a plate 45 to adjustably slide over said slot guided by a stud 46 and clamping screw 47 passing through said slot. The plate 45 is provided with an L-shaped extension 48 which carries an abutment stud 49, the purpose of which will be hereinafter described.

In order to cause the L-shaped plate 29 and stop plate 42 to travel in unison throughout a part of the rotation imparted by the movement of the Bourdon tube and yet allow a further rotation of the L-shaped plate in both directions independent of the stop plate, after its movement has been arrested, a spring 50 is coiled about the bushing 43 between the plates 29 and 42 with both ends extending between said plates with the respective ends engaged with the lower ends of plates 51 and 52 which are pivotally mounted at their opposite ends to the plate 29 by the pivot 53. The plate 29 is provided with a stud 54 which extends between the plates 51 and 52 and the plate 42 is provided with a stud 55 which extends between the plates 51 and 52 between the stud 54 and pivot 53 so that the tension of the spring 50 normally maintains the plates 51 and 52 in engagement with both studs and would normally

cause the two plates 29 and 42 to rotate in unison, and at the same time, whenever the movement of the stop plate 42 is arrested in either direction, a continued movement in the same direction may be imparted to the L-shaped plate 29 against the tension of the spring which will immediately return the plates to their normal relation when released.

To provide abutments to be engaged by the abutment stud 49 carried from the free end of the stop plate 42, a portion of the front plate 14 is cut out as indicated at 56, and two abutment plates 57 and 58 are mounted upon a stud 59 passing through the front plate 14 between the cut out portion 56 and the side wall 1 of the casing which plates extend upward on opposite sides of the abutment stud 49. Each of the plates 57 and 58 is provided at the pivoted end with an angular extension which is bent backward at a right angle thereto and the extremities of these bent back portions are secured together by a coiled spring 60. As these positions extend beyond and below the pivot 59, the coil spring will tend to force the upper free ends of the plates away from each other. On the front side of the front plate 14, two indicators 61 and 62 are mounted at their lower ends upon the pivot stud 59 also mounting the plates 57 and 58. The upper portion of the abutment plate 57 is connected to the indicator 61 by a stud 63 and the abutment plate 58 is similarly connected to the indicator 62 by a similar stud 64 whereby the connected indicators and plates rotate in unison. Each of the indicators 61 and 62 are provided adjacent their pivoted ends with outstanding feet 65 and 66.

Independent movement is imparted to the respective feet to cause a rotation of the indicators and abutment plates against the tension of the spring 60 by means of plungers 67 and 68 mounted to reciprocate in the side wall 1 of the casing. Each plunger is provided with an enlarged contacting head 69 adapted to engage the respective feet 65 and 66 which heads are diametrically slotted and are adapted to travel with the slotted portions in engagement with the edges of parallel cut out portions 70 provided therefor in the front plate 14. The opposite ends of the plungers are each provided with a screw threaded portion 71, as shown in Figure 3, which portions are threaded into sleeves 72 which extend through and are rotatably mounted on the side wall 1 of the casing. The sleeves are provided with annular knurled shoulders 73 which engage the inner wall of the casing and reduced portions beyond the shoulders which are received in cut out portions 74 of the front plate 14. The exterior portions 75 of the sleeves are also knurled so that they may be manually rotated to extend or withdraw the plungers 67 and 68 to impart a rotative movement to the indicators 61 and 62. In order to prevent further rotation of the sleeves after the indicators have been set, a resilient plate 76 having its ends in contact with the knurled shoulders 73 is secured by a central screw 77 to the front plate 14 between the sleeves, as shown in Figure 1.

An arcuate scaled indicator plate 78 is adjustably secured over the front plate 14 over which the pointed ends of the indicators 61 and 62 travel.

From the above description it is seen that when the right hand indicator has been positioned by proper rotation of the knurled sleeve 75 to indicate the pounds pressure desired to cause the

Bourdon tube to throw the switch from the closed to the off position, the expanding of the Bourdon tube will cause the L-shaped plate 29 and the stop plate 42 to rotate together until the abutment stud 49 engages the abutment plate 58 attached to the indicator 62 at the same time the operator plate 22 is caused to rotate with its stud 27 serving as a pivot and as the Bourdon tube still expands the operating link 8 connected thereto will then impart a rotative movement to the operator plate 22 about its pivot 28 and through engagement of its stud 27 within the slot 21 of the carrier, rotate the carrier sufficiently to throw the switch to the open position. Upon setting the indicator 61 to the number of pounds pressure at which it is desired to cause the Bourdon tube to close the switch, as the pressure is relieved from the Bourdon tube it will contract and the operator plate is first rotated about its stud 27 and during this movement the L-shaped plate 29 and the stop plate 42 will rotate together until the abutment stud 49 engages the plate abutment 57 connected with the indicator 61 and then movement will be imparted by the link 8 to the operator plate 22 to cause the operator to be rotated about its pivot 28 and cause the carrier to be rotated in the opposite direction to close the switch.

It is readily seen by the proper adjustment of the indicators 61 and 62, the switch may be caused to open and close at any desired pressure. It may be desirable to provide but a single adjustment whereby the switch will be immediately thrown in one direction upon a predetermined pressure in accordance with the position of the indicator 62 and operated in the reverse direction upon any decrease in pressure therefrom. In such a case, the modified construction illustrated in Figure 7 is employed. As shown, the indicator arms 61 and 62 are joined to each other by a slotted plate 79 adjustably secured to the respective arms by screws 80 and the plunger 67 normally actuating the arms 61 is omitted. In this form, one end of the spring 60 is fixed to a post 60^a mounted on the plate 14. This provides a purely automatic operation of the switch with a fixed differential. It may be desirable to provide a semiautomatic adjustment whereby the indicator 62 may be adjusted to trip the switch when a predetermined pressure has been reached and allow the switch to remain in said position when the Bourdon tube returns to pressures below the high operating point until manually reset to the original position. This is accomplished as illustrated in Figure 8. In this construction, the plunger 67 omits the threaded portion 71 and the sleeve 72 omits the screw threads so that the tension of the spring 60 will maintain the indicator 61 and corresponding abutment plate 57 at the end of its movement. The indicator 62 being set at the desired pressure when the Bourdon tube expands to that pressure, it will throw the switch and upon contracting the travel of the abutment stud 49 being unrestricted, the switch will remain in the thrown position until the plunger 67 is manually depressed causing the abutment stop 49 to be engaged by the abutment plate 57 and through the plate 42 transmit the movement to the other plates to throw the switch to its original position.

The spring 50 allows further expansion or contraction of the Bourdon tube after the abutment stop 49 has engaged either of the abutment plates without placing any of the parts under

undue stress or strain. The calibrated scale plate 57 is adjustably mounted so that each instrument may be adjusted to operate in accordance with a standard master gauge at the factory. The adjustable plate 25 and the adjustable plate 45 allow adjustment to the operating and actuating parts at the factory to compensate for various size Bourdon tubes, or for irregularities therein and to insure operation in accordance with the range indicated upon the scale.

What I claim is:

1. In a switching mechanism, an electric switch mounted upon a rotatable carrier plate, an expansible and contractible power element, and means transmitting movement of said power element to rotate said plate to open and close said switch including a switch operator plate, a floating pivot mounting one end of said operator plate the other end of the operator plate provided with a sliding pivotal connection with the switch carrier plate, a switch actuating link pivoted at one end upon the operator plate adjacent its floating pivot and at the other end upon the power element, and means for limiting the movement of the floating pivot, whereby movement of the said element imparts movement to the floating pivot causing the operator plate to rotate until the movement of the floating pivot is limited and then cause the operator plate to rotate about the floating pivot and cause its sliding pivoted connection to rotate the carrier plate.

2. The structure of claim 1 wherein the means for limiting the movement of the floating pivot is adjustable to predetermine the amount of movement of the expansible and contractible element necessary to operate the switch.

3. The structure of claim 1 wherein the means for limiting the movement of the floating pivot is adjustable to predetermine the amount of movement of the expansible and contractible element necessary to operate the switch and wherein the adjusting means is provided with a visible indicator.

4. The structure of claim 1 including means to limit the movement of the floating pivot in two directions whereby movement of the actuating link in one direction opens the switch and in the opposite direction closes the switch.

5. The structure of claim 1 including means to limit the movement of the floating pivot in two directions whereby movement of the actuating link in one direction opens the switch and in the opposite direction closes the switch and wherein said limiting means is adjustable to limit the travel of the floating pivot in one direction independently of the travel in the opposite direction.

6. In a switching mechanism, an electric switch, a switch carrier plate rotatably mounted upon an intermediate pivot, a prime mover, and means interposed between the carrier and mover to transmit movement from the prime mover to operate the switch, including a plate mounted upon a fixed pivot at one end and carrying a floating pivot upon the free end, a switch operator plate pivotally mounted at one end upon the floating pivot and having a sliding pivotal connection at the other end with the carrier plate, an actuating link pivotally connected at one end to the prime mover at the other end pivoted upon the operator plate adjacent its floating pivot, an abutment plate mounted upon a fixed pivot at one end to travel in unison with the floating pivot plate and carrying an abutment stud at the free end, and adjustable means limiting the travel of the free

ends of said plates upon engagement with the abutment stud.

7. The structure of claim 6 wherein said limiting means includes two pivoted off set arms extending on each side of said abutment stud.

8. The structure of claim 6 wherein said limiting means includes two pivoted off set arms ex-

tending on each side of said abutment stud with said mechanism all mounted within a casing and wherein means for adjusting the relation of the said arms to the said stud are mounted to extend through said casing to be operated upon the exterior thereof. 5

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