RELAYS
AF-, AG-, AND AJ- TYPES
(WIRE SPRING TYPE)
DESCRIPTION

1. GENERAL

1.01 This section describes the AF-, AG-, and AJ-type relays. These relays are referred to as wire spring relays because their contact springs consist of wires having contacts welded to the front ends.

1.02 This section is reissued to include information on the AJ205 relay, a 24-position break-contact relay; to delete paragraphs 2.17 and 2.18 which refer to dampers; to add new paragraph 2.21 and to add Fig. 6.

1.03 AF-type relays are general purpose relays; AG-type, slow releasing relays; and AJ-type are intended to meet marginal requirements or to operate heavy spring loads.

1.04 Wire spring relays are intended for use in place of U-, UA-, UB-, and Y-type relays in new circuits and also where existing circuits will be completely redesigned. Wire spring relays offer a number of advantages over the U-, UA-, UB-, and Y-type relays including:

(a) Fewer parts

(b) Lower cost

(c) Improved operating characteristics

(d) Longer life with reduced maintenance

(e) Greater number of contact pairs per relay.

1.05 Wire spring relays are not interchangeable with U-, UA-, UB-, or Y-type relays. Therefore, equipment and circuit engineering is required in applying them in existing systems.

1.06 The following BSP sections cover information on the maintenance of these relays.

SECTION	TITLE
040-502-701	Relays—AF-, AG-, and AJ-Types—Requirements and Adjustment Procedures
040-502-801	Piece-Part Data and Replacement Procedures for AF-, AG-, and AJ-Type Relays
005-120-101	Winding and Spring Designations

2. DESCRIPTION

GENERAL

2.01 Wire spring relays consist of a few molded units together with the coil, core assembly, armature, actuating card, and balancing spring. A spring clip holds the parts securely together. No screws, nuts, separate insulators, or spacers are required in the relay assembly. The number of parts making up a wire spring relay is considerably less than that required for U- or similar-type relays.

2.02 Fig. 1 and 2 show views of a wire spring relay with the principal parts designated. The magnetic structure consists of a flat, U-shaped armature and an E-shaped core having the coil assembled on the middle leg of the core. The outer ends of the three core legs are secured in a nonmagnetic core plate. This plate, in addition to holding the core legs in alignment, provides the backstop for the armature and supports the molded section at the outer end of the fixed contact spring assembly. Armatures for these relays are made in two lengths, the shorter being used on the AF-type relay and the longer on the AG- and

AJ-types. In order to provide the required operating characteristics, the short armature always has nonmagnetic stop discs where it engages the core in the operated position of the relay. The long armatures may have either stop discs or a dome-shaped embossing.

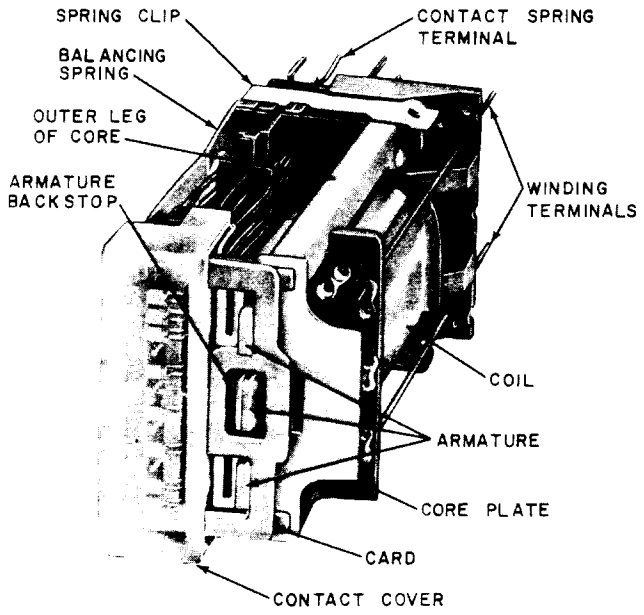

Fig. 1—Wire Spring Relay—Contact Cover In Place

2.03 The armature is supported by a U-shaped hinge spring, the legs of which are secured to the legs of the armature. The hinge spring is positioned in the relay assembly between the core and the molded mounting bracket. This bracket carries a clamp plate which engages the relay mounting screws. Wires connected to the coil winding leads at the front spoolhead pass through the bracket and serve as winding terminals. In addition, the bracket serves as the base for supporting the molded assemblies of the fixed and movable contact springs.

2.04 The movable contact springs are actuated by the card shown in Fig. 1 to ▮6,▮ at the front of the relay. The card is held against the armature and the armature against the armature backstop on the core plate by the U-shaped balancing spring mounted at the left side of the relay. The two legs of the balancing spring engage

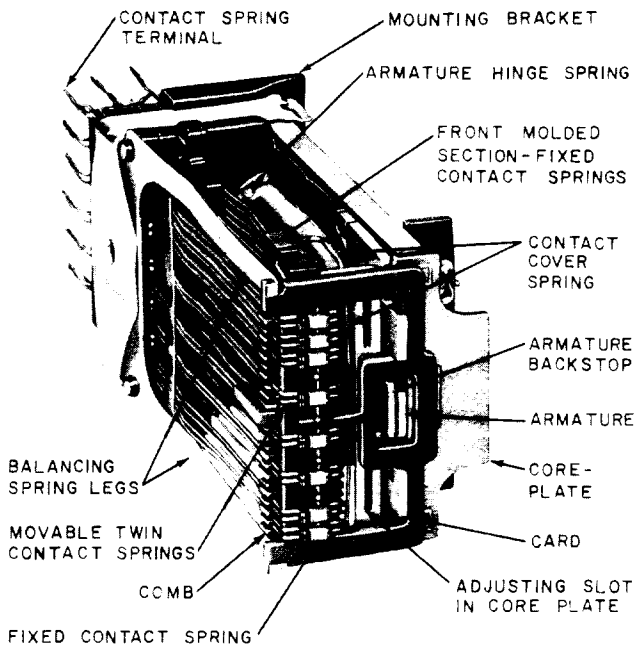

Fig. 2—12-Position Wire Spring Relay—Contact Cover Removed

notches in the card as shown in Fig. 2. The assembly is held together by a heavy spring clip shown in Fig. 1. A transparent cover, mounted at the front of the relay, protects the contacts.

2.05 One of the advantages of the wire spring relay is the large number of contact spring units which can be provided on a single relay. This results in a smaller number of wire spring relays being required for certain circuit functions compared to other types of relays. Thus, a single wire spring relay can provide any one of the following spring combinations; ▮24 makes, 24 breaks,▮ 12 break-before-makes, or 12 make-before breaks. Different combinations of individual spring units are also possible.

Fixed Contact Spring Assemblies

2.06 A wire spring relay has separate molded spring assemblies for the fixed and movable wire contact springs, respectively. Each fixed spring assembly consists of a group of 12 heavy wires molded into two plastic sections, one near the front and the other at the rear of the relay. The fixed springs are pretensioned during manufacture to hold the molded section at the front firmly

against the core plate. AJ-type relays providing 24 make contacts, as shown in Fig. 3, ▶or 24 break contacts, as shown in Fig. 6◀, contain two molded assemblies with fixed contact springs. All other wire spring relays have a single molded assembly of fixed springs.

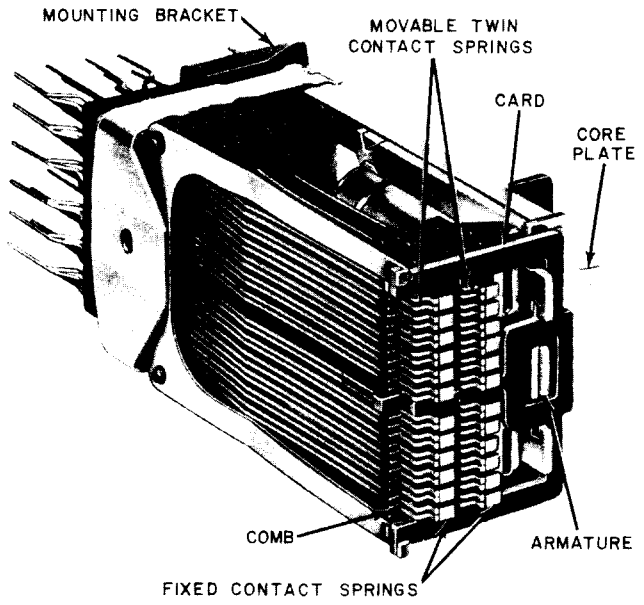

Fig. 3—24-Position Wire Spring Relay—Contact Cover Removed Showing 24 Twin Make Contacts

2.07 As shown in Fig. 1 to ▶6◀, a rectangular contact block is welded to the end of each fixed wire spring with which movable springs are associated. Precious metal contacts are provided on one or both sides of the block as required by the associated movable springs.

Movable Contact Spring Assembly

2.08 A movable contact spring assembly consists of a maximum of twelve pairs of wires molded in a plastic section at the rear of the relay. These wires, which have a smaller diameter than that of the fixed wires, are arranged in a single vertical row. A precious metal contact is welded to the front end of each movable wire. Two movable wires are always associated together as a twin pair. The ends of each pair, which extend through the plastic section at the rear, are ▶twisted◀ together to provide the winding terminal for the twin wires.

2.09 Wire spring relays usually contain two molded assemblies of movable wires. The exception to this is a 12-position relay having only makes or only breaks. In such a case, the assembly of make or break wires not required is replaced by a molded block without wires at the rear of the relay.

2.10 On 12-position relays, one of the assemblies of movable wires is located to the left of the fixed wires and the other to the right. As viewed from the front of the relay, the movable wires to the left of the fixed wires carry the make contacts and those to the right, the break contacts. Movable wires are omitted in any position where they are not required, although the fixed wires are always provided in every position; eg, if a given position requires only a break contact, the movable twin wires which would provide the make are omitted.

2.11 ▶On 24-position make-contact relays, the two assemblies of movable wires are located to the left of their associated fixed wires as viewed from the front of the relay. The wires in both of these assemblies carry make contacts, and a full complement of 24 twin make contacts is always provided. On 24-position break-contact relays, the two assemblies of movable wires are located to the right of their associated fixed wires as viewed from the front of the relay. The wires in both of these assemblies carry break contacts, and a full complement of 24 twin break contacts is always provided.◀

2.12 On all relays, the front portion of each movable wire rests in a groove of a comb which is part of the front molded section on the fixed wire assembly. These grooves serve to align the contacts on a pair of twin wires with the contact on the associated fixed wires. All movable wires are pretensioned toward the fixed wires to provide contact pressure for both make and break contacts.

OPERATING CARD

2.13 The movable wires are actuated by the fiber card at the front of the relay. The card, which is held against the armature by the pretensioned legs of the balancing spring, moves with the armature. In the unoperated position of the relay, all make contact wires rest against the outer left actuating surface of the card. As the card moves toward the right during operation of the armature,

the contacts on these movable wires make with their associated fixed contacts, and the actuating surface of the card leaves the wires. During operation of the armature, a second actuating surface on the card, to the right of the fixed contacts, picks up the break wires, thus opening the break contacts. The point during the armature travel at which make and break contacts function, depends on the location of the corresponding actuating surfaces on the card. By notching the actuating surfaces of the card, movement of the wires can be controlled to make or break their contacts at different points in the armature travel. A number of different cards are provided with which wire spring relays may be equipped to obtain various sequences of make and break contact operation in this manner.

CORE PLATE

2.14 The nonmagnetic core plate is secured to the three legs of the core, and provides the armature backstop. The location of the backstop on the core plate, together with the stop discs or embossing on the armature, determines the armature travel, which is not adjustable. Relays may be equipped with one of the several core plates to provide the required armature travel. The molded section near the front of the fixed wires is tensioned against two legs on the core plate. These legs, which are slotted as shown in Fig. 2, provide means for adjusting the separation between movable and fixed contacts.

BALANCING SPRING

2.15 The U-shaped balancing spring is mounted at the left side of the relay, as shown in Fig. 2. The legs of the spring, which are pretensioned during manufacture, fit in notches at the left side of the card. The pretensioned legs hold the card against the armature and the armature against the backstop in the unoperated position of the relay. The legs of the balancing spring may be adjusted to meet the armature back tension requirement or the nonoperate and release current flow requirements of the relay.

BUFFER SPRING

2.16 The U-shaped buffer spring is mounted on the relay, as shown in Fig. 4. It is provided only on relays where it may be needed to facilitate meeting release electrical requirements. The legs of the spring are pretensioned during manufacture, and have notches which engage the ◆core plate◆ to hold the spring in position on the relay. With the spring in position, the operating lug (see Fig. 5) may be adjusted to engage the card at the required point in the armature travel when its use is necessary to aid in meeting the release requirements.

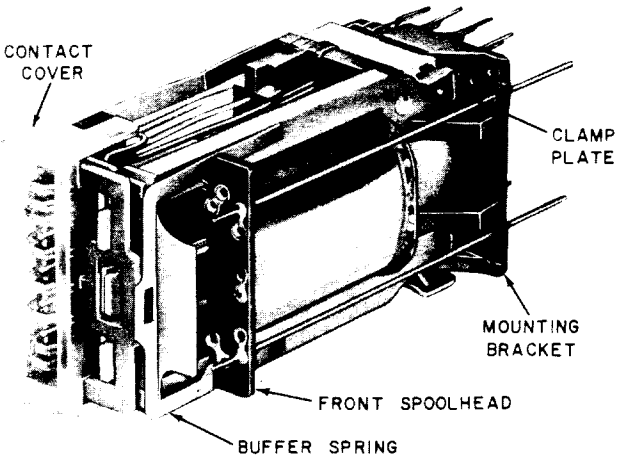

Fig. 4—Wire Spring Relay Equipped With Buffer Spring—Front View

CONTACT AND WINDING SPRING TERMINALS

2.17 As previously described, the wires, to which the coil winding leads are connected, and all contact wires protrude from the rear of the relay and serve as wiring terminals. Wrapped connections are employed on all terminals of wire spring relays. The terminals on the initial lots of these relays were round, and soldering of the wrapped connections was necessary. Later relays have terminals of an approximate rectangular section which eliminates the necessity of soldering the wrapped connections.

CONTACT COVER

2.18 A plastic contact cover is provided with each relay and is mounted as shown in Fig. 1, 4, 5, and 6. This cover protects the contacts from dirt and prevents accidental displacement of the movable wires from their grooves.

2.19 The cover is held securely in place by a spring mounted on the front molded section of the fixed wires back of the core plate as shown in Fig. 2. The top of the cover is indicated by

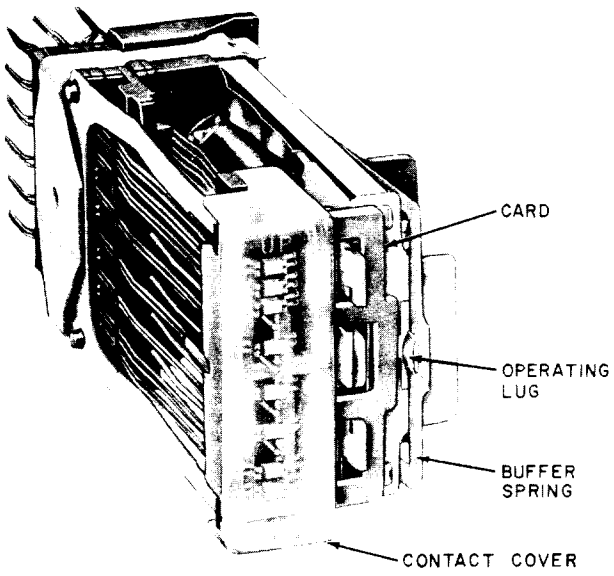

Fig. 5—Wire Spring Relay Equipped With Buffer Spring—Side View

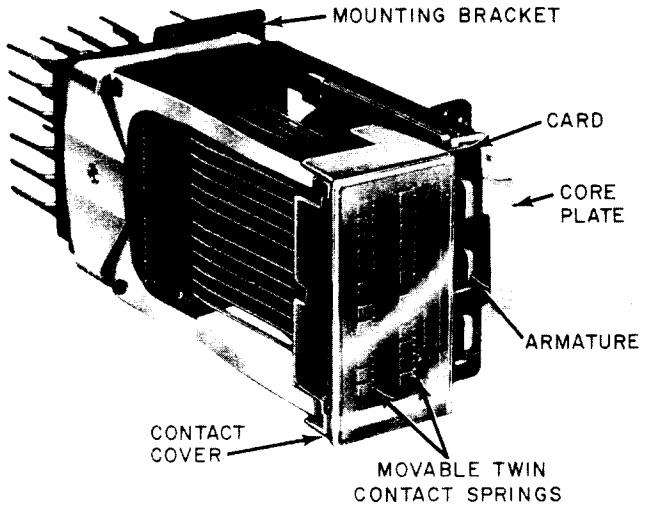

Fig. 6—24-Position Wire Spring Relay With 24 Twin Break Contacts—Contact Cover In Place

the letters UP molded on its surface. These letters serve as a guide to properly position the cover on the relay. This is important since attempts to incorrectly mount the cover may result in damage to the cover or relay. On the initial lots of these relays, a different cover was used. This cover depended on a metal frame to hold it in place. The two types of covers are not interchangeable.

RELAY MOUNTING

2.20 Wire spring relays are not interchangeable with U-, UA-, UB-, and Y-type relays. Wire spring relays in adjacent positions mount on 1-1/2 inch horizontal centers and 2-inch vertical centers, except for the 24-position relay and transmission relays requiring crosstalk shields. In these cases, 1-3/4 inch horizontal centers are required. Where wire spring relays are mounted adjacent to other apparatus, 1-5/8 inch horizontal mounting centers are required. Two mounting screws are provided with each relay, no mounting washers or insulators being required. The clamp plate (Fig. 4), which is secured in the molded mounting bracket, has two threaded holes which engage the mounting screws to hold the relay on its mounting plate. The molded mounting bracket insulates the core of the relay from the mounting plate on the equipment frame.

2.21 All relay requirements apply with the relay mounted in a horizontal position and with the armature in a vertical plane and to the left of the core as viewed from the front of the relay.

3. OPERATING CHARACTERISTICS

SPEED AND SENSITIVITY

3.01 ***AF-type Relay:*** The AF-type relay, like the U-type relay, is used as a general purpose relay. The AF type operates and releases in approximately one-half the time required by a comparable U type. This improvement is due to the relatively short armature travel, light moving parts, and efficient magnetic structure.

3.02 ***AG-type Relay:*** The AG-type relay, like the Y-type relay, is used where slow releasing times are required. While this relay is basically the same as the AF type, the slow releasing characteristics are obtained by the following modifications:

(1) A thicker armature with longer legs.

(2) A dome-shaped embossing on the armature in place of the nonmagnetic stop discs used on the AF-type armature

(3) A metal (aluminum or copper) sleeve assembled on the middle leg of the core under the winding, in most cases.

3.03 ***AJ-type Relay:*** The AJ-type relay, like the UA-type relay, is designed for maximum pull with minimum power. It is capable of operating heavier spring loads than the AF type. It differs from the AF-type relay in having a thicker armature with longer legs similar to that of the AG-type relay. The armature of the AJ-type relay has stop discs similar to those of the AF type. The AJ-type relay is used principally to meet close current flow requirements and to operate heavy spring loads.

CONTACT PERFORMANCE

3.04 In general, wire spring relays provide more reliable contact performance than comparable relays of earlier types. The improved performance is due to the following features:

(a) ***Reliability of Contact***

(1) Troubles due to open contacts are reduced because of the completely independent twin wire contact springs.

(2) The use of palladium for all contacts reduces the probability of open contacts.

(3) A cover over the contacts on each relay effectively protects them from dirt.

(4) Card actuation of the wire springs at a point close to the contacts greatly reduces the probability of locking of contacts.

(5) Contact pressure is maintained at approximately a constant value throughout the life of these relays.

(b) ***Contact Chatter***

(1) The short, light armature used on all AF-type relays reduces armature rebound and provides operation with less contact chatter than obtained on comparable U-type relays.

POWER CONSUMPTION

3.05 Appreciable power savings can be obtained with the coils on these relays due to an improved magnetic structure, shorter contact travel, and lower contact pressure; eg, coils for AF-type relays can be designed to operate on approximately one-half the power required by comparable U-type relays.

MAGNETIC INTERFERENCE

3.06 The magnetic effect of adjacent relays on operation of wire spring relays is negligible. Because of magnetic interference on other types of relays, it has often been necessary to provide considerable space between them where release current flow requirements are required. In some cases, special iron shields were used to isolate the magnetic circuits. Because of the improved characteristics of wire spring relays, such precautions against magnetic interference are not required.