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MECHANICAL INTERLOCK FOR ELECTRIC SWITCHES

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Fig. 1.

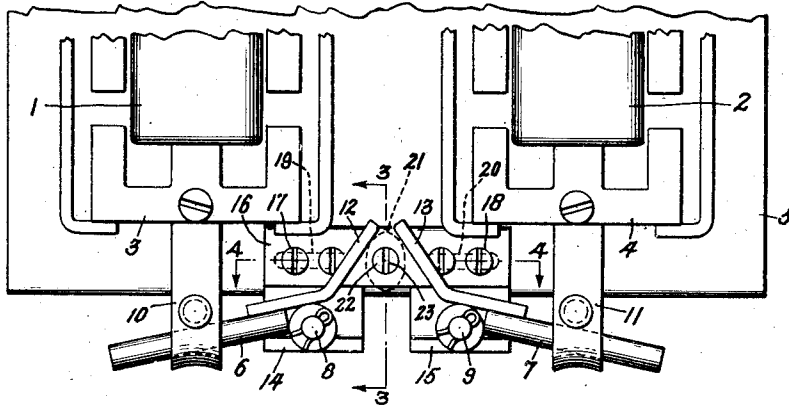


Fig. 2.

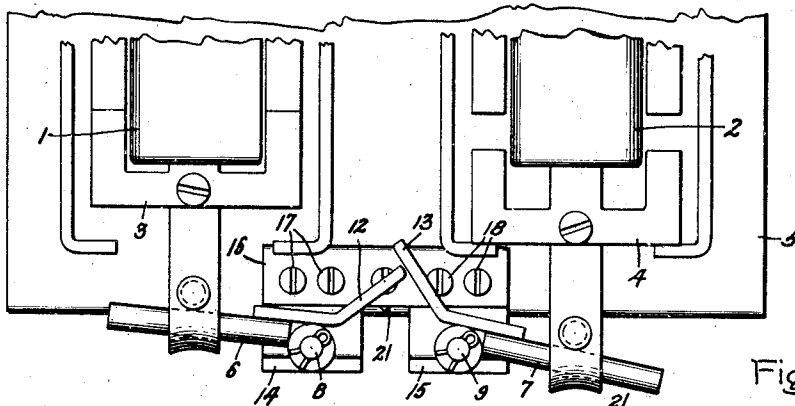


Fig. 3.

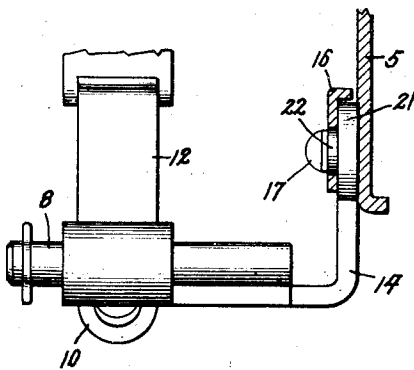
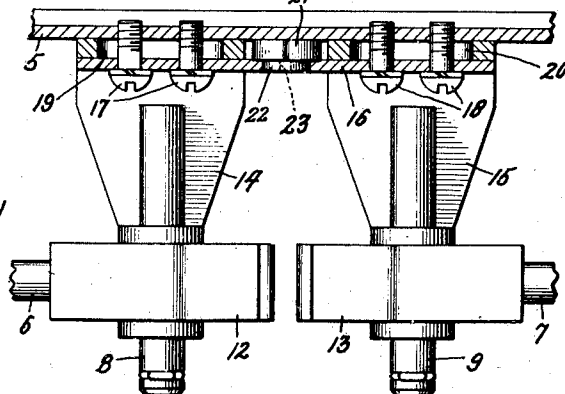


Fig. 4.



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## UNITED STATES PATENT OFFICE

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## MECHANICAL INTERLOCK FOR ELECTRIC SWITCHES

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3 Claims. (Cl. 200—50)

My invention relates to mechanical interlocks for electric switches, more particularly to a mechanical interlock between two electromagnetically operated reversing switches in the circuit of an electric motor for preventing one contactor from picking up until the opposite contactor has dropped out almost completely, and has for its object a simple, reliable and inexpensive interlock providing for a convenient adjustment of the interlocking members and for opening bias on the contactor which is being opened.

For the forward and reverse operation of an electric motor, two contactors are provided, which contactors are selectively closed to give the desired direction of rotation of the motor. A characteristic of such forward and reverse contactors is that the closure of both at the same time forms a short circuit across the supply line for the motor. To guard against this false operation, various mechanical interlocks have been provided between the two contactors, which interlocks require the opening of one contactor before the other can be closed.

Ordinarily the closure of both contactors at the same time results from manual interference with their operation or because of the welding of the contacts of one contactor so that it cannot drop out.

The simplest interlock is a pivoted bar having its ends connected to the two contactors so that one contactor picks up at the same rate as the other drops out. This, however, does not provide sufficient clearance in some cases between the contacts of the opening contactor at the time the other closes to take care of short circuits caused by arcing between the opening contacts. Other interlocks provide for full interference, that is, prevent any movement of the reversing contactor until the other contactor has dropped completely open. Such interlocks, however, are expensive to manufacture and require fine adjustments.

In accordance with my invention, I provide a mechanical interlock which is a compromise between the two interlocks referred to above and permits the reverse contactor to pick up very slowly until the forward contactor has nearly reached its full open position. In one form of my invention, I provide two levers which are mounted on adjustable pivots between the two contactors and have their outer ends secured to the two contactors. The inner adjacent ends of these two levers are arranged to interfere with each other to give the desired interlocking, and are furthermore arranged when one contactor is closed to extend at an angle with each other of

less than ninety degrees so that when the open contactor is energized, an opening force is applied to the closed contactor.

For a more complete understanding of my invention, reference should be had to the accompanying drawing, Fig. 1 of which is a fragmentary elevation view of two contactors provided with mechanical interlock means embodying my invention; Fig. 2 is a view similar to Fig. 1 but showing one of the contactors in its closed circuit position; Fig. 3 is a sectional view taken along the line 3—3 of Fig. 1 looking in the direction of the arrows; while Fig. 4 is a sectional view along the line 4—4 of Fig. 1 looking in the direction of the arrows.

Referring to the drawing, I have shown my invention in one form as applied to two contactors having stationary operating coils 1 and 2 which, when energized respectively, pick up rectilinearly movable armatures 3 and 4. These armatures are each connected to suitable electric switching means (not shown) such as described and claimed in Patent 2,064,632, issued to Richard H. Schmitt, on December 15, 1936. The two contactors are secured to a common support, such as metal panel 5, in spaced relation with each other and in upright positions so that their armatures 3 and 4 move in parallel paths.

The interlock means between the two contactors comprises two levers 6 and 7 mounted on pivots 8 and 9 between the two contactors. As shown, the levers are made of a suitable metal, such as steel, although they may be made of a suitable molded plastic material. The outer ends of these levers, shown as rods, extend loosely through loops on the lower ends of two straps 10 and 11 having their upper ends secured respectively to the armatures 3 and 4. Thus, each of the levers 6 and 7 is movable on its pivot in response to upward and downward movement of the armature to which it is secured.

The inner ends of the levers consist of flat bars or straps 12 and 13 which are bent upward, as seen in Figs. 1 and 2, with respect to the outer ends of the levers from points opposite the pivots 8 and 9. These two ends are adjusted so as to be in closely spaced relation with each other, as indicated in Fig. 1, when the armatures are both in their lowermost unattracted positions. When one armature is moved upward by its coil, the inner end of its lever moves in the path of the other lever and thereby prevents the other armature from moving upward at the same time. As shown in Fig. 2, the armature 3 is in its upper attracted position and the inner end 12 has moved

directly in the path of the inner end 13 of the other lever. Preferably, the adjustment is such that the inner end of each lever in its picked up position is spaced somewhat from the other lever, as indicated in Fig. 2. It will thus be observed that the armature 4 can be moved upward only a very small amount as long as the inner end of the lever 6 is directly in its path, but when the armature 3 has moved downward nearly to its unattracted or fully open position, the lever 6 moves out of the path of the lever 7, which then can move downward for movement of the armature 4 upward to its fully attracted position.

Another feature of my invention is the construction and arrangement of the inner ends 12 and 13 so that when one of the armatures is in its picked up position, these inner ends are at an angle with each other which is less than ninety degrees, whereby a positive opening force is applied to the opening contactor. Preferably, this angle is approximately seventy-five degrees. As shown in Fig. 2, this angular relation provides for the application of an appreciable opening force to the inner end 12 by the inner end 13 in the event that the coil 2 is energized with the armature 3 picked up. In other words, a component of the force applied by the inner end 13 to the inner end 12 is in a direction laterally with respect to the inner end 12 and in a counterclockwise direction so as to pull the armature 3 downward. This takes care of the opening of either contactor, in the event that its contacts have welded, when the other contactor is energized, the coil of the first closed contactor of course being at that time de-energized. To facilitate this opening action, graphite grease is applied to the engaging surfaces of the inner ends, and the edge of each which engages the other is rounded somewhat.

To provide for accurate adjustment of the pivots 8 and 9 with respect to each other, I secure the pivots on plate members 14 and 15 which are clamped in place against the front surface of the panel 5 by means of a clamping plate 16 and two pairs of screws 17 and 18 extending respectively through slots 19 and 20 in the members 14 and 15. Also secured to the clamping plate 16 at its middle is a cam member 21, the cam member having a round projection 22 which has a screw slot 23 at the front of the plate. Thus, by loosening the screws 17 and 18, the supports 14 and 15 may be adjusted accurately apart by suitably turning the cam 21, thereby suitably to adjust the interference between the ends 12 and 13, after which the screws are tightened.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In combination, a support, a pair of electric switches mounted in spaced relation on said support and adapted for independent operation to circuit controlling positions, a pair of supporting members mounted on said support in spaced relation with each other, a lever pivotally mounted on each of said members, a mechanical connection between each of said switches and one of said levers, the inner adjacent ends of said levers being shaped and arranged to interfere with each other when one of said switches is closed so as to prevent the closure of the other of said switches, and cam means mounted between said supporting members and movable to engage and adjust said supporting members with respect to each other thereby to adjust the interfering relation between the adjacent ends of said levers.

2. In combination, a support, a pair of electromagnetically operated electric switches mounted on said support in spaced relation and adapted for independent operation to circuit controlling positions, a pair of supporting members mounted on said support in spaced relation with each other, a lever pivotally mounted on each of said supporting members, a mechanical connection between each of said switches and the outside arm of each of said levers, the inner adjacent arms of said levers being shaped and arranged to interfere with each other when one of said switches is closed so as to prevent the closure of the other of said switches and to extend at an angle of less than ninety degrees with respect to each other when one of said switches is closed so that attempted closure of the open switch applies an opening force to the closed lever and switch, and a cam mounted on said support between said supporting members, said cam being movable to engage and adjust said supporting members with respect to each other thereby to adjust the interfering relation between the adjacent ends of said levers.

3. In combination, a support, a pair of electric switches mounted on said support in spaced relation and adapted for independent operation to circuit controlling positions, a pair of supporting members mounted on said support in spaced relation with each other, a lever pivotally mounted on each of said supporting members, a connection between each of said switches and one of said levers, the inner adjacent ends of said levers being shaped and arranged to interfere with each other when one of said switches is closed so as to prevent the closure of the other of said switches and to extend at an angle of less than ninety degrees with respect to each other when one of said switches is closed so that attempted closure of the other switch applies an opening force to the closed lever and switch, and a cam rotatably mounted between said supporting members and rotatable to move said supporting members with respect to each other thereby to adjust the interfering relation between the adjacent ends of said levers.

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