

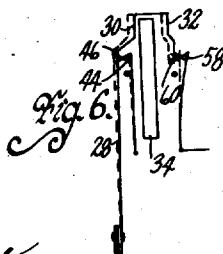
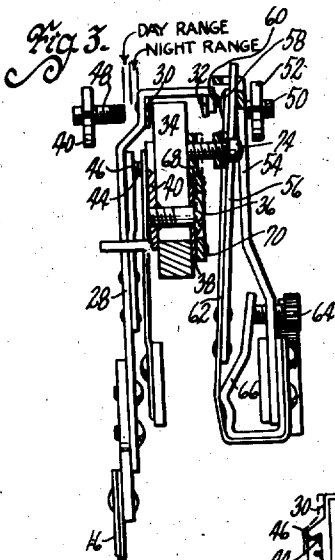
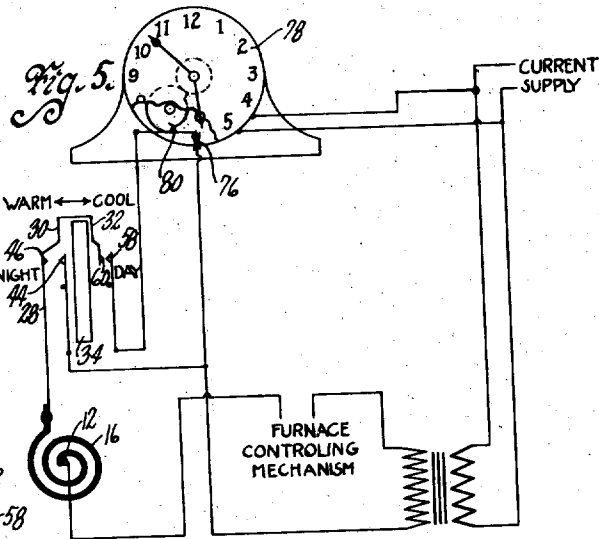
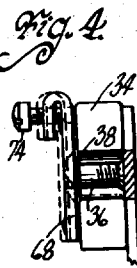
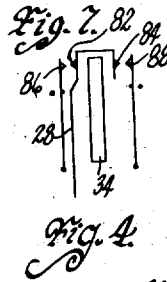
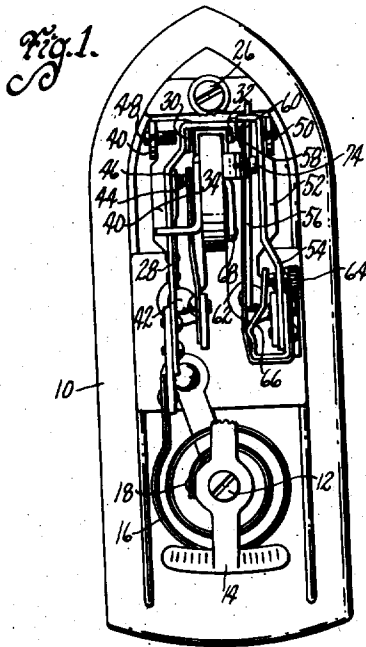
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2,030,933

MAGNET SWITCH

Filed Oct. 16, 1933



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UNITED STATES PATENT OFFICE

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MAGNET SWITCH

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Application October 16, 1933, Serial No. 693,813

10 Claims. (Cl. 200—139)

The object of my invention is to provide a magnet switch which is simple, durable and comparatively inexpensive to manufacture.

A further object of my invention is to provide a switch structure in which a magnet is used for giving snap action to a switch arm, the switch arm being characterized by having a pair of armatures, one on either side of the magnet to give stepped snap action, or a snap action which is equal in both directions, as required.

A further object is to provide a magnet switch structure in which the differential of operation of the switch arm, as affected by the magnet, can be adjusted in a fool proof manner by the use of a magnetic shunt.

With these and other objects in view my invention consists in the construction, arrangement and combination of the various parts of my device, whereby the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawing, in which:

Figure 1 is a front elevation of a room thermostat embodying my invention and showing the cover therefor removed.

Figure 2 is a side elevation of the same.

Figure 3 is an enlarged view, partly in section, showing the essential parts of Figure 1 in a different position.

Figure 4 is a front elevation of the magnetic shunt feature of my invention.

Figure 5 is an electro diagrammatic view showing one installation in which a switch structure embodying my invention can be included.

Figure 6 is a diagrammatic view showing parts of Figure 5 in another position; and

Figure 7 is a similar diagrammatic view showing a modified form of switch structure.

On the accompanying drawing, I have used the reference numeral 10 to indicate a base. Secured to the base 10 is a post 12 having pivoted thereon a bimetal coil carrier arm 14. A bimetal coil 16 is secured, as at 18, to the arm 14.

The pivoted arm 14 can be adjusted and is provided with a projection 20 secured thereto for this purpose. The projection 20 is confined between side bars 22 of a forked adjusting lever 24. The lever 24 is pivoted at 26 to the base 10, as shown in the application of Gustave A. Lennholm, filed December 19, 1932, Serial No. 647,861.

A switch arm 28 is secured to the bimetal coil 16 for swinging movement thereby as caused by room temperature changes. The switch arm 28 has a pair of armatures 30 and 32 secured thereto and located on opposite sides of a permanent

horse-shoe magnet 34, the armatures being in the magnetic field thereof.

The magnet 34 is supported by a screw 36 extending through a plate 38 of leaf spring material positioned against one side of the magnet. The screw 36 extends into a bracket 40 which is secured to the base 10 and extends to a terminal 42. The bracket 40 has mounted thereon a leaf spring carried contact 44, while the switch arm 28 has a coacting leaf spring carried contact 46.

An insulated stop screw 48 extends through an ear-like extension of the bracket 40 for limiting movement of the switch arm 28 in one direction. Its movement in the opposite direction is limited by a stop screw 50 extending through an ear of a bracket 52. A stop bar 54, a contact arm 56 and a leaf spring mounted contact 58 are interposed between the stop screw 50 and a contact 60 carried by the switch arm 28.

The arms 54 and 56 are carried by the bracket 52, the arm 56 being swingably mounted by reason of being secured to a leaf spring 62 which carries the contact 58. The stiffness of the spring 62 can be adjusted by a set screw 64 contacting with an arm 66, which in turn engages the spring 62.

In connection with the magnet 34, I provide a magnetic shunt 68 which is made of soft iron or other magnetic metal. It is in the form of a plate riveted at 70 to the leaf spring plate 38, the shunt being provided with an opening 72 to accommodate the head of the screw 36. The tendency of the leaf spring plate 38 is to retain the magnetic shunt 68 against the poles of the magnet 34. Thus the magnetic field is variable for affecting the armatures 32 and 30. The field can be increased by spacing the portion of the magnetic shunt adjacent the poles of the magnet at a greater distance from the magnet, as shown by dotted lines in Figure 4.

This is simply accomplished by means of a set screw 74 bearing against the magnet and threaded in the magnetic shunt 68.

The structure shown in Figures 1 to 4 is especially adaptable for a night and day thermostat. During the daytime the switch arm will operate through a range indicated in Figure 3 as "Day range". When at the left extreme of the "Day range", as shown in Figure 5, the circuit to the furnace controlling mechanism is broken because the temperature of the room is at, or higher than the predetermined maximum. As the room cools down, the armature 32 will remain attracted by the magnet until sufficient energy has been stored in the bimetal element 16 to

move it away from the magnet and to the right hand limit of the "Day range" in Figure 3, whereupon the contacts 60 and 58 will snap to closed position. This energizes the furnace controlling mechanism so that the furnace will operate and warm up the room, whereupon the switch arm 28 will swing toward the left limit of the "Day range" movement.

It will be noted that the contacts 60 and 58 are connected in series with a pair of contacts 76 of a timing clock 78. The timing clock includes a cam 80 which rotates once each twenty-four hours and can be set for closing the contacts 76 at 5 a. m. for instance and opening them at 10 p. m.

When it opens the contacts 76, the room thermostat becomes operative as a night thermostat by controlling the furnace controlling mechanism through a lower "Night range". The contacts 60 and 58, after they become engaged, cannot then energize the furnace controlling mechanism so that the switch arm 28 will tend to move further toward the right and when the bimetal element 16 has stored sufficient energy to overcome the pull of the magnet 34 on the armature 32, in addition to the spring tension of the arm 56, the switch arm will move to the right limit of the "Night range", as shown in Figure 3, for closing the contacts 46 and 44 which are then the controlling contacts for the furnace controlling mechanism until the contacts 76 are again closed.

Figure 6 illustrates how the contacts 46 and 44 are closed until the furnace controlling mechanism heats the room sufficiently to snap the switch arm 28 to the dotted line position thereof, whereupon the contacts 46 and 44 are separated but the contacts 60 and 58 remain closed. Thus in conjunction with the clock 78, the thermostat is adaptable for controlling a furnace at one temperature in the daytime and another temperature at night.

From the foregoing description, it will be obvious that snap action caused by the magnet 34 is obtainable in two different steps, one in the day range where the armature 32 is movable from adjacent the magnet to a distance slightly spaced therefrom, the armature 30 remaining substantially spaced from the magnet, and the other in which the armature 30 is movable as in Figure 3 to positions adjacent or slightly spaced from the magnet 34 and the armature 32 is substantially spaced therefrom. The same construction can be applied to a three wire thermostat in which the switch arm 28 is provided with contacts 82 and 84, for instance as shown in Figure 7, for cooperation with contacts 86 and 88, one wire running to the switch arm 28 and thereby the contacts 82 and 84 and the other two wires running to the contacts 86 and 88.

Such an installation can be used, for instance, where one circuit turns the furnace controlling mechanism "off" and another turns it "on". The switch arm in this instance would be movable to only two positions instead of three as in Figure 3, one in which the armature 30 is close to the magnet and the armature 32 is spaced therefrom and vice versa. Such an arrangement provides for equal snap action of the switch arm in either direction, whereas with but one armature, the snap action in one direction would be sufficient, but in the other direction would be too sluggish.

The "Night range" of the switch shown in Figure 3 can be reduced to any desired number

of degrees below the "Day range" by increasing the tension of the leaf spring 62, this being accomplished by screwing the set screw 64 inwardly. The snap action characteristics for the two different switches can be controlled somewhat, for instance, by making the magnetic armatures 30 and 32 of different sizes.

The stop screws 48 and 50 are set at the factory to determine the clearance between the armatures and the magnet when the armatures are in their positions thereadjacent. Heretofore these screws have been used for differential adjusting purposes when the thermostat is in operation, but quite often the difficulty has been experienced of someone adjusting them so that the armatures touch the magnet, which increases the differential all out of proportion and is strictly undesirable. By having the screws 48 and 50 set at the factory, however, and using only the magnetic shunt 68 as a differential adjuster, the differential adjustment is entirely fool proof.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the real spirit and purpose of my invention, and it is my intention to cover by my claims, any modified forms of structure or use of mechanical equivalents, which may be reasonably included within their scope.

I claim as my invention:

1. In a switch for controlling an electric circuit, a base, a horseshoe magnet mounted thereon, an operating arm movably mounted on said base, a pair of magnetic armatures supported thereby, one on either side of the poles of said magnet whereby magnetic lines of force pass through each of said armatures from one of said poles to the other, a contact supported by said arm and a coacting stationary contact supported on said base.

2. In a switch structure, a two pole magnet, a switch arm, a pair of armatures on said switch arm, said armatures being spaced from each other and located on opposite sides of the poles of said magnet and each in the magnetic field of both poles, said switch arm being movable through a range with one armature adjacent said poles at one limit of movement of the switch arm and the other armature thereadjacent at the other limit of movement of the switch arm and switch contacts engaged and separated by said switch arm when at opposite limits of its movement.

3. In a switch structure, a two pole magnet, a switch arm, a pair of armatures on said switch arm, said armatures being spaced from each other and located on opposite sides of the poles of said magnet and each in the magnetic field of both poles, said switch arm being movable through a range with one armature adjacent said poles at one limit of movement of the switch arm and the other armature thereadjacent at the other limit of movement of the switch arm and two pairs of switch contacts, one pair being engaged when the switch arm is at one limit of its movement and the other pair being engaged when the switch arm is at its other limit of movement.

4. In a switch structure, a two pole magnet, a switch arm, a pair of armatures on said switch arm, said armatures being spaced from each other and located on opposite sides of the poles of said magnet and each in the magnetic field of both poles, said switch arm being movable through a range with one armature adjacent said poles at one limit of movement of the switch arm and the other armature thereadjacent at the other limit of movement of the switch arm and two

pairs of switch contacts, one pair engaged and disengaged when one armature is adjacent said magnet and the other pair engaged and disengaged when the other armature is adjacent the magnet.

5 5. In a switch structure, a two pole magnet, a switch arm, a pair of armatures on said switch arm, said armatures being spaced from each other and located on opposite sides of the poles of said magnet and each in the magnetic field of both poles, said switch arm being movable through a range with one armature adjacent said poles at one limit of movement of the switch arm and the other armature thereadjacent at the other limit of movement of the switch arm and two pairs of switch contacts, one pair engaged and disengaged when one armature is adjacent said magnet and the other pair engaged and disengaged when the other armature is adjacent the poles and said first mentioned armature is then substantially spaced therefrom.

6. In a control structure, a two pole magnet, a controller arm and a pair of armatures on said arm, said armatures being spaced from each other and located on opposite sides of the poles of said magnet and each in the magnetic field of both poles, said controller arm being movable through a range with one armature adjacent said poles at one limit of movement of the arm and the other armature thereadjacent at the other limit of movement of the arm.

7. In a switch structure, a two pole magnet, a switch arm, a pair of armatures on said switch arm, said armatures being spaced from each other and located on opposite sides of the poles of said magnet and each in the magnetic field of both poles, said switch arm being movable through a range with one armature adjacent said poles at one limit of movement of the switch arm and the other armature thereadjacent at the other limit of movement of the switch arm, switch contacts engaged and separated by said switch arm when at opposite limits of its movement and a magnetic shunt for said magnet to change the differential of operation of said switch arm.

8. In a switch structure, a two pole magnet, a switch arm, a pair of armatures on said switch

arm, said armatures being spaced from each other and located on opposite sides of the poles of said magnet and each in the magnetic field of both poles, said switch arm being movable through a range with one armature adjacent said poles at one limit of movement of the switch arm and the other armature thereadjacent at the other limit of movement of the switch arm, two pairs of switch contacts, one pair being engaged when the switch arm is at one limit of its movement and the other pair being engaged when the switch arm is at its other limit of movement and a magnetic shunt for varying the intensity of the magnetic field of the magnet on said switch arm.

9. In a switch structure, a two pole magnet, a switch arm, a pair of armatures on said switch arm, said armatures being spaced from each other and located on opposite sides of the poles of said magnet and each in the magnetic field of both poles, said switch arm being movable through a range with one armature adjacent said poles at one limit of movement of the switch arm and the other armature thereadjacent at the other limit of movement of the switch arm, two pairs of switch contacts, one pair engaged and disengaged when one armature is adjacent said poles and the other pair engaged and disengaged when the other armature is adjacent said poles and a magnetic shunt for varying the intensity of the magnetic field of the magnet on said switch arm.

10. In a switch for opening and closing an electric circuit, a base, a horseshoe magnet fixed on said base, an operating arm movably mounted on said base for movement simultaneously toward or away from both poles of said magnet and a magnetic shunt for varying the intensity of the magnetic field affecting said operating arm, said magnetic shunt comprising a pole shunting element, a leaf spring secured thereto and to said base, said leaf spring being under tension to bias said pole shunting element to engage the poles of said magnet, and a set screw threaded in said pole shunting element and engaging said magnet to force said pole shunting element away therefrom against the constraint of said leaf spring member.

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