

SWITCH

Filed Dec. 15, 1941

3 Sheets-Sheet 1

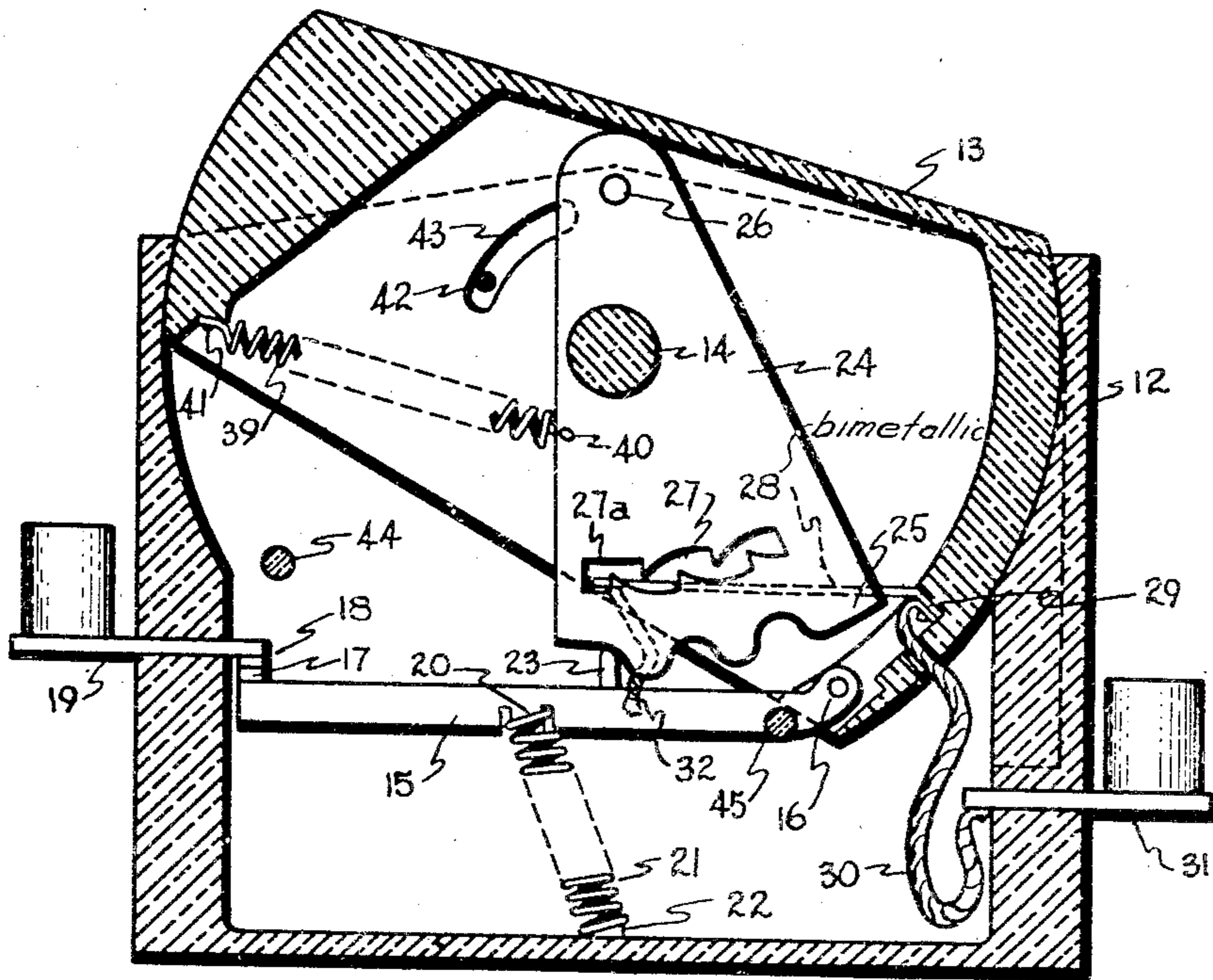


Fig. 1

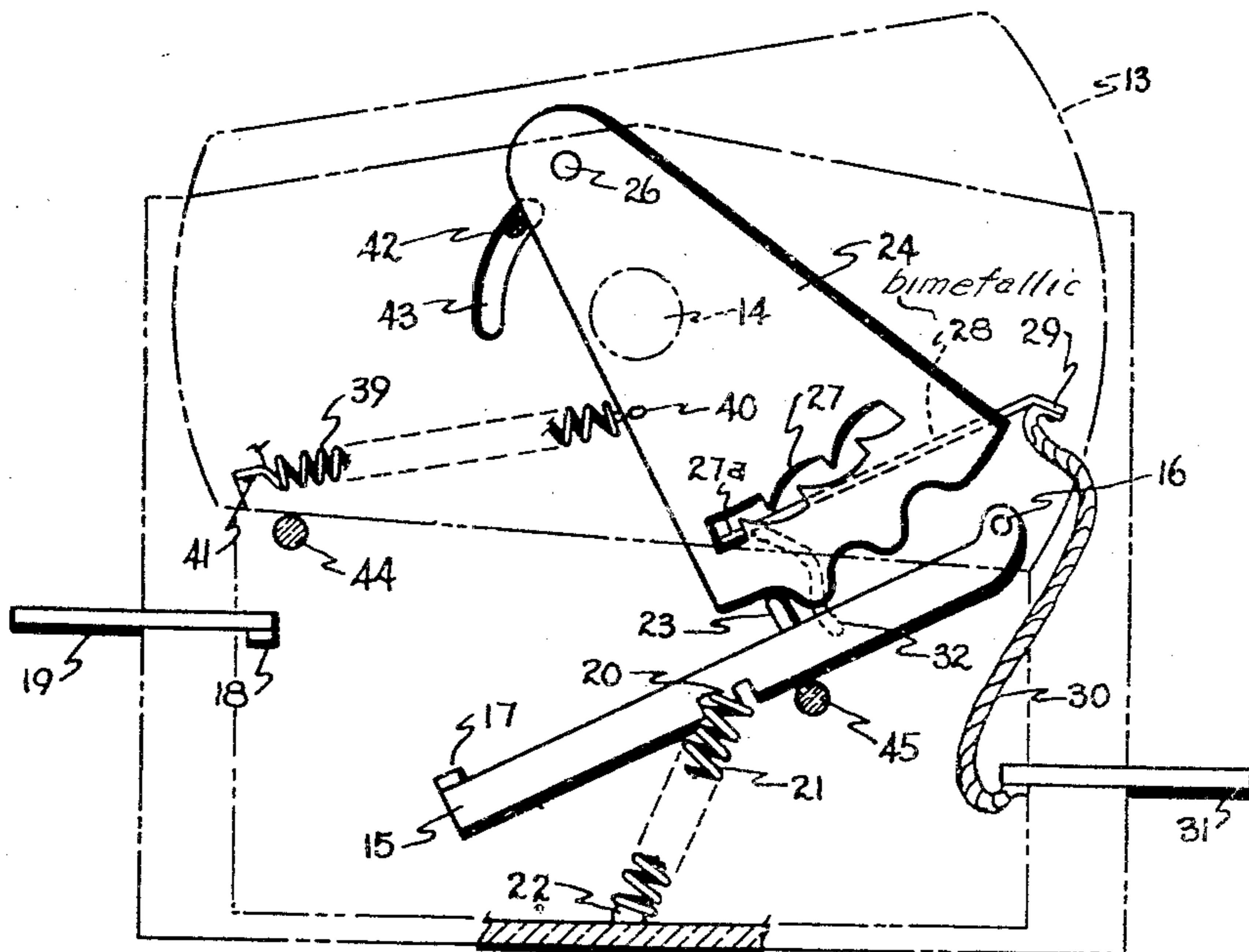


Fig. 2

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3 Sheets-Sheet 2

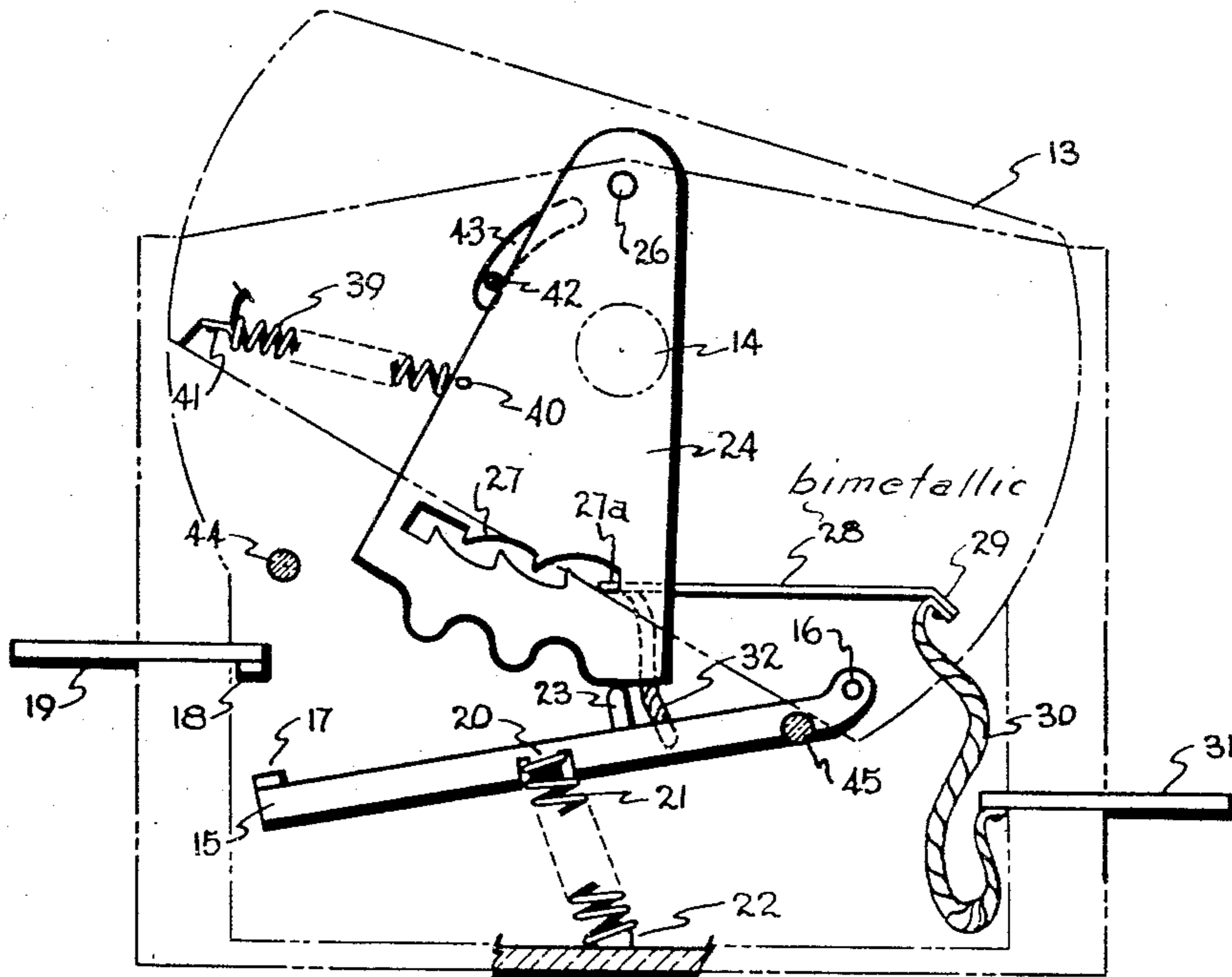


Fig. 3

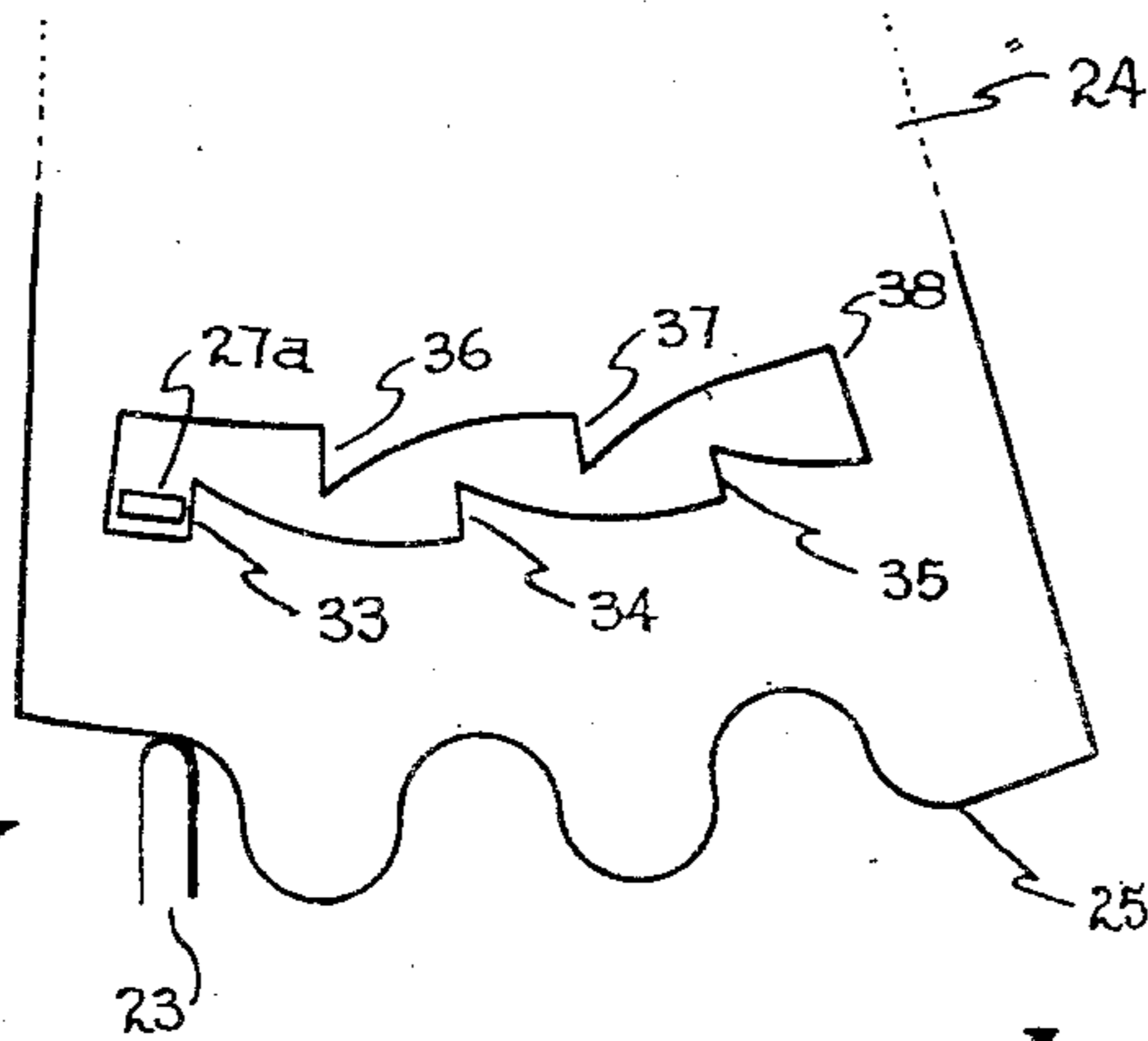


Fig. 7

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March 7, 1944.

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2,343,255

SWITCH

Filed Dec. 15, 1941

3 Sheets-Sheet 3

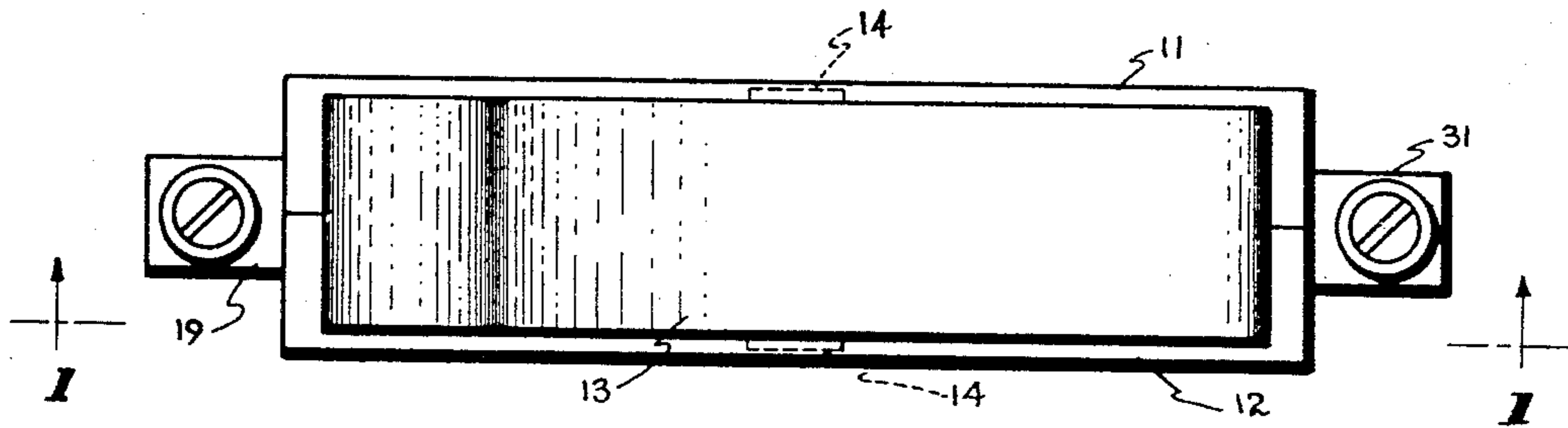


Fig. 4

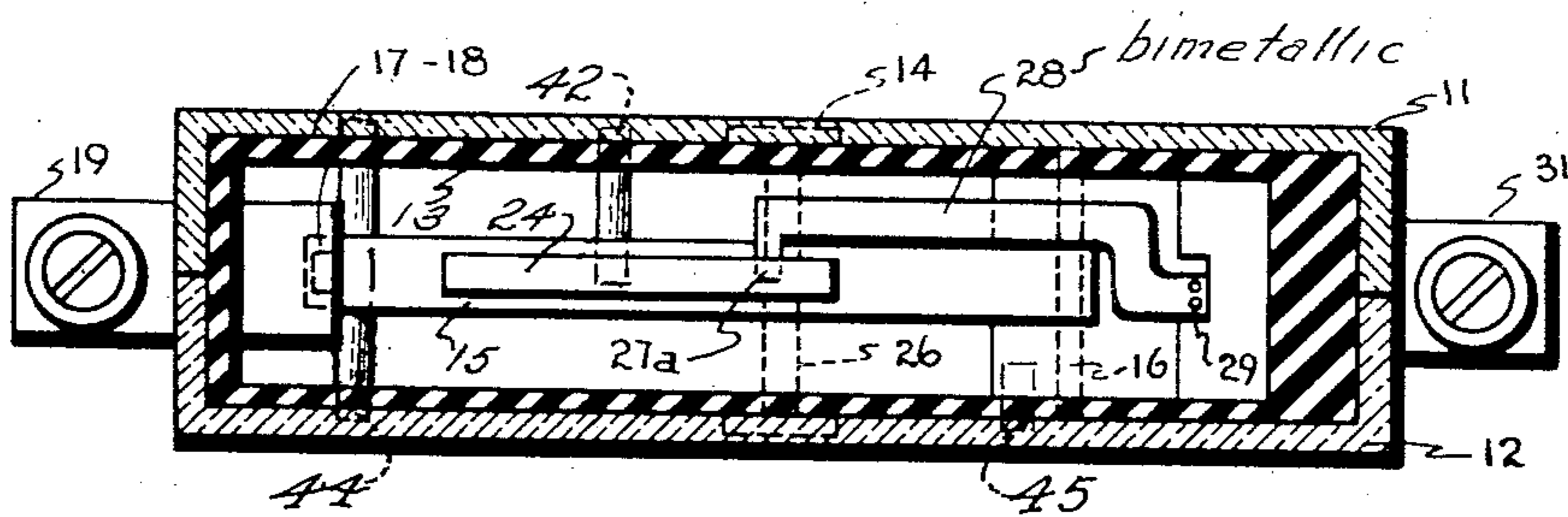


Fig. 5

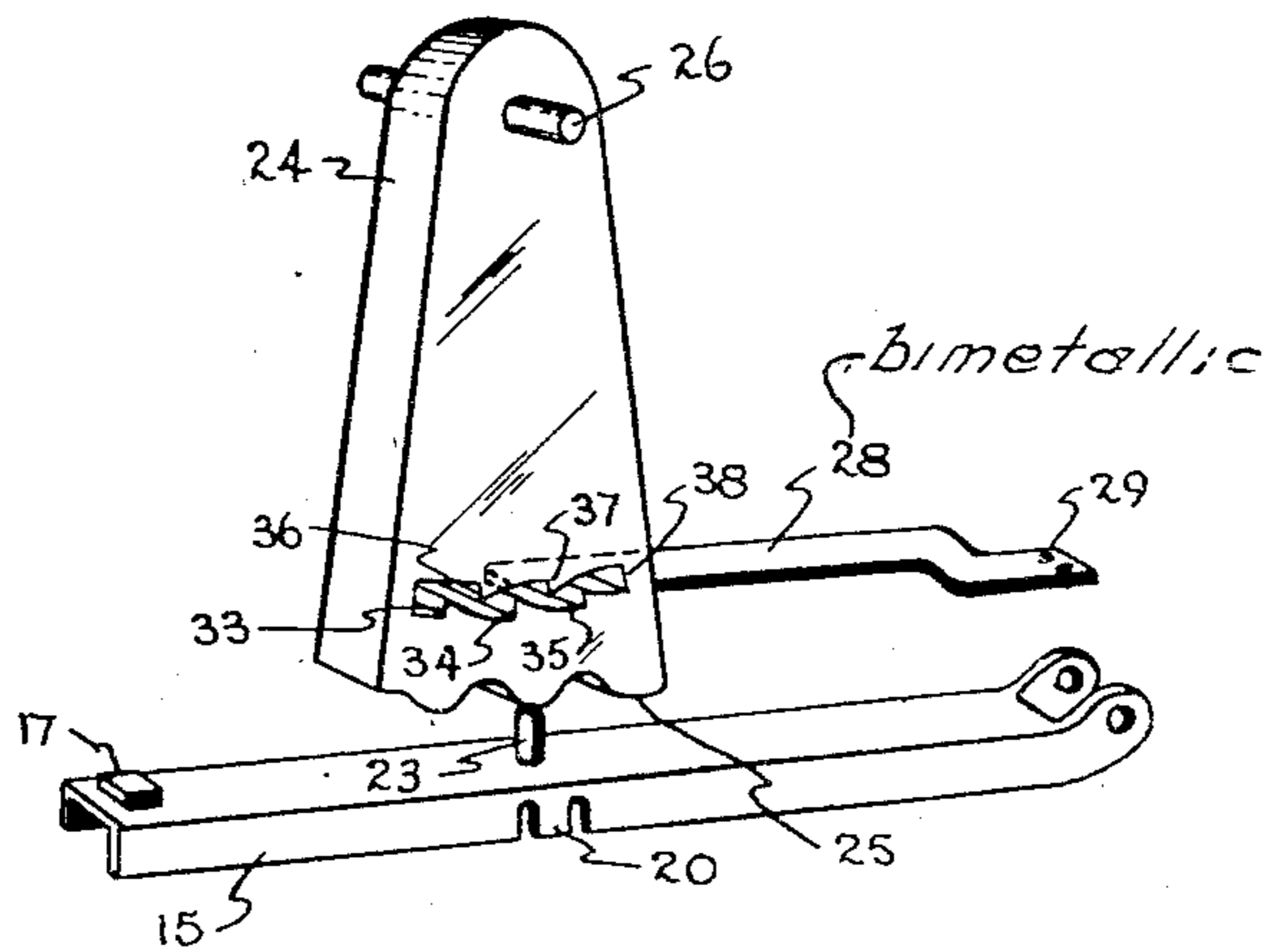


Fig. 6

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UNITED STATES PATENT OFFICE

2,343,255

SWITCH

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Application December 15, 1941, Serial No. 423,117

15 Claims. (Cl. 200—116)

This application relates to switches and aims to provide a switch of such a character that, on the arising of a momentary overload, it will open automatically but only momentarily, reclosing thereafter automatically. However, if the overload persists, the switch will open and will remain open until it is manipulated manually or reset for restoring service.

For an understanding of the switch, reference should be had to the appended drawings: In these drawings,

Fig. 1 is a sectional view, on line 1—1, Fig. 4, showing the switch closed.

Figs. 2 and 3 show the switch open following a manual opening, and an automatic opening, respectively.

Fig. 4 is a top plan view.

Fig. 5 is a transverse sectional view, corresponding to Fig. 3.

Fig. 6 shows parts of the device.

Fig. 7 illustrates the stop action.

The switch herein shown comprises a casing consisting of two sections 11 and 12 made of molded material and containing a molded handle 13 pivoted to the casing by pivot lugs or bosses 14 molded on the outside walls of the handle and fitting into suitable recesses in the casing. A movable contact arm 15 has one end pivotally connected to the handle by a pivot pin 16. At its other end is a movable contact 17 for engaging a stationary contact 18 fastened to a terminal 19. A lug 20 of the contact arm seats one end of a spring 21 whose other end is seated by a boss 22 of the casing, spring 21 constantly biasing arm 15 to rotate clockwise on its pivot 16. The contact arm has a projection 23 functioning as a follower for a ratchet toothed cam or operator 24 whose cam surface or lower edge 25 engages projection 23 to move the contact arm, and which is pivoted to the handle by pivot pin 26 and which has a ratchet toothed escapement slot 27 at all times receiving the free or latching end 27a of a bimetal strip or latch or pawl 28 having one end fastened to the handle by a rivet 29 and having its fixed end connected by a flexible connector 30 to a terminal 31 and having its free end connected to the contact arm by a second flexible connector 32.

The escapement slot 27 is provided with stops or ratchet teeth 33, 34, and 35, on its lower edge radially aligning with the valleys of the lower edge of the cam 24 and these stops selectively engage the latching end 27a of the bimetal strip 28. The escapement slot 27 is also provided with stops or ratchet teeth 36, 37, and 38, on its upper edge,

which radially align with the hills on the cam surface 25 of the cam 24, and the latching end 27a of the bimetal strip 28 is selectively engaged by the stops 36, 37, and 38.

The stop of slot 27 that engages the latch and 27a determines the relation of contact arm 15 and the cam 24. If the stop that engages the latch end 27a is one of the stops 33—34—35, then follower 23 engages the valleys of cam edge 25; and if cam 24 is then in circuit closing position, so will be contact arm 15. If the stop that engages the latch end 27a is one of the stops 36—37—38, then follower 23 engages the hills of cam edge 25; and contact arm 15 will be in open circuit position, regardless of the position of cam 24. Of course, if cam 24 is in open circuit position, then necessarily contact arm 15 will also be in open circuit position, even if its follower is in the valleys of the edge 25.

A spring 39, has one end 40 fixed to the cam 24 and its other end 41 connected to the handle, the spring functioning at all times to bias the cam 24 clockwise about its pivot 26.

A resetting or relocking pin 42 is fastened to the casing and extends through a clearance slot 43 of the handle to be engaged by one edge of the cam 24. Limiting stops 44 and 45 formed integral with the casing, limit the movement of the handle by engaging its lower edge, stop 44 limiting the open circuit movement of the handle in manual operation, and stop 45 limiting the clockwise movement of the handle during overload release operation.

The operation of the switch is as follows: For manual switching operation, the handle 13, the operator 24, the holding strip 28, and the contact arm 15, are held together to move as a unit by the holding strip 28. Rocking of the handle causes switch opening or closing.

Spring 21, passing over-center or crossing the pivot 14, provides snap action for the final part of each switching stroke. Spring 21 also establishes and maintains contact pressure between the movable contact 17, and the stationary contact 18.

On the arising of a circuit abnormality, such as an overload or short circuit, the bimetal strip will warp so that its latching end 27a moves away from the lower edge of the escapement slot 27, to free itself from stop 33, whereupon spring 39 will move operator 24 with respect to the handle until the latch 27a, now in the upper part of the slot 27, is engaged by the stop 36 of the upper edge of the slot. During movement of the operator 24 from the point where latch 27a is engaged by

stop 33 to the point where latch 27a is engaged by stop 36, the lower or cam edge 25 of the operator 24, moves to the left and thus forces the contact arm down to an open circuit position. As soon as the bimetal cools sufficiently, latch 27a will move down, away from stop 36 and towards stop 34, leaving operator 24 free to move until stop 34 of the lower edge engages the latch 27a. In this movement of operator 24, from the point where stop 36 engaged the latch to the point where stop 34 engaged the latch, the lower edge 25 of the operator 24 frees the contact arm follower 23, and the contact arm is once more biased by spring 21 to the closed circuit position.

A similar action takes place for circuit opening again, provided the circuit abnormality persists, with the operator 24 moving on the second stroke from the point where stop 34 engaged the latch to the point where stop 37 engaged it, to open the circuit; thereafter, the switch recloses, cam 24 moving from the point where its stop 37 engaged the latch to the point where its stop 35 engaged the latch, for permitting the contact arm to reclose the circuit, and this completes the second stroke.

On the third stroke, the operator 24 will move from the point where its stop 35 engages the latch, (circuit closed) to the point where its stop 38 engages the latch (circuit open). Because stop 38 defines the end of the escapement slot 27, the parts will come to rest in the position of Fig. 3 with the latch in engagement with stop 38 of the operator 24. No movement will take place from this point on, without a manual manipulation of the handle 13, which may be rotated counter-clockwise, as on a switching stroke, to the position of Fig. 2, from the position of Fig. 3 where it was, for resetting the circuit breaker manually, and restoring service. On such rotation of the handle, its point 26 which is the pivot point for the operator 24, will be moved counter-clockwise, and the operator 24 will now rock counter-clockwise upon the stationary pin 42, engaging its left edge. The handle is free of that pin, because of slot 43, and though it also will move counter-clockwise, the operator will move counter-clockwise independently of, though along with the handle, until the stops of the escapement slot 27 have passed beyond the free end 27a of the bimetal strip and the parts have assumed the position of Fig. 2, where the free end of the bimetal strip is between stop 33 and the left end of the escapement slot, engaging stop 33. The inclined parts of the lower edge of slot 27, between stops 38 and 35, and 35 and 34, and 34 and 33, permit such lower edge stops to ride past the free end of the bimetal strip. The lower edge 25 of the operator 24 rides freely over the follower 23 during the resetting operation, which terminates with the operator 24 once more held to the handle by the bimetal strip and with the parts in the open circuit position of Fig. 2, ready to be moved to the closed circuit position of Fig. 1 by a switching stroke of the handle for restoring service.

It will be observed that the only operations that are necessary for restoring service, after a cycle of automatic opening and reclosing operations, are two switching strokes of the handle, one to the open circuit position of Fig. 2 and the other to the closed circuit position of Fig. 1. Such movements of the handle are the same as its manual switching movements. The manipulation of an auxiliary member, or the rewind-

ing of a spring, is entirely unnecessary in this device.

Handle movement for resetting the parts (to the position of Fig. 2) is a single stroke movement; the handle need not be moved through a number of repeat strokes as if there were a rewinding action.

Contact pressure is established and maintained by an operating spring which determines the position of the movable contact arm 15, and which at all times biases that contact arm clockwise on pivot 16. This bias is effective to close the circuit only when the handle 13, which supports the contact arm 15, and the operator 24, which moves it, are in the closed circuit position. This bias is overcome to open the circuit either by switching movement of the handle 13, or by automatic movement of the operator, when the holding strip 28 releases it and the spring 39 biases such operator to overpower the spring 21 and cause opening of the circuit on overload.

The contact arm is pivotally mounted on the handle and the operator 24, movable relative to the handle, and releasably latched to the handle, is utilized to cause arm 15 to move relative to the handle or support 13. For manual movement, the latch holds the operator in such a position with respect to the handle that the operator and handle move as a unit to control the "on" and "off" positions of the contact arm. On overload release movement, the operator is released from the handle, and is moved with respect to it, or free of the handle, by spring 39, to control the movement of the contact arm for automatic opening of the circuit. For resetting, it is necessary to move the operator again with respect to the handle, once more to relatch it to the handle or cause it to be held by the holding means, which is in effect a part of the handle, so that the operator and handle once more form a unit which can be moved as a unit to determine the position of the contact arm.

Now having described the device herein disclosed, reference should be had to the claims which follow.

I claim:

1. In a circuit breaker, a stationary contact, a movable contact, a spring constantly biasing the movable contact towards the stationary contact to maintain the contacts in engagement, an advanceable cam for camming the movable contact away from the stationary contact in opposition to the spring, means for advancing the cam automatically, when it is free, to cam the movable contact away from the stationary contact for circuit opening automatically, means normally holding the cam against such advance movement and arranged to respond to a circuit abnormality and free it for such advance movement, the movable contact, the cam and the cam holding means being so constructed that when the holding means releases the cam, it will be advanced automatically to cam the movable contact for circuit opening, the cam being so constructed that when it so advances, it advances to a position where the movable contact is held by the cam away from the stationary contact, with the cam free of its holding means, and means whereby the cam can be returned manually to its starting position, held there by the holding means, and to free the movable contact to return to the stationary contact.

2. In a circuit breaker, a stationary contact, a movable contact, a spring constantly biasing the movable contact towards the stationary con-

tact to maintain the contacts in engagement, an advanceable cam for camming the movable contact away from the stationary contact in opposition to the spring, means for advancing the cam automatically, when it is free, to cam the movable contact away from the stationary contact for circuit opening automatically, means normally holding the cam against such advance movement and arranged to respond to a circuit abnormality and free it for such advance movement, the movable contact, the cam and the cam holding means being so constructed that when the holding means releases the cam, it will be advanced automatically to cam the movable contact for circuit opening, the cam being so constructed that when it so advances, it advances to a position where the movable contact is held by the cam away from the stationary contact, with the cam free of its holding means, whereafter the cam advances beyond the position wherein it causes the movable contact to leave the stationary contact and to a position wherein it permits the movable contact to return to the stationary contact, which is a position wherein the cam once more is held by its holding means, the cam having a part engaging the holding means.

3. In a circuit breaker, a stationary contact, a movable contact, a spring constantly biasing the movable contact towards the stationary contact to maintain the contacts in engagement, an advanceable cam for camming the movable contact away from the stationary contact in opposition to the spring, means for advancing the cam automatically, when it is free, to cam the movable contact away from the stationary contact for circuit opening automatically, means normally holding the cam against such advance movement and arranged to respond to a circuit abnormality and free it for such advance movement, the movable contact, the cam and the cam holding means being so constructed that when the holding means releases the cam, it will be advanced automatically to cam the movable contact for circuit opening the cam being so constructed that when it so advances, it advances to a position where the movable contact is held by the cam away from the stationary contact, with the cam free of its holding means, whereafter the cam advances beyond the position wherein it causes the movable contact to leave the stationary contact and to a position wherein it permits the movable contact to return to the stationary contact, which is a position wherein the cam once more is held by its holding means, the cam having a part engaging the holding means, such part being formed with duplicated identical portions engaging the holding means and corresponding in number and location to duplicated identical movable contact engaging portions whereby a limited number of repeated such movements of the cam and movable contact can be caused automatically, during the existence of a circuit abnormality.

4. In a manually operable switch arranged for opening automatically on a circuit abnormality and for automatically reclosing a limited number of times, a movable contact, a toothed ratchet cam for controlling its position, a circuit responsive pawl for engaging the ratchet teeth and thus holding the cam, means for biasing the cam to advance through a complete stroke, step by step between successive releases and reholds thereof by the pawl, until cam advance is terminated with the pawl holding it at the end of its advance, the contact being repeatedly moved to

open and closed positions by the advancing cam, manually operable means for moving the contact manually to open and closed positions and for returning the cam from the point where the pawl holds the cam at the end of cam advance to the point where the pawl holds the cam at the beginning of cam advance, the parts being so formed that a single movement of the manual means is required to return the cam to the starting point of its advance stroke.

5. In a manually operable switch arranged for opening automatically on a circuit abnormality and for automatically reclosing a limited number of times, a movable contact, a toothed ratchet cam for controlling its position, a circuit responsive pawl for engaging the ratchet teeth and thus holding the cam, means for biasing the cam to advance through a complete stroke, step by step, between successive releases and reholds thereof by the pawl, until cam advance is terminated with the pawl holding it at the end of its advance, the contact being repeatedly moved to open and closed positions by the advancing cam, manually operable means for moving the contact manually to open and closed positions and for returning the cam from the point where the pawl holds the cam at the end of cam advance to the point where the pawl holds the cam at the beginning of cam advance, the parts being so formed that a single movement of the manual means is required to return the cam to the starting point of its advance stroke, the pawl and cam moving as a unit, when the pawl holds the cam, and the contact is moved manually.

6. In a manually operable switch arranged for opening automatically on a circuit abnormality and for automatically reclosing a limited number of times, a movable contact, a toothed ratchet cam for controlling its position, a circuit responsive pawl for engaging the ratchet teeth and thus holding the cam, means for biasing the cam to advance through a complete stroke, step by step, between successive releases and reholds thereof by the pawl, until cam advance is terminated with the pawl holding it at the end of its advance, the contact being repeatedly moved to open and closed positions by the advancing cam, manually operable means for moving the contact manually to open and closed positions and for returning the cam from the point where the pawl holds the cam at the end of cam advance to the point where the pawl holds the cam at the beginning of cam advance, the parts being so formed that a single movement of the manual means is required to return the cam to the starting point of its advance stroke, and means constantly biasing the contact to closed position and adapted to be overcome by certain of the steps of the cam advance stroke.

7. In a manually operable switch arranged for opening automatically on a circuit abnormality and for automatically reclosing a limited number of times, a movable contact, a toothed ratchet cam for controlling its position, a circuit responsive pawl for engaging the ratchet teeth and thus holding the cam, means for biasing the cam to advance through a complete stroke, step by step, between successive releases and reholds thereof by the pawl, until cam advance is terminated with the pawl holding it at the end of its advance, the contact being repeatedly moved to open and closed positions by the advancing cam, manually operable means for moving the contact manually to open and closed positions and for returning the cam from the point where the pawl holds

the cam at the end of cam advance to the point where the pawl holds the cam at the beginning of cam advance, the parts being so formed that a single movement of the manual means is required to return the cam to the starting point of its advance stroke, the pawl and cam moving as a unit, when the pawl holds the cam, and the contact is moved manually, and means constantly biasing the contact to closed position and adapted to be overcome by certain of the steps of the cam advance stroke.

8. In a circuit breaker, a stationary contact, a movable contact, a spring constantly biasing the movable contact towards the stationary contact to maintain the contacts in engagement, a handle, a cam for moving the movable contact away from the stationary contact in opposition to the spring and movable to permit the spring to return the movable contact to the stationary contact, means for moving the cam automatically, independent of the handle, when it is free, to move the movable contact away from the stationary contact for circuit opening automatically, a latch formed as part of the handle for normally holding the cam against such movement and arranged to respond to a circuit abnormality and free the cam for such movement, the movable contact, the cam, and the holding latch being so constructed that when the holding latch releases, the cam will move automatically and move the movable contact for circuit opening, the cam being so constructed that when it moves so, it moves to a position where the movable contact is held by the cam away from the stationary contact, with the cam free of the holding latch, whereafter the handle can be moved manually to return the cam to its starting position, to be relatched by the holding latch, and to free the movable contact to return to the stationary contact.

9. In a manually operable switch arranged for opening automatically on a circuit abnormality and for automatically reclosing a limited number of times, a movable contact, a toothed ratchet cam for controlling its position, a circuit responsive pawl for engaging the ratchet teeth and thus holding the cam, means for biasing the cam to advance through a complete stroke, step by step, between successive releases and reholds thereof by the pawl, until cam advance is terminated with the pawl holding it at the end of its advance, the contact being repeatedly moved to open and closed positions by the advancing cam, manually operable means for moving the contact manually to open and closed positions and for returning the cam for the point where the pawl holds the cam at the end of cam advance to the point where the pawl holds the cam at the beginning of cam advance, the parts being so formed that a single movement of the manual means is required to return the cam to the starting point of its advance stroke, the cam, pawl, and contact being so formed that the contact is held in open circuit position by the cam when the latter is at either end of its advance stroke.

10. In a manually operable switch arranged for opening automatically on a circuit abnormality and for automatically reclosing a limited number of times, a movable contact, a toothed ratchet cam for controlling its position, a circuit responsive pawl for engaging the ratchet teeth and thus holding the cam, means for biasing the cam to advance through a complete stroke, step by step, between successive releases and reholds thereof by the pawl, until cam advance is terminated with the pawl holding it at the end of its

advance, the contact being repeatedly moved to open and closed positions by the advancing cam, manually operable means for moving the contact manually to open and closed positions and for returning the cam from the point where the pawl holds the cam at the end of cam advance to the point where the pawl holds the cam at the beginning of cam advance, the parts being so formed that a single movement of the manual means is required to return the cam to the starting point of its advance stroke, the cam, pawl, and contact being so formed that the contact is held in open circuit position by the cam when the latter is at either end of its advance stroke, and means constantly biasing the contact to closed position and adapted to be overcome by certain of the steps of the cam advance stroke.

11. In a circuit breaker, a stationary contact, a movable contact, a spring constantly biasing the movable contact towards the stationary contact to maintain the contacts in engagement, an advanceable cam for camming the movable contact away from the stationary contact in opposition to the spring, means for advancing the cam automatically, when it is free, to cam the movable contact away from the stationary contact for circuit opening automatically, means normally holding the cam against such advance movement and arranged to respond to a circuit abnormality and free it for such advance movement, the movable contact, the cam and the cam holding means being so constructed that when the holding means releases the cam, it will be advanced automatically to cam the movable contact for circuit opening, the cam being so constructed that when it so advances, it advances to a position where the movable contact is held by the cam away from the stationary contact, with the cam free of its holding means, whereafter the cam advances beyond the position wherein it causes the movable contact to leave the stationary contact and to a position wherein it permits the movable contact to return to the stationary contact, which is a position wherein the cam once more is held by its holding means, the cam having a part engaging the holding means, and means for manually moving the movable contact to and from the stationary contact, even when the cam is restrained from advancing by the holding means.

12. In a circuit breaker, a stationary contact, a movable contact, a spring constantly biasing the movable contact towards the stationary contact to maintain the contacts in engagement, an advanceable cam for camming the movable contact away from the stationary contact in opposition to the spring, means for advancing the cam automatically, when it is free, to cam the movable contact away from the stationary contact for circuit opening automatically, means normally holding the cam against such advance movement and arranged to respond to a circuit abnormality and free it for such advance movement, the movable contact, the cam and the cam holding means being so constructed that when the holding means releases the cam, it will be advanced automatically to cam the movable contact for circuit opening, the cam being so constructed that when it so advances, it advances to a position where the movable contact is held by the cam away from the stationary contact, with the cam free of its holding means, whereafter the cam advances beyond the position wherein it causes the movable contact to leave the stationary contact and to a position wherein

it permits the movable contact to return to the stationary contact, which is a position wherein the cam once more is held by its holding means, the cam having a part engaging the holding means, and means for manually moving the movable contact to and from the stationary contact, even when the cam is restrained from advancing by the holding means, said manual means being operable for returning the cam to the start of its advance stroke.

13. In a circuit breaker, a stationary contact, a movable contact, a spring constantly biasing the movable contact towards the stationary contact to maintain the contacts in engagement, an advanceable cam for camming the movable contact away from the stationary contact in opposition to the spring, means for advancing the cam automatically, when it is free, to cam the movable contact away from the stationary contact for circuit opening automatically, means normally holding the cam against such advance movement and arranged to respond to a circuit abnormality and free it for such advance movement, the movable contact, the cam and the cam holding means being so constructed that when the holding means releases the cam, it will be advanced automatically to cam the movable contact for circuit opening, the cam being so constructed that when it so advances, it advances, to a position where the movable contact is held by the cam away from the stationary contact, with the cam free of its holding means, whereafter the cam advances beyond the position wherein it causes the movable contact to leave the stationary contact and to a position wherein it permits the movable contact to return to the stationary contact, which is a position wherein the cam once more is held by its holding means, the cam having a part engaging the holding means, and means for manually moving the movable contact to and from the stationary contact, even when the cam is restrained from advancing by the holding means, said manual means being operable with a single movement, similar to its circuit opening movement, for returning the cam to the start of its advance stroke.

14. In a circuit breaker, a stationary contact, a movable contact, a spring constantly biasing the movable contact towards the stationary contact to maintain the contacts in engagement, an advanceable cam for camming the movable contact away from the stationary contact in opposition to the spring, means for advancing the cam automatically, when it is free, to cam the movable contact away from the stationary contact for circuit opening automatically, means normally holding the cam against such advance movement and arranged to respond to a circuit abnormality and free it for such advance movement, the movable contact, the cam and the cam holding means being so constructed that when the holding means releases the cam, it will be advanced automatically to cam the movable contact for circuit opening the cam being so constructed that when it so advances, it advances to a position where the movable contact is held by the cam away from the stationary contact,

with the cam free of its holding means, whereafter the cam advances beyond the position wherein it causes the movable contact to leave the stationary contact and to a position wherein it permits the movable contact to return to the stationary contact, which is a position wherein the cam once more is held by its holding means, the cam having a part engaging the holding means, such part being formed with duplicated identical portions engaging the holding means and corresponding in number and location to duplicated identical movable contact engaging portions whereby a limited number of repeated such movements of the cam and movable contact can be caused automatically, during the existence of a circuit abnormality, and means for manually moving the movable contact to and from the stationary contact, even when the cam is restrained from advancing by the holding means, said manual means being operable for returning the cam to the start of its advance stroke.

15. In a circuit breaker, a stationary contact, a movable contact, a spring constantly biasing the movable contact towards the stationary contact to maintain the contacts in engagement, an advanceable cam for camming the movable contact away from the stationary contact in opposition to the spring, means for advancing the cam automatically, when it is free, to cam the movable contact away from the stationary contact for circuit opening automatically, means normally holding the cam against such advance movement and arranged to respond to a circuit abnormality and free it for such advance movement, the movable contact, the cam and the cam holding means being so constructed that when the holding means releases the cam, it will be advanced automatically to cam the movable contact for circuit opening the cam being so constructed that when it so advances, it advances to a position where the movable contact is held by the cam away from the stationary contact, with the cam free of its holding means, whereafter the cam advances beyond the position wherein it causes the movable contact to leave the stationary contact and to a position wherein it permits the movable contact to return to the stationary contact, which is a position wherein the cam once more is held by its holding means, the cam having a part engaging the holding means, such part being formed with duplicated identical portions engaging the holding means and corresponding in number and location to duplicated identical movable contact engaging portions whereby a limited number of repeated such movements of the cam and movable contact can be caused automatically, during the existence of a circuit abnormality, and means for manually moving the movable contact to and from the stationary contact, even when the cam is restrained from advancing by the holding means, said manual means being operable with a single movement, similar to its circuit opening movement, for returning the cam to the start of its advance stroke.

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