Oct. 3, 1944. R. P. BALLOU 2,359,606

ELECTRIC SWITCH WITH MECHANICAL INTERLOCK

Filed Feb. 13, 1942 2 Sheets-Sheet 1

Fig. 1

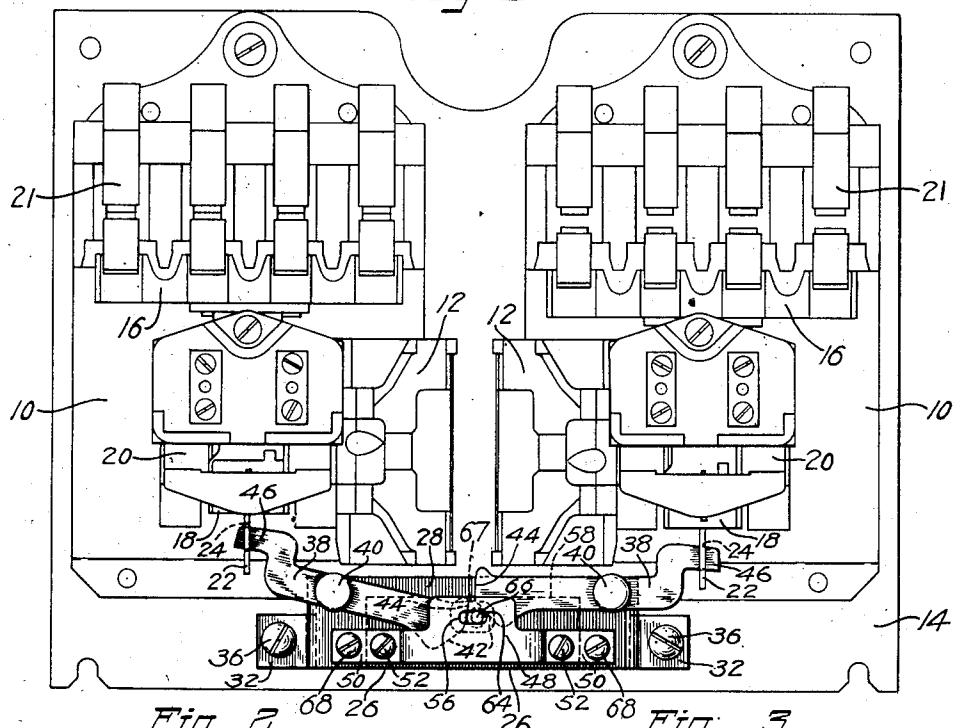


Fig. 2

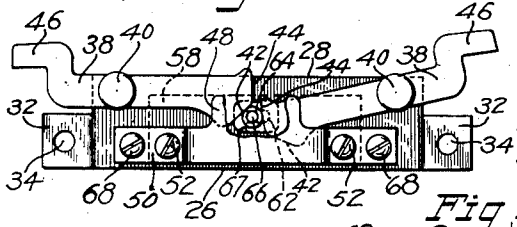


Fig. 3

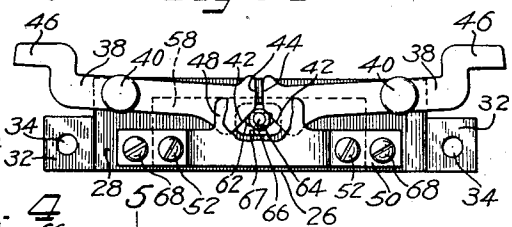


Fig. 4

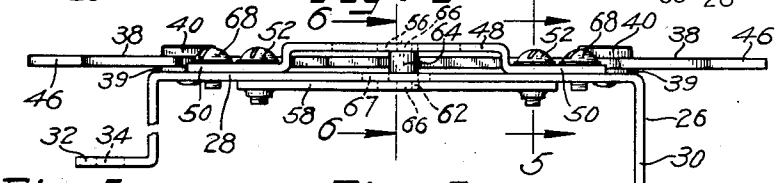


Fig. 5

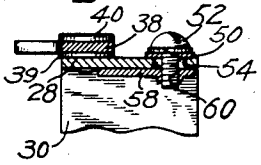
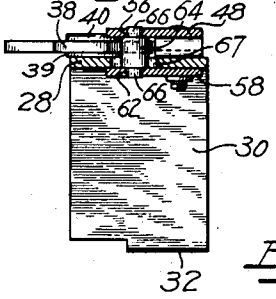


Fig. 6



Inventor
Richard P. Ballou
By S. Jay Tuller
Attorney

Oct. 3, 1944. R. P. BALLOU 2,359,606

ELECTRIC SWITCH WITH MECHANICAL INTERLOCK

Filed Feb. 13, 1942 2 Sheets-Sheet 2

Fig. 7

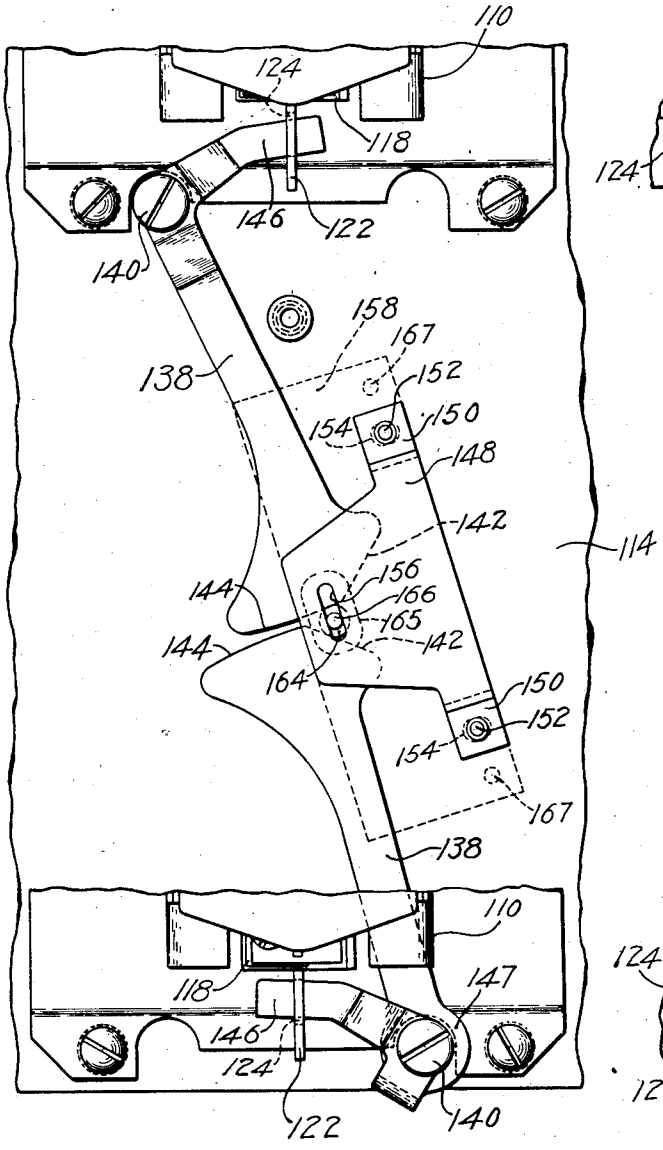
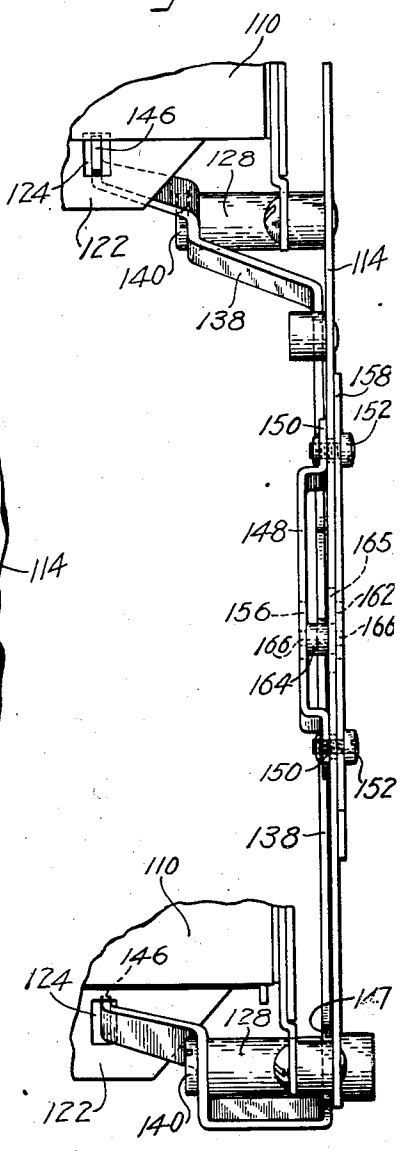


Fig. 8



Inventor
Richard P. Ballou
By S. Jay Teller
Attorney

Patented Oct. 3, 1944 2,359,606

UNITED STATES PATENT OFFICE

2,359,606

ELECTRIC SWITCH WITH MECHANICAL INTERLOCK

Richard P. Ballou, West Hartford, Conn., assignor, by mesne assignments, to Federal Electric Products Company, Inc., Newark, N. J., a corporation of New Jersey

Application February 13, 1942, Serial No. 430,739

5 Claims. (Cl. 200—50)

This invention relates to mechanical interlocks and particularly to the type of interlock that is engageable with a plurality of electrical circuit controlling means to prevent the closing of one of said electrical circuit controlling means when the other electrical circuit controlling means is in closed position.

More particularly, the invention is especially adaptable for use in connection with electrical switches of the magnetic motor starter type such as illustrated in application, Serial No. 373,186, filed January 4, 1941, in the names of P. M. Christensen and R. P. Ballou.

One of the objects of the invention is to provide a durable, simple, and adjustable mechanical interlock for the purpose intended, in which interlock there are relatively few moving parts.

Another object of the invention is to provide a construction including anti-friction means which affords ready and free movement of the various associated movable parts.

A still further object of the invention is to afford an interlock between a plurality of switches of the magnetic motor starter type, in which interlock the moving parts are positively actuated by the movable armatures of the magnetic motor starter switches in such manner that the power required to operate the interlock is relatively negligible whereby the normal functioning of the magnetic motor starter switches is substantially interfered with in no way.

Other objects as well as details of the invention will be apparent from a consideration of the following specification, and the accompanying drawings.

In the drawings:

Fig. 1 is a front elevation view of the interlock incorporated in a magnetic motor starter arrangement including two electro-magnetic actuated switches, one of said switches being in closed circuit position while the other electromagnetically actuated switch is held in open circuit position by the interlock.

Fig. 2 is a front elevation view of the interlock structure per se with the switch engaging arms of the interlock arranged in positions opposite to those shown in Fig. 1.

Fig. 3 is a front elevation view of the interlock structure per se with the switch engaging arms arranged in neutral position wherein both switches will be in open circuit position.

Fig. 4 is a bottom plan view of the interlock structure per se shown in a larger scale with one supporting leg partly broken away.

Fig. 5 is a fragmentary sectional elevation on the line 5—5 of Fig. 4.

Fig. 6 is a sectional elevation on the line 6—6 of Fig. 4.

Fig. 7 is a fragmentary plan view showing another embodiment of my invention applied to two electro-magnetic actuated switches mounted in vertical alignment.

Fig. 8 is a fragmentary side elevation of the structure shown in Fig. 7.

The present invention, as herein described and as illustrated on the accompanying drawings, has several embodiments. In the embodiment disclosed in Figs. 1 through 6, the mechanical interlock primarily consists of a mounting member or bracket on which a pair of switch engaging arms are pivoted intermediate their ends. The outermost ends of the pivoted arms are respectively engageable with a depending member provided on the armature of each magnetic motor starter switch.

The innermost ends of the pivoted arms are provided with cam surfaces which are engageable with a rotatable locking element which is movable in suitable guideways to a plurality of positions. When one of said pivoted arms is held with its outer end in uppermost position by reason of one of the magnetic motor starter switches being closed, a portion of the cam surface of said arm engages the rotatable locking element to hold it in one of its plurality of positions and, when so held in said one position, the rotatable locking element engages a portion of the cam surface on the end of the other pivoted arm to hold the inner end of the pivoted arm against movement downward whereby the outer end of said other pivoted arm will be held against movement upward and thus maintain the armature connected to said outer end of said other pivoted arm against movement upward whereby the second switch may not be closed as long as the first switch is closed.

Conversely, after the first switch has been opened, the outer end of the pivoted arm connected to the armature of said first switch is caused to move downward by the lowering of the armature to open circuit position and the inner end of the pivoted arm is moved upward sufficiently to no longer block the movement of the rotatable locking element and should the second switch be closed, such closing will move the pivoted arm connected to the armature thereof in such a way as to move the rotatable locking element to a second position and hold the same in such position wherein it will engage

a portion of the cam surface on the end of the pivoted arm connected to the armature of the first switch and hold the inner end of said last mentioned pivoted arm against downward movement whereby the outer end of said pivoted arm is held against upward movement to prevent the armature of the first switch connected thereto from upward movement and consequent closing of the first switch while the second switch is in closed position.

When both switches are in open circuit position, the pivoted arms assume what is termed a neutral position which is best illustrated in Fig. 3 and, when in this position, the rotatable locking element is disposed in a position wherein it will prevent the outer end of both pivoted arms from moving upward simultaneously, consequently preventing the simultaneous closing of both switches.

Referring to the drawings, a plurality of magnetic motor starter switches have been illustrated with only sufficient detail to illustrate the principles of the invention which concerns itself mainly with the interlock structure and the manner in which it is connected to the armatures of the respective magnetic motor starter switches. Said switches are the type illustrated and described in the aforementioned application of Christensen et al. but it will be understood that the interlock structure of the present invention is operable with other embodiments of switches of similar type. Each individual magnetic motor starter switch 10 has a thermal relay control unit 12, all of which are mounted on a suitable base plate 14. The respective motor starter switches are provided with a movable contact carrier 16 actuated by an armature 18 movably mounted in the lower portion of the electromagnetic member 20 which electro-magnetic member serves to actuate the armature 18 to move the contact carrier 16 into engagement with the stationary contact blocks 21.

Each armature is provided with a depending plate 22 which, in the preferred embodiment of the invention, is a lamina of the laminae which comprise the armature 18 in conformity with customary construction of such armatures. As clearly shown in Fig. 1, the plate 22 projects below the lower ends of the associated laminae forming the armature 18 sufficiently to afford ample space in which to place an elongated aperture or slot 24 for purposes to be explained. It will be understood that the armature 18 and movable contact carrier 16 to which the armature is connected are mounted for vertical movement with reference to Fig. 1 and such movement is guided by suitable means incorporated in the magnetic motor starter switch structure. Said guiding means, however, does not form a part of the instant invention and therefore is not illustrated.

The mechanical interlock comprising the main feature of the instant invention is generally designated 26. The details of the mechanical interlock comprise a supporting member in the form of a mounting bracket 28 which, as viewed in Fig. 4, has downward extending supporting legs 30 having outward extending plates 32 each provided with an aperture 34 by which the mounting bracket may be suitably secured to the base plate 14 such as by a pair of screws 36.

A pair of switch engaging interlock arms 38 are pivotally mounted to the mounting bracket 28 by suitable pivot studs 40 each of which pivot studs is accommodated in a suitable bearing aperture disposed in each interlock arm 38 intermediate the ends thereof. In the preferred embodiment of the invention, a washer 39 may be placed on the pivot studs between each interlock arm and the mounting bracket to facilitate movement of the interlock arms.

The innermost end of each interlock arm 38 is shaped to form a cam surface 42 angularly disposed to the longitudinal axis of the interlock arm 38. Said end of the interlock arm is also formed with a slightly curved end surface 44 which is substantially a segment of a circle having a radius extending from the pivot stud 40. The curved end surface 44 may be considered a continuation of the cam surface 42 and both surfaces in effect form a composite or continuous cam surface, the curved end surface 44 being in the nature of a dwell on the composite cam surface.

The outer end of each interlock arm 38 is provided with an armature engaging member 46 which is offset upward. The armature engaging member 46 is accommodated in the slot 24 provided in the depending plate 22 on each armature. The dimensions of each slot 24 are such that they provide free movement therein of the respective armature engaging members 46 without binding in order that the armature may be raised and lowered during actuation thereof by the electro-magnet member 20, and during which raising and lowering the outer end of the interlock arm engaged in the slot 24 will be moved therewith.

An interlocking pin bracket or front guide plate 48 having offset mounting ears 50 disposed at either side is secured to the front face of mounting bracket 28, as viewed in Fig. 1, by screws 52 which extend through suitable apertures in the offset mounting ears 50 and also elongated apertures or slots 54 in the mounting bracket 28 and are threaded into locking means hereinafter described. Slots 54 are best illustrated in Fig. 5 and are for purposes also to be described. As clearly shown in Figs. 4 and 6, the offset between the front guide plate and the mounting ears 50 provides a space between the front guide plate and the mounting bracket 28 to accommodate the inner ends of the interlock arms 38.

The front guide plate 48 is provided medially thereof and adjacent the uppermost edge with a guide slot 56, which guide slot is best shown in Fig. 1 and is for a purpose to be described.

Mounted on the rear or underside of the mounting bracket 28 is an interlock pin guide plate 58 which may be termed the rear guide plate, the same being secured to the mounting bracket by the screws 52 which are threadably received in apertures 60 formed in said rear guide plate to not only secure the guide plate 58 but also lock the front guide plate 48 in operative position. Medially disposed in the rear guide plate adjacent its upper edge, as viewed in Figs. 1–3, is a guide slot 62 which is substantially identical to the slot 56, the slots 56 and 62 being so arranged in the respective guide plates that when said guide plates are assembled as shown in Figs. 1–4, said slots are substantially co-extensive, parallel, and superposed over each other so as to form an elongated guideway. Said guide slots are held in alignment with each other as just described by the pair of screws 52 which are threaded into the apertures 60 in the rear guide plate 58. When said screws are suitably loosened, the front and rear guide plates may be moved within certain limits as a unit with

respect to the mounting bracket 28 by reason of the slots 54 in said mounting bracket.

A locking means illustrated in the form of a cylindrical interlock or locking pin 64 is disposed in a generally rectangular aperture 67 in the mounting bracket 28. The locking pin is provided at opposite ends with cylindrical trunnions 66 which are disposed in the guide slots 56 and 62 of the front and rear guide plates to rotatably mount the locking pin 64 between said guide plates. Obviously the locking pin may not only rotate with respect to the guide plates but the same may also move longitudinally with respect to the same within the limits of the slots 56 and 62. The dimensions of aperture 67 are such that at no time during the movement of the locking pin in any direction will the periphery thereof engage the periphery of the aperture 67.

The locking pin is primarily for the purpose of engaging the angularly disposed cam surface 42 provided on the end of each interlock arm to prevent the inner end of said arm from moving downward and correspondingly prevent the armature engaging member 46 on the outer end of the interlock arm from moving upward whereby the movable contact carrier is also prevented from moving into engagement with the stationary contact block on one of the magnetic motor starter switches. This function is clearly illustrated in Figs. 1 and 2. The locking pin 64 is held in engagement with the cam surface 42 of one interlock arm by the end surface 44 of the other interlock arm, as is also clearly illustrated in Figs. 1 and 2. The last mentioned interlock arm is held with the end surface 44 against the locking pin by the depending plate 22 on the closed magnetic motor starter switch which holds the outer end of said interlock arm in uppermost position.

With one magnetic motor starter switch thus closed, the second one may not be closed. After said closed switch has been opened, however, the armature will drop to its lower position, simultaneously moving the outer, raised end of the engaged interlock arm downward. This will move the inner end of the engaged interlock arm upward and remove the end surface 44 from abutting engagement with the locking pin 64 as viewed in either Fig. 1 or 2, following which the locking pin 64 may move from locking engagement with the cam surface 42 of the other interlock arm, particularly when the second switch is closed by energizing its electro-magnet 20 to move the armature of said switch upward, which armature simultaneously carries therewith the outer end of the interlock arm 38 engaged therewith and moves the inner end of said arm downward during which movement the cam surface 42 on said arm will force the locking pin 64 toward the inner end of the other interlock arm and into engagement with the cam surface 42 of said other interlock arm to lock its inner end against movement downward and prevent the closing of the switch with which said second interlock arm is engaged.

Assuming both magnetic motor starter switches are open, the interlock arms will then be substantially disposed in the position illustrated in Fig. 3. This position may be termed the neutral position. It will be readily seen that, from this neutral position, the outer end of either one of the interlock arms may be raised by the closing of the switch associated therewith, which action will lower the inner end of the actuated interlock arm and simultaneously force the locking pin away from the outer end of the interlock arm that is actuated and farther into engagement with the cam surface 42 on the inner end of the other interlock arm to hold or lock said inner end of said other interlock arm against downward movement. The end surface 44 of the first interlock arm will, as explained in the foregoing, hold the locking pin 64 in such locking engagement with the inner end of the second interlock arm.

From the neutral position, both switches may not be simultaneously closed since the cam surface of both interlock arms would be caused to engage the locking pin.

The locking pin 64 is preferably rotatably mounted to provide anti-friction engagement between it and the cam and end surfaces 42 and 44 of each of the interlock arms 38.

It will be appreciated that in the mass production of mechanisms by methods used in modern industry, manufacturing variations will exist and items such as magnetic motor starter switches will not always be exact duplicates of each other in that the spacing of certain elements in said switches with respect to certain other elements is not always the same. For example, it has been found in connection with the development of the present invention that when two magnetic motor starter switches are mounted on a common base plate 14 and both switches are either open or closed, the disposition of the depending plates 22 and the slots 24 therein will not always be the same with respect to a common means on the base plate such as the bottom edge.

To compensate for the above mentioned differences in spacing of the various elements of said magnetic motor starter switches, certain members of the interlock structure comprising the present invention have been made adjustable to permit proper alignment of the armature engaging members 46 with the respective slots 24 through which said armature engaging members project. Such adjustment is afforded by the slots 54 in the mounting bracket 28, which slots permit the vertical movement of the front and rear guide plates 48 and 58. Movement of these guide plates is correspondingly imparted to the locking pin 64 which, in turn, will vary the points of contact upon engagement of said locking pin with the inner ends of the interlock arms 38. After the position of the locking pin has been properly adjusted by so moving the guide plates and the proper position located, said proper position of said guide plates is maintained by tightening the screws 52 into the plate 58. The proper position is such, for example, that when both switches are open, the interlock arms 38 may assume a neutral position similar to that shown in Fig. 3. Similarly, the proper position will also permit one interlock arm to maintain the locking pin in proper locked engagement with the other interlock arm or vice versa to absolutely prevent the closing of one of said switches when the other of said switches is already closed.

The present invention also includes further means for maintaining the proper adjustment of the locking pin with respect to the inner ends of the interlock arms comprising a pair of self-tapping screws 68 which pass through suitable openings in the offset mounting ears 50 on the front guide plate 48. Before inserting said self-tapping screws 68, the mounting bracket 28 is drilled to provide holes therein, using said open-

ings in the offset mounting ears 50 as a templet, following which the self-tapping screws 68 may be threaded into said drilled holes to assist the screws 52 in securing the locking plates in proper position.

From the foregoing, it will be seen that the present invention, as exemplified in the embodiment illustrated in Figs. 1 through 6, provides a compact, sturdy and simple interlock structure having few moving parts and the pivoted interlock arms are so mounted that they are levers of the first order having effective lever arms on either side of each pivot which are so dimensioned that no excessive amount of force has to be applied to the lever arm at one end of either pivoted interlock arm to actuate the other lever arm at the other end thus reducing binding and unusual wear between the various moving parts of the interlock to a minimum. Such an arrangement of the lever arms on the present interlock arm also requires a minimum amount of power from the magnetic motor starter switches to actuate the interlock structure. Furthermore, there is direct contact between each interlock arm, the magnetic motor starter switch connected therewith, and the locking means for the interlock arm comprising the locking pin 64, thus providing few moving parts that have to be actuated by the armatures with a consequent saving of power.

In the embodiment of the invention disclosed in Figs. 7 and 8, the interlock is shown in a slightly different form from that disclosed in Figs. 1 through 6 in order to adapt the interlock to a pair of magnetic motor starter switches disposed in substantially vertical alignment.

Referring to Figs. 7 and 8, a pair of motor starter switches 110 are fragmentarily illustrated to be mounted in vertical alignment on a base plate 114, the lower switch being broken away to expose the interlock details. The respective motor starter switches are provided with a vertically movable armature 118 having a plate 122 depending therefrom, said plates 122 both being substantially disposed and movable in a common vertcial plane. In the preferred embodiment of the invention, each plate 122 is a lamina of the laminae which comprise the armature 118 in conformity with customary construction of such armatures. Each depending plate is provided with an elongated aperture or slot 124.

The mechanical interlock illustrated in Figs. 7 and 8 is the same in principle as that illustrated in Figs. 1 through 6. In order to adapt the interlock to a pair of switches disposed in vertical alignment, the interlock arms have been shaped somewhat differently from those illustrated in Figs. 1 through 6 and, rather than mount the interlock assembly horizontally, in the embodiment in Figs. 7 and 8 the interlock assembly has been mounted to generally extend in a line disposed at an angle of almost ninety degrees to the horizontal and said assembly is mostly disposed between the lowermost switch and the base plate 114.

In the embodiment shown in Figs. 7 and 8, the base plate 114 serves as the equivalent of the mounting bracket 28. Posts 128 are vertically fixed to the base plate 114 as shown in Fig. 8. A pair of interlock arms 138 are respectively pivotally mounted on the posts 128 by suitable pivot studs 140. The inner end of each interlock arm is formed with a cam surface 142 and an end surface 144 corresponding respectively to the surfaces 42 and 44 of the interlock arms shown in Figs. 1 through 3 and the function of said surfaces is the same.

Each interlock arm is also provided with an armature engaging member 146 which is substantially parallel to but laterally offset with respect to the main portion of each interlock arm. Furthermore, the uppermost arm in Fig. 7 has the armature engaging member 146 extending substantially at right angles to the main portion of the interlock arm to resemble a bell crank. The lowermost interlock arm has the armature engaging member 146 substantially parallel to the main portion of the arm but disposed at an angle of about 45 degrees with respect to the main portion of the interlock arm to also resemble a bell crank. The lowermost arm is also U-shaped as viewed in Fig. 8. One leg of the U is provided with a bearing aperture accommodating pivot stud 140 and the other leg has an enlarged portion 147 provided with a bearing aperture pivotally receiving the lower post 128. The provision of the two bearings in the lower interlock arm results in smooth and relatively noiseless pivotal movement of the interlock arm.

The slots 124 provided in the depending plate 122 of each armature are of such dimensions that they provide free movement therein of the respective armature engaging members 146, without binding, in order that the armature may be raised and lowered during actuation thereof and, during such raising and lowering, the outer end of the interlock arm engaged in each slot will be moved therewith to actuate the interlock arm.

A front guide plate 148 having offset mounting ears 150 disposed at either side is secured to the front face of the base plate 114 by screws 152 projecting through the base plate from the under side thereof. Slots 154 are formed in the base plate to receive the screws 152 for the same purpose as slots 54 shown in Fig. 5. The offset between the front guide plate and the mounting ears 150 provide a space to accommodate the inner ends of the interlock arms 138. The front guide plate is provided medially thereof and adjacent one edge with a guide slot 156.

Mounted on the rear side of the base plate is a rear guide plate 158 which is also secured to the base plate by the screws 152. Medially disposed in the rear guide plate adjacent one edge is a guide slot 162 which is substantially identical with the slot 156, the slots 156 and 162 being so arranged in the respective guide plates that when they are assembled in operative position, the slots are substantially co-extensive, parallel, and superposed over each other.

Apertures 167 may be formed in the rear guide plate to receive locking screws similar to screws 68 in Figs. 1 through 4, if desired.

A locking pin 164 is disposed in a generally rectangular aperture 165 formed in the base plate 114. At its opposite ends, the locking pin is provided with cylindrical trunnions 166 which are disposed in the guide slots 156 and 162 of the guide plates to rotatably mount the locking pin 164 between the guide plates. The functions and characteristics of the locking pin 164 are similar to those of locking pin 64 in Figs. 1 through 6. Further elaboration upon the same is not believed necessary in the present description.

As viewed in Fig. 7, the upper magnetic motor starter switch is closed and the upper interlock arm is shown holding the locking pin in such position as to prevent movement of the lower interlock arm whereby the lower magnetic motor

starter switch may be closed. After the closed upper switch has been opened, however, the armature thereof will drop and consequently move the upper interlock arm from locking engagement with the locking pin 164 and, if it is desired to close the lower magnetic motor starter switch, the lower interlock arm will be permitted to move the locking pin upward in the slots 156 and 162 and into position to be contacted by the cam surface 142 of the upper interlock arm to prevent movement of the cam end of the upper interlock arm to the right whereby the upper magnetic motor starter switch may not be closed as long as the lower switch is closed.

In the embodiment of the invention illustrated in Figs. 7 and 8, it will be noted that the major portion of each interlock arm is disposed to one side of a vertical line passing through each pivot and, gravity will act upon the major portion of each arm to assist the movement thereof to a position in which the switches will be in open circuit position whereby the opening of the switches is facilitated after the magnet of each switch is de-energized.

As in the case of the embodiment in Figs. 1 through 6, when both switches shown in Figs. 7 and 8 are open, the armatures will move the interlock arms to a so-called neutral position in which the locking pin 164 does not necessarily engage the inner end surfaces of either interlock arm except as gravity causes the interlocking pin to rest against the cam surface 142 of the lower interlock arm.

The adjustment of the front and rear guide plates 148 and 158 with respect to the base plate takes place in the same manner and is for the same purposes as described in connection with the embodiment shown in Figs. 1 through 6.

While the invention has been illustrated and described in its preferred embodiment and has included certain details, it should be understood that the invention is not to be limited to the precise details herein illustrated and described since the same may be carried out in other ways, falling within the scope of the invention as claimed.

Furthermore, descriptive terms such as "vertical" and the like, as used throughout this specification and in the claims, are to be considered as relative to the position of the various elements and mechanisms as they are shown in the views of the present drawings. Should the mechanism be mounted in positions other than shown in the drawings, said descriptive terms are to apply in the same relative sense as herein used.

What I claim is:

1. A mechanical interlock for use with and adapted to prevent concomitant closing of two electric switches each having a component member movable along a defined path during opening and closing of the switch, said interlock comprising in combination, a supporting member, a plurality of arms each pivoted intermediately of their ends to said supporting member, one end of each of said arms being respectively adapted for connection to the movable component member of one of said switches for actuation thereby while moving along the path thereof and the opposite ends of said arms each comprising a cam surface and another adjacent surface, an elongated guideway on said supporting member, and a locking member movable in said guideway to one of a plurality of positions therein by engagement with the cam surface of one of said arms when said arm is actuated by the closing movement of the switch adapted to be connected thereto, said locking member being held in said position by engagement with the adjacent surface of said one arm and said locking member also then being engageable with the cam surface of the other arm to obstruct movement of said arm in a direction to permit the switch adapted to be connected thereto to close until after the first-mentioned switch has opened and incidently moved said one arm from engagement with the locking member, whereby the cam and adjacent surfaces of said other arm may then function similarly to the cam and adjacent surfaces of said one arm.

2. A mechanical interlock for use with and adapted to prevent concomitant closing of two electric switches each having a component member movable along a defined path during opening and closing of the switch, said interlock comprising in combination, a supporting member, a plurality of arms each pivoted intermediately of their ends to said supporting member, one end of each of said arms being respectively adapted for connection to the movable component member of one of said switches for actuation thereby while moving along the path thereof and the opposite ends of said arms each comprising a cam, a pair of substantially parallel members carried by said supporting member and respectively provided with one of a pair of opposed and aligned slots comprising a guideway, and a locking member having guide members respectively disposed in said slots and movable with said locking member to one of a plurality of positions in said guideway by engagement with the cam of one of said arms when said arm is actuated by the closing movement of the switch adapted to be connected thereto, said locking member when in said position being engageable with the cam end of the other arm to obstruct movement of said arm in a direction to permit the switch adapted to be connected thereto to close until after the first-mentioned switch has opened and incidently moved said one arm from engagement with the locking member, whereby the cam of said other arm may then function similarly to the cam of said one arm.

3. A mechanical interlock for use with and adapted to prevent concomitant closing of two electric switches each having a component member movable along a defined path during opening and closing of the switch, said interlock comprising in combination, a supporting member, a plurality of arms each pivoted intermediately of their ends to said supporting member, one end of each of said arms being respectively adapted for direct connection to the movable component member of one of said switches for actuation thereby while moving along the path thereof and the opposite ends of said arms each comprising a cam, an elongated guideway on said supporting member, and a rotatable locking member movable to one of a plurality of positions in said guideway by antifriction engagement with the cam of one of said arms when said arm is actuated by the closing movement of the switch adapted to be connected thereto, said cam end of said one arm locking said locking member in said position by engaging said locking member at a position substantially in direct line with the pivot of said one arm and the axis of the locking member and said locking member when locked in said position being engageable with the cam end of the other arm to obstruct movement of said arm in a direction to permit the switch adapted to be connected thereto to

close until after the first-mentioned switch has opened and incidently moved said one arm from locking engagement with the locking member, whereby the cam of said other arm may then function similarly to the cam of said one arm.

4. A mechanical interlock for use with and adapted to prevent concomitant closing of two electric switches each having a component member movable along a defined path during opening and closing of the switch, said interlock comprising in combination, a supporting member, a plurality of arms each pivoted intermediately of their ends to said supporting member, one end of each of said arms being respectively adapted for direct connection to the movable component member of one of said switches for actuation thereby while moving along the path thereof and the opposite ends of said arms each comprising a cam, a pair of substantially parallel members adjustably carried by said supporting member and respectively provided with one of a pair of opposed and aligned slots comprising a guideway, and a locking member having guide members respectively disposed in said slots and movable with said locking member to one of a plurality of positions in said guideway by engagement with the cam of one of said arms when said arm is actuated by the closing movement of the switch adapted to be connected thereto, said locking member when in said position being engageable with the cam end of the other arm to obstruct movement of said arm in a direction to permit the switch adapted to be connected thereto to close until after the first-mentioned switch has opened and incidently moved said one arm from engagement with the locking member, whereby the cam of said other arm may then function similarly to the cam of said one arm, the adjustability of said guideway with respect to said supporting member enabling the proper initial positioning of the locking member with respect to the cam ends of said arms.

5. A mechanical interlock for use with and adapted to prevent concomitant closing of two electric switches each having a component member movable along a defined path during opening and closing of the switch, said interlock comprising in combination, a supporting member, a plurality of arms each pivoted intermediately of their ends to said supporting member, one end of each of said arms being respectively adapted for direct connection to the movable component member of one of said switches for actuation thereby while moving along the path thereof and the opposite ends of said arms each comprising a cam, a pair of substantially parallel members carried by and vertically adjustable with respect to said supporting member, said members being respectively provided with one of a pair of opposed and aligned slots comprising a guideway, and a rotatable locking member having pintles respectively disposed in said slots and movable to one of a plurality of positions in said guideway by antifriction engagement with the cam of one of said arms when said arm is actuated by the closing movement of the switch adapted to be connected thereto, said locking member when in said position being engageable with the cam end of the other arm to obstruct movement of said arm in a direction to permit the switch adapted to be connected thereto to close until after the first-mentioned switch has opened and incidently moved said one arm from engagement with the locking member, whereby the cam of said other arm may then function similarly to the cam of said one arm, the vertical adjustability of said guideway with respect to said supporting member enabling the proper initial positioning of the locking member with respect to the cam ends of said arms.

RICHARD P. BALLOU.