April 27, 1965 R. L. COLLETTE ETAL 3,180,954

HOT WIRE RELAY

Filed March 5, 1962

Fig. 2

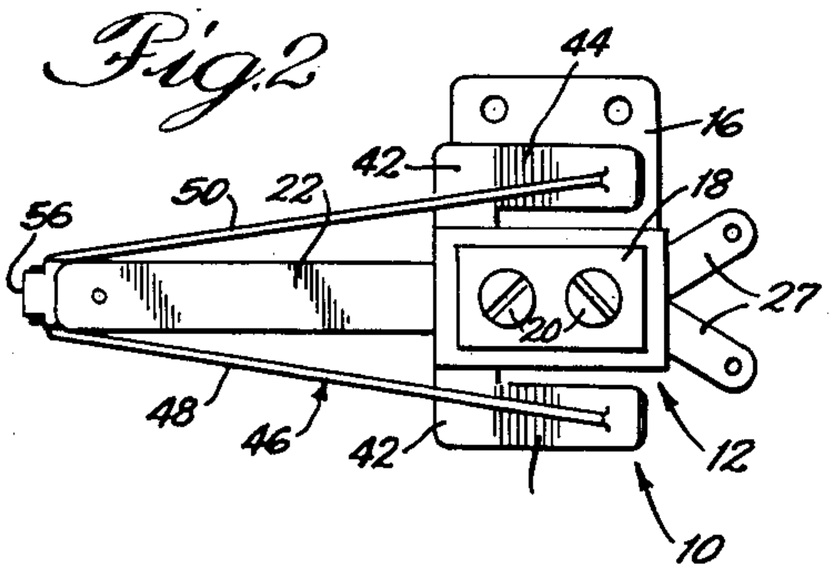


Fig. 1

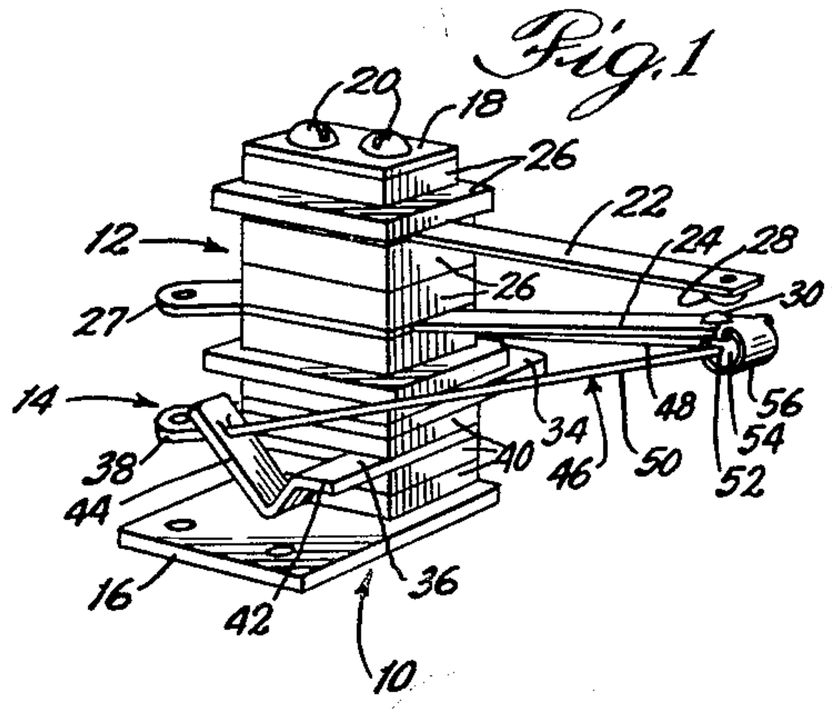


Fig. 3

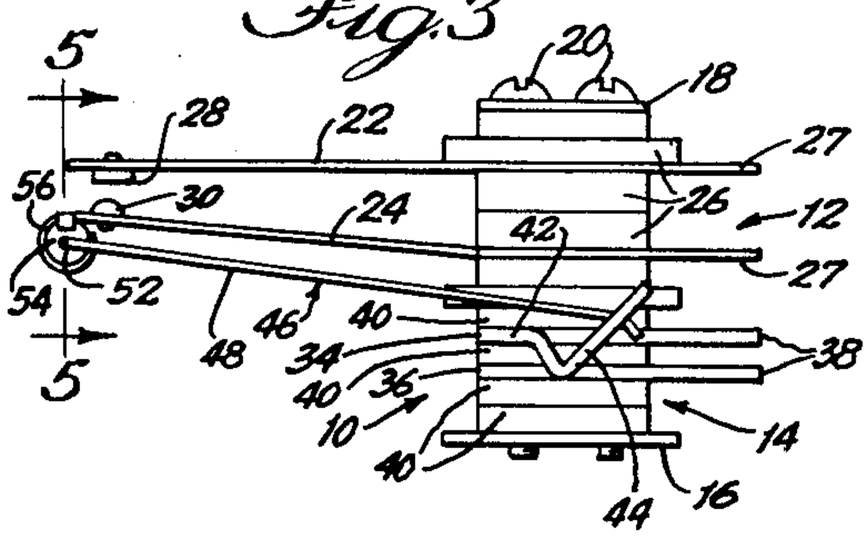


Fig. 4

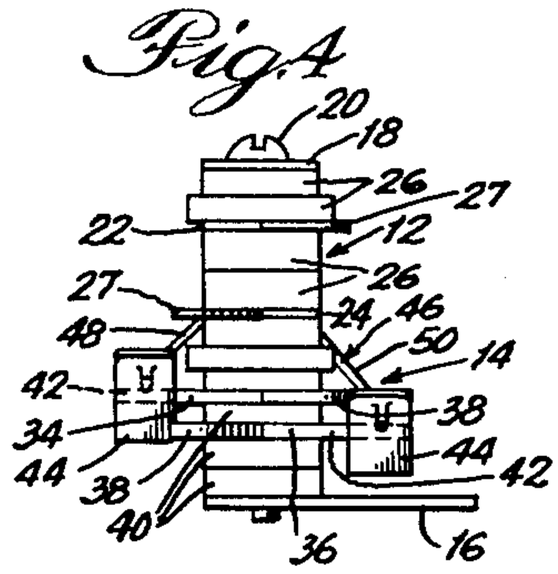
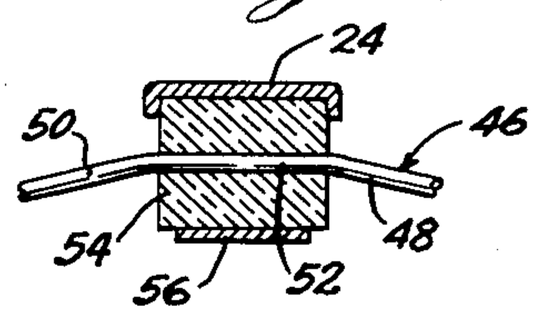


Fig. 5



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3,180,954
HOT WIRE RELAY

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This invention relates in general to hot wire relays and more particularly to a new and improved relay of the type in which the expansion of a hot wire in response to current flow controls the operation of associated relay contacts.

Those skilled in the art appreciate that the concept of utilizing a hot wire in a relay for operating contacts offers a number of advantages over conventional electromagnetic relays. Through the use of hot wire relays, the need for an expensive coil and armature construction is eliminated and the attendant problems of space and adjustment are reduced. One of the problems raised by prior art hot wire relays, however, is the difficulty in securing sufficient power on the expansion or contraction of the hot wire to move the associated contacts into their closed or open position. As a result, it generally has been necessary in the prior art hot wire relays to employ additional mechanical devices, such as levers, to provide the necessary motion amplification of the wire expansion, as the wire is heated by the passage of current and of the wire contraction, upon cooling when the current ceases to flow.

In accordance with a feature of the present invention, such prior art problems are overcome by a unique arrangement of formed leaf spring contact blades, a contact operator assembly, and the hot wire. The contact blades may be formed to be normally open or normally closed and both types of operation are contemplated as fully within the principles of this invention. Advantageously, a connection is provided between at least one of the contact blades and the hot wire at a point some distance from a pivot position for the wire and contact blades defined by the contact operator assembly so that the expansion or contraction of the hot wire in accordance with currrent flow therethrough permits direct actuation of the contacts to make or break the circuit being controlled.

It is therefore, a primary object of the present invention to provide a new and improved relay of the hot wire type.

It is a further object of the invention to provide such a hot wire relay of a unique construction characterized by the leverage gain between the relatively small contraction of the wire and the relatively large movement of the contact blade so as to permit direct actuation and thus eliminate any need for additional mechanical devices to provide motion amplification of the wire expansion.

It is another object of this invention to provide a new and improved hot wire relay as above which is characterized by its relative efficiency, ruggedness, compact size and low cost of construction and operation.

These and other objects, advantages and functions of the invention will be apparent upon reference to the following specification and claims, together with the drawings.

FIGURE 1 is a general perspective view of an illustrative relay assembly embodying the present invention;

FIGURE 2 is a top plan view of the illustrative relay assembly of FIGURE 1;

FIGURE 3 is a side elevational view of the illustrative relay assembly of FIGURE 1;

FIGURE 4 is a rear elevational view of the illustrative relay assembly of FIGURE 1; and

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FIGURE 5 is a sectional view taken substantially as shown through the line 5—5 of FIGURE 3.

One particular illustrative embodiment of the present invention is shown in the drawings in the form of the relay assembly indicated generally by the reference character 10. Advantageously, the relay assembly 10 comprises a conventional spring pile up assembly 12 and a novel hot wire contact operator assembly 14 which replaces the conventional coil and armature construction used in electromagnetic relays for operating a spring pile up assembly.

The spring pile up assembly 12 is assembled in a stack with the contact operator assembly 14 for support on a common mounting plate 16, with a tension plate 18 and screws 20 serving to hold the two assemblies securely in their proper position.

The spring pile up assembly 12 comprises a pair of spaced-apart cantilever contact springs or blades 22 and 24, insulated from electrical contact with each other or with other metal parts by suitable insulating means, such as the insulating plates 26. The cantilever contact blades 22 and 24 each have a terminal lug 27 at one end to enable electrical connections to be established thereto and a respective contact 28 or 30 adjacent the other end. The contact blades or springs 22 and 24 are preformed in accordance with a feature of this invention so that the contacts 28 and 30 carried on the other ends thereof would normally be engaged in a circuit closing position.

The contact operator assembly 14 comprises a pair of spaced apart metal plates 34 and 36 having appropriate terminal lugs 38 to permit electrical connections from a source of controlling current to be established thereto. The plates 34 and 36 are separated from electrical contact with each other and with other metal parts by the insulators 40. A respective projecting leg 42 is provided on opposite sides of each plate 34 and 36 and each leg is provided with an angular flange or tab portion 44. Advantageously, the tabs 44 may be V-shaped and are constructed so that they may be bent or adjusted as desired. An elongated hot wire contact operator 46 is connected between the tabs 44.

The contact operator 46 comprises legs 48 and 50, the ends of which are securely connected to respective tabs 44, and the mid-point 52 of which is operatively fastened to a spacer cylinder 54 of insulating material. The spacer cylinder 54 is in turn received in an arcuate configuration 56 at the contact end of spring blade 24. In accordance with a feature of this invention, the tabs 44 or the wire legs 48 and 50 may be bent or otherwise selectively adjusted so that the spring blade 24 is biased away from spring blade 22 to hold contacts 28 and 30 out of engagement with each other.

When a circuit is established to the contact operator 46, it will be heated in accordance with the current flow therethrough. If it is formed of material having positive temperature coefficient of expansion, as is well known in the art, it will be elongated to thereby eliminate or reduce the stress on the spring blade 24. As the stress on the spring blade 24 is reduced, the blade will rise under its own spring pressure to permit contacts 28 and 30 to engage and thereby complete or prepare an electrical circuit therethrough. It will be appreciated of course that the spring blades 22 and 24 may also be set to disengage upon heating of the contact operator 46.

Those skilled in the art will now appreciate that, due to the unique construction of the invention in operatively coupling the hot wire 46 to the spring blade 24 at the spacer cylinder 54, a point which is remote from the pivot positions for the hot wire and spring blade, the expansion or contraction of the wire in response to current flow is substantially amplified by the leverage gain between

the wire and blade. This provides the highly advantageous result of positive contact opening or closing movement at the switch blades in response to relatively small expansions or contractions of the wire in accordance with the current flow therethrough.

While there has been shown and described a particular embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and, therefore. it is intended in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

We claim:

1. A hot wire expansion relay comprising a pair of cantilever blades each having an electrical circuit contact thereon and mounted in spaced apart planes, said blades being formed to cause said contacts to normally be positioned against each other in electrical circuit closing condition, an arcuate member at the end of one of said blades, an insulating element rigidly held in said arcuate member, a U-shaped elongate wire having its intermediate portion positioned through said insulating element, the terminal ends of said U-shaped elongate wire being connected to respective electrical terminals, and a pair of lugs connected to said elongate wire, each lug being at a pivot point remote from said insulating element to place said U-shaped elongate wire under tension and to bias said one blade in a predetermined open circuit contact position, whereby the heating of said wire enables a reduction of tension on said wire to permit the contact on said one blade to be placed in circuit closing engagement with the contact on the other blade.

2. A hot wire expansion relay comprising a pair of cantilever blades having respective electrical circuit contact elements thereon, said blades being supported in spaced apart relation in an insulating support assembly and formed to cause said contacts to normally be positioned against each other in electrical circuit closing condition, electrical insulating means positioned at the free end of one cantilever blade, an elongate U-shaped wire element supported at an intermediate portion thereof by said electrical insulating means, the terminal ends of said elongate U-shaped wire element being connected to terminal lugs on said support assembly to bias said one cantilever blade so as to prevent its contact element from being in circuit closing condition with the contact element of the other blade, said terminal lugs being adjustable to selectively vary the biasing tension of said elongate U-shaped wire element such that the heating of said wire element as a result of current flow therethrough enables the expansion of said wire and the reduction of tension on said one blade to permit the contact element on said one blade to electrically engage the contact element on the other blade.

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