June 17, 1941. W. M. SCOTT, JR 2,246,072

SWITCHING MECHANISM

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Fig. 1.

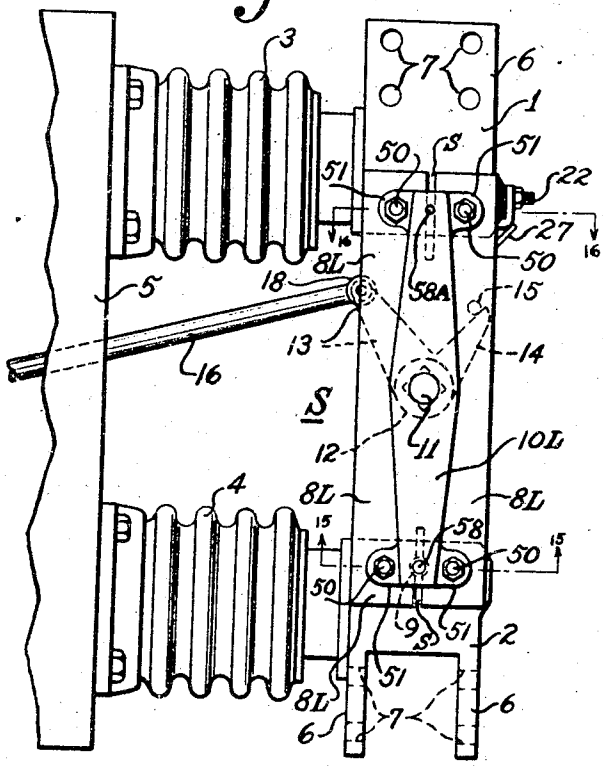


Fig. 2.

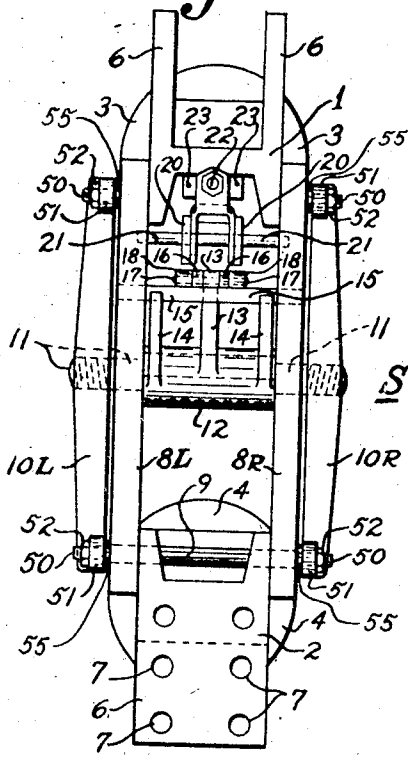


Fig. 3.

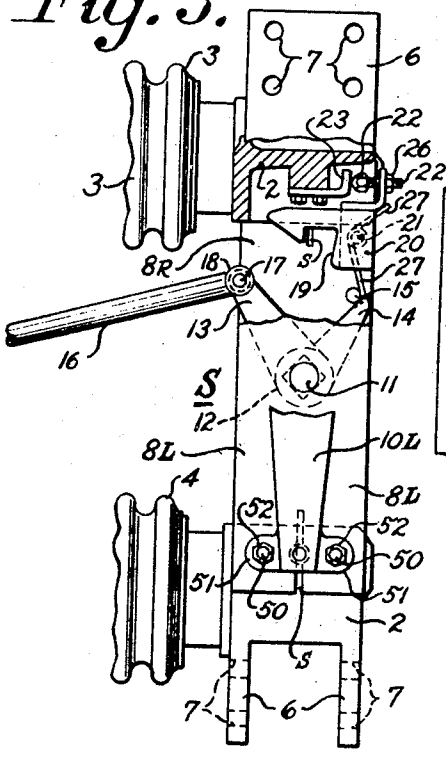
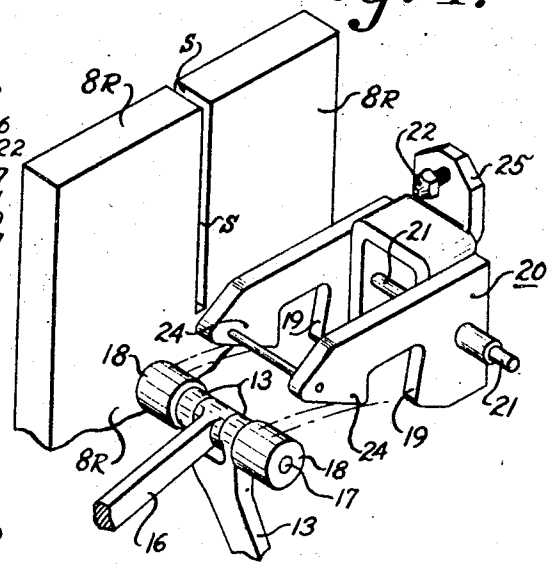


Fig. 4.



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June 17, 1941. W. M. SCOTT, JR 2,246,072

SWITCHING MECHANISM

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Fig. 5.

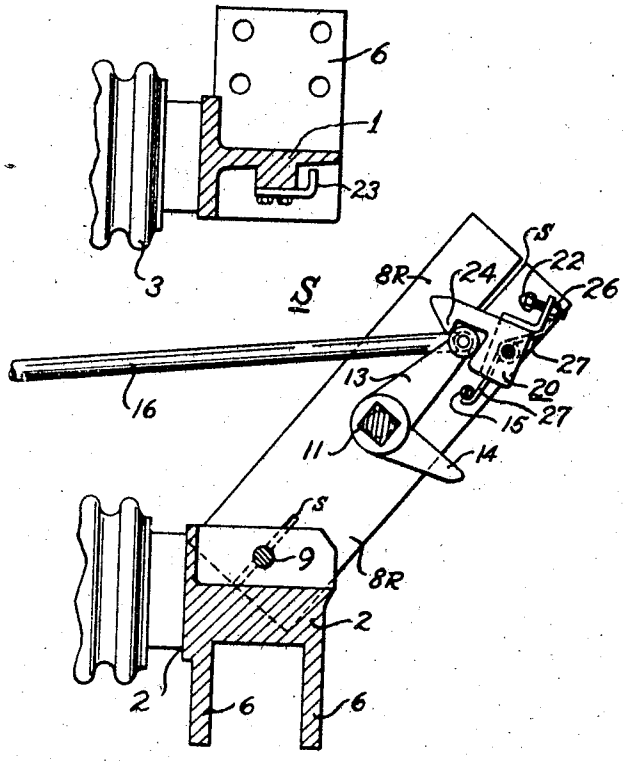


Fig. 13.

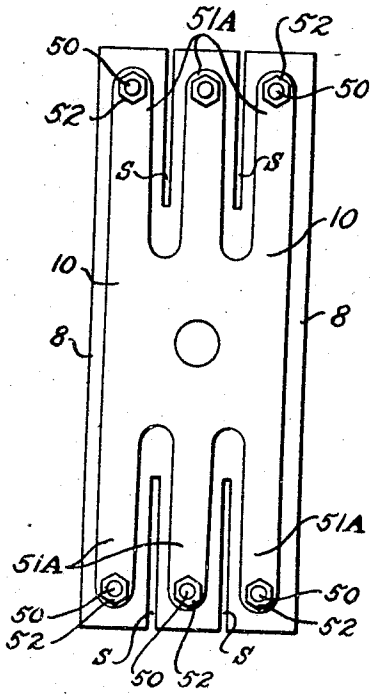
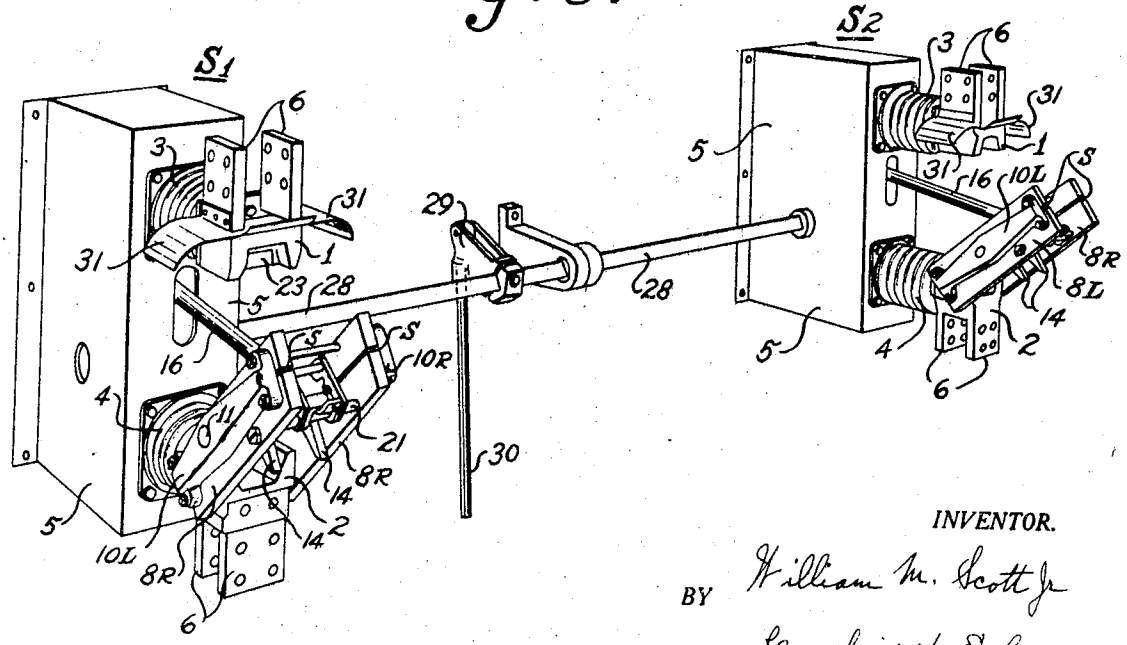


Fig. 6.



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SWITCHING MECHANISM

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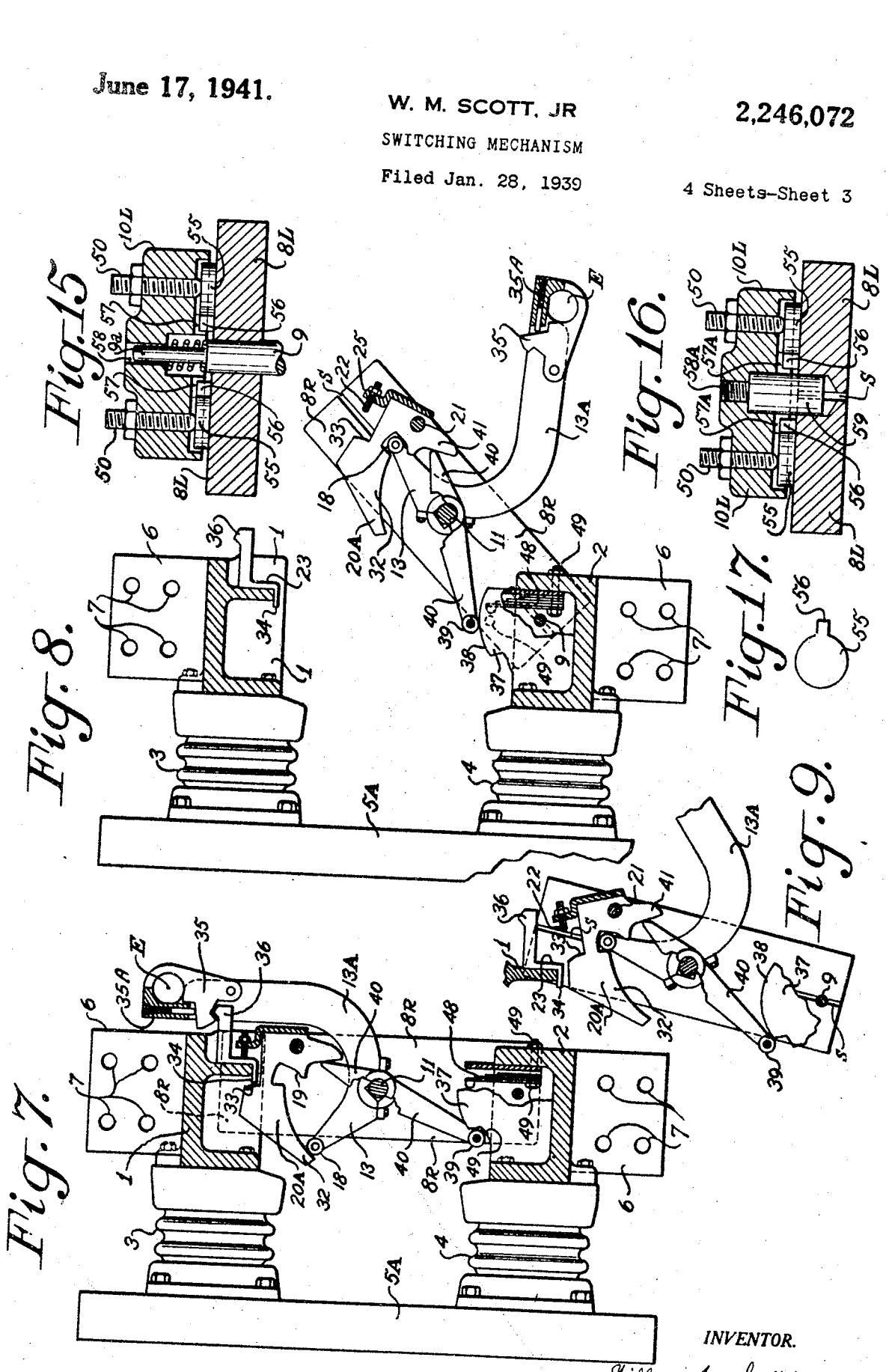

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SWITCHING MECHANISM

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Fig. 11.

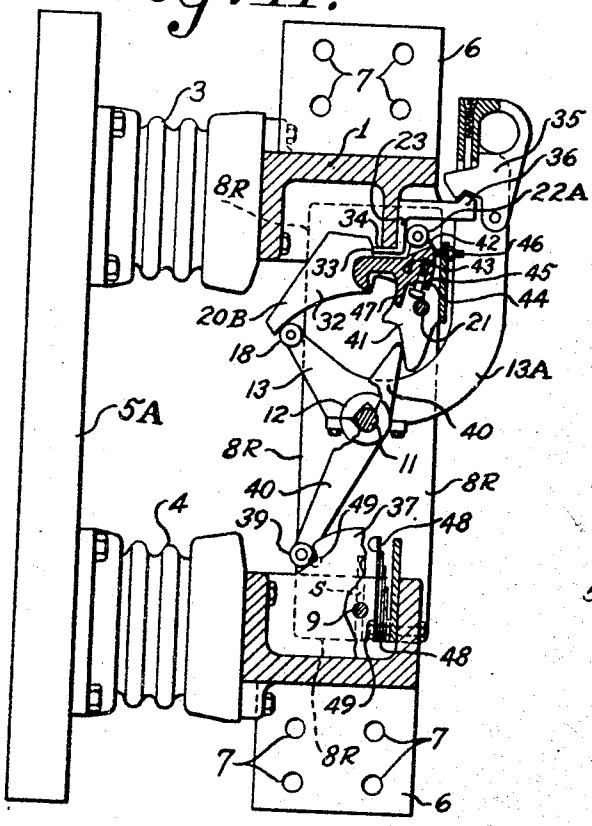


Fig. 12.

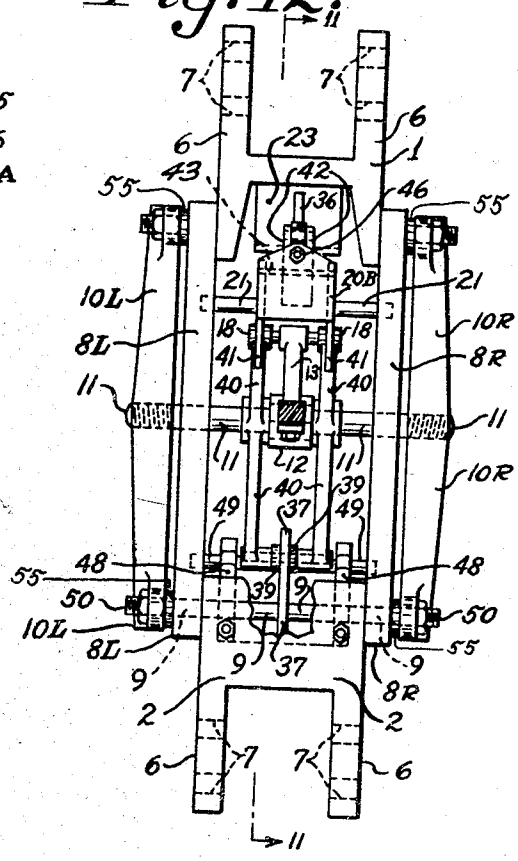


Fig. 10.

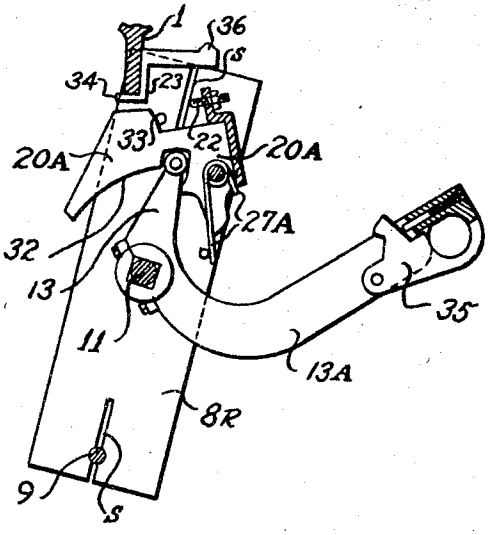
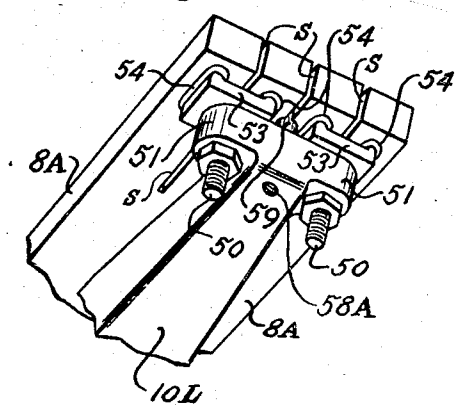


Fig. 14.



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Patented June 17, 1941

2,246,072

UNITED STATES PATENT OFFICE

2,246,072

SWITCHING MECHANISM

William M. Scott, Jr., Bryn Mawr, Pa., assignor to I-T-E Circuit Breaker Company, Philadelphia, Pa., a corporation of New Jersey

Application January 28, 1939, Serial No. 253,426

23 Claims. (Cl. 200—162)

My invention relates to circuit-controlling devices, and particularly to electric switches of the type having an operating member for effecting relative movement of the switch contacts and for actuating means for clamping those contacts to each other in closed-circuit position.

In accordance with one aspect of my invention, there is provided, between the operating member and the movable contact structure, a latch, or system of latches, constructed and arranged to insure transition from actuation of the movable contact structure to actuation of said clamping means by said operating member at a definitely predetermined position of the movable contact structure; more particularly, in some forms of my invention, the latch, or latch system, is adapted, upon release of the operating member from the movable contact structure for actuation of the clamping means, to lock the contact structures against relative movement until the operating member is relocked to the movable contact structure for moving it away from the fixed contact structure.

Furthermore in some forms of my invention, there is provided cam structure which positively prevents actuation of the latch for release of the operating member from the movable contact structure except when the contacts are in closed-circuit position.

My invention further resides in the features of construction, combination and arrangement hereinafter described and claimed.

For an understanding of my invention, and for illustration of some of the various forms it may take, reference is to be had to the accompanying drawings, in which:

Fig. 1 is a side elevational view of a switch in closed-circuit position;

Fig. 2 is a front elevational view of the switch of Fig. 1;

Fig. 3 is a side elevational view, partly in section and with parts broken away, of the switch of Fig. 1;

Fig. 4, in perspective, and on enlarged scale, shows latch structure appearing in Figs. 2 and 3;

Fig. 5 is a side elevational view, in section, showing the relation between parts appearing in Fig. 3 for open-circuit position of the switch;

Fig. 6, in perspective, illustrates several switches, of the type shown in Figs. 1 to 5, mechanically connected for simultaneous operation;

Fig. 7 is a side elevational view, partly in section, of a modification of the switch shown in Figs. 1 to 5;

Figs. 8 and 9 are side elevational views, partly in section, showing parts appearing in Fig. 7 in different operative relations;

Fig. 10 is a fragmentary side elevational view, partly in section, of a modification of the switch shown in Figs. 7 to 9;

Fig. 11 is a side elevational view, partly in section, of a modification of the switch shown in Figs. 7 to 9;

Fig. 12 is a front elevational view of the switch of Fig. 11 with parts omitted or broken away;

Fig. 13 is a side elevational view of a modified form of contact structure, which may be substituted for the movable contact structure of any of the switches of Figs. 1 to 12;

Fig. 14, in perspective, illustrates another modification of the movable contact structure of Figs. 1 to 12;

Figs. 15 and 16 are sectional views taken on lines 15—15 and 16—16 of Fig. 1;

Fig. 17 is a plan view of an element shown in Figs. 15 and 16.

Referring to Figs. 1 to 5, the switch S comprises the fixed contacts or terminals 1, 2 suitably mounted upon insulators 3, 4 attached at their bases to the housing or support 5. For connection with bus bars, the contacts 1, 2 are provided with extensions 6 to which the bus bars may be clamped by bolts passing through the holes 7. The movable contact structure for completing connection between the contacts or terminals 1, 2 comprises the contact members or blades 8L, 8R, slotted at their contacting ends and pivotally mounted upon the contact 2 as by the pin 9. The clamping bars 10L, 10R which overlie and extend lengthwise of the movable contact members 8L, 8R threadably receive intermediate their ends, directly or by nuts adjustably clamped thereto, the oppositely threaded ends of pin 11 which extends through the contact members 8L, 8R and which, between these contact members, passes through the hub 12 of an operating member or arm 13. In the particular construction shown, the central portion of the pin 11 is square in cross-section to fit the bore of hub 12 which is of similar cross-section; any other arrangement providing for rotation of the pin 11 with arm 13 about the axis of pin 11 as a pivotal axis may be utilized.

The threads at the opposite ends of the pin 11 are respectively left and right-hand threads, so that upon counterclockwise rotation of arm 13 about its pivotal axis to the position shown in Figs. 1 and 3, the clamping bars 10L, 10R are drawn toward each other to clamp the movable contact blades 8L, 8R against the fixed contacts

1, 2. Alternatively, the pin 11 may be threaded only at one end, the unthreaded end having a head or shoulder bearing against the associated clamping bar. Counterclockwise or contact-clamping movement of arm 13 about its pivot 11, that is, with respect to the movable contact structure, may be limited, as by provision of arms 14 attached to or integral with hub 11, Figs. 1 and 3, and engageable by stop pin 15 extending between the movable contact members 8L, 8R.

The clamping and unclamping movement of arm 13 may be effected by link 16 pivotally connected to the free end of arm 13, as by pin 17, and extending between the contact blades BL, BR, between the insulators 3, 4 and through the base or housing member 5.

When arm 13 is in the position shown in Figs. 1 and 3 for which the contacts are clamped in closed-circuit position, it is free of the latch 20, which as hereinafter described, locks the arm to the movable contact blades for their movement toward and from closed-circuit position. Latch 20 is pivotally mounted upon pin 21, extending between the movable contact blades 8L, 8R, remote from pivot pin 9.

When arm 13 is rotated in clockwise direction about its pivot pin 11 from the position shown in Figs. 1 and 3 to reduce the pressure between the fixed and movable contact structures, the rollers 18 carried by arm 13 finally engage the surfaces 19 of latch 20, and upon continued movement in clockwise direction effects counterclockwise movement (now reversed with respect to the clockwise movement of contact structure 8L, 8R) of latch 20 about its pivot 21. Because of engagement between the element 22, attached to or part of the latch 20, and the abutment or fixed stop 23, suitably attached to or part of the stationary contact structure 1, this reverse or counterclockwise movement of the latch about its pivot 21 is accompanied by, and in fact effects movement of the movable contact structure in clockwise direction about its pivot pin 9. Briefly restated, the continued clockwise movement of arm 13 from the position of Fig. 3 first effects reduction or release of the contact-clamping pressure and then, upon engagement with latch 20, by continued movement, coacts with the latch 20 and abutment 23 to move and pry the movable contact structure 8L, 8R from the position shown in Figs. 1 and 3. The counterclockwise movement of latch 20 about its pivot 21, and now moving with blades 8L, 8R in clockwise direction about pivot 9, also causes the hooked end 24 of the latch, Fig. 4, quickly and immediately to drop over the rollers 18 on arm 13 and so lock arm 13 to the movable contact structure with the result that both the arm and the contact structure move as a unit about the pivot pin 9, upon further movement of link 16 to the right, as viewed in Figs. 1, 3 and 5, to the full open-circuit position.

Arm 13 remains latched to the movable contact structure during reverse or circuit-closing movement until just before the movable contact structure again reaches the closed-circuit position shown in Figs. 1 and 3, at which time the abutment 23 is engaged by the stop 22 of the latch so that, for the now slight additional movement in counterclockwise direction of the movable contact structure to definitely predetermined closed-circuit position, the latch 20 is rotated about its pivot 21 in clockwise (reversed with respect to the counter-clockwise movement of the contact structure 8R, 8L) direction quickly and immediately to swing the hooked end 24 of the latch 20 clear of the rollers 18. The remoteness from the pivot pin 9 of the point of engagement between the fixed stop or abutment 23 and the latch element 22, and the relatively reverse directions of movement of the latch and the movable contact structure about their respective pivots upon engagement of stop 23 by latch element 22, cumulatively insure that, for successive operations of the switch, the transition from contact-movement to contact-clamping by arm 13 occurs always at a definitely predetermined circuit-closing position of the movable contact structure 8L, 8R, thus to insure always a definite area of engagement between the switch contacts when the switch is closed; the definiteness of the transition point also insures that for successive operations of the switch a predetermined desired contact pressure always obtains upon movement of arm 13 to its extreme and limited position of Figs. 1 and 3. This transition point is determined with nicety by adjustment of element 22 with respect to latch 20 which carries it; in the particular construction shown in Figs. 1 to 5, element 22 is threadably received by extension 25 of latch 20 and is locked in adjusted position by nut 26. Preferably the latch 20 is biased to its arm-locking position, Fig. 5, as by spring 27, which may be coiled about pivot pin 21 with its ends in engagement, respectively, with the latch 20 and aforesaid stop bar 15 on the movable contact structure.

Each of the switch units S1, S2 of the multipole switch of Fig. 6 is similar to the switch of Figs. 1 to 5; their operating links 16 extend into the housings 5 for connection therein, beyond or behind the plane of support of the contact structures, with arms (not shown) connected to the opposite ends of bar or shaft 28 to which is suitably attached an arm 29 pivotally connected to a link 30 which may be operated manually, or by any suitable motor device, to open or close the switches. The particular units illustrated in Figs. 1 to 6 will serve for heavy duty outdoor service as disconnect switches for bus bars. The thin sheet-metal members 31 extending outwardly from each of the upper fixed contacts 1 serve as weather guards or petticoat shields.

In the modified form of switch shown in Figs. 7 to 9, the latch 20A, generally corresponding with latch 20 of Figs. 1 to 5, has extensions 32 along whose arcuate faces the rollers 18 on arm 13 ride as the arm is moved to and from its contact-clamping position, Fig. 7. With latch 20A in the position shown in Fig. 7, the center of the radii of curvature of the arcuate faces of extensions 32 substantially corresponds with the pivotal axis of the arm 13, with the result that arm 13 throughout its actuation of the clamping means locks the latch 20A in position shown in Fig. 7 until, during unclamping movement of the arm, its rollers 18 engage the faces 19 of the latch 20A to initiate circuit-opening movement of the movable contacts 8L, 8R. Throughout the engagement of arm 13 with the extension 32 of latch 20A, the shoulder 33 of latch 20A cooperates with the stationary abutment 34 to lock the movable contact structure to the fixed contact structure.

Upon movement of arm 13 in clockwise or unclamping direction from the position shown in Fig. 7, the clockwise rotation of the threaded pivot pin 11 first effects unclamping of the contacts, and then, upon continued movement of arm 13 in the same direction, it engages the surfaces 19 of

the latch 20A to rock the latch 20A in reverse or counterclockwise direction to release the latch from the stationary abutment 34, thus releasing the movable contact structure from locking engagement with the fixed contact structure, substantially concurrently to effect locking engagement between the latch 20A and the arm 13, and, by coaction between the abutment 23 and the latch element 22, to initiate movement of the movable contact structure from its closed-circuit position even before the arm 13 is fully latched.

Switches of this type are usually either installed with the base 5A vertical, as in Figs. 7 and 8, or with the base 5A horizontal with the supporting insulators 3, 4 and the switch structure depending therefrom. In both cases, the weight of arm 13A biases it to unclamping position.

To avoid unintentional reduction of the contact pressure and possible subsequent opening of the switch, the arm 13A, an extension of arm 13, is provided with a pivoted latch 35 which, when the arm 13A is in the position shown in Fig. 7, locks the arm 13A to the stationary contact structure by engagement with the notched element 36. The latching of the operating arm 13A in this position is particularly desirable in installations where the switch is subjected to continued vibration tending to cause the arm 13A to move in the unclamping direction, so reducing the contact pressure with possible injury to the contacts.

Preferably the latch 35 is extended to comprise one element of the eye E so that when the end of a hook stick is inserted in the eye for opening the switch, the initial movement of the hook stick rocks the latch 35 against the bias of its spring 35A to release the arm 13A from stationary member 36. Further movement of the hook stick first effects unclamping of the contacts by clockwise movement of arm 13 about its pivot 11, and then, upon latching of the arm to the movable contact structure, effects movement of the movable contact structure with the arm 13A from the closed-circuit to the open-circuit position.

To close the switch from the open-circuit position, Fig. 8, the arm 13A is pushed upwardly, by a hook stick, and because the arm, at this time, is locked by latch 20A to the movable contact structure the arm and the contact structure pivot as a unit about the pin 9. Just before the movable contact structure reaches its final circuit-closing position, the latch element 22 engages, remote from the pivot 9, the fixed abutment 23, so that for continued movement of the contact structure in counterclockwise direction, the latch 20A, because of engagement with abutment 23, swings about its pivot 21 in reverse or clockwise direction to release the arm 13 for contact-clamping movement about its pivot 21 with respect to the movable contact structure, and substantially concurrently to lock the movable contact structure to the fixed contact structure, thus insuring always a definite closed-circuit position of the movable contact structure whenever it is released from the arm 13 for actuation, by arm 13, of the contact-clamping means.

In this modification also, the remoteness from the pivot pin 9 of the point of engagement between the abutment 23 and the latch element 22, and the reverse movements of the latch and the movable contact structure about their respective pivots upon engagement of stop 23 and latch element 22, cumulatively insure that for successive operations of the switch the transition from contact movement to contact clamping occurs always at a definite and predetermined position which may be varied by suitable adjustment of element 22 with respect to the latch 20A which carries it.

With the construction as thus far described, the latch 20A can be released, accidentally or by tampering, when the switch is in the open-circuit position, thus making possible movement of arm 13A with respect to the movable contact structure to change the position of the clamping bars with consequence that if the switch is thereafter closed, the contact pressure may be either insufficient or excessive.

Positively to lock the latch in engagement with the arm 13A to prevent actuation of the contact-clamping means at all times except when the movable contact structure is in closed-circuit position, there is provided a cam 37, which may be adjacent pivot 9, having an arcuate surface 38 whose center of curvature substantially coincides with the axis of the pivot pin 9. Surface 38 engages roller 39 attached to one end of an arm 40 loosely mounted upon pin 11 and whose other end remains in locking engagement with the extension 41 of latch 20A throughout movement of the contact structure toward and from its closed-circuit position. Substantially concurrently with, or immediately before, engagement of abutment 23 by the latch element 22, the roller 39 abruptly rides off the arcuate surface 38 of cam 37, Fig. 9, to permit clockwise movement of latch 20A about its pivot 21.

Substantially concurrently with actuation of latch 20A for release of the movable contact structure for movement from the closed-circuit position, the roller 39 on arm 40 rides up on the cam 37 to its arcuate surface 38; substantially concurrently latch 20A relocks arm 13 to the movable contact structure, the cam surface 38 coacting with extension 41 of the latch arm 40 to preclude relative movement between the arm 13A and the movable contact structure until the movable contact structure is again returned to closed-circuit position.

In the modification shown in Figs. 7 to 9, it is not necessary to provide any biasing means for the latch 20A because all its movements are positively effected.

In the modification shown in Fig. 10, similar to that of Figs. 7 to 9, except for omission of cam 37 and arm 40, the latch 20A is biased toward engagement with the rollers 18 on arm 13A by the spring 27A; operation of this modification is apparent from explanation of the operation of Figs. 7 to 9.

The modification shown in Figs. 11 and 12 is similar to that of preceding figures except for the particular latching arrangement between the operating arm 13 and the movable contact structure 8L, 8R. The latch 20B is similar to latch 20A, Fig. 7, except that the latch element 22, Fig. 7, for engaging the abutment 23 is replaced by a second latch 42, Fig. 11, pivotally mounted upon pin 43 extending between the two side members of latch 20B and having an extension or roller 22A for engaging abutment 23. To provide for over-center snap action of the latch 42, there is provided the pin 44 slidable in a recess in the latch and biased by spring 45 within the recess against pivot pin 21 of latch 20B. Movement of snap-latch 42 in clockwise direction about its pivot 43 is limited by the adjustable stop 46 of the main latch 20B. Movement in the reverse direction of the latch 42 about its pivot 43 is

limited by engagement between the tail 47 of the latch and the pivot 21 of the main latch.

Upon movement of the contact structure and the operating arm toward the position shown in Fig. 11, the fixed abutment 23 first engages the roller 22A of the snap-latch 42, whereupon for slight further movement of the movable contact structure, the snap-latch 42 quickly moves to the position shown in Fig. 11, to release the arm 13, the engagement between latch 42 and the stop 46 of the main latch 20B causing the main latch to swing about its pivot 21 to bring its abutment 33 behind the stationary abutment 34 to lock the movable contact structure to the fixed structure and concurrently to release the arm 13 for its actuation of the clamping means. Throughout the movement of the arm 13 from the position at which it is initially released from the latches for actuation of the clamping means, and until it returns to position relocking the arm 13 to the movable contact structure, the rollers 18 on the end of arm 13 contact the arcuate surfaces of the extensions 32 of the latch 20B to lock the latch 20B in the position shown in Fig. 11, for which it is effective to prevent relative movement of the fixed and movable contacts of the switch.

In both modifications, Figs. 7 to 9, and 11, 12, there are preferably provided the spring buffers 48, 48 secured to the lower contact member 2 between the movable contact blades 8L, 8R for engaging the pins 49, or equivalent, projecting inwardly from the inner faces of the contact blades. Each of the yielding stops or buffers 48 preferably comprises a plurality of spring members, of progressively increasing lengths suitably held, as by bolt 49, against an inner face of the contact member 2.

Each of the movable contact blades of Figs. 1 to 14 is slotted, as indicated at S, at their opposite ends to provide separate fingers between each of which and the clamping bar is interposed an adjustable element. Referring, for example, to Figs. 1 and 2, the upper and lower ends of the clamping bar 10L extend over the split or slotted ends of the contact member 8L; the four pins 50 which threadably pass through the four extensions 51 of the clamping bar 10L are individually adjustable to provide for the desired substantially equal distribution of the total pressure applied by the clamping bar to the four contact fingers, and are held in their adjusted position, as by lock nuts 52.

In the modification shown in Fig. 13, the movable contact member 8 is provided at each end with three contact fingers or elements, and the clamping bar 10 is correspondingly modified so that each of the extensions or pressure-applying elements 51A overlies one of the fingers; with each of the extensions is associated an adjustable pin 50 to provide for the desired distribution of pressure between the individual fingers of this digitate contact member. Preferably, the extensions or elements 51A have substantially similar load-deflection characteristics.

In the modification of the movable contact structure of Fig. 14, the contact 8A has slots at one or both ends to provide four contact fingers or digits; the clamping bar 10L is the same configuration shown in Figs. 1 to 12; but with each of the two individually adjustable pressure distributing members 50, at each end of the bar, there is associated an equalizing plate or saddle 53 which bridges the slot between an adjacent pair of fingers. The connection between each equalizing plate 53 and its associated adjustable member 50 should be equivalent to a ball and socket, or other equivalent form of universal joint or connection.

Preferably, the fingers are provided with inserts 54 of hardened steel or equivalent for engagement by the pressure-applying ends of the plates 53.

The modified forms of movable contact structures shown in Figs. 13 and 14 may be substituted for the simpler form of digitate contacts 8L, 8R, shown in Figs. 1 to 12.

In the switches of Figs. 1 to 13, instead of using hardened inserts, as in Fig. 14, hardened steel discs 55 may be interposed between the adjusting screws 50 and the copper contact structure 8R, 8L.

As shown in Fig. 15, the lower end of the clamping bar 10L (bar 10L is identical with bar 10R except for reverse threading of the clamping screw hole) is recessed to receive a pair of free discs 55, each substantially greater in diameter than the end of screw 50 which presses it against one of the fingers of movable contact 8L. Preferably each disc 55 is prevented from rotation during adjustment of the associated screw 50, as by an extension 56 which fits a corresponding slot or keyway 57 in the underface of the clamping bar.

As shown in Fig. 16, at the other end of the clamping bar 10L of Fig. 15, a similar arrangement is employed; in the keyways 57A in 10L are disposed the keys 56 to prevent rotation of the free discs 55 during adjustment of their associated pressure-adjusting screws 50.

To maintain proper or desired alignment of the clamping bar 10L with respect to the associated movable contact 8L, the bar is provided at its lower end, as viewed in Fig. 1, with a hole 58 in which loosely fits, Fig. 15, the end 9A, of reduced diameter, of the pivot pin and its upper end, as viewed in Fig. 1, is provided with a threaded hole 58A into which is screwed an aligning pin 59, Fig. 16, which slidably fits a hole in the upper end of the movable contact structure.

The various switch constructions herein illustrated and described are exemplary of my invention whose scope is coextensive with the appended claims.

What I claim is:

1. A switch comprising fixed contact structure, contact structure movable into and out of engagement therewith, an operating arm pivotally mounted on said movable contact structure, means operated by movement of said arm in one direction about its pivot to clamp said contact structures in closed circuit position, a latch movable with said movable contact structure and disengageably connecting it to said arm to preclude actuation of said clamping means, and an abutment for engaging said latch to release said arm for its pivotal movement in said one direction upon movement of said movable contact structure to predetermined closed circuit position and for cooperating with said latch upon subsequent reverse movement of said arm to initiate movement of said movable contact structure from said predetermined closed circuit position.

2. A switch comprising fixed contact structure, contact structure movable into and out of engagement therewith, an operating arm pivotally mounted on said movable contact structure, means operated by movement of said arm in one direction about its pivot to clamp said contact structures in closed circuit position, a latch movable with said movable contact structure and disen-

gageably connecting it to said arm to preclude actuation of said clamping means, and an abutment effective upon movement of said movable contact structure to predetermined closed circuit position to release said arm for its pivotal movement in said one direction and effective upon subsequent reverse movement of said arm concurrently to reset said latch and therethrough to pry said movable contact structure from said predetermined closed circuit position.

3. A switch comprising movable contact structure, an operating arm pivotally mounted on said contact structure, a latch movable with said contact structure and disengageably connecting it to said arm to preclude movement of said arm about its pivot, and an abutment for engaging said latch upon movement of said movable contact structure to predetermined position to effect release of said arm to allow movement thereof in one direction about its pivot, subsequent reverse movement of said arm effecting upon its reengagement with said latch coaction between said latch and said abutment to move said contact structure from said position concurrently with resetting of said latch.

4. A switch comprising fixed contact structure, contact structure movable into and out of engagement with said fixed contact structure, an operating arm pivotally mounted on said movable contact structure, a latch movable with said movable contact structure for preventing said arm from moving about its axis during movement of said movable contact toward and from engagement with said fixed contact structure and for preventing movement of said movable contact structure from engagement with said fixed contact structure while said arm is free for movement about its axis, and an abutment engaged by said latch upon movement of said movable contact structure to closed circuit position for actuating said latch to release said arm for movement about its axis and substantially concurrently to latch said movable contact structure in said closed circuit position.

5. A switch comprising fixed contact structure, contact structure movable into and out of engagement with said fixed contact structure, an operating arm pivotally mounted on said movable contact structure, a latch movable with said movable contact structure for preventing said arm from moving about its axis during movement of said movable contact toward and from engagement with said fixed contact structure, and an abutment for actuating said latch upon movement of said contact structure to predetermined closed circuit position to release said arm for movement in one direction and to hold said movable contact structure in said position, said arm upon subsequent reverse movement reengaging said latch to release said movable contact structure, to relatch said arm to said contact structure, and by coaction of said abutment to pry said movable contact structure from said position.

6. A switch comprising fixed contact structure, contact structure movable into and out of engagement therewith, an operating arm, means actuated by said arm during its movement in a range thereof to determine the pressure between said contact structures, and latching means cooperative with said arm to lock said contact structures in engagement for movement of said arm in said range and to effect movement of said movable contact structure for another range of movement of said arm.

7. A switch comprising fixed contact structure, contact structure movable into and out of engagement therewith, an operating arm, means for clamping said contact structures in closed circuit position, latching means for selectively holding said movable contact structure to said fixed contact structure or to said operating arm, and means for controlling said latch to release said arm for its actuation of said clamping means substantially upon completion of circuit-closing movement of said movable contact structure and to release said movable contact structure substantially upon completion of reverse actuation of said clamping means by said arm.

8. A switch comprising movable contact structure, an operating arm, latch structure for holding said arm to said movable contact structure for movement thereof to one of its circuit-controlling positions, and means for releasing said latch structure upon movement of said contact structure to said position to permit further movement of said arm, said latch structure subsequent to its said release cooperating with said arm to lock said contact structure in its said circuit-controlling position.

9. A switch comprising movable contact structure, an operating arm, latch structure for holding said arm to said movable contact structure for movement thereof to one of its circuit-controlling positions, means for releasing said latch structure upon movement of said contact structure to said position to permit further movement of said arm, said latch structure subsequently to said release cooperating with said arm to lock said contact structure in said position, and latching means for engaging said arm substantially upon completion of said further movement thereof to maintain the aforesaid contact locking relation of said arm and said latch structure.

10. A switch comprising movable contact structure, an operating arm, means for latching said arm to said movable contact structure, means for releasing said latching means upon movement of said contact structure to one of its circuit-controlling positions, and cam means coacting with said arm and said latching means positively to prevent release of said latching means for other positions of said contact structure.

11. A switch comprising fixed and movable contact structures, means for clamping said structures in closed circuit position, an operating arm for effecting movement of said movable contact structure and by movement relative thereto effecting actuation of said clamping means, a latch between said arm and said movable contact structure to prevent said relative movement, and cam structure coacting with said arm and said latch positively to prevent release of said latch except when said contact structures are in predetermined closed circuit position.

12. A switch comprising pivotally mounted contact structure, an operating arm pivotally mounted thereon, latch structure pivotally mounted on said contact structure for locking the arm thereto and having an arcuate surface which for released position of said latch structure has its center of curvature at the pivot of said arm, a cam having a surface whose center of curvature is at the pivot of said contact structure coacting with said latch structure positively to prevent movement thereof relative to said contact structure for all open-circuit positions thereof, and an abutment engaging said latch structure substantially upon completion of circuit-closing movement of said contact structure to move said latch structure to said released position for which it coacts with said

arm to hold said contact structure in closed-circuit position.

13. A switch comprising movable contact structure, fixed contact structure, an operating arm, a latch on said movable contact structure having an arcuate surface engaging with said arm to hold said contact structures in engagement, and a second latch for locking said arm to said movable contact structure upon release of said first latch.

14. A switch comprising fixed and movable contact structures, an operating arm, a pair of latches on said movable contact structure, and an abutment for engaging one of said latches to release said arm from said movable contact structure and substantially concurrently to effect actuation of the other latch to lock said contact structures in engagement.

15. A switch comprising fixed and movable contact structures, an operating arm, a latch on said movable contact structure for locking it to said fixed contact structure, an over-center-snap latch on said first-named latch, and an abutment engaging said snap latch substantially upon completion of circuit-closing movement of said movable contact structure to release said arm from said movable contact structure for further movement of said arm and to set said first-named latch, said arm upon reverse movement releasing said first-named latch and resetting the snap latch.

16. A switch comprising fixed contact structure, digitate contact structure movable into engagement therewith, and means for clamping said contact structures to each other in closed circuit position comprising a bar overlying said movable contact structure, and individually adjustable members for transmitting pressure from said bar to different elements of said digitate contact structure.

17. A switch comprising fixed contact structures, movable contact structure pivotally mounted on one of said fixed contact structures for movement into engagement with the other of said fixed contact structures and slotted at both ends to form contact fingers, a clamping bar extending along said movable contact structure to overlie the slotted ends thereof, means for applying a clamping pressure to said bar intermediate the ends thereof, and means for transmitting and distributing the pressure applied to said bar comprising individually adjustable members, at each of the opposite ends of said bar, interposed between said bar and the different contact fingers.

18. A switch comprising fixed contacts, movable contact blades pivotally mounted on one of said fixed contacts, and yielding stop structure mounted on said one of said fixed contacts between the blades for limiting the circuit opening movement thereof.

19. A switch comprising fixed and movable contact structures one of which is divided to provide elements for engagement with the other contact structure, and means for clamping said contact structures to each other comprising a member divided to provide elements of substantially similar load-deflection characteristics respectively overlying said first-named elements, and an individually adjustable pressure-transmitting member between each of said first-named elements and its associated second-named element.

20. A switch comprising a fixed contact, a movable contact slotted to provide elements for engagement with said fixed contact, a clamping bar, rotatably adjustable members carried by said bar for transmission of pressure to said elements, and hard non-rotatable elements interposed between each of said members and one of said elements.

21. A switch comprising fixed contact structure, pivotally mounted contact members, an operating arm for moving said members into engagement with said fixed contact structure, a threaded member connecting said arm to said contact members and rotatable by said arm to clamp said members to and unclamp them from said fixed contact structure, control means precluding rotation of said threaded member by said arm during movement of said contact members toward and from said fixed contact structure and permitting rotation of said member by said arm when said contact members are in engagement with said fixed contact structure, a stationary latching member, and a coacting latching member movable with said arm engaging said stationary latching member substantially upon completion of the contact-clamping rotation of said threaded member to hold said arm in fixed contact-clamping position.

22. A switch comprising fixed contact structure, movable contact structure, means for clamping said contact structures to each other, an operating member for effecting movement of said movable contact structure toward and from engagement with said fixed contact structure, cam structure coacting with said operating member to preclude its actuation of said clamping means during movement of said movable contact structure toward or from said fixed contact structure, and latching means for engaging and holding said operating member substantially upon completion of its actuation of said clamping means.

23. A switch comprising fixed contact structure, movable contact structure for engaging said fixed contact structure comprising independently flexible elements arranged side by side, and means for clamping said contact structures to each other in closed circuit position comprising a bar overlying said elements and determining the pressures between each of said individual elements and said fixed contact structure.

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