Feb. 18, 1936. R. R. BUSH 2,031,458

OPERATING MECHANISM

Filed Oct. 30, 1934

Fig. 1.

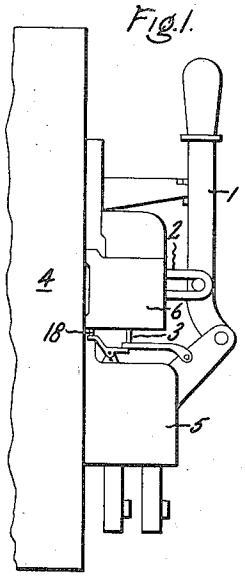


Fig. 2.

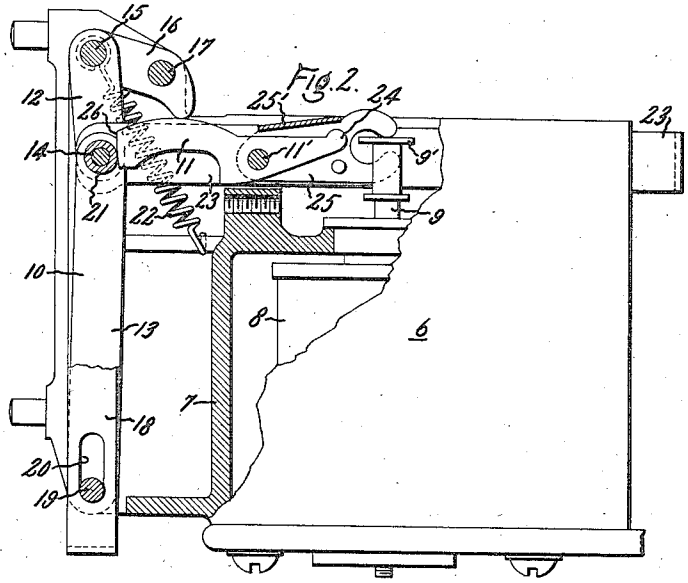
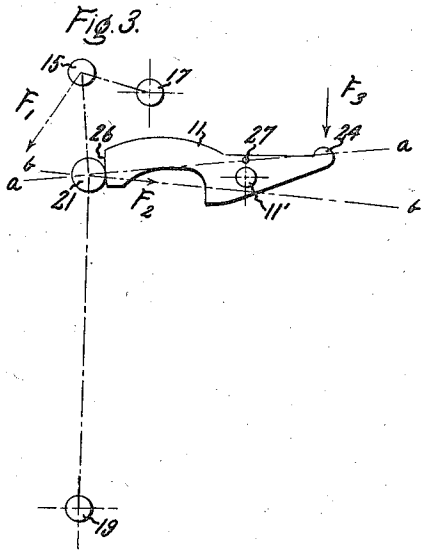


Fig. 3.



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OPERATING MECHANISM

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4 Claims. (Cl. 74—2)

My invention relates to operating mechanisms, more particularly to tripping or releasing means for operating mechanisms, and has for its principal object the provision of an improved operating mechanism having comparatively efficient, inexpensive and sensitive tripping means.

The use of restraining toggles in operating mechanisms for reducing the force transmitted to the actual tripping member is well known and established practice, particularly where the available tripping force is small. The use of latch members directly for this purpose is also known and preferred in certain types of small and low-power mechanisms, the latch in one form having a plane operating edge which must be accurately ground at an angle to the latch radius and machined in order to insure correct alinement of parts of the completed assembly.

In accordance with my invention, a restraining and force reducing latch is provided with an operating edge defined by an arc having its center along a line which is offset with respect to the center of rotation of the latch. This results in an easily constructed and efficient latch having a practically uniform moment arm throughout its operation, while making unnecessary an accurate alinement of surfaces and assembly of parts in order to obtain accurate adjustment.

My invention will be more fully set forth in the following description referring to the accompanying drawing, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

Referring to the drawing, Fig. 1 is an elevational view of a conventional form of operating mechanism to which, by way of example, my invention is applied; Fig. 2 is an elevational view, partly in section, of tripping means embodying my invention, and Fig. 3 is a view of the latch in Fig. 2 showing diagrammatically the application of forces.

Fig. 1 illustrates an operating mechanism comprising a manually operated handle 1, a force transmitting collapsible linkage generally indicated at 2 and a tripping device at 3 for releasing the mechanism. In the present instance the mechanism is associated with a circuit breaker (not shown) and is mounted on a supporting panel 4. Rotation of the handle 1 to the position shown may close the breaker, the opening or tripping thereof being accomplished by either the usual overload relay at 5 or the undervoltage release at 6 through the tripping device at 3 which is related in any well known manner to the collapsible linkage at 2.

Referring more particularly to Fig. 2, the undervoltage release 6 comprises a frame 7 in which is mounted the voltage responsive solenoid 8 having a plunger 9. Likewise mounted on the frame 7 are a trip-actuating toggle 10 and a coacting latch 11.

The toggle 10 comprises links 12 and 13 which are pivotally connected at 14. The link 12 is likewise pivotally connected at 15 to a crank 16 having a fixed pivot 17, and also at 15 to a link 18 which is guided at its lower end as by a pin and slot connection 19—20. The fixed pin 19 also serves as the pivot for toggle link 13.

The pivot 14, or knee, of the toggle includes a roller 21 which is directly engaged by the latch 11 in the normal position, the roller being biased into engagement with the latch, as by a tension spring 22 which is connected at one end to pivot 15 and at the other end to frame 7. A resetting lever slidably mounted for horizontal movement in the frame is connected to the toggle at 14 for straightening and resetting the toggle manually after tripping thereof.

The latch 11, which is pivotally mounted on the frame at 11', includes an extension 24 adapted to be engaged by the overhanging flange 25' of a co-pivoted forked member 25. Member 25 is in turn operatively connected to the plunger 9 as by means of its forked extension coacting with disc 9' carried by the solenoid plunger.

In operation failure of voltage causes the plunger 9 to be depressed, resulting in clockwise movement of 25 and engagement of latch extension 24 by the overhanging flange 25'. When the force is sufficient, the latch 11 rotates clockwise freeing the roller 21, thereby permitting the spring 22 to buckle the toggle and project the link 18 downwards. The link 18, as illustrated by Fig. 1, may act on the tripping device at 3 to cause release of the main mechanism. Resetting is accomplished by pushing link 23 towards the left and straightening the toggle, the latch 11 again falling behind the roller 21 in the event that normal conditions obtain.

Referring to Fig. 3, there is illustrated a force diagram in connection with the latch 11 to show the functioning thereof.

The operating edge 26 of the latch 11 is defined by an arc having a center at 27 which, as illustrated, is offset along the line a—a with respect to the center of rotation of the latch at 11'. With the latch in the restraining position illustrated, the component F_1 of the spring force tends to move

the roller 21 about the fixed toggle pivot 19 along the operating edge 26 of the latch, the roller reacting force F_2 acts along a line *b*—*b* which is offset with respect to pivot 11' at the opposite side thereof. Accordingly, there is a moment tending to rotate the latch counter-clockwise which is suitably resisted, as by a stop member or portion of the frame, (Fig. 2).

Referring more particularly to Fig. 3, the tripping force F_3 is aided by a component of the roller reacting force F_2 proportional to the offset of center 27. The moment of F_3 could, for maximum efficiency, be approximately equal to the frictional moment that restrains the movement of the latch. The amount of F_3 then necessary for actuation of the latch is smaller than that actually required to overcome all of the friction by reason of the aiding component of F_2.

It will likewise be noted that the moment arm determined by the offset distance between line *a*—*a* and the latch center 11' changes but slightly during actuation of the latch in releasing the roller 21 so that the required tripping force F_3 may also be practically constant.

It should be understood that my invention is not limited to specific details of construction and arrangement thereof herein illustrated, and that changes and modifications may occur to one skilled in the art without departing from the spirit of my invention.

I claim:

1. In an operating mechanism having collapsible structure, restraining means therefor comprising a pivoted latch arranged to engage at its operating edge a part of said collapsible structure, said operating edge being defined by an arc having its center along a line offset with respect to the center of rotation of said latch.

2. In an operating mechanism having a collapsible toggle including a roller, restraining means for said toggle comprising a pivoted latch having an operating edge adapted to engage said roller, said operating edge being defined by an arc having its center along a line offset with respect to the center of rotation of said latch to such an extent that there is inappreciable change in direction of the radius of said arc upon actuation of said latch.

3. In an operating mechanism having a collapsible toggle including a roller, restraining means therefor comprising a pivoted latch having an operating edge adapted to engage said roller, said operating edge being defined by an arc having its center along a line adjacent and offset with respect to the center of rotation of said latch, the toggle force tending to move said roller along a portion of said operating edge of decreasing latch radius, and the center of said arc bearing such relation to said roller that the force of friction prevents tripping of said latch.

4. In an operating mechanism having a collapsible toggle including a roller, restraining means for said toggle comprising a pivoted latch having an operating edge adapted to engage said roller, said operating edge being defined by an arc having its center along a line offset with respect to the center of rotation of said latch to such an extent that the latch operating force is aided by a component of the frictional force at said roller and operating edge.

RALPH R. BUSH.