Jan. 31, 1967 R. J. HARKENRIDER 3,302,143

REED RELAY ASSEMBLY HAVING IMPROVED MOUNTING MEANS

Filed July 1, 1965 3 Sheets-Sheet 1

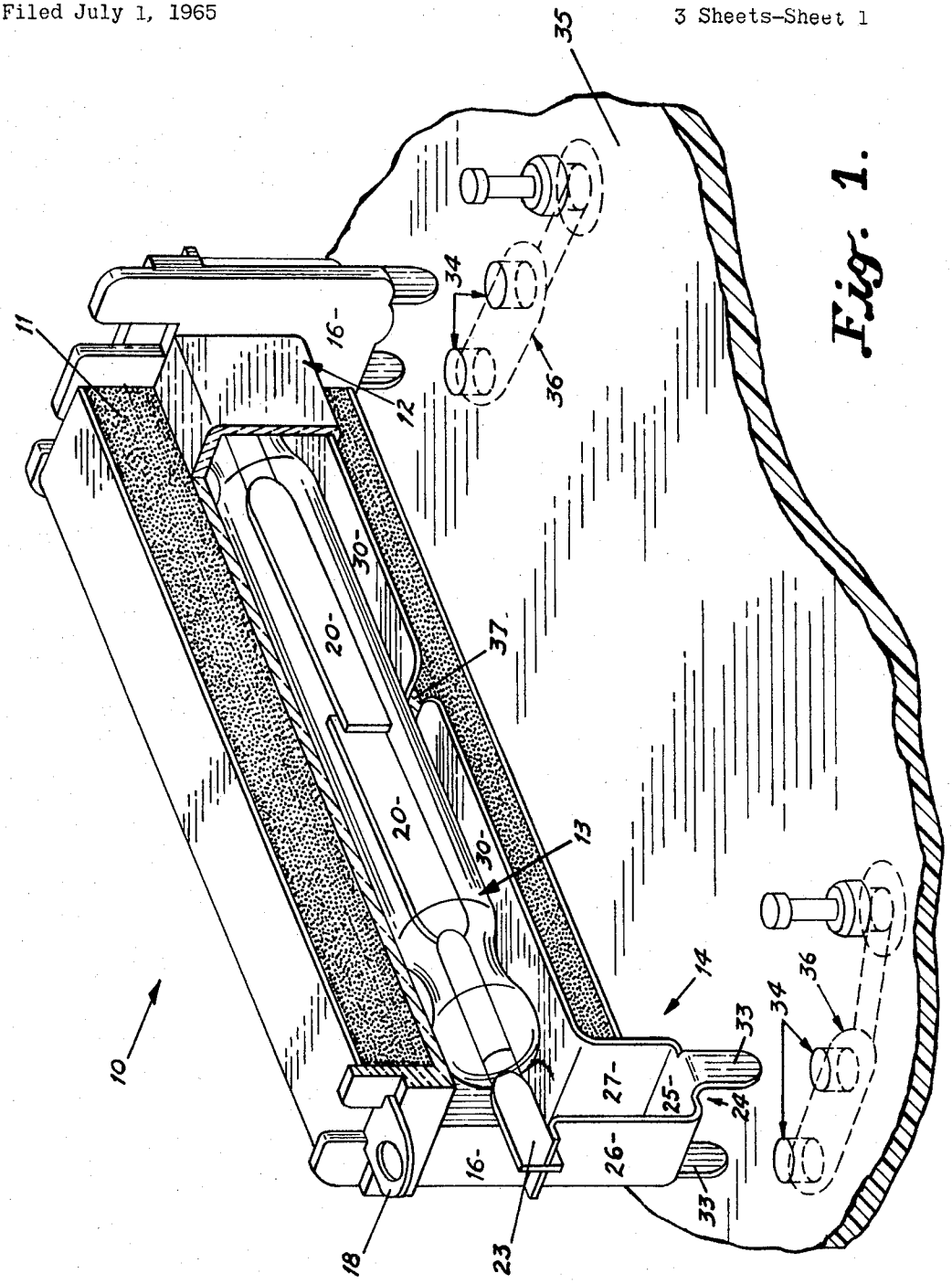


Fig. 1.

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REED RELAY ASSEMBLY HAVING IMPROVED MOUNTING MEANS

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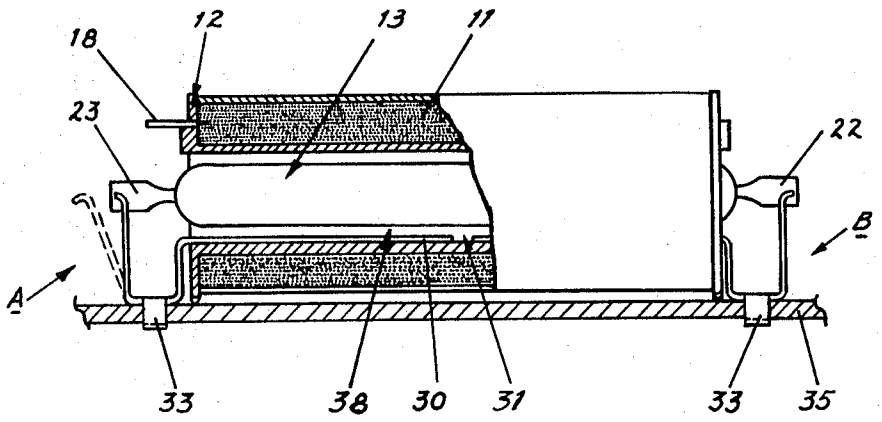


Fig. 2.

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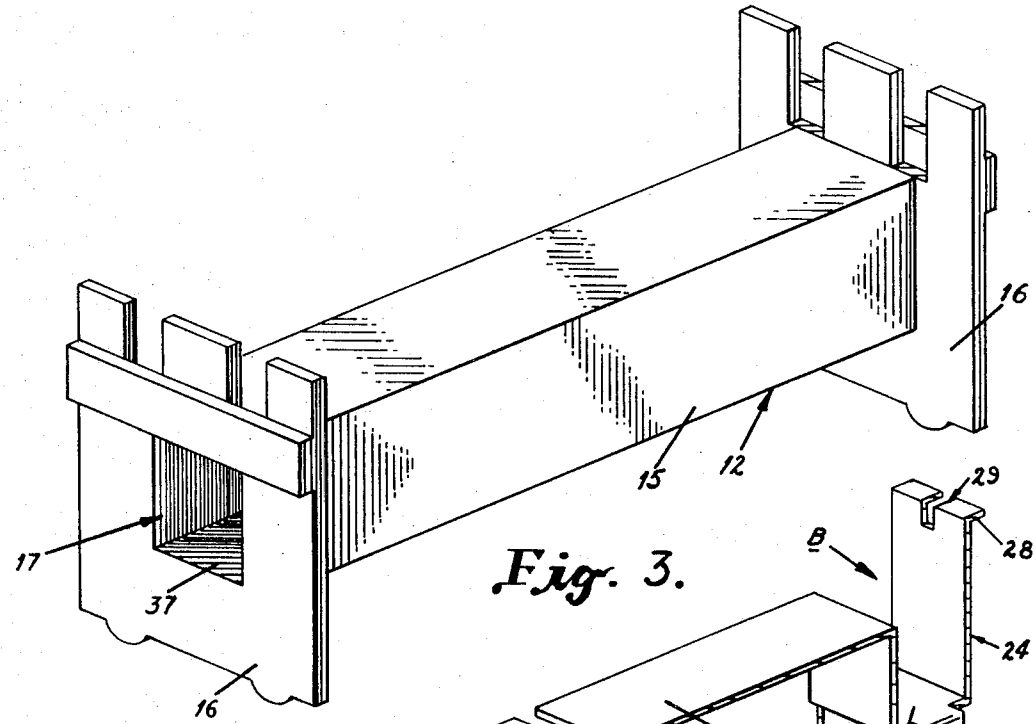


Fig. 3.

Fig. 4.

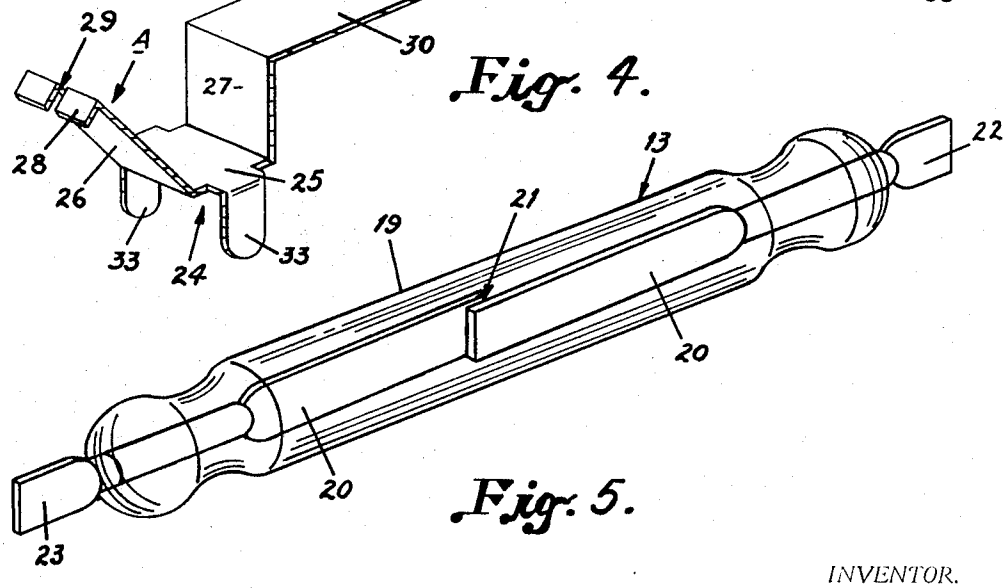


Fig. 5.

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REED RELAY ASSEMBLY HAVING IMPROVED MOUNTING MEANS

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4 Claims. (Cl. 335—154)

This invention relates to relays, and more particularly to glass reed relays.

Relays of this type generally include two overlapping, but spaced apart, magnetic cantilever switch blades sealed in a glass tube and actuated by a magnetic coil surrounding the tube.

Because of the trend toward circuitry miniaturization, it is desirable to operate relays of this type with minimal power, and because of their fragility, provide maximum shock protection.

It is therefore a primary object of the invention to provide a glass reed relay wherein a unique means is used to concentrate the actuating flux in close proximity to the cantilever switch blades for optimum power utilization.

A further object of the invention resides in a novel means for mounting a reed relay switch for maximum shock resistance.

Another object of the invention resides in a novel mounting means which serves to increase the efficiency of the glass reed switch and also acts as a unique terminal clip for physically and electrically connecting the relay assembly to a printed circuit board.

A still further object of the invention resides in a new method of assembling a glass reed relay in a fast and efficient manner.

Other objects and advantages of the invention will become more apparent during the course of the following description when taken in connection with the accompanying drawings wherein:

FIG. 1 is a perspective view, partially in section, of the relay assembly of the invention,

FIG. 2 is a side elevation view of the relay, partially in section.

FIGS. 3, 4 and 5 are perspective views of the relay sub-assembly components namely, the coil-form, terminal clips, and reed switch, respectively.

Turning now to FIG. 1, the relay, indicated by the numeral **10**, includes a coil **11** wound on a coil-form **12**, a glass reed switch **13**, and metal terminal clips **14**.

As shown in FIG. 3, the coil-form **12** is of conventional molded plastic construction having a generally rectangular body **15**, flange ends **16**, and a rectangular bore **17** extending therethrough. Coil **11** is wound on the coil-form **12** between the confining flanges **16** and power is supplied via terminals **18** (FIG. 1), only one of which is shown.

The glass reed switch **13** (FIG. 5) may be of the conventional type wherein a tubular glass envelope **19** surrounds and seals reed cantilever switch blades **20**. Within the glass tube the inner ends of the switch blades overlap one another but are spaced apart as at **21** and have their outer ends extending outwardly of the glass envelope to form electrical leads **22** and **23**.

As brought out hereinbefore, one of the major problems in the use of glass reed relays is to provide maximum power efficiency and at the same time provide maximum protection for the fragile glass envelope. To achieve these results and at the same time overcome the deficiencies of past reed relays, the present invention embodies a unique concept in the terminal clips **14** which not only provide a minimum reluctance magnetic circuit but optimum shock protection.

These clips, as shown in FIG. 1, are provided with a generally U-shaped end portion **24** having a base **25**, a longer side **26**, and a shorter side **27**. Extending outwardly at substantially right angles at the top of the longer leg **26** is a flanged lip **28** slotted at **29** (FIG. 4) in which the lead ends **22** or **23** of the reed switch are received as will be described later.

For the purpose of providing a minimum reluctance magnetic path, the short leg **27** has a right angle extension **30** which acts as an iron bar to concentrate the flux in close proximity to the spaced apart reeds **20**. As shown in FIG. 2, two of the terminal clips **14** are used, one extending into the coil-form bore **17** from each end.

To concentrate the flux and direct it through the reeds and across the switch gap **21**, the ends of the clip bars **30** terminate short of one another and have a space **31** between them. This causes the flux to take the path of least reluctance and travel through the reeds and set up opposite magnetic polarities in the blades **20** across the gap **21** thereby causing the blades to close when sufficient power is applied to the coil. The spacing **31** between the bar ends **30** can of course be varied depending on the "pull-in" and "drop-out" characteristics desired of the relay.

Mounting of the terminal clips on a circuit board is accomplished by tabs **33** struck downwardly from the base **25** of the U portion of the clips. Such tabs are inserted in holes **34** (FIG. 1) in a circuit board **35**, and, in the case of a printed circuit board as shown, the tabs then are bent under and soldered to make contact with the electrically conducting film path **36** shown in dotted lines on the board's underside.

When the tabs **33** are bent on the underside of the circuit board, the bar members **30** of the clips engage the wall **37** of the coil-form bore **17** to securely hold the coil-form against the board. At the same time, the height of the longer legs **26** of the clips is such that they hold the glass reed switch out on contact with the walls of the coil-form bore and spaced above the bars **30** as at **38** (FIG. 2). This latter feature provides very excellent shock protection since deformation of the coil-form itself will not disturb the reed switch and direct shock to the circuit board is damped by the spring characteristics of the clips before being transmitted to the switch. This is extremely important in transporation and other types of controls which are confronted with punishing shock and vibration conditions.

According to another aspect of the invention, as indicated at A in FIGS 2 and 4, assembly of the reed switch in the bore **17** of the coil is facilitated by having the long leg **26** of one of the clips bent outwardly at about 135° angle with respect to the clip-base **25**. In actual assembly, the un-bent terminal clip indicated at B at FIG. 2 is mounted on the circuit board first and its tabs **33** locked. One end of the coil-form **12** is then slid into position with the clip bar extending into the bore **17** and in engagement with the bore wall **37**. The opposite terminal clip with the bent leg A is then moved into position and its bar portion inserted into clamping position in the coil-form bore **17** and the clip tabs **33** locked.

Reed switch **13** is then inserted from the end where the U-leg **26** is bent out as at A in FIG. 2 and lead **22** thereof nested in slot **29** of the opposite un-bent clip at B. After the reed switch is inserted, the bent leg **26** at A is turned upwardly (and substantially parallel to leg **27**) and the free switch lead **23** nested in its slot **29**. Both leads **22** and **23** are then soldered to the clips. Thus it will be apparent that the locking of the reed switch, coil and coil-form to the circuit board is accomplished in a very easy and practical manner.

While the clips **14** have been shown to be attached by the tabs **33**, they can be attached by other means such as eyelets or screws. Also, depending on the magnetic characteristics desired, the length of the clip bars **30** and magnetic properties thereof may be varied. Likewise, the angle of the longer clip leg shown at A may be varied to permit easy insertion of the reed switch. Of course, the invention may take other forms than shown without departing from the spirit of the following claims:

What I claim is:

1. A relay comprising,

a coil-form having a coil wound thereon and a tubular opening therein defined by wall areas of said coil-form,

a reed switch having leads extending from the ends thereof,

clips positioned adjacent the ends of said coil-form, said clips having a generally U-shaped portion having a base and a pair of sides with one side being shorter than the other, said shorter side of each of said clips having a bar portion extending outwardly therefrom and into said coil-form opening and clamping against a wall area of said opening, the longer legs of said U-shaped portion engaging said switch leads and supporting said reed switch in said bore, and

means mounting said clips.

2. A relay as claimed in claim **1** wherein said means for mounting said clips includes bendable tabs for connection to a circuit board.

3. A relay as claimed in claim **1** wherein said longer leg has an outwardly turned lip provided with a slot in which a lead of said reed is received.

4. A relay as claimed in claim **1** wherein said bar portions extending from the shorter leg of said clips on each end of said coil terminate short of one another within the tubular opening of said coil-form.

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