

RELAYS
AF-, AG-, AND AJ-TYPE
PIECE-PART DATA AND REPLACEMENT PROCEDURES

1. GENERAL

1.01 This section covers the information necessary for ordering parts to be used in the maintenance of AF-, AG-, and AJ-type relays. It also covers approved procedures for replacing these parts.

1.02 This section is reissued to update the information with respect to part numbers of bobbin-type replacement coils (Table D) and to make other corrections.

1.03 The 1018A tool kit, which is used only for replacing cards, is a part of the 1017A tool kit but may be ordered separately.

1.04 The older method of repairing wire spring relays using the 1014B tool kit is being retained in the section. It may be used where appropriate.

1.05 Part 2 of this section covers the piece-part numbers and the corresponding names of the parts which it is practicable to replace in the field in the maintenance of these relays. No attempt should be made to replace parts not designated. Part 2 also contains explanatory figures showing the different parts.

1.06 Part 3 of this section covers the approved procedures using the 1017A and 1018A tool kits for the replacement of parts listed in Part 2.

Note: Procedures for the replacement of coil and armature assemblies are not applicable to relays used in Electronic Switching System (ESS) applications where mounting plates are attached to the rear of the equipment frames. See Part 4.

1.07 Part 4 of this section covers the approved procedures using the 1014B tool kit for the replacement of parts listed in Part 2.

1.08 Before making any replacements on the apparatus covered herein, remove the circuit from service in accordance with approved procedures.

1.09 Contact covers for AF-, AG-, and AJ-type relays are now being made of a flame retardant water-white polycarbonate. There is no change in piece-part numbers for these covers, as shown in Table C. All new relays being manufactured will come equipped with the new cover.

1.10 Before replacing an open coil, attempt to repair it by resoldering the leads at the eyelets *or bobbin terminals* after removing the enamel with fine sandpaper. *Where it exists, the normally unfilled eyelet hole* may be filled with solder to restore continuity.

1.11 Complete relays of the same code should be purchased and disassembled in order to obtain the replacement parts for relays to be repaired. Disassembly and repair of the relays should be accomplished using the 1017A tool kit. (See 3.01.)

1.12 All replacement coils should have the letter "R" stamped in a 1/4-inch high character on the front of the front spool head at the time of repair.

1.13 Bobbin coils, when encountered either in relays or as replacement piece-parts, are directly interchangeable with the earlier filled coils and can be replaced by using the existing procedures.

1.14 Some relays of types covered by this section have been purchased from companies other than Western Electric. These may be identified

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by corporate trademarks molded into the covers and stamped on the relays. Since part designation numbers stamped on individual piece parts in these relays may not always correspond to numbers referenced in this section, when piece-part replacements are necessary, an equivalent Western Electric-made relay, if available, should be examined for the part numbers of the proper parts.

2. PIECE-PART DATA

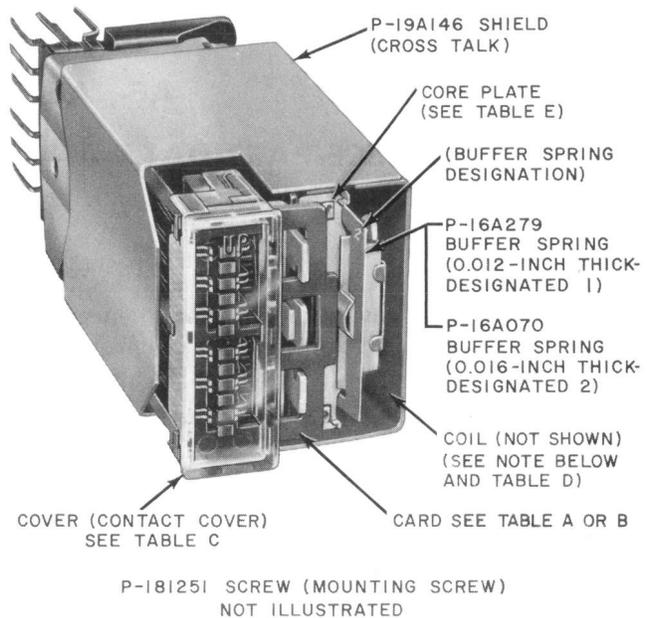
2.01 The figures included in this part show the various piece parts in their proper relation to other parts of the relay. The piece-part numbers of the various parts are given together with the names of the parts as listed by the Western Electric Company Merchandise Department. When these names differ from those in general use in the field, the latter names in some cases are shown in parentheses.

2.02 When ordering parts for replacement purposes, give both the piece-part number and the name of the part; for example, "P-19A132 Card." Do not refer to the BSP number or to any information shown in parentheses following the piece-part number. See Tables B, D, and E.

2.03 When relays manufactured by other than Western Electric are stamped with the year, quarter code, and relay code preceded by the letters NE, replace the card with the Western Electric card bearing the same number.

2.04 When relays are manufactured by other than Western Electric as shown by a date code of the month and year in numbers and a company trademark indented in the core plate, then Table A shall be used to translate the card identification number stamped in the card to the equivalent Western Electric stamping.

2.05 All replaced cards must be stamped with the proper year and quarter code so they can be identified as carrying the Western Electric code rather than a foreign code number.



NOTE: ONLY THE COILS LISTED IN TABLE D ARE AVAILABLE AS REPLACEMENTS, AND NO COILS HAVING OTHER RESISTANCE VALUES SHOULD BE ORDERED.

Fig. 1—12-Position Relay—General View

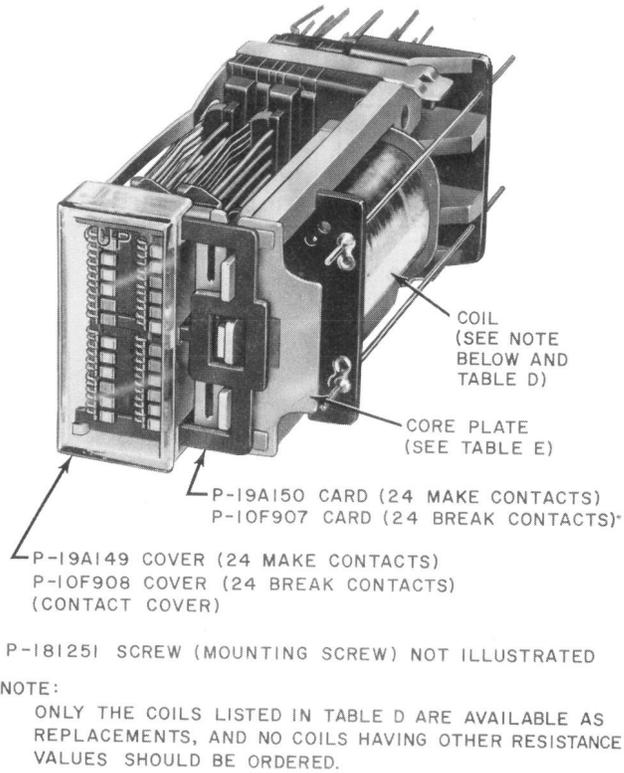


Fig. 2—24-Position Relay—General View

TABLE A

FOREIGN IDENT NO.	WESTERN ELECTRIC PIECE-PART NO.	WESTERN ELECTRIC IDENT NO.
1	P-19A130	0
2	P-19A134	4
3	P-19A131	1
4	P-19A132	2
5	P-19A135	5
6	P-19A133	3
7	P-19A150	10

TABLE B

*CARD IDENTIFICATION NUMBER (12-POSITION RELAY)	CARD PIECE-PART NUMBER
0	P-19A130
1	P-19A131
2	P-19A132
3	P-19A133
4	P-19A134
5	P-19A135
6	P-19A136
7	P-19A137

* The identification number is stamped on each card and is located in the lower right-hand corner with the card properly mounted on the relay. Order the replacement card by the piece-part number corresponding to the identification number on the card to be replaced.

TABLE C

*P-16A144 Cover	Without metal frame — Used on 12-position relays having a contact cover spring.
*P-10F098 Cover	With metal frame — Used on 12-position relays not having a contact cover spring.

* These covers are not interchangeable.

→ TABLE D ←

*COIL RESISTANCE (OHMS)	COIL COMCODE NUMBER	COIL PIECE-PART NUMBER	EQUIVALENT BOBBIN-TYPE REPLACEMENT COIL ASSEMBLIES
4.4	811062017	P-10F201	840750277
16	811062025	P-10F202	840750301
395	811062033	P-10F203	
400	811062041	P-10F204	840749972
700	811062058	P-10F205	840021620
1050	811062066	P-10F206	
2500	811062074	P-10F207	840750434
Pri 1000 — Sec 2700	811062082	P-10F208	
Pri 425 — Sec 425	811062090	P-10F209	
200	811062108	P-10F210	840750095
950	811062157	P-10F215	840750376
Pri 450 — Sec 57	811062165	P-10F216	
180	811062173	P-10F217	840750004
Pri 400 — Sec 210	811062181	P-10F218	
Pri 1000 — Sec 42	811062199	P-10F219	
2200	811062207	P-10F220	
Pri 400 — Sec 400	811062215	P-10F221	
1000	811062223	P-10F222	
9100	811062231	P-10F223	840750509

* Obtain the resistance of the coil for the relay involved from the circuit drawing, and order the replacement coil by the piece-part number corresponding to the resistance value. (See Note on Fig. 1 and Note on Fig. 2.) The piece-part number stamped on the coil to be replaced should be ignored since this number covers the coil and core assembly and is used in connection with manufacture only.

Caution: Do not attempt to remove coils not listed in the above table. Coils that are not listed may be cemented to the core. If an attempt is made to remove these coils, the ratchet head or the ratchet handle may be damaged.

TABLE E

IDENTIFICATION NUMBER	PLATING	CORE PLATE† PIECE-PART NUMBER
12-POSITION RELAYS		
1	None	P-15A212 or 841527732
2	None	P-15A213 or 841527740
3	None	P-15A214
1	Chromium	P-15A215
2	Chromium	P-15A216
3	Chromium	P-15A217
4	None	P-15A277
5	None	P-15A278
6	Chromium	P-15A279
6	None	P-15A280
4	Chromium	P-15A281
7	None	P-15A282
24-POSITION RELAYS		
1	None	P-15A212 or 841527732
None	None	P-15A342
None	Chromium	P-15A343

† Except for AJ-type relays having 24 make contacts, identify the core plate to be replaced by the identification number stamped on the upper right side of the core plate adjacent to the card and by whether or not the core plate is chromium plated. Core plates of AJ-type relays having 24 make contacts have no identification number, and the core plate is identified by whether it is chromium plated. Order the replacement core plate by the piece-part number corresponding to the combination of identification number and plating of the core plate to be replaced.

3. REPLACEMENT PROCEDURES USING 1017A AND 1018A TOOL KITS

3.01 List of Tools

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
768A	Armature blocking tool
1017A	Tool kit consisting of:
QTY	DESCRIPTION
1	Case, carrying, KS-20499 L1
1	P-11H619, detail 1, retainer, wedge support assembly
2	P-11H620, detail 2, spacer nut
1	P-11H621, detail 3, post, anchoring
2	P-11H622, detail 4, stud, spacing
1	P-11H623, detail 5, wedge inserter assembly
4	P-12B536, detail 6, tubes with plastic container, P-12B537
1	P-11H624, detail 7, yoke assembly
4	P-11H625, detail 8, insulator
2	P-11H627, detail 10, retainer assembly
2	P-11H628, detail 11, retainer, stud spacer
1	P-11H629, detail 12, support, top wedge
1	P-11H634, detail 17, support, bottom wedge
1	P-11H635, detail 18, bracket assembly
1	P-11H613, detail 15, bracket

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QTY	DESCRIPTION
1	P-11H636, detail 19, clip
1	P-11H637, detail 20, wedge, top
1	P-11H644, detail 21, wedge, bottom
1	P-11H638, detail 22, wedge, top
1	P-11H645, detail 23, wedge, bottom
1	P-11H639, detail 24, wedge, top
1	P-11H646, detail 25, wedge, bottom
1	P-11H640, detail 26, wedge, top
1	P-11H647, detail 27, wedge, bottom
1	P-11H641, detail 28, wedge, top
1	P-11H648, detail 29, wedge, bottom
1	P-11H642, detail 30, wedge, top
1	P-11H649, detail 31, wedge, bottom
1	P-11H643, detail 32, wedge, top
1	P-11H650, detail 33, wedge, bottom
1	P-11H632, detail 34A, wedge
1	P-11H651, detail 34B, wedge
1	P-12B564, plastic box for details 7 and 19
1	628A tool
1	Tool kit, 1018A consisting of:
1	P-11H630, detail 13, comb
1	P-11H631, detail 14, comb
1	P-11H633, detail 16, lifter
1	840440168, detail 35, lifter
1	840286199, detail 36, lifter
1	840286207, detail 37, comb
1	840286215, detail 38, comb lifter

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
AT-7860	B long-nose pliers
KS-6320	Orange stick
◆KS-6854	Screwdriver◆
KS-8511	Tweezers
◆R-2315	Lettering and numbering set◆
—	6-inch C screwdriver

3.02 Figure 3 shows the tools comprising the 1017A and 1018A tool kits.

3.03 No replacement procedures are specified for screws or other parts where the replacement consists of a simple operation.

3.04 After making any replacement of parts of an AF-, AG-, or AJ-type relay, the part or parts replaced shall meet the readjust requirements involved as specified in Section 040-502-701. Other parts whose adjustments may have been directly disturbed by the replacing operations shall be checked to the readjust requirements, and an overall operation check shall be made of the relay before restoring the circuit to service.

3.05 Crosstalk Shield: To replace a crosstalk shield, remove the contact cover. Grasp the upper or lower right side of the shield with the B long-nose pliers, and pull the shield straight out from the relay. To mount the new shield, hold it with the shield spring to the right. Tilt the shield slightly to the left, keeping the spring against the spoolhead in order to avoid shorting the make contacts. Push the shield in until the left edge of the shield clears the front edge of the cover guide. Then swing the front of the shield to the right so that the shield is approximately in line with the relay, and push the shield on the relay until the crimped end of the spring engages the core plate. Remount the contact cover.

3.06 Buffer Spring

(a) **Removing Buffer Spring:** If the relay is equipped with a crosstalk shield, remove it as covered in 3.05. If the buffer spring is positioned by the core plate, disengage the lugs on the upper positioning arm from the core plate using a KS-6320 orange stick and pull the upper part of the spring slightly forward.

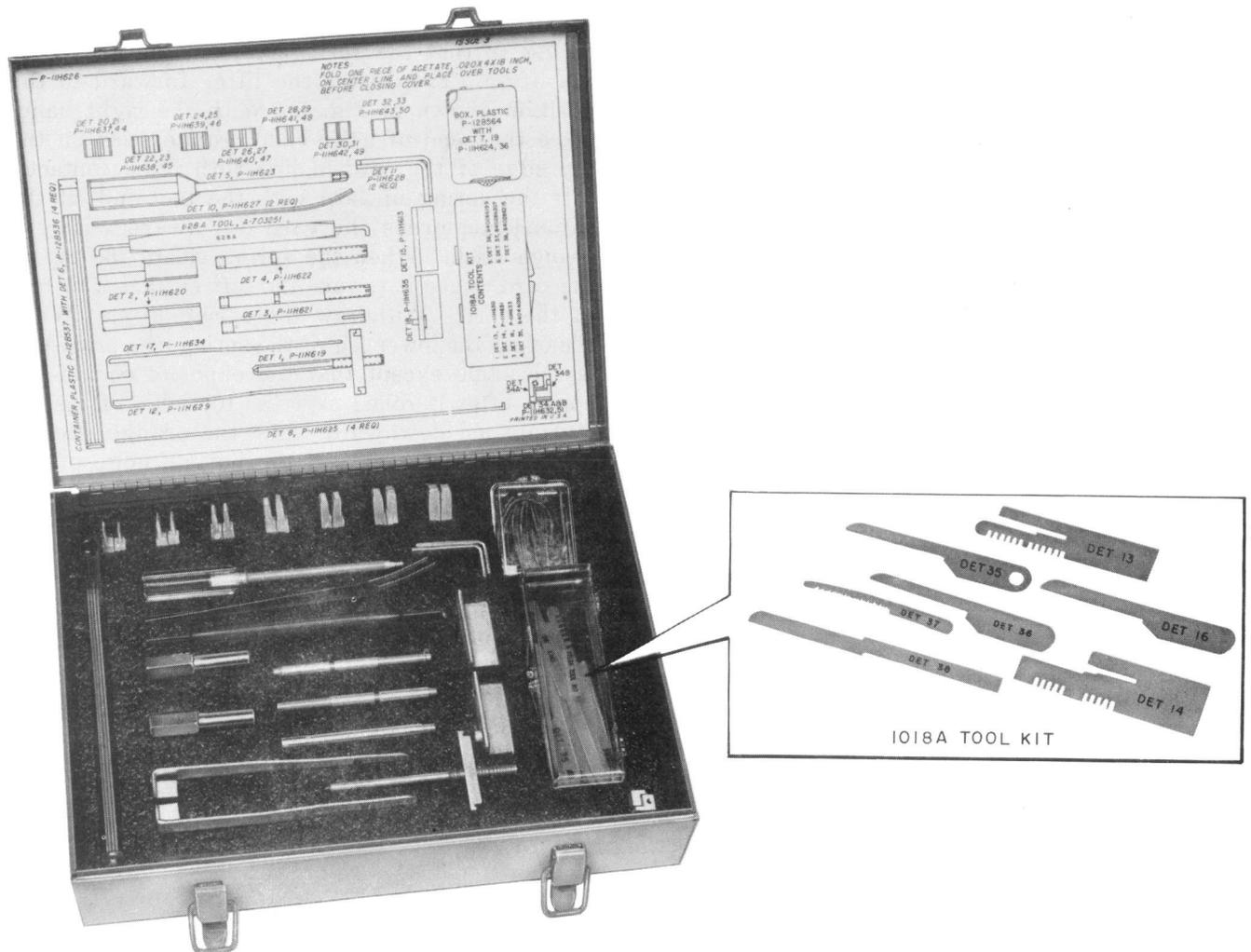


Fig. 3—1017A Tool Kit Including 1018A Tool Kit

Similarly disengage the lower lugs, and pull the spring straight out. If the buffer spring is positioned by the spoolhead, disengage the upper leg of the buffer spring from the spoolhead by pressing the leg gently toward the core with the KS-6320 orange stick and pull the upper part of the spring slightly forward. Similarly disengage the lower leg, and pull the spring straight out.

(b) **Mounting Buffer Spring:** Holding the buffer spring with the operating lug toward the relay card, insert the positioning arms between the spoolhead and the outer legs of the core. Carefully push the buffer spring inward, deflecting it slightly to the right to

engage the positioning lugs on the core plate. Check the requirements for buffer spring position and tension covered in Section 040-502-701.

3.07 4B Cover Clip: (Fig. 4)—This clip is used to minimize displacement of operating cards, contact covers, and contact springs of wire spring relays during shipping and handling.

(a) **Removing 4B Cover Clip:** Insert the tip of a KS-6854 screwdriver between the upper end of the clip and relay cover. A slight twist will disengage the tang. Slide the clip out and down to disengage bottom tang.

(b) **Mounting 4B Cover Clip:** Slide clip over the lower end of the contact cover enough to engage the tang. Press the upper end over the contact cover until the top tang engages with a snap.

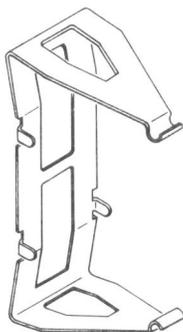


Fig. 4—4B Cover Clip

CARD REPLACEMENT—12-POSITION RELAYS

Removing Contact Cover, Crosstalk Shield, Buffer Spring, and 4B Cover Clip

3.08 Remove the clip as covered in 3.07. Remove the contact cover. If the relay is equipped with a crosstalk shield, remove it as covered in 3.05. Remove the buffer spring, if provided, as covered in 3.06.

Stamping Relay Code on New Card

3.09 Note the code number and date of manufacture stamped on the card to be replaced. Before mounting the new card, stamp the code number and date on the card in the same location using the R-2315 lettering and numbering set. Make sure that this information is stamped on the same side (black side) of the new card as the single digit (0 to 6) located in the lower right-hand corner with the card in its proper position on the relay.

Disengaging Balancing Spring Legs

3.10 Disengage the balancing springs legs from the card as follows. Block the relay operated using the 768A tool. Holding the 628A balancing spring lifter in the left hand, insert the spring lifter next to the upper leg of the balancing spring with the end of the lifter just behind the comb.

Roll the end of the lifter under this leg of the spring so that the spring rests in the groove of the lifter. Then draw the lifter forward to the position shown in Fig. 5. With the right hand, place the end of a KS-6320 orange stick on the top edge of the card in line with fixed contacts. Lift the spring upward with the tool and, at the same time, press the card downward with the orange stick. When the spring clears the top of the card, move it toward the left so that it is free of the card. Withdraw the spring lifter. When removing the lower leg of the spring, the procedure is the same except that the opposite end of the spring lifter is rolled over the top edge of the leg and pushed downward while the orange stick is pressed upward against the bottom edge of the card. Remove the wedge.

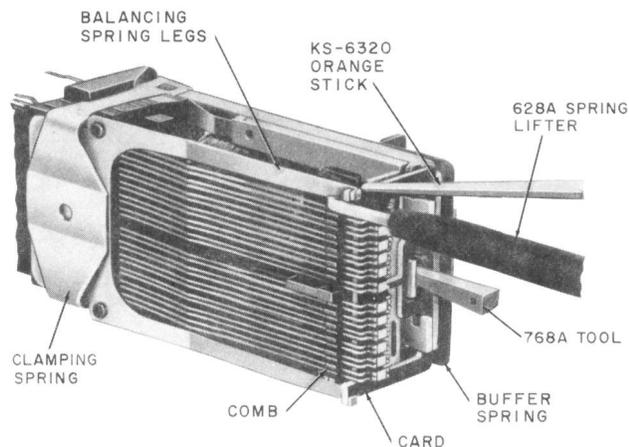


Fig. 5—Disengaging Balancing Spring From Card

3.11 On the top left side of the relay, with the taper of detail 36 lifter facing to the left, place the lifter behind the card inserting it between the left movable twin contact springs and the fixed single contact springs as shown in Fig. 6. Push the lifter down until all the movable contacts are lifted away from the fixed contacts.

3.12 Insert detail 37 comb behind the card and in front of detail 36 lifter with the teeth facing the lifted movable contacts as shown in Fig. 7. The comb automatically will come to rest on the stop, and the movable contact springs will align in pairs between the teeth of the comb.

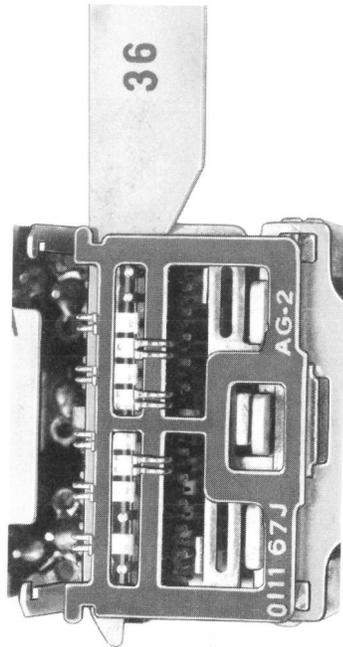


Fig. 6—Detail 36 Lifter in Place

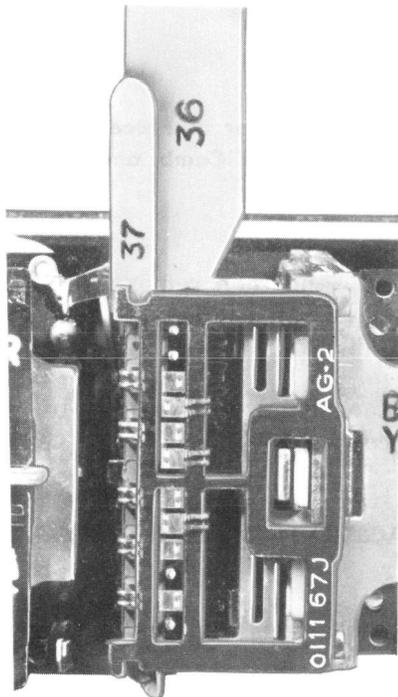


Fig. 7—Detail 37 Comb in Place With Detail 36 Lifter

3.13 Remove detail 36 lifter.

3.14 With the taper of detail 38 comb lifter facing to the right, place the groove (on left side of detail 38) over the right side of the protruding detail 37 comb. Holding the comb with the left hand, slowly push detail 38 comb lifter down until all movable contact springs are lifted in pairs as shown in Fig. 8.

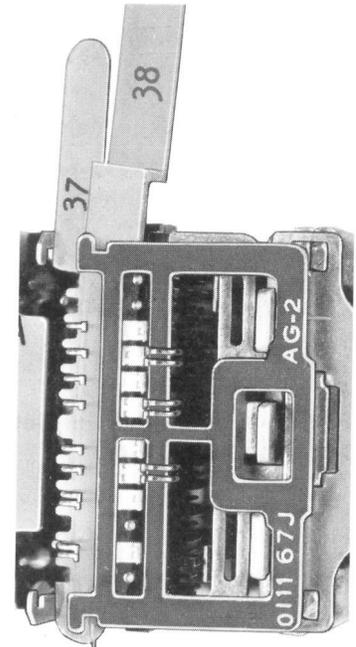


Fig. 8—Detail 38 Comb Lifter in Place With Detail 37 Comb

3.15 On the top right side of the relay, insert detail 13 comb behind the card with the teeth of the comb facing to the left and the slot straddling the armature as shown in Fig. 9. The stop on the comb shall come to rest on the top edge of the armature leg so that the movable springs align in pairs between teeth of the comb.

3.16 With the taper of detail 16 lifter facing to the right, place the lifter behind the card inserting it between the right movable twin contact springs and the fixed single contact springs as shown in Fig. 10. Push the lifter down until all the movable contact springs are lifted in pairs between the teeth of the detail 13 comb.

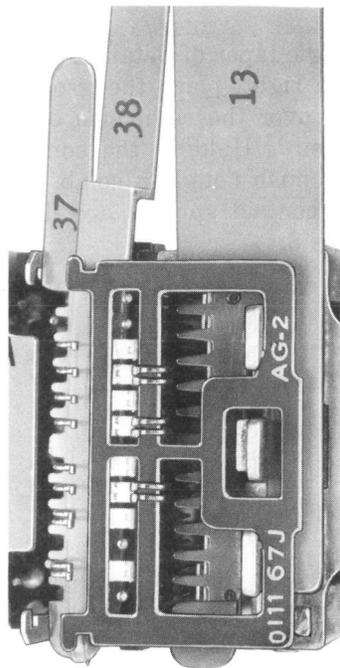


Fig. 9—Detail 13 Comb in Place With Detail 37 Comb and Detail 38 Comb Lifter

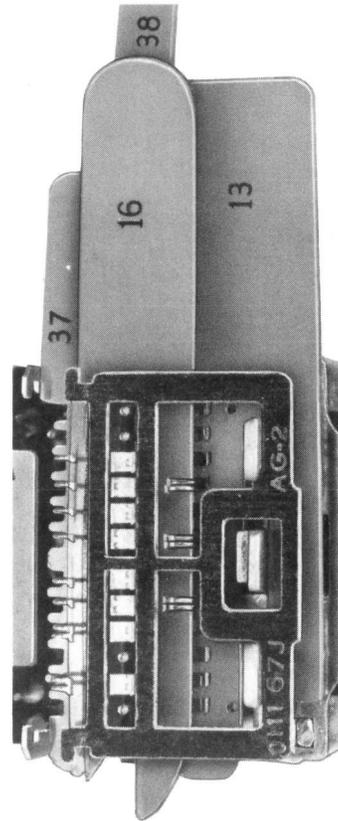


Fig. 10—Detail 16 Lifter in Place With Detail 13 Comb, Detail 37 Comb, and Detail 38 Comb Lifter

3.17 Using the KS-6320 orange stick, hold down the armature in the unoperated position and with the KS-8511 tweezers disengage the card from the armature leg notches and remove the card (Fig. 11).

Replacing the Card

3.18 Hold the new card with the notches to the left and the stamped information on the card visible. Insert the left vertical section of the card between the movable and fixed contacts. Hold the armature against the armature backstop with the KS-6320 orange stick, and with the other hand, position the card on the legs of the armature. Release the armature, and move the card up and down until the projections on the card engage the notches in the outer legs of the armature.

3.19 Remove detail 16 lifter carefully so that all contacts fall back into their respective positions. Remove detail 13 comb.

3.20 Hold detail 37 comb with the left hand, and carefully remove detail 38 comb lifter. Replace detail 36 lifter as outlined in 3.11. Remove

detail 37 comb and then remove detail 36 lifter carefully so that all contacts fall back into the respective positions.

3.21 Reattach balancing springs to card, and replace cover.

CARD REPLACEMENT—24-POSITION BREAK CONTACT RELAYS

3.22 Release balancing springs as covered in 3.10.

3.23 On the top left side of the relay with the taper of detail 35 lifter facing to the right, place the lifter behind the card inserting it between the movable twin contact springs and the fixed single contact springs. Push the lifter down until all the movable contacts are lifted from the fixed contacts.

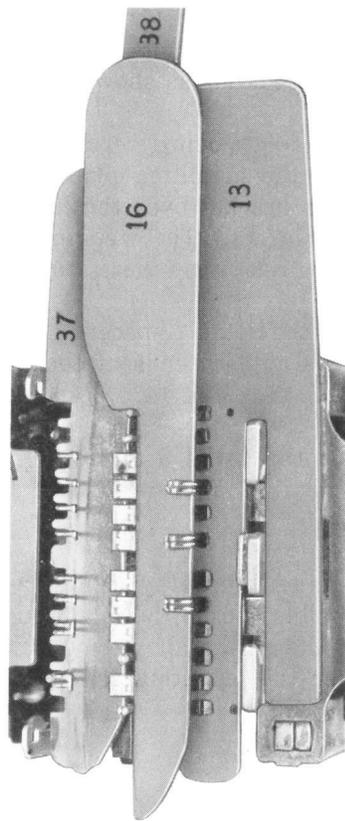


Fig. 11—Card Removed

- 3.24** Follow the procedures outlined in 3.15 through 3.19.
- 3.25** Remove detail 35 lifter carefully so that all contacts fall back into their respective positions.
- 3.26** Reattach balancing springs to card, and replace cover.

CARD REPLACEMENT—24-POSITION MAKE CONTACT RELAYS

- 3.27** Release balancing springs as covered in 3.10.
- 3.28** Follow the procedures outlined in 3.11 through 3.14.
- 3.29** With the taper of detail 35 lifter facing to the left, place the lifter behind the card inserting it in the right-hand row of contacts between the movable twin contact springs and the

fixed single contact springs. Push the lifter down until it comes to rest, and all movable contacts are lifted.

- 3.30** With the KS-6320 orange stick, hold down the armature in the unoperated position, and with the KS-8511 tweezers, disengage the card from the armature leg notches and remove the card.
- 3.31** To insert a new card, follow the procedures outlined in 3.18.
- 3.32** Remove detail 35 lifter carefully so that all contacts fall back into their respective positions.
- 3.33** Follow procedure outlined in 3.20.
- 3.34** Replace balancing springs and replace cover.

REPLACEMENT OF COIL AND ARMATURE ASSEMBLY—12- AND 24-POSITION RELAYS

Note 1: See 1.10.

Note 2: This procedure may not be applicable for ESS installations. See 1.06.

- 3.35** To obtain replacement parts for each relay to be repaired, a complete relay of the same code should be purchased and disassembled.
- 3.36** All replacement coils should have the letter "R" stamped in a 1/4-inch high character on the front of each front spool head at the time of replacement.
- 3.37** *Preparation of Wiring and Cabling:*
Remove components and wiring connected to the winding terminals of the relay to be repaired. Remove excess solder from terminals or cut off terminals flush with mounting plate to permit terminals to be drawn through holes in the relay mounting bracket in subsequent operations.
- 3.38** If the wiring to relays mounted on 2-inch wide plates does not permit moving the mounting plate forward at least 1 inch, cut the cable stitching and reposition the cable. It is not necessary to disturb the wiring or cabling for relays mounted on wider plates.

3.39 If the relay to the left of the relay being repaired has more than one winding, the secondary and tertiary terminals will interfere with the subsequent wedging operation.

Caution: *Unsolder and remove these terminals, using care to avoid damage to the coil lead wires and connections.*

3.40 Positioning of Mounting Plate

(a) Remove the upper mounting plate screws, and loosen the lower screws several turns. Insert the short thread end of the detail 4 studs through the upper mounting holes at both ends, and screw into frame as shown in Fig. 12.

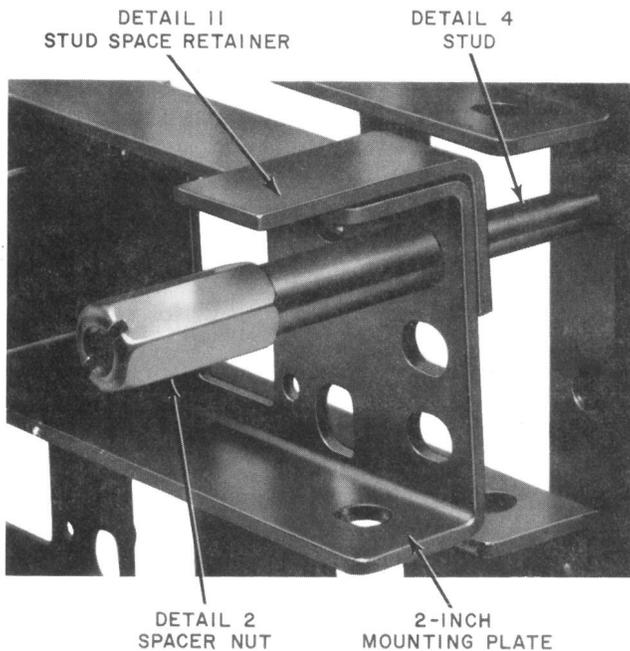


Fig. 12—Detail 4 Stud in Place With Detail 11 Stud Space Retainers

(b) Place an 0.020- by 4- by 18-inch acetate strip on top of the row of relays on the mounting plate below the relay being repaired. This will avoid short-circuiting or damaging the relays.

(c) Remove lower mounting plate screws.

(d) Move the mounting plate forward approximately 1 inch until the edge is beyond the grooves in the upper detail 4 studs.

(e) Insert the detail 11 stud spacer retainers behind the mounting plate into the grooves of the detail 4 studs as shown in Fig. 12.

(f) If the relay being repaired is at the left end of the mounting plate, place the detail 18 wedging bracket over the left detail stud as shown in Fig. 13. The wedging bracket is not required for relays in other mounting positions.

(g) Screw the detail 2 spacer nuts into the detail 4 studs at both ends of the mounting plate and tighten. See Fig. 14.

(h) Insert the detail 3 anchoring post into the left detail 2 spacer nut and hand tighten. (See Fig. 15.)

(i) To make the relay being repaired more accessible, loosen the mounting screws 1-1/2 turns on the plates above and below the relay; also loosen the mounting screws of the relay to its right.

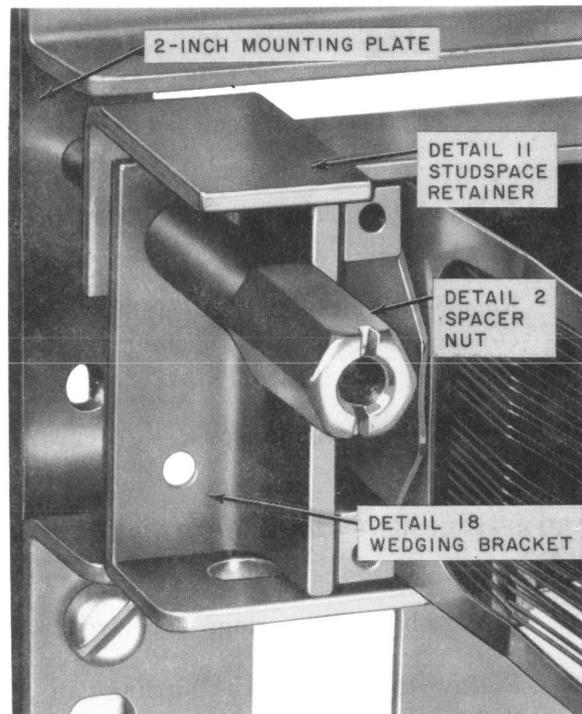


Fig. 13—Detail 18 Wedging Bracket in Place Over Left Detail 4 Stud

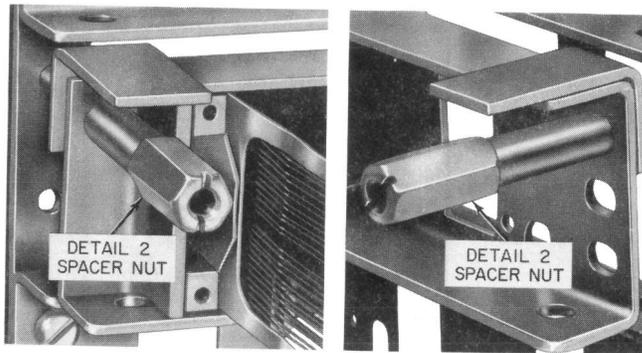


Fig. 14—Detail 2 Spacer Nuts in Place

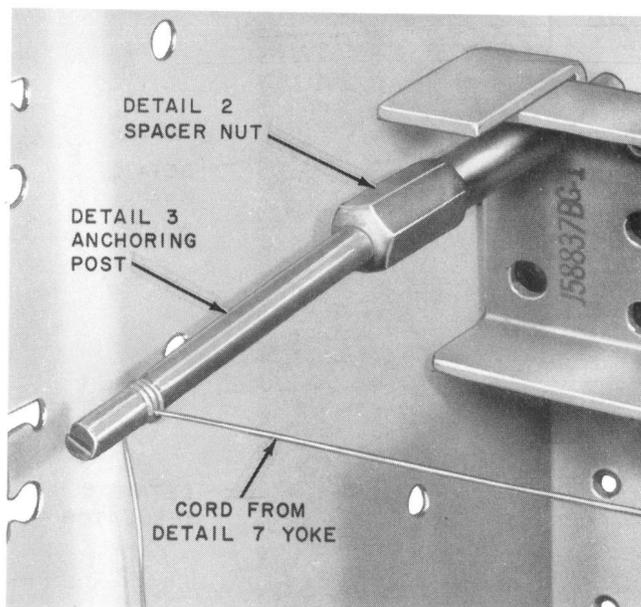


Fig. 15—Detail 3 Anchoring Post Inserted in Left Detail 2 Spacer Nut

- 3.41 Remove 4B cover clip as covered in 3.07. Remove contact cover and, if provided, crosstalk shield and buffer springs as covered in 3.05 and 3.06.
- 3.42 Disengage the balancing spring legs from the card as covered in 3.10.
- 3.43 Remove the card as covered in 3.11 through 3.30.
- 3.44 Procedures for wedging a relay to be repaired depend upon the position in which the relay

is mounted on the mounting plates. These different positions are outlined in 3.40 and 3.41.

Removing the Core or Armature Assembly and Coil of Relays Mounted on 2-Inch Wide Plates and on Wider Plates

3.45 Relays Mounted on 2-Inch Wide Plates

- (a) Nominal 7/32-inch horizontal separation between relays
- (b) Blank position to left of relay
- (c) Other apparatus to left of relay
- (d) Relay in extreme left mounting position
- (e) Relay to be repaired with empty holes of wire spring relay to the left.

3.46 Relays Mounted on Wider Plates

- (a) Nominal 7/32-inch horizontal separation between relays
- (b) Relay in extreme left mounting position
- (c) Relay to be repaired with empty holes of a wire spring relay to the left.

Wedging

3.47 Wedging of relay mounted on a 2-inch wide plate with nominal 7/32-inch separation between relays is as follows.

- (a) Place detail 8 insulator over the winding terminals of the relay to the left of the relay to be repaired. Place with the 1/8-inch long leg in an up position on the upper terminal and in a down position on the lower terminal. (See Fig. 16.)
- (b) Screw the detail 5 wedge inserter into the detail 34A upper wedge. With its wide end down, force the wedge between the clamping spring of the relay being repaired and the core of the relay to its left. (See Fig. 16.) After the wedge is firmly in place, unscrew the wedge inserter.

Note: If the relays are too closely spaced to permit normal insertion of the wedges,

loosen the mounting screws of both relay and reposition the relays to increase the separation. Follow the same procedure to decrease the separation if the wedges do not sufficiently compress the clamping spring to permit its tabs to be readily disengaged from the core grooves on the right side of the relay.

Note: In the event that the relay to the left of the relay being repaired has four terminal wires, it will be necessary to remove temporarily the upper and lower terminal rods during the repair operation. This removal of the terminal rods is necessary for proper wedging of the relay being repaired. After repair is made, make sure terminal rods are replaced.

- (c) Screw the wedge inserter into the detail 34B lower wedge and, with the wide end up, insert the wedge using the procedure followed in inserting the upper wedge. (See Fig. 16.)

3.48 Wedging of relay on 2-inch wide plates with blank position or other apparatus to the left is as follows.

- (a) Place the detail 12 wedge support on the top flange of the mounting plate as shown in Fig. 17 and the detail 17 wedge support on the lower flange (Fig. 17) close to the left corners of the relay. Assemble the detail 1 wedge support assembly to details 12 and 17, and tighten the screw against the mounting plate as shown.

- (b) Use the detail wedge inserter to force details 20 through 33 wedges of sufficient thickness to compress the relay clamping spring between the spring and the wedge supports as shown in Fig. 18.

3.49 Wedging of relay on 2-inch wide plate with relay in extreme left position is as follows.

- (a) Place detail 18 wedging bracket on detail 4 stud, and then fasten detail 2 spacer nut as shown in Fig. 19.
- (b) Use the detail 5 wedge inserter to force details 20 through 33 wedges of sufficient thickness to compress the relay clamping spring between the spring and the detail 18 wedging bracket on the top and bottom. (See Fig. 19.)

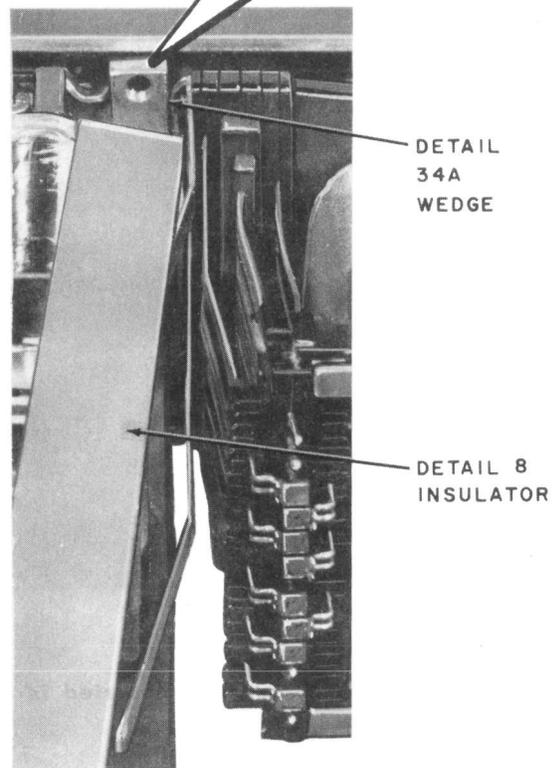
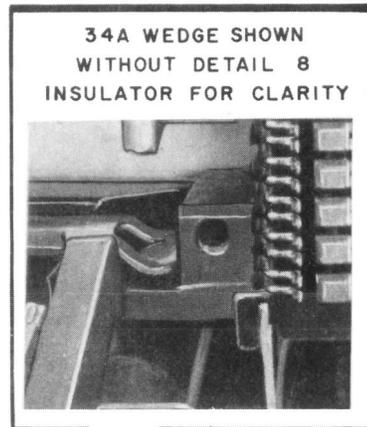


Fig. 16—Details 34A and 34B Wedges in Place With Detail 8 Insulators (34B not shown)

3.50 Wedging of relay on 2-inch wide plate with empty mounting holes of a wire spring relay to the left is as follows.

- (a) Place detail 15 wedging bracket to the left of the defective relay (Fig. 20) so that the flat upright of the angle shall provide a backing for the details 20 through 30 wedges against

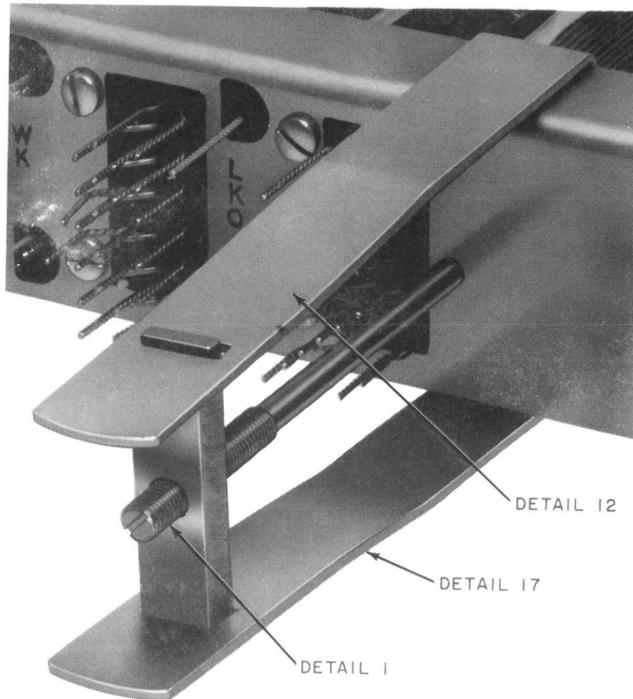


Fig. 17—Detail 12 Wedge Support, Detail 17 Wedge Support, and Detail 1 Wedge Support Assembly

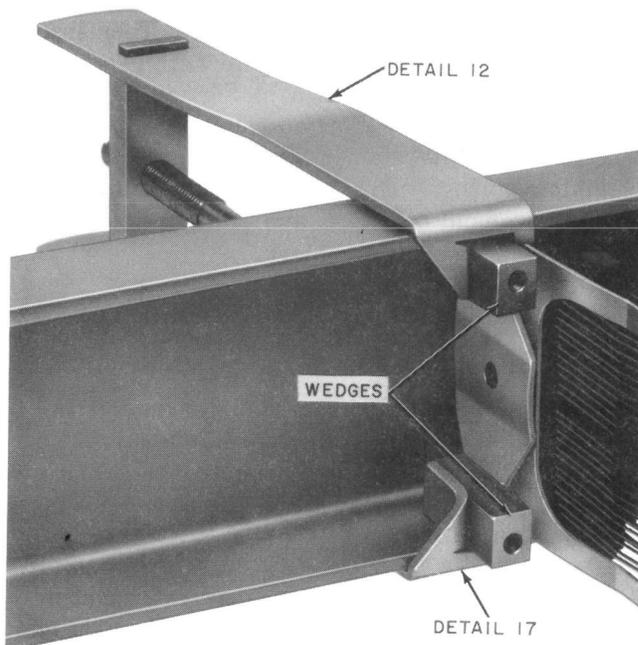


Fig. 18—Wedges in Place With Details 12 and 17

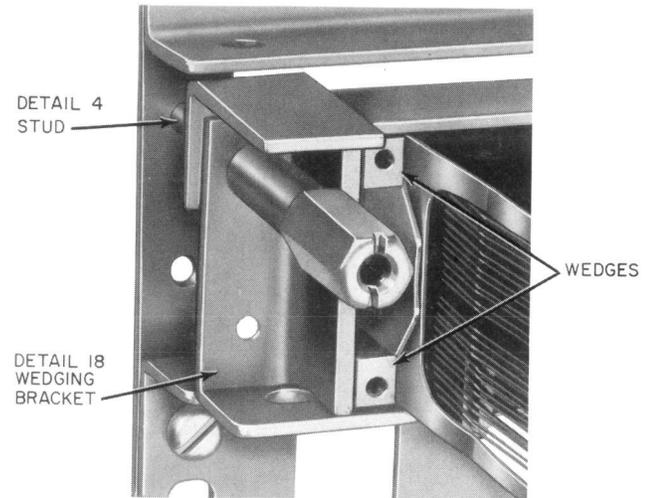


Fig. 19—Detail 18 Wedging Support on Detail 4 Stud

the clamping spring of the defective relay. The 2-threaded holes of the wedging bracket shall align with the empty mounting holes on the left next to the defective relay. Insert the mounting screws from the rear and tighten.

(b) Use the detail 5 wedge inserter to force details 20 through 33 wedges of sufficient thickness to compress the relay clamping spring between the spring and the detail 18A wedging bracket on the top and bottom.

3.51 Wedging a relay mounted in the extreme left position on greater than 2-inch mounting plates provided the mounting plate is mounted in the front of the bay is as follows.

(a) Remove the mounting plate screws on the extreme left, and place detail 18 wedging bracket so that the dowel pin will fit into the lower mounting screw hole. Then place No. 12-24 by 3/8-inch long mounting screw in the upper hole, and tighten the detail 18 wedging bracket and mounting panel to the frame of the bay.

(b) Use the detail 5 wedge inserter, and force details 20 through 33 wedges of sufficient thickness to compress the relay clamping spring between the spring and the detail 18 wedging bracket both on top and bottom.

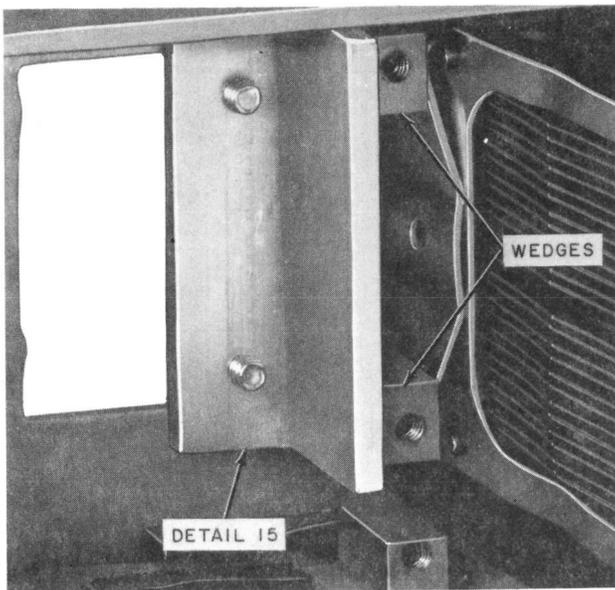


Fig. 20—Detail 15 Wedging Bracket in Place

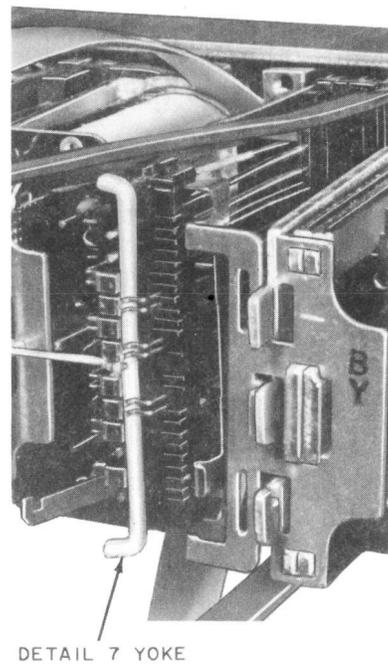


Fig. 21—Detail 7 Yoke in Place Between Contacts

DISMANTLING RELAY—12 POSITION

- 3.52** Remove card as covered in 3.11 through 3.17.
- 3.53** Remove comb and lifter on left side of relay as covered in 3.20.
- 3.54** Insert detail 7 yoke between the right movable contacts and fixed single contacts as shown in Fig. 21. Hold detail 13 comb in place, and carefully remove first detail 16 lifter; then remove detail 13 comb. All contacts should mate properly.
- 3.55** Tie detail 7 yoke assembly (Fig. 21) to detail 3 (Fig. 15) anchoring post using lock stitch. Pull only tight enough to release the pressure of the spring assembly against the core plate of the relay and tie. Clamp spring can now be released.
- 3.56** Using 6-inch C screwdriver, release clamp springs from coil, core, and armature assembly.
- 3.57** Lift clamp springs; remove defective coil, core, and armature assembly with a shaking motion.

- 3.58** Apply the B long-nose pliers to the clamping springs as close to the relay mounting bracket as possible and squeeze ends of clamping spring to the flange of the mounting plate. Then insert detail 10 retainer between clamp spring end and mounting bracket as shown in Fig. 22. Use one retainer for retaining the top clamping spring and a second detail 10 retainer for retaining the bottom clamping spring. This provides accessibility for new replacement coil, core, and armature assembly.

REPLACEMENT AND REASSEMBLY OF RELAY—12 POSITION

- 3.59** Apply detail 19 (Fig. 23) clip on the front tip of the new coil, core, and armature assembly. This clip will hold both the armature core and coil together until all parts fit into terminal bracket.
- 3.60** Insert terminals of the new relay coil into detail 6 tubes, and guide the terminals into their respective holes in the terminal bracket. Upper detail 6 tubes should protrude approximately 1 inch ahead of the lower tubes to facilitate insertion into the terminal bracket. The tubes are used to

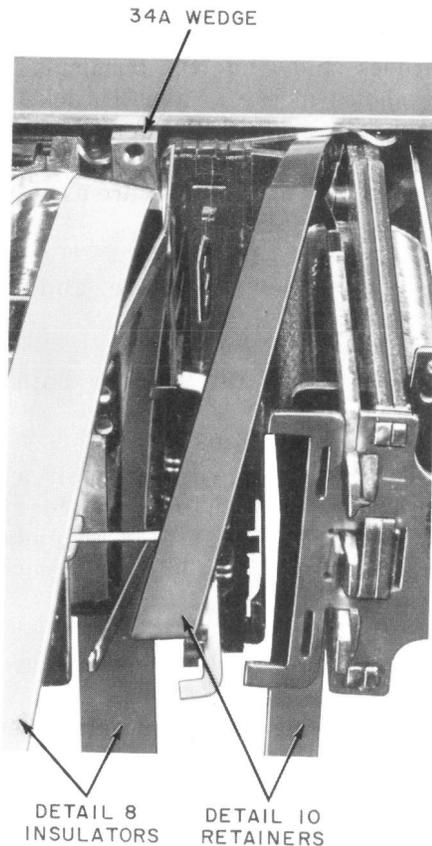


Fig. 22—Detail 10 Retainers in Place

prevent shorting of the coil terminals. (See Fig. 23.)

- 3.61** Insert the new coil, core, and armature assembly.
- 3.62** Remove detail 10 retainers, both top and bottom.
- 3.63** Using the C screwdriver, apply a force to both rear ends of the relay core close to the terminal bracket so that the tab ends of the clamping springs will snap into the grooves in the core.
- 3.64** Remove detail 19 clip from armature.
- 3.65** Release lacing cord from detail 3 anchoring post.

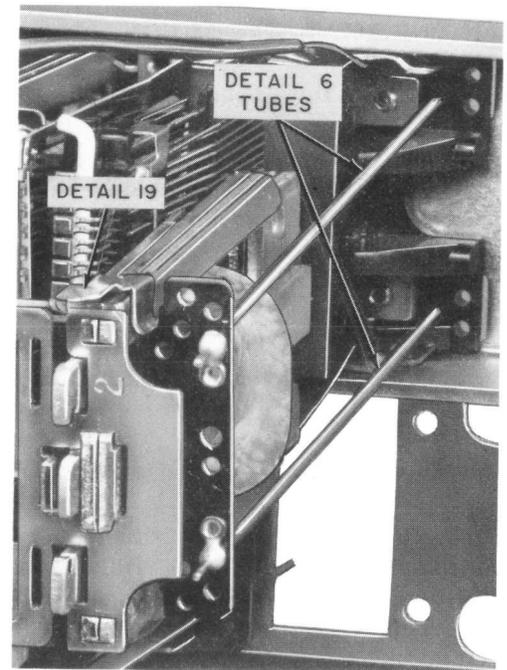


Fig. 23—Detail 6 Tubes on Terminal Rods

- 3.66** Remove bottom wedge first; then the top wedge. These wedges should be removed by pulling out cautiously without twisting.
- 3.67** Replace combs and lifters as covered in 3.11 through 3.16, omitting the words "behind the card."
- 3.68** Remove detail 7 yoke, and proceed as covered in 3.18 through 3.21.
- 3.69** Remove detail 6 guides.
- 3.70** Remove detail 3 post, loosen detail 2 spacer nut on both sides, and remove detail 11 clamps.
- 3.71** Replace mounting plate to its original position, replace bottom mounting screws, remove detail 4 studs, and replace with mounting screws.
- 3.72** Rewire relay coil terminals; check for mechanical and electrical adjustments. Put circuit designation on relay and position and relace cabling.

DISMANTLING RELAY—24-POSITION BREAK RELAY

3.73 Remove balancing springs as covered in 3.10.

3.74 On the top left side of relay with the taper of detail 35 lifter facing to the right, place the lifter behind the card, inserting it between the movable contact springs and the fixed single contact springs. Push the lifter down until all movable contacts are lifted from the fixed contacts.

3.75 Remove the card as covered in 3.15 through 3.17.

3.76 Remove comb and lifter as covered in 3.20.

3.77 Insert detail 7 yoke on right side of fixed contacts. (See Fig. 21.) Holding detail 13 comb in place, carefully remove detail 16 lifter and then remove detail 13 comb. All contacts should mate properly.

3.78 Tie detail 7 yoke assembly to detail 3 anchoring post using lock stitch. Pull only tight enough to release the pressure of the spring assembly against the core plate of the relay and tie. Clamp spring now can be released.

3.79 Using the C screwdriver, release clamp springs from coil, core, and armature assembly.

3.80 Lift clamp springs; remove defective coil, core, and armature assembly.

3.81 Apply the B long-nose pliers to the clamping springs as close to the relay mounting bracket as possible, and squeeze ends of clamping spring to the flange of the mounting plate. Then insert detail 10 retainer between clamp spring and mounting bracket. (See Fig. 22.) Use one retainer for retaining the top clamping spring and a second retainer for retaining the bottom clamping spring. This provides accessibility for the new replacement coil, core, and armature assembly.

REPLACEMENT AND REASSEMBLY OF RELAY—24-POSITION BREAK CONTACT RELAY

3.82 Apply detail 19 (Fig. 23) clip on the front tip of the new coil, core, and armature assembly. This clip will hold the armature core and coil together until all parts will fit into terminal bracket.

3.83 Insert terminals of new relay coil into detail 6 tubes, and guide the terminals into their respective holes in the terminal bracket. Upper detail 6 tube shall protrude approximately 1 inch ahead of the lower tube to facilitate insertion into the terminal bracket. The tubes are used to prevent shorting of the coil terminals.

3.84 Insert the new coil, core, and armature assembly.

3.85 Remove detail 10 retainers, both top and bottom.

3.86 Using the C screwdriver, apply a force to both rear ends of the relay core close to terminal bracket so that the tab ends of the clamping springs will snap into the grooves in the core.

3.87 Remove detail 19 clip from armature.

3.88 Release lacing cord from detail 3 anchoring post.

3.89 Remove bottom wedge first, then top wedge. These wedges should be removed by pulling out cautiously without twisting.

3.90 On the top left side of the relay with the taper of detail 35 lifter facing to the right, insert the lifter between the movable twin contact springs and the fixed single contact springs. Push the lifter down until all movable contacts are lifted from fixed contacts.

3.91 Replace combs and lifters as covered by procedure in 3.15 and 3.16 except that the words "behind the card" shall be omitted.

3.92 Remove detail 7 yoke, and insert new card as covered in procedure in 3.18.

3.93 On the right side of the relay, remove detail 16 lifter carefully so that all contacts fall back into their respective positions. Remove detail 13 comb.

3.94 On the left side of the relay, remove detail 35 lifter carefully so that all contacts fall back into their respective positions.

3.95 Follow procedure outlined in 3.69 through 3.72.

DISMANTLING RELAY—24-POSITION MAKE RELAY

- 3.96** Remove balancing springs as covered in 3.10.
- 3.97** Remove card as covered in 3.11 through 3.14, 3.29, and 3.30.
- 3.98** Remove comb and lifter on left side of relay as covered in 3.20.
- 3.99** Insert detail 7 yoke (see Fig. 21) on the right side of the fixed contacts, and carefully remove detail 35 lifter. All contacts shall mate properly.
- 3.100** Tie detail 7 yoke assembly to detail 3 anchoring post using lock stitch. Pull only tight enough to release the pressure of the spring assembly against the core plate of the relay and tie. Clamp spring can now be released.
- 3.101** Using the C screwdriver, release the clamp springs from the coil, core, and armature assembly.
- 3.102** Lift clamp springs, and remove defective coil, core, and armature assembly with a shaking motion.
- 3.103** Apply the B long-nose pliers to the clamping springs as close to the relay mounting bracket as possible, and squeeze ends of clamping springs to the flange of the mounting plate. Then insert detail 10 retainer between clamp spring and mounting bracket. (See Fig. 22.) Use one retainer for retaining the top clamping spring and a second retainer for retaining the bottom clamping spring. This provides accessibility for the new replacement coil, core, and armature assembly.

REPLACEMENT AND REASSEMBLY OF RELAY—24-POSITION MAKE CONTACT RELAY

- 3.104** Apply detail 19 (Fig. 23) clip on the front of the new coil, core, and armature assembly. This clip will hold both the armature and coil together until all parts will fit into the terminal bracket.
- 3.105** Insert terminals of the new relay into detail 6 tubes, and guide the terminals into their respective holes in the terminal bracket. Upper detail 6 tube shall protrude approximately 1 inch ahead of the lower tube to facilitate insertion into

the terminal bracket. The tubes are used to prevent short-circuiting of coil terminals.

- 3.106** Insert the new coil, core, and armature assembly.
- 3.107** Remove detail 10 retainers, both top and bottom.
- 3.108** Using the C screwdriver, apply a force to both rear ends of the relay core close to the terminal bracket so that the tab ends of the clamping springs will snap into the grooves in the core.
- 3.109** Remove detail 19 clip from armature.
- 3.110** Release lacing cord from detail 3 anchoring post.
- 3.111** Remove bottom wedge first, then top wedge. These wedges shall be removed by pulling out cautiously without twisting.
- 3.112** Replace combs and lifter as covered by procedure in 3.11 through 3.14 and 3.29 except that the words "behind the card" shall be omitted.
- 3.113** Remove detail 7 yoke, and then replace card as covered in 3.18.
- 3.114** On left side of relay, hold detail 37 comb with the left hand and carefully remove detail 38 comb lifter. Replace detail 36 lifter as outlined in 3.11. Remove detail 37 comb; then remove detail 36 lifter carefully so that all contacts shall fall back into their respective positions.
- 3.115** On the right side of the relay, remove detail 35 lifter carefully so that all contacts fall back into their respective positions.
- 3.116** Reattach the balancing springs.
- 3.117** Follow procedures outlined in 3.69 through 3.72.

4. REPLACEMENT PROCEDURES USING THE 1014B TOOL KIT**4.01 *List of Tools and Materials***

SECTION 040-502-801

CODE OR SPEC NO.	DESCRIPTION	CODE OR SPEC NO.	DESCRIPTION
TOOLS		TOOLS	
628A	Balancing spring lifter	KS-6320	Orange stick
629A	Spring holder (positions 7 through 12 on 12-position relays)	KS-8511	Tweezers
629B	Spring holder (positions 1 through 6 on 12-position relays)	R-1640	Center punch
630A	Spring holder and removable clamp (positions 1 through 12 on 12- and 24-position relays)	R-2315	Lettering and numbering set
652A	Spring holder (positions 19 through 24 on 24-position relays)	AT-7860	B long-nose pliers
652B	Spring holder (positions 13 through 18 on 24-position relays)	—	4-inch E screwdriver
656A	Insulator (2 required)	—	4-ounce riveting hammer
768A	Armature blocking tool	—	5-inch diagonal pliers
1014B	Tool kit consisting of:	MATERIALS	
		KS-2423	Cloth
		KS-7187	Bell seal bond paper
QTY	DESCRIPTION	4.02 1014B Tool Kit: Figure 24 shows the tools comprising the 1014B tool kit used for replacing coils on wire-spring type relays. The 666B core plate replacer, 669A separators, 674A spring lifter, and 716B ratchet head furnished with the tool kit are not required for AF-, AG-, and AJ-type relays. The 716B ratchet head is used for AK-type relays. The 666B core plate replacer, 669A separators, and the 674A spring lifter are used on 286-, 287-, and 288-type relays. To prepare the ratchet head and handle for use, proceed as follows.	
1	20B carrying case containing:	<p>(a) The 716A ratchet head is mounted on the 715A ratchet handle for removing the core plate and coil from the relay. To mount the head on the handle, rotate the ratchet rod so that its teeth face away from the trigger and move the rod back through the handle until it engages its stop. Insert the head mounting rail in the handle slot so that the hole in the rail lines up with the rod. Push the rod through the rail hole sufficiently to hold the head in position, and rotate the rod 180 degrees so that the teeth face the trigger. In this position the rod may be advanced by pulling the trigger.</p>	
1	666B core plate replacer		
1	674A spring lifter		
6	669A contact separators		
1	715A ratchet handle		
1	716A ratchet head		
1	716B ratchet head		
1	717B coil setter		
1	P-12B564 plastic box (for wedges)		
4	718A wedges		
1	P-12B537 container (for terminal guide tubes)		
8	P-12B536 tubing (terminal guide tubes)		
1	P-16A068 container (for contact separators)		

(b) To remove the ratchet head from the ratchet handle, rotate the rod so that the teeth face away from the trigger. Then move the rod back through the handle until it engages its stop, and slide the head off the handle.

4.03 No replacement procedures are specified for screws or other parts where the replacement consists of simple operation.

4.04 After making any replacement of parts of an AF-, AG-, or AJ-type relay, the part or parts replaced shall meet the readjust requirements involved as specified in Section 040-502-701. Other parts whose adjustments may have been directly disturbed by the replacing operations shall be checked to the readjust requirements, and an overall operation check shall be made of the relay before restoring the circuit to service.

4.05 *Crosstalk Shield:* To replace a crosstalk shield, remove the contact cover. Grasp the upper or lower right side of the shield with the B long-nose pliers, and pull the shield straight out from the relay. To mount the new shield, hold it with the shield spring to the right. Tilt the shield slightly to the left, keeping the spring against the spoolhead in order to avoid shorting the make contacts. Push the shield in until the left edge of the shield clears the front edge of the cover guide. Then swing the front of the shield to the right so that the shield is approximately in line with the relay, and push the shield on the relay until the crimped end of the spring engages the core plate. Remount the contact cover.

4.06 *Buffer Spring*

(a) *Removing Buffer Spring:* If the relay is equipped with a crosstalk shield, remove it as covered in 4.05. If the buffer spring is positioned by the core plate, disengage the lugs on the upper positioning arm from the core plate using a KS-6320 orange stick and pull the upper part of the spring slightly forward. Similarly, disengage the lower lugs and pull the spring straight out. If the buffer spring is positioned by the spoolhead, disengage the upper leg of the buffer spring from the spoolhead by pressing the leg gently toward the core with the KS-6320 orange stick and pull the upper part of the spring slightly forward. Similarly disengage the lower leg, and pull the spring straight out.

(b) *Mounting Buffer Spring:* Holding the buffer spring with the operating lug toward the relay card, insert the positioning arms between the spoolhead and the outer legs of the core. Carefully push the buffer spring inward, deflecting it slightly to the right to engage the positioning lugs on the core plate. Check the requirements for buffer spring position and tension covered in Section 040-502-701.

CARD—12-POSITION RELAY

Removing Contact Cover, Crosstalk Shield, Buffer Spring, and 4B Cover Clip

4.07 Remove the clip as covered in 3.07. Remove the contact cover. If the relay is equipped with a crosstalk shield, remove it as covered in 4.05. Remove the buffer spring, if provided, as covered in 4.06.

Stamping Relay Code on New Card

4.08 Note the code number and date of manufacture stamped on the card to be replaced. Before mounting the new card, stamp the code number and date on the card in the same location using the R-2315 lettering and numbering set. Make sure that this information is stamped on the same side of the new card as the single digit (0 to 6) located in the lower right-hand corner with the card in its proper position on the relay.

Disengaging Balancing Spring Legs

4.09 Disengage the balancing spring legs from the card as follows. Block the relay operated using the 768A tool. Holding the 628A balancing spring lifter in the left hand, insert the spring lifter next to the upper leg of the balancing spring with the end of the lifter just behind the comb. Roll the end of the lifter under this leg of the spring so that the spring rests in the groove of the lifter. Then draw the lifter forward to the position shown in Fig. 5. With the right hand, place the end of a KS-6320 orange stick on the top edge of the card in line with fixed contacts. Lift the spring upward with the tool and, at the same time, press the card downward with the orange stick. When the spring clears the top of the card, move it toward the left so that it is free of the card. Withdraw the spring lifter. When removing the lower leg of the spring, the procedure is the same except that the opposite end of the

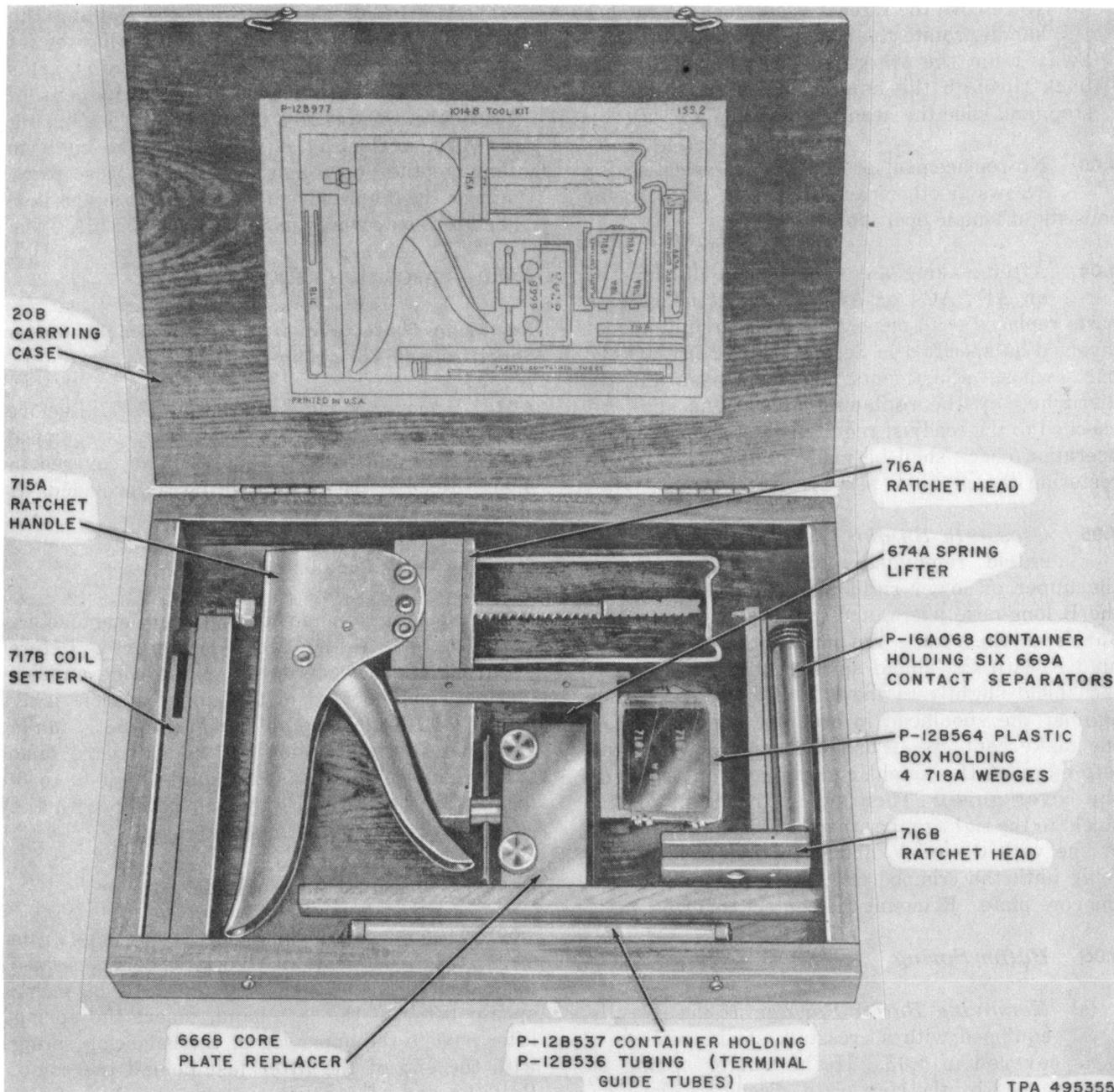


Fig. 24—1014B Tool Kit

spring lifter is rolled over the top edge of the leg and pushed downward while the orange stick is pressed upward against the bottom edge of the card. Remove the wedge.

Insulating Contact Cover Spring

4.10 Relays Having Break Contacts and Contact Cover Spring: On these relays it is necessary to prevent shorting of the movable break contact springs with the contact cover spring during replacement of the card. For this purpose, one or two 656A insulators are required. When the relay has break contacts in both the 1- through 6- and 7- through 12-position groups, two insulators are required. If only one of these groups has break contacts, only one insulator is required. To insert a 656A insulator, proceed as follows. Hold the tab of the insulator with the offset portion toward the contact cover spring. Insert the insulator between the contact cover spring and the break contact spring combination until the insulator touches the spoolhead. (See Fig. 25.)

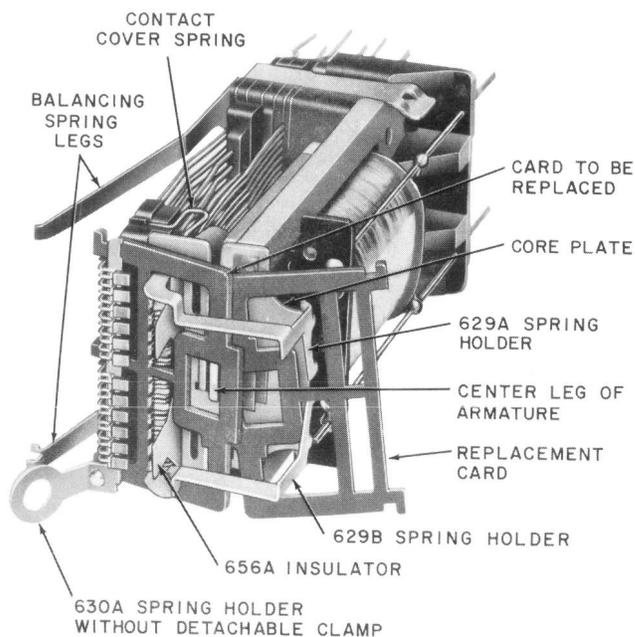


Fig. 25—12-Position Relay—Card Removal Tools Mounted in Place Except Detachable Clamp of 630A Spring Holder

Applying Spring Holders to Break Contact Springs

4.11 The 629A spring holder is used to hold the break contact springs in positions 7 through 12 and the 629B holder in positions 1 through 6 during replacement of the card. Each of the tools has six notches to engage the six pairs of two springs with which it may be used. It is important that the pairs of springs are engaged by the proper notches in the tools. Special care is required to engage the break springs in the proper notches where all positions on the relay are not equipped with these springs. These spring holders are shown mounted on the relay in Fig. 25.

4.12 If there are any break contacts in positions 7 through 12, insert the 629A spring holder between the fixed and break contact springs in these positions as follows. Holding the new card with the notched ends at the left and the code and date information visible, insert the notched leg of the holder through the opening in the card adjacent to the upper right-hand corner. The shank of the holder should be adjacent to the top of the card. Hold the spring holder and new card in one hand and, with the other hand, push the card to be replaced to the right to open the gap between the fixed and break contacts sufficiently to insert the holder. Insert the notched leg of the holder into the gap with the six notches in line with the six positions (7 through 12) on the relay. Swing the outer end of the holder to the right, and clip it on the core plate as shown in Fig. 25. Release the card, and make sure that each pair of twin springs is engaged by the proper notch in the tool.

4.13 If there are any break contacts in positions 1 through 6, insert the notched leg of the 629B spring holder through the lower right opening in the new card suspended on the 629A spring holder. If the 629A spring holder was not required, place the new card on the 629B spring holder with the shank of the holder adjacent to the bottom of the card. Then push the card to be replaced to the right to open the gap between the fixed and break contacts sufficiently to insert the holder. Insert the notched leg of the holder between the fixed and break contacts with the six notches in the holder in line with the six positions (1 through 6) on the relay. Swing the outer end of the holder to the right, and clip it on the core plate as shown in Fig. 25. Release the card, and make sure that each pair of twin springs is engaged by the proper

notch in the holder. Swing the new card suspended on the holders as far to the right as possible.

Applying Spring Holder and Clamp to Make-Contact Springs

4.14 Referring to Fig. 25, insert the 630A spring holder without the clamp between the fixed and make-contact springs as follows. Pry the card to be replaced from its position on the armature with the KS-6320 orange stick, placing one end of the orange stick over the end of the center leg of the armature and under the adjacent edge of the card. Tilt the card outward so that it can be moved over the ends of the armature legs. With the right hand, push the card to the left to open the gap between the fixed and make contacts sufficiently to permit insertion of the spring holder. With the left hand, insert the spring holder through this gap and turn the handle to the left. Release the card. Position the spring holder so that its larger projection is centered between positions 6 and 7 on the relay and the pairs of twin make springs are engaged by the proper notches in the holder.

4.15 Hold the clamp associated with the spring holder by the handle with the notch at the bottom. Place the metal loop at the top of the clamp on the end of the spring holder that extends out above the make-contact springs. Move the clamp downward so that the notch in the bottom of the clamp engages the pin located adjacent to the handle on the spring holder. The clamp will hold the make-contact springs in their proper notches on the spring holder. (See Fig. 26.)

4.16 Using the 628A balancing spring lifter in the right hand, place the outer end of the top leg of the balancing spring in the notch at the top of the spring holder as shown in Fig. 6. Similarly, place the outer end of the bottom leg of the balancing spring in the notch at the bottom of the spring holder.

Removing Card

4.17 *Relays Having Break Contacts (With or Without Make Contacts):* Grasp the horizontal section at the center of the card to be replaced with the KS-8511 tweezers. Carefully remove the card from between the contacts, moving the make-contact springs slightly to the left if necessary. Swing the card to the right so that it

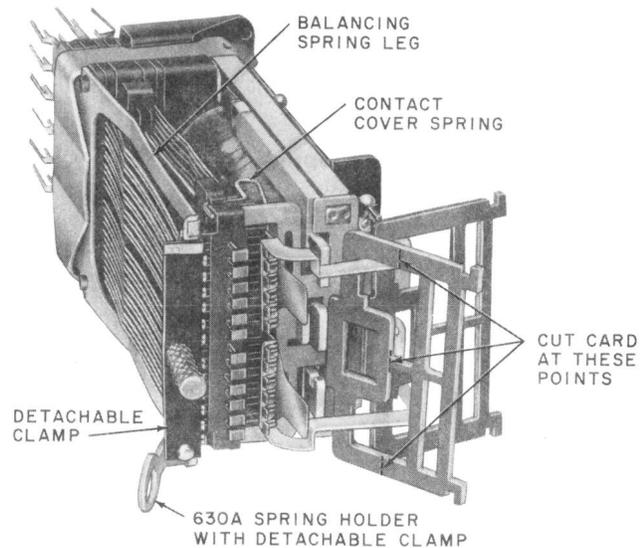


Fig. 26—12-Position Relay—Card Removal Tools Mounted in Place With Detachable Clamp on 630A Spring Holder

hangs freely on the 629A and B spring holders. Cut this card with the 5-inch diagonal pliers at the three points indicated in Fig. 26. Remove the portion of the card between the holders with the tweezers.

4.18 *Relays Having Make Contacts Only:* On relays having make contacts only, grasp the horizontal section at the center of the card to be replaced with the KS-8511 tweezers. Carefully remove the card from between the contacts, moving the make-contacts springs slightly to the left if necessary.

Mounting New Card and Removing Tools

4.19 *Relays Having Break Contacts (With or Without Make Contacts)*

(a) Swing the new card so that the vertical sections at the free side of the card are behind the fixed contacts. Do not position the other side of the card on the ends of the armature legs at this time.

(b) If the relay has make contacts, grasp the hand of the 630A spring holder and clamp and move it slightly to the left. With the balancing spring lifter in the other hand, remove

the top leg of the balancing spring and then the bottom leg from the notches of the holder. Carefully move the holder to the right, permitting the make-contact springs to fall into their proper grooves in the comb. Remove the clamp from the spring holder. With the right hand, push the card to the left to open the gap between the movable and fixed contacts sufficiently to permit withdrawing the holder. Swing the holder to the right, withdraw it, and release the card.

- (c) Move the armature against the armature backstop with the KS-6320 orange stick, and hold the armature in this position. With the other hand, position the card on the legs of the armature. Release the armature, and hold it against the core with the orange stick. Move the card up and down slightly until the projections on the card engage the notches in the outer legs of the armature.
- (d) Remove the 629A and B spring holders as follows. Push the card to the right. Unclip one of the holders from the core plate and move it to the left, permitting the break springs to enter the grooves in the comb. Swing the holder to the left, and withdraw it through the gap between the fixed and movable break contacts. Remove the other holder in the same manner. Release the card. Make sure that each movable break-contact spring is in its proper groove in the comb.
- (e) If the 656A insulators were used, remove them.
- (f) Block the relay operated with the 768A tool. Remount the balancing spring legs in their respective notches in the card, employing a method similar to that covered in 4.09 for disengaging the legs. Remove the wedge and make sure that the card is properly engaged on the armature.
- (g) Where the relay was equipped with a buffer spring, remount the spring as covered in 4.06.
- (h) Where the relay was equipped with a crosstalk shield, remount the shield as covered in 4.05.
- (i) Remount the contact cover on the relay.

4.20 Relays Having Make Contacts Only

- (a) Hold the new card with the notches at the left and the stamped information on the card visible. Insert the extreme left vertical section of the card between the movable make and fixed contacts. Do not position the other side of the card on the ends of the armature legs at this time.
- (b) Grasp the handle at the bottom of the 630A spring holder and clamp with the left hand and move it slightly to the left. With the balancing spring holder in the other hand, disengage the top leg of the balancing spring and then the bottom leg from the notches of the spring holder. Carefully move the holder to the right, permitting the movable make-contact springs to fall into their proper grooves in the comb. Remove the clamp from the spring holder. With the right hand, push the card to the left to open the gap between the fixed and movable make contacts sufficiently to permit withdrawing the spring holder. Swing the holder to the right, and withdraw it.
- (c) Move the armature against the armature backstop with the KS-6320 orange stick, and hold the armature in this position. With the other hand, position the card on the legs of the armature. Release the armature, and hold it against the core with the orange stick. Move the card up and down slightly until the projection on the card engages the notches in the outer legs of the armature.
- (d) Block the relay operated with the 768A tool. Remount the balancing spring legs in their respective notches in the card, employing a method similar to that covered in 4.09 for disengaging the legs. Remove the wedges, and make sure that the card is properly engaged on the armature.
- (e) Where the relay was equipped with a buffer spring, remount the spring as covered in 4.06.
- (f) Where the relay was equipped with a crosstalk shield, remount the shield as covered in 4.05.
- (g) Remount the contact cover on the relay.

COIL—12-POSITION RELAY

4.21 Replacement of the coil requires replacement of the core plate. Note the circuit designation on the core plate to be replaced. Before mounting the new core plate, stamp the circuit designation on the core plate in the same location using the R-2315 lettering and numbering set. Make sure that this information is stamped on the same side of the core plate as the projecting armature stop.

Removing Contact Cover, Crosstalk Shield, and Buffer Spring

4.22 Remove the contact cover and, if provided, crosstalk shield and buffer spring as covered in 4.05 and 4.06.

Disengaging Balancing Springs Legs

4.23 Disengage the balancing spring legs from the card as covered in 4.09.

Insulating Contact Cover Spring

4.24 On relays having break contacts and a contact cover spring, prevent shorting of the movable break-contact springs with the contact cover spring by using the 656A insulators as covered in 4.10.

Applying Spring Holders to Break-Contact Springs

4.25 If the relay has break-contact springs, use the 629A and B spring holders to hold the springs during removal of the card as covered in 4.11 through 4.13, but do not mount a new card on the spring holders.

Applying Spring Holder and Clamps to Make-Contact Springs

4.26 Use the 630A spring holder and associated clamp to hold the make-contact springs as covered in 4.14 through 4.16.

Removing Card

4.27 On relays having break contacts, proceed as covered in 4.17 but do not cut the card; allow it to hang freely on the 629A and B spring holders as shown in Fig. 27. Then remove the spring holders with the card. Remove the 656A insulators if they were used.

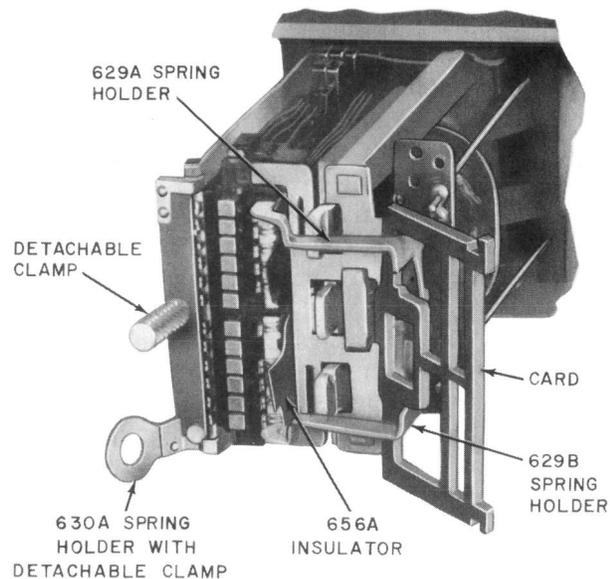


Fig. 27—12-Position Relay—Card Removal Tools Mounted in Place

4.28 On relays having make contacts only, remove the card as covered in 4.18.

Removing Core Plate

4.29 To remove the core plate, proceed as follows.

- (a) Mount the 716A ratchet head on the 715A ratchet handle as covered in 4.02(a).
- (b) Position the insulated loop of the 716A ratchet head behind the core plate with the ratchet rod in line with and against the center core leg as shown in Fig. 28. Make sure that the rod teeth are positioned downward and that the straight vertical portion of the loop engages the rear of the core plate. Hold the tool so that the rod is in line with the core leg, and pull the trigger until the core plate is freed from the relay. Withdraw the ratchet tool with the core plate.
- (c) Remove the core plate from the ratchet tool by rotating the rod 180 degrees and moving it back into the handle.

Removing Coil

Note: See 1.10.

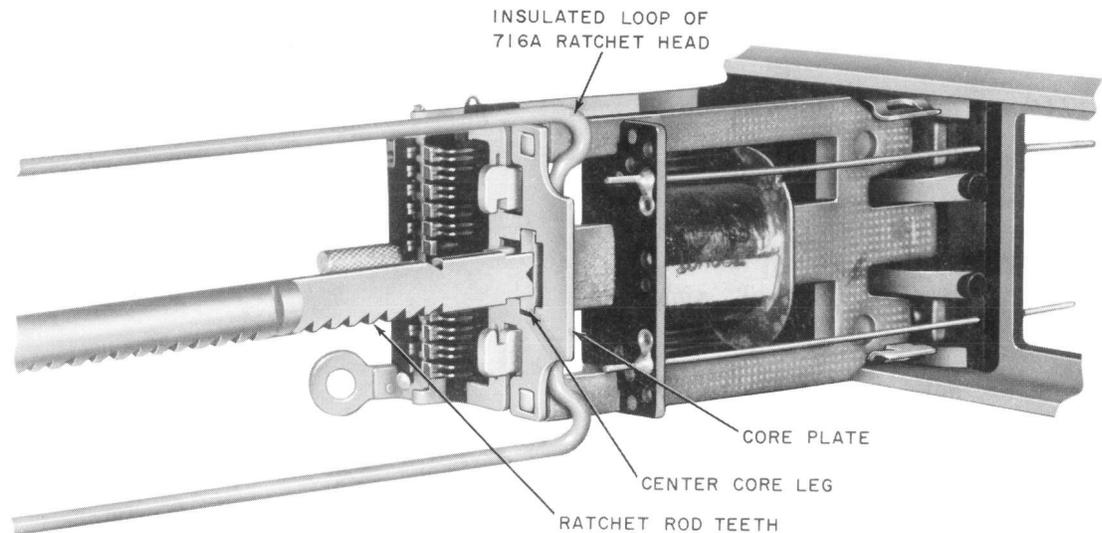


Fig. 28—12-Position Relay—Removing Core Plate

4.30 To remove the coil, proceed as follows.

(a) Disconnect the external leads from the coil winding terminals. If the leads were soldered, clip off the ends of the terminals as close as possible to the relay mounting plate using the diagonal pliers. Using the 4-inch E screwdriver, loosen the mounting screws of the relay and of the adjacent relays, if necessary, one full turn to permit greater separation between relays when replacing the coil.

(b) Place a KS-2423 cloth under the relay, as shown in Fig. 29, to shield adjacent apparatus from solder drippings when removing the coil winding terminals as covered in (c).

(c) Except in the case of the 1050-ohm coil (coil mounted on copper sleeve), remove the coil winding terminals using the soldering copper and the B long-nose pliers as shown in Fig. 29. Note the holes in the molded mounting bracket of the relay from which the terminals were removed.

Caution: *Do not remove the coil winding terminals on 1050-ohm coils.*

(d) Position 718A wedges between the armature and upper and lower core legs as shown in Fig. 30. To do this, move the armature to the

left with the left hand. With the other hand, insert approximately 1/2 inch of the smaller end of the wedge between the armature and upper core leg with the straight side of the wedge against the core leg. Similarly, position the second wedge between the armature and lower core leg and release the armature. Carefully push the wedges alternately inward a short distance at a time until the base of each wedge is flush with the outer end of its associated core leg. Make sure that both wedges are horizontal, and do not extend beyond the lower edge of the upper core leg and the upper edge of the lower core leg.

(e) Position the rod of the 715A ratchet handle so that its end is approximately 3 inches from the end of the loop and the rod teeth are facing the trigger as covered in 4.02(a).

(f) **All Coils Except 1050-Ohm Coil (Coil Mounted on Copper Sleeve):** Position the insulated loop of the 716A ratchet head behind the rear spoolhead of the coil with the end of the ratchet rod in line with and against the center leg of the core as shown in Fig. 30. Make sure that the straight vertical portion of the loop engages the rear spoolhead of the coil. Hold the tool with the rod horizontal, and advance the rod by pulling the trigger until the coil is

off the core leg. Remove the coil from the tool as covered in (h).

(g) **1050-Ohm Coil (Coil Mounted on Copper Sleeve):** All 1050-ohm coils are mounted on copper sleeves which are secured to the core leg of the relay. The copper sleeve should remain on the core leg when the coil is removed. If the copper sleeve is loosened or is removed with the coil, replace the relay. To remove the coil, proceed as follows.

- (1) Note the holes in the molded mounting bracket of the relay that position the coil terminals.
- (2) Position the insulated loop of the 716A ratchet head behind the coil with the straight portion of the loop pressed lightly against the coil terminals and the end of the ratchet rod in line with and resting against the center core leg. Holding the tool with the rod horizontal, pull the trigger until the coil is off the copper sleeve and remove from the relay.

Caution: Avoid putting heavy pressure against the coil terminals since this might permit the loop of the tool to engage the copper sleeve with possible damage to the tool.

(h) Remove the coil from the ratchet tool by rotating the rod 180 degrees and moving the rod back into the handle.

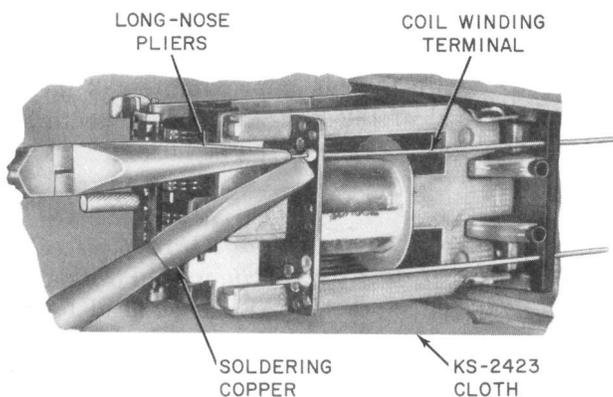


Fig. 29—12-Position Relay—Removing Coil Winding Terminals

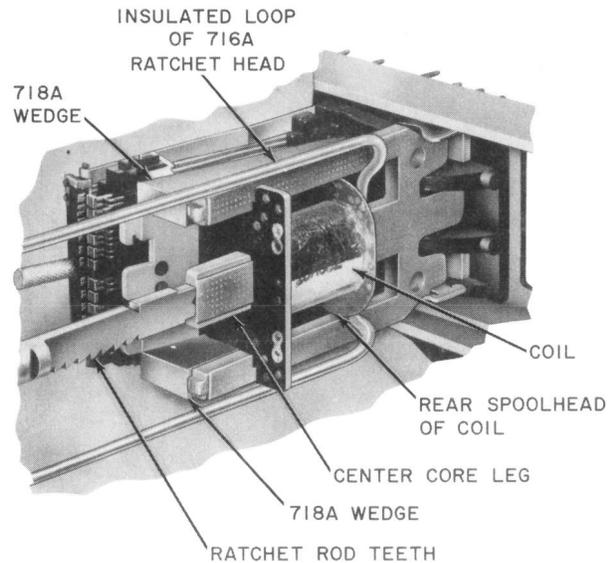


Fig. 30—12-Position Relay—Removing Coil

Mounting New Coil

4.31 To mount the new coil, proceed as follows.

- (a) From the rear of the relay, insert the terminal guide tubes furnished with the 1014B tool kit into the holes in the molded mounting bracket of the relay which position the coil terminals and move the tubes forward until they extend beyond the front of the relay.
- (b) **All Coils Except 1050-Ohm Coil (Coil Mounted on Copper Sleeve):** Insert the terminals of the new coil into their respective terminal guide tubes with the opening in the coil in line with the center leg of the core. Manually push the coil onto the core leg, carefully tapping it, if necessary, using the slotted end of the 717B coil setter and the 4-ounce riveting hammer until the core leg extends slightly beyond the opening at the front of the coil. Then proceed as covered in (d).
- (c) **1050-Ohm Coil (Coil Mounted on Copper Sleeve):** Position the 1050-ohm coil as covered in (b), except push the coil onto the copper sleeve until the center core leg extends slightly beyond the opening at the front of the coil.
- (d) Place the short slot of the 717B coil setter over the center leg of the core as shown in

Fig. 31. Position the coil on the core leg by gently tapping the coil setter with the 4-ounce riveting hammer until the bottom of the slot in the coil setter rests against the end of the core leg.

(e) Carefully remove the 718A wedge and the KS-2423 cloth. Remove the terminal guide tubes and tighten the screws of the relay and of adjacent relays if they were loosened.

(f) Connect the external leads to the coil winding terminals.

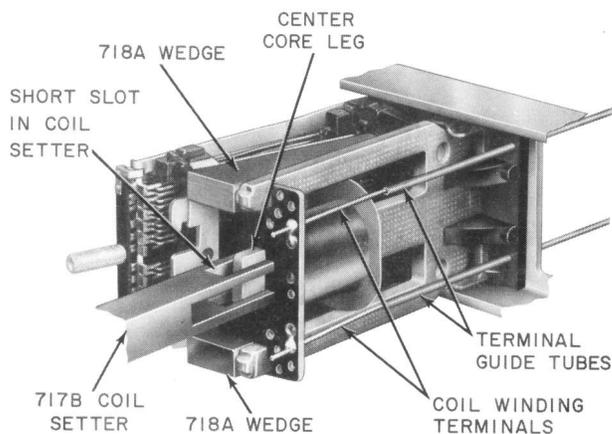


Fig. 31—12-Position Relay—Positioning Replacement Coil With 717B Coil Setter

Mounting New Core Plate

4.32 Make sure that the circuit designation has been stamped on the new core plate as covered in 4.21. Proceed as follows.

(a) Place the tip of the KS-6320 orange stick against the center portion of the front molded section of the relay, and push the molded section to the left. Position the new core plate in front of the core legs with the armature stop on the core plate facing away from the relay. Manually start the core plate on the core legs, and position the upper and lower portion of the front molded section against the core plate. Using the 717B coil setter and the 4-ounce riveting hammer, gently tap the core plate into position on the core legs. Figure 32 shows the coil setter being

used to position the core plate on the lower core leg.

(b) Using the R-1640 center punch and the 4-ounce riveting hammer, stake each corner of the upper and lower core legs to secure the core plate as shown in Fig. 33.

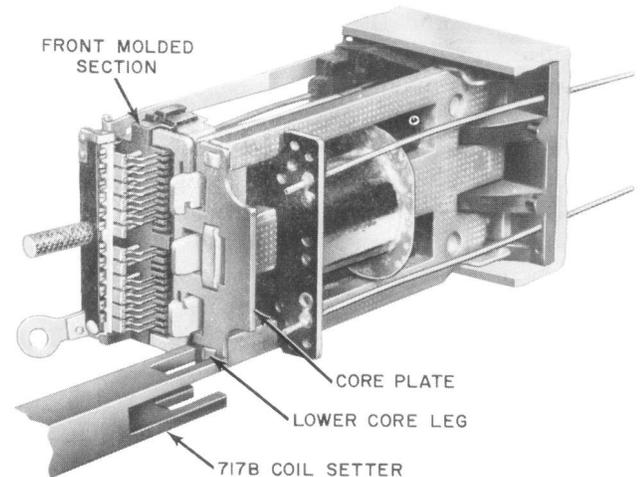


Fig. 32—12-Position Relay—Positioning Core Plate With 717B Coil Setter

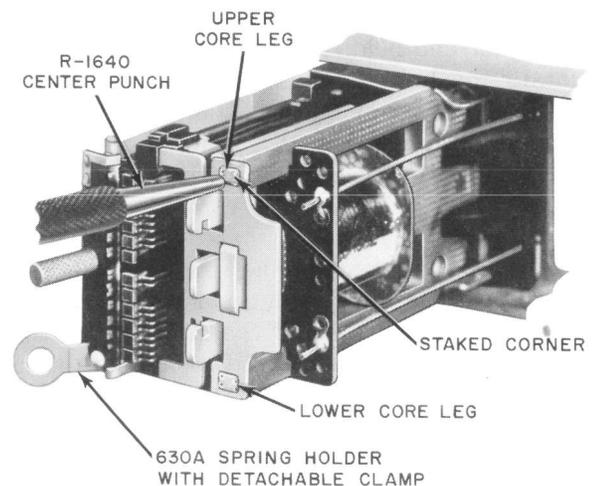


Fig. 33—12-Position Relay—Staking Core Legs to Secure Core Plate

Remounting Card**4.33 *Applying Spring Holders to Break-Contact Springs***

(a) If the relay has break contacts in positions 7 through 12, apply the 629A spring holder between the fixed and break-contact springs as follows. Holding the card with the notched ends at the left and the code and date information visible, insert the notched leg of the holder through the opening in the card adjacent to the upper right-hand corner. The shank of the holder should be adjacent to the top of the card. Then, with the card on the spring holder, insert the notched leg of the holder behind the movable break contacts from above so that the six notches in the holder line up with the six positions (7 through 12) on the relay. Swing the outer end of the holder to the right, and clip it on the core plate as shown in Fig. 27. Make sure that each pair of twin springs is engaged by the proper notch in the holder.

(b) If the relay has break contacts in positions 1 through 6, apply the 629B spring holder between the fixed and break-contact springs as follows. If the 629A spring holder was used in positions 7 through 12, insert the notched leg of the 629B spring holder through the lower right-hand opening of the card. With the notched leg of the spring holder pointing downward and the other end held slightly away from the relay, rotate the holder toward the relay and insert the notched leg behind the contacts from below. Position the holder so that the six notches line up with the six positions (1 through 6) on the relay. Swing it onto the core plate as shown in Fig. 27. Make sure that each pair of twin springs is engaged by the proper notch in the holder. If the 629A spring holder was not used, insert the notched leg of the 629B spring holder through the lower right-hand opening of the card. Then insert the notched leg of the holder between the fixed and break contacts in positions 1 through 6 as covered above.

Remounting Card and Removing Tools**4.34 *Relays Having Break Contacts (With or Without Make Contacts)***

(a) Swing the card to the left so that the vertical sections at the left are positioned behind

the fixed contacts. Do not position the other side of the card on the ends of the armature legs at this time.

(b) Position the card on the armature, remount the buffer spring and the crosstalk shield, if provided, and remount the contact cover as covered in 4.19(b) through (i).

4.35 *Relays Having Make Contacts Only*

(a) Hold the card with the notches at the left and the stamped information on the card visible. Insert the extreme vertical section of the card between the make and fixed contacts. Do not position the card on the ends of the armature legs at this time.

(b) Position the card on the armature, remount the buffer spring and crosstalk shield, if provided, and remount the contact cover as covered in 4.20(b) through (g).

CARD—24-POSITION RELAY

4.36 Remove the contact cover.

Stamping Relay Code on New Card

4.37 Note the code number and date of manufacture stamped on the card to be replaced. Before mounting the new card, stamp the code number and date on the card in the same location using the R-2315 lettering and numbering set. This stamping may be applied to either side of the new card.

Disengaging Balancing Spring Legs

4.38 Disengage the balancing spring legs from the card as follows. Block the relay operated using the 768A tool. Holding the 628A balancing spring lifter in the left hand, insert the spring lifter next to the upper leg of the balancing spring with the end of the lifter just behind the comb. Roll the end of the lifter under the leg of the spring so that the spring rests in the groove of the lifter. Then draw the lifter forward to the position shown in Fig. 5 for the 12-position relay. With the right hand, place the end of a KS-6320 orange stick on the top edge of the card in line with the fixed contact springs in positions 1 through 12. Lift the spring upward with the spring lifter, and at the same time, press the card downward

with the orange stick. When the spring clears the top of the card, move it toward the left so that it is free of the card. Withdraw the spring lifter. When removing the lower leg of the spring, the procedure is the same except that the opposite end of the spring lifter is rolled over the top edge of the leg and pushed downward while the orange stick is pressed upward against the bottom edge of the card. Remove the wedge.

Applying Spring Holders to Movable Contact Springs

4.39 Positions 13 Through 24: Pry the card to be replaced from its position on the armature with the KS-6320 orange stick, placing one end of the orange stick over the center leg of the armature and under the adjacent edge of the card. Tilt the card outward so that it can be moved over the ends of the armature legs. With one hand, push the card to the left. With the other hand, insert the straight end of the 652A spring holder in positions 19 through 24 (upper six positions in the right row of contacts). Position this end of the tool against the movable contact springs behind the card. Swing the holder to the right, and wedge the square-formed section of it against the top leg of the armature as shown in Fig. 34. Position the 652B spring holder against the movable springs in positions 13 through 18 following the same procedure.

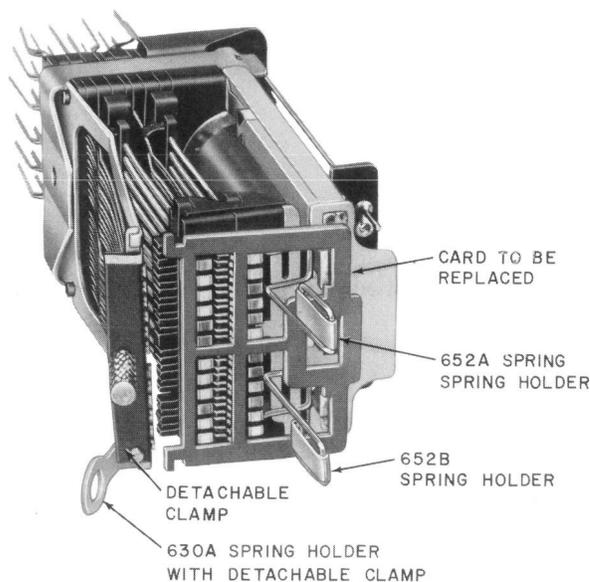


Fig. 34—24-Position Relay—Card Removal Tools Mounted in Place

4.40 Positions 1 Through 12: Insert the 630A spring holder without the clamp between the contact springs in positions 1 through 12 as follows. With the right hand, push the card to the left to open the gap between the fixed and movable contacts sufficiently to permit insertion of the spring holder. With the other hand, insert the spring holder through this gap and turn the handle to the left. Release the card. Position the spring holder so that the larger projection is centered between positions 6 and 7 on the relay and the pairs of twin make springs are engaged by the proper notches in the holder. Next, hold the clamp associated with the spring holder by its handle with the notch at the bottom. Place the metal loop at the top of the clamp on the end of the spring holder that extends above the make-contact springs. Move the clamp downward so that the notch in the bottom of the clamp engages the pin located adjacent to the handle on the spring holder. The clamp will hold the contact springs in their proper notches on the spring holder. (See Fig. 34.)

Removing Card

4.41 Grasp the horizontal section at the center of the card to be replaced with the KS-8511 tweezers. Move the springs in positions 1 through 12 slightly to the left, and carefully remove the card from between the contacts.

Mounting New Card and Removing Tools

4.42 Position the new card on the relay so that the stamped information is on the front surface of the card. Move the springs in positions 1 through 12 slightly to the left, and insert the card so that the vertical sections of the card are behind the fixed contacts. Do not position the other side of the card on the ends of the armature legs at this time.

4.43 Carefully move the 630A spring holder to the right, permitting the movable contact springs to fall into their proper grooves in the comb. Remove the clamp from the spring holder. With the right hand, push the card to the left to open the gap between the fixed and movable contacts sufficiently to permit withdrawing the spring holder. Swing the holder to the right and withdraw it.

4.44 Remove the 652A and B spring holders as follows. Disengage the holder from the

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armature, and swing the holder to the left. Push the card to the left, and withdraw the straight end of the holder through the gap between the contacts. Release the card.

4.45 Move the armature against the armature backstop with the KS-6320 orange stick, and hold the armature in this position. With the other hand, position the card on the legs of the armature. Release the armature, and hold it against the core with the orange stick. Move the card up and down slightly until the projections on the card engage the notches in the outer legs of the armature.

4.46 Block the relay operated with the 768A tool. Remount the balancing spring legs in their respective notches in the card, employing a method similar to that covered in 3.38 for disengaging the legs. Remove the wedge, and make sure that the card is properly engaged on the armature. Remount the contact cover on the relay.

COIL—24-POSITION RELAY

4.47 Replacement of the coil requires replacement of the core plate. Note the circuit designation, and stamp it on the new core plate as covered in 4.21.

4.48 Remove the contact cover.

Removing Card

4.49 Remove the card as covered in 4.38 through 4.41.

Removing Core Plate

4.50 Before removing the core plate from the relay, insulate the contacts and remove the 652A and B spring holders as follows.

- (a) If there are relays mounted directly above or below the relay, remove their contact covers.
- (b) Insulate the right row of contacts (positions 13 through 24) by inserting a KS-7187 Bell seal bond paper vertically between the movable and fixed contacts as shown in Fig. 35.
- (c) To remove the 652A and B spring holders, disengage the holder from the armature

and swing it to the left. Withdraw the straight end of the holder from behind the contacts.

(d) Remove the core plate as covered in 4.29.

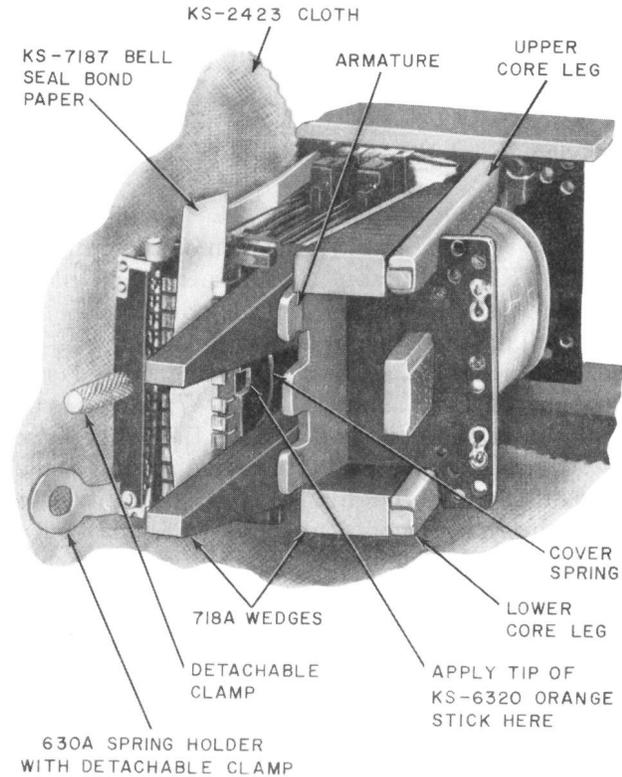


Fig. 35—24-Position Relay—Coil Removal Tools Mounted in Place

Removing Coil

4.51 Remove the coil winding terminals, insert the 718A wedges, and remove the coil as follows.

- (a) Disconnect the external leads from the coil winding terminals; loosen the screws of the relay and, if necessary, of the adjacent relays; and remove the terminals as covered in 4.30(a), (b), and (c).
- (b) Insert two 718A wedges between the armature and cover spring of the relay as follows. Apply the tip of the KS-6320 orange stick to the notch in the front molded section adjacent to the center portion of the cover spring (Fig.

35), and carefully move the spring assembly to the left. Avoid touching the fixed contact springs with the orange stick. Hold a wedge at the small end with the parallel sides vertical, and insert it between the lower portion of the armature and the cover spring until it stops against the coil spoolhead. Similarly, insert a second wedge adjacent to the upper portion of the armature. These wedges, which are shown in Fig. 35, will prevent distortion of the armature springs when the second pair of wedges is inserted between the armature and core legs.

- (c) Insert a second pair of 718A wedges between the armature and core legs as covered in 4.30(d) and as shown in Fig. 35.
- (d) Remove the coil as covered in 4.30(e), (f), and (h).

4.52 *Mounting New Coil:* Mount the new coil as covered in 4.31.

4.53 *Mounting New Core Plate:* Mount the new core plate as covered in 4.32.

4.54 *Remounting Card*

- (a) Insert the straight end of the 652A spring holder behind the movable contacts in positions 19 through 24 (upper six positions in the right row of contacts) from above. Swing the holder to the right, and wedge the square-formed section of it against the top leg of the armature as shown in Fig. 34. Similarly, position the 652B spring holder behind the movable springs in positions 13 through 18 from below.
- (b) Remount the card, remove the tools, and remount the contact cover as covered in 4.42 through 4.46.
- (c) If covers were removed from adjacent relays, remount their contact covers.