Westinghouse

Type F

A-C. Magnetic Controllers

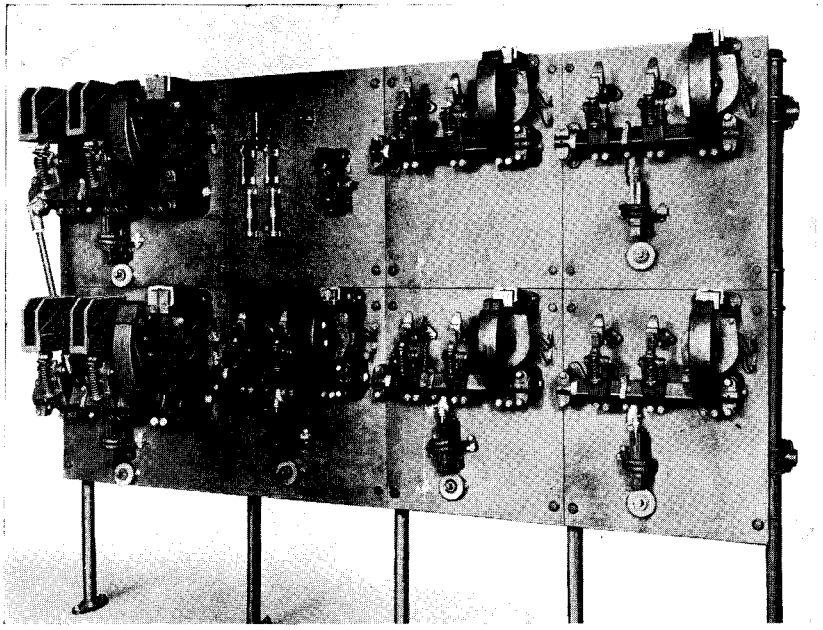


Fig. 1—Westinghouse Type F Magnetic Controller for 150-Horsepower Wound-Rotor Motor in Reversing Service

Westinghouse Electric & Manufacturing Company

East Pittsburgh Works East Pittsburgh, Pa.

INDEX

Westinghouse
Type F
A-C. Magnetic Controllers

DESCRIPTION

1. Westinghouse type F magnetic controllers are used for starting and controlling alternating-current motors in all classes of industrial service. They provide full protection to operators and machinery and permit the use of automatic and remote control.

2. Type F Magnetic controllers are made in the following different forms:

For Squirrel-Cage Motors

Form A—Non-Reversing starters.

For Wound-Rotor Motors

Form B—Non-Reversing without speed control.

Form D—Reversing with speed control.

3. Type F controllers consist of part or all of the following devices:

Type F Contactors	
Low-Voltage relays	Interlocks
Overload relays	Push buttons
Series accelerating relays	Master switches

OPERATION

4. With the use of a type F controller, an alternating-current motor can be started and automatically accelerated by simply closing a knife switch, snap switch or push button, or by means of a pressure gauge or float switch. The controller then, without further attention, makes the proper connections. A squirrel-cage motor is first supplied with low voltage from auto-transformers or by inserting resistance in the circuit and then connected directly across the line; a wound-rotor motor is started with full resistance in the secondary circuit, the resistance being then cut out in several steps. In all cases, the starting current is limited and the rate of acceleration is varied according to the load on the motor so that the machine will attain full speed as rapidly as is consistent with safety.

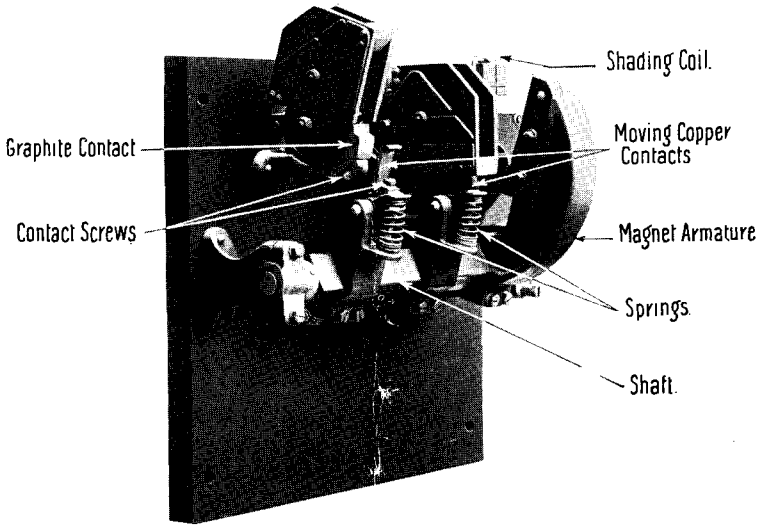


Fig. 2—250 Ampere Contactor

LUBRICATION

5. To secure the best operation, no lubrication of any kind should be used with type F controllers.

INSTALLATION

6. The control panels should be installed as near the motor as possible in a location free from excessive dust and moisture.

7. The master switch or push-button control stations can be located at some distance from the motor controller, in any convenient place desired.

TYPE F CONTACTORS

8. The moving contacts (Fig. 2) and the magnet armature are mounted on a common shaft and so arranged that the contactor opens by gravity, assisted by the action of strong non-adjustable springs.

9. In contactors of 250 amperes capacity and larger, instead of copper - to - copper, copper to graphite contacts (Fig. 3) are sometim s used for making and breaking the circuit, but in all cases the final contact is between heavy copper pieces. The two types mechanically are interchangeable. In closing, the contacts roll against each other with a very slight wiping motion, and are finally pressed firmly together.

Fig. 3—New Contacts

10. Contacts—Fig. 3 illustrates a set as they appear when new. When they have worn away, as shown in Fig. 4, they should be replaced. Since the surface of a new contact will not fit that of one which is worn, they should always be replaced in sets—never singly.

11. Contacts must never be filed or otherwise dressed, because their life will be materially shortened by filing, the best shape for the surfaces resulting from natural wear.

12. To remove the contacts it is only necessary to take out the contact screws (Fig. 6). Those of small size are held in place by one screw; larger ones have two screws. The contact screws should be replaced by new ones whenever a new set of contacts is installed.

13. Contacts can be obtained in complete sets from any district office or from the East Pittsburgh Works by ordering one of the style numbers in Fig. 5 or 5-A.

14. The pivot on which the moving contact turns, can be removed easily and without the use of tools. Fig. 6 shows one style of pivot. This is held in its support by snap pins at each end. It can be removed by taking out the snap pins and pushing it out of the support. Another style of pivot is used on large sizes. This kind is held in place by a small pin which in turn is held by a flat spring. The pivot, however, can be removed by simply pushing it out by hand.

15. The arc shields shown in Fig. 6 are hinged so that they can be lifted to expose the contacts. Should an arc shield need removing it can easily be replaced by removing the arc shield pivot, taking off the old shield and slipping on a new one in its stead.

16. Blow-out coils, shown in Fig. 6, are used on all line contactors, but those in the secondary circuit of the motor, as a rule, do not require them. They are riveted and soldered to the stationary contact support and in case of accident are replaced with the support with which the coil is always furnished.

17. Operating coils are wound for continuous service at their rated voltage and frequency. The coils are designed so that they will close the contacts with proper presssure at 80 per cent of normal voltage. Failure of the contactors to close may be due to the following causes:

No voltage.	Broken connections.
Low voltage.	Mechanical obstacles.
Wrong connections.	

18. If an operating coil should burn out, the characteristics of the power supply should be checked up very carefully before making any replacements. The coils are conservatively rated so that there should be no burn outs, unless the coils are subjected to high over-voltage or abnormal frequency variation.

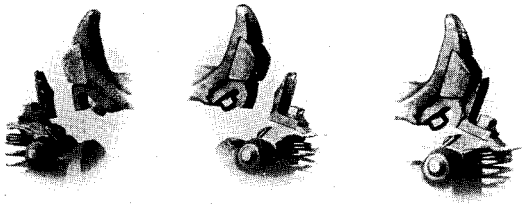


Fig. 4—Worn Contacts Requiring Replacement

19. The removal of an operating coil is simple. The stop pin is first pushed out after removing a cotter pin from either end. This allows the armature to fall back, as shown in Fig. 6, so that the two screws holding the coil can be removed and the two connecting leads unfastened. The coil can then be slipped off the magnet core.

20. Shaft—The shaft is supported in bearings which are interchangeable, reversible and self-adjusting, so that the shaft can be easily removed and replaced in perfect alignment. Removing four screws allows the shaft with the moving contacts and operating arm to drop down, as shown in Fig. 7.

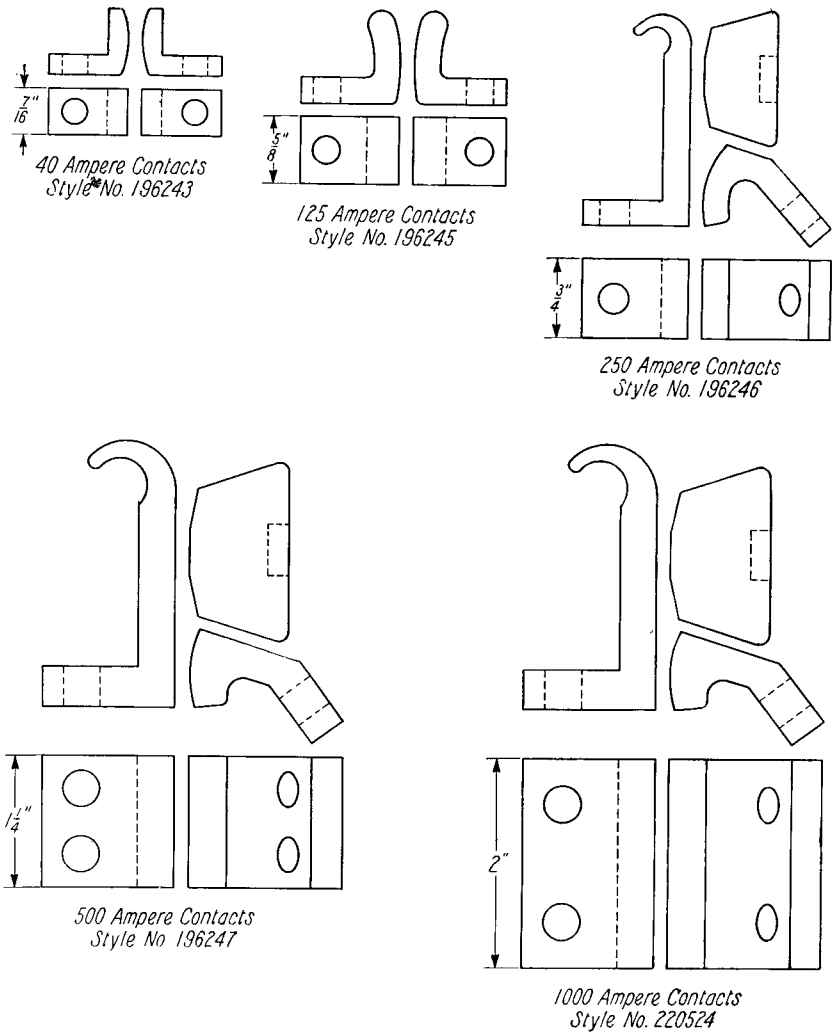


Fig. 5—Type F Contacts—Style Numbers Include Complete Set of Contacts with Screws and Lock Washers

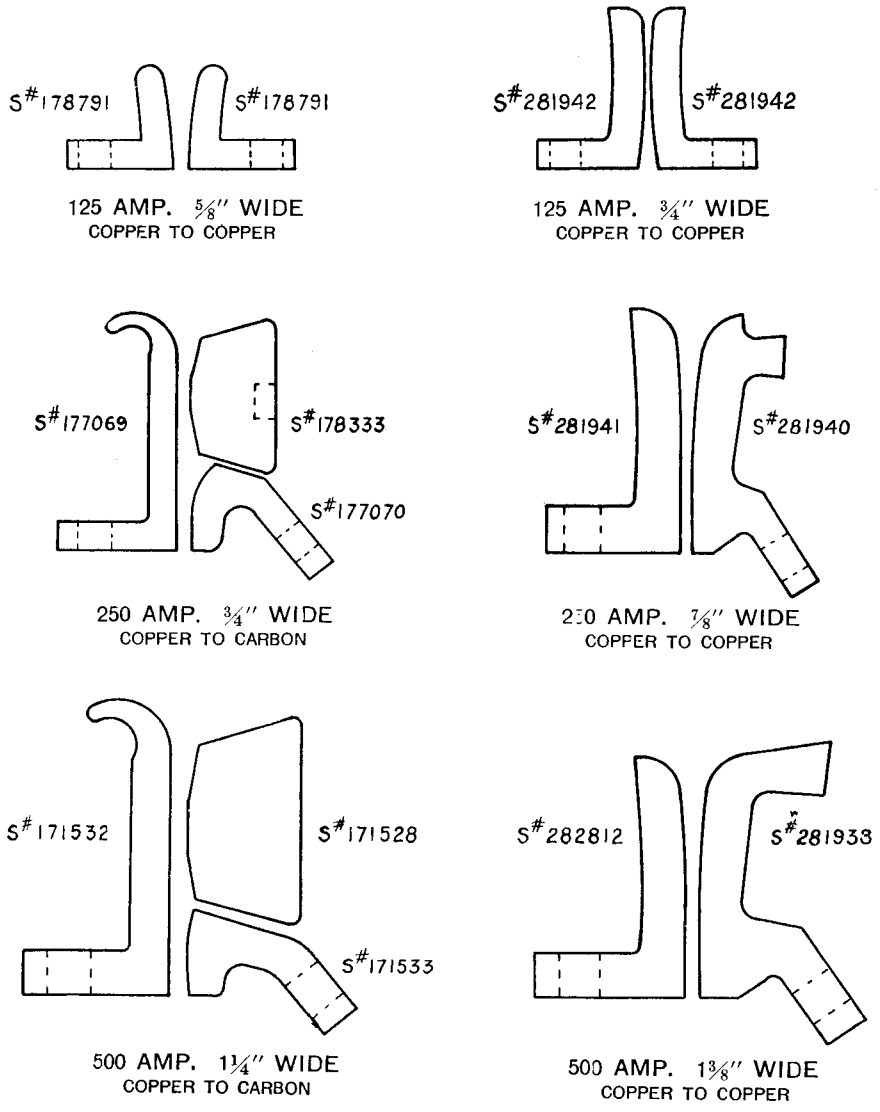


Fig. 5-A—Type F Contacts Showing Copper to Carbon and Copper to Copper. Style Numbers are for Individual Contacts, and Do not Include Screws or Washers

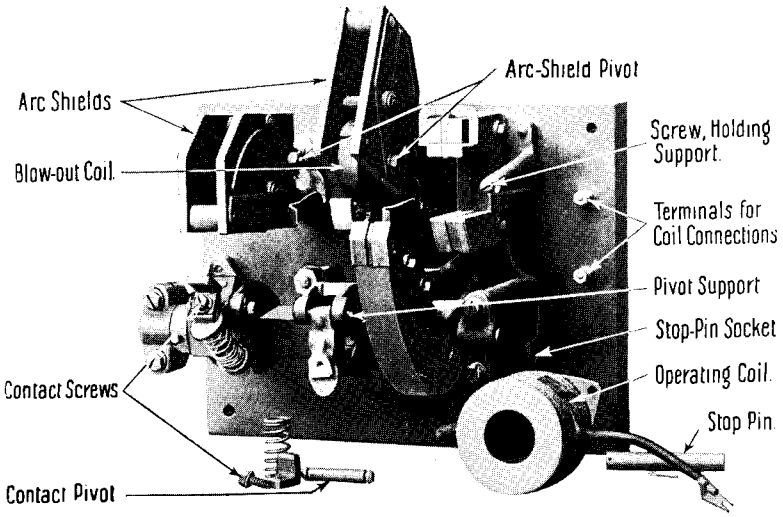


Fig. 6—125-Ampere Contactor

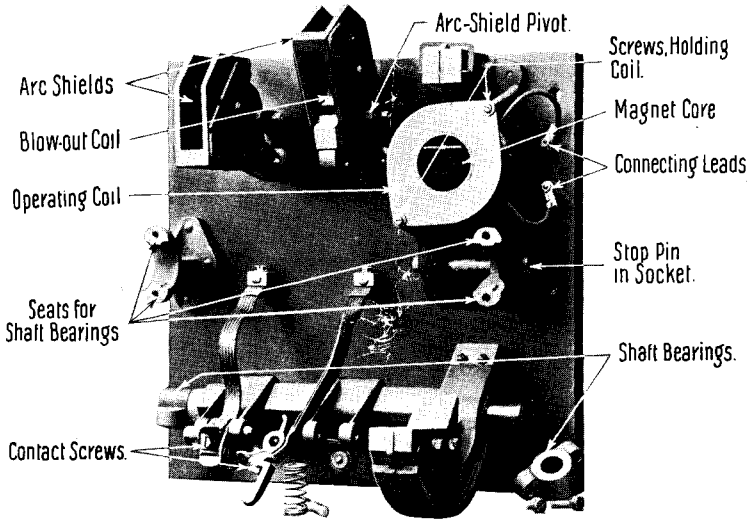


Fig. 7—250-Ampere Contactor Partly Dismantled

OVERLOAD RELAY—TYPE KN

21. Operation—The principle of operation is the same for the automatically, manually or electrically operated relays. The trip coils are so designed that under ordinary conditions there is not enough magnetic pull to lift the plunger. When an overload occurs, the added magnetic pull lifts the plunger against the contact bridge and forces the contacts apart, thus opening the control circuit. The relays may be reset automatically, manually, or electrically.

To cause the relay to trip at a lower current value raise the dashpot by turning it to the right; if a higher tripping value is desired, lower the dashpot by turning it to the left.

27. All of these relays are provided with calibration scales to indicate the current value for which the relay is set. Intermediate points may be estimated, or, if a more accurate setting is desired, it can be obtained by trial with an ammeter in the circuit.

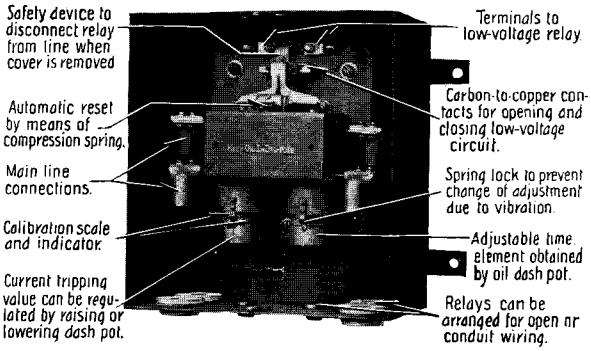


Fig. 8—Type KN Overload Relay Separately Mounted and Enclosed

22. Automatic Reset—With this method the plunger drops as soon as the overload is removed, and the contact bridge lever spring forces the contact bridge against the contacts, closing the control circuit.

23. Hand Reset—As shown in the illustration, relays arranged for hand reset are provided with a lever which catches the contact bridge lever when lifted by the plunger, and holds it away from the contacts. By pressing the reset lever, the catch is released and the contact bridge closes the control circuit in the same manner as if done automatically.

24. Electrical Reset—This method is the same as the hand reset, with the exception that the reset lever is operated by a magnet coil, which is energized by means of a push-button switch or by means of reset contacts on the master switch.

25. Current Adjustment—In making any adjustments of current values, care should be taken that the relay is not set at a point where it will fail to open at loads dangerous to the apparatus.

26. Type KN relays may be adjusted by turning the dashpot so as to raise or lower it.

28. Time Adjustment—Type KN relays are designed to allow a time interval to elapse before the relay trips on overload. This time interval can be varied by adjusting the brass segment washer, or time adjusting disc, which covers a number of small by-pass holes for the oil. To increase the time element, move the washer so that more holes are covered. The minimum tripping time will be obtained with all by-pass holes open.

To make this adjustment, the dashpot must be removed. It is removed by simply unscrewing it off. This will allow the dashpot and plunger to drop. The piston can then be pulled out and by loosening the nut at the bottom of the piston rod, the adjustment can be made as desired.

29. Caution—*Before putting the relay into service, be sure the dashpots contain sufficient oil of the proper grade.*

The oil furnished with these relays is especially adapted for this purpose and will give satisfactory operation at all ordinary temperatures. This oil is in a small can, and may be ordered by specifying style number 229296-A. Relays subjected to temperatures below freezing require a lighter oil. If temperatures are

so high that the relay does not give sufficient time element a heavier oil should be used.

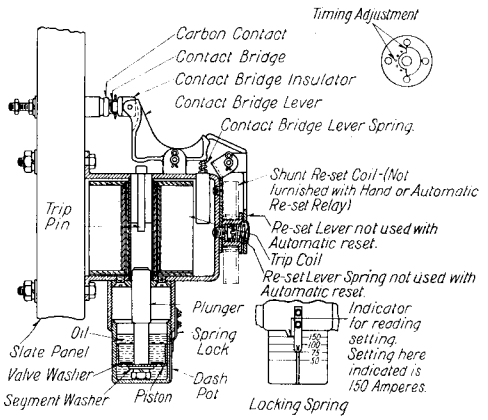


Fig. 9 –Sectional View of Type KN Overload Relay

LOW VOLTAGE PROTECTION

30. Should the line voltage fail, protection to both workmen and equipment against unexpected starting is provided by a low voltage relay, Fig. 10. The instant the voltage fails, this device opens the control circuit which can be closed only by means of a push button or a reset contact on the master switch in the OFF position. When the relay is closed the holding circuit is completed so that the push button can be released and the master switch moved on past the reset contact.

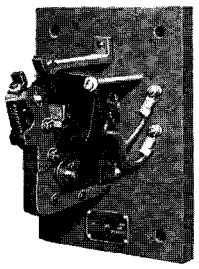


Fig. 10 –Low Voltage Relay

31. A clapper type interlock is sometimes used with these relays. When the relay closes, the tail piece of the armature actuates the interlock, so that it completes some desired control circuit.

32. The contacts of the relay seldom need replacing as they carry small currents. Should they need replacement, however, it can easily be done by removing the single contact screw in each one. New contacts can be ordered from any agent or district office. When ordering repair parts specify the name of the part as shown in Fig. 11 and give the information requested on page 12. 40 ampere contacts are used on this relay, (see Fig. 5).

33. The armature upon which is mounted the moving contact is easily removed by taking out the small pivot upon which it stands. This pivot is kept in place by a spring at either end and can be pushed out by removing one of the clips.

34. The operating coil can be taken off by dropping back the armature, disconnecting the leads and taking out the two coil screws.

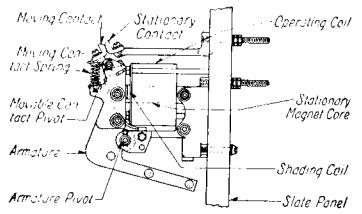


Fig. 11—Sectional View of Low-Voltage Relay

TYPE KS SERIES ACCELERATING RELAY

35. A type KS alternating-current accelerating relay, as shown in Fig. 12, is mounted with each contactor, except the last one to close. These relays are mechanically connected to the contactors under which they are mounted in such a way that they are inoperative as long as the contactors are open. When the first contactor closes, it presses down the cap of the relay which is mounted below it and thereby leaves the armature of the relay held only by the current in the series operating coil. As the motor speeds up the current in this coil is reduced until it reaches the value for which the relay was set. At this point the armature falls and the relay operates to close the next contactor.

36. Adjustments—The relays are adjusted before shipment to operate at a current value considered proper to accelerate the motor under the conditions specified in the order. Means are provided, though, for introducing and varying an air-gap in the magnetic circuit of the relay so that the setting of the relay can be changed should adjustments be necessary to to meet special conditions. However, the relay should not be set at a point where the disc fails to drop while the motor is accelerating.

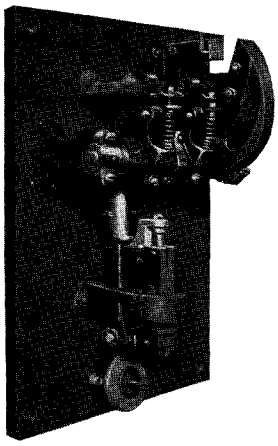


Fig. 12—Type KS Series Accelerating Relay Mounted with Type F Contactor

37. The value of the current at which the moving magnet armature (see Fig. 13) falls, is fixed by the adjustment of the air-gap. Lowering the moving magnet core by means of the screw and lock nuts above it, decreases the air-gap and lowers the value of the current at which the relay operates. Increasing the air-gap, raises the current value at which it operates and causes the relay disc to drop at a higher current.

38. The contactor, with which relay is mounted, should be closed before the tail piece or operating arm hits the relay cap. Contacts should therefore be renewed often enough to maintain this condition.

39. The contacts and disc for the control of the secondary circuit are of graphite and have sufficient capacity for the currents handled. The disc is mounted in the vertical position, which tends to prevent the accumulation of dust or dirt at the contact surface.

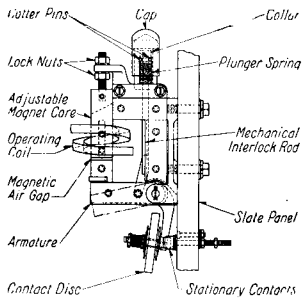


Fig. 13—Sectional View of Type KS Series Accelerating Relay

40. If at any time the relay contacts need renewing, they can be ordered from any agent or district office. When ordering repair parts, specify the name of the part as shown in Fig. 13 and give the information requested on page 12.

TYPE KT, A-C. AND D-C. TIME LIMIT ACCELERATING RELAY

41. The type KT time limit accelerating relays, with air dashpots, Fig. 15, are used with type F controllers, to change the motor speed after definite intervals of time without reference to the amount of current flowing. They are operated by potential coils controlled from the master switch. These coils should not be operated continuously with a voltage greater than 550 volts alternating current. The time element feature is obtained by means of an air dashpot which can be adjusted by a simple needle valve in its bottom.

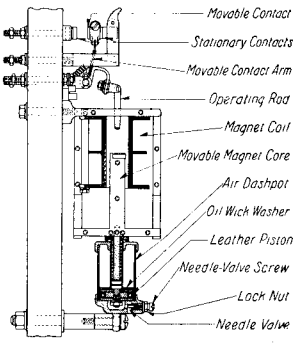


Fig. 14—Sectional View of Type KT Time Limit Accelerating Relay

42. Adjustments—No calibration of the relay is made at the Works so that the valve setting must be adjusted after the controller is installed. The maximum interval obtainable with alternating current is 20 seconds.

43. The adjustment of the time element is made by the needle valve in the bottom of the dashpot, as shown in Fig. 14. After loosening the nut, the needle valve screw should be turned to the left to decrease the time element; to the right, to increase it. After making the adjustment the lock nut should be tightened.

44. There is an oil wick washer on top of the piston which keeps the leather piston valve properly lubricated. Occasionally this washer should be moistened with a few drops of glycerine or light oil.

45. The contacts, between which the circuit is made and broken, are graphite and have ample current carrying capacity. Should these or any other parts need replacing they can be ordered from any district office. When ordering repair parts specify the name of the part as shown in Fig. 14 and give the information requested on page 12.

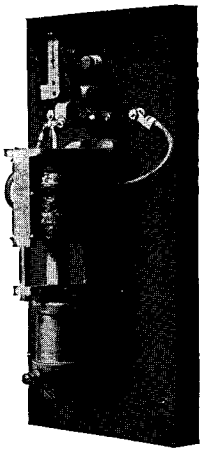


Fig. 15—Type KT Time Limit Accelerating Relay

TRANSFER RELAY

46 The transfer relay is similar to the type KT time limit accelerating relay, differing from it in that it has no dashpot but possesses a small clapper type interlock actuated by an arm attached to the moving magnet core. It is used in connection with a series accelerating relay to operate the contactor connecting a squirrel-cage motor directly across the line. When the accelerating relay closes, it energizes the transfer relay coil which in turn causes the line contactor to close.

47. All parts are similar to the type KT relay and in case repairs are required refer to Fig. 14.

TYPE C PUSH-BUTTON STATIONS

48. Push-button control stations perform many of the same functions as a master controller. They enable the operator to start, speed up, slow down, stop or reverse the motor at will by means of remote control. The stations should be located at any desired point convenient to the operator.

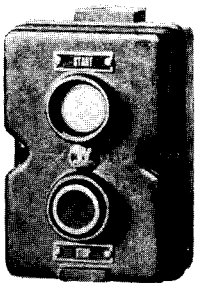


Fig. 16—Type C Push-Button Station

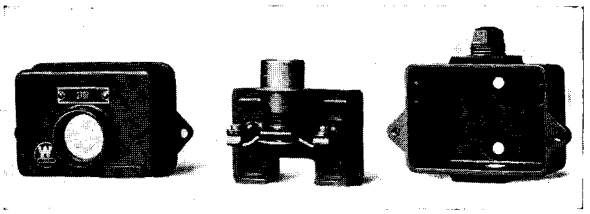


Fig. 17—Single-Button "Break" Station

49. The stations are easily opened for inspection by removing the covers. Covers can be removed from one and two button stations by taking out two screws. On larger stations four screws must be taken out to remove the covers.

50. If the button is the "make" type station, the circuit is normally open. In this type a copper disc is pushed down so that it bridges two copper contacts and completes the control circuit. When the pressure on the button is released the spring on the button spindle lifts the disc and breaks the circuit.

51. Fig. 17 shows a single-button "break" type station. In this type the circuit is normally closed. When the button is pressed in against a spring action, the disc is moved away from its contacts and the circuit is broken. The circuit is again closed when the button is released.

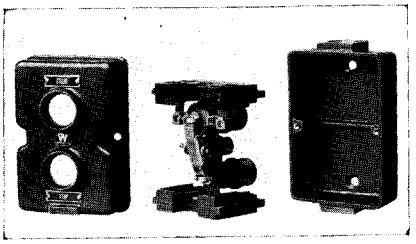


Fig. 18—Two-Button Interlocked Station of the "Walking Beam" Type

52. When two buttons are interlocked, a "walking-beam" construction is employed, as shown in Fig. 18. This construction allows either button to remain depressed but makes it impossible to press both buttons at the same time.

53. All contacts and discs are of copper and can be quickly renewed when worn out. Renewals, however, are required infrequently as the current handled is of low value and the destructive arcing is reduced to a minimum.

REPAIR PARTS

1. In case of trouble, consult the nearest district office of the Company as shown in the list given on inside back cover. In all cases describe the nature of the trouble and give the following information:

2. Give the complete nameplate reading. See illustration below.

3. Complete nameplate reading of motor.

4. Normal operating voltage and frequency and variation above and below normal.

5. Minimum and maximum running current.

6. Description of machinery operated by the motor and the location of control panel.

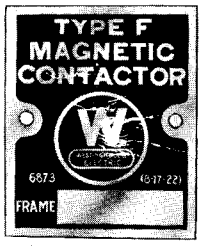
7. Is the controller exposed to excessive dust or moisture?

8. Number of blue-print wiring diagram used when connecting the outfit.

9. State whether shipment is to be made by freight, express (and name the route) or by parcel post. If by parcel post, shall we insure the shipment?

10. Small orders should he combined so as to amount to a value of at least one dollar, as shipping expenses prevent us from billing a smaller amount.

11. Send all orders or correspondence to the nearest district office of the Company.



This Nameplate is Typical of those Used on Type F Magnetic Contactors