May 19, 1942. C. G. KRONMILLER 2,283,374

SWITCHING MECHANISM

Filed May 7, 1937 2 Sheets-Sheet 1

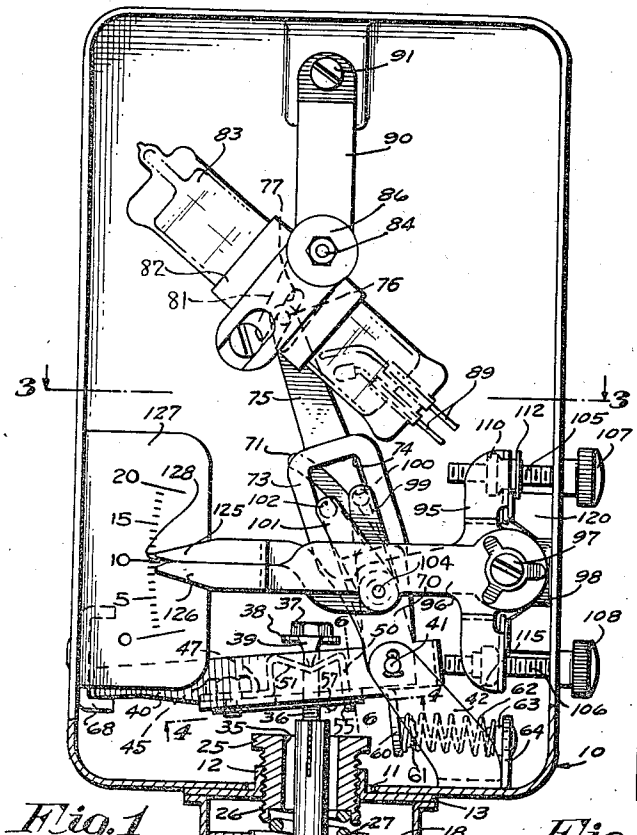


Fig. 1

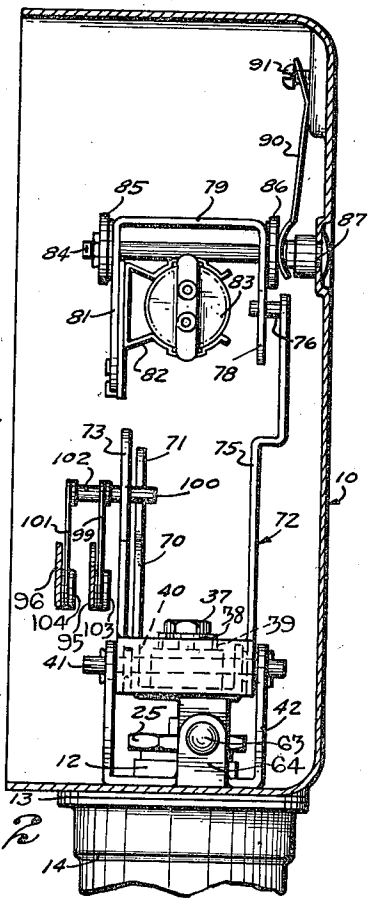


Fig. 2

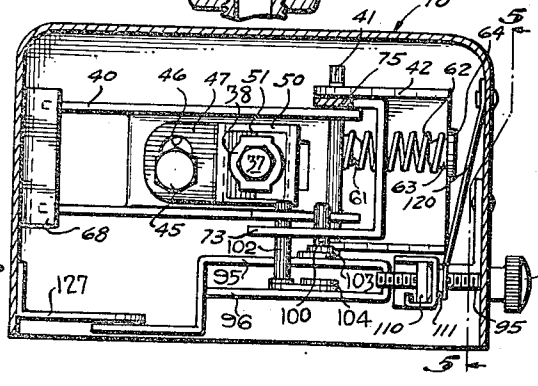


Fig. 3

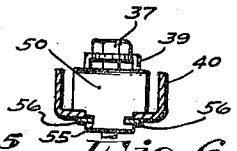


Fig. 6

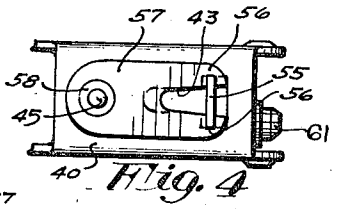


Fig. 4

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SWITCHING MECHANISM

Filed May 7, 1937 2 Sheets-Sheet 2

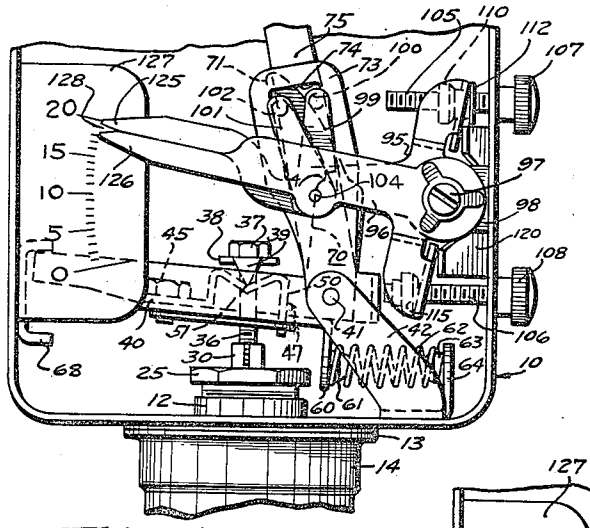


Fig. 7

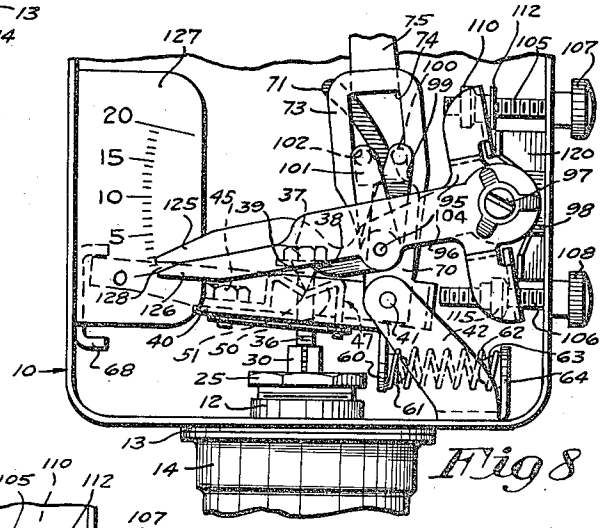


Fig 8

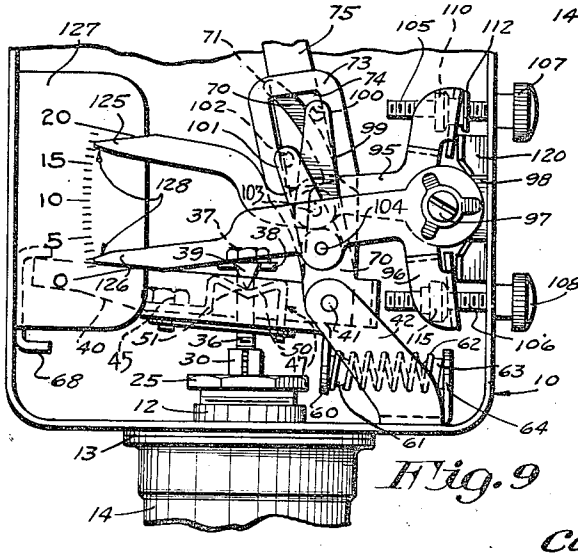


Fig. 9

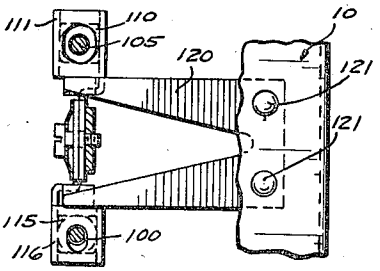


Fig. 5

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2,283,374

SWITCHING MECHANISM

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Application May 7, 1937, Serial No. 141,301

20 Claims. (Cl. 200—83)

This invention relates to switching mechanism and more particularly to that type of mechanism adapted to make or break an electrical circuit in response to changes in a condition value to control the operation of mechanism affecting the condition.

One object of this invention is to provide an improved switching mechanism responsive to changes in the value of a condition and to provide in such a mechanism an improved means for varying the condition values to which the mechanism responds.

An additional object is the provision, in a switching mechanism which responds to one condition value to open a circuit and to another condition value to close a circuit, of means whereby either of these values may be varied independently of the other.

A further object resides in the provision of means to adjust the operating differential of such a switching mechanism which are readily accessible and operable without the use of tools.

A further and more specific object is the provision of indicating means in association with such a differential adjusting means as will be hereinafter described whereby the condition value or values to which the switching mechanism responds may be readily ascertained at a glance.

As conducive to a clearer understanding of this invention, it may be pointed out that in certain types of switching mechanism, such as refrigeration controls, it is often desirable that the controlling electrical circuit for such refrigerating mechanism be broken upon the achievement of a predetermined high or low pressure or temperature in the apparatus, and likewise made upon the achievement of a second predetermined high or low temperature. Likewise, it is frequently necessary that these condition values differ from each other by a greater or less degree in accordance with the particular installation in order to obviate a relatively rapid making and breaking of the circuit and consequent strain on the operating mechanism thereof. Again, the requisite differential between the values at which the circuit makes or breaks varies with different conditions and for different installations. Thus, it is desirable that means be provided to adjust the differential in the switching mechanism in accordance with existing conditions.

An additional object of this invention is, therefore, the provision of means whereby either end of the operating differential, that is, the value of the first predetermined temperature or pressure above mentioned and the value of the second predetermined temperature or pressure, may be varied, each independently of the other.

An additional object is to provide a structure of the character to be hereinafter described which is durable, relatively inexpensive to construct and simple and reliable in operation.

Other objects will in part be obvious and in part pointed out hereinafter.

The invention, accordingly, consists in the combination of elements, arrangements of parts and features of construction all as will be more fully pointed out hereinafter and shown in the accompanying drawings.

Referring now to the drawings wherein is shown one illustrative embodiment of this invention:

Figure 1 is a front elevational view, partly in section, of a structure embodying the instant invention;

Figure 2 is a side sectional view of the structure of Figure 1 as viewed from the right, certain parts being broken away and certain other parts being shown in a different position of adjustment;

Figure 3 is a sectional view taken substantially along the line 3—3 of Figure 1 as viewed from the top;

Figure 4 is a plan view taken along the line 4—4 of Figure 1 as viewed from the bottom;

Figure 5 is a sectional view taken substantially along the line 5—5 of Figure 3 as viewed from the left, certain parts thereof being broken away;

Figure 6 is a detailed sectional view taken along the line 6—6 of Figure 1; and

Figures 7, 8 and 9 are detailed views showing certain of the mechanism shown in Figure 1 in different positions of adjustment, certain parts thereof being broken away.

Similar reference characters denote similar parts throughout the several views of the drawings.

Referring now to the drawings in detail, a casing generally indicated at 10 has an aperture 11 in the bottom thereof through which is passed a flange 12 of a top portion 13 of a housing 14. Housing 14 has a threaded member 15 having an aperture 16 therethrough rigidly secured to the lower portion thereof in any suitable manner. A pressure tube 17 communicates with aperture 16 and threadedly engages the threaded portion of member 15 to transmit pressure to the interior of housing 14 from any suitable source. An annulus 18 is rigidly secured to the interior of housing 14 and has secured thereto one end of a

sylphon bellows 19. The other end of bellows 19 is secured to a plate 20 which abuts one end of a coil spring 21, the opposite end of which abuts the base of housing 14. Secured to a suitably threaded interior portion of flange 12 is a guide 25, the lower end of which is provided with a recess 26 forming a seat for one end of a helical spring 27, the other end of which abuts a flange 28 secured to base plate 20. Flange 28 is provided with an aperture to accommodate a reduced end 29 of an operating rod 30. End 29 of rod 30 is provided with a head 31 which is predisposed within flange 28 in such a manner that movement of bellows 19 in either direction is transmitted directly to operating rod 30.

The upper extremity of rod 30 passes through an aperture 35 in guide 25 and a suitably threaded interior portion thereof is engaged by a screw 36 having a head 37. Screw 36 has positioned peripherially thereabout adjacent head 37 a collar 38 having a pair of oppositely disposed downwardly extending projections 39 thereon. A lever 40 is pivotally mounted on a pivot 41 carried by a bracket 42 rigidly secured to the base of casing 10 and has therein, as better shown in Figure 4, an aperture 43 through which screw 36 is passed. A set screw 45 passes through a slot 46 in a member 47 and engages a suitably threaded aperture (not shown) in lever 40. Member 47 is comprised of a bridge portion 50 having a groove 51 therein adapted to be engaged by projections 39. The end of bridge portion 50 is provided, as best shown in Figure 4, with an extending portion 55 adapted to engage and be held in place by the bifurcations 56 of a bifurcated resilient member 57 which in turn is engaged by the lower end of screw 45, being held in place in any desired manner as by a collar 58 (see Figure 4).

Thus it will be seen that upon a drop in pressure adjacent bellows 19, operating rod 30 moves screw 36 and its associated projections 39 downwardly, such movement in turn being transmitted to lever 40 to move the same in a downward direction as viewed in Figure 1. Slot 46 is provided in order that should for any reason projections 39 become out of alignment with groove 51 after previous factory adjustment of the bellows and their associated springs and a previous predetermination of the requisite depth to which screw 36 should be threaded into operating rod 30, member 47 may be displaced angularly in order to properly align groove 51 and projections 39.

Lever 40 is provided with a downwardly extending projection 60 carrying a stud 61, which latter forms a seat for one end of a coil spring 62, the opposite end of which engages a corresponding stud 63 carried by an upwardly extending member 64 secured to or forming an integral part of bracket 42. Spring 62 is of sufficient strength to compensate for the difference in strength between springs 27 and 21, which it should be noted are of different strength, spring 27 being the stronger, and serves normally to bias lever 40 upwardly against the pressure exerted and the bellows assembly through projection 39. When the device is adjusted for vacuum operation which may sometimes be desirable, the strength of spring 62 is sufficient to urge lever 40 to its uppermost limit in the absence of any subatmospheric pressure in housing 14.

The limits of movement of lever 40 are defined by a bracket 68 secured in any suitable manner to a side wall of casing 10 and provided with upper and lower flanges adapted to be abutted by the extremity of lever 40.

Thus from the foregoing, it will be seen that changes in pressure or other analogous condition in the desired locality at which the far end of pressure tube 17 terminates are transmitted to corresponding movement of lever 40, as previously described, and correspondingly to the switching mechanism in a manner to be described hereinafter.

Lever 40 is provided with an upwardly extending portion 70 which may be integral therewith and which is provided at its extremity with a narrow curved cam member 71. Mounted on pivot 41 is a substantially U-shaped member 72 (see Fig. 2), one leg of which, 73, is provided with a box-like aperture 74 positioned adjacent cam member 71, motion being transmitted from cam member 71 to leg 73 in a manner to be hereinafter described. The opposite leg 75 extends upwardly a substantial distance and is provided at its extremity with a pin 76. Pin 76 is engaged by a slot 77 carried by one leg 78 of a U-shaped bracket 79, the other leg 81 of which has secured thereto in any desired manner a mercury switch clip 82 which, in turn, carries a mercury switch 83. Bracket 79 is pivotally mounted on a pivot pin 84 between suitable washers 85 and 86, pivot pin 84 being secured at 87 to the rear wall of casing 10.

Thus it will be seen, that movement of bracket 72 is transmitted through movement of pin 76 to bracket 79 and hence mercury switch 83. Suitable leads (not shown) extend from the terminals 89 of mercury switch 83 to provide an electrical circuit to energize or deenergize any desired apparatus utilized in conjunction with the switching mechanism.

Means are also provided whereby mercury switch 83 is held in any position to which it is moved by pin 76, such means taking the form of a resilient leaf spring member 90 secured as by a screw 91 to the rear wall of casing 10, the opposite end thereof abutting washer 86 and biasing the same, and hence bracket 79 and mercury switch clip 82, away from the rear wall of casing 10 in such manner that the frictional engagement of the parts is, due to the normal resiliency of spring 90, sufficient to overcome any movement of switch 83 occasioned as by gravity in the absence of the relatively greater pressure exerted in the manner previously described through pin 76.

Having reference now to the manner in which movement of cam member 71 is transmitted to U-shaped member 72, a pair of bell crank levers 95 and 96 are pivoted as at 97 to a supporting bracket 98 secured to the side wall of casing 10. Lever 95 has pivoted thereon, as by a pivot pin 103, an upwardly extending portion 99 which carries at its extremity a transversely disposed pin 100. Similarly, lever 96 is provided with an upwardly extending portion 101 pivoted thereon, as by a pivot 104, and provided with a transversely extending pin 102. As best shown in Figure 2, pins 100 and 102 are of sufficient length to pass through aperture 74 and extend beyond cam member 71, as shown in Figures 1, 7, 8 and 9, upon opposite sides thereof. It should here be noted that aperture 74 is of a width to substantially accommodate pins 100 and 102 when spaced by the exact width of cam member 71. Thus, when the parts are in the position shown in Figure 1, movement of lever 40 is transmitted through cam 71 directly and substantially without lost motion to either pin 100 or 102 to move U-shaped bracket 72 substantially directly and

hence move mercury switch 83 to its open or closed position. Means are provided, however, for varying the position of levers 95 and 96 and their corresponding pins 100 and 102. These means take the form of screws 105 and 106 passed through suitably disposed apertures in the side wall of casing 10 and provided, respectively, with heads 107 and 108 which may be provided with knurled grips to facilitate rotation thereof as desired. The inner end of screw 105 engages a squared nut 110 positioned, as better shown in Figure 3, in a recess 111 formed by bending the material comprising the outer end of bell crank lever 95 into a hooked shaped portion of a dimension sufficient only to accommodate nut 110 and insufficient to permit rotation of nut 110 therein. Nut 110 is provided with a flange 112. Thus it will be seen that rotation of head 107, and consequently of screw 105, causes movement of nut 110 inwardly or outwardly thereon and corresponding movement of bell crank lever 95 about its pivot 97. Similarly, screw 106 engages a nut 115 fitted, as shown in Figure 5, into a recess 116 similar to recess 111 comprised of a correspondingly bent outer extremity of lever 96. Nut 115 may or may not be provided with a flange corresponding to flange 112 of screw 110 inasmuch as the presence of such a flange is unnecessary, as will be hereinafter described. A bifurcated spring member 120 is, as best shown in Figure 5, secured as by rivets 121 or in any other suitable manner to the side wall of casing 10 and serves by engagement with the extremities of levers 95 and 96 to prevent the movement of heads 107 and 108 of screws 105 and 106 outwardly from the side wall of the casing, whereby the position of nuts 110 and 115 is at all times accurate with respect to the desired calibration of the instrument. Flange 112 is provided in order that pressure exerted by cam 71 upon pin 100 may not be transmitted to movement of the entire lever assembly including screw 105 and head 107 under certain circumstances to be pointed out hereinafter.

Levers 95 and 96 are provided respectively at their extremities with pointers 125 and 126 adapted to indicate certain indicia carried by a scale plate 127 secured in any desired manner to the side wall of casing 10 adjacent these pointers. It should be pointed out that the pointers 125 and 126 are so arranged as to lie in substantial alignment with each other but are angularly cut in such manner that there is always a distance between the two ends thereof, as generally indicated at 128. The purpose of this and its utility will be pointed out hereinafter.

From the foregoing, the operation of the structure should now be apparent to those skilled in the art. In the mechanism as shown in Figure 1 an increase in pressure in housing 14 adjacent bellows 19 will cause the bellows to contract moving operating rod 30 and its associated mechanism upwardly to permit spring 62 to tilt mercury switch 83 to its open circuit position. Assuming that the indicia on the scale 127 indicate pressure in pounds with the setting of the instrument as in Figure 1, when the pressure adjacent bellows 19 has increased to 11 pounds it will be seen that mercury switch 83 will, as above stated, move to its open position. Upon a subsequent drop in pressure, however, the pressure must drop to 9 pounds before the switch will move to its circuit closing position. The differential of 2 pounds in the illustrative embodiment of the invention herein shown and described may be considered as the minimum permissible in the instrument since in controls of this character a slight differential is always desirable. Assuming now, however, that it is desired to increase the pressure at which mercury switch 83 will tilt to open the circuit therethrough and simultaneously increase the pressure at which it closes to 18 pounds, upon a suitable rotation of screw 105 through its head 107, lever 95 and its associated pointer 125 will be moved to the position shown in Figure 7. Correspondingly, rotation of screw 106 through head 108 in the opposite direction will move lever 96 and its associated pointer 126 to a point adjacent the indicating character indicative of 18 pounds on the scale plate 127. Such movement of these pointers through their associated screws will correspondingly move pins 100 and 200 upwardly in aperture 74 until they are at opposite sides of cam member 71 adjacent the upper limit of aperture 74.

Thus it will be seen that due to the configuration of cam member 71 a relatively greater pressure must be exerted by bellows 19 through operating rod 30 and its associated mechanism on lever 40 in order to permit mercury switch 83 to be moved by spring 62 to its open circuit position, since lever 40 must travel a greater distance in order to move cam 71 sufficiently to cause movement of mercury switch 83 through member 72. In Figure 1 it will be noted that the mechanism is shown in circuit closed position. In Figures 7, 8 and 9, however, the mechanism is disclosed in the position assumed when the pressure adjacent bellows 19 has risen to such a degree as to cause mercury switch 83 to be moved to its open position.

Assuming that it is desired, still maintaining the same 2 pounds differential, to have the mercury switch open upon the achievement of a pressure of 2 pounds and closed when the pressure adjacent bellows 19 drops to zero pounds. Reverse rotation of screw 106 will cause a downward movement of bell crank lever 96 and its associated pointer 126 and, likewise, opposite rotation of screw 105 will cause a similar downward movement of bell crank lever 95 and its associated pointer 125, such movement in turn moving pins 102 and 100, respectively, downwardly until they are adjacent the lower limit of aperture 74. This downward movement, it will be seen will affect the position of switch 83, since due to the configuration of the cam 71 previously described a certain amount of the requisite travel of the switch necessary to cause the same to move to open or closed position will be taken up by the abutment of cam 71 with pins 100 and 102. Thus, a relatively less pressure will be required to cause the operation of mercury switch 83 to its open and/or closed positions.

Assume now, however, that it is desired to vary the differential from the previously discussed minimum differential of 2 pounds. Starting with the parts in the position as shown in Figure 1, rotation of screw 107 in one direction will cause bell crank lever 95 to move its associated pointer 125 to a position as shown in Figure 9 adjacent any desired numeral. Similarly, rotation of screw 106 will cause a downward movement of pointer 126 carried by bell crank lever 96 and a corresponding upward and downward movement, respectively, of pins 100 and 102. With the parts in the position shown in Figure 9, a wide operating differential is provided. It will be seen that upon a decrease in pressure in housing 14 sufficient to cause operating lever 40 to be

moved downwardly, there will be a considerable amount of lost motion before cam member 71 engages pin 102 whereby to move member 72 and hence tilt mercury switch 83. Conversely, upon an increase in pressure, the same lost motion will prevail prior to the abutment of cam member 71 with pin 100 to move the switch in a reverse direction.

Thus it will be seen that any desired differential may be provided simply by a slight adjustment of screws 105 and 106 whereby there may be provided a wide range of both the points at which the switch is opened and the points at which the switch is closed, such ranges being capable of independent variation in order to provide a differential which may vary from 2 to 20 pounds in the illustrative embodiment of the invention as shown.

While the mechanism of the instant invention is herein described as adapted to open a circuit through a switch mechanism upon an increase in pressure and close the same upon a decrease in pressure, it will be readily apparent to those skilled in the art that the reverse operation, that is, closing a circuit upon the achievement of a given low pressure and opening the circuit upon the achievement of a given high pressure may also be accomplished without material change in the structure as described, a mere reversal of the position of mercury switch 83 being sufficient to accomplish this result.

Thus it will be seen that there is herein provided a structure which accomplishes the objects of this invention and others in a satisfactory, reliable and dependable manner and includes many advantages of great practical importance.

As many embodiments may be made of this invention and as many modifications may be made in the embodiment above described, it is to be understood that all matter hereinbefore described or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In a device of the character described, in combination, a member movable in response to changes in the value of a condition, switch means, a lost motion connection between said switch means and said member whereby the latter moves the former, said lost motion connection comprising a slot having two pins extending therethrough and a cam engaged on opposite sides by said pins, and means to vary the position of each of said pins in said slot independently of the other.

2. In a device of the character described, in combination, a member movable in response to changes in the value of a condition, switch means, a lost motion connection between said switch means and said member whereby the latter moves the former, said lost motion connection comprising a slot having two pins extending therethrough and a cam engaged on opposite sides by said pins, means to vary the position of each of said pins in said slot independently of the other, and visual means to indicate the position of each of said pins.

3. In a device of the character described, in combination, a member movable in response to changes in the value of a condition, a tiltable mercury switch, a lost motion connection between said switch and said member whereby the former is tilted by the latter, said lost motion connection comprising a slot having two pins extending therethrough and a cam engaged on opposite sides by said pins, and means to vary the position of each of said pins in said slot independently of the other.

4. In a device of the character described, in combination, a member movable in response to changes in the value of a condition, a tiltable mercury switch, a lost motion connection between said switch and said member whereby the former is tilted by the latter, said lost motion connection comprising a slot having two pins extending therethrough and a cam engaged on opposite sides by said pins, means to vary the position of each of said pins in said slot independently of the other, and visual means for indicating the position of each of said pins whereby to indicate the operating differential of the instrument.

5. In a device of the character described, in combination, a casing, a member in said casing movable in response to changes in the value of a condition, switch means, a lost motion connection between said switch means and said member whereby the latter moves the former, said lost motion connection comprising a slot having pins extending therethrough and a cam engaged on opposite sides by said pins, and means to vary the position of each of said pins independently of the other, said means being accessible from the exterior of said casing.

6. In a device of the character described, in combination, a casing, a member in said casing movable in response to changes in the value of a condition, mechanism operable by said member, means occasioning one operation of said mechanism upon the achievement of a given condition value and a converse operation upon the achievement of a different condition value, fixed supporting means, and means mounted on said fixed supporting means for adjusting each of said values independently of the other, the range of adjustment of one of said values overlapping the range of adjustment of the other of said values.

7. In a device of the character described, in combination, a casing, a member in said casing movable in response to changes in the value of a condition, mechanism operable by said member, means occasioning one operation of said mechanism upon the achievement of a given condition value and a converse operation upon the achievement of a different condition value, fixed supporting means, means mounted on said fixed supporting means for adjusting each of said values independently of the other, the range of adjustment of one of said values overlapping the range of adjustment of the other of said values and visual indicating means denoting each of said condition values.

8. In a device of the character described, in combination, a casing, a member in said casing movable in response to changes in the value of a condition, switch means in said casing, means to move said switch means to circuit closing position upon the achievement of a given condition value and to circuit opening position upon the achievement of a different condition value, fixed supporting means, and means mounted on said fixed supporting means for adjusting each of said values independently of the other, the range of adjustment of one of said values overlapping the range of adjustment of the other of said values.

9. In a device of the character described, in combination, a casing, a member in said casing movable in response to changes in the value of

a condition, switch means in said casing, means to move said switch means to circuit closing position upon the achievement of a given condition value and to circuit opening position upon the achievement of a different condition value, fixed supporting means, means mounted on said fixed supporting means for adjusting each of said values independently of the other, the range of adjustment of one of said values overlapping the range of adjustment of the other of said values and visual indicating means indicative of each of said condition values.

10. In a switching mechanism, in combination, a casing, a member movable in response to variations in the value of a condition, a tiltable mercury switch in said casing movable by said member, a lost motion connection between said member and said mercury switch, means operable from the exterior of the casing to vary independently each of the limits of said lost motion connection to vary the operating differential between the condition value at which the mercury switch tilts in one direction and the condition value at which it tilts in the opposite direction, and visual means indicative of each of the limits of said lost motion connection.

11. In a switching mechanism, in combination, a casing, a member in said casing movable in response to variations in the value of a condition, switch means operable by said member, a lost motion connection between said switch means and said member, fixed supporting means, means mounted on said fixed supporting means to vary independently each of the limits of said lost motion connection and hence the operating differential of the device, and visual means indicating the extent of said lost motion connection.

12. In a device of the character described, in combination, a member movable in response to changes in the value of a condition, said member having an extending portion having a slot therein, a lever having an extending portion comprising a curved cam surface, said cam surface being positioned adjacent said slot, a mercury switch movable by said lever, two members pivotally mounted adjacent said slot and cam, pins secured to each of said last mentioned members extending through said slot and abutting opposite sides of said cam and surface, and means to rotate each of said last mentioned members about said pivot to vary the position of each of said pins in said slot to vary the condition values at which said switch is moved.

13. In a device of the character described, in combination, a member movable in response to changes in the value of a condition, said member having an extending portion having a slot therein, a lever having an extending portion comprising a curved cam surface, said cam surface being positioned adjacent said slot, a mercury switch movable by said lever, two members pivotally mounted adjacent said slot and cam, pins secured to each of said last mentioned members extending through said slot and abutting opposite sides of said cam surface, means to rotate each of said last mentioned members about said pivot to vary the position of each of said pins in said slot to vary the condition values at which said switch is moved, and visual means indicating the relative position of each of said pins in said slot.

14. In a device of the character described, in combination, a casing, a member in said casing movable in response to changes in the value of a condition, said member having an extending portion having a slot therein, a lever having an extending portion comprising a curved cam surface, said cam surface being positioned adjacent said slot, a mercury switch movable by said lever, two members pivotally secured to said casing, pins carried by each of said last mentioned members extending through said slot and abutting opposite sides of said cam surface, and means extending exteriorly of said casing to rotate each of said last mentioned members about said pivotal securing means to vary the position of each of said pins and hence the condition values at which said switch is moved.

15. In a device of the character described, in combination, a casing, a member in said casing movable in response to changes in the value of a condition, said member having an extending portion having a slot therein, a lever having an extending portion comprising a curved cam surface, said cam surface being positioned adjacent said slot, a mercury switch movable by said lever, two members pivotally secured to said casing, pins carried by each of said last mentioned members extending through said slot and abutting opposite sides of said cam surface, means extending exteriorly of said casing to rotate each of said last mentioned members about said pivotal securing means to vary the position of each of said pins and hence the condition values at which said switch is moved, and visual means indicating the relative position of each of said pins in said slot.

16. In a device of the character described, in combination, a condition responsive device, a movably mounted control member, connections between said device and member, a first means individually determining the condition value at which said device operates said member in one direction, and a second means individually determining the condition value at which said device operates said member in the opposite direction, the range of adjustment of one of said values overlapping the range of adjustment of the other of said values, said first and second means being mounted independently of said device, member, and connections.

17. In a device of the character described, in combination, a condition responsive device, a movably mounted control member, a lost motion connection between said device and member, and means mounted independently of said condition responsive device, connection and control member for determining the amount of said lost motion and hence the differential of operation.

18. In a device of the character described, in combination, a condition responsive device, a movably mounted control member, a lost motion connection between said device and member, a first means for determining one limit of said lost motion, and a second means for determining the other limit of said lost motion, said first and second means being mounted independently of said condition responsive device, member, and connection.

19. In a device of the character described, in combination, a condition responsive device, a movably mounted control member, a lost motion connection between said device and member, a casing for said member and connection, a first means mounted on said casing for determining one of the limits of said lost motion, and a second means mounted on said casing for determining the other limit of said lost motion, said first and second means being individually adjustable from

outside said casing for varying the two limits of said lost motion.

20. In a switching mechanism, in combination, a member movable in response to variations in the value of a condition, switch means operable by said member, a lost motion connection between said switch means and said member, means for independently varying each of the limits of said lost motion connection to vary the operating differential of the switch means, stationary means for supporting said varying means, and visual means indicating the extent of said lost motion connection.

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