Feb. 18, 1969 J. F. DREES ET AL 3,428,764

INTERLOCKING MECHANISM FOR ELECTRICAL CONTROLLERS

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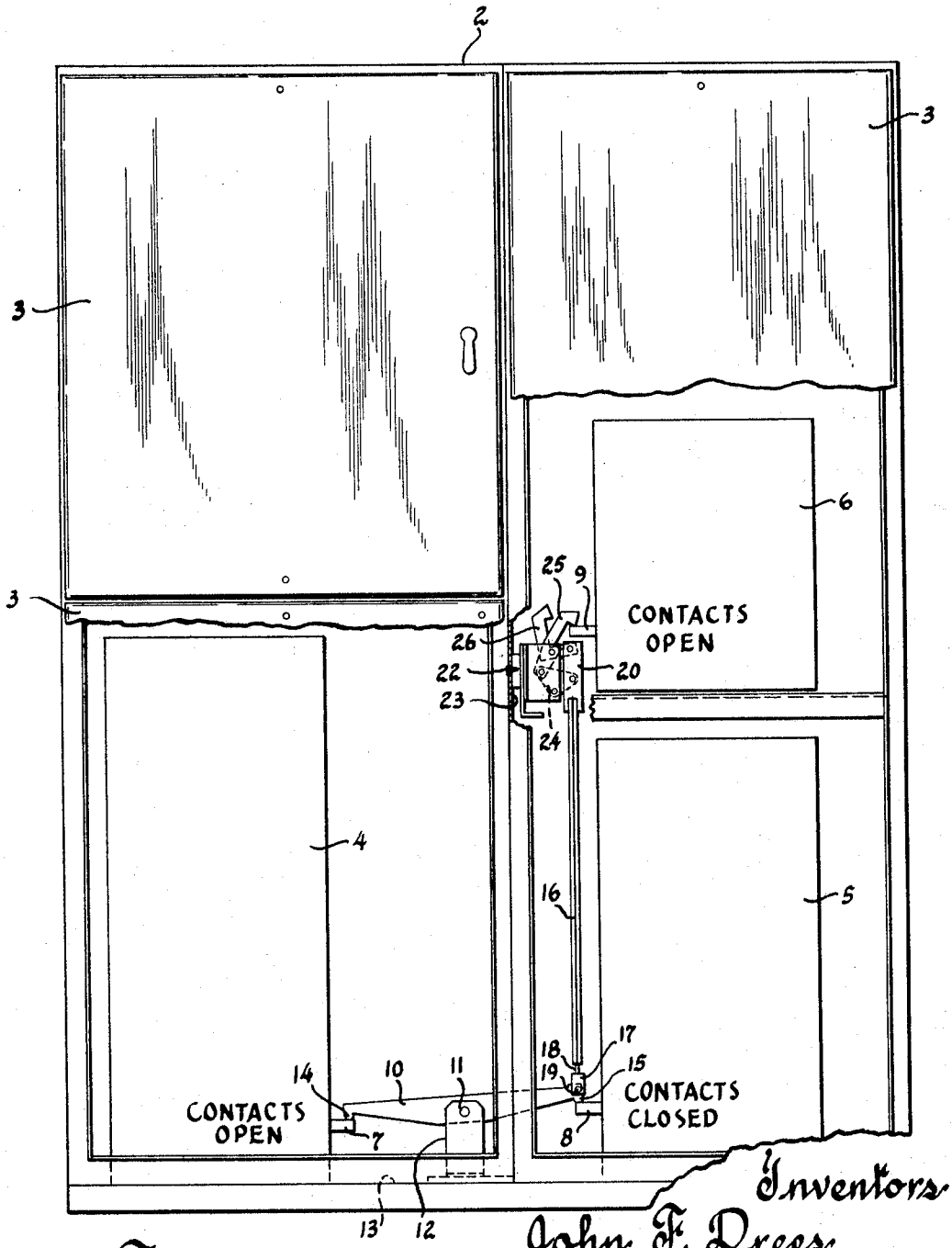

Fig. 1

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INTERLOCKING MECHANISM FOR ELECTRICAL CONTROLLERS

Fig. 2

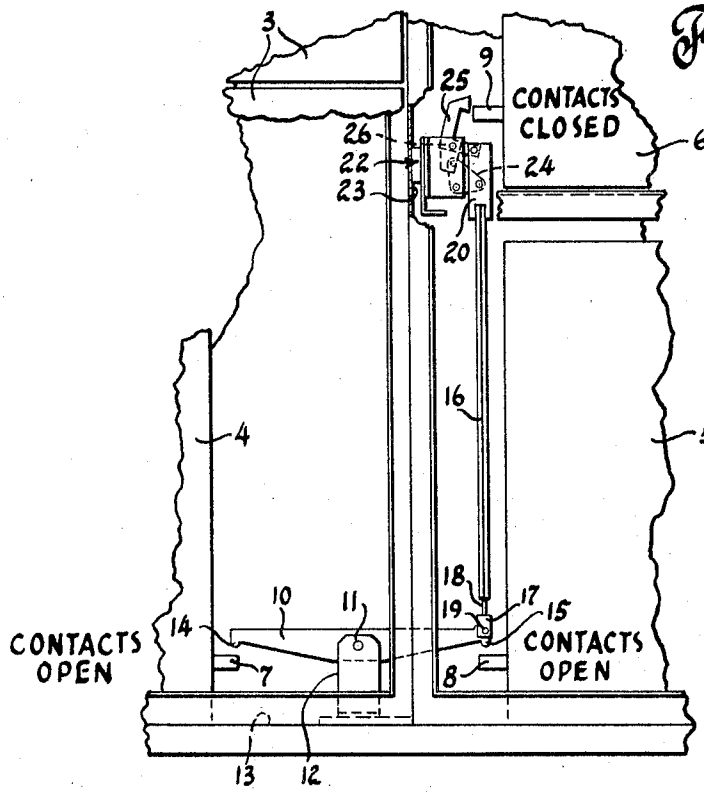

Fig. 3

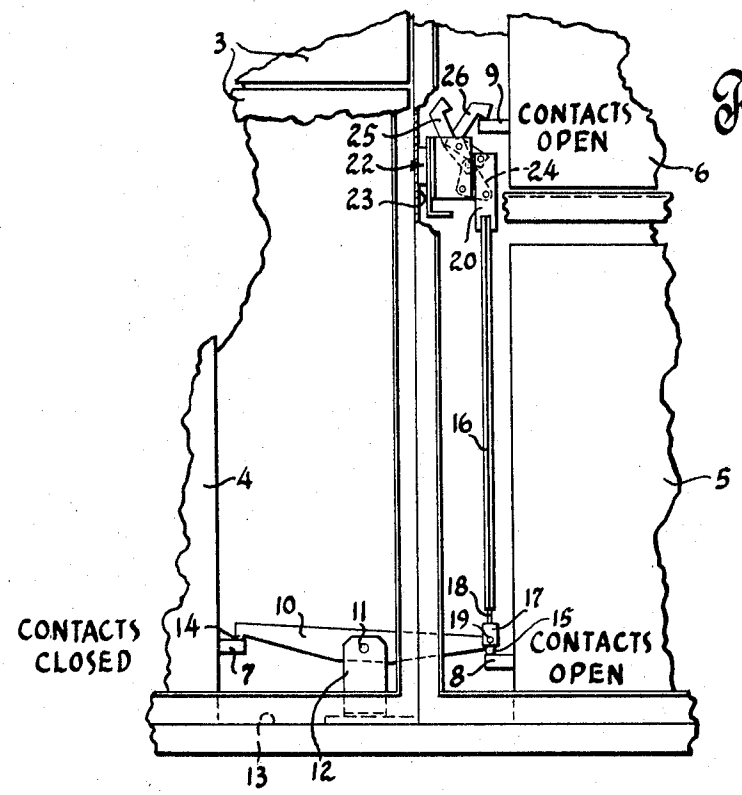

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Fig. 4

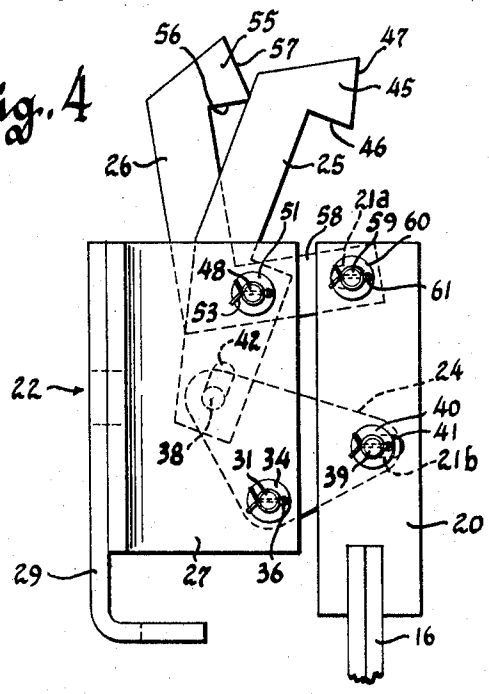


Fig. 5

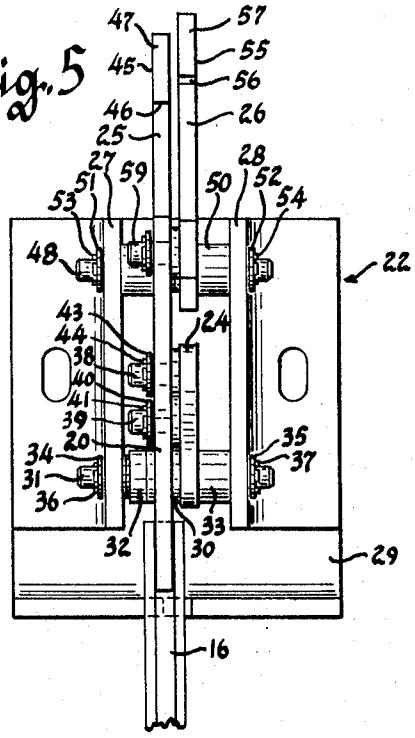
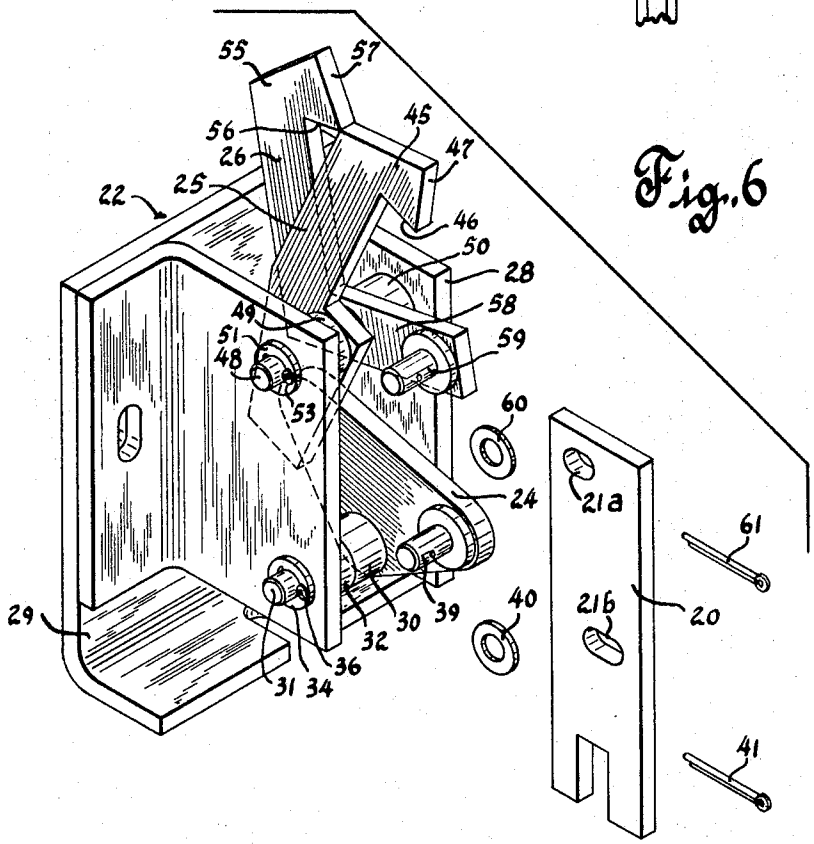


Fig. 6



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INTERLOCKING MECHANISM FOR ELECTRICAL CONTROLLERS

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U.S. Cl. 200—50 4 Claims
Int. Cl. H01h 9/24, 33/52

ABSTRACT OF THE DISCLOSURE

An interlocking mechanism for three electromagnetically operated contactors, each of which has an open and closed position. The interlock comprises a lever for preventing the simultaneous closure of the first two of the contactors and further comprises a single connecting rod and multiple lever system for preventing closure of the third contactor while either of the first two contactors are closed and preventing closure of either of the first two contactors while the third contactor is closed.

Back ground of the invention

This invention relates to mechanical interlocks for electrical devices and more particularly for mechanical interlocks for motor controllers including forward, reverse and dynamic braking contactors.

Prior to the present invention there existed a variety of mechanisms for performing interlocking functions similar to that of the mechanism herein disclosed. However, because of the multiple interlocking functions involved in a controller such as is herein disclosed, the previous mechanisms tended to be complex and might consist of several separate linkage and lever systems. The present device improves on the prior art in combining the several interlocking functions into a single easily adjusted mechanical lever and linkage system of minimum complexity.

Summary

It is an object of the invention to provide a more simple and reliable mechanical interlock system for electrical controllers which include multiple electrical contactors.

It is a more specific object of the invention of the aforedescribed type for an electric motor controller comprising forward, reverse and dynamic braking contactors which are mounted adjacently within the controller cabinet.

The objects of the invention are accomplished by providing first mechanical interlocking means between first and second contactors to prevent simultaneous closure of these contactors and further coupling the first interlocking means to a second interlocking means associated with a third contactor. The second interlocking means comprises a multiple member system arranged so that a first member is moved into position to block the closure of the third contactor when the first contactor is closed. Another member moved to block closure of the third contactor when the second contactor is closed. The second interlocking means is further arranged so that when the third contactor is closed, movement of the two members is blocked. The second interlocking means is also coupled to the first interlocking means to consequently prevent closure of either of the first two contactors.

Brief description of the drawings

FIGURE 1 is a front elevational view of an interlocked electrical controller with the doors thereof partially broken away which incorporates the present invention;

FIG. 2 is a fragmentary view of the device shown in FIG. 1 showing the mechanism in a second position;

FIG. 3 is a fragmentary view similar to FIG. 2, but with the mechanism in a third position;

FIG. 4 is a fragmentary view showing a portion of the mechanism of FIGS. 1, 2 and 3;

FIG. 5 is a side view of the portion shown in FIG. 4; and

FIG. 6 is an isometric partially exploded view of the mechanical portion shown in FIGS. 4 and 5.

Description of the preferred embodiment

A motor controller assembly is illustrated in FIG. 1 consisting of an enclosure **2** with front doors **3** and three electromagnetically operated contactors **4**, **5** and **6** mounted in compartments of enclosure **2**. Contactors **4**, **5** and **6** can be of various commonly available types of medium voltage electromagnetically operated controllers, each having open and closed contact positions. Contactors **4**, **5** and **6** have projections **7**, **8** and **9**, respectively, extending therefrom which are attached to the operating mechanisms thereof. Projections **7**, **8** and **9** move vertically between positions corresponding to the open and closed positions of the associated contacts. As preferably illustrated, projections **7**, **8** and **9** are in their open positions when in their lower positions and are in their closed positions when in their upper positions.

The arrangement shown in FIG. 1 is typical of a motor controller for forward, reverse and dynamic braking control. Contactor **4** is the reverse contactor which when closed causes a motor (not shown) to run in a reverse direction. Contactor **5** is the forward contactor which when closed causes the motor to run in a forward direction. Contactor **6** is a dynamic braking contactor which when closed causes dynamic braking of the motor.

As is well known, it is necessary to prevent the forward contactor **5** and the reverse contactor **4** from being closed at the same time. For this purpose there is provided a rocking lever interlock or teeter bar **10**. Lever **10** is pivotally mounted at its center on a pin **11** which is supported by a steel bracket assembly **12**. Bracket **12** is rigidly secured to a bottom surface **13** of enclosure **2**. At opposite ends of lever **10** there are similar depending rounded protuberances **14** and **15** which are positioned to contact projections **7** and **8**, respectively, during operation. FIG. 2 shows both the forward contactor **5** and the reverse contactor **4** in their open positions. Projections **7** and **8** are in their lower positions spaced from protuberances **14** and **15** on lever **10**. From this position either one or the other of contactors **4** or **5** may be activated to a closed position as shown in FIG. 3 and FIG. 1, respectively. However, both may not be closed simultaneously because if contactor **4** is closed as shown in FIG. 3, projection **7** rises to raise the left end of lever **10**. The right end of lever **10** consequently lowers and protuberance **15** holds projection **8** down to prevent closure of contactor **5**. Similarly, as shown in FIG. 1, if contactor **5** is closed, projection **8** tilts lever **10** to the left and contactor **4** is held open by the engagement of protuberance **14** with projection **7**.

As is also well known in the field of motor control, the dynamic braking contactor must not close if either one of contactors **4** and **5** is closed, and neither one of contactors **4** and **5** may be allowed to close if the dynamic braking contactor **6** is closed. For these purposes another interlocking mechanism is provided to cooperate with projection **9** on contactor **6**.

The linkage for this additional interlock mechanism includes a connecting rod **16** of hexagonal cross section. Rod **16** is pivotally connected at its lower end to the right end of lever **10** by a clevis **17**. A stud **18** is welded

to the bight of clevis **17** and is threaded into the lower end of rod **16** to provide an adjustable connection. By disconnecting and rotating clevis **17** the effective length of the connection may be adjusted by turning stud **18** into or out of the threaded end of rod **16**. Clevis **17** is pivotally connected to lever **10** by a pin **19** passing therethrough. The upper end of rod **16** is welded to a plate **20** which is best shown in FIG. 6. A pair of transversely elongated holes **21***a* and **21***b* are formed in plate **20**.

A lever assembly **22** is fastened adjacent the lower end of contactor **6** to a vertical partition **23** in enclosure **2**. Assembly **22** comprises a group of three levers **24**, **25** and **26** pivotally supported on a mounting frame consisting of two spaced apart angle brackets **27** and **28** welded to a plate **29**.

Lever **24** consists of a roughly triangular shape with a boss **30** welded to one side near one corner. A shaft **31** passes through brackets **27** and **28** and loosely through an aperture in boss **30** and lever **24** to provide pivotal support for lever **24**. A pair of tubular spacers **32** and **33** are arranged on opposite sides of lever **24** on shaft **31** to properly aline lever **24** in the mechanism. Washers **34** and **35** and cotter pins **36** and **37** serve to retain shaft **31** in place. Pins **38** and **39** are securely fastened to the other two corners of lever **24** and extend to one side of lever **24**. Pin **39** fits slidingly within hole **21***b* to provide a mechanical connection between lever **24** and plate **20**. A washer **40** and cotter pin **41** secures pin **39** within hole **21***b*.

Lever **25** has at its lower end a slot **42** which sildingly fits over pin **38** and is secured thereon by washer **43** and a cotter pin **44**. At its upper end lever **25** has a hook-like portion **45** having a lower edge **46** and a lateral edge **47**. Lever **25** is pivotally mounted on shaft **48** which passes through lever **25** and a boss **49** which is welded to lever **25**. Thus, the lever system including levers **24** and **25** is arranged so that when connecting rod **16** moves upwardly, hook-like portion **45** moves away from partition **23** into engagement with or into the path of projection **9**.

Lever **26** is also pivoted upon shaft **48** which passes through lever **26** and a boss **50** attached to lever **26**. Shaft **48** passes through apertures in brackets **27** and **28** and is secured by washers **51** and **52** and cotter pins **53** and **54**. At its upper end, lever **26** has a hook-like member **55** similar to that of lever **25**. Member **55** has a lower edge **56** and a lateral edge **57**. Lever **26** has a lateral extension **58** with an attached pin **59** which fits sildingly within hole **21***a* and is secured therein by washer **60** and cotter pin **61**. This lever **26** is arranged so that when connecting rod **16** moves upwardly member **55** moves toward partition **23** or just oppositely to the movement of member **45**.

Referring to FIG. 2, the contactors **4** and **5** are both shown to be in their open positions. Under these circumstances the interlock mechanism permits levers **25** and **26** to assume the position shown wherein projection **9** clears members **45** and **55** and therefore free to move upwardly to the position shown in FIG. 2. Consequently, dynamic braking contactor **6** is free to close. As long as dynamic braking contactor **6** remains closed, the engagement of edges **47** and **57** with prejection **9** will not permit either of members **45** or **55** to move to the right. As a result the linkage including connecting rod **16** prevents lever **10** from tilting in either direction from the position shown in FIG. 2. Consequently, under these circumstances neither of contactors **4** or **5** may close.

When contactor **6** is open as shown in FIGS. 1 and 3, levers **25** and **26** are unrestrained and lever **10** may tilt either to the right as shown in FIG. 3, in which position contactor **4** may be closed or to the left as shown in FIG. 1, in which position contactor **5** may close. When

contactor **4** closes as shown in FIG. 3, the linkage including connecting rod **16** moves member **55** to the right in which position lower edge **56** restrains the upward movement of projection **9** to prevent closure of contactor **6**.

When contactor **5** closes lever **10** tilts to the left and through lever **24** causes hook-like member **45** to move to the right where lower edge **46** blocks the upward movement of projection **9**. Closure of dynamic braking contactor **6** is thereby prevented when contactor **5** is closed.

We claim:

1. An interlocking mechanism for an electrical controller including first, second and third contactors, each having open and closed positions comprising:

first interlocking means having a first position which it assumes when said first and second contactors are both open, and effective when held in said first position to block the closure of either of said first and second contactors, said first interlocking means being movable to a second position by closure of said first contactor to block closure of said second contactor and movable by closure of said second contactor to a third position to block closure of said first contactor;

second interlocking means for interlocking the operation of said third contactor with said first and second contactors comprising:

first and second pivoted levers mechanically linked to pivot in opposite directions,

connecting means for connecting said first and second levers to said first interlocking means,

said first lever being movable to block closure of said third contactor when said first contactor closes,

said second lever being movable to block closure of said third contactor when said second contactor closes, and

means on said third contactor movable by closure of said third contactor for blocking movement of said first and second levers to thereby hold said first interlocking means in its first position to prevent closure of either of said first and second contactors.

2. The invention as defined in claim **1**, in which said second interlocking means comprises in addition to said first and second levers:

a third pivoted lever connected to said second lever to cause said first and second levers to pivot in opposite directions; and

said connecting means comprises a single connecting rod linking said first and third levers to said first interlocking means.

3. The invention as defined in claim **2**, in which said first interlocking means comprises a pivoted lever between said first and second contactors.

4. The invention as defined in claim **3**, in which:

said first contactor is a forward motor contactor;

said second contactor is a reverse motor contactor; and

said third contactor is a dynamic braking contactor.

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