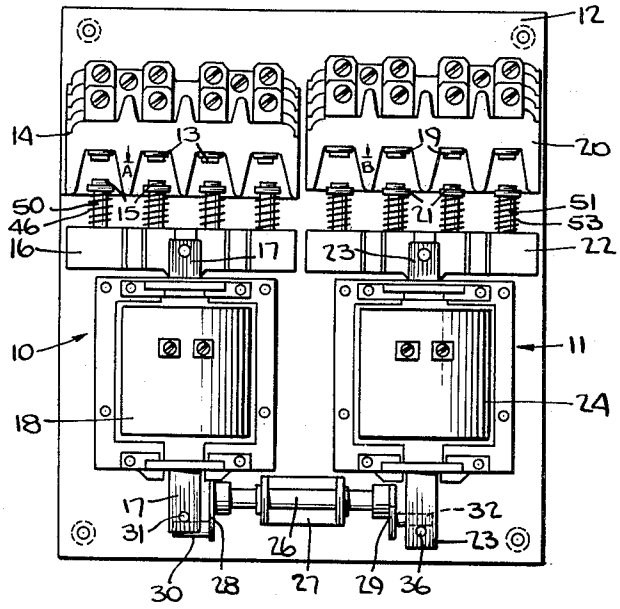
July 23, 1963 J. SCHEIB, JR 3,098,909

MECHANICAL INTERLOCK FOR ELECTRIC SWITCHES

Filed Dec. 27, 1960 2 Sheets-Sheet 1

Fig. 1.



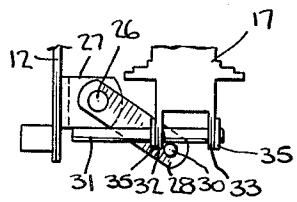


Fig. 2.

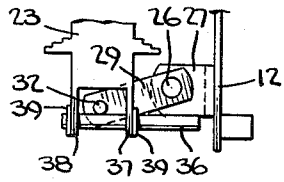


Fig. 3.

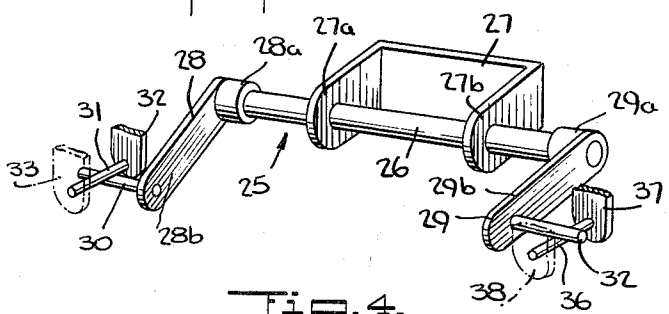


Fig. 4.

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MECHANICAL INTERLOCK FOR ELECTRIC SWITCHES

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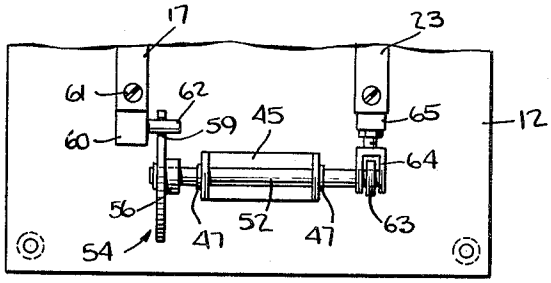


Fig. 6.

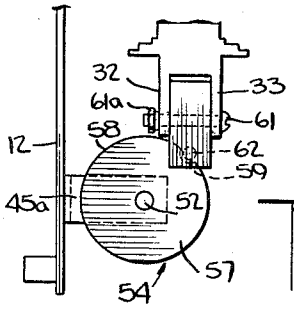


Fig. 7.

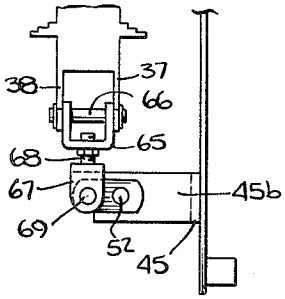


Fig. 8.

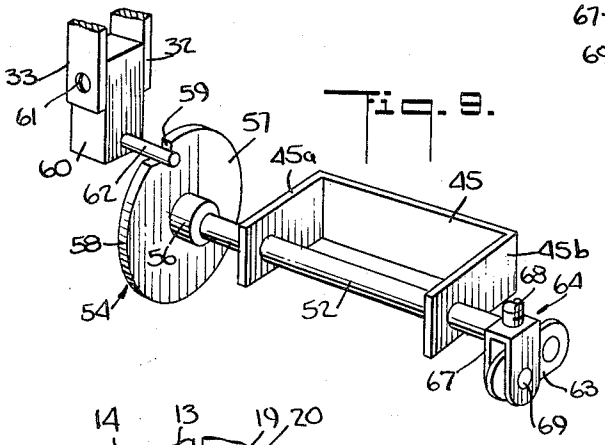


Fig. 9.

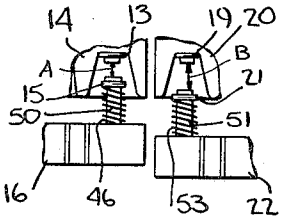


Fig. 5.

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United States Patent Office 3,098,909 Patented July 23, 1963

3,098,909

MECHANICAL INTERLOCK FOR ELECTRIC SWITCHES

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Filed Dec. 27, 1960, Ser. No. 78,379
3 Claims. (Cl. 200—98)

This invention relates to timing the period of contact engagement of at least two contactors and is directed particularly to definitely having the contacts of one contactor closing before and opening after the contacts of another contactor.

An object of the invention is to mechanically interlock two electrically operated contactors to close one contactor prior to a second contactor and maintain the first contactor closed during the engagement of the second contactor and opening after the opening of the second contactor.

Other and further objects and advantages will be apparent from the following description taken in connection with the drawings in which:

FIG. 1 is a front view of two electrical contactors with a mechanical interlock;

FIG. 2 is an end view of the mechanical interlock and a partial side view of the first contactor;

FIG. 3 is a view of the other end of the mechanical interlock and a fragmentary side view of the second contactor;

FIG. 4 is a perspective view of the mechanical interlock of FIGS. 1–3;

FIG. 5 illustrates the movable contacts at different levels and the fixed contacts at the same level;

FIG. 6 is a front view of another embodiment of the mechanical interlock with the lower portions of the armatures of the electrical contactors;

FIG. 7 is an end view of the embodiment of the mechanical interlock of FIG. 6, illustrating the cam means and a fragmentary side view of the contactor;

FIG. 8 is an end view of the embodiment of the mechanical interlock of FIG. 6 illustrating the linkage means and a fragmentary side view of the contactor; and

FIG. 9 is a perspective view of the second embodiment of the mechanical interlock.

Referring to FIGS. 1–4 the electrical contactors **10** and **11** are mounted on panel **12**. The first electrical contactor comprises a first set of fixed contacts **13** securely mounted in the contactor block **14** mounted on the panel **12** and a first set of movable contacts **15** are mounted on the first contactor head **16** actuated by the first armature **17**. The armature **17** is reciprocally mounted in an actuating solenoid **18** fastened to the panel **12**.

The second contactor comprises a second set of fixed contacts **19** mounted in a second contactor block **20** fastened to the panel **12**. The second set of movable contacts **21** is mounted in the second contactor head **22** actuated by the second armature **23**. The armature **23** is reciprocally mounted in the solenoid **24**. The solenoid **24** may be fastened to the panel **12** in any convenient manner. The lower end of the armature **17** is yoke shape with arms **32, 33** extending downward and spaced apart as illustrated. A cylindrical rod **31** extends through openings in the arms and is held in place by lock rings or members **35** positioned on the outer sides of the arms. The cylindrical rod **31** spans the space between the arms and extends through the inside arm **32** towards the panel **12** and terminates closely adjacent thereto.

The armature **23** is similarly constructed with arms **37, 38** forming the lower portion of the armature in the shape of a yoke. The cylindrical rod **36** extends through openings in the arms and spans the space between the arms.

Lock rings **39** hold the rod in place by fitting in grooves in the rod. The rod **36** extends towards the panel and terminates closely adjacent thereto.

The lower ends of the armatures **17** and **23** are interconnected or interlinked by a mechanical interlock **25**. The mechanical interlock comprises a U-shaped bracket **27**, a shaft **26** and two bell cranks **28, 29**. The U-shaped bracket **27** may be stamped from sheet steel or made from other suitable material and fastened to the panel **12** by any suitable means. The shaft rotatably fits in openings in the arms **27*a*, 27*b*** extending perpendicularly from the panel. Lock washers or lock rings fitted on the shaft **26** bear against the arms **27*a*, 27*b*** to hold the shaft axially in position. The shaft **26** terminates adjacent the armatures **17** and **23** and bell cranks **28** and **29** are fixedly fitted on the opposite ends of the shaft.

The bell cranks **28** and **29** comprise collar portions **28*a*, 29*a*** and arms **28*b*, 29*b*** respectively. The collar portions **28*a*, 29*a*** are fitted on the ends of the shaft **26** and locked in place by set screws or other suitable fastening means. On the ends of arms **28*b*, 29*b*** opposite from the shaft **26** are pins **30, 32** respectively extending parallel to the shaft **26**.

The pin **30** engages the shaft **31** between the arms **32, 33** on the armature of contactor **10**. The pin **34** engages the shaft or rod **36** between the arms **37, 38** of the armature of contactor **11**. Pins **30** and **34** rotate in the same direction about the shaft **26** so that if pin **34** is raised pin **30** is raised or if pin **34** is lowered pin **30** is also lowered. The pin **30** is positioned underneath the rod **31** and the pin **34** is positioned above the rod **36**. Thus if the armature **23** with contacts **21** is moved upward by the solenoid **24**, the armature **17** with contacts **15** will move upward simultaneously. Or if the contacts **15** and **21** are in engagement with the respective fixed contacts **13** and **19** and the solenoid **18** deenergizes, the armature **17** will be held in contacting position.

The movable contacts **15** move through a distance A to engage the fixed contacts **13**. The movable contacts **21** move through a distance B to engage the fixed contacts **19**. The distance A is less than distance B so that on the simultaneous movement of the armatures **17** and **23** the movable contacts **15** engage the fixed contacts **13** before the movable contacts **21** engage the fixed contacts **19** and remain in engagement after the movable contacts **21** disengage the fixed contacts **19**.

The movable contacts **15** and **21** are slideably mounted on posts **50** and **51** respectively and resiliently urged towards the fixed contacts **13** and **19** by helical springs **46** and **53**. The posts **50** have a sufficient length to permit the movable contacts **21** to properly seat in the fixed contacts **13**.

The movable contacts **15** and **21** may be positioned at the same level and the fixed contacts **13** positioned closer to contacts **15** than fixed contacts **19** to contacts **21**. Or the fixed contacts may be positioned on the same level and the movable contact **15** positioned at a higher level than movable contacts **21**. In either case the contacts of contactor **10** are closer than the contacts of contactor **11**.

In FIG. 9 a modification **70** of the mechanical interlock is illustrated in which the U-shaped supporting bracket **45** has arms **45*a*, 45*b*** for rotatably supporting the shaft **52**. The bracket **45** may be fastened to the panel **12** in any suitable manner. Locking rings **47** are snapped on the shaft **52** to hold the shaft axially in position. At the opposite ends of the shaft **52** are cam **54** and lever **63**.

The armature **23** is connected to the shaft **52** by means of the lever **63** clamped to the shaft **52** and turning therewith and the linkage **64** connecting the armature **23** to the lever **63**. The linkage **64** comprises a U-shaped mem-

ber 65 coupled to the arms 37, 38 of the armature by the shaft 66. The member 65 is connected to the lever 63 by U-shaped strap 67 and the threaded stud 68. The strap 67 and lever 63 are pivotally connected by the pin 69. On actuation of the armature 23 by the solenoid 24 the shaft 52 is rotated depending on the location of the pin 62 in the notch 59.

The cam 54 comprises a collar portion 56 and a disc 57 extending radial therefrom to form a circular peripheral surface 58 with a notch 59. The collar portion is fitted on the shaft and secured in place to rotate with the shaft 52 by any suitable means such as a set screw or lock washer. The armature 17 instead of a shaft between the arms 32 and 33 has a rectangular member 60 supported by a bolt 61 extending through the arms 37, 38 and the member 60 and secured in place by a nut 61*a*. The member 60 has a pin 62 extending parallel to the shaft 52 and engaging the cam 54 on the peripheral surface 58 and fitting in the notch 59 to prevent rotation of the cam.

The notch 59 and pin 62 form the immobilizing means preventing the contactor 11 from closing when contactor 10 is not energized. The peripheral surface 58 and pin 62 form the immobilizing means preventing the contactor 10 from disengaging when the contactor 11 is still energized and in engaging position. When the pin 62 is in notch 59 the cam 54 cannot rotate and the shaft 52 cannot rotate. The contactor 11 is locked in the open position with the contactor 10. If contactor 10 is energized the pin 62 is lifted out of the notch 59 permitting the shaft 52 to rotate and contactor 11 to move into engaging position. The notch is rotated from underneath the pin and the surface 58 positioned under the pin. If the contactor 10 inadvertently de-energizes while the contactor 11 is still in engaging position the pin 62 engages the peripheral surface 58, holding the contactor 10 in engaging position.

From the foregoing description it is thus seen that one set of contacts must be in engagement when the other set is in engagement. This is extremely desirable in the application of voltages to various types of electrical equipment. The voltage on one part of the equipment affects another part. The voltage on the first part must be applied first. One set of contacts must engage before the other set and disengage after the other set and if the source of energization should fail on the set required to be in contact, means are provided to maintain the engaging relationship. For example in klystron vacuum tubes having a grid, plate and cathode it is essential that the grid voltage be applied at all times that plate voltage is applied. If there is no grid bias when plate voltage is being applied, severe damage to the tube can occur.

The interconnecting means as described interlocks the armature of the two contactors so as to always have contactor 10 in engagement when contactor 11 is in engagement.

I claim:

1. An electric control means comprising a first contactor having first fixed contacts, a first movable armature with first movable contacts and a solenoid for actuating said armature to move said first movable contacts in and out of engagement with said first fixed contacts, a second contactor having second fixed contacts, a second movable armature with second movable contacts and a second solenoid for actuating said armature to move said second movable contacts in and out of engagement with said second fixed contacts, said first fixed contacts positioned closer to said first movable contacts than said second fixed contacts to said second movable contacts to provide an engagement of said first contacts prior and subsequent to the engagement of said second contacts, interconnecting means movably mounted and having a first means attached thereto and solely engaging said first armature over a pressure contact area between said first means and said armature for transmitting force urging said first armature to a contact closed position and separable from said first armature in the opposite direction to permit independent movement of said armature and second means attached to said interconnecting means and solely engaging said second armature over a pressure contact area between said second means and said second armature for transmitting force from said second armature to said second means and said interconnecting means on movement of said second means to a contact closed position and separable from said first armature in the opposite direction to permit independent movement of said second armature from said second means whereby said armatures are coupled on the assuming of closed contact position and separable on assuming an open contact position.

2. An electric control means as set forth in claim 1 wherein said second means comprises a bell crank with a pin and a rod on said second armature positioned underneath said pin to raise said pin and rotate said bell crank on movement of said second movable contacts to engaging position and said first means comprises a shaft coupled to said bell crank and rotated thereby, a first bell crank firmly attached to said shaft and a pin on said bell crank engaging said armature to move said armature upwardly to engaging position on rotation of said first bell crank.

3. An electric control means comprising a first contactor having first fixed contacts, a first movable armature with first movable contacts and a solenoid for actuating said armature to move said first movable contacts in and out of engagement with said first fixed contacts, a second contactor having second fixed contacts, a second movable armature with second movable contacts and a second solenoid for actuating said armature to move said second movable contacts in and out of engagement with said second fixed contacts, said first fixed contacts positioned closer to said first movable contacts than said second fixed contacts to said second movable contacts to provide an engagement of said first contacts prior to the engagement of said second contacts, interconnecting means comprising a rotatably mounted shaft, linkage means between said shaft and said second armature rotating said shaft on actuation of said armature, cam means firmly mounted on and rotating with said shaft and having a peripheral surface with a notch, a pin on said first armature engaging said cam means to allow rotation of said shaft on engagement of said pin with said peripheral surface and to prevent rotation on the meshing of said pin and notch and prevent the movement of said first and second movable contacts unless in the desired relationship.

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