

Jan. 23, 1962

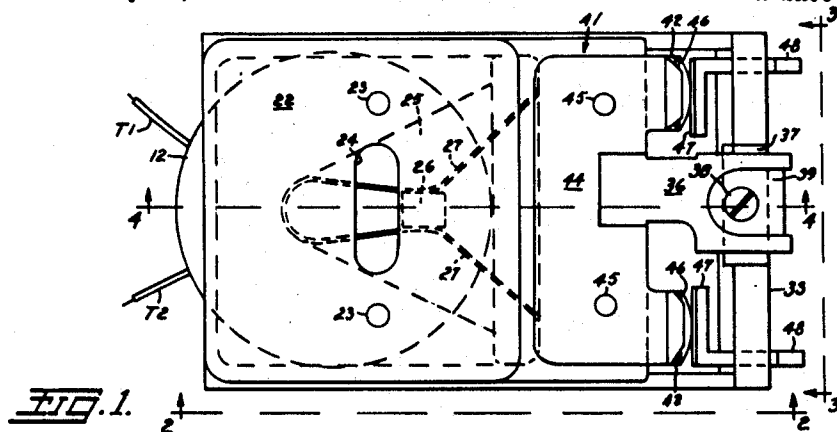
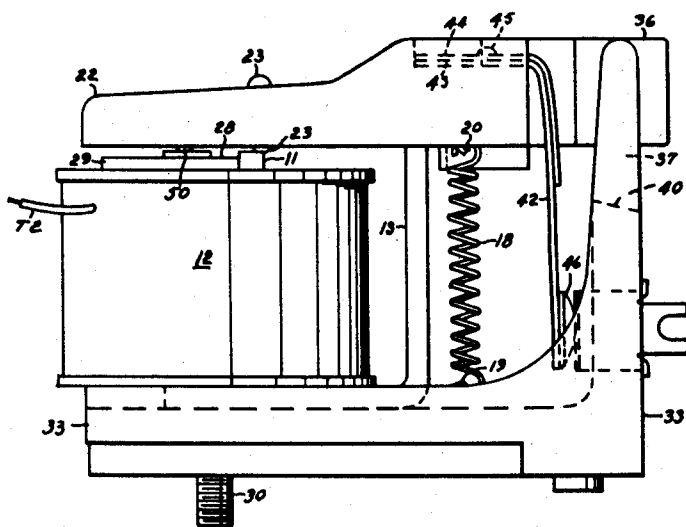
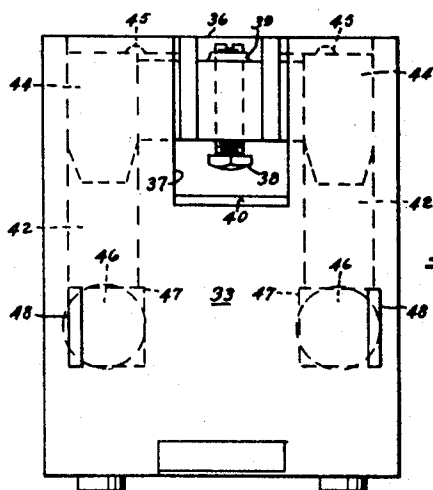
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3,018,347

ELECTRIC RELAY

Filed May 12, 1960

2 Sheets-Sheet 1



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FIG. 4.

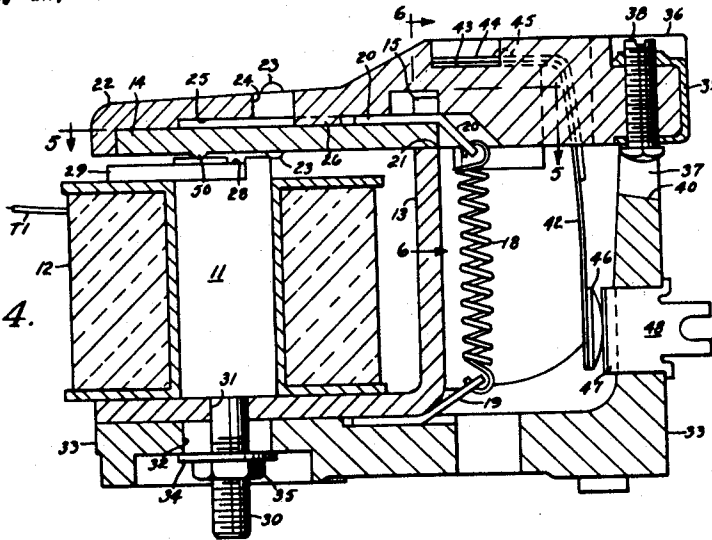
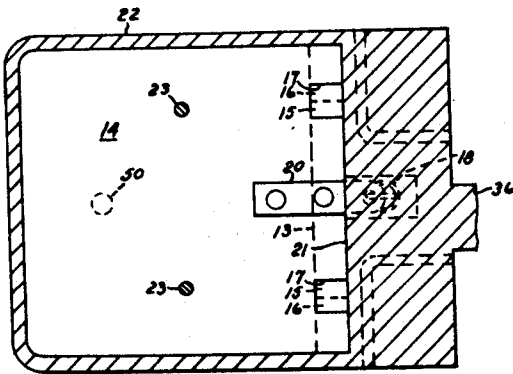


FIG. 5.

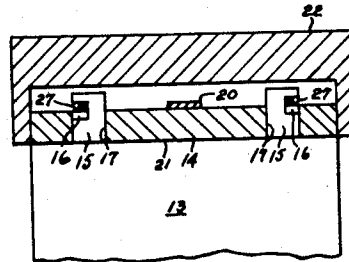


FIG. 6.

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3,018,347

ELECTRIC RELAY

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Filed May 12, 1960, Ser. No. 28,682
6 Claims. (Cl. 200—87)

This invention relates generally to electric relays and more particularly to an electromagnetically operated electric switch used in the control system for a fluid fuel fired residential heating system.

Such a switch will generally be required to handle a one phase, 60 cycle, electric load of three quarter horse power or less and the switch will usually be electromagnetically operated by a coil carrying a twenty four volt thermostat current of one ampere or less.

It is a primary object of this invention to provide such an electromagnetically operated electric switch, or electric relay, which will be quiet in operation since control systems for the purpose noted are usually found in residences where the heating equipment will be in or close to the living space where relay noise would be particularly objectionable.

It is to be understood that noise in alternating current energized magnetic circuits is usually the result of the varying strength of the magnetic flux in its flow path and the varying reluctance of the flow path both in section and over its length. This is particularly true when the iron elements making up the flow path are not firmly secured together.

It is then a second object of this invention to provide an electric relay in which, when the magnetic circuit is energized and the electric switch closed, there can be substantially no variation of reluctance in the air gap of the magnetic circuit and no rocking or vibration of the armature of the relay.

To attain the second object it is a third object of this invention to provide an electric relay in which when the magnetic circuit is energized the armature link in the magnetic circuit will have a three point compression structure with mechanically resilient means urging said armature to rotate in one direction about a two point hinging axis of said structure in one direction and magnetic means urging said armature to rotate in the other direction about said hinging axis together with a single point stop means limiting the rotation of said armature in said other direction.

How these and other objects are attained is explained in the following description leading to the attached drawing in which

FIG. 1 is a top plan view of an assembly of the basic parts of the relay of this invention.

FIG. 2 is a side elevation of the relay as viewed from the line 2—2 of FIG. 1.

FIG. 3 is an end elevation of the relay as viewed from the line 3—3 of FIG. 1.

FIG. 4 is a side sectional elevation of the relay as viewed from the line 4—4 of FIG. 1.

FIG. 5 is a fragmental plan sectional elevation of the relay as viewed from the offset plan line 5—5 of FIG. 4.

FIG. 6 is a fragmental end sectional elevation of the relay as viewed from the line 6—6 of FIG. 4.

Like reference numerals refer to like parts in the several figures of the drawing.

Referring now to the drawing, particularly side vertical section FIG. 4, the magnetic operating circuit comprises the rectangular iron core 11 of the solenoid or operating coil 12, L-shaped iron bracket 13 and armature 14. Ears 15 of bracket 13 are notched as at 16 and extend upwardly through slots 17 of armature 14. Armature return spring 18 is hooked in tension, as shown, between

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tab 19 secured to L-bracket 13 and tab 20 secured to armature 14 to urge armature 14 towards clockwise motion about the common edge 21 of L-bracket 13 and armature 14.

The underside of insulating Bakelite molded armature cap 22 is recessed to receive armature 14 secured to cap 22 by rivets 23. Cap 22 is formed with oval ended slot 24 therethrough.

Under armature 14 the triangular space 25 is sunk around block 26 to receive music wire interlock spring 27 which is biased inwardly to be laterally positioned by block 26 at its knees and to press inwardly at its ends into slots 16 of ears 15 of L-bracket 13 to retain ears 15 of L-bracket 13 in slots 17 of armature 14.

The rectangular iron core 11 of the operating coil 12 is seen to be grooved at 28 to receive one side of the continuous copper shading, coil 29 to cause the magnetic flux through shading coil 29 to be delayed in time and thus prevent the total alternating magnetic flux from having a zero value at any time the operating coil is energized. At its lower end the core is reduced in size and threaded at 30 to pass through a hole 31 in L-bracket 13 and a hole 32 in base 33 and to secure core 11, coil 12 and L-bracket 13 to insulating Bakelite base 33 by washer 34 and nut 35.

Base 33 is seen to be L-shaped to extend upwardly near the top of armature cap 22 and is there formed with a gap 37 to pass the forward extending center leg 36 of armature cap 22. The bottom surface 40 of gap 37 in base 33 is forwardly sloped to form a stop for adjustment screw 38 adjustably positioned in adjustment lock nut 39 secured to the end of leg 36 of armature cap 22 to determine the maximum air gap length at pull in between core 11 and armature 14.

U-shaped flat contact spring 41 has two laterally spaced movable contact blades 42 extending downwardly from its horizontal connecting bar 43 and is strengthened by U-shaped keeper blade 44, both connected to armature cap 22 by rivets 45. Movable contacts 46 are secured respectively to blades 42. Stationary contacts 47 are secured on contact terminals 48 riveted through the upright front part of base 33.

The relay is operated by connecting an electric control or pilot circuit from a source of power through a condition responsive switch to terminals T1 and T2 of operating coil 12 to energize the magnetic circuit 11, 13, and 14 to overcome the restraint return spring 18 and close armature 14 on core 11, at the same time moving load switch blades 42 to close moving contacts 46 respectively into contact with stationary contacts 47 of stationary contact terminals 48 and thereby connecting a series load circuit from one terminal 48, one stationary contact 47, one moving contact 46, one switch blade 42, connecting bar 43, the other switch blade 42, the other moving contact 46, the other stationary contact 47 and the other terminal 48.

Note particularly in FIGS. 4, 5 and 6 that the method of hinging armature 14 to magnetic circuit L-bracket 13 is such that at its hinging end 21 armature 14 is held down onto L-bracket 13 with a straight line contact 21. Contact blades 42 and interlock spring 27 both tend to hold the bottoms of slots 17 of armature 14 away from the upright ears 15 of L-bracket 13 so that there is substantially no hinge friction during the relay operation.

And it should be noted that by forming the under side of armature 14 with the single small raised magnetic polar terminal 50 the construction gives at most a three point support for armature 14 when the magnetic circuit is closed or if line 21 is perfectly formed the support will be by line 21 and point 50 so that in either case armature 14 can never have an unstable or chattering support.

Finally it is seen that interlock spring 27, FIGS. 1, 4 and 6, is resiliently biased at its knees to grip block 26 to remain in position but also at its ends is resiliently

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biased towards entrance into slots 16 of ears 15 of L-bracket 13 and thereby both prevents armature 14 from raising off L-bracket 13 and urges hinging edge 21 of armature 14 forwardly to remain on the top flat surface L-bracket 13 to rock without friction when the relay is being operated. Uniquely interlock spring 27 is also the means for assembling armature 14 with its cap 22 to L-bracket 13 with its base 33. In assembly the slots 17 of armature 14 are laid over ears 15 of L-bracket 13 and the assembly will be stopped by ears 15 striking the ends of spring 27 which will be laying over slots 17. A small stiff wire or the like can then be placed downwardly through hole 24 in armature cap 22 and by pressing outwardly on the legs of spring 27 one after the other ears 15 will be allowed to pass upwardly through slots 17 and then springs 27 can return into notches 16 of ears 15 as shown in FIG. 6. Reversely when it is desired to disassemble the armature 14 from L-bracket 13 it is only necessary to line up on the armature at its hinge end while spreading the ends of spring 27 out of notches 16 of ears 15 of L-bracket 13.

Having recited some of the objects of this invention, illustrated and described a preferred form in which the invention may be practiced and explained its operation, we claim:

1. An electromagnetic operator for an electric switch, said operator comprising a two pole U-shaped magnet, an armature for completing the magnetic circuit between the two poles of said magnet, one end of said armature including hinging means axially non-tippably supported on one end of said magnet, electric means encircling part of said magnet to energize said magnet and said armature to close said armature across the ends of said magnet when said electric means is energized, a shading coil around part of the other end pole face of said magnet, an armature return spring engaged at its respective ends to said one end of said magnet and said one end of said armature to urge said armature to rotate about said hinging means to separate the other end of said armature from the other end of said magnet, stop means secured on said magnet to limit the movement of said other end of said armature from said other end of said magnet, and a small topped magnetic pole tip means raised from the pole face of said other end of said armature to abut said other end of said magnet to give said armature at its other end an unstrained support at a single point on said other end of said magnet when said magnet is energized.

2. The switch operator of claim 1 in which said one end of said magnet and said one end of said armature are formed of similar flat bars of magnetic iron having substantially identical rectangular end sections perpendicular to their respective boundary surfaces, said one end of said armature bar being formed with a laterally spaced pair of slots through the short dimension thereof to receive perpendicularly to said armature bar a laterally spaced pair of ears formed on said one end of said magnet to extend longitudinally therefrom, the magnet con-

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tacting edge of said one end of said armature on either side of said slots forming said hinging means and the flat end surface of said one end of said magnet forming a supporting means for said hinging means, said hinging means being non-tippable on said supporting means in the hinging axis direction thereof.

3. The switch operator of claim 2 in which said ears formed on said one end of said magnet to extend through said slots formed in said one end of said armature are each formed with a respective notch near its end and said armature includes a pair of latch means supported thereon, each of said latch means being respectively biased towards entrance into one of said notches rockably to hold said one end of said armature on said one end of said magnet.

4. The switch operator of claim 3 including a cap for said armature, said cap being secured to said armature with said pair of latch means independently movable therebetween, said cap being formed with a hole there-through over part of each of said pair of latches whereby a latch releasing pointer can be inserted through said hole to engage each of said latches respectively to move said latches from said notches to release said armature from said magnet at the hinge position of said armature on said magnet.

5. An electromagnetic operator for an electric switch, said operator including a stationary magnetizable U-shaped structure together with a movable magnetizable armature structure forming a closed magnetic circuit structure, said armature structure at one end being formed with a straight edge thereacross for hinging support of said armature structure on a flat surface formed on one end of said U-shaped structure, the other end of said armature being formed with a magnetic contact raised on the same side thereof as said straight edge for contacting the other end of said U-shaped structure to close said magnetic circuit without vibration when said magnetic circuit is energized by an alternating current electric circuit looped therewith.

6. The switch operator of claim 5 including resilient means for positioning said straight edge of said armature structure at its hinging position on said flat surface on said one end of said U-shaped structure together with resilient means operable when said alternating current circuit is de-energized for rocking said armature over said straight edge from its position of contact of its said other end on said other end of said U-shaped structure to contact with a second stop means adjustably fixed to said U-shaped structure.

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