Jan. 29, 1952 F. B. AUBERT 2,584,079

THERMOSTATIC STACK SWITCH HAVING MAGNETIC CLUTCH MECHANISM

Filed Jan. 26, 1949

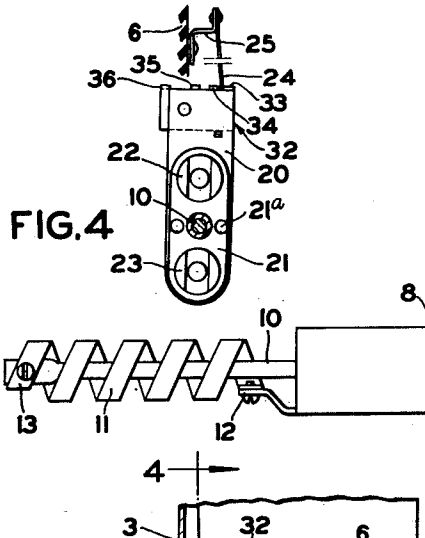

FIG.4

FIG.1

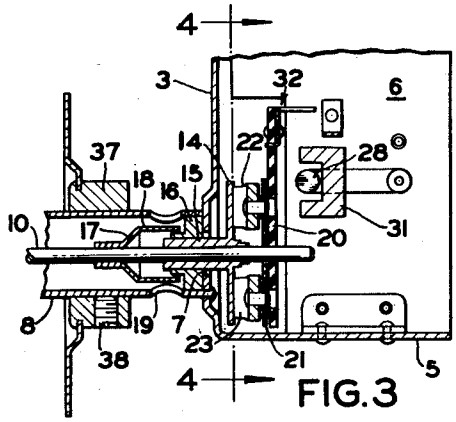

FIG.3

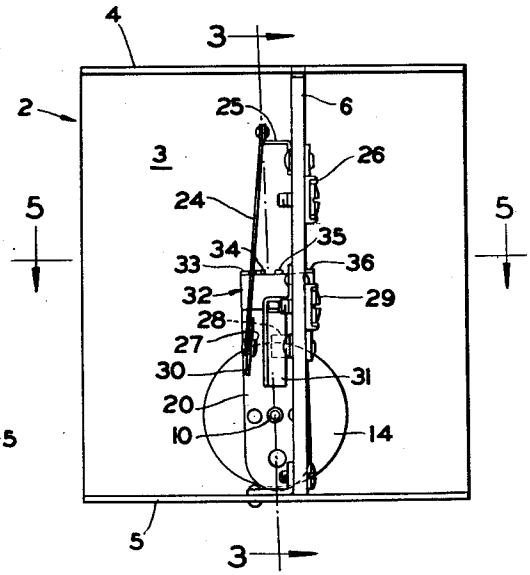

FIG. 2

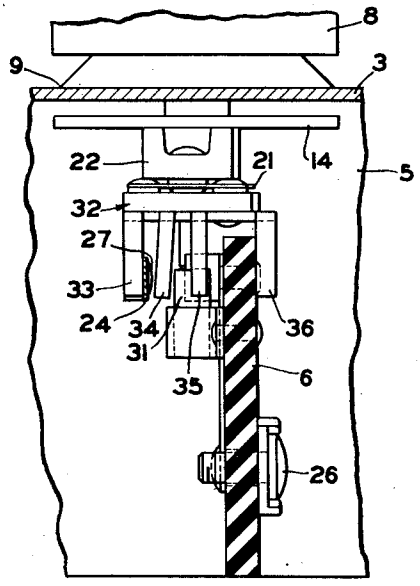

FIG. 5

INVENTOR.

Fred B. Aubert

BY

Andrew K. Foulds

his ATTORNEY

Patented Jan. 29, 1952 2,584,079

UNITED STATES PATENT OFFICE

2,584,079

THERMOSTATIC STACK SWITCH HAVING MAGNETIC CLUTCH MECHANISM

Fred B. Aubert, Detroit, Mich.

Application January 26, 1949, Serial No. 72,958

17 Claims. (Cl. 200—138)

1

This invention relates to new and useful improvements in control devices in general and more particularly to thermostatically operated stack switches.

One of the objects of this invention is to provide a new and improved thermostatically operated switch.

Another object is to provide an improved thermostatic switch having a magnetic clutch mechanism.

Another object is to provide a new and improved thermostatic switch especially adapted for use as a stack switch and having a means to prevent discharge of foreign matter from the stack into the switch.

Another object is to provide a new and improved thermostatic switch having a novel means for varying the differential of switch operation.

Other objects will become apparent from time to time throughout the specification and claims as hereinafter related.

This invention comprises the new and improved construction and combination of parts and their cooperative relationship to each other which will be described more fully hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawings to be taken as part of this specification there is clearly and fully illustrated one preferred embodiment of this invention, in which drawings—

Figure 1 is a view in elevation of a thermostatically operated stack switch embodying this invention,

Fig. 2 is a view in right elevation of Fig. 1 and showing the switch mechanism,

Fig. 3 is a detail sectional view taken on the line 3—3 of Fig. 2,

Fig. 4 is a detail sectional view taken on the line 4—4 of Fig. 3, and showing a portion of the magnetic clutch mechanism, and

Fig. 5 is a detail sectional view slightly enlarged and taken on the line 5—5 of Fig. 2.

Referring to the drawings by characters of reference there is shown in Fig. 1 a thermostatically operated stack switch mechanism generally designated as 1. The switch 1 comprises a switch supporting casing 2 having a bottom wall 3 and end walls 4 and 5. There is a switch supporting wall member 6 which extends transversely of the casing 2 and is secured to the walls 4 and 5. The casing wall 3 has an aperture 7 therein (see Fig. 3). There is a tubular member 8 which is secured to the casing wall 3 at one end as at 9 and which is alined with the aperture 7. An

2

operating rod 10 extends through the tubular member 8 and the aperture 7 and projects into the casing 2 at one end and out of the tubular member 8 at the other end. At the other end of the rod 10 there is a thermostatic bimetal helix 11 which is secured at one end to the tubular member 8 as at 12 and at its other end to the rod member 10 as at 13. On the other end of the rod 10 there is a magnetic armature 14 which has a sleeve portion 15 through which the rod 10 extends and which is secured to the rod 10 for movement therewith. There is a bearing 16 in the end of the tubular member 8 adjacent the casing wall 3 which supports the magnetic member sleeve portion 15 and rod member 10 for rotary movement. There is a sleeve member 17 which is carried by the rod 10 and which has a portion 18 spaced therefrom and shielding the bearing 16 against discharge of foreign particles therethrough. There are a plurality of apertures 19 in the end portion of the tubular member 8 adjacent the sleeve member 17 which are operable to permit discharge of foreign matter which may be blown therethrough. An operating member or arm 20 is pivotally carried by the rod 10 and has secured thereto a spring member 21 which is secured at its center portion as at 21a and has two free ends forming leaf springs for supporting a pair of permanent magnets 22 and 23 which cooperate with the armature 14. The flexibility of the spring 21 permits the magnets 22 and 23 to follow any irregularities in the surface of the armature 14 and to maintain a universal contact therewith. The armature 14 and magnets 22 and 23 are operable to transmit movement from the rod 10 to the operating arm 20 and are operable to permit lost motion therebetween. There is a switch structure supported by the supporting wall member 6 in the casing 2 which comprises a contact carrying arm 24 which overlies and is spaced from the supporting wall 6 by a bracket 25 which is connected to an electric terminal connection 26. The arm 24 carries a contact 27 which is cooperable with a fixed contact 28 which is in turn connected to a terminal connection 29. There is a magnetic armature 30 which is carried by the contact arm 24 and which cooperates with a fixed permanent magnet 31 to produce the snap action of the switch. There is a bracket member 32 which is carried by the operating arm 20 and which provides a plurality of laterally extending bendable fingers 33, 34, 35 and 36. The fingers 35 and 36 straddle the switch supporting member 6 and are engageable therewith upon movement of the operating arm 20 to de-

termine the range of movement of the arm 20. These fingers 35 and 36 also serve as stops to limit the thrust of the helix 11 upon the switch operating arm 24. The fingers 33 and 34 straddle the movable contact arms 24 and are engageable therewith to move the same. The fingers 33 and 34 are bendable to determine the amount of movement of the operating arm 20 which is required to move the contact carrying arm 24 for operation of the switch and to determine the differential of switch operation. The switch structure in general is operable to be secured to a furnace stack by a collar member 37 which is secured on the tubular member 8 by a set screw 38 and which is positioned so that the apertures 19 in the tubular member 8 will lie outside of the furnace stack.

The operation of the switch mechanism is as follows: The bimetal helix 11 is responsive to temperature changes such as in a furnace stack and is operable to rotate the operating rod 10. Rotation of the rod 10 will cause the magnetic armature 14 to rotate therewith and to transmit movement through the magnets 22 and 23 to the switch operating arm 20. The spring 21 which supports the magnets 22 and 23 is sufficiently flexible so that the magnets may maintain a smooth surface contact with the armature 14 independently of any irregularities in the surface of the armature 14. This structure has been provided to overcome the difficulties which are encountered in the prior construction of thermostatic stack switches. By this construction the frictional force between the armature 14 and the magnets 22 and 23 is maintained substantially constant independently of irregularities in the surface of the armature 14 since the magnets may follow such irregularities to maintain a constant and universal contact therewith. The flexible carrying of the magnets 22 and 23 also serves to correct irregularities of contact which might result from the arm 20 not being exactly parallel to the armature 14 since the flexing of the spring arm 21 will permit the pole faces of the magnets to seat flatly against the armature. The magnets 22 and 23 also serve to hold and locate the arm 20 on the rod 10 while permitting its ready withdrawal from and assembly on said rod.

The switch structure shown is constructed for closure upon temperature increase and is shown in an open, cold position. The finger 36 is engaged with the wall 6 which limits movement of the arm 20 in an opening direction. The contact carrying arm 24 is normally flexed outward and in this position engages the finger 33. As the temperature is increased the bimetal helix 11 twists or rotates the rod 10 and the armature 14 which is carried thereon. This rotary movement of the armature 14 carries with it the magnets 22 and 23 causing the switch operating arm 20 to rotate in a clockwise or switch closing direction (as viewed in Fig. 2). The switch closing movement of the arm 20 causes the finger 33 to move the contact carrying arm 24 to close the contact 27 against the fixed contact 28. When the magnetic armature 30 carried by the contact carrying arm 24 is moved within the attraction of the magnet 31 the contacts are closed with a snap action, the arm 24 moving away from the finger 33. Continued heating of the helix 11 will move the operating arm further until the finger 33 again engages the arm 24 and the finger 35 engages the supporting wall 6, said last engagement stopping further movement of the arm 20. Continued heating of the helix 11 beyond this point will cause the armature 14 to slip and move relative to the magnets 22 and 23. Upon cooling of the bimetal helix 11 the rod 10 and switch operating arm 20 are rotated in a counterclockwise or switch opening direction (as viewed in Fig. 2). However, the finger 34 must move by approximately the distance between the fingers 33 and 34 before it engages the arm 24 to begin to open the switch contacts and thus there is a small differential of temperature on temperature decrease before the switch is opened. The fingers 33 and 34 are laterally bendable to vary the distance therebetween and provide a simple means of varying the differential of switch operation. When the finger 34 engages the arm 24 on switch opening movement it must overcome the magnetic attraction between the magnet 31 and the armature 30 to open the switch. This results in the helix 11 having to cool further to build up and transmit the force required to overcome this magnetic attraction. When the magnetic attraction is overcome and the switch contacts opened the switch arm 24 will spring outward and engage and follow the finger 33 upon further movement thereof. Upon further switch opening movement the finger 36 will engage the supporting wall 6 and stop further movement of the operating arm 20 whereupon there will be slippage between the magnets 22 and 23 and the armature 14 as the bimetal helix is cooled further. Upon reheating the switch will again close according to the operation previously described.

It has been found in the construction of stack switches for use on oil burning furnaces that occasionally minor explosions may take place which tend to blow soot or dust or other foreign matter through the tubular member 8 and the bearing 16 into the switch casing which may foul the operation of the switch or produce additional friction within the bearing 16 as to vary the responsive temperature of the bimetal helix 11. To overcome this condition, there is provided in this switch structure a sleeve member 17 carried by the rod 10 which has a portion 18 spaced from the rod 10 and overlying a tubular extension which projects from the bearing 16 to prevent the discharge of foreign matter into the space or clearance between the bearing and sleeve member 15 or around rod 10. There is also provided a plurality of discharge apertures 19 which will permit any such dust, soot or foreign particles to be blown therethrough rather than into the switch casing or into the bearing.

Having thus described the invention what is claimed and desired to be secured by Letters Patent of the United States is:

1. In a control device, an operating member mounted for rotary movement, a second operating member for moving said first-named operating member, automatic means for moving said second operating member, cooperable magnetic members comprising a magnetic armature carried by one of said members and a magnet carried by the other in frictional engagement, means securing one of said magnetic members to its operating member for universal contact with the other magnetic member, and said magnetic members being operable to transmit movement from said second operating member to said first-named operating member.

2. A thermostatic switch mechanism comprising a switch operating member mounted for rotary movement, a second operating member for moving said first-named member, thermostatic means for moving said second operating member,

cooperable magnetic members comprising a magnetic armature carried by one of said operating members and a magnet carried by the other in frictional engagement, resilient means securing one of said magnetic members to its operating member, and said magnetic members being operable to transmit movement from said second operating member to said switch operating member.

3. A thermostatic switch mechanism comprising a switch operating member mounted for rotary movement, a stop member limiting movement by said operating member, a second operating member for moving said first-named member, thermostatic means for moving said second operating member, cooperable magnetic members comprising a magnetic armature carried by one of said operating members and a magnet carried by the other in frictional engagement, resilient means securing one of said magnetic members to its operating member, and said magnetic members being operable to transmit movement from said second operating member to said switch operating member and to permit lost motion therebetween upon limiting engagement of said switch operating member with said stop member.

4. A thermostatic switch mechanism comprising a switch operating member mounted for rotary movement, a stop member limiting movement by said operating member, a second operating member for moving said first-named member, thermostatic means for moving said second operating member, cooperable magnetic members comprising a magnetic armature carried by one of said operating members and a magnet carried by the other in frictional engagement, a leaf spring securing one of said magnetic members to its operating member so as to provide resilient universal contact with the other of said magnetic members, and said magnetic members being operable to transmit movement from said second operating member to said switch operating member and to permit lost motion therebetween upon limiting engagement of said switch operating member with said stop member.

5. A thermostatic switch mechanism comprising a switch supporting member having an aperture through one portion thereof, a tubular member secured at one end to said supporting member and alined with said aperture, an operating rod extending through said aperture and said tubular member, a bimetal helix having one end secured to the other end of said tubular member and its other end secured to one end of said operating rod for rotating the same in response to temperature changes, a disc shaped magnetic armature secured to the other end of said rod and rotatable therewith, a switch operating member pivotally supported on the other end of said rod and operable to have movement relative thereto, a magnet engaging the surface of said armature, a leaf spring securing said magnet to said switch operating member so as to provide a resilient universal contact with said armature and said magnet and said armature being cooperable to transmit movement of said rod to said switch operating member.

6. A thermostatic switch mechanism comprising a switch supporting member having an aperture through one portion thereof, a tubular member secured at one end to said supporting member and alined with said aperture, an operating rod extending through said aperture and said tubular member, a bimetal helix having one end secured to the other end of said tubular member

and its other end secured to one end of said operating rod for rotating the same in response to temperature changes, a disc shaped magnetic armature secured to the other end of said rod and rotatable therewith, a switch operating member pivotally supported on the other end of said rod and operable to have movement relative thereto, a magnet engaging the surface of said armature, a leaf spring securing said magnet to said switch operating member so as to provide resilient universal contact with said armature, a stop member engageable with said switch operating member and limiting the range of movement thereof, and said magnet and said armature being cooperable to transmit movement of said rod to said switch operating member and to permit lost motion therebetween upon movement of said rod beyond the limits of the range of movement of said switch operating member.

7. A thermostatic switch mechanism comprising a switch supporting member having an aperture through one portion thereof, a tubular member secured at one end to said supporting member and alined with said aperture, an operating rod extending through said aperture and said tubular member, a bimetal helix having one end secured to the other end of said tubular member and its other end secured to one end of said operating rod for rotating the same in response to temperature changes, a disc shaped magnetic armature secured to the other end of said rod and rotatable therewith, a switch operating member pivotally supported on the other end of said rod and operable to have movement relative thereto, a snap acting switch mechanism carried by said supporting member and operable to be actuated by said switch operating member, a magnet engaging the surface of said armature, a leaf spring securing said magnet to said switch operating member so as to provide resilient universal contact with said armature, a stop member engageable with said switch operating member and limiting the range of movement thereof, and said magnet and said armature being cooperable to transmit movement of said rod to said switch operating member and to permit lost motion therebetween upon movement of said rod beyond the limits of the range of movement of said switch operating member.

8. A thermostatic switch mechanism comprising a switch supporting member having an aperture through one portion thereof, a tubular member secured at one end to said supporting member and alined with said aperture, an operating rod extending through said aperture and said tubular member, a bearing carried in said one end of said tubular member and supporting said rod for rotary movement, a sleeve member carried by said rod and having a portion spaced from said rod and shielding said bearing against discharge of foreign matter therethrough, one or more apertures in said tubular member adjacent said sleeve member for discharge of foreign matter which may be blown therethrough, a bimetal helix having one end secured to the other end of said tubular member and its other end secured to one end of said operating rod for rotating the same in response to temperature changes, a disc shaped magnetic armature secured to the other end of said rod and rotatable therewith, a switch operating member pivotally supported on the other end of said rod and operable to have movement relative thereto, a magnet engaging the surface of said armature, a leaf spring securing said magnet to said switch operating member so

as to provide resilient universal contact with said armature, and said magnet and said armature being cooperable to transmit movement of said rod to said switch operating member.

9. A thermostatic switch mechanism comprising a switch supporting member having an aperture through one portion thereof, a tubular member secured at one end to said supporting member and alined with said aperture, an operating rod extending through said aperture and said tubular member, a bearing carried in said one end of said tubular member and supporting said rod for rotary movement, a sleeve member carried by said rod and having a portion spaced form said rod and shielding said bearing against discharge of foreign matter therethrough, one or more apertures in said tubular member adjacent said sleeve member for discharge of foreign matter which may be blown therethrough, a bimetal helix having one end secured to the other end of said tubular member and its other end secured to one end of said operating rod for rotating the same in response to temperature changes, a disc shaped magnetic armature secured to the other end of said rod and rotatable therewith, a switch operating member pivotally supported on the other end of said rod and operable to have movement relative thereto, a snap acting switch mechanism carried by said supporting member and operable to be actuated by said switch operating member, a magnet engaging the surface of said armature, a leaf spring securing said magnet to said switch operating member so as to provide resilent universal contact with said armature, a stop member engageable with said switch operating member and limiting the range of movement thereof, and said magnet and said armature being cooperable to transmit movement of said rod to said switch operating member and to permit lost motion therebeween upon movement of said rod beyond the limits of the range of movement of said switch operating member.

10. A thermostatic switch mechanism comprising a switch supporting member having an aperture through one portion thereof, a tubular member secured at one end to said supporting member and alined with said aperture, an operating rod extending through said aperture and said tubular member and supported for rotary movement, a bimetal helix having one end secured to the other end of said tubular member and its other end secured to one end of said rod for rotating the same in response to temperature changes, a disc shaped magnetic armature secured to the other end of said rod and rotatable therewith, a switch operating member pivotally supported on the other end of said rod and operable to have movement relative thereto, said switch operating member having a plurality of bendable fingers extending from its end portion, a second supporting member carried by said first-named supporting member, a snap acting switch mechanism including a movable arm and carried by said second supporting member, two of said fingers being positioned on opposite sides of said second supporting member and engageable therewith to determine the range of movement of said switch operating member, two of said fingers being positioned on opposite sides of said movable arm and engageable therewith to move the same, said second-named two fingers being bendable to determine the range of movement of said switch operating member required to actuate said movable arm, a magnet engaging the surface of said armature, a leaf spring securing said magnet to said switch operating member so as to provide resilient universal contact with said armature, and said magnet and said armature being cooperable to transmit movement of said rod to said switch operating member and to permit lost motion therebetween upon movement of said rod beyond he limits of the range of movement of said switch operating member.

11. A thermostatic switch mechanism comprising a switch supporting member having an aperture through one portion thereof, a tubular member secured at one end to said supporting member and alined with said aperture, an operating rod extending through said aperture and said tubular member and supported for rotary movement, a bearing carried in said one end of said tubular member and supporting said rod for rotary movement, a sleeve member carried by said rod and having a portion spaced from said rod and shielding said bearing against discharge of foreign matter therethrough, one or more apertures in said tubular member adjacent said sleeve member for discharge of foreign matter which may be blown therethrough, a bimetal helix having one end secured to the other end of said tubular member and its other end secured to one end of said rod for rotating the same in response to temperature changes, a disc shaped magnetic armature secured to the other end of said rod and rotatable therewith, a switch operating member pivotally supported on the other end of said rod and operatble to have movement relative thereto, said switch operating member having a plurality of bendable fingers extending from its end portion, a second supporting member carried by said first-named supporting member, a snap acting switch mechanism including a movable arm and carried by said second supporting member, two of said fingers being positioned on opposite sides of said second supporting member and engageable therewith to determine the range of movement of said switch operating member, two of said fingers being positioned on opposite sides of said movable arm and engageable therewith to move the same, said second-named two fingers being bendable to determine the range of movement of said switch operating member required to actuate said movable arm, a magnet engaging the surface of said armature, a leaf spring securing said magnet to said switch operating member so as to provide resilient universal contact with said armature, and said magnet and said amature being cooperable to transmit movement of said rod to said switch operating member and to permit lost motion therebetween upon movement of said rod beyond the limits of the range of movement of said switch operating member.

12. A thermostatic switch mechanism comprising a switch supporting member having an aperture through one portion thereof, a tubular member secured at one end to said supporting member and alined with said aperture, an operating rod extending through said aperture and said tubular member and supported for rotary movement, a bimetal helix having one end secured to the other end of said tubular member and its other end secured to one end of said rod for rotating the same in response to temperature changes, a switch operating member pivotally supported on the other end of said rod, said switch operating member having a plurality of bendable fingers extending from its end por-

tion, a second supporting member carried by said first-named supporting member, a snap acting switch mechanism including a movable arm and carried by said second supporting member, two of said fingers being positioned on opposite sides of said second supporting member and engageable therewith to determine the range of movement of said switch operating member, two of said fingers being positioned on opposite sides of said movable arm and engageable therewith to move the same, said second-named two fingers being bendable to determine the range of movement of said switch operating member required to actuate said movable arm.

13. A thermostatic switch mechanism comprising a switch supporting member having an aperture through one portion thereof, a tubular member secured at one end to said supporting member and alined with said aperture, an operating rod extending through said aperture and said tubular member and supported for rotary movement, a bearing carried in said one end of said tubular member and supporting said rod for rotary movement, a sleeve member carried by said rod and having a portion spaced from said rod and shielding said bearing against discharge of foreign matter therethrough, one or more apertures in said tubular member adjacent said sleeve member for discharge of foreign matter which may be blown therethrough, a bimetal helix having one end secured to the other end of said tubular member and its other end secured to one end of said rod for rotating the same in response to temperature changes, a switch operating member pivotally supported on the other end of said rod, said switch operating member having a plurality of bendable fingers extending from its end portion, a second supporting member carried by said first-named supporting member, a snap acting switch mechanism including a movable arm and carried by said second supporting member, two of said fingers being positioned on opposite sides of said second supporting member and engageable therewith to determine the range of movement of said switch operating member, two of said fingers being positioned on opposite sides of said movable arm and engageable therewith to move the same, said second-named two fingers being bendable to determine the range of movement of said switch operating member required to actuate said movable arm.

14. A thermostatic switch mechanism comprising a switch supporting member having an aperture through one portion thereof, a tubular member secured at one end to said supporting member and alined with said aperture, an operating rod extending through said aperture and said tubular member, a bimetal helix having one end secured to the other end of said tubular member and its other end secured to one end of said operating rod for rotating the same in response to temperature changes, a disc shaped magnetic armature secured to the other end of said rod and rotatable therewith, a switch operating member pivotally supported on the other end of said rod and operable to have movement relative thereto, a snap acting switch mechanism carried by said supporting member and operable to be actuated by said switch operating member, adjustable means carried by said switch operating member to determine the movement thereof required to actuate said snap acting switch mechanism, a magnet engaging the surface of said armature, a leaf spring securing said magnet to said switch operating member so as to provide resilient universal contact with said armature, a stop member engageable with said switch operating member and limiting the range of movement thereof, and said magnet and said armature being cooperable to transmit movement of said rod to said switch operating member and to permit lost motion therebetween upon movement of said rod beyond the limits of the range of movement of said switch operating member.

15. In a switch mechanism, a switch supporting member, a movable arm carried by said supporting member, an operating arm supported for rotary movement adjacent said supporting member and having a plurality of bendable fingers extending therefrom, two of said fingers straddling said supporting member and engageable therewith upon movement to determine the range of movement of said operating arm, two of said fingers straddling said movable arm and engageable therewith upon movement to move the same, and said last-named fingers being laterally bendable to determine the amount of movement of said operating arm required to actuate said movable arm.

16. A thermostatic switch mechanism comprising a rotary operating rod, thermostatic means to rotate said rod, an armature fixed on and rotatable with said rod, a rotary switch operating member, means pivotally supporting said operating member for rotation about an axis in line with said rod, a leaf spring secured at its mid-portion to said operating member, at least two permanent magnets secured one to each end portion of said leaf spring so that said magnets may have a limited universal movement relative to said operating member, said magnets being positioned on opposite sides of said rod and having their pole faces engaging said armature, and switch means operated by said switch operating member.

17. A thermostatic switch mechanism comprising a rotary operating rod, thermostatic means to rotate said rod, an armature fixed on and rotatable with said rod, a rotary switch operating member pivotally mounted on said rod, a leaf spring secured at its mid-portion to said operating member and having an aperture therethrough for passage of said rod, at least two permanent magnets secured one to each end portion of said leaf spring so that said magnets may have a limited universal movement relative to said operating member, said magnets being positioned on opposite sides of said rod and having their pole faces engaging said armature, said magnets holding said operating member on said rod, and switch means operated by said switch operating member.

FRED B. AUBERT.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
689,522	Titus	Dec. 24, 1901
1,847,036	Phelan	Feb. 23, 1932
2,214,901	Griffin	Sept. 17, 1934
2,235,338	Shaw	Mar. 18, 1941
2,305,974	Matthews	Dec. 22, 1942