

Sept. 21, 1965

H. E. WHITING ETAL
ELECTRICAL SWITCH WITH MECHANICALLY INTERLOCKED
MOVABLE CONTACT CARRIERS

3,207,869

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3 Sheets-Sheet 1

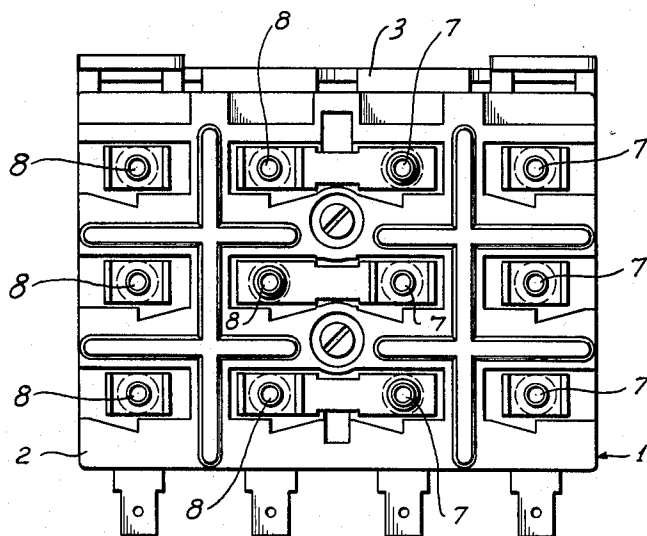


Fig. 1.

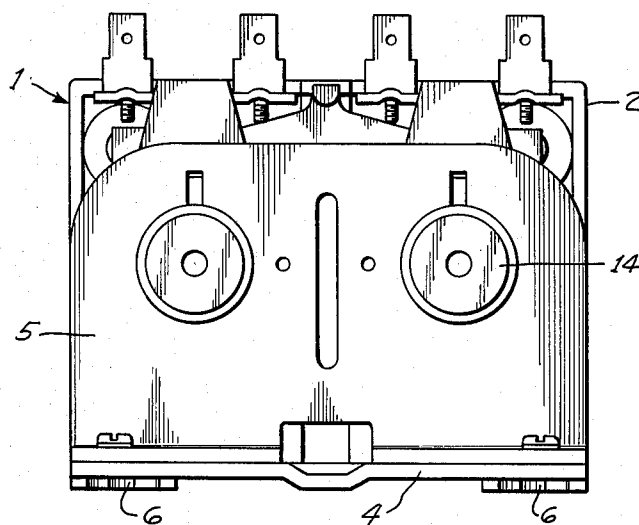


Fig. 3.

INVENTOR
Harold E. Whiting, &
BY Walter C. Karch,
John H. Leonard,
their ATTORNEY.

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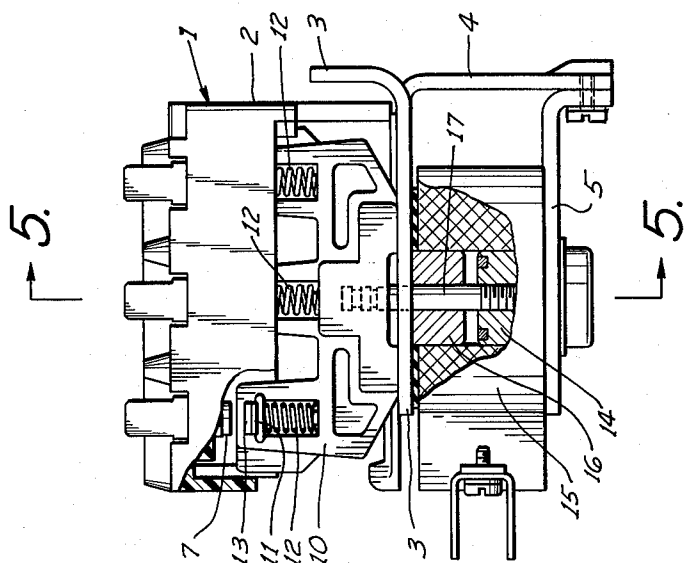


Fig. 4.

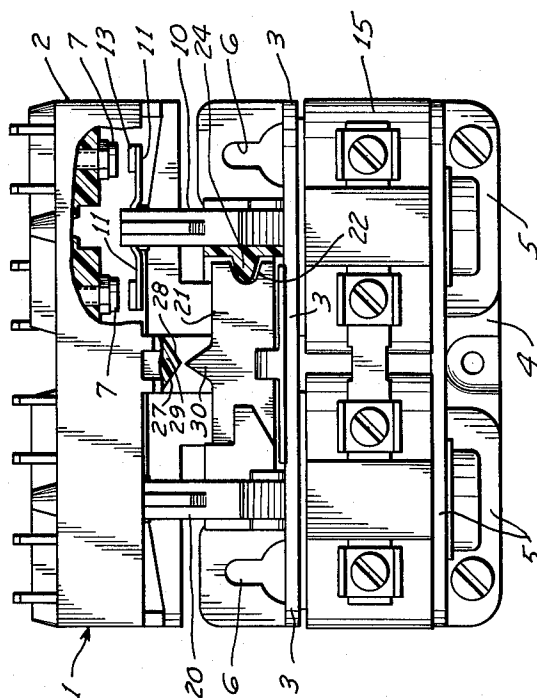


Fig. 2.

INVENTOR.
Harold E. Whiting &
BY Walter C. Karch,
John H. Karch,
their ATTORNEY.

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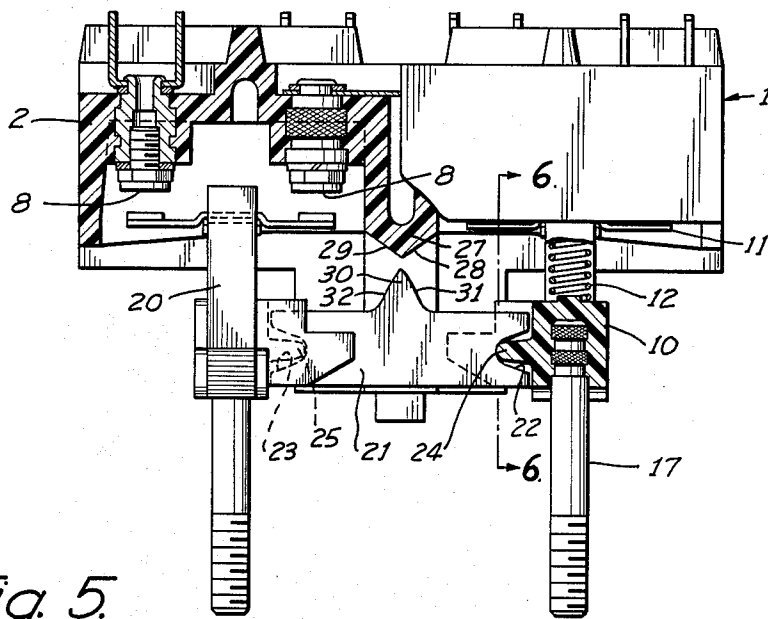


Fig. 5.

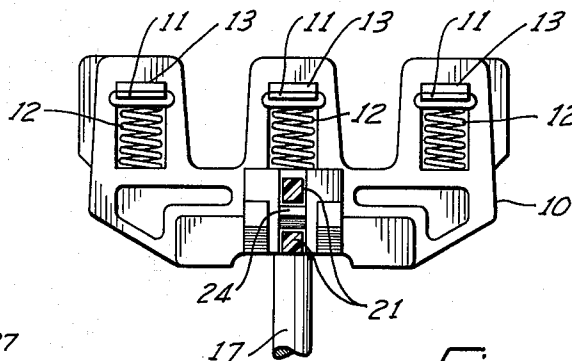


Fig. 6.

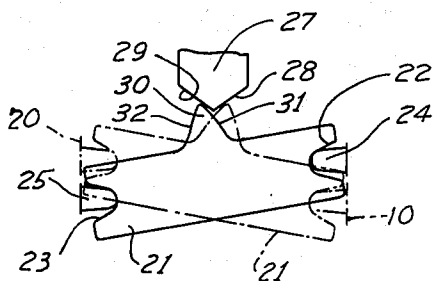


Fig. 7.

INVENTOR.
Harold E. Whiting &
Walter C. Karch,
BY
John H. Leonard,
ATTORNEY.

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3,207,869

ELECTRICAL SWITCH WITH MECHANICALLY INTERLOCKED MOVABLE CONTACT CARRIERS

Harold E. Whiting and Walter C. Karch, Milwaukee, Wis., assignors to Square D Company, Park Ridge, Ill., a corporation of Michigan

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4 Claims. (Cl. 200—50)

This invention relates to interlocked electromagnetically actuated electrical switches and particularly to a new and improved mechanical interlock between a pair of electromagnetically actuated contactors.

Mechanically interlocked contactors are old in the art, however, in prior contactor combinations, the interlocks provided were either assembled of complicated lever arrangements to provide satisfactory operation and long life or when less expensive designs were used, short life or unsatisfactory operation resulted. The interlock arrangement according to the present invention operates virtually without friction between the parts so as to have a long life and without imposing any lateral thrust upon the parts of the contactor to which it is connected so as to ensure a satisfactory operation.

The mechanical interlock of the present invention assures that the electromagnetic means of one of two contactors must be substantially completely deenergized before the electromagnetic means of the other of the two contactors can be moved by its electromagnetic means to contact making position, and so that last to be energized of two electromagnetic means cannot impose lateral force on the one which was first to be energized while the latter is in the process of de-energization.

In accordance with the present invention, lateral thrusts cannot be imposed by the working parts of either contactor onto the working parts of the other contactor because of a more nearly positive interlock provided between the moving parts of the contactors.

Various other objects and advantages of the present invention will become apparent from the following description, wherein reference is made to the drawings, in which:

FIG. 1 is a top plan view of a pair of mechanically interlocked contactors embodying the principles of the present invention;

FIG. 2 is a front elevation of the structure illustrated in FIG. 1, part thereof being broken away for purposes of illustration;

FIG. 3 is a bottom plan view of the structure illustrated in FIGS. 1 and 2;

FIG. 4 is a right end elevation of the structure illustrated in FIG. 2;

FIG. 5 is an enlarged vertical sectional view of the contactors and interlock of the present invention, and is taken on line 5—5 of FIG. 4, part thereof being shown in elevation;

FIG. 6 is an enlarged fragmentary sectional view taken on the line 6—6 of FIG. 5; and

FIG. 7 is a diagrammatic illustration of the manner of cooperation of the parts of the interlock in different operating positions of the interlock.

For the purposes of illustration, the invention is shown as a mechanical interlock interconnecting a pair of hoist contactors, each employing a plurality of stationary contacts and a plurality of complementary movable contacts. The specific nature of the contacts themselves and the circuits controlled thereby may be conventional, the invention herein residing in the interlock.

Referring first to FIG. 1 through FIG. 4, the hoist contactors comprises a body, indicated generally at 1, which preferably has a molded housing portion 2 of

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electrical insulating material which is common to the two contactors and is fixedly mounted on a metal mounting plate 3. The mounting plate 3 has a depending flange 4 to which is connected a second mounting plate 5. The plate 5 supports the electromagnetic coils and cores of the pair of contactors. The plate 3 is provided with suitable screw receiving slots 6 by which the body 1 can be supported on suitable screws in an upright position, such as shown in FIG. 2, on an upright supporting wall or panel.

Each of the hoist contactors have three pairs of stationary contacts, those of one contactor being indicated at 7 and those of the other at 8. The contacts 7 are cooperative with the movable contacts carried on the single carrier of one contactor, and the contacts 8 with the movable contacts carried on the single contact of the other contactor, as later described.

The particular arrangement and number of contacts form no part of the present invention, but are dictated by each particular circuit to be controlled.

In the form shown for purposes of illustration, one contactor has an electromagnetic contact actuator comprising an insulating carrier 10 carrying three contact bridges 11 which are held in place resiliently, and urged in contact making direction relative to the carrier 10, by springs 12. Each bridge 11 has two contacts 13 for bridging an associated pair of contacts 7. This carrier 10 is of electrical insulating material and is operated by an armature 14. The armature 14 is reciprocable in, and operated by, a coil 15 having a core 16, and is connected to the carrier 10 by a rod 17 for movement of the armature and carrier as a unit. The coil 15 is arranged so that upon energization, it moves the carrier 10 to contact making, or extended position. Upon de-energization, the carrier 10 drops to contact breaking, or retracted, position.

For convenience in reference, the carrier of the contactor which has contacts 7 is designated as 10, the carrier of the contactor which has contacts 8 designated as 20, its structure, bridging contacts, electromagnetic operating means, and operation being the same as are those of the carrier 10.

The electromagnetic actuators are arranged to drive their carriers 10 and 20 in parallel paths which are spaced apart from each other in a direction transversely of the housing portion 2. Each actuator is adapted to be operated independently of the other, except for the interlock herein disclosed, and each is operable so that upon energization of its coil, its associated carrier is moved to contact making position and upon deenergization of its coil its carrier drops back to contact breaking position.

As mentioned hereinbefore, it is desirable and necessary that neither actuator be operable to move its carrier and contacts into contact making position while the other is holding its carrier and contacts in contact making position. Therefore, the interlock of the present invention is provided to prevent overlapping of the contact making relations of the two carriers and to assure that the contacts of one carrier have dropped out before the contacts of the other make contact.

As mentioned hereinbefore, the contact carriers 10 and 20 are spaced apart laterally from each other and are arranged to move in parallel paths. Disposed between the paths of the carriers is an interlocking member 21 preferably of nylon or other electrical insulating material. The interlocking member 21 is connected at its ends to both carriers for swinging about each end, relative to the carrier at that end, in directions toward and away and to be supported solely by the carriers. For this purpose, the member 21 is provided at its ends with

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notches 22 and 23 which open outwardly endwise of the member 21 and which extend transversely of the swinging path of the member. Mounted for movement with the carriers 10 and 20, and thus for movement by the actuators, are fingers 24 and 25, respectively. These fingers extend into the notches, respectively, and fit loosely therein. In this manner the member 21 is supported solely by the fingers 24 and 25. In the form illustrated, when both carrier and their actuators are in fully retracted position, the member 21 is supported substantially horizontally, which is normal to the paths of the carriers 10 and 20. However, if either one of the carriers is moved toward contact making position, its finger swings the member 21 about the finger of the other one of the carriers as an axis or pivot. Thus the member 21 can be swung about either of two parallel axes provided by the engagement of the opposite ends of the member 21 with the fingers 24 and 25, respectively.

Mounted within the housing 2, and preferably forming an integral part thereof is a hindering bridge 27. This hindering bridge is spaced in the direction of movement of the carriers toward contact making position from the member 21. The bridge 27 has faces 28 and 29, one face 28 of which faces toward the carrier 10 and the other face 29 of which faces toward the carrier 20. The faces 28 and 29 converge to a peak end in a direction toward the member 21. These faces are obstructing or interlocking faces for cooperating with the member 21 to provide the desired interlock without imposing undue stresses on the member 21 or on the contact carriers 10 and 20. For cooperation with the faces 28 and 29, the member 21 is provided with an integral finger 30 having interlocking faces 31 and 32, which are provided at opposite sides of the finger 30 which are normally spaced from the bridge 27 in the direction of retraction of the carriers 10 and 20. The faces 31 and 32 converge to a peak in a direction toward the hindering bridge 27. The finger 30 is so positioned that when both of the carriers 10 and 20 are in retracted position, the peak end of the finger 30 is closely adjacent but spaced from the peak end of the bridge 27.

The finger 30 with its faces 31 and 32 are positioned so that when one of the carriers 10 and 20 is moved to extended or contact position while the other is in retracted or contact breaking position, the extended carrier swings the member 21 about the finger on the retracted carrier to dispose the finger 30 to the side of the member 27 which is adjacent the retracted carrier, thus disposing the face 31 of the finger 30, facing toward the extended carrier, closely adjacent to, and aligned with, the face of the bridge 27 facing toward the retracted carrier. For example, as illustrated in FIGS. 5 and 7, assuming the carrier 10 is in fully retracted position and the carrier 20 is moved by energization of its coil to extend contact making position, the member 21 is pivoted about the finger 24 so that the finger 30 is swung upwardly in the contact making direction past the bottom of the bridge 27 and to the side of the bridge 27 facing the carrier 10, which is the left in FIGS. 5 and 7. This disposes the face 32 of the finger 30 closely adjacent the face 28 of the hindering bridge 27, as shown in dot-dash lines in FIG. 7.

In this position, the energization of the coil for moving the carrier 10 urges the carrier 10 to rise, whereupon the face 32 engages the face 28 and prevents any further movement of the carrier 10. This does not impose any lateral thrust on the carrier 20. Conversely, if the member 10 is operated first while the member 20 is retracted, as shown in FIG. 5, the finger 30 is disposed at the opposite side of the hindering bridge 27, or to the left thereof, as shown in solid lines in FIG. 7. This disposes the face 31 in alignment with, and close to, the face 29 so as to prevent operation or movement of the carrier 20 by its energizing coil. Thus, whenever either one of the energizing coils of the carriers 10 and 20 is energized,

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the first energized assumes a position of making contact and disposes the finger 30 so that it engages the hindering bridge 27 and prevents the movement of the other of the carriers into contact making position while the first remains in contact making position. Not until the first is fully deenergized and drops back to the retracted or contact breaking position, can the other carrier be moved to contact making position. This assures that there is no possibility of overlap of the contact making by the carriers 10 and 20.

Furthermore, due to the coaction of the faces 28 and 29 with the faces 31 and 32, energization of one actuator while the other is already in the extended contact making position, does not impose any stresses on the other or any bending strains on the interlocking member 21.

As mentioned, the contact carriers 10 and 20 may be of conventional shape and structure and may be guided in conventional internal slots or guideways in the housing portion 2. Also, for precision work, the housing portion 2 and the carriers 10 and 20 are preferably molded of suitable synthetic organic plastic substance, thereby assuring effective electrical isolation of circuits through the contactor relative to each other.

Having thus described out invention, we claim:

1. An electrical switch comprising a support, a pair of electromagnetic operated contact carriers mounted therein in spaced relation to each other for guided movement of the carriers in laterally spaced parallel paths to extended contact making position and retracted contact opening position independently of each other, a rigid elongated interlocking member between the carriers, connecting means connecting the ends of the interlocking member to the carriers, respectively, for rocking relative to the carriers about parallel axes at its ends, respectively, so that upon movement of each carrier to extended contact making position while the other remains in retracted position the interlocking member is caused to swing in the extending direction about the one of its ends connected to the retracted carrier, a hindering bridge on the support and having a portion protruding toward the interlocking member, said portion having hindering faces facing the opposite ends of the interlocking member and converging, in the retracting direction of movement of the carriers, toward a common plane parallel to said paths, an interlocking finger on the interlocking member and spaced from the hindering faces, in the retracting direction of movement of the carriers, when both carriers are retracted, and positioned so that, upon movement of one of the carriers to extended position while the other carrier remains in retracted position, the interlocking finger is moved in a direction toward the path of the carrier which is retracted, into alignment with, and at least close to, the hindering face facing toward the end of the interlocking member which is connected to the retracted carrier, thereby blocking swinging of the interlocking member in a direction which would permit movement of the retracted carrier toward extended position while the extended carrier remains in extended position, said interlocking member being constrained by the carriers to limited rocking movement wherein the interlocking finger, in all rocked positions of the interlocking member, is closer, endwise of the interlocking member, to said plane than to the connection of the end of the interlocking member with the one of the carriers which is retracted.

2. A switch according to claim 1 wherein the connecting means of the interlocking member and carriers comprise notches in the ends of the interlocking member, respectively, said notches opening outwardly endwise of the interlocking member and each extending transversely of the path of movement of the carrier adjacent to it, connecting fingers on the carriers, respectively, and said fingers being loosely accommodated in the notches.

3. A switch according to claim 2 wherein sockets are provided on the carriers, respectively, the fingers on the

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carriers are disposed in the sockets, and the ends of the interlocking member are loosely received in the sockets, respectively.

4. A switch according to claim 1 wherein the interlocking finger has contact faces complementary to the 5
hindering faces, and said contact faces converge in the extending direction of movement of the carriers at an acute angle to each other.

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BERNARD A. GILHEANY, *Primary Examiner.*