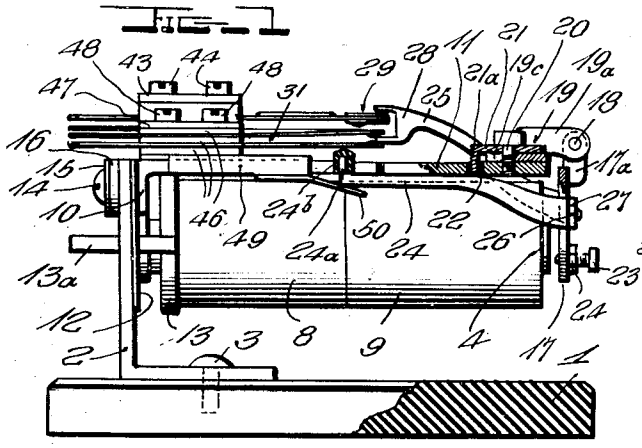
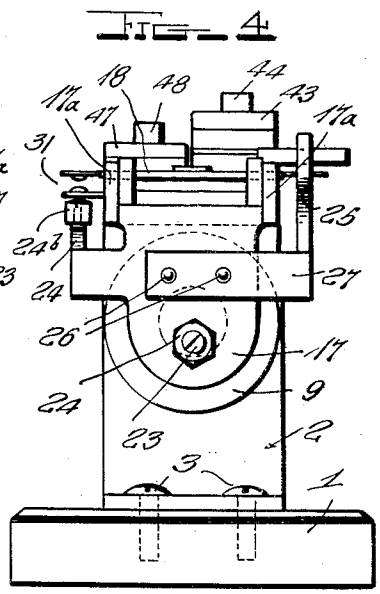
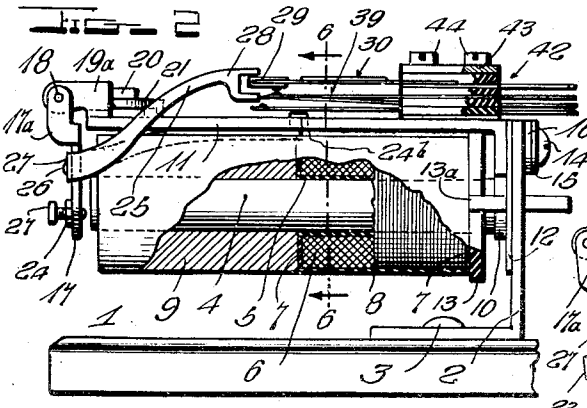
Aug. 17, 1943. C. P. CLARE 2,326,760

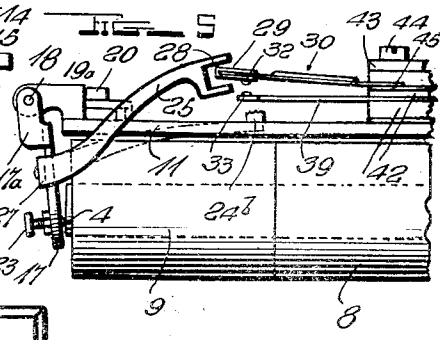
ELECTRIC SNAP SWITCH

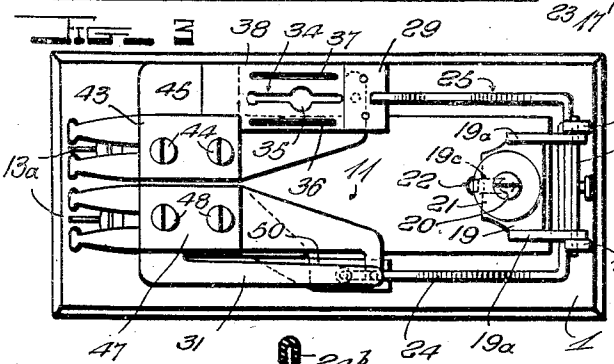
Filed Feb. 1, 1941 2 Sheets-Sheet 1

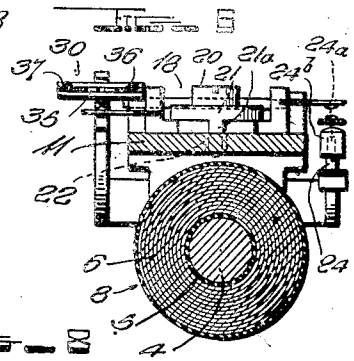


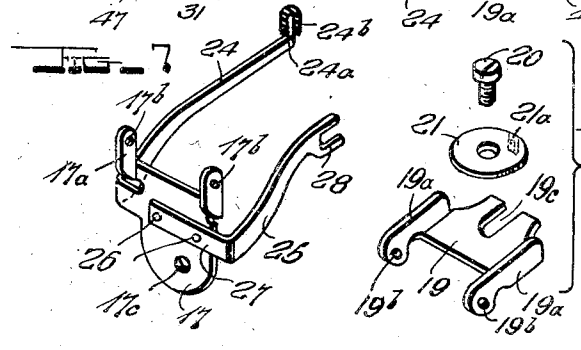


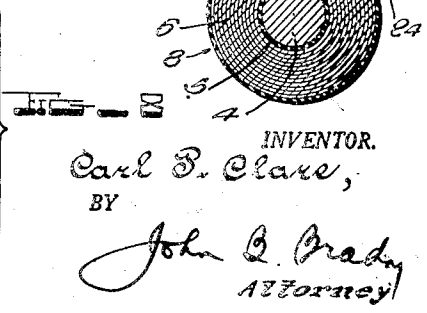












INVENTOR.

Carl P. Clare,

BY

John B. Brady

Attorney

Aug. 17, 1943. C. P. CLARE 2,326,760

ELECTRIC SNAP SWITCH

Filed Feb. 1, 1941 2 Sheets-Sheet 2

FIG. 9

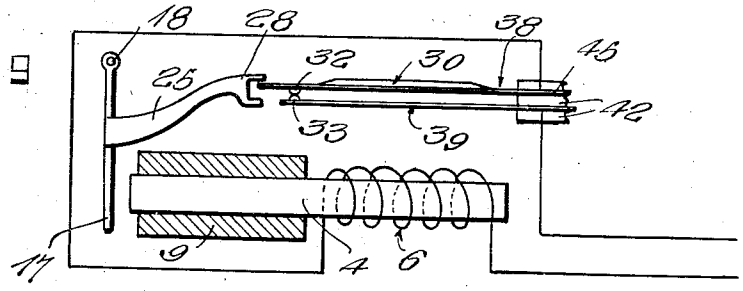


FIG. 10

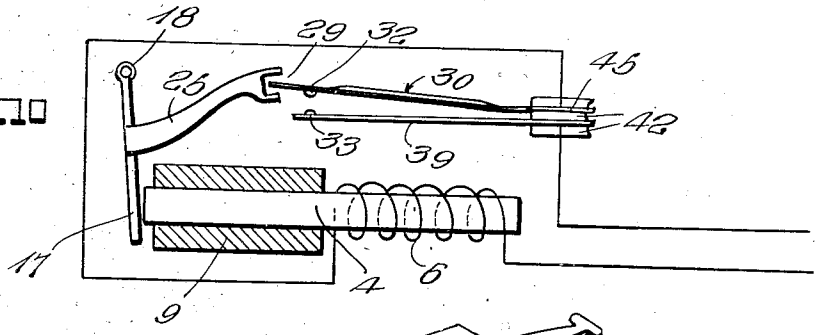


FIG. 11

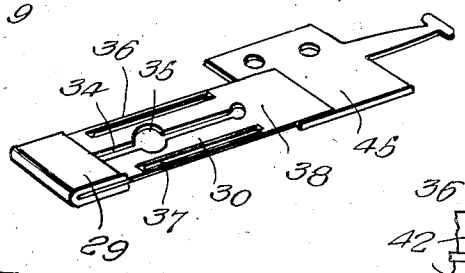


FIG. 14

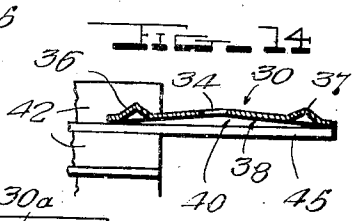


FIG. 12

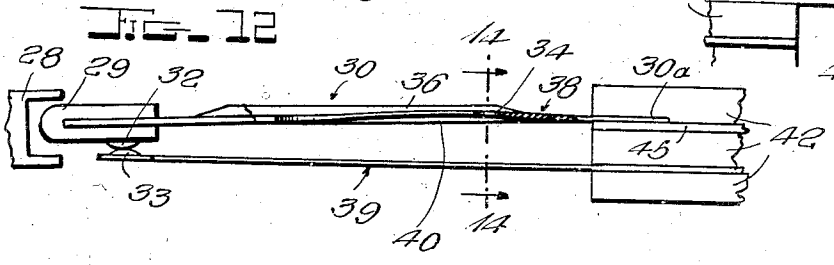


FIG. 13

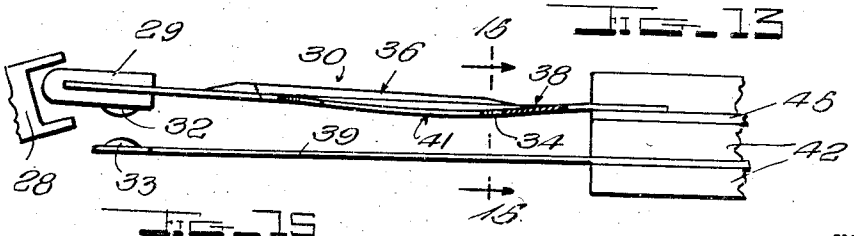
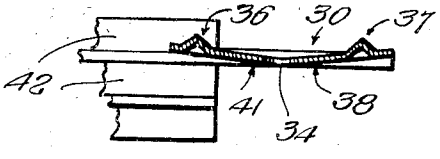


FIG. 15



INVENTOR.
Carl P. Clare,
BY
John B. Brady
Attorney

Patented Aug. 17, 1943

2,326,760

UNITED STATES PATENT OFFICE

2,326,760

ELECTRIC SNAP SWITCH

Carl P. Clare, Arlington Heights, Ill., assignor to C. P. Clare and Company, Chicago, Ill., a corporation of Illinois

Application February 1, 1941, Serial No. 377,074

5 Claims. (Cl. 200—67)

My invention relates broadly to electric relay systems and more particularly to an improved construction of self-interrupting type of relay for controlling the interconnection of electrical circuits at a predetermined time rate.

One of the objects of my invention is to provide a construction of self-interrupting type of electrical relay including a magnetic operating system controlling a movable armature arranged to control a snap action switch for interrupting the control circuit through the relay operating winding and also to control a spring pile-up assembly for controlling the operation of a multiplicity of electrical circuits at a similar time rate.

Another object of my invention is to provide a construction of self-interrupting electrical relay system including a magnetic core system and operating winding thereon for effecting angular movement of a movable armature having a pair of arms and wherein a two-position snap action switch electrically in series with the operating winding is controlled by one of the arms and a spring pile-up assembly controlled by the other of the arms.

Still another object of my invention is to provide a self-interrupting circuit control means for a relay system in which the armature of the relay carries a member terminating in a yoke which embraces opposite sides of a spring contact member and effects movement of the spring contact member to open and closed position as the armature reaches substantially the end of its normal travel stroke in either operating or release position.

A further object of my invention is to provide an arrangement of snap action switch for opening or closing the circuit through the operating winding of a relay system in accordance with the movement of the armature controlled by the operating winding and under conditions where the switch remains either in an open or closed position until the armature reaches the last portion of its stroke whereby the magnetic flux cycle in the magnetic system of the relay may be substantially completed intermediate a succession of strokes of the armature.

A still further object of my invention is to provide an arrangement of repeat action relay system in which the movement of the armature of the relay system controls a two-position snap action switch through a yoke embracing the switch and operating to shift the switch to either an open or closed position at substantially the limits of the path of travel of the armature for controlling the continuity of the circuit through the operating winding of the relay.

Other and further objects of my invention reside in the construction of two-position snap action switch for electric relay systems as set forth more fully in the specification hereinafter following by reference to the accompanying drawings, in which:

Figure 1 is a side elevational view of the self-interrupting type of electrical relay system of my invention showing the armature in release position and the contacts of the spring pile-up assembly open, parts of the relay system being shown in section to more clearly explain the construction thereof; Fig. 2 is a side elevational view looking at the opposite side of the relay system illustrated in Fig. 1 and showing certain of the parts in cross section for more clearly explaining the construction of the relay system; Fig. 3 is a top plan view of the relay system shown in Figs. 1 and 2 showing more particularly the snap action switch controlled by one lever arm carried by the armature and the spring pile-up assembly controlled by the other lever arm carried by the armature; Fig. 4 is an end view of the relay shown in Figs. 1–3 looking in the direction of the arrow 4—4 in Fig. 1; Fig. 5 is an elevational view showing the movable armature of the relay moved to operating position and illustrating the snap action switch shifted to open position; Fig. 6 is a vertical sectional view taken through the relay system on line 6—6 of Fig. 2; Fig. 7 is a perspective view of the armature showing the two lever arms carried thereby, one of which operates the spring pile-up assembly for controlling various electrical circuits and the other of which terminates in a yoke embracing the operating member of the snap action switch for effecting the closing and opening thereof in accordance with the movement of the armature; Fig. 8 is a perspective view illustrating the parts of the adjustable journaling means for the movable armature by which the special relation between the armature and the end of the magnetic core structure may be determined; Fig. 9 is a schematic view showing the arrangement of the armature with respect to the magnetic core structure of the relay system and the lever arm carried thereby which terminates in a yoke embracing opposite sides of the operating member of the contact system and showing the contact system closed during the release position of the armature; Fig. 10 is a schematic view showing the armature moved to operating position and the snap action switch moved to open position; Fig. 11

is a perspective view of the operation member of the snap action switch; Fig. 12 is an enlarged side elevational view of the snap action switch in closed position with the stressed resilient portion thereof illustrated in longitudinal section; Fig. 13 is a view similar to the view shown in Fig. 12 where the snap action switch is illustrated in open position, the stressed portion of the operating member being illustrated in longitudinal section in a manner similar to the showing in Fig. 12; Fig. 14 is a transverse sectional view through the operating member of the snap action switch taken on line 14—14 of Fig. 12 where the switch is in closed position; and Fig. 15 is a vertical sectional view through the snap action switch taken on line 15—15 of Fig. 13.

The self-interrupting relay of my invention includes a snap action switch which is controlled in accordance with the movement of the armature to delay the opening of the circuit through the operating winding of the relay system until substantially the end of the mechanical movement of the armature on the operating stroke and to delay the closing of the operating winding circuit to substantially the end of the release stroke of the armature. In addition to this mechanical control arrangement, I provide a conductive sleeve or slug in the magnetic field of the operating winding of the relay constituting an eddy current ring and forming means for controlling the rate of increase and decrease of the magnetic lines of force and correspondingly controlling the time period of operation of the relay. One of the arms carried by the armature terminates in a yoke embracing opposite sides of the operating member of the snap action switch. The snap action operating member of the snap action switch is formed from a strip of resilient copper alloy adapted to normally position a contact in closed relation to an adjacent contact. A yoke embraces the resilient operating member and tends to shift the contact member to break the contact with respect to the fixed contact upon movement of the armature. The snap action switch controls the circuit to the solenoid while the armature is provided with another arm to function the spring pile-up of contacts in any number or arrangement desired. The armature is normally spring pressed to open position so that the yoke tends to maintain the resilient operating member for the snap action contact device in closed position. Thus the control circuit to the relay winding is not opened until the armature reaches its last portion of its stroke, that is, approximately 5% of its stroke.

Referring to the drawings in more detail, reference character 1 designates a base on which the relay system is mounted by means of an angle member 2 secured in any suitable manner such as by securing means 3. The magnetic core system of the relay is indicated at 4 having a wrapping of suitable insulation material such as heavy empire cloth 5 wrapped over a portion thereof to receive the turns of operating winding 6 which are wound between the discs of insulation material 7 and over which a wrapping of insulation material 8 is wound. A spool-head of insulation material represented at 13 is mounted on magnetic core structure 4 and provides a support for strip-like soldering terminals 13a which extend through the sheet of insulation material 12 and through the angle member 2 to provide terminal casings for opposite ends of the turns of winding 6. Immediately adjacent the winding 6 on magnetic core 4, I provide a metallic sleeve or slug 9 disposed within the field of magnetic flux from the turns of winding 6 and operating as a short-circuiting or eddy current ring for controlling the time of the building up and decreasing of the magnetic lines of force. The magnetic core structure 4 is suitably secured to the heelpiece 10 of the magnetic frame 11 which forms the return path for the magnetic lines of force in the magnetic system. The heelpiece 10 is suitably insulated from the angle 2 by means of sheet of insulation material 12 coextensive with the angle member 2 through which the securing screws 14 extend. The securing screws 14 pass through suitable washers 15 and suitable bushings 16 of insulation material and through the sheet of insulation 12 and to the heelpiece 10 of the magnetic frame, the path of flux through the magnetic frame being thereby confined to the magnetic core structure 4 and to the movable armature member indicated at 17.

The movable armature 17 is provided with lugs 17a thereon apertured at 17b for the passage of a transverse shaft member 18 which extends through the apertures 19b in the side members 19a of the armature journaling plate 19 shown more particularly in Fig. 8. The journaling plate 19 is provided with a slot 19c therein which extends on opposite sides of the adjustable screw 20. Adjustable screw 20 passes through the yieldable washer member 21 which is maintained in alignment with magnetic frame 11 of the relay system by means of a tongue 21a which projects into the aperture 22 in the frame 11. By loosening screw 20, plate 19 may be shifted longitudinally of the frame 11 for correspondingly varying the spacial relation between armature 17 and the end of the magnetic core structure 4.

The armature 17 is provided with a screw threaded aperture 17c through which an adjustable residual screw 23 extends with a lock nut 24 for securing the adjustable screw 23 in selected position whereby the residual gap between the face of the magnetic core structure 4 and the armature may be selected with the residual screw 23 touching the end of the magnetic core structure 4. The movable armature 17 carries two lever arms, one of which is indicated at 24 serving as the spring pile-up assembly operating arm and the other of which is indicated at 25 forming the operating member for the self-interrupting contact switch of the relay system. The operating lever 24 terminates in a pin member 24a which receives a cap 24b of insulation material and which serves as the actuating means for controlling the spring pile-up assembly shown at 31. The operating lever 25 is secured to armature 17 in any suitable manner such as by means of rivets 26 which pass through the right-angular portion 27 of the arm 25. The lever 25 terminates in a yoke 28 which embraces opposite sides of the operating member 29 of the snap action switch shown more clearly at 30 in Fig. 11.

The snap action switch 30 is formed from a strip of resilient copper alloy adapted to normally position a contact 32 in closed relation to an adjacent contact 33. The strip of resilient copper alloy forming snap action switch 30 is centrally slotted as represented at 34 and provided with a central aperture indicated at 35 The strip is pressed outwardly to provide ribs 36 and 37 which impart rigidity along the marginal edges of the strip substantially throughout the entire length of the strip up to the resilient zone which I have indicated at 38. This construction enables the strip 30 to be flexed from one extreme

position to another and to remain in the flexed position. I have illustrated in Fig. 12 the strip 30 flexed downwardly, thereby establishing connection between contact 32 and contact 33 carried by leaf spring 39. The central portion of strip 30 adjacent the resilient portion 38 is bowed upwardly as represented at 40 in Fig. 12 and Fig. 13. When, however, the strip 30 is flexed upwardly as represented in Figs. 13 and 15, the central portion of strip 30 adjacent the resilient portion 38 is bowed downwardly as represented at 41 in Figs. 13 and 15. This has the effect of maintaining contacts 32 and 33 operated in spaced relation.

The leaf springs 30 and 39 are suitably mounted between stacked insulator strips which I have shown generally at 42 which are maintained in position beneath plate 43 secured by screws 44. The leaf spring 39 extends directly between the strips of insulation material 42 but the strip of resilient copper alloy 30 is secured in any suitable manner such as by soldering or welding at its end thereof indicated at 30a to the plate 45 which extends between the insulated strips 42. This permits the flexing of strip 30 in the resilient zone 38 thereof just beyond the secured end of the strip. Lever arm 25 has the yoked end 26 thereof so located with respect to the end 29 of the operating contact member 30 that the flexing of operating member 30 occurs only when armature 17 reaches substantially the end of its stroke on the operating stroke or substantially the end of its stroke on release.

The spring pile-up assembly 31 may comprise a multiplicity of leaf spring members carrying coacting contacts but for purposes of explaining my invention, I have shown a single pile-up assembly 31 consisting of leaf springs disposed in predetermined spaced relation by means of strips of insulation material 46 secured beneath plate 47 by means of screws 48 which pass through the limiting stop strip 49. The limiting stop strip 49 has an extension 50 thereon forming an abutment against which lever arm 24 abuts in the release position of armature 17. In this position the spring pile-up assembly 31 has the contacts thereof open preparatory to the closing operation upon movement of armature 17 from the position illustrated in Figs. 1, 2 and 9 to an operating position illustrated in Figs. 5 and 10 at which time the coacting contacts of spring pile-up assembly 31 are closed.

The relay system of my invention includes the lost motion yoke arrangement 28 on the end of operating lever 25 which may shift throughout substantially the entire stroke of the armature without disturbing the position of the control switch constituted by strips 30 and 39. However, at substantially the end of the operating stroke illustrated in Figs. 5 and 10, the control switch is flexed to open position and at substantially the end of the release stroke illustrated in Figs. 1, 2 and 9, the control switch is flexed to closed position. Inasmuch as the control switch is disposed in series with operating winding 6 as shown in Figs. 9 and 10 a repeated succession of movements of the armature occurs so long as the control circuit to operating winding 6 is closed. This permits a source of controlling potential applied through the spring pile-up assembly 31 to a load circuit to be successively connected and disconnected by the operation of the spring pile-up assembly at a time rate determined by the speed of operation of the relay system.

While I have described my invention in one of its preferred embodiments, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A relay system including angularly shiftable actuating means terminating in a yoke member having limited angular displacement, a displaceable strip of resilient material, a contact member adjacent one end thereof, a fixed support for the other end thereof, a fixed contact member aligned with the contact member on said strip, a pair of longitudinally extending ribs in said strip terminating short of the fixed support for said strip whereby said strip may be flexed from one position to another and retained therein, the yoke member of said angularly shiftable actuating means embracing the end of said strip for flexing said strip from one position to another for opening and closing a circuit through said contacts at substantially the limits of movement of said angularly shiftable actuating means.

2. A relay system including angularly shiftable actuating means terminating in a yoke member and having limited angular displacement, a plate member insulatingly supported in spaced relation to said yoke member, a flat strip of resilient material secured at one end to said plate member and extending to a position in which the free end thereof is disposed within said yoke member, a contact member mounted adjacent the free end of said flat strip, a fixed coacting contact member aligned with the aforesaid contact member, said strip having a pair of marginal ribs adjacent opposite edges thereof terminating short of the fixed end and the free end thereof, said strip being apertured at substantially the center portion thereof and being provided with symmetrically arranged slots extending longitudinally thereof in opposite directions from the centrally apertured portion of the strip whereby said strip may be flexed downwardly or upwardly for closing or opening a circuit through said coacting contacts at substantially the limits of movement of the yoke member of said angularly shiftable actuating means.

3. In an electrical relay system, electrical control means comprising a contact device including a fixed member and a two-position movable member fixed at one end and free at the other end, said movable member comprising a strip of resilient material having an apertured portion in substantially the center thereof and provided with a symmetrically extending slot along the longitudinal axis thereon on opposite sides of the apertured central portion of said strip for forming adjacent stiffened and reversing zones whereby said strip remains in either position to which it is moved, and an angularly shiftable member engageable with the free end of said two-position movable member.

4. In an electrical relay system, electrical control means comprising a fixed member carrying a contact and a two-position movable member carrying a coacting contact, said movable member comprising a strip of resilient material fixed at one end and free at the opposite end and having a stiffened zone and a reversing zone whereby said strip remains in either position to which it is moved, a lever member having limited angular movement, said lever member including a

pair of spaced arms loosely enveloping the free end of said strip for imparting operating forces thereto when either arm abuts against and shifts said strip for controlling the opening or closing of said contacts at substantially the end of the angular movement of said lever member.

5. In an electrical relay system, electrical control means comprising a resilient member carrying a contact and a two-position movable member, said movable member being fixed at one end and being free at the opposite end and comprising a strip of resilient material apertured at substantially the center thereof with symmetrically disposed slots extending longitudinally of the strip on opposite sides of the apertured portion thereof, an operating member enveloping the end of said two-position movable member and carrying a contact coacting with said first mentioned contact, an angularly displaceable member having limited angular movement, said member terminating in a yoke engaging opposite sides of said operating member whereby said strip may be flexed to either of two positions and retained therein under control of said yoke as pressure is applied to said operating member through said yoke.

CARL P. CLARE.