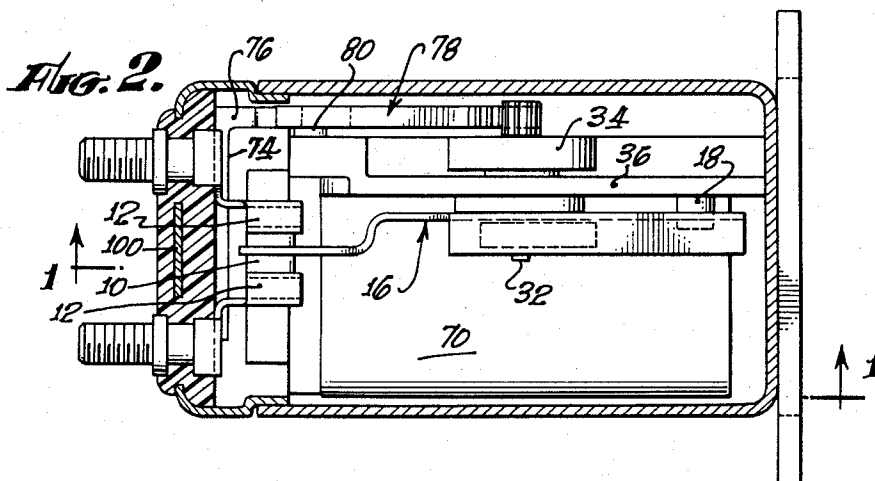
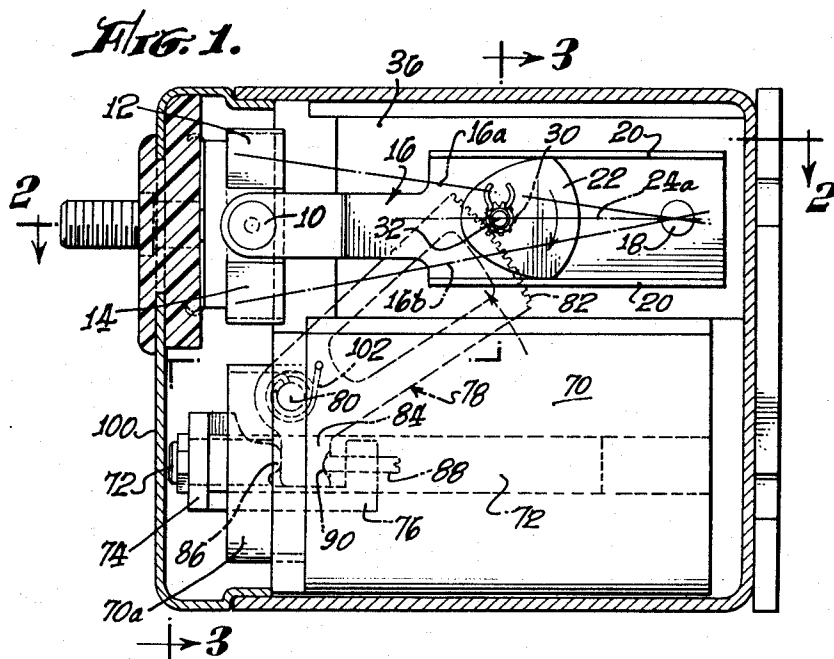


A. LANDAU ET AL
LATCHING RELAY

Filed Jan. 15, 1960

2 Sheets-Sheet 1



ALFRED LANDAU,
CURTIS LEE PILACH,
INVENTORS.

BY
Bachelus & Lewis

Dec. 6, 1960

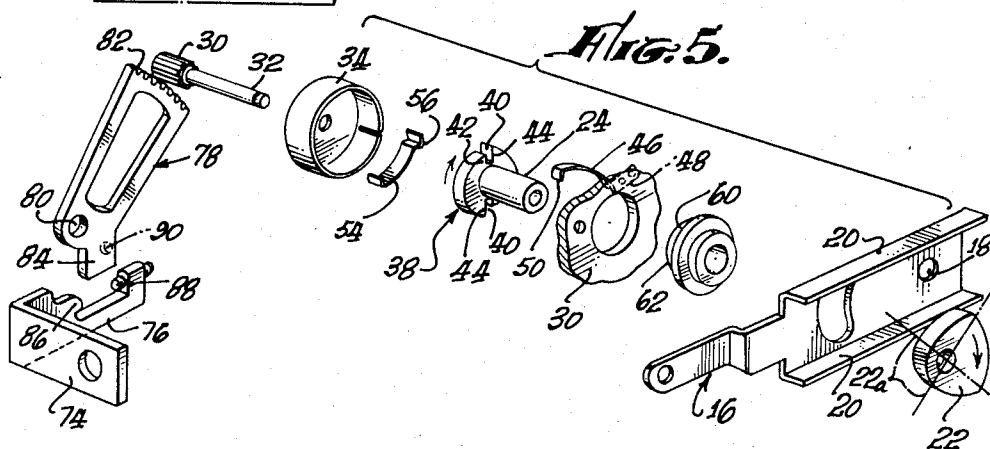
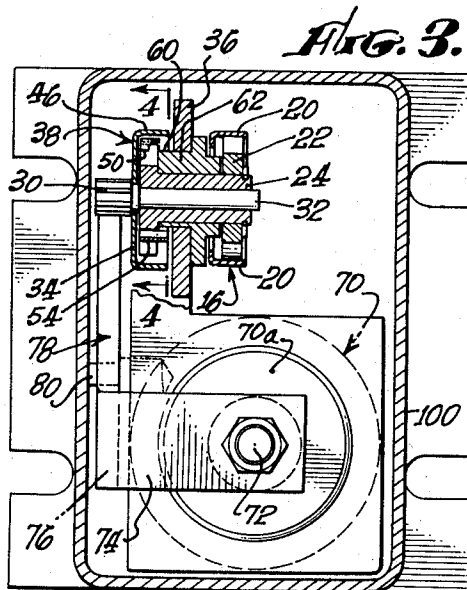
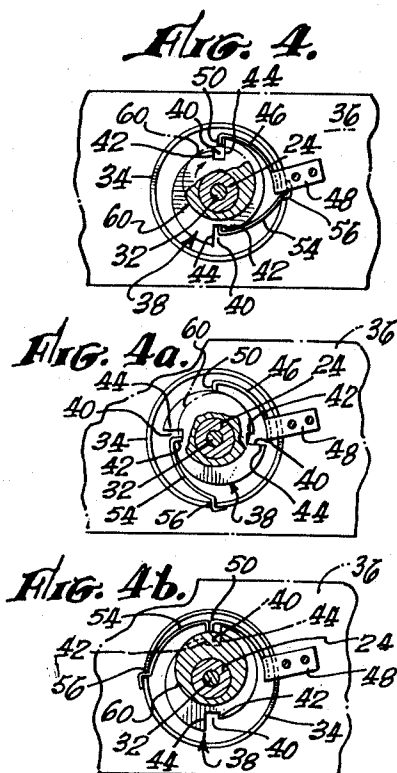
A. LANDAU ET AL

2,962,908

LATCHING RELAY

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2 Sheets-Sheet 2



ALFRED LANDAU,
CURTIS LEE HILACH,
INVENTORS.

BY
Buckelew & Lewis

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2,962,908

LATCHING RELAY

Alfred Landau, Manhattan Beach, and Curtis Lee Flach, Sunland, Calif., assignors to Mitchell Camera Corporation, Glendale, Calif., a corporation of Delaware

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8 Claims. (Cl. 74—99)

This invention relates to improvements in latching relays, and its general objectives include, among other things, the provision of a relay of sturdy and simple structure, resistant to shock and vibration, positively operated to its two circuit controlling positions by successive energizations of a single magnet or solenoid, and not requiring continued solenoid energization to hold it in either position. The relay of the invention requires successive succinct pulses for its operation; each operating pulse must be concluded and the relay again pulse energized before it will unlatch, switch to another position and latch in that other position. Other objects include the provision of a design requiring no fine tolerances, and in which a switch blade is positively retained in its thrown positions.

The illustrative embodiment of the invention described here by way of example, has a switch blade which is thrown to its two opposite positions by successive rotations of a blade operating cam through successive rotational angles in one direction. The preferred type of operating cam is one of constant diameter, of the so-called heart type, that has large angles of dwell. That cam is rotated through successive angles of 180° by a solenoid actuated ratchet mechanism, and the cam and its thrown blade are positively held in both thrown positions while the ratchet drive and solenoid return to their original positions with the solenoid de-energized. One of the reasons that no fine tolerances are required is the large dwell angle of the operating cam.

The invention in its several features will be best understood from the following description of an illustrative embodiment, with reference to the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional elevation taken as indicated by line 1—1 on Fig. 2;

Fig. 2 is a longitudinal section on line 2—2 of Fig. 1;

Fig. 3 is a transverse section on line 3—3 of Fig. 1;

Fig. 4 is a detail section on line 4—4 of Fig. 3, showing the ratchet mechanism in its normal position of rest;

Figs. 4a and 4b show that mechanism in two positions of operation; and

Fig. 5 is an exploded perspective showing the ratchet drive and the switch blade and its operating cam.

The switch blade moves between two positions, to engage its contact 10 between two spring contacts 12 in one position, and in the other position either merely to break the contacts with 12, or to engage another pair of contacts such as 14. The switch may be either single or double pole. The switch blade may be mounted, for movement between those two positions, in any desired or suitable manner. It is here shown, by way of example, as a blade 16 pivoted at 18, and its two thrown positions are indicated by the lines 16a and 16b. Fig. 1 shows the blade in a medial position.

The switch blade carries two cam follower flanges 20 which bear oppositely on the constant diameter cam 22 carried rigidly on the intermittently rotating shaft member 24 of the ratchet mechanism. That mechanism ro-

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tates cam 22 through successive angles of 180°. The cam's positions of rest are 90° removed from the medial position shown in Fig. 1, with the position line shown at 24a transverse of the switch blade and substantially at right angles to the follower flanges 20. In either rest position the cam has large dwell angles, indicated in Fig. 5 by the angles between the lines 22a. Consequently, no great accuracies in the exact rest positions of the cam are required, and, correspondingly, no great accuracy in the ratchet drive.

A preferred design for the ratchet drive is shown more particularly in Figs. 3 to 5. As there shown, the initial drive is via a pinion 30 carried on a shaft 32 that is journaled in the ratchet shaft member 24. The pinion, or its shaft, carries a rigidly attached cup 34 that is open toward the fixed member 36 forming a part of the carrying frame of the relay. Within cup 34 and rigidly mounted on the sleeve-shaft 24 is a ratchet disk 38 with two diametrically opposed peripheral notches 40. The direction of rotation of 40 is indicated by the arrow—clockwise in the aspects of Figs. 1 and 4. Between the notches the periphery of disk 38 has increasing radius in the direction opposite to the direction of rotation, so that, at each notch there is a forward facing shallow shoulder 42 and a rearward facing deep shoulder 44. A position holding spring pawl 46 is stationarily mounted at 48 on frame member 36 and has an end 50 that, in the rest position of the mechanism, hooks over one of the deep shoulders 44. Fig. 4 shows the rest position.

In that rest position, a driving spring pawl 54 hooks over the shallow shoulder 42 of the opposite notch 40. That pawl 54 is mounted at its base end, at 56, in the periphery of cup 34. It is noted at this point that, in this position of rest, if pinion 30 and cup 34 are held against rotation, as will be explained later, the two pawls 46 and 54 hold ratchet disk 38 and operating cam 22 against rotation in either direction and consequently hold the switch blade in thrown position.

The ratchet mechanism is operated by rotating pinion 30 and cup 34 through 180° in the direction indicated by the arrows in Figs. 4 and 4a. Fig. 4a shows cup 34 and driving pawl 54 rotated about 90° from the rest position. The driving pawl, pushing against shoulder 44 has correspondingly rotated ratchet disk 38 and, with it, the operating cam 22. Fig. 4a corresponds in position to the position of operating cam 22 in Fig. 1. As pawl 54 drives 38 to that position, the shallow hook end 50 of holding pawl 46 has cleared the shallow shoulder 42, as will be apparent from Fig. 4, allowing rotation of disk 38 in the direction indicated.

At the end of 180° rotation of cup 34 and driving pawl 54, the parts reach the position shown in Fig. 4b. As they reach that position pawl 54 is raised by an eccentric surface 60 formed by an eccentric member 62 that is fixedly set in frame member 36. As Fig. 3 shows, the end of driving pawl 54 overhangs 62. Pawl 54 is thus raised high enough to clear the shallow shoulder 42 on subsequent return of 34 and 54 to the position of Fig. 4. But, in reaching the position of Fig. 4b pawl 54 is not raised out of engagement with deep shoulder 44 and pushes that shoulder at least approximately to the position of Fig. 4b where the holding pawl drops over that shoulder. The ends of the two pawls may be offset from each other, right and left in the aspect of Fig. 3, to enable pawl 54 to drive shoulder 44 to its final position (Fig. 4b) where pawl 46 hooks over it. That, however, is not necessary. As shoulder 44 is reaching its final position, pawl 46 is riding the high surface at shoulder 44. Pawl 54 may then ride to final position under the hooked end of 46, and when pawl 54 backs off, 46 then drops into place hooked over 44.

Eccentric 62, set rigidly in frame member 36, is ex-

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tended to form a bearing in which the ratchet tube-shaft 24 is journaled.

The system for driving pinion 30 through 180°, as here shown in example, uses a solenoid 70 with a movable core 72. An arm 74 is rigidly mounted on the outer end of the core and has an angled portion 76 (see Fig. 5) extending lengthwise of the solenoid at its side. A gear sector 78, pivoted at 80, has its gear teeth 82 meshing with pinion 30. The sector has a lug 84 lying between a projection 86 and an adjustable screw 88, the latter being set into a recess 90 in lug 84. Energization of the solenoid causes movement of its core and arm 74, 76 to swing gear sector 78 in the direction indicated by the arrow in Fig. 1, causing rotation of the ratchet mechanism and the operating cam 22 in the direction indicated. Any suitable stop, such for example as arm 74 bringing up against the end 70a of the solenoid body, may limit movement to the final ratchet position indicated in Fig. 4b. On solenoid de-energization a spring such as shown at 102 may immediately move the gear sector and ratchet cup 34 and pawl 54 back to the position of Fig. 4; and any suitable stop, for example the end of core 72 coming up against case 100, may limit the movement in that direction. During that back movement of driving pawl 54, the holding pawl 46 holds ratchet disk 38 and operating cam 22 against backward movement. The mechanism then stands in the position of Fig. 4. Pawl 54 is held in that position by the return spring 102; and consequently the switch arm is held in either of its thrown positions not only by its frictional engagement between spring contacts, but also by the positive locking of the ratchet mechanism by the two pawls 46 and 54.

On each succinct pulse energization the ratchet mechanism drives the switch to one of its thrown positions. The switch is then held in that thrown position not only by its frictional switch engagement, but also by the holding pawl 46. The solenoid may then be immediately de-energized and the driving pawl backed off to its initial position. In fact, the solenoid must be de-energized and the driving pawl backed off, before the switch can be moved out of that thrown position; which can only be accomplished by a successive succinct energization after de-energization.

We claim:

1. In a latching relay, the combination of a switch member mounted to be movable in opposite directions between two thrown positions, a rotary cam engaging the switch member and adapted by successive cam rotations through successive predetermined rotational angles in one and the same direction about its axis, to positively drive the switch member successively in opposite directions between its two thrown positions, rotary ratchet mechanism having a driving pawl adapted, on movement of the pawl in said one direction from a predetermined normal position, to drive the cam through the predetermined rotational angle, energizable means for moving the pawl in said direction from its normal position, and means for returning the pawl to its normal position on de-energization of said pawl moving means.

2. The combination defined in claim 1 and including a locking pawl preventing cam rotation oppositely to the said one direction of rotation.

3. The combination defined in claim 2, in which the cam is of the constant diameter type, the successive predetermined rotational angles are of 180°, and in which the movable switch member has cam followers in constant engagement with opposite sides of the cam.

4. The combination defined in claim 1, in which the cam is of the constant diameter type, the successive predetermined rotational angles are of 180°, and in which the movable switch member has cam followers in constant engagement with opposite sides of the cam.

5. In a latching relay, the combination of a switch member mounted to be movable in opposite directions between two thrown positions, a rotary cam engaging the

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switch member and adapted, by successive cam rotations through successive predetermined rotational angles in one and the same direction about its axis, to positively drive the switch member successively in opposite directions between its two thrown positions, rotary ratchet mechanism adapted to drive the cam through the predetermined rotational angle, said mechanism embodying a ratchet disk rotatably connected to the cam, said disk having notches in its periphery spaced apart by said predetermined rotational angle, the peripheral face of the disk, in each of its extents between notches, decreasing in radius in the direction of rotation of the disk, thus providing a relatively shallow forwardly facing shoulder at one side of each notch and a relatively deep rearwardly facing shoulder at the opposite side of each notch, a fixed position locking pawl with an end adapted to drop over the relatively deep shoulders, a driving pawl carrier rotatable about the disk axis, a driving pawl mounted on the carrier and having an end adapted to drop over the relatively shallow shoulders, and a fixed cam surface adapted to raise the end of the driving pawl out of engagement with a shallow shoulder, energizable means for rotating the carrier through the predetermined rotational angle from a normal position of rest, and means for returning the carrier and the driving pawl to normal position on de-energization of said rotating means.

6. In a latching relay, the combination of a switch arm mounted to be movable laterally in opposite directions between two thrown positions, laterally spaced cam follower flanges on the switch arm, a cam shaft and a cam of constant diameter with extended dwell surfaces carried by the cam shaft and located between the follower flanges, said cam operating, by successive rotations through angles of 180° in one and the same direction, to move the switch arm in successively opposite directions between its two thrown positions, and ratchet mechanism operable by successive energizations to rotate the cam shaft through successive angles of 180° in one and the same direction.

7. The combination defined in claim 6 and in which the ratchet mechanism comprises a disk mounted on the cam shaft and having two diametrically opposed notches in its periphery, the peripheral face of the disk, in each of its extents between the notches, decreasing in radius in the direction of cam rotation, providing a relatively shallow forwardly facing shoulder at one side of each notch and a relatively deep rearwardly facing shoulder at the opposite side of each notch, a fixed position locking pawl with an end adapted to drop over the relatively deep shoulders, a driving pawl carrier rotatable about the axis of the cam shaft, a driving pawl mounted on the carrier and having an end adapted to drop over the relatively shallow shoulders, means energizable for driving the pawl carrier in said direction of rotation through an angle of 180° from a normal position, and means for returning the pawl carrier to normal position on de-energization of the driving means.

8. Ratchet mechanism, comprising the combination of a ratchet disk mounted for rotation about a central axis, said disk having a plurality of equi-angularly spaced notches in its periphery, the peripheral face of the disk, in each of its extents between the notches, decreasing in radius in the direction of a pre-determined direction of rotation of the disk, thus providing a relatively shallow forwardly facing shoulder at one side of each notch and a relatively deep rearwardly facing shoulder at the opposite side of each notch, a fixed position locking pawl with an end adapted to drop over the relatively deep shoulders, a driving pawl carrier rotatable about the disk axis, a driving pawl mounted on the carrier and having an end adapted to drop over the relatively shallow shoulders, and a fixed cam surface adapted to raise the end of the driving pawl out of engagement with a shallow shoulder.

No references cited.