

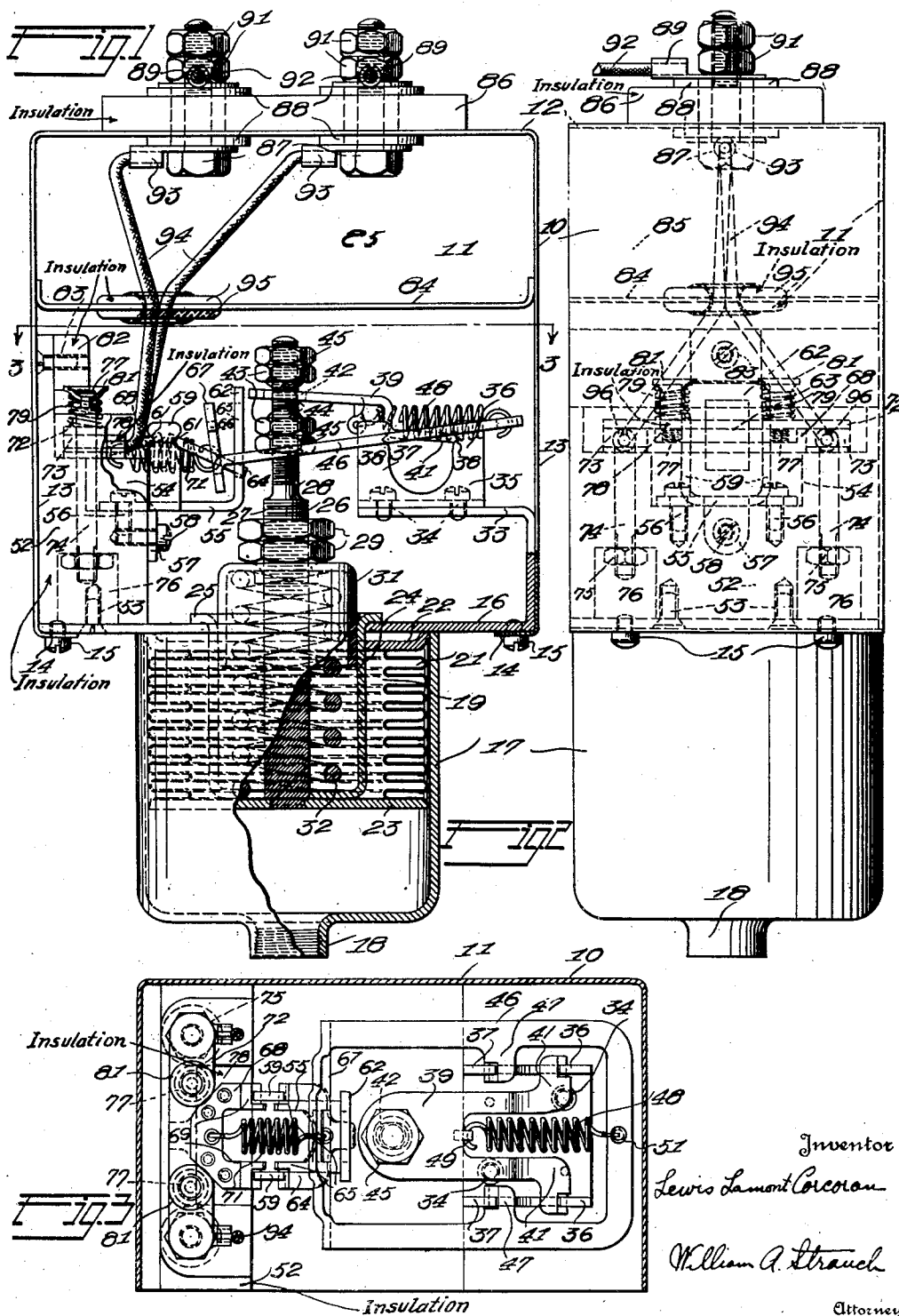
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SWITCH MECHANISM

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SWITCH MECHANISM

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The present invention relates to electric switches and particularly automatic switches of this character.

More specifically the invention relates to thermal or pressure controlled electric switches. Said invention is capable of many uses and the switch is capable of use under conditions necessitating manual operation though the preferred embodiment thereof hereinafter set forth is designed for use in connection with a refrigerating apparatus and has for an object to provide an improved device in which an electric switch is controlled and positively and smoothly operated upon predetermined changes in temperature conditions in the apparatus the switch in turn being intended for controlling an electric motor which drives the compressor of the apparatus that is started or stopped according to predetermined conditions in a manner known in the art.

Another object of the invention is the provision of a device of the above noted character embodying a simple means for adjustably controlling the operation of the electric switch in accordance with variations of desired temperature in said apparatus.

A further object of the invention is the provision of a device of the above noted character which is comparatively simple in construction, durable, accurate and reliable in operation and which is capable of sensitive adjustment for effective operation of the electric switch in accordance with wide variations in temperature or pressure within the apparatus to be controlled by said device.

Still another object of the invention is to provide a switch operating with a snap action under the force exerted by a spring or springs in which the operating of the switch is brought about by simply shifting the spring or springs bodily so that the line of pull thereof is moved from one side to the other of the pivot or pivots of levers whereby such change in position of the spring or springs causes the reverse positive action of the switch.

A still further object of the invention is to provide an automatic or manually operated switch in which the switch is operated with quickness, precision and certainty by the combined effect of a plurality of springs operating in succession and each contributing to the effectiveness of the operation of the parts of the switch that are effective to bring about a change in condition in the medium under control of said switch.

Another object of the invention lies in the

provision of an automatic switch having an element responsive to a change of condition in which simple and convenient means are provided to permit adjustment of the normal condition of said element and in which a simple and readily operable means of adjusting the range of movement of said element before it causes actuation of the switch is provided.

Still a further object of the invention consists in the provision of a switch including a plurality of pairs of toggle members or levers, the pairs of levers being connected together so that each lever acts individually immediately after a lever adjacent thereto and responsive to the movement of the last named lever.

With these objects in view as well as others that will appear from the following disclosure, reference will now be had to the accompanying drawing in which is illustrated one of the embodiments of my invention and in which—

Figure 1 is a side elevational view with parts removed and partly in vertical section.

Figure 2 is an elevational view at right angles to the view illustrated in Figure 1.

Figure 3 is a horizontal sectional view on a plane designated by line 3—3 in Figure 1.

Referring to the drawing by reference characters in which like characters designate like parts, 10 designates a casing which as shown is of relatively light construction and which may be constructed of sheet metal or other suitable material. Casing 10 comprises a back 11, top 12 and sides 13, thereby providing a box-like structure open in one face thereof for access to the operating mechanism hereinafter described, a suitable door normally closing the open side of casing 10. As shown in Figure 1 sides 13 of casing 10 are provided with inwardly projecting flanges 14 which rest against and are secured by means of suitable screw bolts 15 to the base of a switch supporting frame 16.

Suitably secured to the base of frame 16 intermediate flanges 14 is the outer open end of a housing 17 which is preferably cylindrical in form and provided at the inner end thereof with an internally threaded nozzle 18 for connection with a source of pressure, vacuum or any fluid subject to variable temperature.

Disposed within housing 17 is a sylphon 19 which comprises a bellows member 21 one end of which is secured to and closed by a plate 22, which in turn is secured to frame 16. The other end of bellows 21 is secured to and closed by plate 23 which as indicated in Figure 1 is normally spaced a substantial distance from the bottom of housing 17. A spring housing and limiting cup shaped

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member 24 projects through aligned apertures in plate 22 and the base of frame 16 and is provided with a flange 25 secured to the base of frame 16.

Secured to plate 23 at the inner end thereof and slidably extending through member 24 is a vertically projecting stud 26 which comprises an enlarged section 27 and an outer reduced section 28. Threadedly engaged with the outer end of enlarged section 27 are differential adjusting nuts 29 one of which serves as a lock nut for the other. Slidably mounted on enlarged section 27 of stud 26 is an inwardly opening cup member 31 the skirt of which is slidably engaged within member 24 with the base thereof held in engagement with one of nuts 29 by means of a helical spring 32 the opposite ends of which engage the opposing closed ends of member 24 and cup 31. The tension of spring 32 may be adjusted by manipulating nuts 29.

Frame 16 comprises an overhanging support 33 in spaced relation to the base thereof to which is secured by means of screw bolts 34 the base of a U-shaped support 35 each leg of which comprises projections 36 and 37 each of which projections is provided with a V-shaped knife edge bearing 38.

Disposed between the legs of support 35 is a toggle arm 39 provided with spaced legs 41 the ends of which have a knife edge engagement in bearings 38 of projections 36. Arm 39 adjacent the end thereof opposite its knife edge connection is apertured as at 42 for the reception of reduced section 28 of stud 26, the arm having limited movement relative to stud 26 determined by the range between adjusting nuts 43 threadedly engaged with section 28 and provided with oppositely facing spherical arm contacting surfaces 44. Nuts 43 have associated therewith suitable lock nuts 45.

Surrounding support 35 as well as stud 26 is a rectangular toggle member 46 which intermediate its ends is provided with inwardly facing projections 47 having knife edge engagement with bearings 38 of projections 37. A helical spring 48 is disposed between legs 41 of arm 39 and has one end thereof detachably secured to a projection 49 of arm 39 and the opposite end thereof detachably secured in an eye 51 of toggle member 46.

As will be seen from Figure 1 toggle arm 39 and toggle member 46 are normally disposed in acute angular relation to each other and spring 48 is so connected to members 39 and 46 that it shifts its line of pull from one side to the other of the pivots of both toggle members when one only of the toggle members is moved, causing both said members to move in opposite rotative directions when one of them is moved thus shifting the line of pull of spring 48.

Disposed within casing 10 in engagement with frame 16 and side 13 of casing 10 on the opposite side of stud 26 from that on which support 35 is located is a block of insulating material 52 which is secured to frame 16 by screws 53. Disposed within a recess 54 in block 52 is one end of a member 55 which is secured to block 52 by screws 56 and adjacent said end member 55 is provided with a right angular projection 57 which is secured to block 52 by means of screw 58. Member 55 adjacent projection 57 is provided with vertically projecting projections 59 on opposite sides thereof each of which projections is provided with a pair of oppositely facing knife edge bearings 61 in the opposite edges thereof. Member 55 projects toward stud 26 and adjacent thereto is provided with a vertical extension 62 parallel with stud 26 and provided with an elongated rectangular aperture 63 the ends of which

constitute stops to limit movement of the various toggle members.

A toggle arm 64 is provided with legs 65 the ends of which have a knife edge engagement with bearings 61 of corresponding edges of projections 59. The intermediate portion of arm 64 adjacent the opposite end thereof extends through an aperture 66 in a widened end portion 67 of toggle member 46, the end of arm 64 projecting within aperture 63 of projection 62. A second toggle arm 68 is provided with legs 69 having knife edge engagement with corresponding bearings 61 in projections 59. A helical spring 71 rests between legs 65 and 69 and has the opposite ends thereof secured to toggle arms 64 and 68 in a manner so that the movement of one of the arms will cause the line of pull of the spring to shift to the other side of both arm pivots when one of said arms is functioning similarly to arms 39 and 46 before referred to.

Toggle arm 68 is attached to a contact arm 72 for engagement with contacts 73 for closing a circuit, the latter contacts being secured in position by means of bolts 74 provided with nuts 75 resting in recesses 76 of block 52. Contact arm 72 comprises an elongated strip which is guided by studs 77 which studs are attached to insulating material 78 which in turn is connected to toggle arm 68. A spring 79 is interposed between a plate 81 fastened to the top of each stud 77 and contact arm 72 causing the contact arm to be held against insulating material 78 by virtue of springs 79.

An insulating lug 82 is secured to block 52 by screw 83 and serves as a stop for contact arm 72.

A metal partition 84 is suitably secured within casing 10 providing a junction box 85 above the switch box housing the mechanism hereinbefore described.

Secured to the top of casing 10 is an insulating block 86 in which are mounted studs 87 which are surrounded by insulating washers 88 in contact with casing 10 and block 86. Terminals 89 engage outer washers 88 and are maintained in position by nuts 91 threadedly engaged with studs 87, terminals 89 having connected thereto lead in wires 92 from the house circuit. Engaged with inner washers 88 are terminals 93 to which are connected electrical connections 94 which extend through suitable insulating washers 95 in partition 84 and the inner ends thereof are connected to terminals 96.

It will be understood that suitable fuses are interposed in the house circuit switch box for the protection of the switch herein described.

In operation of the structure above described housing 17 is put into communication with the device whose temperature or pressure it is desired to control through connection with nozzle 18 as a result of which bellows 21 will expand or contract thereby moving plate 23 downwardly as indicated in Figure 1 in which the switch is closed which in turn moves stud 26 in like direction whereupon the end of toggle arm 39 through which stud 26 passes will be drawn inwardly shifting the line of pull of spring 48 until said line passes to the other side of the knife edge connection of arm 39 at which time the arm will be moved by said spring into engagement with the opposing nut 43 with a snap action. When spring 48 assumes its new position the line of thrust will also have passed the pivotal connection of member 46 causing it to move reversely with a snap action its movement being

limited by aperture 63 of projection 62. At the same time, through engagement with toggle arm 64 by means of member 67, arm 64 will be moved upward against the action of spring 71 shifting the line of pull of said spring until it passes to the other side of the pivotal connection of arm 64 at which time arm 64 will move upward with a snap action into engagement with the outer wall of aperture 66 in member 67. The shifting of the line of pull of spring 71 then causes actuation of arm 68. The latter will accordingly move upwardly with a snap action simultaneously with arm 64 resulting in contact arm 72 carried by arm 68 being disengaged from contacts 73 thus breaking the electrical circuit and consequently stopping the motor for the device to which the switch is connected.

After the motor has been idle for an interval of time bellows 21 will contract due to a differential pressure which may result from change in temperature as in refrigerating machines as a consequence of which stud 26 will be moved upward and the spherical surface 44 of lower nut 43 will engage arm 39 causing a reverse successive operation of toggle members 39, 46, 64 and 68 from that above described whereupon the mechanism will assume the relative positions indicated in Figure 1 with contact arm 72 again in engagement with contacts 73 and the motor again set into operation.

By adjusting nuts 29 on enlarged section 27 of stud 26 cup 31 can be moved inwardly or outwardly thereby increasing or decreasing the length of spring 32 which in turn increases or decreases the pressure on bottom plate 23 whereby adjustments can be accurately and expeditiously made for differential pressures affecting bellows 21 and the chamber surrounding same.

By adjusting nuts 43 on reduced section 28 of stud 26 toggle arm 39 can be caused to go over center upon either up or down movement at any desired point of contraction or expansive movement of bellows 21 thereby providing a ready adjustment for range of movement of stud 26 for actuating the switch mechanism.

The springs 48 and 71 can be made relatively stiff without rendering the initiation of operation difficult since the shifting of the line of pull of even stiff springs may be readily effected. The springs will then act positively successively and with a desired snap action. Said action is cumulative in effect so that the movement of the final lever of the series is positive and certain resulting in very satisfactory operation.

From the foregoing disclosure it will be seen that a switch mechanism is provided which is comparatively simple in construction, accurate and reliable in operation and which comprises sensitive adjustments for effecting a closing or opening of the motor controlling circuit in accordance with variations of temperature or pressure within the apparatus being controlled thereby.

While I have disclosed a specific embodiment of my invention, this disclosure is to be considered as illustrative only and not restrictive since the scope of the invention is to be determined by the appended claims.

Accordingly, what I claim as new and desire to secure by U. S. Letters Patent, is:—

1. An electric switch comprising a stationary support, a circuit controlling member carried by a lever swingingly mounted on said support and extending to one side thereof, a swingingly

mounted actuating lever pivoted on said support and extending away from said first named lever, a spring interconnecting said levers and arranged so that it exerts a pull on both levers on a line relatively close to but to one side of a line passing through the pivots of said swingingly mounted levers, and means to swing said last named lever on its pivot so that the line of pull of said spring is shifted to the other side of said line passing through the lever pivots, whereby said first named lever is caused to follow the movement of the last named lever under the action of said spring with a snap action.

2. The combination defined in claim 1 in which the pivots of said levers are formed by knife edge projections on which said levers rock.

3. An electric switch comprising a circuit controlling member carried by a swingingly mounted lever, a second swingingly mounted actuating lever, a spring exerting a pull on a line relatively close to but to one side of a line extending through the pivots about which said levers swing, a third swingingly mounted spring controlled actuating lever means to oscillate said third lever with a snap action between two extreme positions, and means to cause said third lever to actuate said first named lever through said second named lever by swinging said second named lever about its pivot to shift the line of pull of said spring from one side of the line extending through the pivots to the other side thereof whereby the first named lever and the circuit controlling member carried thereby is actuated by said spring.

4. An electric switch comprising a plurality of pairs of swingingly mounted levers, the levers of each pair being connected together by a spring whose line of pull extends relatively close to but to one side of a line passing through the pivots about which said pair of levers swing, so that when the movement of one lever of each pair causes the line of pull of the spring of that pair to be shifted to the other side of said line passing through the pivots its companion lever is actuated by the spring of that pair, said pairs of levers being connected in series so that they are actuated successively, a circuit controlling member carried by the lever at one end of the series and a switch actuating means connected to the lever at the other end of the series.

5. The combination defined in claim 4 in which all of said levers are mounted to swing about projections provided with knife edges.

6. An electric switch operating mechanism comprising a pair of spaced supports, a lever swingingly mounted with respect to one of said supports, a loop-shaped lever surrounding said first named lever, and swingingly mounted with respect to the other of said supports, a spring secured to both of said levers and exerting a line of pull on both levers at a point relatively close to but to one side of the line passing through the pivots of said levers, means to swing one of said levers on its pivot to carry the end of the spring secured thereto to the other side of said line thereby shifting the line of pull of said spring to the other side of the line through said pivots and causing said spring to then operate the other of said levers with a snap action and means to connect said loop-shaped lever to a circuit controlling member.

7. The combination defined in claim 6 in which said last named means includes a plurality of spring actuated levers operatively connected for successive operation when the switch is operated.

8. An electric switch comprising a pivoted con-

tact lever carrying electric contacts, stationary contacts engaged thereby in one position of said contact lever, a pivoted actuating lever, a biasing spring connecting said levers to form a spring toggle and moving said contact lever with a snap action when said actuating lever moves said spring across the line of pivots of said levers, a pivoted intermediate lever, a lost-motion connection between said actuating lever and said intermediate lever, and means to move said inter-

mediate lever with a snap motion to thereby actuate said actuating and contact levers with a snap motion.

9. The invention as defined in claim 8 wherein said last-named means includes a movement-initiating lever, and a spring connecting said intermediate lever and said movement-initiating lever to form a spring toggle.

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