Sept. 9, 1941. A. L. JUDSON 2,255,667

PRESSURE OPERATED SWITCH

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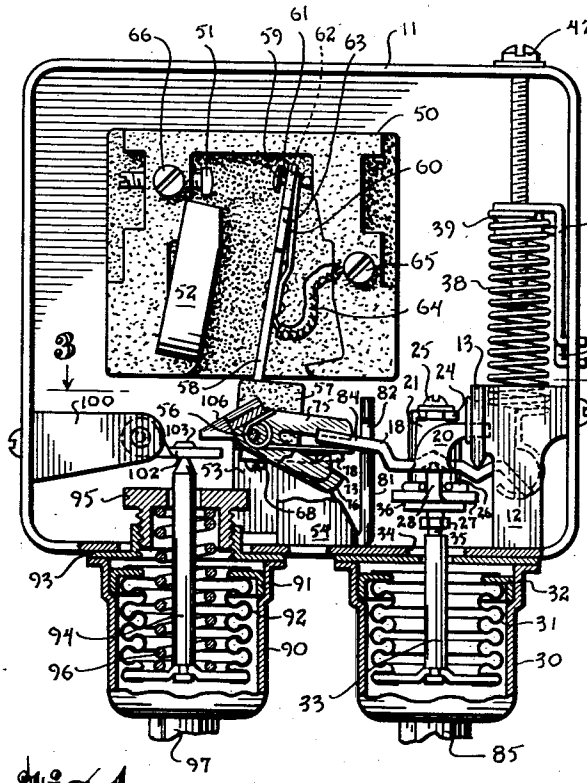

Fig. 1

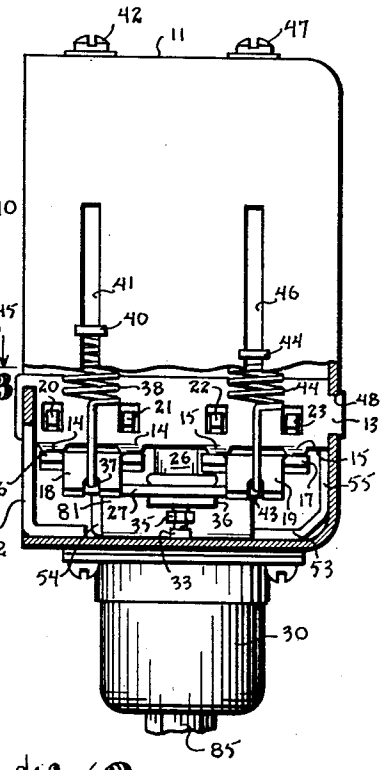

Fig. 2

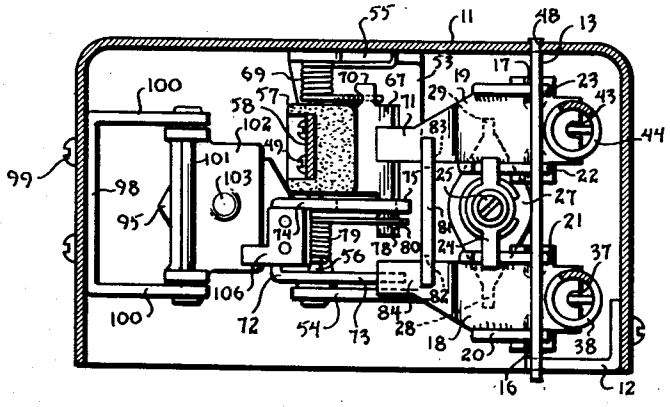

Fig. 3

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PRESSURE OPERATED SWITCH

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22 Claims. (Cl. 200—83)

This invention relates broadly to a temperature or pressure operated switch, and more specifically to an open contact switch which is operated by a plurality of bellows:

A low pressure bellows is provided which operates, through suitable linkage, to close a switch at one pressure and open it at a second pressure. It is an object of this invention to provide a pressure operated switch of this character wherein the pressure at which the switch is closed and the pressure at which the switch is open are individually adjustable and wherein such adjustments are indicated to the operator outside of the switch casing.

It is a further object of this invention to combine with such a switch a high pressure bellows which is capable of opening the switch at any time regardless of the condition of the low pressure bellows and without placing any excessive strain on either of the bellows in performing such a function.

A further object of the invention is to provide a switch arm which is biased in one direction and which is provided with two levers, one lever operating the arm in one direction against its bias, and the other lever determining when the bias shall be permitted to rotate the arm in the opposite direction.

A further object is to provide individually adjustable springs for varying the force opposing movement of these levers by the low pressure bellows so that this bellows will rotate these levers at different pressures.

A still further object is to have one of these levers operate on the switch arm through a spring, and to provide a magnet for cooperating with the switch arm so that the spring is of sufficient strength to hold the switch arm in open position against its bias but is incapable of moving it from closed position against its bias plus the pull of the magnet.

In the field of refrigeration, for which this switch is particularly adapted, the low pressure bellows is connected to respond to the pressure in the suction line between the evaporator and the suction side of the compressor to normally control the compressor motor in accordance with this pressure. The high pressure bellows is connected to the high pressure line between the compressor and condenser in order to open the circuit to the compressor motor upon the occurrence of an abnormally high pressure at this point.

Although these bellows will be described as responding to pressure it will be clear that they may be connected with a thermal bulb so as to respond to temperature, or some other condition, and I therefore wish it understood that I consider as my invention the use of a means for operating the switching mechanism to be described later, regardless of the condition to which that means responds.

These and other objects will become readily apparent to those skilled in the art as the following specification is read in the light of the accompanying drawing in which:

Figure 1 is a front elevation of my device with the cover removed, some parts being broken away and some shown in section for the sake of clarity,

Figure 2 is a side elevation with part of the casing broken away to show the adjusting springs and operating levers, and

Figure 3 is a section taken on the line 3—3 of Figure 1 and looking in the direction of the arrows.

The various elements which go to make up the mechanism of this invention are mounted within a metallic casing which is indicated at 11. A bracket 12 is suitably attached to the casing at the forward end thereof and the bracket supports one end of a bar 13, the other end of which is inserted through a hole 48 in the rear of the casing 11. The bar 13 carries two pairs of knife edges 14 and 15 which extend downwardly and are adapted to cooperate with depressions 16 and 17 located in two operating levers 18 and 19. Each lever is provided with a pair of arms which are inserted through holes in the bar. The arms on the lever 18 are designated 20 and 21 and the arms on the lever 19 are designated 22 and 23. The arms 21 and 22 are provided with rounded surfaces on their upper edges across which is located a connecting member 24. Suspended from this connecting member by means of screw 25 and extending downwardly between the two levers is a post 26 which carries at its lower extremity a transversely extending carriage 27 which has at each extremity an upstanding knife edge 28 and 29. The knife edges 28 and 29 engage in depressions located in each of the levers 18 and 19. Suitably fastened to the underneath side of the casing 11 is a housing 30 in which is located a bellows 31 which is sealed to an annular member 32. A stem 33 is fastened to the lower end of the bellows and extends upwardly through a hole 34 in the bottom of the casing 11 and carries at its upper end an operating pin 35 which engages in a bearing member 36 carried by the carriage 27. The lever 18

has in its right-hand end, as viewed in Figure 3, a notch 37 in which is looped one end of a coiled tension spring 38. The upper end of this spring is securely fastened to a nut 39 having an extension 40, the end of which extends through a slot 41 in the side of the casing. A screw 42 depends loosely through a hole in the top of the casing 11 and screw threadedly engages the nut 39. Rotation of the screw 42 will cause a vertical adjustment of the nut 39 due to the fact that engagement of the extension 40 with the slot 41 in the casing will prevent the rotation of nut 39 upon rotation of the screw 42. Lever 19 is likewise provided with a notch 43 in which is looped one end of a spring 44 whose upper end is securely fastened to a nut (not shown) which is similar to the nut 39. This nut also has an extension 45, the end of which is inserted in a slot 46 in the side of the casing and thereby prevents rotation of the nut. A screw 47 loosely depends through the top of casing 11 and screw threadedly engages the nut so that upon rotation of the screw the nut will be vertically adjusted to vary the tension of the spring 44. The arrangement of the bellows 31 and the springs 38 and 44 is such that the bellows on increase in pressure within the housing 30 will rotate the levers in a clockwise direction and on a decrease in pressure will permit the springs 38 and 44 to rotate the levers in a counter-clockwise direction.

Suitably fastened on the rear of the casing 11 is a hollow block of insulation 50. Adjustably positioned in one side of block 50 is a stationary electrical contact 51 and immediately below this contact is secured a permanent magnet 52. The magnet 52 is positioned at a slight angle with respect to the vertical and has a slight bevel at the pole faces.

A bracket 53 is suitably fastened to the bottom of the casing 11 and is provided with two upstanding arms 54 and 55 between which extends a spindle 56. A piece of insulating material 57 is mounted to rotate freely on the spindle 56 and carries a contact arm 58 by means of screws 49, said contact arm extending upwardly into the block of insulation 50. At its upper end the contact arm 58 carries a movable contact 59 by means of a leaf spring 60 and a short stem 61. The contact 59 is located on one side of the arm 58 and the stem 61 extends through a hole 62 in the arm 58 to engage the leaf spring 60 on the opposite side of the contact arm. The spring functions normally to hold the contact 59 away from the arm as shown in Figure 1 so as to permit a certain amount of press back as the movable contact 59 engages the stationary contact 51. Contact arm 58 is provided with transversely extending arms 63 which are adapted to lie adjacent the beveled pole faces of the permanent magnet 52 when the contacts are closed. A flexible conductor 64 connects the contact arm 58 with a terminal 65. The stationary contact 51 is also electrically connected with a second terminal 66 by means of which the switch contacts may be connected with an outside circuit.

The insulating piece 57 carries an operating arm 67 by means of the screws 68. A spring 69 is coiled about a portion of the spindle 56 and has one end looped over the arm 55 of the bracket 53 and the other end looped beneath an extension 70 on the operating arm 67 for the purpose of biasing the contact arm toward the contact closing position. It will be noted that the end 71 of the lever 19 lies immediately above the operating arm 67.

Also freely rotatable on the spindle 56 is the U-shaped member generally indicated at 72 having legs 73 and 74. The leg 74 is bifurcated to provide an upper extension 75 and lower extension 76. It will be noted that an extension 78 of the operating arm 67 is located between 75 and 76 as shown more clearly in Figure 1. A spring 79 is coiled about the spindle 56 between legs 73 and 74 of member 72, one end of the spring being looped over a notch 80 in extension 78 of arm 67 (see Figure 3), the other end being looped under the connecting portion of the U-shaped element 72 as shown in Figures 1 and 3. The spring 79 will therefore tend to keep the extension 76 against extension 78 of the operating arm 67. The end 84 of lever 18 extends immediately above the leg 73 of the U-shaped element 72.

The bracket 53 is provided with an upstanding portion 81 comprising two cut-away portions or slots 82 and 83. One slot 82 is shown in Figure 1 and both are shown in Figure 3 in dotted lines. They form stops to limit the travel of the two levers 18 and 19.

The operation of the mechanism so far described should now be clear. It is to be understood that the nipple 85 on housing 30 is adapted to be connected to a source of pressure to be controlled or if desired it might be connected to a thermally responsive bulb. For the sake of this description it is assumed that it is connected to a source of variable pressure. With the parts in the position shown in Figure 1 it will be seen that the pressure within the housing 30 is very low and the two levers 18 and 19 are in their lowermost positions. It is one of the objects of this invention to provide a switch which will close at one pressure and open at a second pressure and to further provide for a means for independently adjusting these two pressures. This is accomplished by means of the two springs 38 and 44 which, as can readily be seen, are adjustable independently of each other. Let it be assumed for example that the spring 44 exerts a pull of 10 pounds and the spring 38 exerts a pull of 15 pounds, the pressure at present within the housing 30 will therefore be below 10 pounds. As it increases to slightly above this amount, the lever 19 will be raised by the carriage 27 and at this time it will permit the spring 69 to rotate the insulation 57, contact arm 58, and the U-shaped member 72 as a unit until the leg 73 engages the end 84 of the lever 18 which will stop the rotation of member 72. The force exerted by the spring 79 on operating member 67 is sufficient to keep the contact arm 58 stationary in this position on continued movement of the lever 19, which will continue to rotate until it strikes the upper limit of the slot 83. During its rotation it will have separated from the operating arm 67. The parts will remain in this position until the pressure within the housing 30 reaches a value slightly less than 15 pounds at which time the carriage 27 will start to rotate the lever 18. Such movement will allow the U-shaped member 72 to rotate under the effort of the spring 69 through spring 79 until the contact arm 58 approaches the magnet 52 to the point where it exerts a strong enough pull to cause contacts 59 and 66 to snap closed. At this point the lever 18 will be practically at its upper limit.

Assuming now that the closure of the contacts 59 and 51 causes a reduction in pressure within the housing 30 to a point slightly above

15 pounds, the stem 33 will start to lower and permit the spring 38 to start rotating the lever 18 in a counter-clockwise direction. Lever 18 will cause rotation of the U-shaped element 72 due to the coaction between the end 78 and the leg 73 but the contact arm 58 will remain stationary. This is because the spring 79, although it was strong enough to hold the contact arm 58 in open contact position after the lever 19 has been raised, does not have sufficient strength to pull the contact arm 58 away from the field of the permanent magnet 52. Therefore the movement of the lever 18 will only tension the spring 79 more until the lever has moved to the bottom of the slot 82. The parts will remain in this position until the pressure within the housing 30 decreases to a point slightly above 10 pounds at which time the spring 44 will start to rotate the lever 19. The force produced by the spring 44 and exerted by the lever 19 on the arm 67 in addition to the force exerted thereon by the spring 79 is sufficient to pull the contact arm 58 out of the field of the magnet 52 and the contacts 59 and 66 will therefore open with a snap action.

It will therefore be seen that the pressure at which the switch contacts will close is dependent upon the force exerted by the spring 38 because it is this spring which determines the pressure at which the lever 18 will rise to permit movement of spring 79 and U-shaped member 72 to allow closing of the contacts by the biasing spring 69. Also it is seen that the tension of the spring 44 determines the pressure at which the contacts will be opened because this spring determines the pressure at which the lever 19 lowers to engage the operating arm 67 and open the switch contacts. Each one of these springs is independently adjustable, one by the screw 42 and the other by the screw 47 and the positions of the extensions 40 and 45 in the slots 41 and 46 indicate the adjustment of these springs. It is therefore clear that suitable scale markings may be placed adjacent the slots 41 and 46 on the outside of casing 11 so that the two pressures at which the switch will open and close may be correctly read.

It is a further object of this invention to provide a second pressure responsive device which is capable of independently opening the switch contacts regardless of the position of the bellows 31. Such a device is located within the housing 90 which supports by means of the annular ring 91 a bellows 92. The casing 90 is suitably supported on the underneath side of the casing 11 through a screw threaded sleeve 93. A stem 94 connected with the lower end of the bellows extends through the bellows and through the sleeve into the casing 11. A nut 95 is threaded in the sleeve 93 and confines between itself and the bottom of the bellows a compression spring 96. Rotation of the nut 95 will therefore adjust the force exerted by the compression spring on the bellows thereby adjusting or varying the pressure at which the bellows will operate. It is to be understood that the nipple 97 is suitably connected to a source of variable pressure to which it is desired to have the bellows respond. A bracket 98 suitably secured to one side of the casing 11 by means of screws 99 is provided with a pair of ears 100 between which extends a spindle 101. Freely rotatable on spindle 101 is a lever 102 having a depression 103 in which the upper end of the stem 94 is inserted. A connecting piece 106 is suitably attached to the U-shaped member 72 and extends above the end of the lever 102 so that as the lever is rotated in a counter-clockwise direction by the bellows 92 it will strike the piece 106 and rotate the U-shaped element 72 in a clockwise direction. If the contacts 59 and 66 are closed at this time such rotation of the element 72 will first merely tension the spring 79 but on continued rotation by lever 102 the extension 75 will strike the extension 78 on the operating member 67 to positively rotate the contact arm 58 and open the contacts 59 and 66, the tension built up in spring 79 causing the contacts to open with a snap action. This operation will not in any way affect the bellows 31 or the levers 18 and 19 but will cause the operating member 67 by its clockwise rotation to merely separate from these levers. Therefore there can be no possibility of any strain transmitted to the mechanism as the switch is positively opened by the bellows 92.

One application of this instrument may be in the field of refrigeration with the bellows 31 responding to the temperature or pressure on the suction side of a mechanical refrigeration system and the bellows 92 responding to the high pressure side of the refrigeration line. Normally the bellows 31 will control the switch contacts 59 and 66 to alternately energize and deenergize the compressor motor to maintain the proper suction pressure. However, if the pressure on the high side of the line should become dangerously high the bellows 92 will take control and positively open the circuit to the compressor motor. It is to be understood however that this instrument is not necessarily limited to such use as it could just as easily be used in a temperature controlled system.

From the foregoing it will be clear that I have provided a device which meets all of the objects set forth. The device will operate a switch in a manner providing a simple adjustment of the opening and closing pressures and furthermore will provide a high pressure cut-out which will operate efficiently and positively and not place any strain on the low pressure bellows or the connecting operating mechanism.

Various changes and modifications in this invention will occur to those who are skilled in the art and it is therefore to be distinctly understood that I am to be limited by the scope of the appended claims and not by the specific embodiment disclosed.

I claim as my invention:

1. In a device of the character described comprising in combination, a control member mounted for movement back and forth in opposite directions, means biasing said member in one direction, a first lever having a one-way connection with said member for controlling its movement in the opposite direction, a second lever having a one-way resilient connection with said member for controlling its movement in said one direction, condition responsive means for rotating said levers, and means causing said condition responsive means to rotate said first lever back and forth at one value of said condition while said second lever remains stationary and to rotate said second lever back and forth at a second value of said condition while said first lever remains stationary.

2. In a device of the character described comprising in combination, a control member mounted for movement back and forth in opposite directions, means biasing said member in one direction, a first lever having a one-way connection with said member for moving it in the op-

posite direction, a second lever having a one-way resilient connection with said member for moving it in said opposite direction, an arm loosely connecting said levers, a pressure responsive device connected to said arm for moving said levers, and an adjustable spring connected to each lever for opposing movement by said pressure responsive device whereby said levers can be operated at different pressures.

3. In a device of the character described comprising in combination, a pivoted arm, a movable contact carried by said arm, a stationary contact mounted for cooperation with said movable contact, means biasing said arm in one direction, a first lever having a one-way connection with said arm for rotating it in said opposite direction, a spring tending to rotate said arm in said opposite direction, a second lever for varying the tension of said spring, and a condition responsive device for moving both levers.

4. In a device of the character described comprising in combination, a pivoted arm, a movable contact carried by said arm, a stationary contact mounted for cooperation with said movable contact, means associated with said pivoted arm for causing said contacts to open and close with a snap, means biasing said pivoted arm in one direction, a first lever having a one-way connection with said pivoted arm for rotating it in the opposite direction, a spring tending to rotate said arm in said opposite direction, a second lever having a one-way connection with said spring for varying its tension, a pressure responsive means for rotating said levers, and individually adjustable spring means associated with each lever for individually adjusting the pressure at which each lever will be operated.

5. In a device of the character described comprising in combination, a spindle, an arm rotatably mounted on said spindle, a movable contact carried by said arm, a stationary contact mounted for cooperation with said movable contact, a magnet, an armature carried by said arm, said armature lying adjacent said magnet when said contacts are in closed position, a lost motion device including a spring rotatably mounted on said spindle, one part of said device engaging said arm, a first lever having a one-way connection with said arm for opening the contacts, a second lever having a one-way connection with another part of said lost motion device for increasing the tension of said spring tending to open said contacts, and means for moving said levers at different values of a condition.

6. In a device of the character described comprising in combination, a spindle, an arm rotatably mounted on said spindle, a movable contact carried by said arm, a stationary contact mounted for cooperation with said movable contact, a magnet, an armature carried by said arm, said armature lying adjacent said magnet when said contacts are in closed position, a lost motion device including a spring rotatably mounted on said spindle, one part of said device engaging said arm, a first lever having a one-way connection with said arm for opening the contacts, a second lever having a one-way connection with another part of said lost motion device for increasing the tension of said spring tending to open said contacts, and pressure responsive means operating said first lever back and forth at one pressure and the second lever back and forth at another pressure.

7. In a device of the character described comprising in combination, a spindle, an arm rotatably mounted on said spindle, a movable contact carried by said arm, a stationary contact mounted for cooperation with said movable contact, a magnet, an armature carried by said arm, said armature lying adjacent said magnet when said contacts are in closed position, a lost motion device including a spring rotatably mounted on said spindle, one part of said device engaging said arm, a first lever having a one-way connection with said arm for opening the contacts, a second lever having a one-way connection with another part of said lost motion device for increasing the tension of said spring tending to open said contacts, a member bridging said levers, a bellows bearing against said bridging member for rotating said levers, and separate springs individually adjustable for opposing the rotation of each lever by the bellows whereby a differential of operation of the switch is obtained.

8. In a device of the character described comprising in combination, a spindle, an arm rotatably mounted on said spindle, a movable contact carried by said arm, a stationary contact mounted for cooperation with said movable contact, a magnet, an armature carried by said arm, said armature lying adjacent said magnet when said contacts are in closed position, a lost motion device including a spring rotatably mounted on said spindle, one part of said device engaging said arm, a first lever having a one-way connection with said arm for opening the contacts on a movement in a first direction and for separating from said arm on a movement in a second direction, a second lever having a one-way connection with another part of said lost motion device for increasing the tension of said spring on a movement in said first direction, said spring being incapable of opening said contacts against the pull of said magnet, and for decreasing said spring tension upon movement in said second direction to permit the biasing means to cause closing of the contacts, and condition responsive means for moving one lever at one value of said condition and the other lever at another value of said condition.

9. In a device of the character described comprising in combination, a pivotally mounted switch arm, an open contact switch adapted to be opened and closed by said switch arm, means biasing said arm to switch closed position, a magnet positioned to cooperate with said switch arm when said switch is in closed position whereby a greater force is required to open said switch than is required to hold it in open position, a pair of levers, and a spring associated with one of said levers, movement of said levers in one direction causing said one of said levers to exert a force on said switch arm through said spring which is incapable of moving said arm out of switch closed position, and the other of said levers to exert at a later time an additional force on said arm to cause it to move to open contact position, movement of said levers in the opposite direction causing said other lever to remove its force from said arm, at which time said spring is capable of holding said arm in open contact position, and said one of said levers at a later time to remove at least some of the force exerted by said spring on said arm at which time said biasing means will rotate said arm to switch closing position.

10. In a device of the character described comprising in combination, a pivotally mounted switch arm, an open contact switch adapted to

be opened and closed by said switch arm, means biasing said arm to switch closed position, a magnet positioned to cooperate with said switch arm when said switch is in closed position whereby a greater force is required to open said switch than is required to hold it in open position, a pair of levers and a spring associated with one of said levers, movement of said levers in one direction causing said one of said levers to exert a force on said switch arm through said spring which is incapable of moving said arm out of switch closed position, and the other of said levers to exert at a later time an additional force on said arm to cause it to move to open contact position, movement of said levers in the opposite direction causing said other lever to remove its force from said arm, at which time said spring is capable of holding said arm in open contact position and said one of said levers at a later time to remove at least some of the force exerted by said spring on said arm at which time said biasing means will rotate said arm to switch closing position, pressure responsive means for rotating said levers, a separate spring for opposing rotation of each lever by said pressure responsive means, and individual adjusting means for each spring whereby said pressure responsive means will rotate said levers at different pressures.

11. In a device of the character described comprising in combination, a control member mounted for movement back and forth in opposite directions, means biasing said member in one direction, a first lever having a one-way connection with said member for moving it in the opposite direction, a second lever having a one-way resilient connection with said member for moving it in said opposite direction, condition responsive means for rotating said levers, means causing said condition responsive means to rotate said first lever back and forth at one value of said condition and to rotate said second lever back and forth at a second value of said condition, and a second condition responsive means for moving said control member independently of said levers.

12. In a device of the character described comprising in combination, a control member mounted for movement back and forth in opposite directions, means biasing said member in one direction, a first lever having a one-way connection with said member for moving it in the opposite direction, a second lever having a one-way resilient connection with said member for moving it in said opposite direction, condition responsive means for rotating said levers, means causing said condition responsive means to rotate said first lever back and forth at one value of said condition and to rotate said second lever back and forth at a second value of said condition, a second condition responsive device having a one-way connection with said control member for moving it against its bias independently of said other condition responsive means, and means to adjust the value of the condition at which said second condition responsive means will move said control member.

13. In a device of the character described comprising in combination, a pivoted arm, a movable contact carried by said arm, a stationary contact mounted for cooperation with said movable contact, means biasing said arm in one direction, a first lever having a one-way connection with said arm for rotating it in the opposite direction, a spring tending to rotate said arm in said opposite direction, a second lever for varying the tension of said spring, a condition responsive device for moving both levers, and a second condition responsive device for rotating said arm and separating the one-way connection between said arm and said first lever.

14. In a device of the character described comprising in combination, a pivoted arm, a movable contact carried by said arm, a stationary contact mounted for cooperation with said movable contact, means associated with said pivoted arm for causing said contacts to open and close with a snap, means biasing said pivoted arm in one direction, a first lever having a one-way connection with said pivoted arm for rotating it in the opposite direction, a spring tending to rotate said arm in said opposite direction, a second lever having a one-way connection with said spring for varying its tension, a pressure responsive means for rotating said levers, individually adjustable spring means associated with each lever for individually adjusting the pressure at which each lever will be operated, and a second condition responsive device for rotating said pivoted arm in said opposite direction and cause separation of the one-way connection between said first lever and said arm and between said second lever and said spring.

15. In a device of the character described comprising in combination, a spindle, an arm rotatably mounted on said spindle, a movable contact carried by said arm, a stationary contact mounted for cooperation with said movable contact, a magnet, an armature carried by said arm, said armature lying adjacent said magnet when said contacts are in closed position, a lost motion device including a spring rotatably mounted on said spindle, one part of said device engaging said arm, a first lever having a one-way connection with said arm for opening the contacts, a second lever having a one-way connection with another part of said lost motion device for increasing the tension of said spring tending to open said contacts, means for moving said levers at different values of a condition, and separate means having a one-way connection with said arm for positively opening said contacts independently of said other means.

16. In a device of the character described comprising in combination, a spindle, an arm rotatably mounted on said spindle, a movable contact carried by said arm, a stationary contact mounted for cooperation with said movable contact, a magnet, an armature carried by said arm, said armature lying adjacent said magnet when said contacts are in closed position, a lost motion device including a spring rotatably mounted on said spindle, one part of said device engaging said arm, a first lever having a one-way connection with said arm for opening the contacts, a second lever having a one-way connection with another part of said lost motion device for increasing the tension, and a second pressure responsive means for rotating said arm to contact open position independently of said levers and said first pressure responsive means.

17. In a device of the character described comprising in combination, a spindle, an arm rotatably mounted on said spindle, a movable contact carried by said arm, a stationary contact mounted for cooperation with said movable contact, a magnet, an armature carried by said arm, said armature lying adjacent said magnet when said contacts are in closed position, a lost motion device including a spring rotatably

mounted on said spindle, one part of said device engaging said arm, a first lever having a one-way connection with said arm for opening the contacts on a movement in a first direction and for separating from said arm on a movement in a second direction, a second lever having a one-way connection with another part of said lost motion device for increasing the tension of said spring on a movement in said first direction, said spring being incapable of opening said contacts against the pull of said magnet and for decreasing said spring tension upon movement in said second direction to permit the biasing means to cause closing of the contacts, condition responsive means for moving one lever at one value of said condition and the other lever at another value of said condition, and a second condition responsive means for engaging said lost motion device for first tensioning said spring and then positively rotating said arm to open said contacts independently of said first condition responsive means.

18. In a device of the character described comprising in combination, a pivoted switch arm, a spring biasing said switch arm in one direction, a pair of levers, a pressure responsive device, means causing said pressure responsive device to operate one of said levers at one pressure while the other lever remains stationary, and the other lever at another pressure while said one lever remains stationary, one of said levers operating to permit said spring to rotate said arm in one direction, and the other of said levers operating to rotate said arm in the opposite direction.

19. In a device of the character described comprising in combination, a pivoted switch arm, a spring biasing said switch arm in one direction, a pair of levers, a pressure responsive device, means causing said pressure responsive device to operate one of said levers at one pressure while the other lever remains stationary, and the other lever at another pressure while said one lever remains stationary, one of said levers operating to permit said spring to rotate said arm in one direction, and the other of said levers operating to rotate said arm in the opposite direction, and a second pressure responsive device for rotating said arm in said opposite direction independently of said levers.

20. In a device of the character described comprising in combination, a pivotally mounted switch arm, an open contact switch adapted to be opened and closed by said switch arm, means biasing said arm to switch closed position, a magnet positioned to cooperate with said switch arm when said switch is in closed position whereby a greater force is required to open said switch than is required to hold it in open position, and a pair of levers, movement of said levers in one direction causing one of said levers to exert a force on said switch arm through a spring which is incapable of moving said arm out of switch closed position, and the other of said levers to exert at a later time an additional force on said arm to cause it to move to open contact position, movement of said levers in the opposite direction causing said other lever to remove its force from said arm, at which time said spring is capable of holding said arm in open contact position, and said one of said levers at a later time to remove at least some of the force exerted by said spring on said arm at which time said biasing means will rotate said arm to switch closing position, pressure responsive means rotating said levers, a separate spring for opposing rotation of each lever by said pressure responsive means, individual adjusting means for each spring whereby said pressure responsive means will rotate said levers at different pressures, and a second pressure responsive means for rotating said switch arm in a contact opening direction independently of said other pressure responsive means.

21. A control device comprising in combination, snap action mechanism, a floating member having a pair of ends, a condition responsive element for moving said member, a first means for opposing movement of one end of said member by said element, a second means for opposing movement of the other end of said member by said element, means for adjusting each of said opposing means whereby one end of said member may be made to move at one condition value and the other end at a second condition value, and connections between said member and said snap action mechanism whereby one end of the member controls the snapping of said mechanism in one direction and the other end of said member controls the snapping of said mechanism in the opposite direction.

22. A control device comprising in combination, a floating lever having a pair of ends, a condition responsive device exerting a force on said lever at a point intermediate its ends, a first spring resisting movement of one end of said lever by said device, a second spring resisting movement of the other end of said lever by said device, means for individually adjusting said springs, snap action mechanism, and connections between said snap action mechanism and lever whereby one end of said lever snaps said mechanism in one direction and the other end of said lever snaps said mechanism in the other direction.

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