Oct. 13, 1959 D. BRUNICARDI 2,908,781

RELAY SWITCH ROCKER MEANS

Filed April 1, 1958

FIG. 1

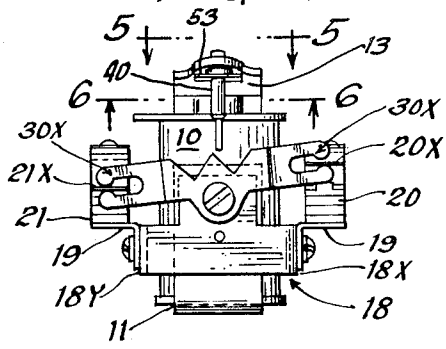


FIG. 2

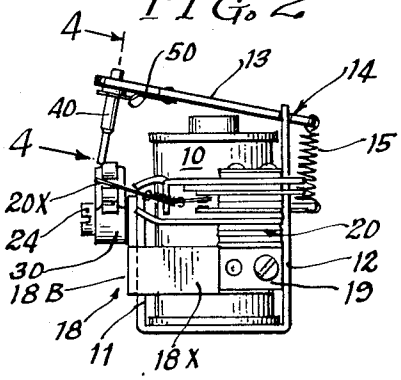


FIG. 3

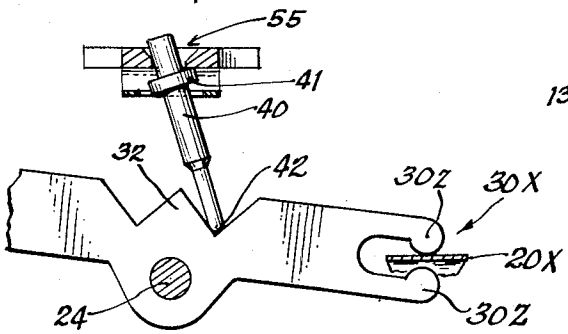


FIG. 4

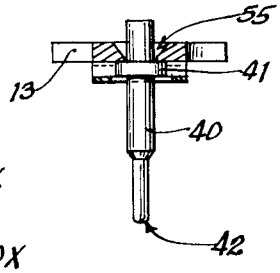


FIG. 5

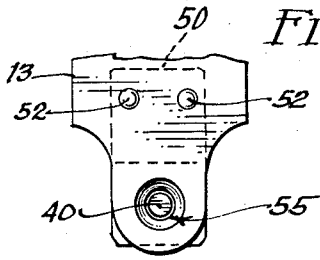


FIG. 7

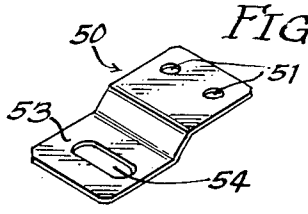
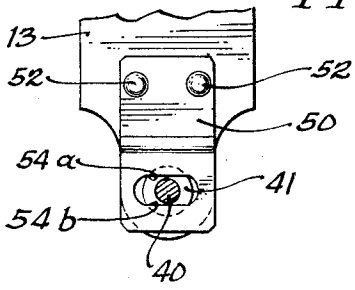


FIG. 6



INVENTOR.
Daniel Brunicardi
BY
Attorney

United States Patent Office

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RELAY SWITCH ROCKER MEANS

Daniel Brunicardi, Wood Dale, Ill., assignor to Comar Electric Company, Chicago, Ill., a corporation of Illinois

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2 Claims. (Cl. 200—87)

This invention relates to a mechanical movement of the over-center toggle action variety, especially as applied to switching devices and relays, it being the principal object of the disclosed construction to provide an improved mechanism of the class described for use in electromagnetic relays to provide for reliable operation of snap-switch means in the smaller low-power types of relay.

More particularly, it is an object to provide a switch-operating rocker arm and drive-pin means of the type having a W-shaped rocking wedge and a spring-centered pin which is carried by the relay armature to engage the wedge on opposite sides and rock the latter back and forth, the improvements relating particularly to the form and mounting of the drive pin and the provision of a compact stepped blade spring for reliably centering the pin with minimum loading of the relay armature, and long operating life.

Another object is the provision of a rocker arm cooperable with said drive pin means and having a yoked end with bearing formations at the ends of the yoke to engage the switch blade or other driven objects.

It is a further object to provide a sensitive relay having snap-action contact means actuated by a toggle-pin and wedge means of the class described.

Additional objects and aspects of novelty and utility relate to details of the construction and operation of the embodiment described hereinafter in view of the annexed drawing in which:

Fig. 1 is a front elevation of the relay;

Fig. 2 is a side elevation thereof;

Fig. 3 is a magnified fragmentary detail of the drive pin and rocker in an operated condition with parts shown in section;

Fig. 4 is a detail of the drive pin in normal position looking along lines 4—4 of Fig. 2;

Fig. 5 is a fragmentary plan detail of the end of the armature showing the top of the drive pin, as seen along lines 5—5 of Fig. 1;

Fig. 6 is a bottom plan detail of the structure of Fig. 5, looking along lines 6—6 of Fig. 1;

Fig. 7 is a perspective detail of the centering and retaining spring for the drive pin.

In the embodiment of the relay depicted in Fig. 2, an electromagnet 10 is staked into the bight of a U-shaped frame stamping having front and rear legs 11 and 12 with an armature 13 rockably mounted on the longer rear leg, as at 14, and urged to normal position by a traction spring 15, such structure being conventional in these respects.

The switch mechanism comprises a U-shaped bracket 18 (Figs. 1 and 2) which is fixed at its bight 18B (Fig. 1) as by spot-welding, screws, etc., to the face of the shorter frame leg 11 so that the two side arms 18X and 18Y thereof respectively project along the sides of the electromagnet toward the rear frame leg.

Mounted upon angle brackets 19 are snap-action stack switches 20 and 21 of known construction and each having a snap-acting or over-center type actuator blade 20X and 21X, respectively (Figure 1), so contrived that an operating force acting upwardly or downwardly upon either such blade will cause the same to reach an over-center condition and be spring-snapped into an opposite position to open or close appertaining contact means in a well-known manner. The type of snap-switch is not critical and for some purposes it is not necessary that such switch or other actuated device be snap-acting at all, or that the actuated member 20X or 21X remain in the actuated condition, as does the type of snap-switch depicted herein.

Pivotally mounted by means of a suitable shoulder screw 24 threaded into bracket bight 18B and leg 11 is a double-ended rocker arm 30 the opposite ends of which are formed as yokes or forks 30X (Fig. 1), each of which straddles the ends of one of the switch-actuator blades 20X, 21X. This rocker arm is preferably made of a molded plastic insulating material having good bearing action with metal, for example nylon.

Formed in the upper mid-region of the rocker arm is a W-shaped wedge cam 32, the peak of the wedge of which is aligned radially with the center of the rocking axis (i.e. screw 24) for the rocker arm. Such rocker wedge cams 32 have been employed in a variety of applications heretofore to produce reverse or oscillatory motions for operation of switches and other mechanism on relays and control devices, and no novelty is claimed for the wedge part per se of rocker 30.

However, the rocker 30 is formed, according to this disclosure, so that the end yokes 30X (Fig. 3, also) each have a pair of rounded bulbous bearing protuberances 30Z at the ends of the respective arms of each yoke, said protuberances constituting localized integral bearing members respectively engageable with opposite flat faces of the switch actuator blades 20X, 21X, in rocking motions of the rocker member. This construction affords a long-wearing, trouble-free switch actuator which also minimizes the frictional loading on the cam rocker and drive means.

Preferably the bearing parts 30Z should be somewhat wholly bulbous in the sense of being spherical to procure the closest clearance possible to allow the blade 20X to work freely therebetween in all blade positions. However, the spherical or bulb form is more costly to make, and for most applications satisfactory clearance may be had where the radius of curvature for parts 30Z is only in one direction (e.g. the plane of the sheet in Fig. 3).

The clearance (for the switch blade) between the bearing parts 30Z is important because the wider this clearance must be the greater must be the throw of the peak of the wedge 32 past center. Thus, by achieving a close clearance between parts 30Z the throw of the rocker (and the peak of 32) is mainly determined by the throw of the switch blade 20X (or 21X) and the centering for the drive pin will be less critical in case of wear.

Means for driving or oscillating the rocker arm comprises, as detailed in Fig. 3 and 4, and as shown in assembly in Fig. 1, a pin 40 having a circumambient shoulder or collar 41 near its upper end, and a rounded nose 42 at its lower end, said pin being carried at the free end of the armature 13 in a normal position in which the long axis of the pin is at right angles (i.e. "normal") to the plane of the armature and also in alignment with the peak of the cam wedge 32 when the armature moves downwardly.

The normal position of the drive pin 40 is shown in Figs. 1 and 2.

For reliable operation, it is essential that the drive pin 40 be accurately maintained in said normal position; but the pin must also be movable to rock into the fully operated position shown in Fig. 3 in order that the armature

may make its full operating stroke and the nose 42 of the pin may find its way into the trough at the side of the wedge to exert the necessary eccentric force on the rocker to displace the latter, it being important to take into account the character of the electromagnetic force, by reason of which the maximum driving effort available increases to an effective value as the armature 13 reaches the end of its stroke.

Thus, the travel downwardly of the nose 42 of the pin from its fully elevated normal position (e.g. Fig. 1) until the nose begins to approach the bottom of the trough of the wedge 32, is mainly an idle or travelling stroke, and the nose of the drive pin glides down the slope of the wedge and assumes an increasingly tilted position, as in Fig. 3.

The spring means for returning and maintaining the pin 40 in normally aligned condition is especially contrived for long, trouble-free wear with minimized extra-loading of the electromagnetic driving means, at low cost, and without occupying too much space in the region beneath the armature. In prior mechanisms of this class (e.g. Patent No. 1,051,219) it has been common practice to employ helical compression and traction springs for centering the drive pin, but such arrangements require too much space for use in small relays. Also, in some prior switches, attempts have been made to fix the pin more or less rigidly on the driving member, but such expediencies are not suited to use with large rocker or armature displacements, or weak driving forces are encountered in small relays. In still other prior arrangements the pin is more or less loosely connected and guided at both ends as by having a helical spring at one end and some form of link at the opposite end. It is also known to fix the pin in a diaphragm or to a ribbon of spring metal so that some freedom of rocking motion is permitted. All such expediencies are objectionable for relay use.

According to the present disclosures, the spring means for normalizing the pin consists of a simple stepped spring blade 50 formed, as shown in Fig. 7, with one end portion pierced as at 51 to receive attaching means such as rivets 52, by which the spring is secured to the underside of the armature 13, as in Figs. 2 and 3.

The opposite end portion 53 of the blade spring is stepped down or offset and provided with a long narrow or oblate slot 54 too narrow transversely to pass the circumambient shoulder 41 on the pin, but long enough to accommodate the shank of the pin in rocking motions, as in Fig. 3.

The upper end portion of the pin above the shoulder passes through an opening 55 in the end of the armature above the step on the spring, and said opening 55 is enlarged preferably by counterboring (Fig. 4) so as not to limit the rocking excursions of the upper end parts of the pin.

The stepped spring blade exerts a force on the underside of shoulder 41 which tends to fit the upper flat face of the pin shoulder flush against the flat under surface of the armature to seat the pin in erect aligned condition, as in Fig. 4.

When the pin rocks, the curved margins of the annular shoulder on diametrically opposite sides of the latter respectively engage the surface of the armature and the opposite edges or margins (e.g. at 54*a*, 54*b*, Fig. 6) of the oblate slot when the rocking of the pin is transverse to the armature (i.e. Fig. 3) in the direction of the length of said slot.

It is important to point out that the path travelled by the nose 42 of the pin on the surface of the wedge cam is arcuate as the armature descends because the end of the armature carrying the pin moves in an arc and the pin, being held normal to the plane of the armature, also tends to describe an arc; but the pin tends to yield upon striking the side of the wedge and the result of these tendencies is that the nose of the pin describes an arc down along the side of the wedge from the front or outer side inwardly toward the rearward side of the rocker. For this reason, the rocker arm is thick enough (see Fig. 2) to provide a full gliding surface for this arcuate travel of the pin nose.

The stepped blade spring permits a somewhat circular rocking of the annular pin shoulder when the pin describes the aforesaid arcuate motion with no objectional change in spring pressure resulting from the progressive change of contact of the shoulder on the spring as the pin alters direction.

In this action the annular shoulder has its points of contact with the spring and armature substantially on the rim portions thereof and acts somewhat in the manner of a canted rolling hoop or wheel. Such action affords a minimized spring wear and fatigue with reliable centering of the pin and firm driving stroke when the pin nose reaches the bottom of the trough; and this drive means, together with the plastic bearing material used therewith and the bulb-tipped yoke formations on the rocker, all afford a highly satisfactory mechanism for use on relays, particularly the smaller varieties.

The relay shown in the ink drawing herein is substantially full size and has a commercial input rating of two watts with a possible working rating of one watt. Ordinary materials used, the relay including the wedge cam pin and rocker arm means will provide up to 200,000 operations, the switches breaking down long before failure of the toggle mechanism.

The 1-watt sensitivity of this relay arises from the construction of the described features of the rocker or toggle means including the pin and stepped spring, nylon rocker and the bulb-ended blade-contacting yokes. The device will operate reliably in any position, including that on its side (i.e. with pin 40 pointing horizontally), because the stepped blade spring straightens the pin without permitting wobble and without substantially loading the relay.

The rocker 30 may be made single-ended with only one yoke 30X for relays having but one switch 20.

Because of the wide margin of operating sensitivity achieved by the improved toggle mechanism, the switch 20 may have multiple contact blades without necessarily changing the rating of coils 10.

I claim:

1. In a relay having a rocking armature and a switch-operating toggle rocker arm with wedge cam, improvements in a cam and pin-actuating means for the rocker comprising: a stepped blade spring fixed on the underside of the armature above the wedge cam, the step of said blade having an oblate hole therein aligned with a hole in said armature; a drive pin having portions disposed freely in both holes and an annular shoulder disposed between the armature and step of the blade and of a thickness larger than the space between the armature and step so as to tension the blade spring and yieldingly and firmly clamp the shoulder and maintain said pin in a normally erect position in operative alignment with said cam.

2. In a relay having a rocking armature and switch-actuating means including a wedge cam above the rocking axis, and actuated by a pin on the armature and moving toward the cam peak to engage either of two opposite sides of the wedge, improvements in the rocker mechanism comprising, namely: a drive pin having an annular shoulder between its ends and one of the ends projecting loosely into a hole in the armature at one side of said shoulder, the other end of the pin projecting normally close to said cam peak, and a blade spring member secured near one margin to said armature adjacent said hole therein, said blade having a step therein spaced from the armature slightly less than the thickness of said shoulder, an oblate hole in said step narrower than the diameter of said shoulder and aligned with the hole in the armature, the part of the pin which lies on

the opposite side of the shoulder away from the armature extending through said step hole and the blade spring acting to seat said shoulder normally in substantially flush fit up against the armature and against said spring step, whereby the pin is maintained yieldably in position extending substantially at right angles to the armature and in radial alignment with said wedge to engage one side or the other thereof responsive to movement of the armature toward the same.

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