

**RELAYS**  
**AF, AG, AND AJ TYPE**  
**(WIRE SPRING 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 add piece-part data and replacement procedures for the core plate and coil. Detailed reasons for reissue will be found at the end of this section. Since this reissue covers a general revision, the arrows ordinarily used to indicate changes have been omitted.

**1.03** Part 2 of this section covers the piece-part numbers and the corresponding names of the parts which it is practical to replace in the field in the maintenance of these relays. No attempt shall be made to replace parts not designated. Part 2 also contains explanatory figures showing the different parts. This information is called Piece-Part Data.

**1.04** Part 3 of this section covers the approved procedures for the replacement of the parts covered in Part 2. This information is called Replacement Procedures.

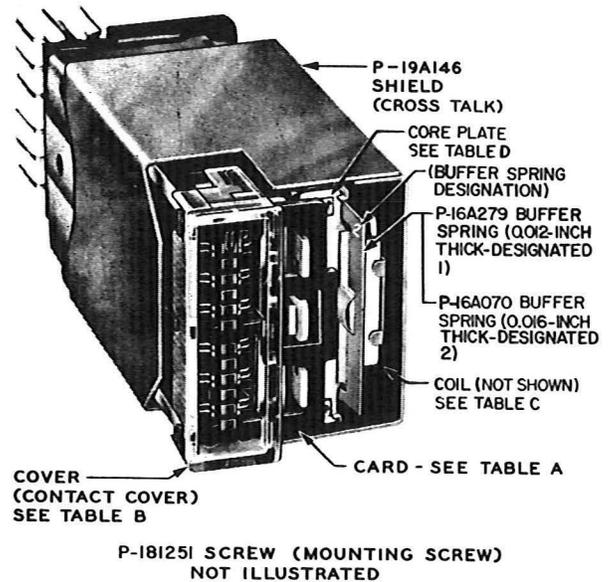
**1.05** Before making any replacements on the apparatus covered herein, remove the circuit from service.

**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.



**Fig. 1 - 12-Position Relay - General View**

**TABLE A**

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

\* 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 B**

**P-16A144 Cover	Without metal frame— used on 12-position re- lays having a contact cover spring
**P-10F098 Cover	With metal frame— used on 12-position re- lays not having a contact cover spring

\*\* These covers are not interchangeable.

**TABLE C**

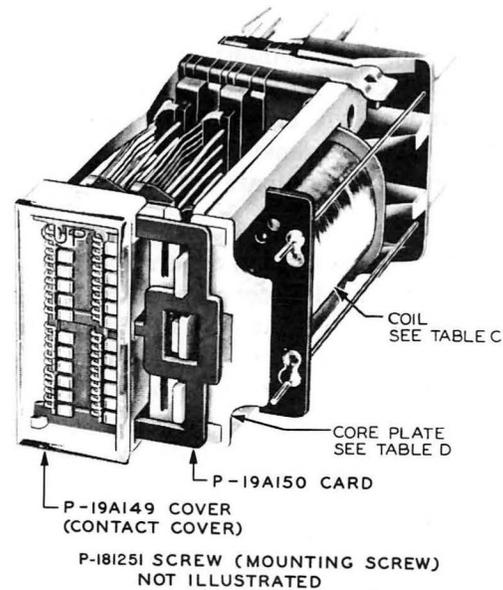
†COIL RESISTANCE (OHMS)	COIL PIECE-PART NUMBER
4.4	P-10F201
16	P-10F202
395	P-10F203
400	P-10F204
700	P-10F205
1050	P-10F206
2500	P-10F207
1000 and 2700	P-10F208 (double-wound coil)
425 and 425	P-10F209 (double-wound coil)
200	P-10F210

† 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.

**TABLE D**

12-POSITION RELAYS		CORE PLATE PIECE-PART NUMBER
††CORE PLATE IDENTIFICATION NUMBER	PLATING	
1	None	P-15A212
2	None	P-15A213
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		
None	None	P-15A342
None	Chromium	P-15A343

†† Except for 24-position AJ-type relays, 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 24-position AJ-type relays have no identification number and the core plate is identified by whether or not 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.



**Fig. 2 - 24-Position Relay — General View**

**3. REPLACEMENT PROCEDURES**

**3.01 List of Tools and Materials**

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
628A	Balancing Spring Lifter
629A	Spring Holder (positions 7 to 12 on 12-position relays)
629B	Spring Holder (positions 1 to 6 on 12-position relays)
630A	Spring Holder and Removable Clamp (positions 1 to 12 on 12- and 24-position relays)

CODE OR SPEC NO.	DESCRIPTION
<b>TOOLS</b>	
652A	Spring Holder (positions 19 to 24 on 24-position relays)
652B	Spring Holder (positions 13 to 18 on 24-position relays)
656A (2 Req'd)	Insulator
1014A	Tool Kit (See 3.02) (includes the following)
	<b>AMT                      DESCRIPTION</b>
	One     715A Ratchet Handle
	One     716A Ratchet Head
	One     716B Ratchet Head
	One     717A Coil Setter
	One     P-12B564 Plastic Box (for wedges)
	Four    718A Wedges
	One     P-12B537 Container (for terminal guide tubes)
	Eight   P-12B536 Tubing (terminal guide tubes)
KS-6320	Orange Stick
KS-8511	Tweezers
KS-16887, L1	Wedge
R-1640	Center Punch
R-2315	Lettering and Numbering Set
—	Long-Nose Pliers
—	4-Inch E Screwdriver
—	4-Ounce Riveting Hammer
—	5-Inch Diagonal Pliers
<b>MATERIALS</b>	
KS-2423	Cloth
KS-7187	Bell Seal Bond Paper

**3.02 No. 1014A Tool Kit:** Fig. 3 shows the tools comprising the No. 1014A tool kit used for replacing coils on wire-spring type relays. The No. 716B ratchet head furnished with the tool kit is not required for AF-, AG-, and AJ-type relays. This ratchet head is used for

AK-type relays. Preparing the ratchet handle and head for use is covered below.

(a) The No. 716A ratchet head is mounted on the No. 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.

(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.

**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 A461.014. Other parts whose adjustments may have been directly disturbed by the replacing operations shall be checked to the readjust requirements, and an over-all 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 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.

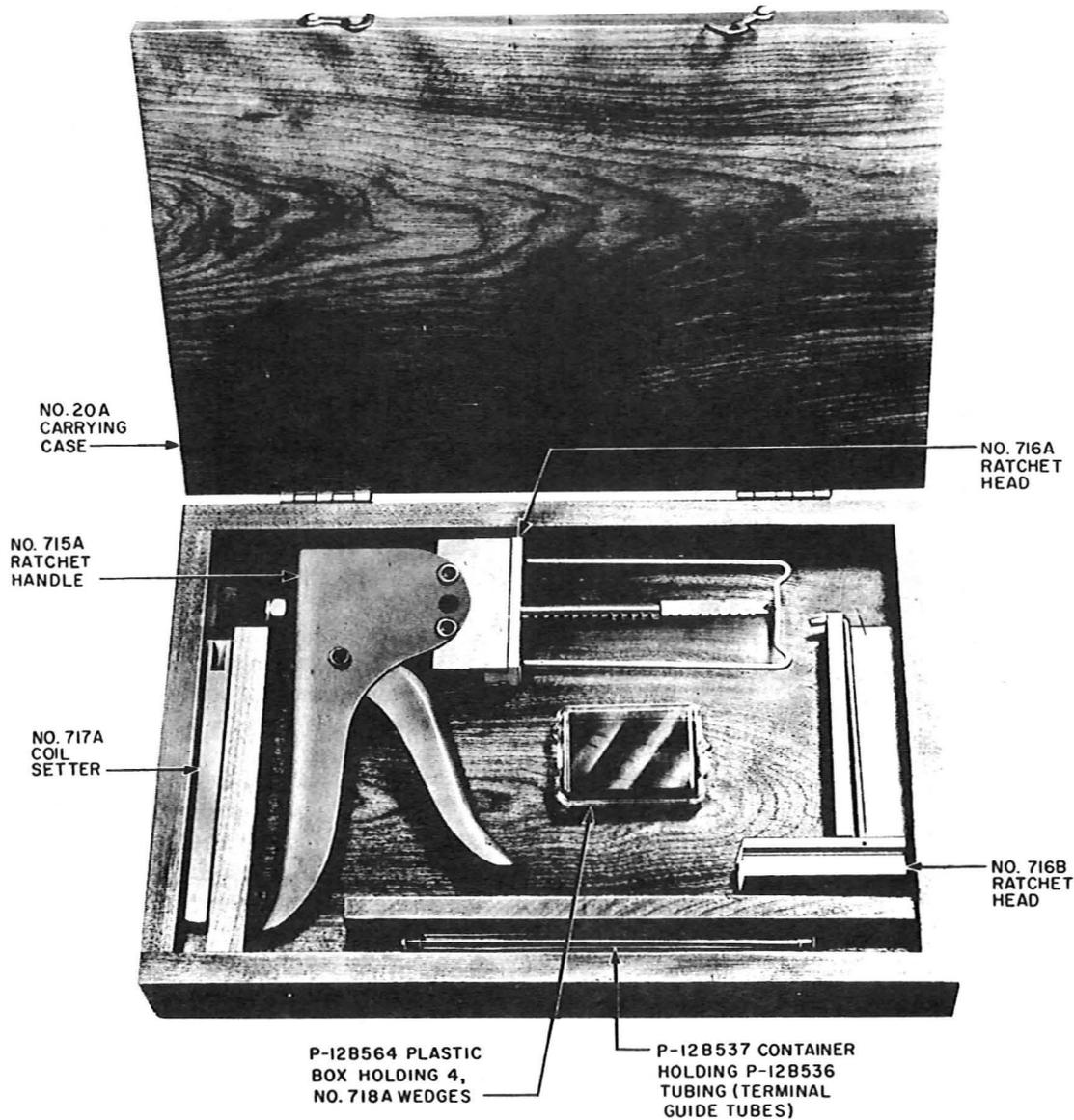


Fig. 3 - No. 1014A Tool Kit

### 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. 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 A461.014.

#### CARD — 12-POSITION RELAY

##### Removing Contact Cover, Crosstalk Shield, and Buffer Spring

**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

**3.08** 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

**3.09** Disengage the balancing spring legs from the card as follows. Block the relay operated, using the KS-16887, L1 wedge. Holding the No. 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. 4. 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.

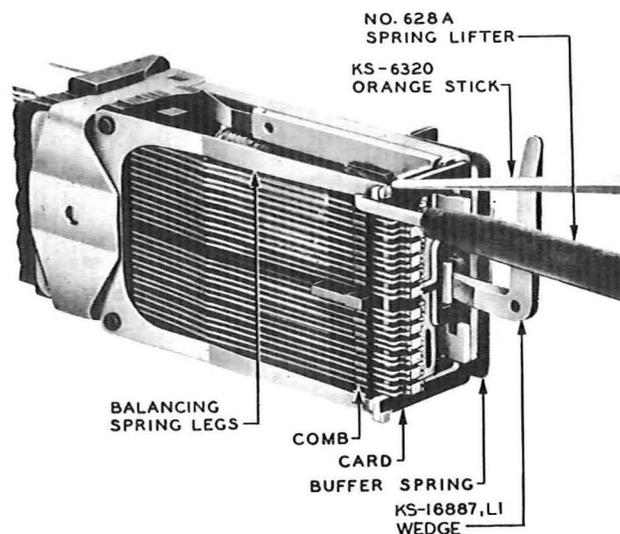


Fig. 4 — Disengaging Balancing Spring From Card

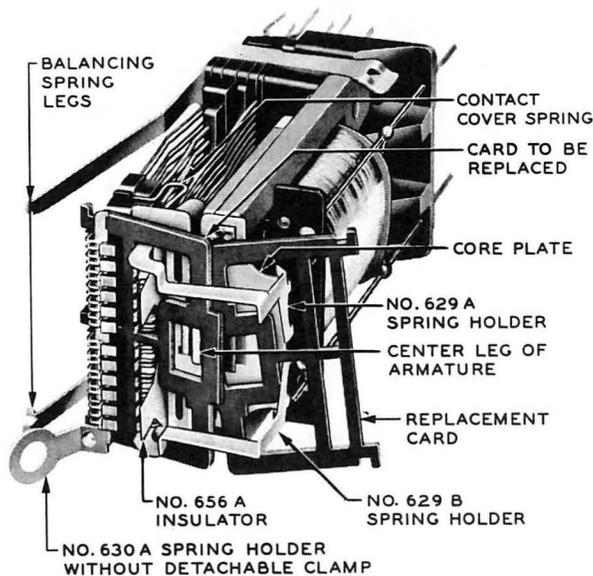
##### Insulating Contact Cover Spring

**3.10 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 No. 656A insulators are required. When the relay has break contacts in both the 1- to 6- and 7- to 12-position groups, two insulators are required. If only one of these groups has break contacts, only one insulator is required. To insert a No. 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. 5.)

##### Applying Spring Holders to Break Contact Springs

**3.11** The No. 629A spring holder is used to hold the break contact springs in positions 7 to 12 and the No. 629B holder in positions 1 to 6 during replacement of the card. Each of the tools has six notches to engage the six pairs of twin 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. 5.



**Fig. 5 — 12-Position Relay — Card Removal Tools Mounted in Place Except Detachable Clamp of No. 630A Spring Holder**

**3.12** If there are any break contacts in positions 7 to 12, insert the No. 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 to 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. 5. Release the card and make sure that each pair of twin springs is engaged by the proper notch in the tool.

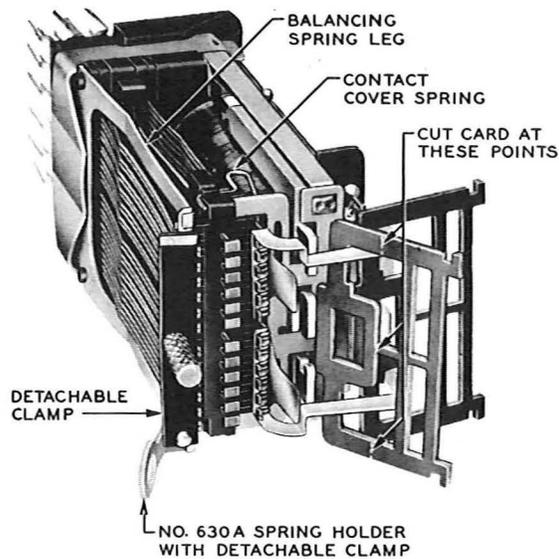
**3.13** If there are any break contacts in positions 1 to 6, insert the notched leg of the No. 629B spring holder through the lower right

opening in the new card suspended on the No. 629A spring holder. If the No. 629A spring holder was not required, place the new card on the No. 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 to 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. 5. 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**

**3.14** Referring to Fig. 5, insert the No. 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.

**3.15** 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. 6.)



**Fig. 6 - 12-Position Relay — Card Removal Tools Mounted in Place With Detachable Clamp on No. 630A Spring Holder**

**3.16** Using the No. 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

**3.17 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 hangs freely on the No. 629A and 629B spring holders. Cut this card with the 5-inch diagonal pliers at the three points indicated in Fig. 6. Remove the portion of the card between the holders with the tweezers.

**3.18 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-contact springs slightly to the left, if necessary.

#### Mounting New Card and Removing Tools

##### 3.19 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 handle of the No. 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 No. 629A and 629B 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 No. 656A insulators were used, remove them.

(f) Block the relay operated with the KS-16887, L1 wedge. Remount the balancing spring legs in their respective notches in the card, employing a method similar to that covered in 3.09 for disengaging the legs. Remove the wedge and make sure that the card is properly engaged on the armature.

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- (g) Where the relay was equipped with a buffer spring, remount the spring as covered in 3.06.
- (h) Where the relay was equipped with a crosstalk shield, remount the shield as covered in 3.05.
- (i) Remount the contact cover on the relay.

### 3.20 *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 No. 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 KS-16887, L1 wedge. Remount the balancing spring legs in their respective notches in the card, employing a method similar to that covered in 3.09 for disengaging the legs. Remove the wedge 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 3.06.

- (f) Where the relay was equipped with a crosstalk shield, remount the shield as covered in 3.05.

- (g) Remount the contact cover on the relay.

### COIL — 12-POSITION RELAY

**3.21** 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**

**3.22** Remove the contact cover and, if provided, crosstalk shield and buffer spring as covered in 3.05 and 3.06.

#### **Disengaging Balancing Spring Legs**

**3.23** Disengage the balancing spring legs from the card as covered in 3.09.

#### **Insulating Contact Cover Spring**

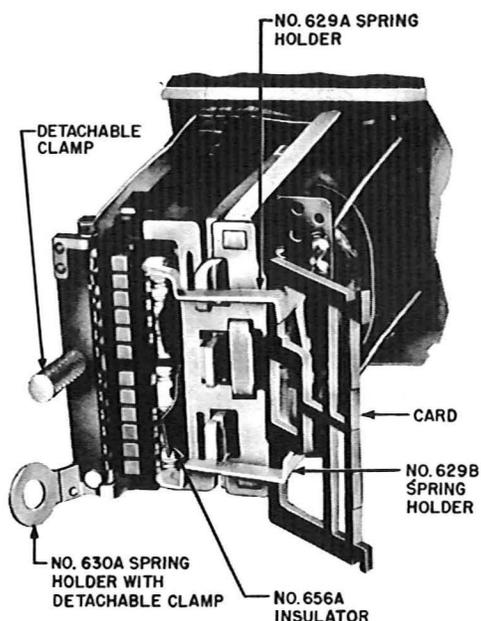
**3.24** On relays having break contacts and a contact cover spring, prevent shorting of the movable break-contact springs with the contact cover spring by using the No. 656A insulators as covered in 3.10.

#### **Applying Spring Holders to Break-Contact Springs**

**3.25** If the relay has break-contact springs, use the No. 629A and 629B spring holders to hold the springs during removal of the card as covered in 3.11 through 3.13, except do not mount a new card on the spring holders.

#### **Applying Spring Holder and Clamp to Make-Contact Springs**

**3.26** Use the No. 630A spring holder and associated clamp to hold the make-contact springs as covered in 3.14 through 3.16.



**Fig. 7 - 12-Position Relay — Card Removal Tools Mounted in Place**

#### Removing Card

**3.27** On relays having break contacts, proceed as covered in 3.17, except do not cut the card but allow it to hang freely on the No. 629A and 629B spring holders as shown in Fig. 7.

Then remove the spring holders with the card. Remove the No. 656A insulators if they were used.

**3.28** On relays having make contacts only, remove the card as covered in 3.18.

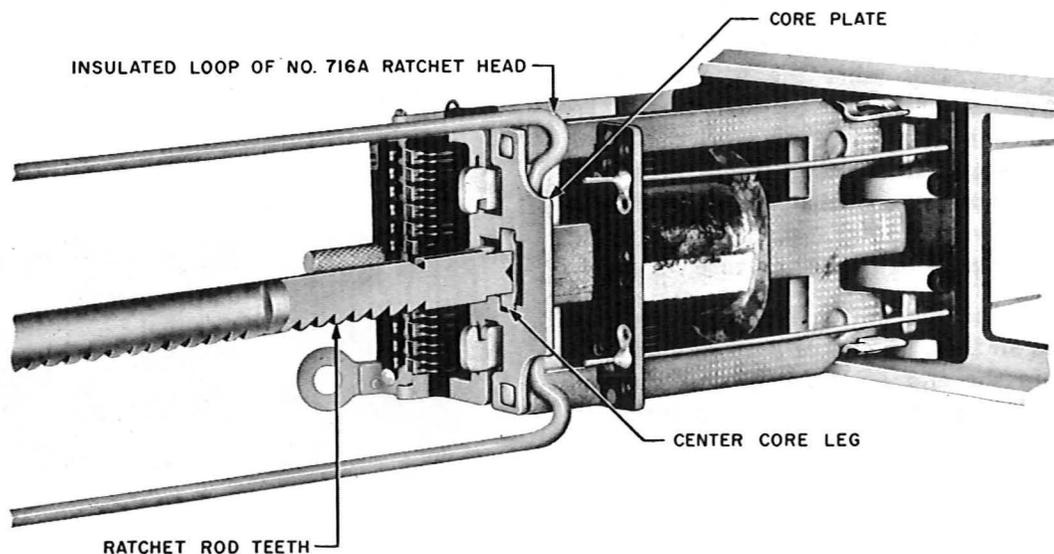
#### Removing Core Plate

**3.29** To remove the core plate proceed as follows.

(a) Mount the No. 716A ratchet head on the No. 715A ratchet handle as covered in 3.02(a).

(b) Position the insulated loop of the No. 716A ratchet head behind the core plate with the ratchet rod in line with and against the center core leg as shown in Fig. 8. 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.



**Fig. 8 - 12-Position Relay — Removing Core Plate**

## Removing Coil

3.30 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. 9 to shield adjacent apparatus from solder drippings when removing the coil winding terminals as covered in (c).

(c) **Except 1050-Ohm Coil (coil mounted on copper sleeve):** Use the soldering copper and the long-nose pliers as shown in Fig. 9 to remove the coil winding terminals. Note the holes in the molded mounting bracket of the relay from which the terminals were removed. The coil winding terminals on 1050-ohm coils should not be removed.

(d) Position No. 718A wedges between the armature and upper and lower core legs as shown in Fig. 10. 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 No. 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 in 3.02(a).

(f) **Except 1050-Ohm Coil (coil mounted on copper sleeve):** Position the insulated loop of the No. 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. 10. 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 No. 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 removed from the relay.

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

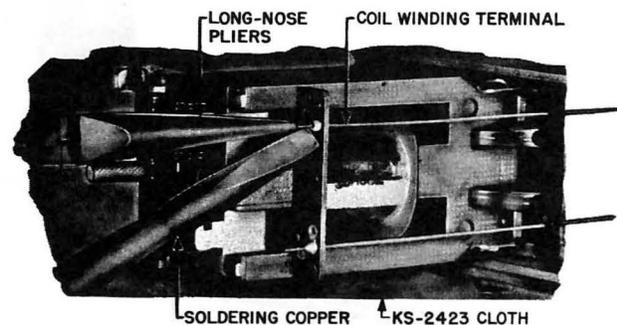


Fig. 9 - 12-Position Relay — Removing Coil Winding Terminals

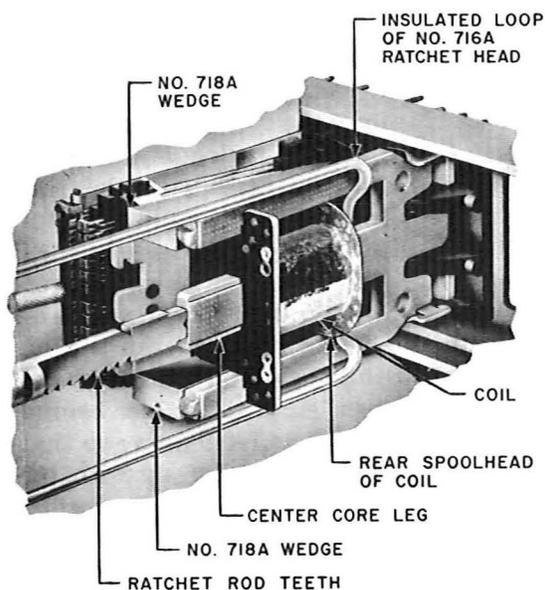


Fig. 10 - 12-Position Relay — Removing Coil

### Mounting New Coil

3.31 To mount the new coil proceed as follows.

(a) From the rear of the relay, insert the terminal guide tubes furnished with the No. 1014A 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) *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 No. 717A coil setter and the 4-ounce riveting hammer until the core leg extends slightly beyond the opening at the front of the coil.

(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 slotted end of the No. 717A coil setter over the center leg of the core as shown in Fig. 11. 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 No. 718A wedges 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.

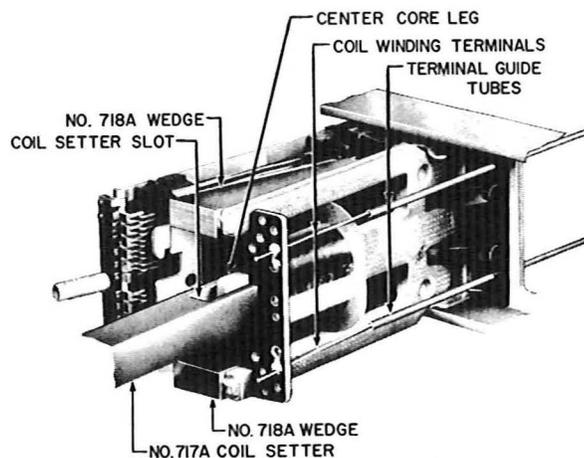


Fig. 11 - 12-Position Relay — Positioning Replacement Coil With No. 717A Coil Setter

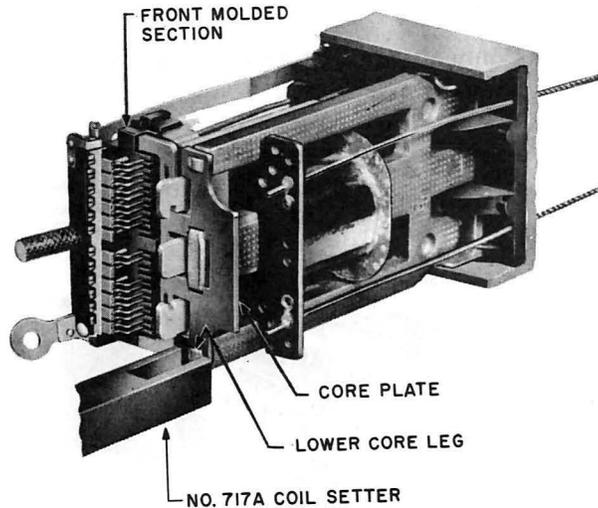
### Mounting New Core Plate

3.32 Make sure that the circuit designation has been stamped on the new core plate as covered in 3.21. Proceed as follows.

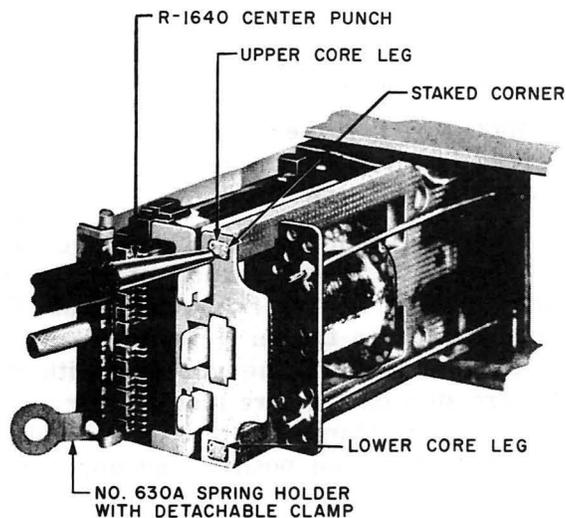
(a) Place the tip of the KS-6320 orange stick against the center portion of the front molded section of the relay and push the molded section to the left. Position the new core plate in front of the core legs with the armature stop on the core plate facing away from the relay. Manually start the core plate on the core legs and position the upper and lower portion of the front molded section against the core plate. Using the No. 717A coil setter and the 4-ounce riveting hammer, gently tap the core plate into position on the core

legs. Fig. 12 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. 13.



**Fig. 12 — 12-Position Relay — Positioning Core Plate With No. 717A Coil Setter**



**Fig. 13 — 12-Position Relay — Staking Core Legs to Secure Core Plate**

## Remounting Card

### 3.33 Applying Spring Holders To Break-Contact Springs

(a) If the relay has break contacts in positions 7 to 12, apply the No. 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 to 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. 7. 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 to 6, apply the No. 629B spring holder between the fixed and break-contact springs as follows. If the No. 629A spring holder was used in positions 7 to 12, insert the notched leg of the No. 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 to 6) on the relay. Swing the outer end of the holder to the right and clip it onto the core plate as shown in Fig. 7. Make sure that each pair of twin springs is engaged by the proper notch in the holder. If the No. 629A spring holder was not used, insert the notched leg of the No. 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 to 6 as covered above.

## Remounting Card and Removing Tools

### 3.34 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 3.19(b) through 3.19(i).

### 3.35 *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 3.20(b) through 3.20(g).

## CARD — 24-POSITION RELAY

3.36 Remove the contact cover.

### Stamping Relay Code on New Card

3.37 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

3.38 Disengage the balancing spring legs from the card as follows. Block the relay operated, using the KS-16887, L1 wedge. Holding the No. 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. 4 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 to 12. Lift the

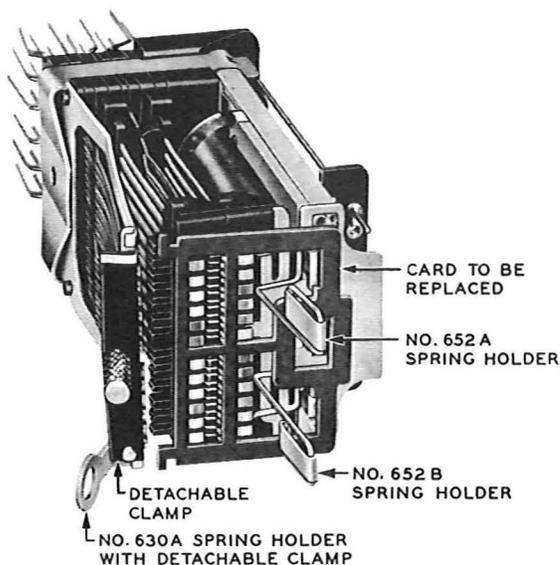
spring upward with the spring lifter and at the same time press the card downward with the orange stick. When the spring clears the top of the card, move it toward the left so that it is free of the card. Withdraw the spring lifter. When removing the lower leg of the spring, the procedure is the same 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

3.39 *Positions 13 to 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 No. 652A spring holder in positions 19 to 24 (upper 6 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. 14. Position the No. 652B spring holder against the movable springs in positions 13 to 18 following the same procedure.

3.40 *Positions 1 to 12:* Insert the No. 630A spring holder without the clamp between the contact springs in positions 1 to 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. 14.)



**Fig. 14 — 24-Position Relay — Card Removal Tools Mounted in Place**

#### Removing Card

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

#### Mounting New Card and Removing Tools

**3.42** 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 to 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.

**3.43** Carefully move the No. 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.

**3.44** Remove the No. 652A and 652B spring holders as follows. Disengage the holder from the 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.

**3.45** 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.

**3.46** Block the relay operated with the KS-16887, L1 wedge. 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

**3.47** 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 3.21.

**3.48** Remove the contact cover.

#### Removing Card

**3.49** Remove the card as covered in 3.38 through 3.41.

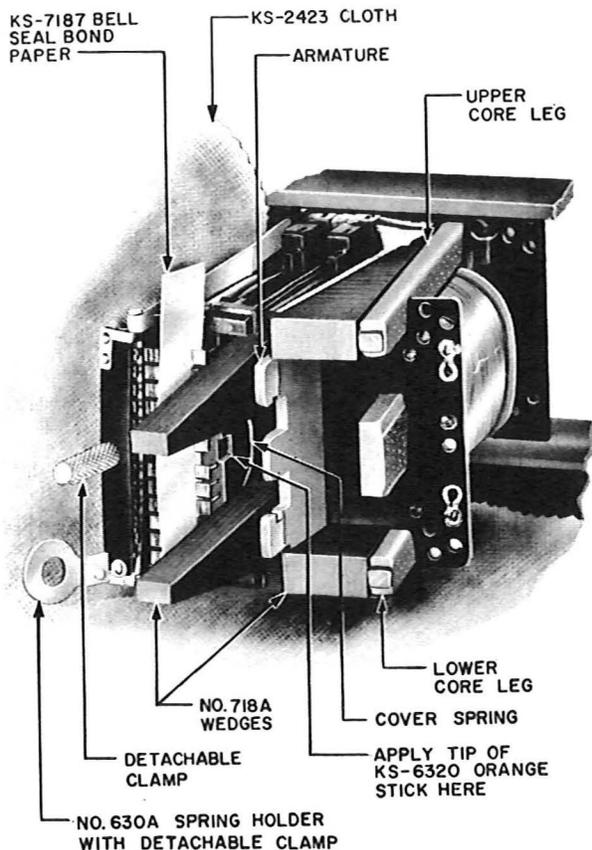
#### Removing Core Plate

**3.50** Before removing the core plate from the relay, insulate the contacts and remove the No. 652A and 652B 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 to 24) by inserting a KS-7187 Bell Seal Bond Paper vertically between the movable and fixed contacts as shown in Fig. 15.

(c) To remove the No. 652A and 652B 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 3.29.



**Fig. 15 - 24-Position Relay — Coil Removal Tools Mounted in Place**

### Removing Coil

**3.51** Remove the coil winding terminals, insert the No. 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 3.30(a), (b), and (c).

(b) Insert two No. 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. 15) 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 the figure, 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 No. 718A wedges between the armature and core legs as covered in 3.30(d) and as shown in Fig. 15.

(d) Remove the coil as covered in 3.30(e), (f), and (h).

**3.52** *Mounting New Coil:* Mount the new coil as covered in 3.31.

**3.53** *Mounting New Core Plate:* Mount the new core plate as covered in 3.32.

### 3.54 Remounting Card

(a) Insert the straight end of the No. 652A spring holder behind the movable contacts in positions 19 to 24 (upper 6 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. 14. Similarly, position the No. 652B spring holder behind the movable springs in positions 13 to 18 from below.

(b) Remount the card, remove the tools, and remount the contact cover as covered in 3.42 through 3.46.

(c) If covers were removed from adjacent relays, remount their contact covers.

**SECTION A507.211**

**REASONS FOR REISSUE**

1. To revise Fig. 1, 2, and 4.
2. To revise Tables A and B.
3. To add Tables C and D.
4. To revise the list of tools.
5. To add Fig. 3.
6. To add information on No. 1014A tool kit (3.02).
7. To omit the No. 627A armature blocking tool and to substitute the KS-16887, L1 wedge wherever specified in the section.
8. To add procedures for replacing coil of 12-position relays (3.21 through 3.35).
9. To add Fig. 7 through 13.
10. To add procedures for the coil of 24-position relays (3.47 through 3.54).
11. To add Fig. 15.