

# **Westinghouse**

## **Types MC, M, MF and MS**

### **Auxiliary Relays**

**INSTRUCTION BOOK**



**Westinghouse Electric & Manufacturing Company**  
**Newark Works**

**Newark, N. J.**

**I. B. 5320-C**

## Combinations and Ratings

### TYPE MC MULTIPLE-CONTACT AUXILIARY RELAYS

| Style Number for<br>Type MC Relays—Glass Cover<br>4 Independent Circuits |  |  |  | Style Number for<br>Type MC Relays—Metal Cover<br>6 Contact Circuits |  |   |   | External<br>Series<br>Resistance<br>Style<br>Number | Type MC Relay Coil Data |                               |   |                      |
|--|--|--|--|--|--|---|---|---|-------------------------|-------------------------------|---|----------------------|
| Circuits<br>4-Make<br>*Fig. 11   | Circuits<br>3-Make<br>1-Break<br>Fig. 12 | Circuits<br>2-Make<br>2-Break<br>Fig. 13 | Circuits<br>1-Make<br>3-Break<br>Fig. 14 | 5-Parallel<br>Circuits<br>Closing<br>1-Circuit<br>Opening<br>Fig. 15 | 1-Circuit<br>Closing<br>5-Parallel<br>Circuits<br>Opening<br>Fig. 16 | 4-Parallel<br>and<br>1 Independent<br>Circuits<br>Made<br>Fig. 17 | 6-Parallel<br>Circuits<br>Made<br>Fig. 18 |   | Coil<br>Style<br>Number | Resistance<br>25 °C.<br>Ohms. | Standard<br>Minimum<br>Operating<br>Setting | Name plate<br>Rating |
| 423387   | 423403                                   | 423419                                   | 423435                                   | 423499   | 423451   | 423467  | 423483                                    | None  | 372517                  | 0.07                          | 4.2 Amp. D-C.                               | 8 Amp. D-C.          |
| 423388   | 423404                                   | 423420                                   | 423436                                   | 423499   | 423452   | 423468  | 423484                                    | None  | 476903                  | 9.00                          | 5.0 V. D-C.                                 | 8 V. D-C.            |
| 423389   | 423405                                   | 423421                                   | 423437                                   | 423499   | 423453   | 423469  | 423485                                    | None  | 372518                  | 26.00                         | 7.5 V. D-C.                                 | 12 V. D-C.           |
| 423390   | 423406                                   | 423422                                   | 423438                                   | 423499   | 423454   | 423470  | 423486                                    | None  | 372519                  | 36.00                         | 10.0 V. D-C.                                | 16 V. D-C.           |
| 423391   | 423407                                   | 423423                                   | 423439                                   | 423499   | 423455   | 423471  | 423487                                    | None  | 476906                  | 81.00                         | 15.0 V. D-C.                                | 25 V. D-C.           |
| 477263   | 477264                                   | 477265                                   | 477266                                   | 477303   | 477307   | 477315  | 477311                                    | None  | 333370                  | 143.0                         | 20. V. D-C.                                 | 32 V. D-C.           |
| 423392   | 423408                                   | 423424                                   | 423440                                   | 477304   | 423456   | 423472  | 423488                                    | None  | 333364                  | 365.0                         | 30. V. D-C.                                 | 5 V. D-C.            |
| 477267   | 477268                                   | 477269                                   | 477270                                   | 477304   | 477308   | 477316  | 477312                                    | None  | 476908                  | 640.0                         | 35. V. D-C.                                 | 62 V. D-C.           |
| 477271   | 477272                                   | 477273                                   | 477274                                   | 477305   | 477309   | 477317  | 477313                                    | None  | 476909                  | 1550.                         | 60. V. D-C.                                 | 110 V. D-C.          |
| 423393   | 423409                                   | 423425                                   | 423441                                   | 477306   | 423457   | 423473  | 423489                                    | None  | 374893                  | 2500.                         | 70. V. D-C.                                 | 125 V. D-C.          |
| 477275   | 477276                                   | 477277                                   | 477278                                   | 477306   | 477310   | 477318  | 477314                                    | 78894-C   | 374893                  | 2500.                         | 125. V. D-C.                                | 250 V. D-C.          |
| 477279   | 477280                                   | 477281                                   | 477282                                   | 477319   | 477325   | 477337  | 477333                                    | None  | 476906                  | 81.0                          | 35.0 V-25 Cy.                               | 62 V-25 Cy.          |
| 423394   | 423410                                   | 423426                                   | 423442                                   | 477320   | 423458   | 423474  | 423490                                    | None  | 476907                  | 270.0                         | 60.0 V-25 Cy.                               | 110 V-25 Cy.         |
| 477283   | 477284                                   | 477285                                   | 477286                                   | 477320   | 477326   | 477338  | 477332                                    | None  | 333364                  | 365.0                         | 70.0 V-25 Cy.                               | 130 V-25 Cy.         |
| 423397   | 423413                                   | 423429                                   | 423445                                   | 375001   | 423461   | 423477  | 423493                                    | None  | 476909                  | 1550.                         | 140.0 V-25 Cy.                              | 220 V-25 Cy.         |
| 423400   | 423416                                   | 423432                                   | 423448                                   | 375004   | 423464   | 423480  | 423496                                    | 78897-C   | 374893                  | 2500.                         | 270.0 V-25 Cy.                              | 440 V-25 Cy.         |
| 477287   | 477288                                   | 477289                                   | 477290                                   | 477321   | 477327   | 477339  | 477333                                    | None  | 372518                  | 26.                           | 35. V-50 Cy.                                | 62 V-50 Cy.          |
| 423395   | 423411                                   | 423427                                   | 423443                                   | 477322   | 423459   | 423475  | 423491                                    | None  | 476906                  | 81.                           | 60. V-50 Cy.                                | 110 V-50 Cy.         |
| 477291   | 477292                                   | 477293                                   | 477294                                   | 477322   | 477328   | 477340  | 477334                                    | None  | 333370                  | 143.0                         | 70. V-50 Cy.                                | 130 V-50 Cy.         |
| 423398   | 423414                                   | 423430                                   | 423446                                   | 375002   | 423462   | 423478  | 423494                                    | None  | 333364                  | 365.0                         | 140. V-50 Cy.                               | 220 V-50 Cy.         |
| 423401   | 423417                                   | 423433                                   | 423449                                   | 375005   | 423465   | 423481  | 423497                                    | None  | 476909                  | 1550.                         | 270. V-50 Cy.                               | 440 V-50 Cy.         |
| 477295   | 477296                                   | 477297                                   | 477298                                   | 477323   | 477329   | 477341  | 477335                                    | None  | 476904                  | 16.0                          | 35. V-60 Cy.                                | 62 V-60 Cy.          |
| 423396   | 423412                                   | 423428                                   | 423444                                   | 375000   | 423460   | 423476  | 423492                                    | None  | 476905                  | 57.0                          | 60. V-60 Cy.                                | 110 V-60 Cy.         |
| 477299   | 477300                                   | 477301                                   | 477302                                   | 477324   | 477330   | 477342  | 477336                                    | None  | 476906                  | 81.0                          | 70. V-60 Cy.                                | 130 V-60 Cy.         |
| 423399   | 423415                                   | 423431                                   | 423447                                   | 375003   | 423463   | 423479  | 423495                                    | None  | 476907                  | 270.                          | 140. V-60 Cy.                               | 220 V-60 Cy.         |
| 423402   | 423418                                   | 423434                                   | 423450                                   | 375006   | 423466   | 423482  | 423498                                    | None  | 333360                  | 920.                          | 270. V-60 Cy.                               | 440 V-60 Cy.         |

TABLE 1

### TYPE M MULTIPLE-CONTACT AUXILIARY RELAYS (Intermittent Service—D-C. Only)

| Style Numbers for Type M Relays               |   |   | Type M Relay Coil Data  |   |                              |  |
|---|---|---|-------------------------|---|------------------------------|--|
| Glass Cover                                   |   | Iron Cover                                | Coil<br>Style<br>Number | Name plate<br>Rating<br>(Intermittent Duty) | Resistance<br>(Cold)<br>Ohms | Standard<br>Minimum<br>Operating<br>Setting<br>Volts |
| Circuits<br>2-Make<br>Independent<br>*Fig. 22 | Circuits<br>4-Make<br>Parallel<br>Fig. 23 | Circuits<br>6-Make<br>Parallel<br>Fig. 18 |                         |   |                              |  |
| 423871  | 423875                                    | 304791                                    | 315983                  | 12 V. D-C.                                  | 3.1                          | 7.0  |
| None  | None                                      | None                                      | 438148                  | 24 V. D-C.                                  | 12.2                         | 14.0   |
| 423874  | 423878                                    | 311005                                    | 315941                  | 50 V. D-C.                                  | 51.0                         | 30.0   |
| 423872  | 423876                                    | 304792                                    | 315969                  | 125 V. D-C.                                 | 305.0                        | 75.0   |
| 423873  | 423877                                    | 304793                                    | 315940                  | 250 V. D-C.                                 | 970.0                        | 150.0  |

TABLE 2

### TYPE MF FLASH-OVER RELAY

| Relay<br>Style<br>Number<br>420545 | Contact<br>Circuits<br>1-Make<br>1-Break | Coil Data              |                           |   |  |
|------------------------------------|--|------------------------|---------------------------|---|--|
|                                    |  | Style<br>No.<br>495992 | Max.<br>Cont.<br>100 Amp. | Impedance<br>60 Cy.-Open Gap<br>.00331 Ohms | Standard<br>Minimum<br>Operation<br>Settings<br>100 Amp. |

TABLE 3

### TYPE MS BANKED MULTIPLE-CONTACT RELAYS

| Relay<br>Style<br>Number | Name plate<br>Rating | Coil<br>Data                            |
|--------------------------|----------------------|---|
| 439233                   | 50 V. D-C.           | { Same as MC Relays<br>of same rating } |
| 407272                   | 16 V. D-C.           |   |

TABLE 4

\*Refers to this instruction book.

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### Auxiliary Relays

#### General Information

**Auxiliary Relays**—In many of the present day relay schemes for protection or control work, so many exacting functions are required of the relays used that it is impractical to try to incorporate all the features necessary for the proper operation of the scheme in question in one relay. The relays which are primarily responsible for setting the scheme in action must necessarily be highly sensitive and delicately constructed instruments. A certain degree of ruggedness must be incorporated in the construction of any relay, yet if the moving parts are such as will give the necessary sensitivity, it is very difficult to design them to operate contacts sufficiently large to carry the amount of current sometimes required in the control circuit, or for carrying the required number of contacts necessary for the number of control circuits to be actuated. These difficulties have introduced another link into the relay chain which is known as the auxiliary or secondary relay. Although this auxiliary relay must be dependable and positive in its action, as the success of the entire scheme may depend upon its operation yet its construction can be made more flexible, inasmuch as it can be given a definite amount of energy to operate on, at all times, and certain characteristics such as time delay, inverse time, etc., are not necessary. Such a relay may be made to operate several different contacts, or different arrangements of contacts, and also carry contacts sufficiently large to handle control current of the desired magnitude.

**Uses of Auxiliary Relays**—The use of auxiliary relays may be grouped under three headings:

First, the energization of multiple control circuits.

Second, to furnish contact capacity for control circuits requiring current higher than can be safely handled by primary relay contacts.

Third, to obtain a various assortment of contact arrangements such as opening several circuits and closing several cir-

cuits when energized, as is necessary in control work.

The auxiliary relays are designed to accomplish these requirements, operating when their coils are energized by the closure of the primary relay contacts.

**Types**—The types included in the Westinghouse M line of auxiliary multi-contact relays are as follows:

(a) The type MC relay is suitable for either a-c. or d-c. service, and is supplied with eight different contact arrangements as shown in table 1.

(b) The type M multiple contact auxiliary relay is similar to the type MC except that its operating parts are simplified and all contacts are in parallel, making it less expensive. It is suitable for intermittent d-c. service only.

(c) The type MF Flash relay is a slight modification of the type MC, made for a special application.

(d) The type MS multiple contact relay is a group of type MC elements mounted in a (single) case, thus supplying a number of contactors in a compact arrangement.

#### Installation

In the handling of all relays, it should be remembered that they are more or less delicate instruments, and must not be subjected to any unnecessary bumps, knocks, or rough usage.

Relays of this line, except type MF, are all built with mounting studs suitable for mounting the relay case on switch-board panels.

In many cases, the relays are mounted on the panels at the factory, thus relieving the customer of this labor. In cases where the relays are shipped already mounted on the panels, they should, however, be thoroughly inspected after the panels have been placed in their permanent position. All dirt and dust should be removed from the relay, both inside and outside, and the connections on the rear of the panel carefully checked out to see that no damage has been done in shipment.

Figures 30 to 38 inclusive, pages 12 and 13, give full information for properly drilling the panel prior to mounting the relays upon it. When the relays are received, they should be carefully inspected for damage done in shipment such as bent or broken terminals, misaligned internal parts due to jars or bumps, etc. If all is found to be satisfactory, the relay may then be mounted on the panel, being placed in a vertical position. As pivotal action is involved in most of the relays, it is important that they should be mounted in the proper vertical position. Otherwise friction may be introduced into the action of the pivot, or unnecessary wear may be caused, thus diminishing the natural sensitivity of the relay. Care should also be taken in mounting relays that the hard composition or fibre terminals extending through the relay case are not cracked or broken, as such conditions may easily lead to a grounding of that terminal. Many troubles in the operation of relays can be traced to such a breaking down of insulation.

**Connections**—All external connections made to the relays after they have been properly mounted should be made in the most careful manner. Where wires are connected directly to the stud of the relay, the nuts should be firmly tightened. Where other connections are to be made, they should be well soldered.

**Location**—The placement of relays is usually fixed by the layout of other apparatus, and in such cases it is usually endeavored to have the relays placed in a position as free from vibration as possible. The construction of the type M line of relays is such that they are not directly affected by any reasonable amount of vibration.

**Current-Carrying and Rupturing Capacity**—The contact fingers which make when the relay is energized are large enough to carry ten or fifteen amperes continuously without overheating. The contact fingers which make when the relay is de-energized are smaller than the others, and will not carry more than

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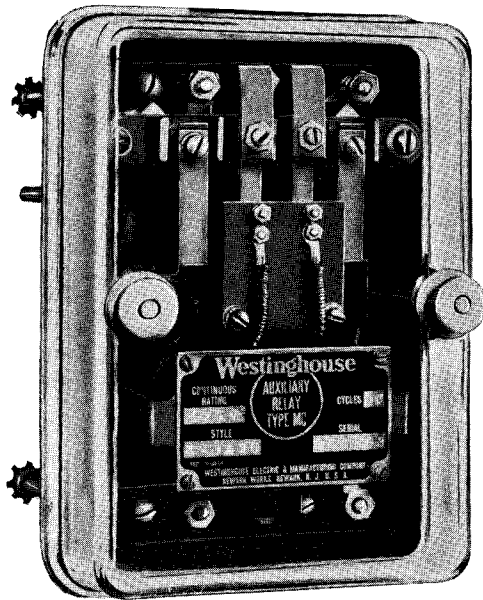


Fig. 1—Westinghouse Type MC Multi-Contact Relay with Glass Cover

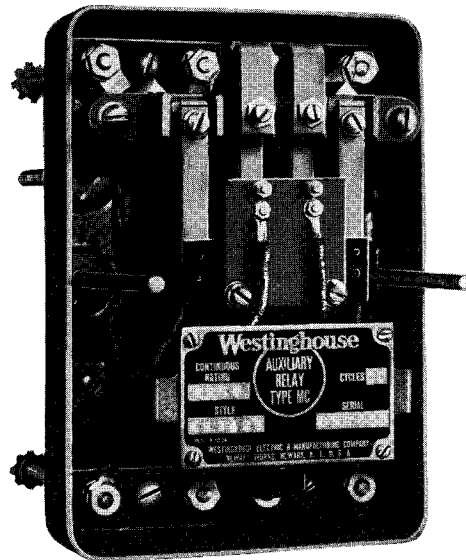


Fig. 2—Westinghouse Type MC Multi-Contact Relay with Cover Removed

five amperes continuously. Due to small contact travel and absence of means for extinguishing arcs, these relays should never be required to break more than five amperes at 125 volts d-c. or ten amperes at 110 volts a-c.

### Type MC Multi-Contact Relay

**Construction**—The mechanical structure of the type MC relay is composed of the following main assemblies of parts:

(a) The magnetic circuit, consisting of punchings and hinged armature.

(b) The contact assembly, consisting of the stationary contact block and the stationary contacts.

(c) The moving contact block, attached directly to the hinged armature.

(d) The contact spring and the front and back moving contacts.

(e) The base and cover assembly, consisting of the cast iron base and glass or iron cover.

(f) The electric circuit terminals.

(g) The mounting studs.

Figures 1 and 2 are views of the relay.

Figure 1 shows relay with glass cover, but all 6 circuit styles given in table 1 have iron covers.

Figure 3 shows a front and side cross-section view of the relay. The main magnetic circuit consists of U shaped punchings riveted together, one end of the U supporting the coil, and the other end being fitted with brackets suitable for mounting the pivoted armature. The iron armature is mounted on the hinge-brackets by means of a small steel pin.

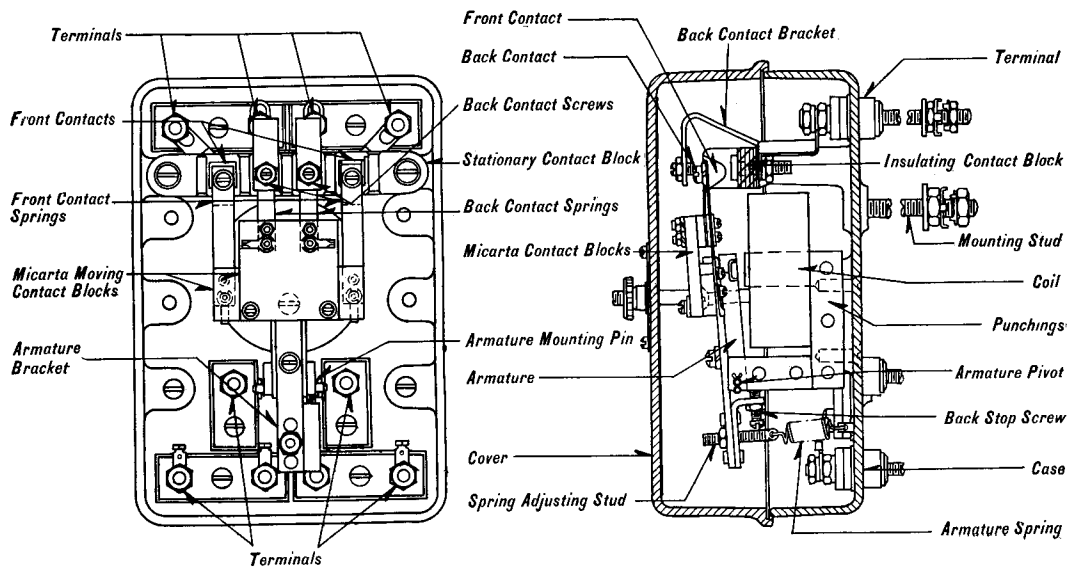
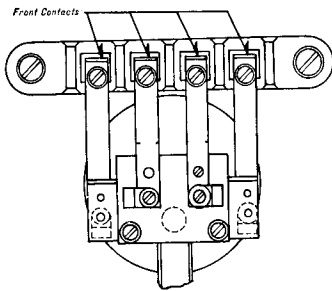
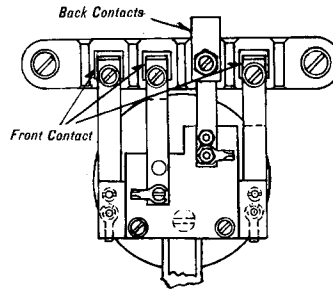


Fig. 3—Front and Side Cross Section View of Type MC Relay (Two Front and Two Back Contacts)

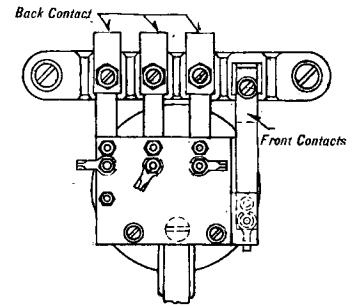
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**Fig. 4—Four Front Contacts**



**Fig. 5—One Back and Three Front Contacts**



**Fig. 6—Three Back and One Front Contacts**

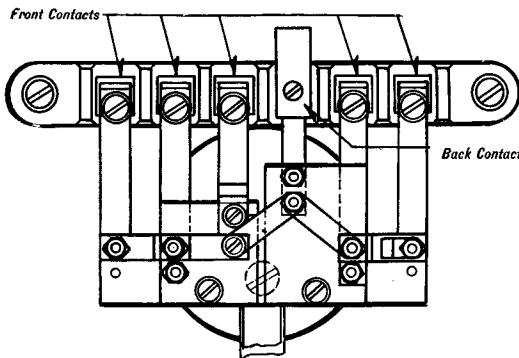
A bracket, extending somewhat below the pivoted end of the armature, and containing the screw for adjusting or limiting the travel of the armature, and also the stud for adjusting the tension of the spring which holds the contacts in the open position when coil is de-energized, is fastened to the armature by means of screws. To the upper end of the armature is fastened a micarta block, to which in turn the moving contact springs are attached. This makes an insulated support for the contact springs. The front contacts are mounted directly to these

springs, and serve to make contact with the studs in the stationary contact block. The stationary back contact is supported by a bracket mounted directly on the stationary contact block and lines up with the back moving contact which is mounted in a manner similar to the front moving contacts. The back contacts are made of silver.

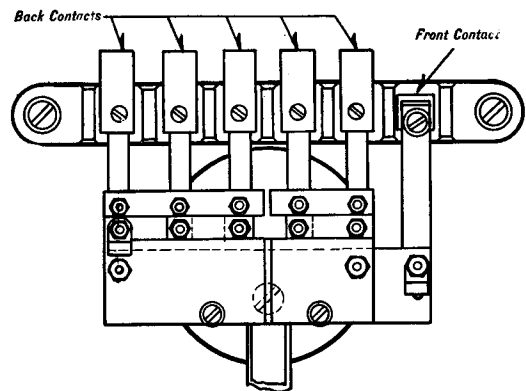
As shown in table 1, the type MC relay may be supplied with any one of a number of different contact arrangements. Front contacts are those which are normally open when the relay

is de-energized and closed when the relay is energized. Back contacts are those which are normally closed when the relay is de-energized and open when the relay is energized. The following contact assemblies may be obtained:

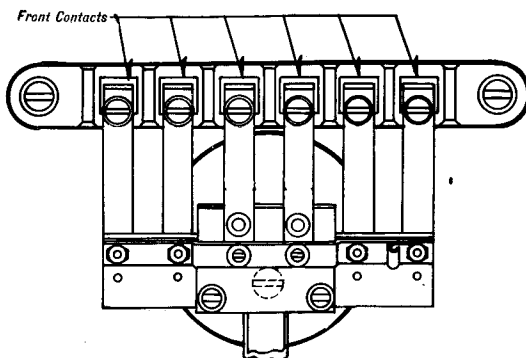
- (a) Four front contacts (Figures 4 and 11).
- (b) One back and three front contacts (Figures 5 and 12).
- (c) Two front and two back contacts (Figures 3 and 13).
- (d) Three back and one front contacts (Figures 6 and 14).



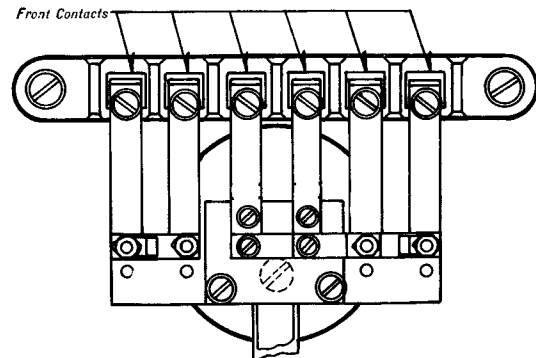
**Fig. 7—One Back and Five Front Contacts**



**Fig. 8—Five Back and One Front Contacts**



**Fig. 9—No Back and Six Front Contacts**



**Fig. 10—No Back Contacts, Four Front Contacts in Parallel and Two Front Contacts, Making One Independent Circuit**

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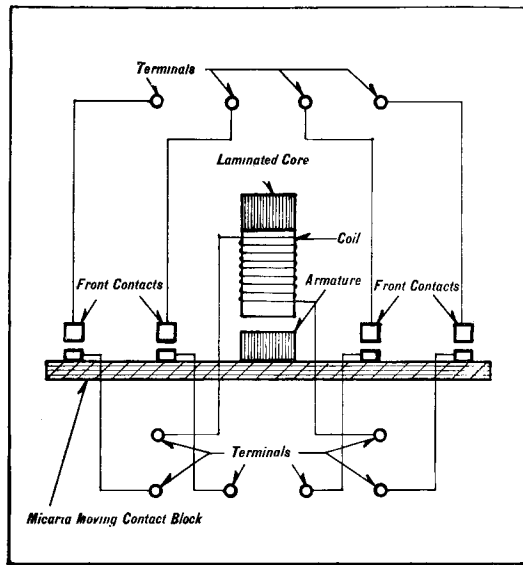


Fig 11—Internal Wiring Diagram of Type MC Relay, Four Independent Circuits are Made When Relay is Energized. (Rear View)

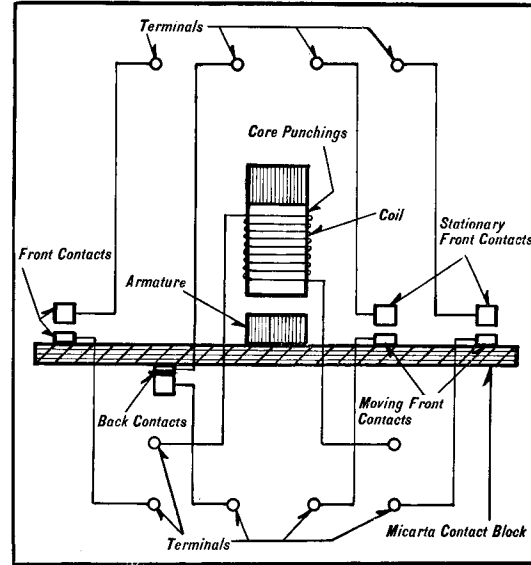


Fig 12—Internal Wiring Diagram of Type MC Relay. Three Independent Circuits Made and One Broken When Relay is Energized. (Rear View)

In the first four combinations the circuits are all independent of each other. The following combinations require six moving contacts all strapped together by a connecting strip, a longer contact block and a slightly larger case than the preceding four combinations.

These combinations are:

- (a) One back and five front contacts (Figures 7 and 15).
- (b) Five back and one front contacts (Figures 8 and 16).
- (c) No back, six front contacts (Figures 9 and 18).
- (d) No back, six front contacts, with connector strip separated to give a group of four fingers tied in parallel and another group of two fingers tied in parallel (Figures 10 and 17).

**Coils**—The coils are wound self supporting (except in the case of the series coils) and mounted directly on one leg of the punchings. Coils are wound for potentials up to one hundred twenty-five volts d-c. and four hundred forty volts for all standard frequencies. All are used without external resistance. For voltages higher than one hundred twenty-five volts d-c., an external resistance must be used with type MC relays. Table 1 contains the data on the different coils used in this type of relay.

The type MC relay is so constructed that it may be used on either a-c. or d-c. installations. The laminated magnetic circuit makes this possible and thus the

only difference in the relays for a-c. and d-c. service is in the coil. The coils are designed so that they may be left energized continuously at the rated voltage.

**Specific Application**—The number of different contact arrangements which may be obtained makes the MC relay applicable for a large variety of uses where not only a large capacity contact is desired but where contact arrangement must be such that certain circuits are made and certain circuits broken when the relay is energized. Thus the MC relay is used not only as an auxiliary relay for tripping or closing several circuits upon the action of a primary relay, but is also used largely in control work as a primary relay.

**Operation**—The operation of the type MC relay is simply that of a contactor in which when the coil is energized, the armature is attracted closing the contacts in one direction and opening the contacts in the other direction.

**Adjustment**—The armature spring serves two purposes in the type MC relay. It is primarily for the purpose of holding the armature in the open position when the coil is not energized, and in combinations having back contacts it also serves the purpose of introducing enough tension into the back contact spring so that the back contacts will not chatter when they are made.

The following method of adjustment is carried out in the factory tests and should

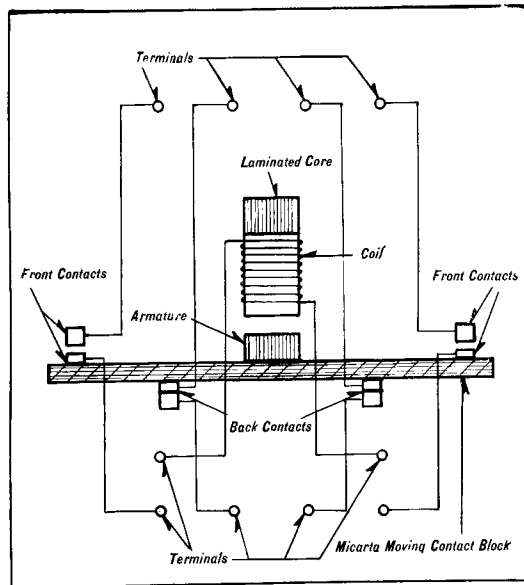
be used whenever changes are made or any adjustments are found necessary.

Set the armature back-stop screw to give approximately three-eighths of an inch contact separation when armature is resting against stop. Then energize the coil and adjust the armature spring so that the armature will be attracted, or in other words so that the relay will operate at the minimum operating value of excitation as given in table 1. The contact separation may be varied somewhat if necessary but should never be made less than three-sixteenths of an inch.

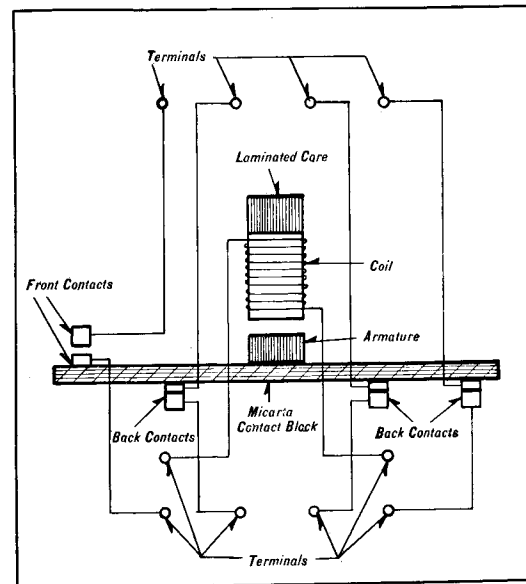
**Back Contact Action**—The action of the back contact should then be noted. If the tension of the armature spring is too small the back contacts will chatter for an instant after they are made. If such is found to be the case the tension on the armature spring should be increased until the back contact makes positively and does not tend to chatter. Increasing the tension of this spring will raise the minimum voltage at which the relay will operate, so in order to restore this to the given value the back stop should be so adjusted as to shorten the air gap, thus lowering the minimum operating voltage. The screw mounted back contact can then be adjusted to make good contact with the other existing settings.

The back stop screw should never allow the armature to drop open far enough to cause the contact block to strike the cover.

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**Fig. 13—Internal Wiring Diagram of Type MC Relay. Two Independent Circuits Made and Two Broken When Relay is Energized. (Rear View)**



**Fig. 14—Internal Wiring Diagram of Type MC Relay. One Independent Circuit Made and Three Independent Circuits Broken When Relay is Energized. (Rear View)**

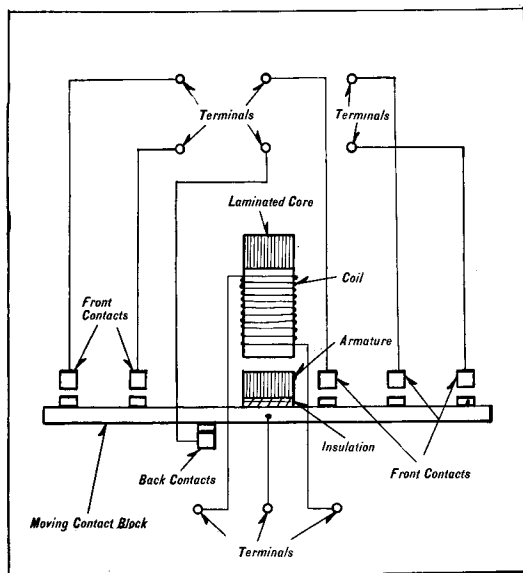
**Maintenance**—The structure of the type MC relay is so simple and rugged that after it is once properly installed little attention is necessary. As with any apparatus, however, when performing an important function in any scheme of relays, it should be inspected at frequent intervals, special attention being given to the condition of the contacts. These contacts move through a radius sufficient to give them considerable wiping action

when closing. This action tends to keep the contact clean at all times unless they are subject to an excessively heavy duty or very frequent operation. **In case the moving or the stationary contacts become pitted, they should be smoothed up with a fine file so that good contact is assured.**

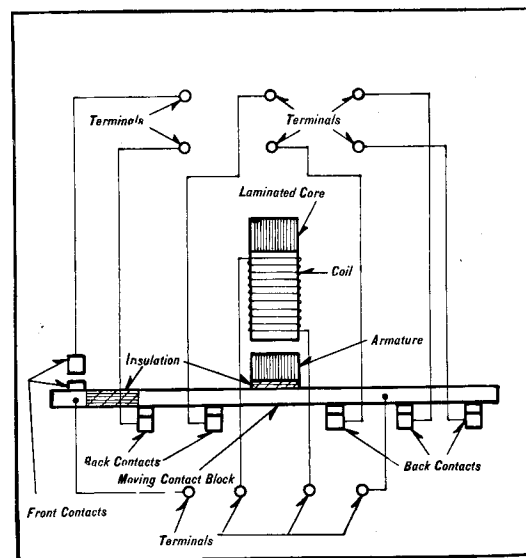
The back contacts are of silver and have less of the wiping action than the front contacts. They are not intended

to break as heavy a current as the front contacts, which fact should be remembered in making installation. If they become rough or pitted they should be cleaned with a fine file.

The contacts are pure silver and tarnish quickly when in the presence of sulphurous gases. The layer of silver sulphide resulting is a non-conductor and this injures the action of the contact greatly. This fact should be remembered ;



**Fig. 15—Internal Wiring Diagram of Type MC Relay. Five Parallel Circuits Made and One Broken When Relay is Energized. (Rear View)**



**Fig. 16—Internal Wiring Diagram of Type MC Relay. One Circuit Made and Five Parallel Circuits Broken When Relay is Energized. (Rear View)**

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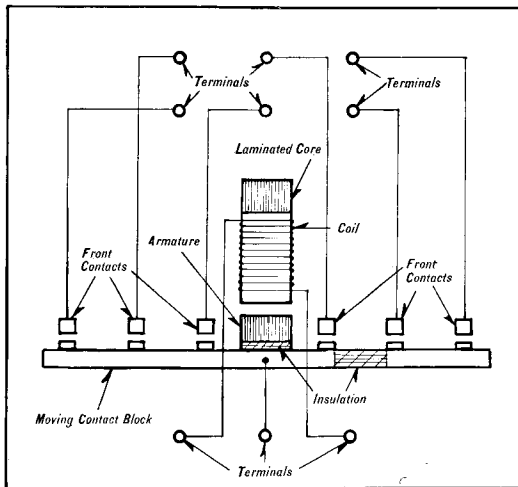


Fig. 17—Internal Wiring Diagram of Type MC Relay. Four Parallel Circuits and One Independent Circuit Made When Relay is Energized. (Rear View)

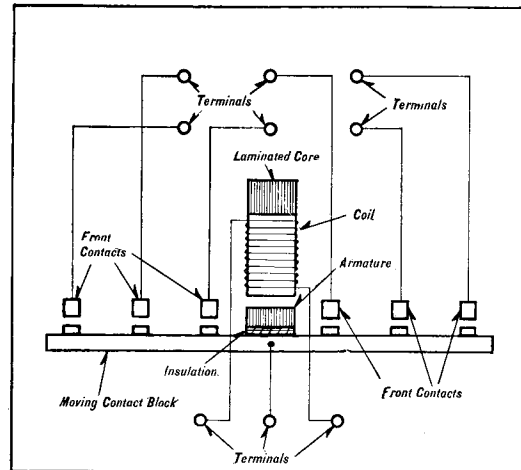


Fig. 18—Internal Wiring Diagram of Type MC Relay or M Relay. Six Parallel Circuits Made When Relay is Energized. (Rear View)

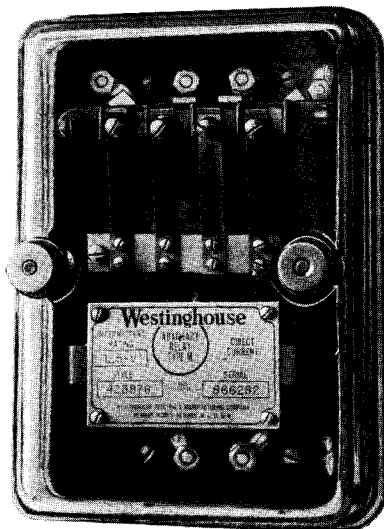


Fig. 19—Westinghouse Type M Multi-Contact Relay with Glass Cover

if relays are located in places where they are subject to exposure to sulphurous gases such as soft coal smoke, the cover should be kept on at all times. Frequent cleaning of the contact may also be necessary in such cases.

The relays are given an insulation test of 1500 volts between all terminals and the case, and between all circuits. Periodic inspection should include the removal of all accumulated dust or dirt, as this accumulation sometimes may be great enough to cause a circuit to be grounded to the case.

### Type M Multi-Contact Relay

**Construction**—The structure of the type M multiple-contact relay is similar to the type MC but simpler. The main parts of the type M relay are the coils, the armature with mounting bracket, the

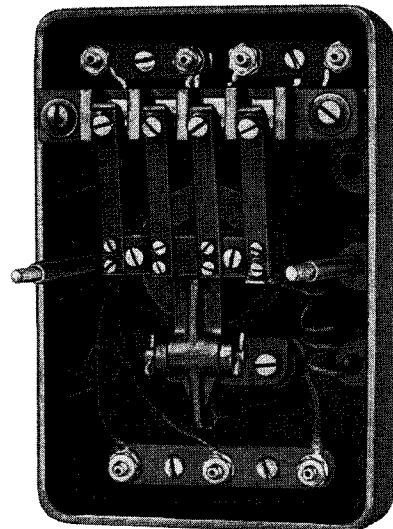


Fig. 20—Westinghouse Type M Multi-Contact Relay with Cover Removed

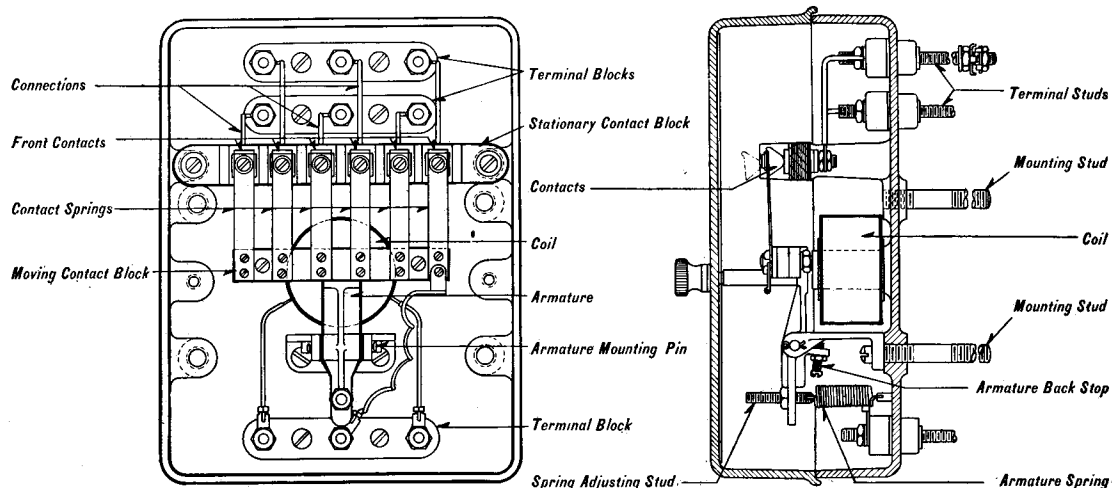


Fig. 21—Front and Side Cross Section View of Type M, Multi-Contact Relay (Six Front Contacts)



## Westinghouse Types MC, M, MF and MS Auxiliary Relays

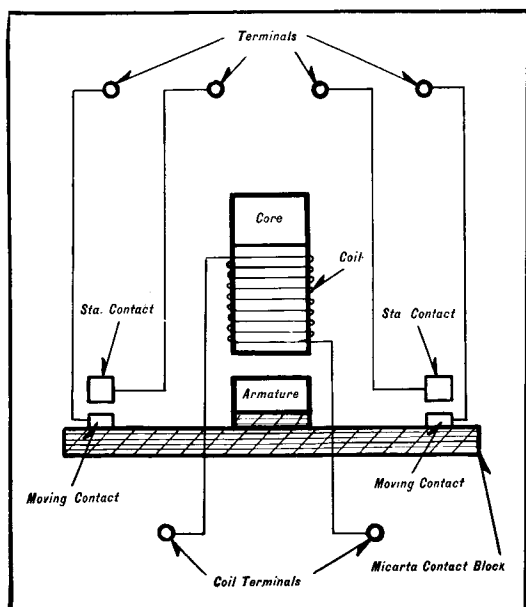


Fig. 22—Internal Wiring Diagram of Type M-2 Relay. Two Independent Circuits Made When Relay Operates

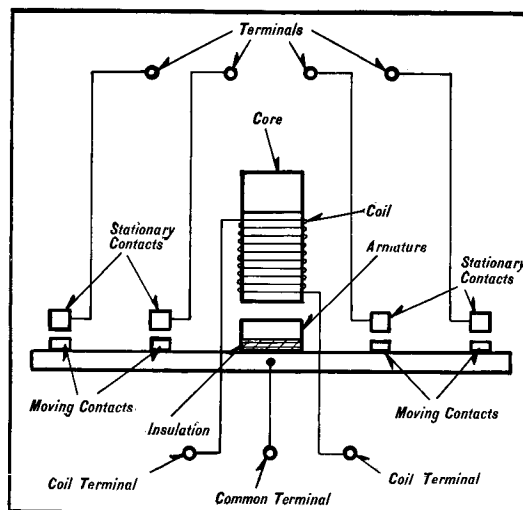


Fig. 23—Internal Wiring Diagram of Type M-4 Relay. Four Parallel Circuits Made When Relay Operates

contact assembly, the terminals, the case and the cover.

The coil is mounted on a solid core which is a screw threaded into the cast iron base. The armature is mounted below and in front of the coil by means of a pivot rod supported by a suitable bracket mounted on the base. At the end of the armature just below the mounting bracket the spring adjusting stud and the back stop screw are located. On the upper end of the armature the contact assembly is mounted on a bar extending horizontally. As shown in Figures 20 and 21 the contacts are mounted on a common bar for the four and six contact relays. This bar is insulated from the armature by a micarta strip. The moving contacts are mounted on the upper end of the contact springs and correspond with the stationary contacts mounted in the stationary contact block. This type of relay is not made with back contacts.

Three contact arrangements are used, namely:

- M-2—Two independent make contacts (Figure 22)
- M-4—Four parallel make contacts (Figures 20 and 23)
- M-6—Six parallel make contacts (Figures 18 and 21)

The contacts are made of copper and will handle the same amount of current given for MC relays, on page 3.

The type M relay is suitable only for

d-c. service. The coils are wound self supporting and may be supplied for various voltages. They are so designed that they are only suitable for intermittent service and will not stand being energized longer than a few minutes at a time.

**Application**—The type M relay is, due to its simple construction, less expensive than the type MC. It is suitable for any application where a multi-contact relay is desired for intermittent service with a direct-current source of energy. Thus three factors enter into the choice between the type MC and type M relay for auxiliary service, namely:

- (a) The difference in the price.
- (b) The contact arrangement.
- (c) The character of service.

**Operation and Adjustment**—The operation and adjustment of the type M relay is the same as that already described for the type MC relay except that there are no back contacts. Table 2 gives the values for which the coils are designed to operate positively. The spring adjusting stud should be set so as to have the spring exert sufficient pull on the armature that it will never be closed due to a jar or excess vibration. The back stop is adjusted so that the movement of the armature gives a definite value of minimum pick up voltage. Increasing or decreasing the air gap respectively raises or lowers the minimum pick up voltage.

The setting of the armature spring also affects the pick up voltage.

**Maintenance**—The type M relay should be inspected at regular intervals to see that the contacts are in good condition and that all nuts and screws are tight and that no adjustment has been changed. Care should be taken in adjusting the relays both upon initial installation and upon routine inspection, that the contacts are in proper alignment. All contacts should make at the same time, thus placing practically the same pressure on all contacts when the armature is drawn in to the core. This adjustment may be made by bending the contact springs slightly to bring them into the proper alignment. Contacts which are burnt or pitted may be dressed up with a fine file unless they are in very poor condition, in which case they should be replaced.

### Type MF Flash Relay

**The construction** of the MF relay is similar to the standard MC relay. It has one back and two front contacts. Due to lack of space, terminals are provided for only one front and one back contact. A special high-current coil with special terminal is used and operation indicator is added in the front contact circuit. In addition to this a different cover is used having a glass window in its lower part so located that the operation indicator may be plainly seen. Figures 24 and 25

## Westinghouse Types MC, M, MF and MS Auxiliary Relays

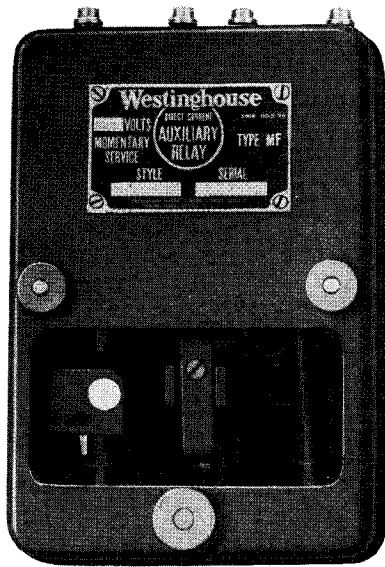


Fig. 24—Westinghouse Type MF Flash Relay

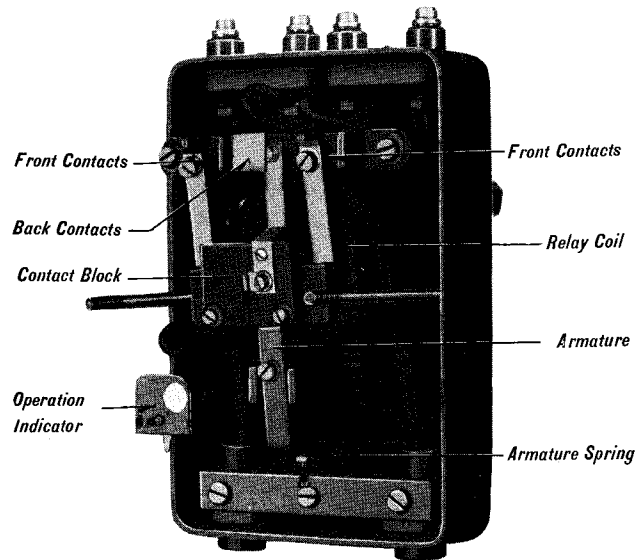


Fig. 25—Westinghouse Type MF Flash Relay with Cover Removed

show the flash relay with and without cover.

**Application**—The type MF flash relay is used for the protection of rotary converters after the occurrence of grounded flashovers. It is connected between the frame of the converter and ground, the frame being left ungrounded except for the connection through the relay winding. Upon the occurrence of flashover on the d-c. end of the converter a large current will tend to flow to ground. As the relay winding is the only connection to ground, this current will flow through the relay causing it to operate and trip the machine off the line. The relay is designed to operate on 100 amperes flowing

in the coil but the construction is such that 1000 amperes or more may flow momentarily without injuring the winding or the relay mechanism. Figure 26 shows a schematic diagram of connections for the MF relay.

**The operation and adjustment** of the MF relay is the same as those described under the type MC. The same rules for testing and maintenance should be applied.

### Type MS Relay

**Construction**—The type MS supervisory control relay is a group of MC contact assemblies mounted in a suitable case. The coils and magnetic circuits are

the same as those used in the MC relay. The armature assembly is similar except that it is much more simple. The coil and magnetic circuit are so mounted that the contacts are held open by gravity and thus the spring at the end of the armature as used in the type MC relay is unnecessary. The back stop screw is used, however. The contact assembly consists of two spring-mounted contacts with the springs mounted on a micarta block which is in turn mounted on the armature. These moving contacts engage with two stationary contacts mounted on a micarta contact block which is in turn mounted on the main bracket serving as a support for the entire contactor assembly. A small terminal board is placed in front of the coil containing four terminals. Two of these terminals, marked A and B, are connected to one pair of contacts while the other two are connected to the coil leads. The leads to the other set of contacts are connected to terminals at the rear of the coil on the base. Figure 29 shows the internal wiring diagram.

The type MS relay assembly contains ten separate contact assemblies mounted in two rows as shown in Figures 27 and 28. Coils may be supplied for the different voltages as shown in table 1, since the same coils are used as for the type MC relay.

**Application**—The type MS multi-contact relay is used in supervisory control equipment and in other applications

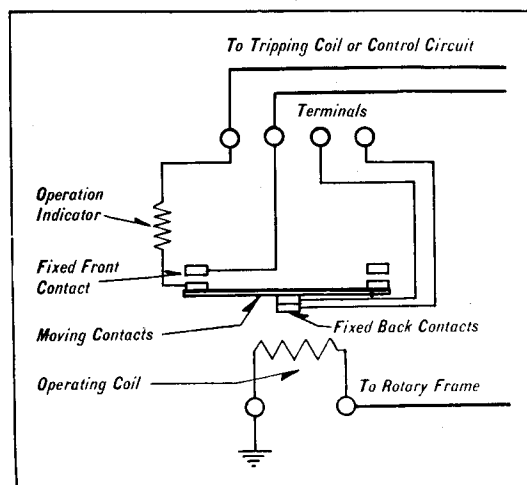


Fig. 26—Internal Wiring Diagram of Type MF Flash Relay. (Rear View)

*Westinghouse Types MC, M, MF and MS Auxiliary Relays*

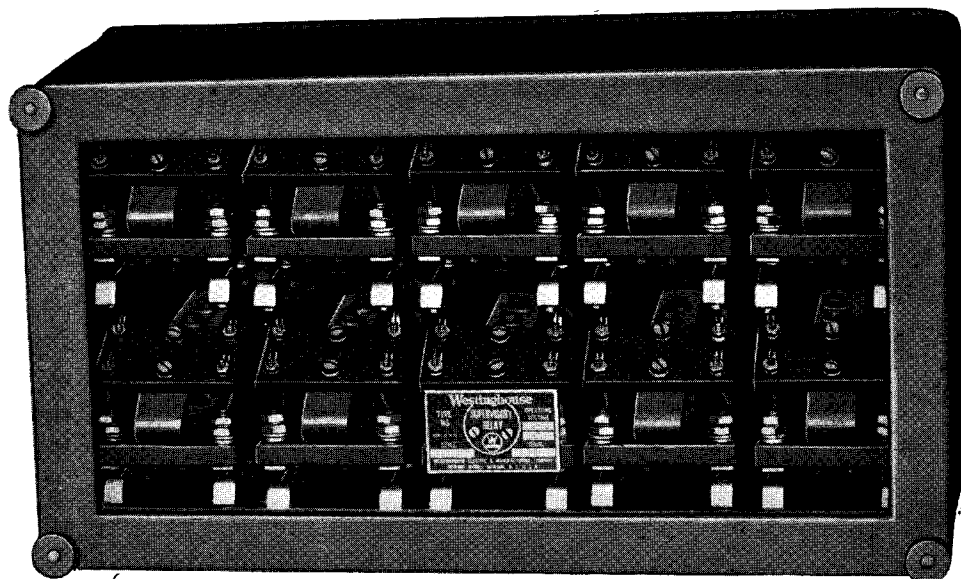


Fig. 27—Westinghouse Type MS Multi-Contact Relay

where a great number of contactors are necessary and it is desirable to have them in as compact arrangement as possible. The specific use of the type MS relay is for supervisory control where it is necessary to insulate the low voltage telephone equipment from the higher voltage control circuit. The electrical impulses sent in over the supervisory circuit are thus relayed to the circuits which control the power apparatus. The arrangement of the ten contactor assemblies into two rows is such that the standard telephone cable can be brought in through an open-

ing at each end of the case and connections made to the terminal boards.

**Operation and Adjustment**—As shown in the figure, the contacts are held open by gravity as long as the relay coil remains de-energized. The movement of the armature, or in other words, the width of the air gap when the contacts are open may be adjusted by means of the small back stop screw located in the end of the armature opposite to that on which the contacts are mounted. By the proper adjustment of this screw the minimum voltage at which the relay will

pick up and attract the armature may be varied somewhat. Generally speaking, however, these values of minimum pick up voltage and continuous values are the same as given on table 1 for the type MC relay coils.

This entire assembly of contactors is mounted on a suitable cast iron base and enclosed in a cover with a glass front so that the action of all of the contacts may be observed at all times. This makes inspection easy and in case any of the contacts require attention they are readily accessible by removing the cover.

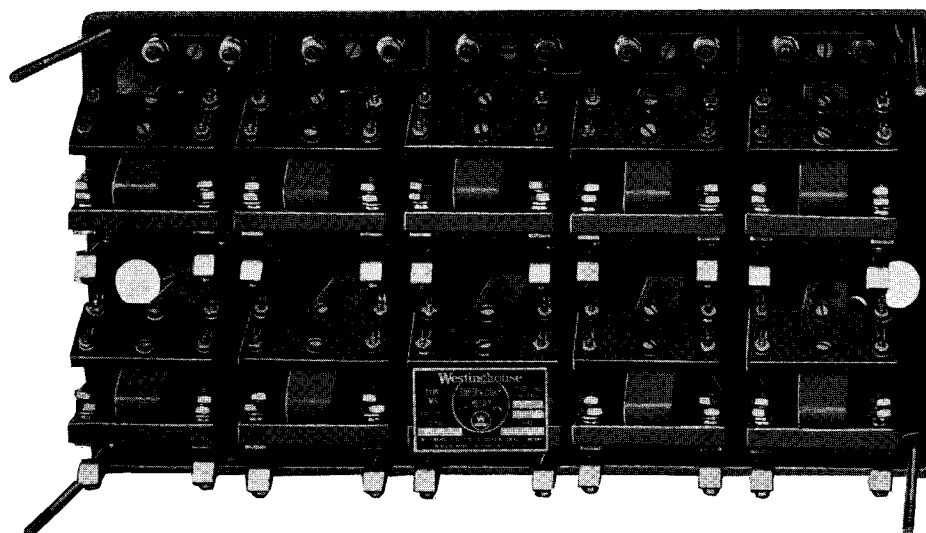


Fig. 28—Westinghouse Type MS Multi-Contact Relay with Cover Removed

# Westinghouse Types MC, M, MF and MS Auxiliary Relays

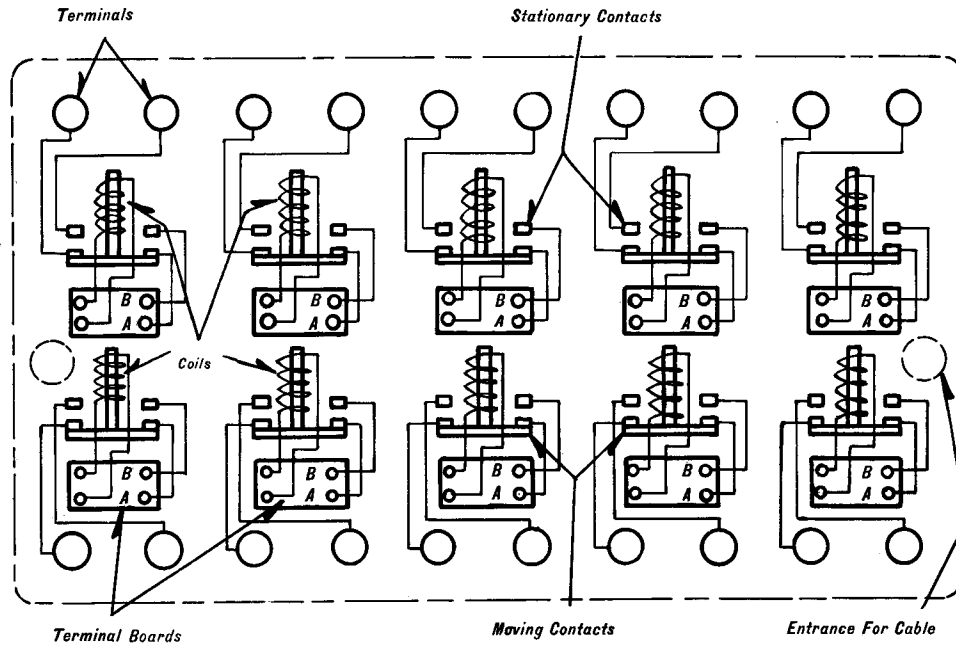


Fig. 129—Internal Wiring Diagram of Type MS Multi-Contact Relay. (Rear View)

## Outline and Drilling Plans

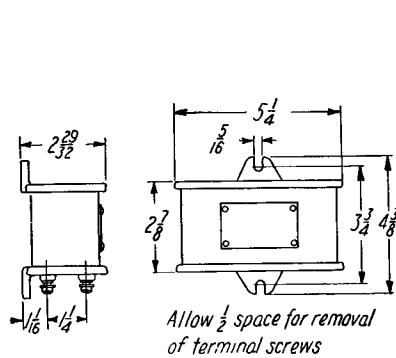


Fig. 30—External Series Resistor—2-Spool Size

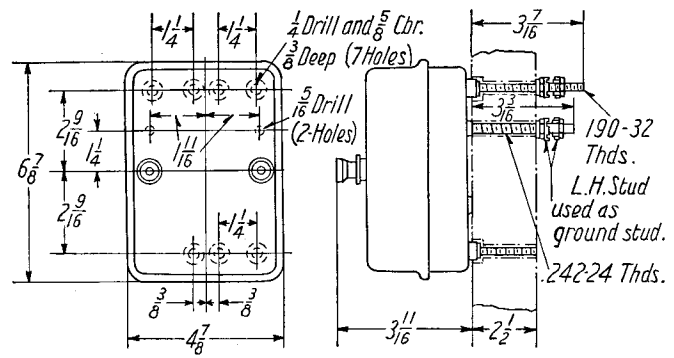


Fig. 31—Type M—Multi-Contact—7 Terminals

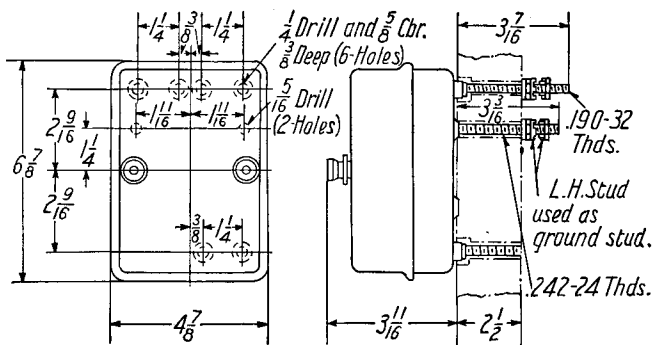


Fig. 32—Type M—Multi-Contact—6 Terminals

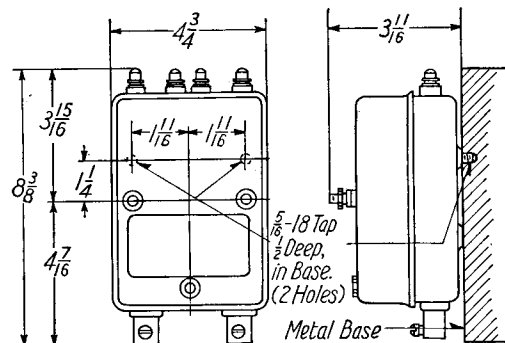


Fig. 33—Type MF Flash Relay

Westinghouse Types MC, M, MF and MS Auxiliary Relays

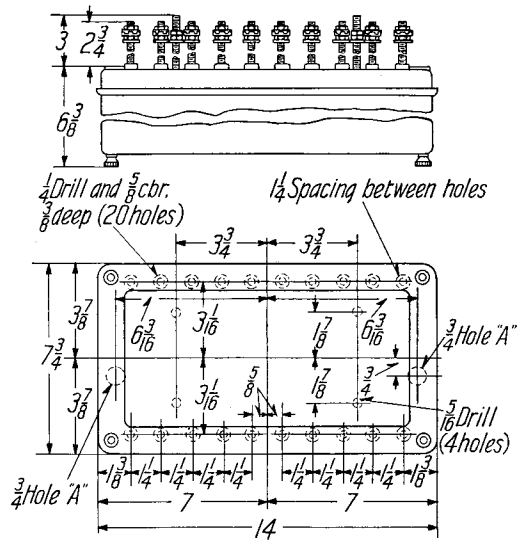
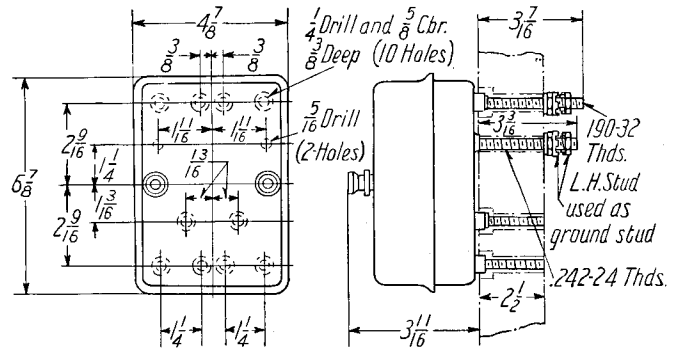
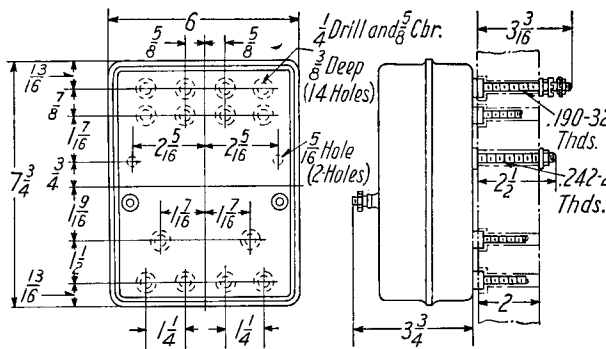


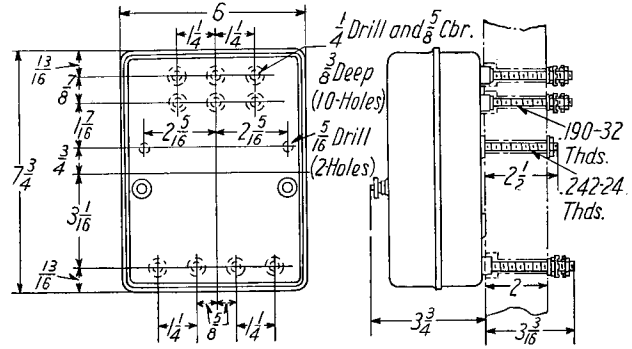
Fig. 34—Type MS Banked Multi-Contact



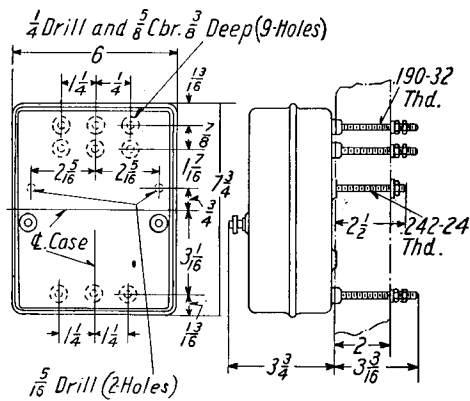
Type MC Relay  
Fig. 35—Four Independent Contact Circuits—Various Combinations of Make and Break



Type MC Relay  
Fig. 36—Six Independent Contact Circuits—Various Combinations of Make and Break



Type MC Relay  
Fig. 37—Five-Circuit Opening, One-Circuit Closing, All in Parallel



Type MC Relay  
Fig. 38—Five-Circuit Closing, One-Circuit Opening, Also with Six "Make" Contacts, all in Parallel

# Westinghouse Types MC, M, MF and MS Auxiliary Relays

## Renewal Parts

### Repairing

Repair work can be most satisfactorily accomplished at our nearest Service Shop. However, interchangeable renewal parts can be furnished, as listed below, to customers, who are equipped for doing repair work.

## Recommended Stock of Renewal Parts

Below is a list of the renewal parts and the minimum quantities of each that should be carried in stock. These are the parts most subject to wear in ordinary operation and damage or breaking due to possible abnormal conditions. The maintenance of such stock will minimize service interruptions due to breakdowns.

## Ordering Instructions

When ordering renewal parts, give the name plate reading. Always give the name of the part wanted, also the stock order number of the apparatus on which the part is to be used. Refer to the back of this book for the nearest District Office from which to order parts.

## Recommended Stock of Renewal Parts

These lists cover the minimum quantity of renewal parts that should be carried in stock.

### TYPE M AUXILIARY RELAY

(See Fig. 21)

| Total number of relays up to and including |           | 2 CONTACTS    |                       |   |   | 4 CONTACTS    |                       |   |    | 6 CONTACTS    |                       |    |    |
|--|-----------|---------------|-----------------------|---|---|---------------|-----------------------|---|----|---------------|-----------------------|----|----|
|  |           | 2             |                       | 5 |   | 15            |                       | 2 |    | 5             |                       | 15 |    |
| NAME OF PART                               | STYLE No. | No. PER RELAY | RECOMMENDED FOR STOCK |   |   | No. PER RELAY | RECOMMENDED FOR STOCK |   |    | No. PER RELAY | RECOMMENDED FOR STOCK |    |    |
| Relay complete                             |           | 1             | 0                     | 0 | 1 | 1             | 0                     | 0 | 1  | 1             | 0                     | 0  | 1  |
| Armature                                   | 311826    | 1             | 0                     | 0 | 1 | 1             | 0                     | 0 | 1  | 1             | 0                     | 0  | 1  |
| Contact spring                             | 311836    | 2             | 1                     | 2 | 4 | 4             | 2                     | 4 | 8  | 6             | 3                     | 6  | 12 |
| Contact—moving                             | 311835    | 2             | 2                     | 4 | 8 | 4             | 4                     | 8 | 16 | 6             | 6                     | 12 | 24 |
| Armature mounting pin                      | 63589     | 1             | 0                     | 1 | 1 | 1             | 0                     | 1 | 1  | 1             | 0                     | 1  | 1  |
| Armature spring                            | 408225    | 1             | 1                     | 1 | 2 | 1             | 1                     | 1 | 2  | 1             | 1                     | 1  | 2  |
| *Stationary contact                        | 311831    | 2             | 2                     | 4 | 8 | 4             | 4                     | 8 | 16 | 6             | 6                     | 12 | 24 |
| Coil—12 Volts                              | 315938    | 1             | 1                     | 1 | 2 | 1             | 1                     | 1 | 2  | 1             | 1                     | 1  | 2  |
| Coil—24 Volts                              | 438148    | 1             | 1                     | 1 | 2 | 1             | 1                     | 1 | 2  | 1             | 1                     | 1  | 2  |
| Coil—50 Volts                              | 315941    | 1             | 1                     | 1 | 2 | 1             | 1                     | 1 | 2  | 1             | 1                     | 1  | 2  |
| Coil—125 Volts                             | 315939    | 1             | 1                     | 1 | 2 | 1             | 1                     | 1 | 2  | 1             | 1                     | 1  | 2  |
| Coil—250 Volts                             | 315940    | 1             | 1                     | 1 | 2 | 1             | 1                     | 1 | 2  | 1             | 1                     | 1  | 2  |
| *Glass cover                               | 423831    | 1             | 0                     | 0 | 1 | 1             | 0                     | 0 | 1  | 1             | 0                     | 0  | 1  |
| *Thumb nut for glass cover                 | 289840    | 2             | 1                     | 2 | 4 | 2             | 1                     | 2 | 4  | 2             | 1                     | 2  | 4  |
| *Thumb nut for metal cover                 | 242574    | 2             | 1                     | 2 | 4 | 2             | 1                     | 2 | 4  | 2             | 1                     | 2  | 4  |

### TYPE MC AUXILIARY RELAY

(See Fig. 3)

| Total number of relays up to and including |           | 4 CONTACTS    |                       |    |                |               |                       |                |    |               |                       |   |    |
|--|-----------|---------------|-----------------------|----|----------------|---------------|-----------------------|----------------|----|---------------|-----------------------|---|----|
|  |           | 4 MAKE        |                       |    | 1 MAKE 3 BREAK |               |                       | 3 MAKE 1 BREAK |    |               | 2 MAKE 2 BREAK        |   |    |
|  |           | 2             | 5                     | 15 | 2              | 5             | 15                    | 2              | 5  | 15            | 2                     | 5 | 15 |
| NAME OF PART                               | STYLE No. | No. PER RELAY | RECOMMENDED FOR STOCK |    |                | No. PER RELAY | RECOMMENDED FOR STOCK |                |    | No. PER RELAY | RECOMMENDED FOR STOCK |   |    |
| Relay complete                             |           | 1             | 0                     | 0  | 1              | 1             | 0                     | 0              | 1  | 1             | 0                     | 0 | 1  |
| Armature                                   | 375114    | 1             | 0                     | 0  | 1              | 1             | 0                     | 0              | 1  | 1             | 0                     | 0 | 1  |
| Front contact and spring—short             | 476937    | 2             | 2                     | 4  | 8              | 1             | 1                     | 2              | 4  | 2             | 2                     | 4 | 8  |
| Front contact and spring—long              | 476939    | 2             | 2                     | 4  | 8              | 1             | 1                     | 2              | 4  | 2             | 2                     | 4 | 8  |
| Back contact and spring—moving             | 464004    | 2             | 2                     | 4  | 8              | 3             | 3                     | 6              | 9  | 1             | 1                     | 2 | 4  |
| *Spring support for front contact—curved   | 446719    | 2             | 1                     | 2  | 4              | 1             | 0                     | 1              | 2  | 1             | 0                     | 1 | 2  |
| *Spring support for front contact—straight | 464001    | 2             | 1                     | 2  | 4              | 1             | 0                     | 1              | 2  | 2             | 1                     | 2 | 4  |
| *Spring support for back moving contact    | 464720    | 2             | 1                     | 2  | 4              | 3             | 1                     | 3              | 6  | 1             | 0                     | 1 | 2  |
| Armature mounting pin                      | 438105    | 1             | 0                     | 1  | 1              | 1             | 0                     | 1              | 1  | 1             | 0                     | 1 | 1  |
| Armature spring                            | 477948    | 1             | 1                     | 1  | 2              | 1             | 1                     | 1              | 2  | 1             | 1                     | 1 | 2  |
| *Stationary contact and screw              | 476935    | 4             | 4                     | 8  | 16             | 1             | 1                     | 2              | 4  | 3             | 3                     | 6 | 12 |
| Back stationary contact and screw          | 420430    | 1             | 1                     | 1  | 2              | 3             | 3                     | 6              | 12 | 1             | 1                     | 2 | 4  |
| *Glass cover                               | 423831    | 1             | 0                     | 0  | 1              | 1             | 0                     | 0              | 1  | 1             | 0                     | 0 | 1  |
| *Thumb nut for cover                       | 289840    | 2             | 1                     | 2  | 4              | 2             | 1                     | 2              | 4  | 2             | 1                     | 2 | 4  |

\*Not listed on illustration.

Westinghouse Types MC, M, MF and MS Auxiliary Relays

RECOMMENDED STOCK OF RENEWAL PARTS—Continued

TYPE MC AUXILIARY RELAY

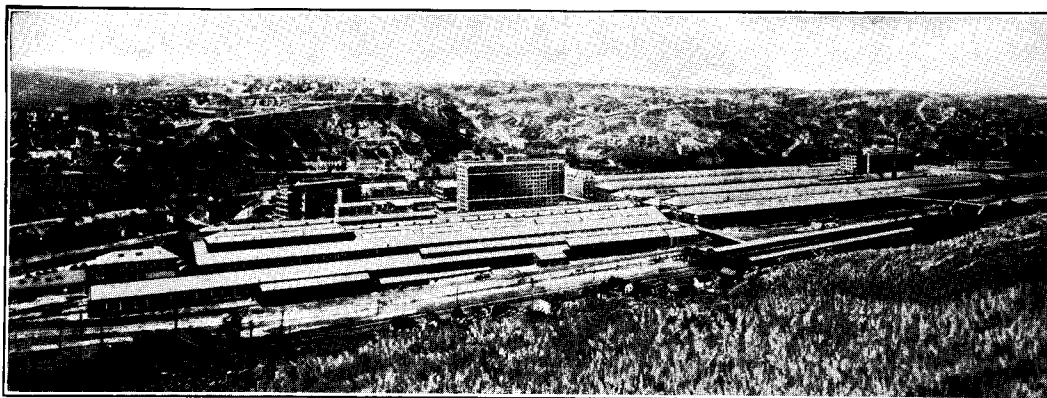
| Total number of relays up to and including |  | 6 CONTACTS |               |                       |    |                |               |                       |    |                |               |                       |    |                |               |                       |    |    |
|--|--|------------|---------------|-----------------------|----|----------------|---------------|-----------------------|----|----------------|---------------|-----------------------|----|----------------|---------------|-----------------------|----|----|
|  |  | 6 MAKE     |               |                       |    | 1 MAKE 5 BREAK |               |                       |    | 5 MAKE 1 BREAK |               |                       |    | 4 MAKE 2 BREAK |               |                       |    |    |
|  |  | 2          |               | 5                     | 15 | 2              |               | 5                     | 15 | 2              |               | 5                     | 15 | 2              |               | 5                     | 15 |    |
| NAME OF PART                               |  | STYLE No.  | No. Per Relay | RECOMMENDED FOR STOCK |    |                | No. Per Relay | RECOMMENDED FOR STOCK |    |                | No. Per Relay | RECOMMENDED FOR STOCK |    |                | No. Per Relay | RECOMMENDED FOR STOCK |    |    |
| Relay complete                             |  |            | 1             | 0                     | 0  | 1              | 1             | 0                     | 0  | 1              | 1             | 0                     | 0  | 1              | 1             | 0                     | 0  | 1  |
| Armature                                   |  | 375114     | 1             | 0                     | 0  | 1              | 1             | 0                     | 0  | 1              | 1             | 0                     | 0  | 1              | 1             | 0                     | 0  | 1  |
| Front contact and spring—short             |  | 476936     | 2             | 2                     | 4  | 8              | .             | .                     | .. | ..             | 1             | 1                     | 2  | 4              | 2             | 2                     | 4  | 8  |
| Front contact and spring—long              |  | 476938     | 4             | 4                     | 8  | 16             | .             | .                     | .. | ..             | .             | .                     | .. | ..             | 4             | 4                     | 8  | 16 |
| Front contact and spring—moving            |  | 476939     | .             | .                     | .. | ..             | 1             | 1                     | 2  | 4              | 4             | 4                     | 8  | 16             | .             | .                     | .. | .. |
| Back contact and spring—moving             |  | 464004     | .             | .                     | .. | ..             | 5             | 5                     | 10 | 20             | 1             | 1                     | 2  | 4              | .             | .                     | .. | .. |
| *Spring support for front contact—curved   |  | 446719     | 2             | 1                     | 2  | 4              | .             | .                     | .. | ..             | 1             | 0                     | 1  | 2              | 2             | 1                     | 2  | 4  |
| *Spring support for front contact—straight |  | 464001     | 4             | 2                     | 4  | 8              | 1             | 0                     | 1  | 2              | 4             | 2                     | 4  | 8              | 4             | 2                     | 4  | 8  |
| *Spring support for back moving contact    |  | 446720     | .             | .                     | .. | ..             | 5             | 2                     | 4  | 8              | 1             | 0                     | 1  | 2              | .             | .                     | .. | .. |
| Armature mounting pin                      |  | 438105     | 1             | 0                     | 1  | 1              | 1             | 0                     | 1  | 1              | 1             | 0                     | 1  | 1              | 1             | 0                     | 1  | 1  |
| Armature spring                            |  | 408225     | 1             | 1                     | 1  | 2              | 1             | 1                     | 1  | 2              | 1             | 1                     | 1  | 2              | 1             | 1                     | 1  | 2  |
| *Stationary contact and screw              |  | 476935     | 6             | 6                     | 12 | 24             | 1             | 1                     | 2  | 4              | 5             | 5                     | 10 | 20             | 6             | 6                     | 12 | 24 |
| Back stationary contact and screw          |  | 420430     | .             | .                     | .. | ..             | 5             | 5                     | 10 | 20             | 1             | 1                     | 2  | 4              | .             | .                     | .. | .. |
| *Thumb nut for cover                       |  | 242574     | 2             | 1                     | 2  | 4              | 2             | 1                     | 2  | 4              | 2             | 1                     | 2  | 4              | 2             | 1                     | 2  | 4  |

| †Total number of relays up to and including                        | 2                   |                          | 5 |   | 15           |  |
|--|---------------------|--------------------------|---|---|--------------|--|
| NAME OF PART   | No.<br>PER<br>RELAY | RECOMMENDED<br>FOR STOCK |   |   | STYLE<br>No. |  |
| Coil— 5 Amperes D-C.   | 1                   | 1                        | 1 | 2 | 372517       |  |
| Coil— 8 Volts D-C.   | 1                   | 1                        | 1 | 2 | 476903       |  |
| Coil— 12 Volts D-C.  | 1                   | 1                        | 1 | 2 | 372518       |  |
| Coil— 16 Volts D-C.  | 1                   | 1                        | 1 | 2 | 372519       |  |
| Coil— 25 Volts D-C.  | 1                   | 1                        | 1 | 2 | 476906       |  |
| Coil— 32 Volts D-C.  | 1                   | 1                        | 1 | 2 | 333370       |  |
| Coil— 50 Volts D-C.  | 1                   | 1                        | 1 | 2 | 333364       |  |
| Coil— 62 Volts D-C.  | 1                   | 1                        | 1 | 2 | 476908       |  |
| Coil—110 Volts D-C.  | 1                   | 1                        | 1 | 2 | 476909       |  |
| Coil—130 Volts D-C. or 250 Volts D-C.                              | 1                   | 1                        | 1 | 2 | 374893       |  |
| Coil— 62 Volts, 25 Cycle; 110 Volts, 50 Cycle; 130 Volts, 60 Cycle | 1                   | 1                        | 1 | 2 | 476906       |  |
| Coil— 62 Volts, 50 Cycle   | 1                   | 1                        | 1 | 2 | 372518       |  |
| Coil— 62 Volts, 60 Cycle   | 1                   | 1                        | 1 | 2 | 476904       |  |
| Coil—110 Volts, 25 Cycle or 220 Volts, 60 Cycle                    | 1                   | 1                        | 1 | 2 | 476907       |  |
| Coil—110 Volts, 60 Cycle   | 1                   | 1                        | 1 | 2 | 476905       |  |
| Coil—130 Volts, 25 Cycle or 220 Volts, 50 Cycle                    | 1                   | 1                        | 1 | 2 | 333364       |  |
| Coil—130 Volts, 50 Cycle   | 1                   | 1                        | 1 | 2 | 333370       |  |
| Coil—220 Volts, 25 Cycle or 440 Volts, 50 Cycle                    | 1                   | 1                        | 1 | 2 | 476909       |  |
| Coil—440 Volts, 25 Cycle   | 1                   | 1                        | 1 | 2 | 374893       |  |
| Coil—440 Volts, 60 Cycle   | 1                   | 1                        | 1 | 2 | 333360       |  |
| *Resistance box for 250 Volt, D-C. Relay                           | 1                   | 0                        | 0 | 1 | 78894        |  |
| *Resistor tube, 1200 Ohms  | 2                   | 1                        | 1 | 2 | 99853        |  |
| *Resistance box for 440 Volt, 25 Cycle Relay                       | 1                   | 0                        | 0 | 1 | 78897        |  |
| *Resistor tube, 2000 Ohms  | 2                   | 1                        | 1 | 2 | 99855        |  |

\*Not listed on illustration.

†This list applies to both 4 and 6 contact relays.

Parts indented are included in the part under which they are indented.



The Company's Works at East Pittsburgh, Pa.

## Westinghouse Products

A few of the Westinghouse Products are listed below and will furnish some idea of the great variety of electrical apparatus manufactured by the Company and the many extensive fields for their use.

### For Industrial Use

Instruments  
Motors and controllers for every application, the more important of which are: Machine shops, wood-working plants, textile mills, steel mills, flour mills, cement mills, brick and clay plants, printing plants, bakeries, laundries, irrigation, elevators and pumps.

Welding outfits

Gears

Industrial heating devices, such as: Glue pots, immersion heaters, solder pots, hat-making machinery and electric ovens.

Lighting systems

Safety switches

### For Power Plants and Transmission Lines

Carrier current equipment  
Circuit-breakers and switches

Condensers

Controllers

Control switches

Frequency changers

Fuses and fuse blocks

Generators

Insulating material

Instruments

Lamps, incandescent and arc

Lightning arresters

Line material

Locomotives

Meters

Motors

Motor-generators

Portable Power Stands, 110 volts

Rectifiers

Regulators

Relays  
Solder and soldering fluids  
Stokers  
Substations, portable and automatic  
Switchboards  
Synchronous converters  
Transformers  
Turbine-generators

### For Transportation

Locomotives

Railway equipment

Marine equipment

### For Mines

Automatic substations

Lamps

Locomotives

Motors for hoists and pumps

Motor-generators

Portable substations

Switchboards

Line material

Ventilating outfits

### For Farms

Fans

Household appliances

Motors for driving churns, cream separators, corn shellers, feed grinders, pumps, air compressors, grinders, fruit cleaning machines and sorting machines.

Generators for light, power and heating apparatus.

Portable Power Stands, 32 Volts

Radio Apparatus

Transformers

### For Office and Store

Electric radiators

Fans

Arc lamps

Incandescent lamps

Sol-Lux lighting fixtures

Small motors for driving addressing machines, dictaphones, adding machines, cash carriers, moving window displays, signs, flashers, envelope sealers, duplicators, etc.

Ventilating outfits

### For Electric and Gasoline Automobiles and the Garage

Battery charging outfits

Charging plugs and receptacles

Lamps

Instruments

Motors and controllers

Small motors for driving lathes, tire pumps, machine tools, polishing and grinding lathes.

Solder and soldering fluids

Tire vulcanizers

### For the Home

Electric ware, including: Table stoves, toasters, irons, warming pads, curling irons, coffee percolators, chafing dishes, disc stoves, radiators and sterilizers.

Automatic electric ranges

Fans

Incandescent lamps

Radio apparatus

Sol-Lux lighting fixtures

Small motors for driving coffee grinders, ice cream freezers, ironing machines, washing machines, vacuum cleaners, sewing machines, small lathes, polishing and grinding wheels, pumps and piano players.

Sew-motors.