April 23, 1957 W. F. ROESEN 2,790,045

MAGNETIC RELAY

Filed Dec. 12, 1955

Fig. 3.

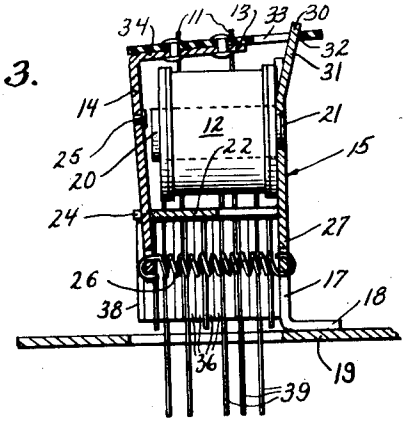


Fig. 1.

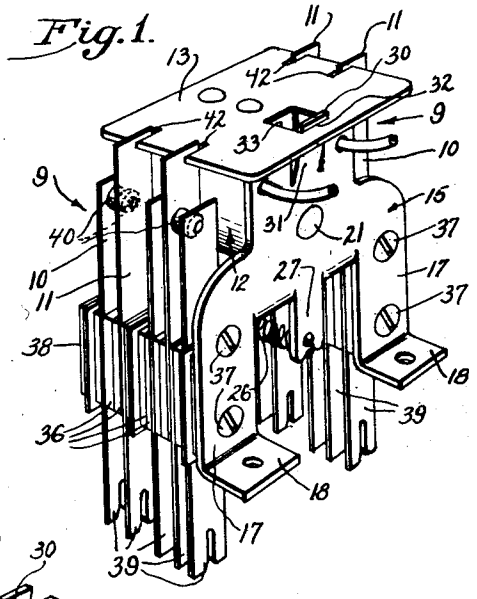


Fig. 2.

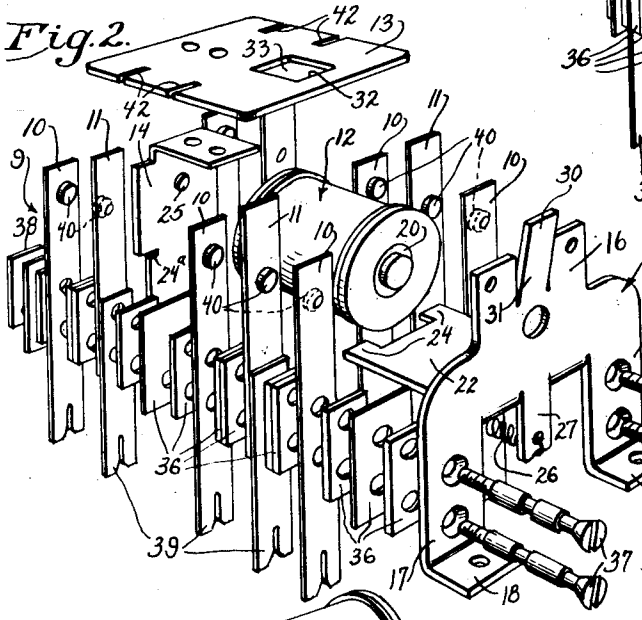


Fig. 4.

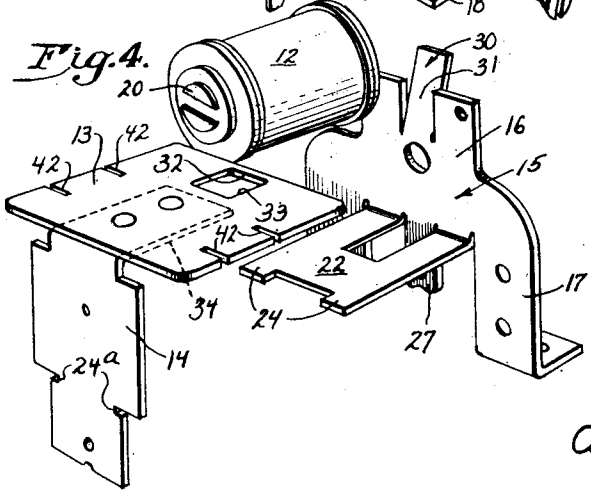
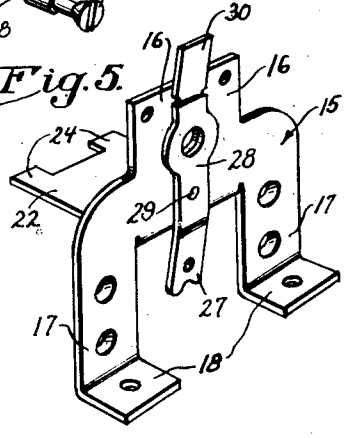


Fig. 5.



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MAGNETIC RELAY

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7 Claims. (Cl. 200—104)

This invention relates to a relay having a pivoted armature and a plurality of switches actuated thereby and carried by elongated resilient arms.

The general object is to provide a magnetic relay of the above character which, as compared to prior relays, is simpler in construction, more reliable in operation, and which is easier to install and maintain because of the ready visibility and accessibility of all of the switch contacts, the contact arms, and the conductor terminals associated therewith.

A more detailed object is to provide a novel construction and arrangement of the relay frame and the armature to permit the contact arms to be disposed in readily accessible positions at opposite sides of the magnet and actuated by a member lying along a third side of the magnet.

The invention also resides in the novel construction of the frame plate to facilitate mounting of the relay, adjustment of the armature gap, and the stress of the armature spring.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figure 1 is a perspective view of a multiple switch magnetic relay embodying the novel features of the present invention.

Fig. 2 is an exploded view of the relay parts.

Fig. 3 is a vertical central section of the relay and its support.

Fig. 4 is an exploded view of the principal parts of the relay.

Fig. 5 is a perspective view showing a modified form of the frame plate.

Generally stated, the improved relay comprises one or more banks **9** of resilient switch arms **10** and **11** disposed in readily accessible positions outwardly from opposite sides of a magnet **12** and actuated by an insulating plate **13** which extends along a third side of the magnet and is carried by the magnet armature **14**. All of these parts are supported by a frame plate **15** stamped from a flat sheet of magnetic metal and preferably having a generally Y shape with one leg **16** projecting from the closed end of a fork formed by two flat legs **17**. Right-angular lugs **18** bent from the ends of the legs **17** may be secured to a suitable support **19** to mount the frame in upright position.

The magnet comprises a coil surrounding and fixed to a core in the form of a bar **20** which abuts at one end against the upper leg of the frame plate and is riveted or otherwise rigidly attached as indicated at **21** to the frame leg **16** intermediate the ends of the latter. The core thus projects perpendicularly from the frame for cooperation of its free end with the armature **14**. The latter comprises a flat sheet of iron paralleling the frame plate and fulcrumed near its lower end on the free end of an arm **22** which underlies the magnet and extends alongside the latter from the center of the Y. Preferably, the arm is

flat and integral with the frame plate being, in this instance, struck out of the end portion of the frame plate blank and bent inwardly from the center of the plate.

The armature hinge is formed by notching the free end of the arm **22** to form ears **24** which are received in squared notches **24a** punched in opposite edges of the armature. Movement of the armature toward the free end of the magnet core is limited by a button **25** of non-magnetic material.

The armature is biased away from the core end by a contractile spring **26** disposed below the arm **22** and stretched between the lower end of the armature plate and a point of anchorage on the frame plate. This point may be integral with the frame plate and formed by a lug **27** struck out of the plate as shown in Figs. 1 to 3. As an alternative the anchor may be the end of a flat bar **23** (Fig. 5) riveted or spot welded at **29** against the outer face of the frame plate, the bar end projecting downwardly between the frame legs **17**.

Movement of the armature away from the core end is limited through the provision of a stop **30** on the end of the leg **16** of the frame formed by an extension **31** of the frame (Figs. 1 and 2) or by the extended end of the bar **28**. The stop is engageable with an abutment **32** comprising the outer edge of a hole **33** punched in the free end of the plate **13** of insulation. The other end portion of this plate is riveted to a flange bent from the upper end of the armature. Being at the top of the final assembly, the stop **30** is readily accessible for bending relative to the frame to vary the stop position and thereby adjust the gap between the magnet and the armature in the released position of the latter. In a similar way, the tension of the spring **26** may be adjusted by bending the lug **27** which forms the spring anchor.

The switch arms **10** and **11** comprise flat strips of resilient metal paralleling each other and the frame plate **12** and are supported intermediate their ends for flexing of their free upper ends toward and away from the frame plate. This is accomplished by clamping the strips between adjacent spacers **36** of insulation stacked together with the strips and apertured to receive two screws **37**. The latter extend through matching holes vertically spaced along one leg **17** of the frame plate and thread into plates **38** at the opposite end of the stack. By tightening of the screws, the spacers and the contact strips are clamped together to form a rigid stack disposed below the level of the magnet and projecting from the back of the frame plate. The lower end portions **39** of the strips project below the support **19** and are well spaced to afford convenient access for soldering or otherwise attaching conductors thereto.

The other ends of the strips project upwardly from the insulating mounting and carry contacts **40** arranged in opposed pairs which cooperate to form a switch disposed at about the level of the magnet core. The contacts may be arranged and the strips bent so as to provide for normal opening or closing as desired of the switches. With the strips arranged in banks on opposite sides of the magnet and the contacts secured near the upper ends of the strips, convenient access to the strips is afforded for adjustment of the contact spacing both at the time of initial manufacture and also for inspection or cleaning of the switches after installation of the relay.

The strip **11** of each switch is elongated so as to project upwardly beyond the magnet for actuation by the insulating plate **13** in the back and forth movement of the armature. Notches **42** are cut in opposite side edges of the plate **13** to receive the inner edge portions of the strips **11**, the spacing of the notches corresponding to the desired arrangement of the switches. By projecting the

plate 13 only partially across the strips 11 the ready visibility of the switches from above is preserved as is the accessibility of the switch contacts for cleaning or adjustment.

I claim as my invention:

1. A relay having, in combination, a generally flat Y-shaped frame plate of magnetic material having the ends of the fork legs bent laterally to provide mounting lugs, two stacks of insulating spacers clamped against said legs and projecting therefrom on the side opposite said lugs, banks of elongated flat contact strips paralleling said plate and clamped intermediate their ends between adjacent ones of said spacers and thereby insulated from each other, one end portion of each strip projecting beyond said lugs for attachment of a conductor thereto, the second end portions carrying contacts cooperating to form switches, a magnet disposed between said banks of strips and having a core projecting laterally from and anchored at one end to the third leg of the Y intermediate the ends thereof, a flat arm rigid with said plate and projecting from the center of the Y alongside said magnet, an armature plate paralleling said frame plate and fulcrumed intermediate its ends on the free end of said arm for swinging of one end of the plate toward and away from the free end of said core, a contractile spring disposed between said stacks of spacers and stretched between said frame and armature plates, a rigid plate of insulation paralleling said arm and lying alongside said magnet and having outwardly opening notches along opposite side edges, one end of the plate being secured to the free end of said armature plate, and interengageable means on the other end of said insulating plate and the end of said frame plate coacting to limit the movement of the armature away from said core, certain of said contact strips lying in said notches for actuation of the associated switches in response to movements of said armature plate.

2. A relay having, in combination, a generally flat frame plate of magnetic material and Y shape with the ends of the fork legs laterally spaced apart, a magnet having a core projecting from and rigidly secured at one end to the third leg of said Y intermediate the ends thereof, two stacks of insulating spacers clamped against said fork legs and projecting therefrom parallel to said magnet, two banks of contact arms disposed on opposite sides of said magnet and each comprising a plurality of elongated flat strips paralleling said plate and clamped intermediate their ends between adjacent ones of said spacers, said strips carrying contacts cooperating to form switches, certain of said strips projecting across and beyond said magnet, a flat arm integral with said plate and projecting from the center of the Y along a third side of said magnet and between said banks of contact arms, an armature plate paralleling said frame plate and fulcrumed intermediate its ends on the free end of said arm for swinging of one end of the plate toward and away from said core end, a contractile spring stretched between said frame plate and the other end of the armature plate, a rigid plate of insulation paralleling said arm and lying along the fourth side of said magnet and having notches along opposite side edges receiving said projecting contact strips, one end of the plate being secured to the free end of said armature plate, and interengageable means on the free end of said insulating plate and said third leg of said frame plate coacting to limit the movement of the armature away from the end of said core.

3. A relay having, in combination, a generally flat frame plate of magnetic material bent laterally at one end to provide mounting lugs, a magnet having a core projecting from and rigidly secured at one end to said frame plate intermediate the ends thereof, two stacks of insulating spacers clamped together against said plate and projecting therefrom on the side opposite said lugs, banks of elongated flat contact strips disposed on opposite sides of said magnet and clamped intermediate their ends between adjacent ones of said spacers for flexing of the strips toward and way from the frame plate, the end portions of said strips adjacent said magnet carrying contacts cooperating to form switches and certain of the strips being elongated and projecting beyond the magnet, a flat arm rigid with said plate and projecting therefrom alongside said magnet, an armature plate fulcrumed intermediate its ends on the free end of said arm for swinging of one end of the plate toward and away from the free end of said core, a spring stretched between said frame and armature plates, a rigid plate of insulation paralleling and lying alongside said magnet and having notches along opposite side edges receiving said elongated strips, one end of the plate being secured to the free end of said armature plate, a stop on the end of said frame plate opposite said lugs, and an abutment on said insulating plate engageable with said stop to limit the movement of said armature away from said core.

4. A relay having, in combination, a generally flat frame plate of magnetic material, a magnet having a core projecting from and rigidly secured at one end to said frame plate intermediate the ends thereof, two stacks of insulating spacers clamped together against one end of said plate and projecting therefrom parallel to said magnet core, banks of elongated flat contact strips disposed on opposite sides of said magnet and clamped intermediate their ends between adjacent ones of said spacers for flexing of the strips toward and away from the frame plate, the end portions of said strips adjacent said magnet carrying contacts cooperating to form switches and certain of the strips being elongated and projecting beyond the magnet, a flat arm rigid with said plate and projecting therefrom alongside said magnet, an armature plate fulcrumed intermediate its ends on the free end of said arm for swinging of one end of the plate toward and away from the free end of said core, a spring acting against said frame and armature plates, a rigid plate of insulation paralleling and lying alongside said magnet and hving notches along opposite side edges receiving said elongated strips, one end of the plate being secured to the free end of said armature plate, a stop on said frame plate, and an abutment on said insulating plate engageable with said stop to limit the movement of said armature away from said core.

5. A relay having, in combination, a generally flat frame plate of magnetic material, a magnet having a core projecting from and rigidly secured at one end to said frame plate intermediate the ends thereof, two stacks of insulating spacers clamped together against one end of said plate and projecting therefrom parallel to said magnet core, a bank of elongated flat contact strips disposed on one side of said magnet and clamped intermediate their ends between adjacent ones of said spacers for flexing of the strips toward and away from the frame plate, the end portions of said strips adjacent said magnet carrying contacts cooperating to form switches and certain of the strips being elongated and projecting beyond the magnet, an arm rigid with said plate and projecting therefrom alongside said magnet, an armature plate fulcrumed intermediate its ends on the free end of said arm for swinging of one end of the plate toward and away from the free end of said core, a spring acting against said frame and armature plates, a rigid plate of insulation lying alongside said magnet and having notches along one side edge receiving said elongated strips, means securing said plate to the free end of said armature plate, a stop on the end of said frame plate bendable toward and from the plane of the plate, and an abutment on said insulating plate engageable with said stop to limit the movement of said armature away from said core.

6. A relay having, in combination, a generally flat frame plate of magnetic material, a magnet having a core projecting from and rigidly secured at one end to

said frame plate intermediate the ends thereof, two stacks of insulating spacers clamped together against one end of said plate and projecting therefrom parallel to the magnet core, a bank of elongated flat contact strips disposed on one side of said magnet and clamped intermediate their ends betweeen adjacent ones of said spacers for flexing of the strips toward and away from the frame plate, the end portions of said strips adjacent said magnet carrying contacts cooperating to form switches and certain of the strips being elongated and projecting beyond the magnet, an arm rigid with said plate and projecting therefrom alongside said magnet, an armature plate fulcrumed intermediate its ends on the free end of said arm for swinging of one end of the plate toward and away from the free end of said core, a spring acting against said frame and armature plates, a rigid plate of insulation lying alongside said magnet and having outwardly opening notches along one side edge receiving said elongated strips and extending only partially across the width of the strips, one end of the plate being secured to the free end of said armature plate, a stop on the end of said frame plate, and an abutment on said insulating plate engageable with said stop to limit the movement of said armature away from said core.

7. A relay having, in combination, a generally flat frame plate of magnetic material and Y shape with the ends of the fork legs laterally spaced apart, a magnet having a core projecting from and rigidly secured at one end to the third leg of said Y intermediate the ends thereof, a stack of insulating spacers clamped against one of said fork legs and projecting therefrom parallel to said

magnet, a bank of elongated flat contact strips clamped intermediate their ends between adjacent ones of said spacers and carrying contacts cooperating to form switches, certain of said strips projecting across and beyond one side of said magnet, a magnetic arm projecting from the center of the Y along another side of said magnet between said banks of contact arms, an armature plate paralleling said frame plate and fulcrumed intermediate its ends on the free end of said arm for swinging of one end of the plate toward and away from said core end, a lug rigid with said frame plate and projecting along the latter into the fork of said Y, a contractile spring stretched between said lug and the other end of the armature plate, said lug being bendable relative to said plate to vary the tension of said spring, a rigid plate of insulation paralleling said arm and lying along the fourth side of said magnet and having notches along opposite side edges receiving said projecting contact strips, one end of the plate being secured to the free end of said armature plate, and interengageable means on the free end of said insulating plate and said third leg of said frame plate coacting to limit the movement of the armature away from the end of said core.

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