

Feb. 28, 1939.

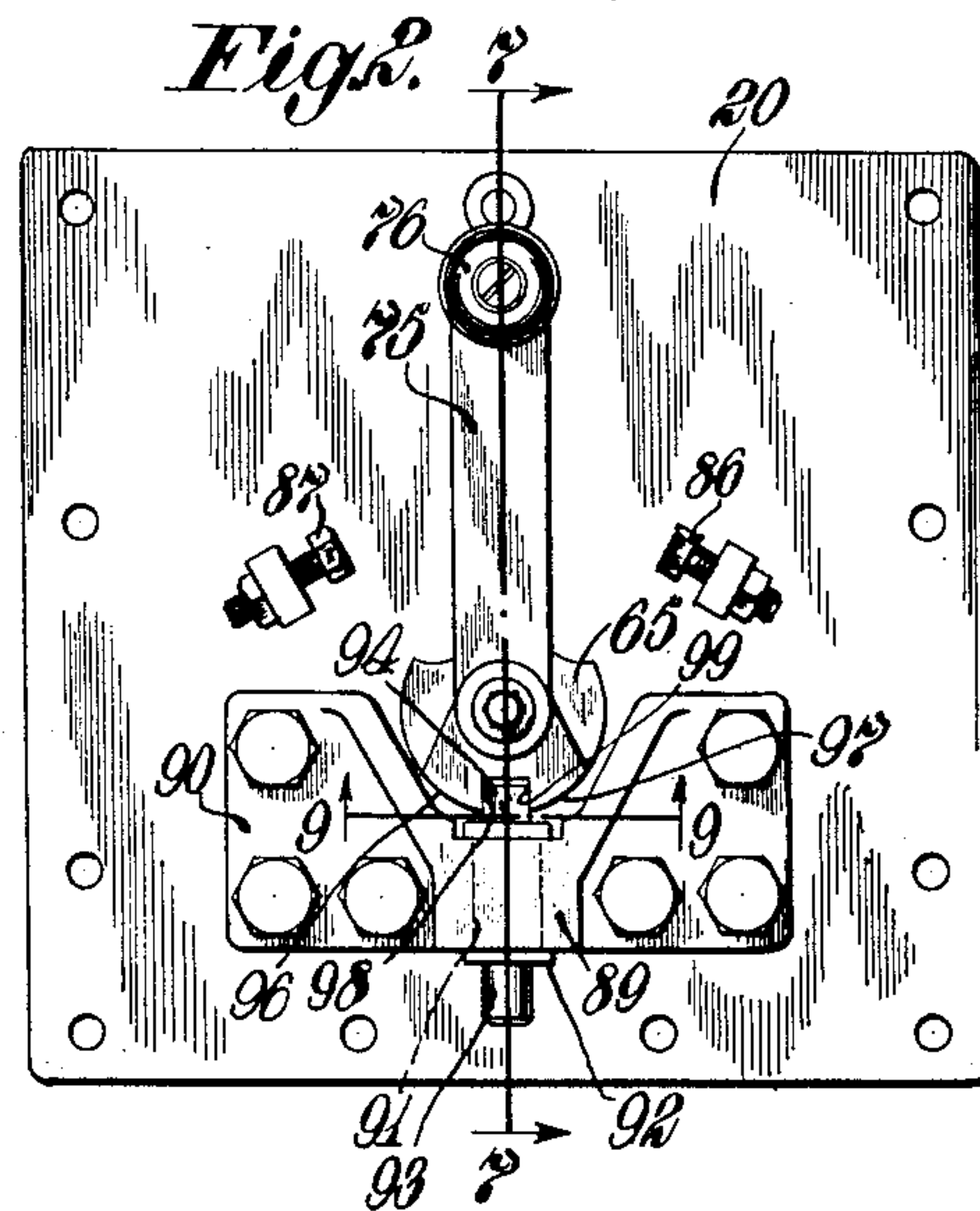
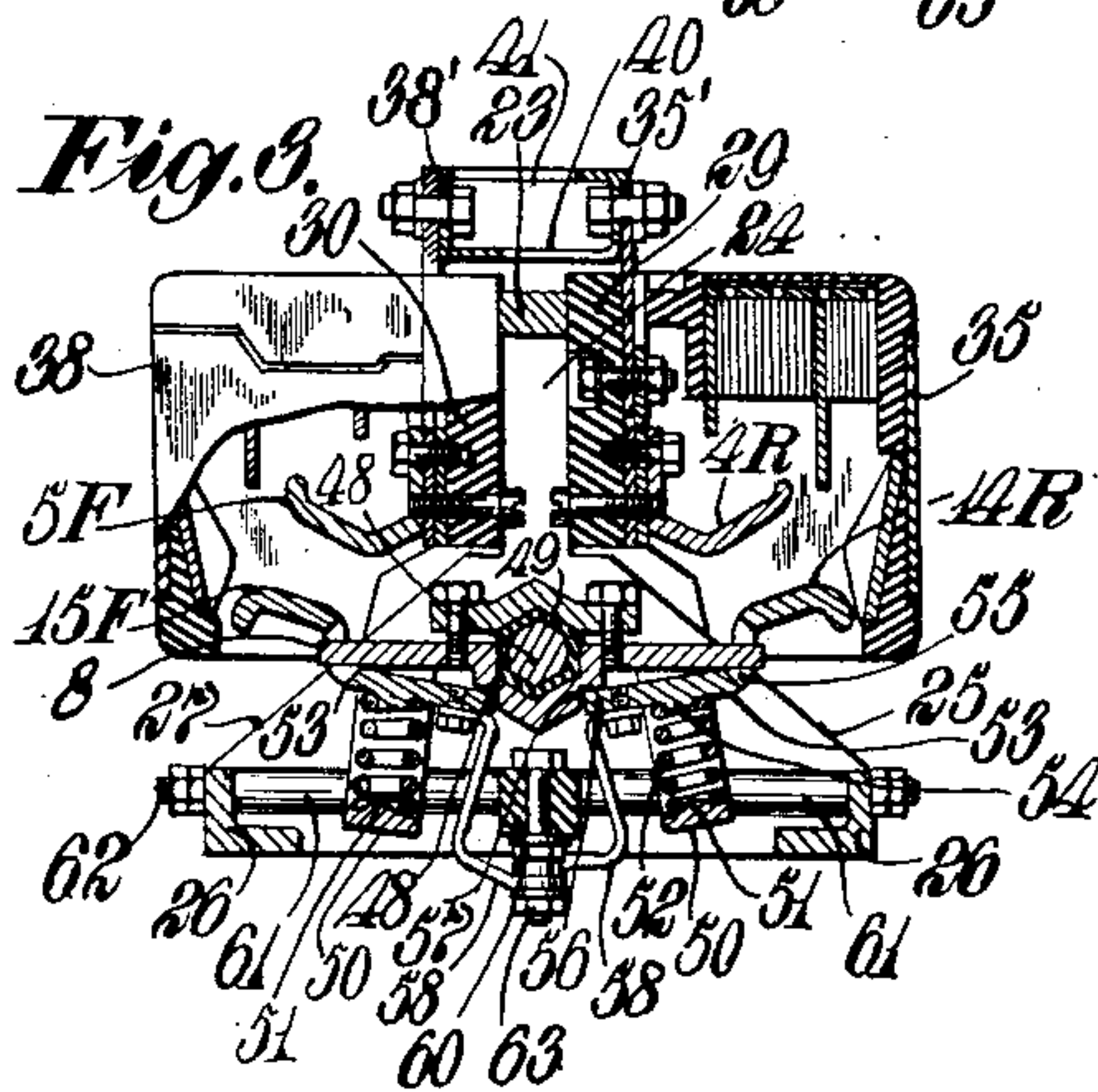
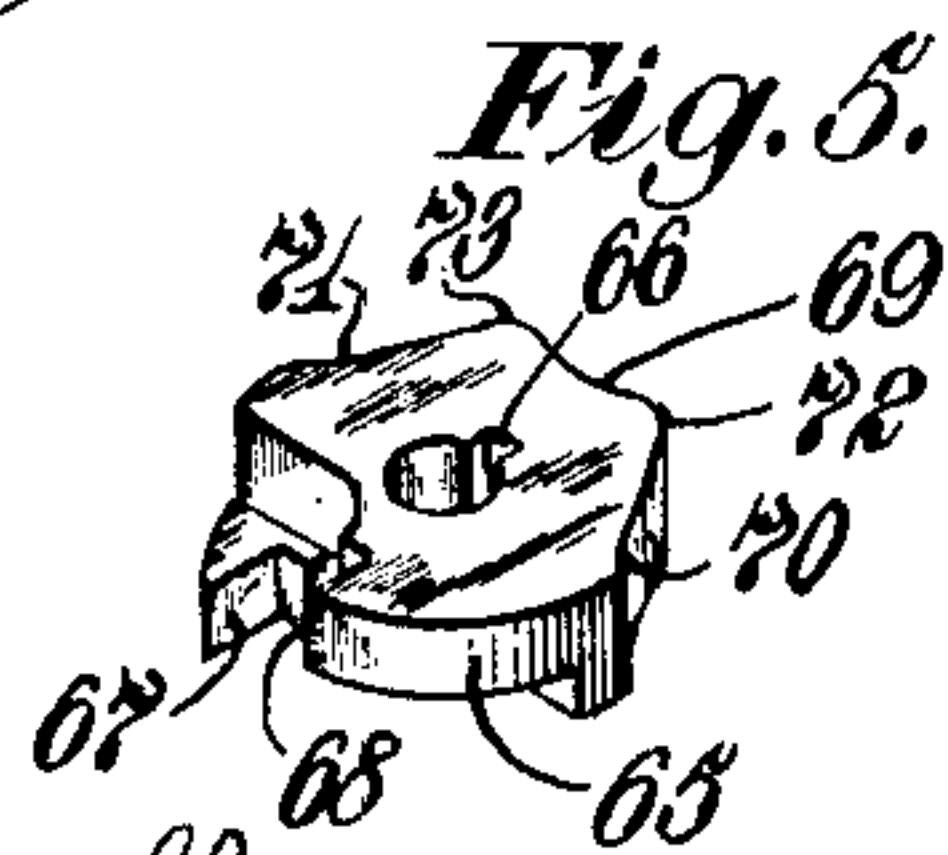
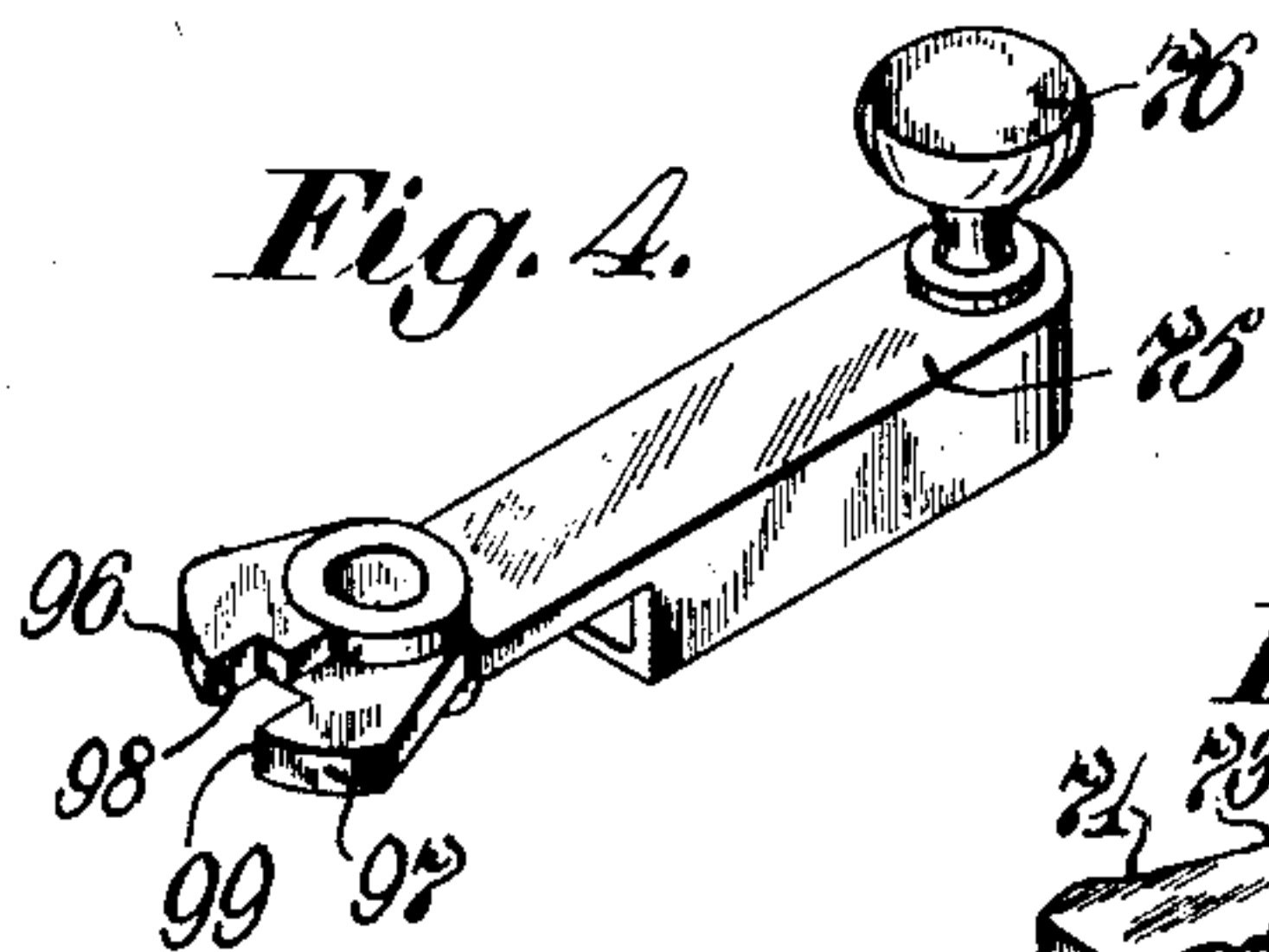
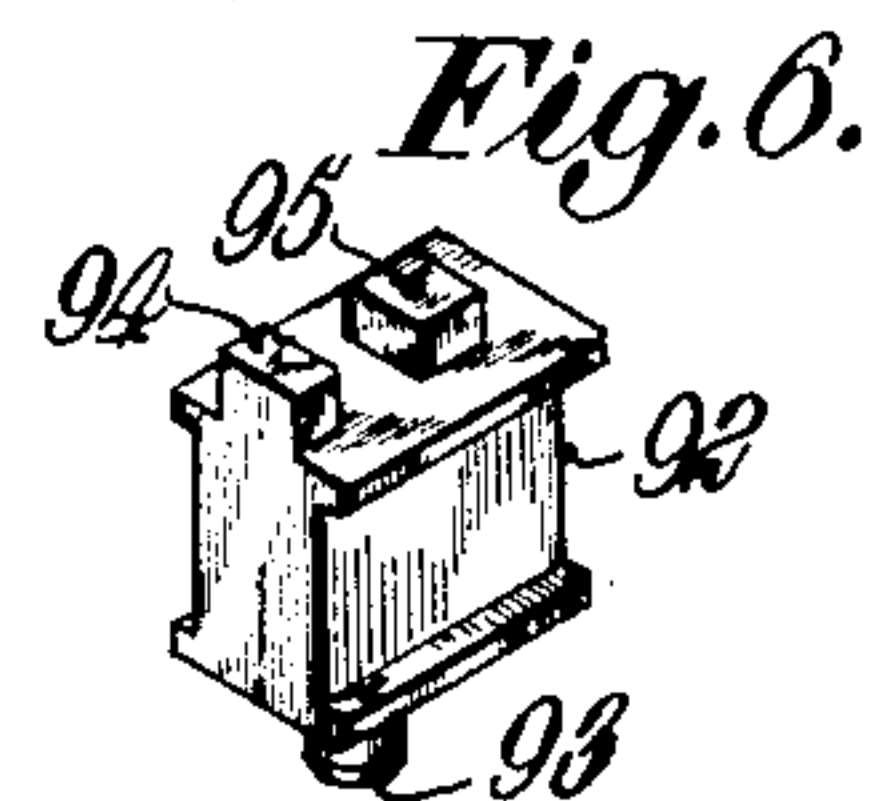
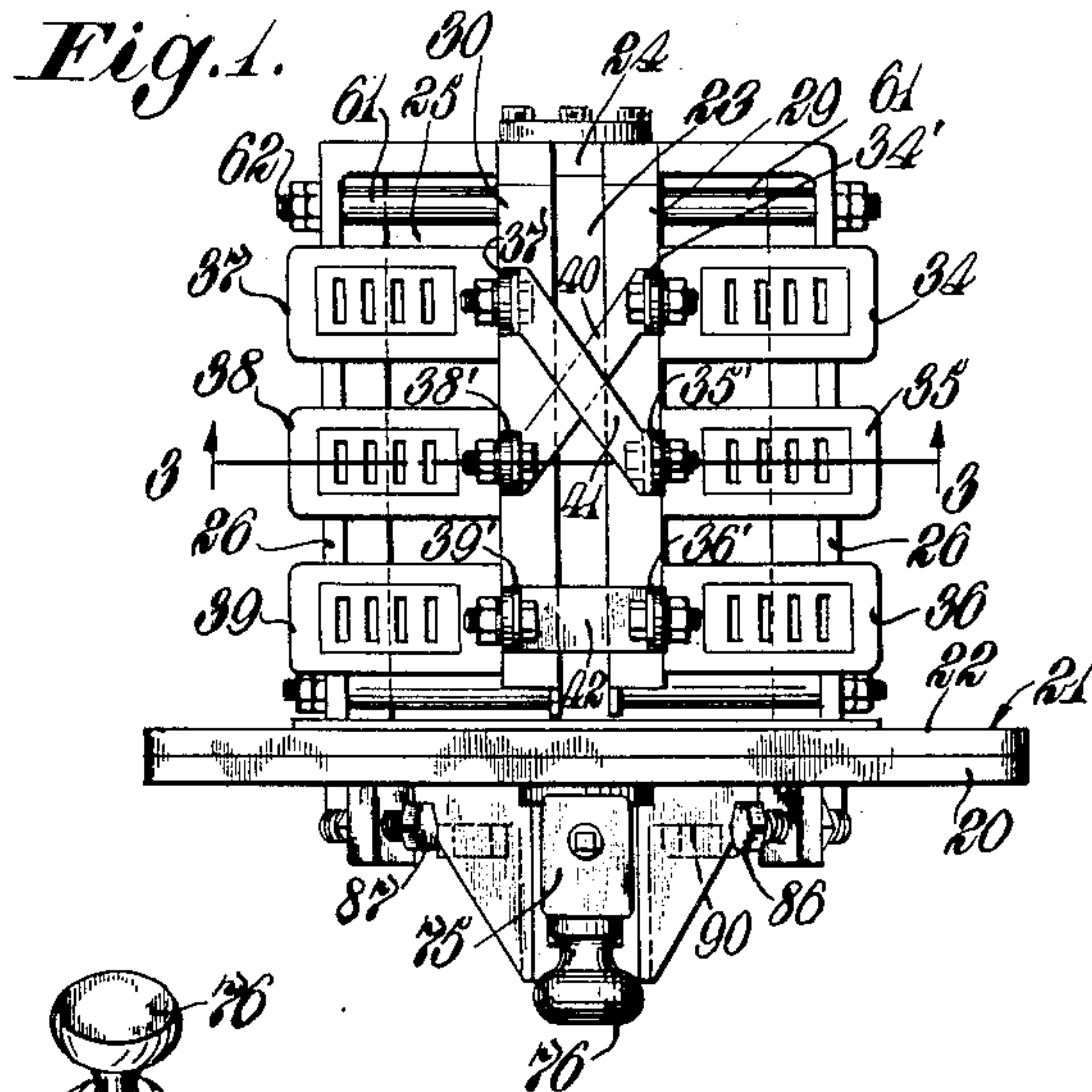
J. F. JOY

2,148,473

ELECTRICAL CONTROLLING APPARATUS

Filed Jan. 2, 1936

2 Sheets-Sheet 1



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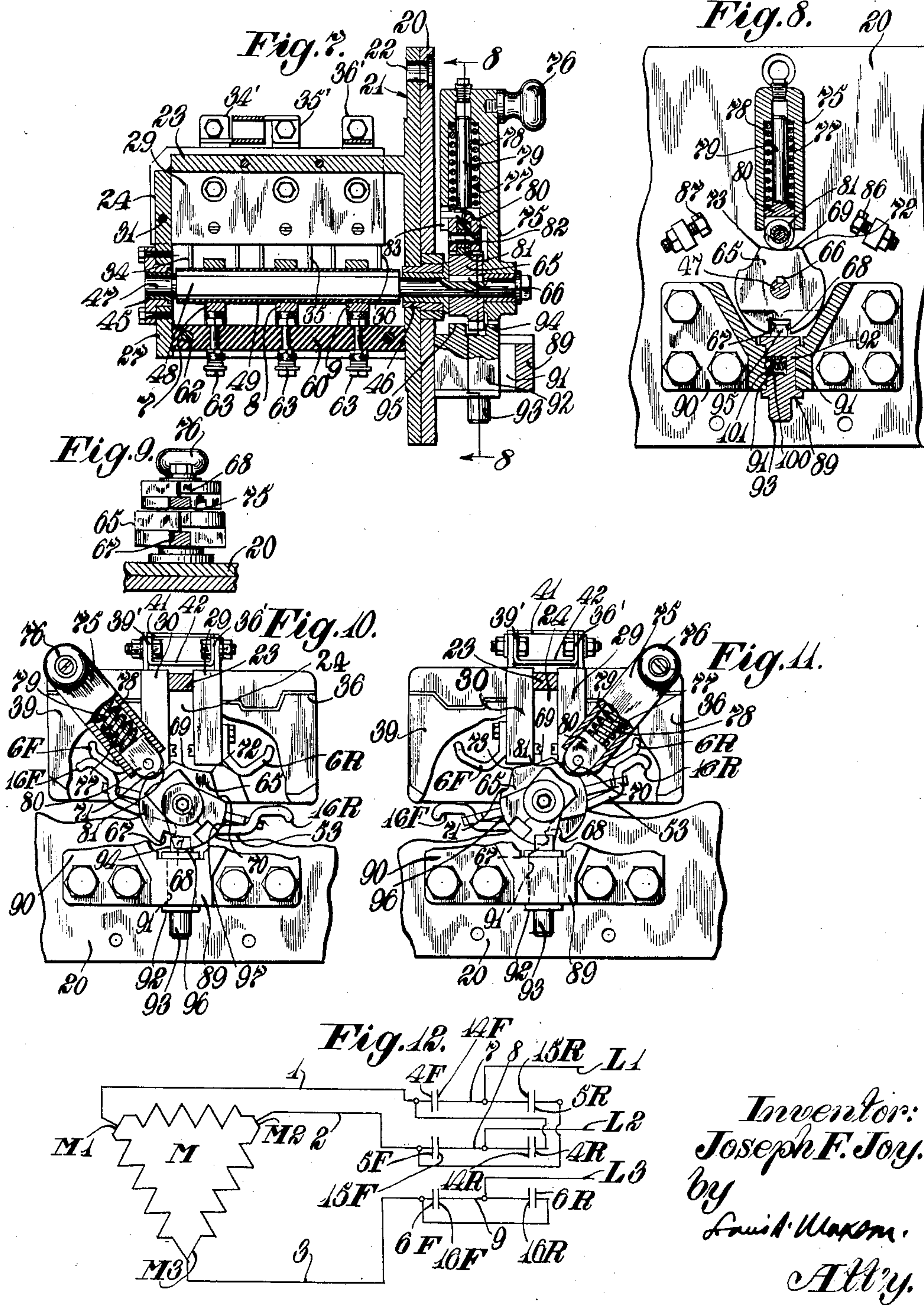
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ELECTRICAL CONTROLLING APPARATUS

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,148,473

ELECTRICAL CONTROLLING APPARATUS

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Application January 2, 1936, Serial No. 57,169

15 Claims. (Cl. 200—6)

My invention relates to electrical controlling apparatus, and more particularly to electrical controlling apparatus of the reversing contactor type.

5 An object of my invention is to provide an improved electrical controlling apparatus. Another object of my invention is to provide an improved reversing contactor. A further object of my invention is to provide an improved reversing contactor operating with a snap action, whereby burning of the contacts is minimized. A further object of my invention is to provide an improved snap actuating mechanism for an electrical controlling apparatus. Still another object of my invention is to provide an improved electrical controlling apparatus having improved interlocking means locking both the primary actuating element and the contactor device actuable thereby, so that the connections to be effected by the actuation of said device may be positively predetermined, and so that inadvertent reversal will be impossible. Other objects and advantages of my invention will hereinafter more fully appear.

25 In the accompanying drawings, in which one illustrative embodiment of the invention is shown for purposes of illustration—

Fig. 1 is a top view of the illustrative embodiment of the controlling apparatus, showing the same as it would appear from above when removed from its position in a suitable casing or compartment.

Fig. 2 is a front elevation of the apparatus shown in Fig. 1.

35 Fig. 3 is a vertical transverse section on the plane of the line 3—3 of Fig. 1, with parts shown in full.

Fig. 4 is a perspective view of an operating handle.

40 Fig. 5 is a perspective view of an operating cam.

Fig. 6 is a perspective view of an interlock.

Fig. 7 is a vertical longitudinal section on a plane corresponding to the line 7—7 of Fig. 2.

45 Fig. 8 is a vertical transverse section on the planes of the line 8—8 of Fig. 7.

Fig. 9 is a horizontal section looking upward on the plane of the line 9—9 of Fig. 2.

50 Fig. 10 is a more or less diagrammatic view, with parts in section and other parts broken away, showing the contactor device in one operating position.

Fig. 11 is a similar view, showing the operating parts in an opposite position.

Fig. 12 is a wiring diagram showing the connections of the apparatus.

Referring first briefly to Fig. 12, it will be noted that the motor M has its windings connected in delta, and that conductors 1, 2 and 3 lead from the connecting points of the windings M1, M2, and M3 respectively to stationary contacts 4F and 4R, 5F and 5R, and 6F and 6R. It will be noted, moreover, that operating bars 7, 8 and 9 respectively carry, at their opposite ends and electrically connected to them, appropriate contacts; the bar 7 carrying contacts 14F and 15R, the bar 8 carrying contacts 15F and 14R, and the bar 9 carrying contacts 16F and 16R. It will be observed that the power lines L1, L2 and L3 are each connected to one of the contact carrying bars and to the contacts thereon, the line L1 connected to the contacts 14F and 15R, the line L2 connected to the contacts 15F and 14R, and the line L3 connected to the contacts 16F and 16R. The three bars 7, 8 and 9 move together, as will later be described, and in one position connect contacts 4F and 14F, contacts 5F and 15F, and contacts 6F and 16F; while in the other operating position of the bars 7, 8 and 9, contacts 5R and 15R, contacts 4R and 14R, and contacts 6R and 16R are connected. It will be noted that with this arrangement a reversal of the position of the bars 7, 8 and 9 will effect a reversal of the motor in a well known manner.

Now, referring to the construction of the contactor device per se, of which the bars 7, 8 and 9 and the various contacts previously mentioned form a part, it will be noted that a front plate 20 has secured thereto a frame, generally designated 21, made up of a plate 22 carrying a rearwardly extending frame member 23 welded to the top portion 24 of another frame portion 25 which comprises a pair of side bars 26 of angular construction secured at their forward ends to the plate 22 and a rear plate portion 27 extending upwardly in parallelism with the plate portion 22. It will be observed that the portion 27 may be said to be held in spaced parallel relation to the plate portion 22 by three parallel, triangularly arranged brace or supporting portions 23, 26 and 26. Suitable insulating panels 29 and 30 are supported, as by suitable bolts 31, in parallel, forwardly and rearwardly extending relation at opposite sides of the upper portion of the frame part 23 and the upper part of the frame part 24. These support suitable removable arc boxes 34, 35, 36, 37, 38 and 39, the first three arc boxes mentioned being detachably mounted

upon the panel 29, and the other three detachably mounted upon the panel 30, in a well known manner. Appropriate arc boxes for this purpose are well known commercial articles, and it is therefore unnecessary to go into detail with respect to either their construction or their mode of removability from the panels 29 and 30. Each panel supports three stationary contacts, one within each of the arc boxes, and Fig. 3 shows the stationary contacts 4R and 5F, previously mentioned. Each of the stationary contacts is connected to an upwardly extending conductor strip, to which prime numbers corresponding to the numbers of the arc boxes have been applied. For example, the stationary contact 4R is connected to an upwardly extending, rigid contact strip 35'. These contact strips, the contacts, and the arc box supports are all appropriately supported by the panels 29 and 30. The contact strips 34', 38' and 35', 37' are respectively connected together by cross connections 40 and 41, while the contact strips 36' and 39' are cross connected by a connection 42.

Within a bearing bushing 45 formed in the plate 27, and another bearing bushing 46 carried by the plates 20 and 22, there is journaled an operating shaft 47 which has a polygonal portion 48 intermediate said bearings surrounded by an insulating cover 49 and having clamped thereto arms 7, 8 and 9. As will be apparent from Fig. 3, each of the arms 7, 8 and 9 comprises portions at opposite sides of the shaft 48, and each of the portions mentioned carries a stirrup-like part 50 having a button 51 on which a spring 52 reacts to maintain one of the movable contacts 14F, 15F, 16F, 15R, 14R, 16R yielding in position on the arm. As shown in Fig. 3, the movable contact elements comprise supporting portions 53 having buttons 54 also engaged by the spring 52 and loosely interlocked at 55 with an end of the supporting arm, while its other end, 56, seats in a recess 57 in the arm mounting. Pigtails 58 connect each of the supporting arms 53 with appropriate stationary contacts which will now be described.

A terminal board, so to speak, 60 is positioned between sleeves 61 on transverse bolts 62 extending between the frame parts 26 adjacent to and herein beneath the operating shaft 47; and the pigtails 58 previously mentioned are connected to suitable connector devices 63, to each of which one of the lines L1, L2 and L3 is connected. Now, from what has been described, it will be evident that the shaft 47, upon rocking in one direction, will move the yieldingly mounted contacts at one side thereof into engagement with one of the series of stationary contacts supported by the panels 29 and 30, while, upon a rocking movement in the opposite direction, the shaft 47 will cause the movable contacts at the other side thereof to engage the other set of stationary contacts.

To control the movement of the shaft 47 and with it the movable contacts, to prevent undesired movements thereof, and to insure a snap movement thereof, operating and controlling mechanism, which will now be described, is employed. The forward end of the shaft 47 is provided forwardly of the bearing bushing 46 with an operating cam 65 which is keyed thereto, as at 66. This cam has thereon two series of surfaces; at its lower portion it has interlock surfaces including a surface 67 near the rearward end thereof facing in one direction, and a surface 68 near the other end thereof facing in the opposite direction; these surfaces, when engaged by a suitable

abutment, respectively preventing rotation of the cam in mutually opposite directions. The cam member also has three other surfaces including a surface 69 which is depressed between its ends and which is directly opposite the space formed between the planes of the surfaces 67 and 68. It has a slightly concave throwing surface 70 and another slightly concave throwing surface 71, the surfaces 70 and 71 being at opposite sides of the surface 69 and separated from the latter by so-called speak humps 72 and 73, respectively.

In advance of the cam 65, the forward end of the shaft 47 carries an operating handle 75, which, while supported by the shaft 47, is rotatable relative thereto. This handle has an operating, manual grasping portion 76 and is provided with a longitudinally extending bore 77 in which an operating spring 78 surrounding a plunger 79 carrying a guide 80 slidably guided within the handle 75, is adapted to press the guide 80 radially toward the shaft 47 at all times. The guide 80 carries a cam-engaging roller 81, and a pin 82 cooperating with a slot 83 in the handle assures guided movement of the roller supporting guide.

Now, when the cam 65 occupies the position of Fig. 8, and the handle 75 occupies the position of that figure, there is no tendency to turn the cam 65 or the shaft 47. However, if the handle is thrown laterally in either direction so that the roller passes just beyond one or the other of the humps 72 or 73, the compression of the spring 78 will act to cause the roller 81 to turn the cam 65 to rock the shaft 47. Adjustable stop devices 86 and 87, to limit the motion of the handle 75, are provided on the face of the plate 20.

To prevent undesired motion of the cam 65, and also to lock the handle 75 in the position of Figs. 7 and 8, there is provided an interlock device 89 mounted in a suitable frame or support 90 secured to the face of the plate 20. The frame 90 provides a pair of spaced guide surfaces 91 between which there is slidably mounted an interlocking element 92 having a lower pin 93 to be grasped during the sliding of the member 92 longitudinally between its guides, and the member 92 is provided at its top with a pair of upstanding lugs 94 and 95, the lug 94 being adapted to cooperate with the handle in controlling the movement of the latter, and the lug 95 to cooperate with the surfaces 67 and 68 in controlling the movement of the cam 65. The handle 75 is provided with portions 96 and 97 at the opposite side of the shaft 47 from the main body of the handle and providing surfaces 98 and 99 respectively offset from each other longitudinally of the axis of pivotal movement of the shaft, but facing generally oppositely. The surfaces 98 and 99 are spaced sufficiently so that the lug 94 on the interlock 92 may slide longitudinally from a position in which one side thereof engages the surface 98 and prevents turning movement of the handle 75 in one direction, to a position in which the other side of the lug 94 may engage the surface 99 and prevent opposite movement of the handle 75. In like manner, the surfaces 67 and 68 are spaced sufficiently far apart in a direction perpendicular to their respective planes, so that the lug 95 on the interlock 92 may be slid from a position in which one side thereof engages the surface 67 and prevents turning of the cam 65 in one direction, to a position where the other side of the lug 95 engages the surface 68 and prevents opposite turning movement of the cam 65. It will be observed that the lug 94 will engage the surface 98 at the same time that the lug 95 engages the

surface 68, and that in the opposite position of the interlock 92 the lug 94 will engage the surface 99, while the lug 95 engages the surface 67. From this it follows that when the interlock is in one of its two motion-permitting positions, the cam 65 may turn in one direction about its axis, turning the shaft 47 with it in that direction; while the handle 75 is free to turn only in the direction opposite that in which the cam is free to move.

10 A suitably spring-actuated ball 100 cooperating with recesses 101 (of which one is shown in Fig. 8) in the guideway 91, holds the interlock 92 in different adjusted positions.

Now, the mode of operation of this apparatus will be apparent from what has already been said, but it may be summarized for convenience at this point. With the interlock member 92 in what may be called its intermediate position, the opposite faces of the lug 94 will engage portions of both the surface 98 and the surface 99 and lock the handle 75 in its mid-position. Concurrently, opposite faces of the lug 95 will engage portions of both the surface 67 and the surface 68; and the cam 65, and with it the shaft 47, will be locked in neutral position. In this position of the parts, no connections between the power lines and the motor will be made.

Now, if the operator grasps the pin 93 and moves the interlock 92 forwardly, this will effect disengagement of the lug 95 from the surface 67, and of the lug 94 from the surface 99. Accordingly, the handle 75 may be thrown clockwise, with reference to Fig. 8, and the cam 65, and with it the shaft 47, will be free to rotate counter-clockwise and thereby effect the movement of the parts to the position of Fig. 11. It will be evident that during the motion of the handle from its vertical position to the position shown in Fig. 11, engagement of the surface 68 with the lug 95 prevented clockwise turning of the cam 65.

It will be possible for the operator to move the handle back to mid-position without having to effect any change in position of the interlock 92; and if this is done, the action of the spring-pressed roller will be to restore the shaft 47 to its non-contact-making position. If the operator desires to bring about an opposite action of the motor, he will slide the contact block 92 rearwardly to disengage the lug 94 from the surface 98, and the lug 95 from the surface 68, and then the handle 75 may be thrown to the position shown in Fig. 10, with the result that the cam 65, and with it the shaft 47, will be thrown to the opposite contact-making position.

From the foregoing description, it will be clear that I have provided a simple, safe contactor device, adapted to lock the parts thereof in "off" position when desired, and effective to permit the establishment of forward or reverse connection at the will of the operator, but effective to preclude accidental making of any except the desired connections. It will be further noted that the device is effective to produce sharp, full snap movements of the contacts, thereby to minimize burning of the contacts. It will be observed that the device is built up of simple parts and is particularly free from any liability to mishap, due to its rugged and simple construction.

While I have in this application specifically described one form which my invention may assume in practice, it will be understood that this form is shown for purposes of illustration only, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a reverse switch, a shaft movable oppositely from a neutral position to establish opposite running conditions, a cam on said shaft, an element yieldably pressed against said cam, means for supporting and moving said element to different positions with respect to the cam including a neutral position and positions respectively at opposite sides of said neutral position, said cam having a surface upon which said element in said neutral position reacts to maintain said cam stationary and having surfaces at opposite sides of its first mentioned surface upon which said element reacts in its positions at opposite sides of its neutral position to impart opposite turning moments to said cam, and means coacting both with said cam and with the supporting and moving means for said element, for controlling the movements of both of the same.

2. In a reverse switch, a shaft movable oppositely from a neutral position to establish opposite running conditions, a cam on said shaft, an element yieldably pressed against said cam, means for supporting and moving said element to different positions with respect to the cam including a neutral position and positions respectively at opposite sides of said neutral position, said cam having a surface upon which said element in said neutral position reacts to maintain said cam stationary and having surfaces at opposite sides of its first mentioned surface upon which said element reacts in its positions at opposite sides of its neutral position to impart opposite turning moments to said cam, and interlocking means cooperating both with said cam and with the supporting and moving means for said element, for locking both of the same against movement in either direction or freeing the same for movements in mutually opposite directions.

3. In a reverse switch, a shaft movable oppositely from a neutral position to establish opposite running conditions, a cam fixed on said shaft, a handle rotatably mounted on said shaft and carrying a yieldably pressed cam engaging member, and interlocking means optionally movable to preclude movement of said cam in one direction and of said handle in the opposite direction.

4. In a reverse switch, a shaft movable oppositely from a neutral position to establish opposite running conditions, a cam on said shaft, a handle rotatably mounted on said shaft and carrying yieldingly-pressed cam-throwing means, and an interlocking device for controlling the movement both of said cam and of said handle, slidable longitudinally of said shaft to alter the movements permitted said handle and said cam.

5. In a reverse switch, a shaft movable oppositely from a neutral position to establish opposite running conditions, a cam on said shaft, a handle rotatably mounted on said shaft and carrying yieldingly-pressed cam-throwing means, and an interlocking device for controlling the movement both of said cam and of said handle, slidable longitudinally of said shaft to alter the movements permitted said handle and said cam and precluding movements of said cam in the same direction as said handle is moved.

6. In a reverse switch, a shaft movable oppositely from a neutral position to establish opposite running conditions, sets of movable contacts carried thereby, banks of stationary contacts selectively engageable by one or the other of said sets of movable contacts, means rotatable relative to said shaft for actuating said shaft in opposite

directions, and means for locking said shaft and said actuating means individually.

7. In a reverse switch, a shaft movable oppositely from a neutral position to establish opposite running conditions, sets of movable contacts carried thereby, banks of stationary contacts selectively engageable by one or the other of said sets of movable contacts, means for actuating said shaft in opposite directions, and means for locking said shaft and said actuating means individually, movable to release them only simultaneously.

8. In a reverse switch, a shaft movable oppositely from a neutral position to establish opposite running conditions, sets of movable contacts carried thereby, banks of stationary contacts selectively engageable by one or the other of said sets of movable contacts, means for actuating said shaft in opposite directions, and means for locking said shaft and said actuating means individually, movable to release them only simultaneously and for movements in angularly opposite directions.

9. In a reverse switch, a contact moving member movable oppositely from a neutral position to establish opposite running conditions, a cam fixed to said member, means movable relative to said cam while the latter remains stationary for causing the latter to move said member in directions generally opposite to the directions of movement of said means, and means for holding said cam against movement in the direction of movement of said movable means.

10. In a switch mechanism, a cam supported for turning movement, devices operatively connected with said cam and movable upon opposite movements of said cam from a neutral position to establish different running conditions, an element yieldingly pressed against said cam, means for supporting and moving said element to different positions with respect to said cam to cause the same to exert oppositely effective throwing forces on said cam, and means coacting with said cam and also coacting with said supporting and moving means for said element, for controlling the movements of each of the same.

11. In a switch mechanism, a cam supported for turning movement, devices operatively connected with said cam and movable upon opposite movements of said cam from a neutral position to establish different running conditions, an ele-

ment yieldingly pressed against said cam, means rotatable about the axis of turning of said cam for supporting and moving said element to different positions with respect to said cam to cause the same to exert oppositely effective throwing forces on said cam, and means coacting with said cam and also coacting with said supporting and moving means for said element, for controlling the movements of each of the same.

12. In a switch mechanism, a cam supported for turning movement, devices operatively connected with said cam and movable upon opposite movements of said cam from a neutral position to establish different running conditions, an element yieldingly pressed against said cam, means rotatable about the axis of turning of said cam for supporting and moving said element to different positions with respect to said cam to cause the same to exert oppositely effective throwing forces on said cam, and means coacting with said cam, as distinguished from the means for exerting a throwing force thereon, for controlling the turning thereof.

13. In a switch mechanism, a cam supported for turning movement, devices operatively connected with said cam and movable upon opposite movements of the latter from a neutral position to establish different operating conditions, means for selectively exerting on said cam throwing forces operative to turn the same in opposite directions, and means coacting individually with said cam and with said force-exerting means for locking both of the same.

14. In a switch mechanism, a cam movable oppositely to effect different operating conditions, means for selectively exerting thereon forces respectively operative to throw the same oppositely, and means for individually locking both said cam and said force-exerting means.

15. In a switch mechanism, a shaft movable into any one of a plurality of positions to effect different operating conditions, means for effecting a snap actuation of said shaft including a cam movable with said shaft and means movable relative to said shaft and coacting with said cam, and means for selectively locking said cam and said last mentioned means against movement in the same direction or against movement in any direction.

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