RELAYS

286, 287, AND 288 TYPES

PIECE-PART DATA AND REPLACEMENT PROCEDURES

1. GENERAL

1.01 This section covers the information necessary for ordering parts to be used in maintenance of 286-, 287-, and 288-type relays. It also covers approved procedures for replacing these parts using either the 1012A or 1014B tool kit. It also covers the use of the KS-20558 L1 tool kit in the replacement of a defective half of a 287- or a 288-type relay.

1.02 This section is reissued to incorporate the information contained in the addendum, to add two new codes to Table A, to add a new 1.06, and to revise the List of Tools and Materials.

1.03 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. No attempt should be made to replace parts not designated. Part 2 also contains explanatory figures showing the different parts.

1.04 Part 3 of this section covers approved procedures for the replacement of the parts listed in Part 2. It also covers the procedures for replacing the defective half of a 287- or 288-type relay.

1.05 ***D-179985 Relay:*** The D-179985 relay is a modified 287B relay. The replacement procedures for the 287-type relay also apply to the D-179985 relay.

1.06 ***D-180441 Relay:*** The D-180441 relay is a modified 287A relay. The replacement procedures for the 287-type relay also apply to the D-180441 relay.

1.07 The procedure for the replacement of a defective half of a 287-type relay also applies to a 288-type relay.

1.08 If practicable, remove the circuit from service before making any replacements on the apparatus covered herein.

1.09 Initially, the 1012A tool kit was provided for replacing parts of 286-, 287-, and 288-type relays. Subsequently, the 1014A tool kit used for replacing parts of AF-, AG-, AJ-, and AK-type relays was modified by the addition and replacement of the following tools:

- Additional Tools:

  666B core plate replacer

  674A spring lifter

  P-16A068 container holding six 669A contact separators

- Replaced Tools:

  717A coil setter replaced by 717B

  20A carrying case replaced by 20B

The modified tool kit, which is coded 1014B, supersedes the 1014A and can be used for replacing parts of all wire-spring relays. The 1012A tool kit will not be furnished in the future, but its individual tools will be available as replacements.

1.10 Replacement procedures covering the use of the 1012A tool kit are given in 3.01 through 3.32; procedures covering the use of the 1014B tool kit are given in 3.33 through 3.50; and procedures covering the use of the KS-20558 L1 tool kit are given in 3.51 through 3.83.

1.11 Some relays of types covered by this section have been purchased from companies other than Western Electric. These may be identified by corporate trademarks molded into the covers and stamped on the relays. Part designation numbers stamped on individual piece parts in these relays may not always correspond to numbers referenced in this section. Therefore, when piece-part replacements are necessary, an equivalent

Western Electric-made relay should be examined to determine the pertinent part numbers.

1.12 ◗The material of the plastic cover P-19A162 is made from a flame-retardant, water-white, transparent polycarbonate. The replacement date is governed by the depletion date of the formerly used material with no change in the part number. All new relays will be equipped with a cover of the new-type material.◖

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 apparatus. The piece-part numbers are given with the names of the parts as listed by the Western Electric Company Merchandise Department.

2.02 Information enclosed by parentheses ( ) is not ordering information. This information may be references to notes, parts referred to in other portions of the section and not considered replaceable, or part names in general use in the field if these names differ from those assigned by the manufacturer.

2.03 When ordering piece parts for replacement purposes, give both the number and name of the piece parts; for example, P-16A091 coil assembly. Do not refer to the BSP number.

3. REPLACEMENT PROCEDURES

REPLACEMENT PROCEDURES USING 1012A TOOL KIT

3.01 ***List of Tools and Materials***

CODE OR SPEC NO. TOOLS	DESCRIPTION
102	3/8-inch single-end socket wrench
532B	Adjuster
1012A	Tool kit (includes the following)

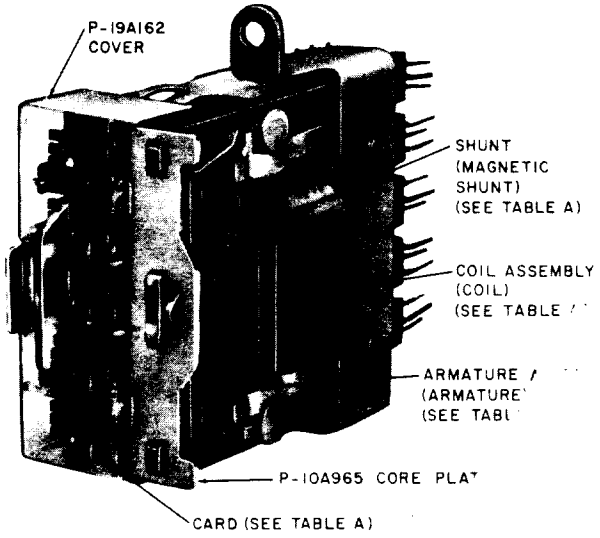

Fig. 1—◗286-Type Relay◖

CODE OR SPEC NO. TOOLS	DESCRIPTION	AMT
	1 19A carrying case containing:	
	1 665A bridge (used with 287- and 288-type relays only)	
	1 665B bridge (used with 286-type relay only)	
	1 666A core plate replacer	
	1 667A coil positioner	
	1 668A coil remover	
	6 669A contact separators	
	1 674A spring lifter	
	1 P-16A068 container (for 669A contact separators)	
KS-6320	Orange stick	

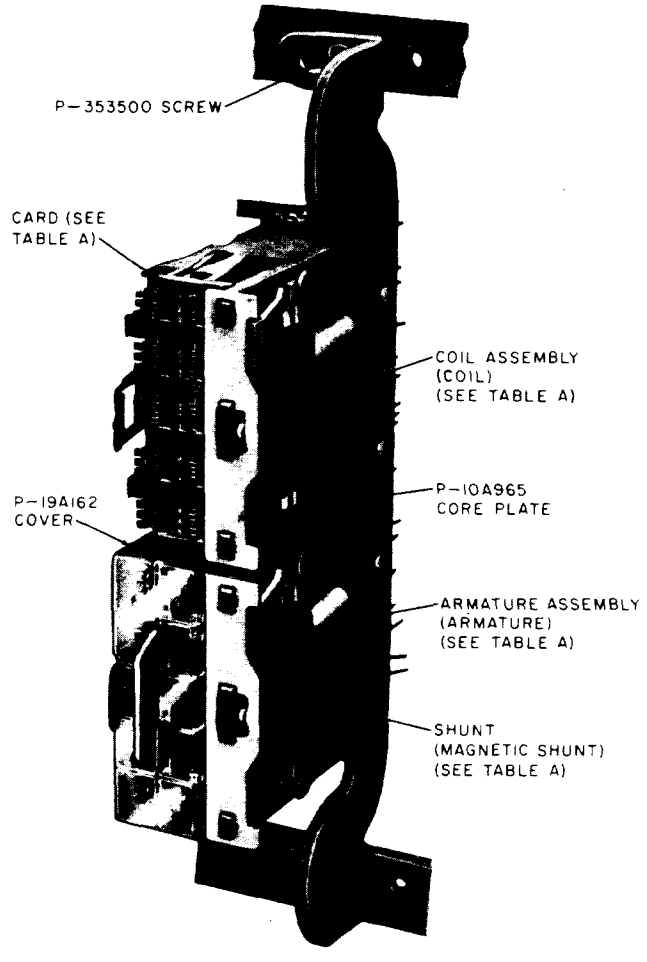

Fig. 2—287- and 288-Type and D-179985 Relays (Upper Contact Cover Removed)

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
R-1640	Center punch
R-2315	Lettering and numbering set
♦AT-7860	B long-nose pliers♦
—	6-inch C screwdriver
—	4-ounce riveting hammer
MATERIALS	
KS-2423	Cloth
KS-14666	Cloth

3.02 Figure 3 shows the tools comprising the 1012A tool kit used in replacing parts of the 286-, 287-, and 288-type relays. The 665B bridge is used on the 286-type relay and the 665A bridge on the 287- and 288-type relays.

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 the relay, the part or parts replaced shall meet the readjust requirements involved as specified in Section 040-272-701. 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.

286-TYPE RELAY

General

3.05 Remove the cover from the relay to be worked on and from the relay in the adjacent position to the right if this position is equipped. Do not remove the covers from any other relays.

3.06 Before proceeding with removal of parts, insert a 669A contact separator between the fixed and movable contact springs in both vertical rows as follows. Hold the contact separator with the hook portion at the left, as shown in Fig. 4, and carefully insert the tip behind the card and between the fixed and movable contact springs in one of the vertical rows. Then place the end of the KS-6320 orange stick so it bears lightly against both the right edge of the separator and the adjacent edge of the card to guide the separator during insertion. Slowly insert the separator while maintaining light pressure on the orange stick. Keep the separator vertical so the springs will remain in their proper horizontal positions and move the separator downward until the hook portion engages the upper fixed contact springs. Similarly, insert another contact separator between the fixed and movable contact springs in the other vertical row. Figure 4 shows one contact separator fully inserted and the other contact separator partially inserted.

3.07 After replacement of parts has been completed, carefully remove the contact separators, taking care to keep them in a vertical position while removing them. Check that the movable contact springs lie in the grooves which properly

TABLE A

RELAY CODE NO.	COIL ASSEMBLY PART NO. #	CARD PART NO.	ARMATURE ASSEMBLY PART NO.	SHUNT PART NO.	CORE PLATE PART NO.
286A	P-16A091	P-15A397	P-15A408	—	
286B	P-16A092	P-15A397	P-15A408	—	
286C	P-16A093	P-15A398*	P-15A409	P-10A971	
286D	P-16A094	P-15A398*	P-15A409	P-10A971	
286E	P-16A095	P-15A397	P-15A408	—	
286F	P-16A092	P-15A397	P-15A408	—	
286G	P-16A091	P-15A397	P-15A408	—	
286H	P-16A092	P-15A397	P-15A408	—	
286J	P-16A093	P-15A398*	P-15A409	P-10A971	
286K	P-16A094	P-15A398*	P-15A409	P-10A971	
286L	P-16A095	P-15A397	P-15A408	—	
286M	P-16A092	P-15A397	P-15A408	—	
286N	P-16A091	P-15A397	P-15A409	—	
287A	P-16A094	P-15A398*	P-15A409	P-10A971	See Note
287B	P-16A093	P-15A398*	P-15A409	P-10A971	
287C	P-16A092	P-15A397	P-15A408	—	
287D	P-16A691	P-15A397	P-15A408	—	
287E	P-16A094	P-15A398*	P-15A409	P-10A971	
287F	P-16A093	P-15A398*	P-15A409	P-10A971	
287G	P-16A092	P-15A397	P-15A408	—	
287H	P-16A091	P-15A397	P-15A408	—	
287J	P-16A094	P-15A398*	P-15A409	—	
D-179985 (modified 287B)	P-16A091	P-15A397	P-15A408	—	
D-180441 (modified 287A)	P-16A092	P-15A397*	P-15A408	—	
288A	P-16A094	P-15A398*	P-15A409	P-10A971	
288C	P-16A094	P-15A398*	P-15A409	P-10A971	

#The part number stamped on the replaced coil includes the core which is not required for replacement. This number should be ignored.

*"R" stamped on card.

Note: Core plate P10A965 used on all codes.

position their contacts with respect to the associated fixed contacts. Check for this condition as covered in Section 040-272-701. Remount the relay covers which were removed.

Coil

3.08 ***Removing Core Plate:*** Remove the core plate as follows. Place the 666A core plate replacer on the relay so the grooves in the tool fit over the sides of the core plate with the thumb nuts at the right, as shown in Fig. 5. Tighten the thumb nuts so the replacer firmly engages the core plate. Turn the spindle of the replacer clockwise until the core plate is free of the core and remove the replacer and core plate. Do not remove the core plate from the core plate replacer.

3.09 ***Removing Armature:*** With the KS-6320 orange stick, lift one of the armature hinge

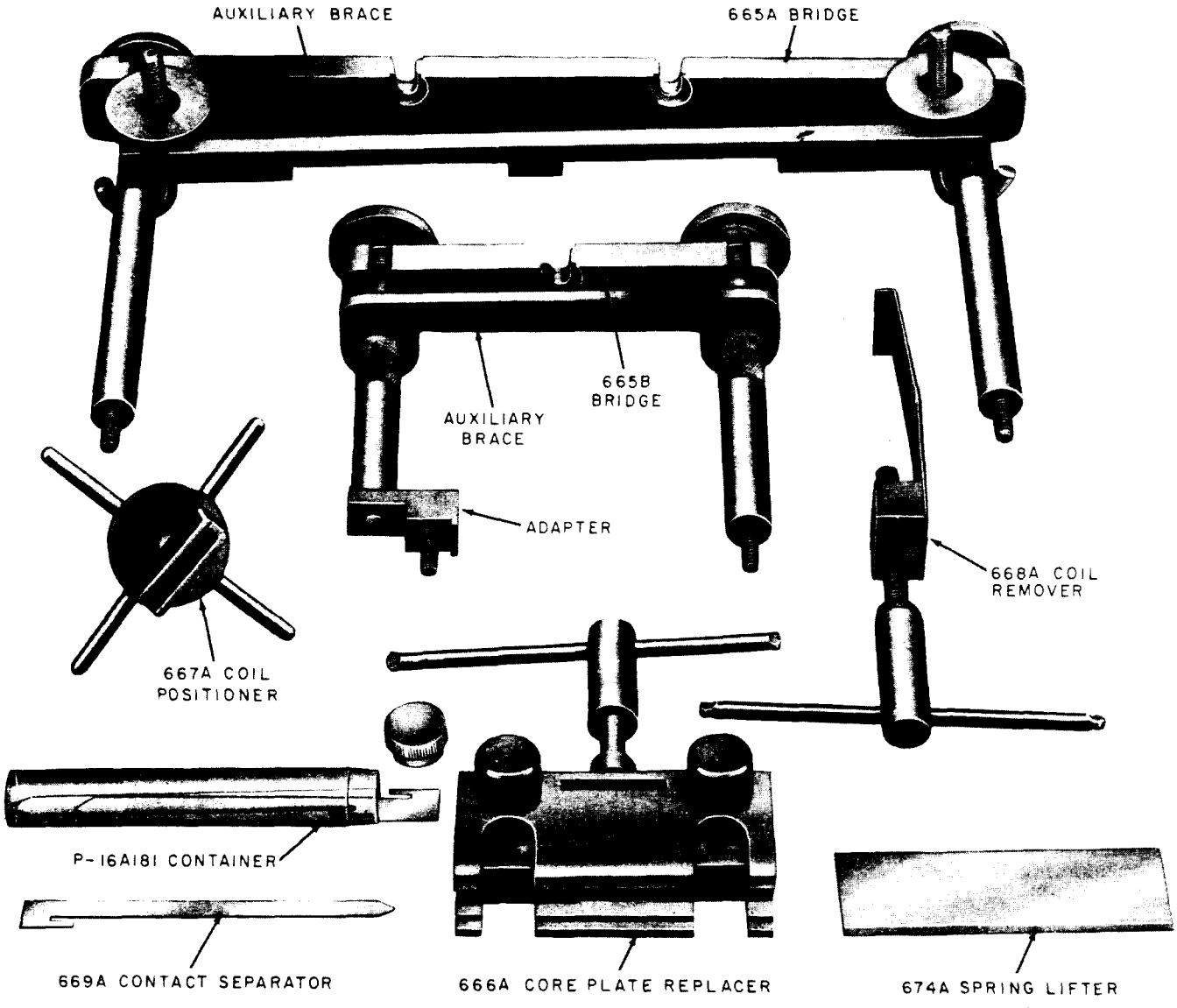

Fig. 3—Tools Included in 1012A Tool Kit

springs just enough to remove the armature from under the spring. Then lift the other spring in the same manner and remove the armature from the relay.

3.10 ***Removing Card:*** Remove the card as follows. Place the 674A spring lifter against the right side of the cover spring and ends of the balancing spring legs with the bevel toward the card. Hold the card toward the right with the KS-6320 orange stick and move the spring lifter slightly to the left to disengage the balancing spring legs from the card. Then insert the spring lifter between the adjusting lugs and the cover spring and balancing spring legs until the outer edge of the lifter is in line with the outer edge of the cover spring, as shown in Fig. 6. Remove the pressure against the card by moving the spring lifter to the left with the left hand. Then grasp the card between the thumb and forefinger, as shown in Fig. 6, and carefully remove the card.

3.11 ***Removing Coil:*** Remove the coil as follows.

(1) Tag, unsolder in the case of soldered connections, and unwrap the leads to the

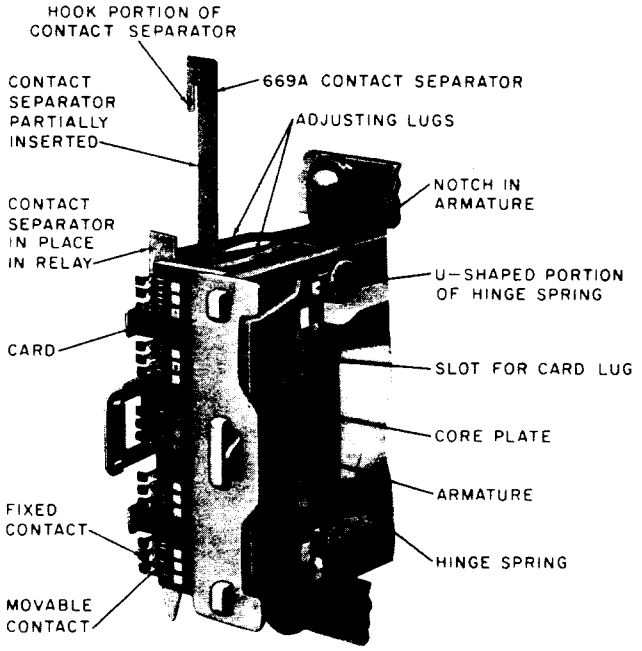

Fig. 4—286-Type Relay—Positioning 699A Contact Separator

terminals of the coil to be replaced. Remove any lumps of solder remaining on the terminals. Place a KS-2423 cloth under the relay to shield adjacent apparatus from solder drippings while unsoldering the leads.

(2) If the relay has a magnetic shunt mounted on the core (see Fig. 1), remove the shunt as follows. Note the position of the shunt on the core in order to ensure proper remounting of the shunt. Using the ◗B◖ long-nose pliers, alternately grasp the horizontal portion of the upper and lower legs of the shunt and carefully pull the shunt straight forward on the core. Avoid turning the pliers.

(3) If any apparatus is mounted at the rear of the frame on a relay mounting screw, remove the nut and washer using the 102 socket wrench and remove the apparatus. Then remove the top relay mounting screw with the 6-inch C screwdriver. Screw the short-threaded end of the longer stud or the 665B bridge into the hole from which the relay mounting screw was removed. Remove the lower mounting screw and mount the adapter of the bridge below the relay by screwing the captive screw of the

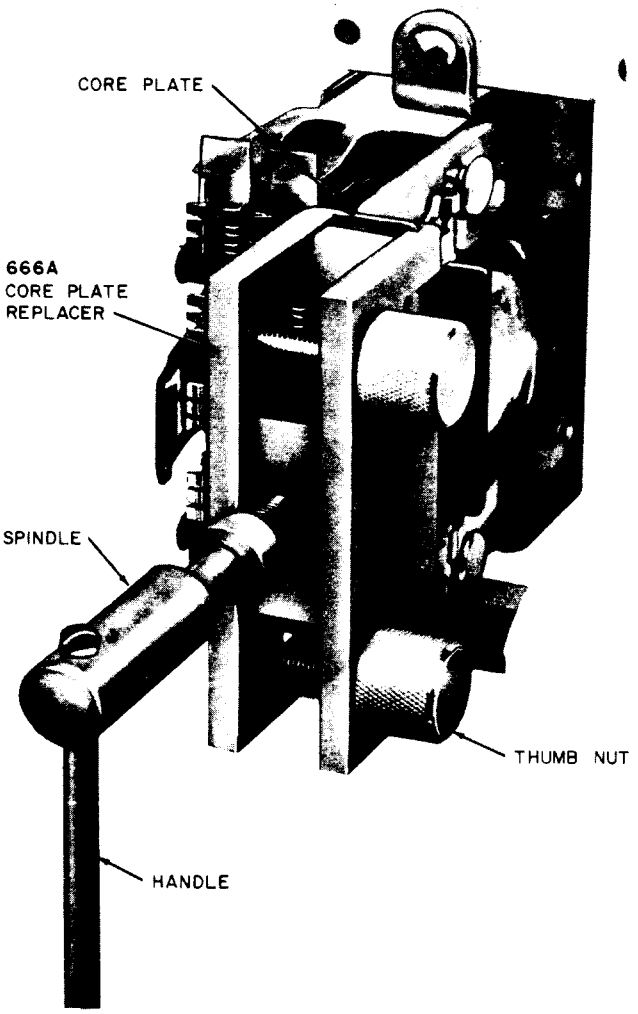

Fig. 5—286-Type Relay Removing Core Plate

adapter into the hole from which the mounting screw was removed. Mount the adapter in a horizontal position with the offset portion to the right of the screw and the screw hole for the stud in vertical alignment with the upper stud. Screw the short-threaded end of the shorter stud of the 665B bridge into the screw hole in the adapter. Start a thumb nut on the end of each of the studs.

(4) Turn the spindle of the 668A coil remover so the inner end of the screw is flush with the inner surface of its mounting. Insert the coil remover at the right of the relay so the hook portion of the remover is above the rear spoolhead of the relay. Then lower the coil

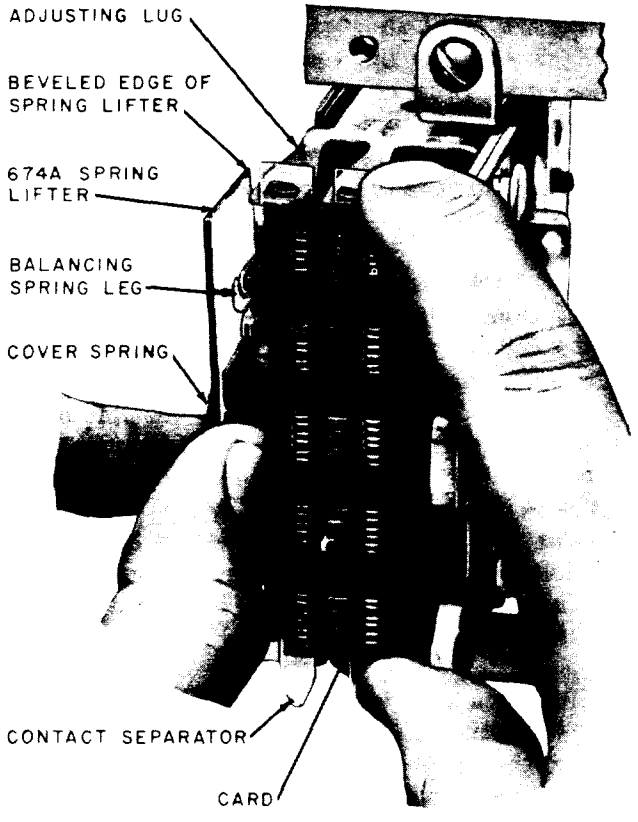

Fig. 6—286-Type Relay Inserting 674A Spring Lifter

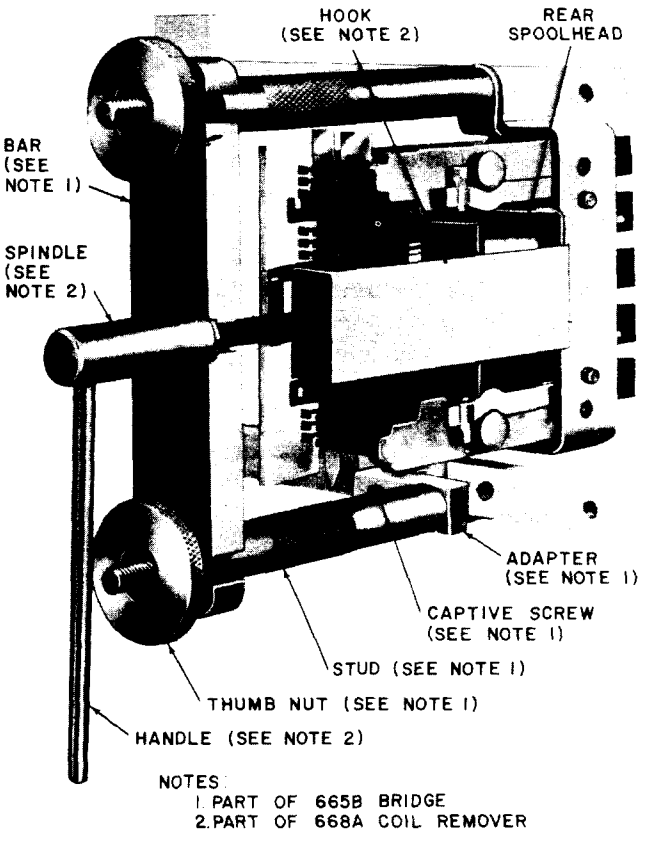

Fig. 7—286-Type Relay Removing Coil

remover so the hook is behind the rear spoolhead, as shown in Fig. 7. Position the bar of the bridge on the studs with the end of the bar marked TOP uppermost and with the center notch in the bar engaging the spindle of the coil remover. Securely tighten the thumb nuts against the bar of the bridge. Press against the right side of the coil remover to obtain maximum possible engagement of the hook portion with the rear spoolhead and turn the spindle of the remover clockwise until the coil is loose on the core. Loosen the bridge thumb nuts and remove the bar from the studs. Remove the coil remover and then remove the coil.

Note: If the rear spoolhead breaks while following the above procedure, remove the coil as covered in (5).

(5) ***Removing Coil With Broken Spoolhead:*** Place a KS-14666 cloth over any apparatus directly below the relay being worked on. Loosen the bridge thumb nuts and remove the bar from the studs of the 665B bridge. If the relay has a magnetic shunt mounted on the core, remove the shunt as follows. Using the ◆B◆ long-nose pliers, alternately grasp the horizontal portion of the upper and lower legs of the shunt and carefully pull the shunt straightforward on the core. Avoid twisting the pliers. Grasp the front spoolhead across its width with the pliers and attempt to loosen the coil on the core. If the coil cannot be loosened in this way, break the spoolhead with the 532B adjuster by applying the slot in the adjuster to the spoolhead at a number of points around its edge. Remove the spoolhead in sections. Then manually pull the coil from the core, prying it loose, if necessary, with the KS-6320 orange stick.

3.12 ***Mounting Coil:*** Mount the coil as follows.

(1) Manually start the new coil on the core with the coil terminals at the rear and to the left of the core. Make sure the terminals enter

the associated slots at the rear of the relay. If the terminals do not enter the slots, bend them at their base so they will enter.

(2) Place the hub of the 667A coil positioner on the screw of the positioner with the shoulder of the hub toward the outer end of the screw. Turn the hub on the screw as far as possible. Place the rectangular shell of the coil positioner on the outer end of the core. Position the bar of the 665B bridge on the studs with the end of the bar marked TOP uppermost and with the screw of the coil positioner passing through the center notch in the bar. Securely tighten the thumb nuts against the bar. Turn the hub of the coil positioner counterclockwise until the shoulder of the hub seats in the center notch of the bar, as shown in Fig. 8.

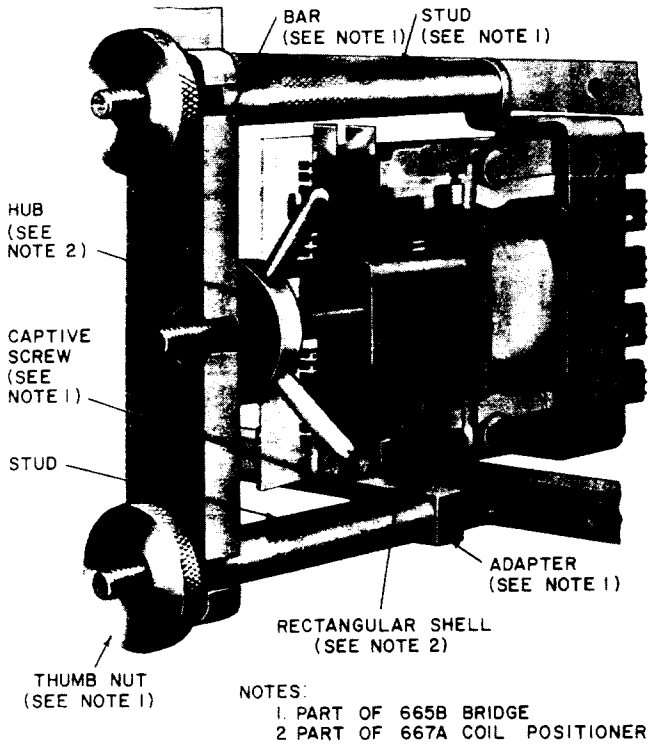

Fig. 8—286-Type Relay Mounting Coil

(3) Continue to turn the hub counterclockwise until the inner end of the rectangular shell butts on the shoulders of the core. This properly positions the coil on the core. Turn the hub clockwise to disengage the coil positioner from the core and remove the positioner.

Caution: To avoid damaging the relay, turn the hub of the coil positioner slowly as soon as the coil starts to drag on the core. Stop exerting torque on the hub as soon as the rectangular shell of the positioner comes into contact with the shoulders of the core. This point may be judged by feel.

(4) If the relay is provided with a magnetic shunt, place the shunt on the core against the coil with the upper and lower legs of the shunt toward the front end of the core and the vertical portion of the legs to the left of the core. If necessary, use the ◗B◖ long-nose pliers to hold the shunt while placing it on the core. Check that the upper and lower legs of the shunt clear their adjacent legs of the core by 1/32-inch minimum. If necessary, remove the shunt and bend the legs with the ◗B◖ long-nose pliers to obtain this clearance.

(5) Place the rectangular shell of the coil positioner on the outer end of the core. Turn the hub of the coil positioner counterclockwise until the shoulder of the hub seats in the center notch of the bar. Continue to turn the hub counterclockwise until the magnetic shunt is positioned against the shoulder of the core. Turn the hub clockwise to disengage the coil positioner from the core and remove the positioner. Check that the shunt is not loose on the core by pulling gently on it with the ◗B◖ long-nose pliers. If the shunt is loose, replace it with a new one using the coil positioner as described above.

3.13 ***Mounting Card:*** Mount the card as follows. Loosen the thumb nuts and remove the bar from the 665B bridge. Remove the bridge studs. Hold the card between the thumb and forefinger, as shown in Fig. 6, with the surface of the card having recesses toward the relay and the larger rectangular openings in the card toward the left. Place the thumb of the other hand against the right side of the 674A spring lifter which was previously positioned on the relay (3.10). While pushing the spring lifter to the left, insert the card through the gaps between the contacts. Remove the spring lifter. Position the card so the balancing spring legs engage the associated lugs of the card.

3.14 ***Mounting Armature:*** Using the KS-6320 orange stick, successively lift the top and bottom armature hinge springs just enough to insert

the armature under these springs. Insert the armature under the springs with the armature stop plate toward the core. Then position the armature so the U-shaped portion of each hinge spring engages its associated notch in the armature, as shown in Fig. 4. Make sure both hinge springs fully engage the armature by pushing against the U-shaped portion with the orange stick. Position the card so the card lugs engage the associated slots in the armature.

3.15 ***Mounting Core Plate:*** Mount the core plate as follows.

(1) Suspend the brace of the 665B bridge on the longer bridge stud with the longitudinal section of the brace at the right, as shown in Fig. 9. Then partially screw the stud into the upper mounting hole of the relay. Insert the other stud of the bridge through the other hole in the brace. Partially screw this stud into the adapter. Position the brace on the studs so it is in line with the relay card and then tighten both studs. The brace limits the lateral strain on the relay during mounting of the core plate. Position the bar of the bridge on the studs with the end of the bar marked TOP uppermost and the notches of the bar at the right. Securely tighten the thumb nuts against the bar.

(2) Slightly loosen the thumb nuts of the core plate replacer so the core plate which was left in the replacer (3.08) may shift, as required, for proper assembly on the core legs. Hold the replacer with the thumb nuts at the right. Position the replacer on the relay so the slots in the core plate are in line with their associated legs of the core, the armature extends through the outer hole in the core plate, and the spindle of the replacer is in the center notch of the bridge bar as shown in Fig. 9. Turn the spindle of the replacer counterclockwise until the core plate butts on the shoulders of the top and bottom core legs.

Caution: To avoid damaging the relay, turn the spindle of the core plate replacer slowly. Stop exerting torque on the spindle as soon as the core plate is seated against the shoulders of the core legs.

(3) Relieve the pressure of the core plate replacer spindle on the bridge bar by backing off the spindle slightly. Loosen the thumb nuts on

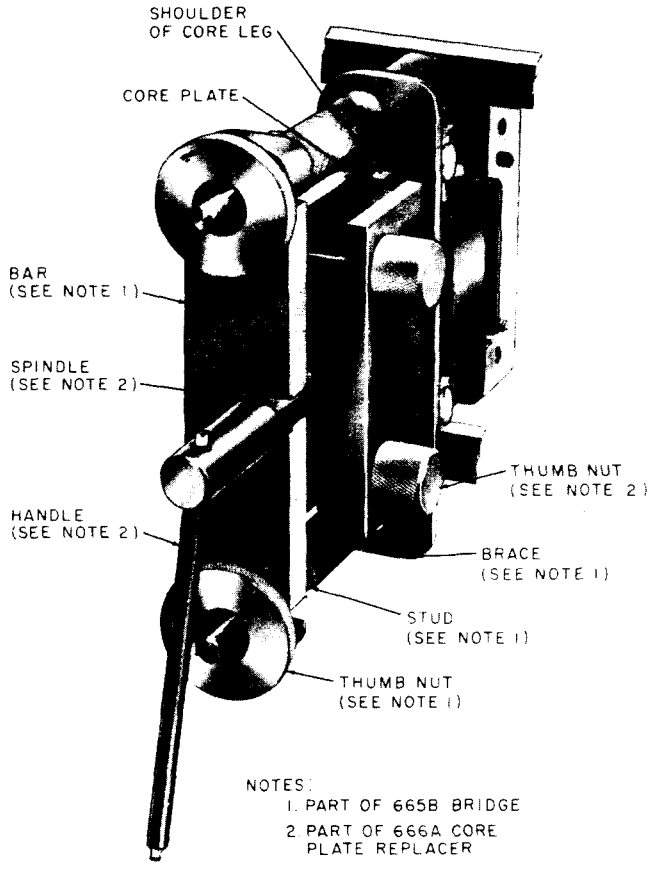

Fig. 9—286-Type Relay Mounting Core Plate

the bridge and remove the bar. Loosen the thumb nuts on the core plate replacer and remove the replacer.

(4) Remove the bridge studs. Remove the bridge brace, turning it 90 degrees if the position adjacent to the relay is equipped. Remount the top mounting screw. Remove the adapter. Remount the bottom mounting screw. Securely tighten the mounting screws.

(5) Using the R-1640 center punch and the 4-ounce riveting hammer, stake the upper surface of the top and bottom core legs to secure the core plate as shown in Fig. 10.

(6) If any apparatus was mounted at the rear of the frame on a relay mounting screw, remount the apparatus with washer and securely tighten the mounting nut. Reconnect and solder the leads to the coil. Remove the contact

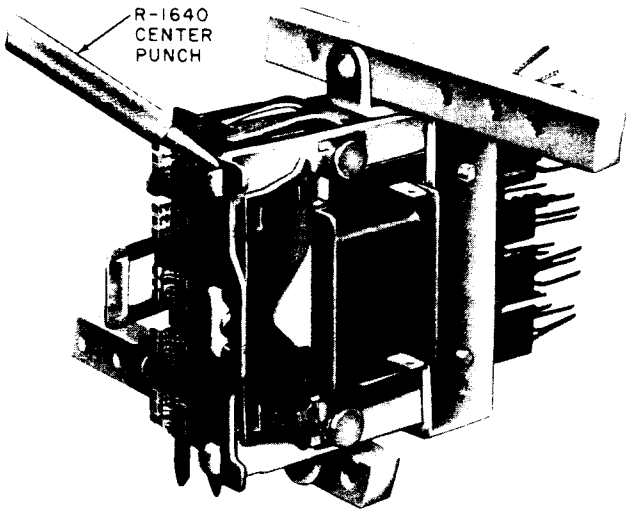

Fig. 10—Staking Core Legs to Secure Core Plate

separators and remount the covers in accordance with 3.07.

Core Plate

3.16 Replace the core plate as follows.

(1) Remove the core plate from the relay as covered in 3.08. Remove the core plate from the core plate replacer.

(2) Position the new core plate in the core plate replacer so the surface of the plate on which the holes are chamfered (edges not sharp) is outermost, the hole in the plate for the armature is toward the thumb nuts, and the sides of the plate are in the grooves of the core plate replacer. Turn the thumb nuts of the replacer clockwise so the core plate is loosely held in the replacer to permit slight shifting of the plate during mounting on the core.

(3) Mount the core plate on the relay as covered in 3.15.

(4) If the replaced core plate had stamped designations on it, stamp the same designations on the new core plate using the R-2315 lettering and numbering set.

Armature (Nickel-Silver Core Plates Only)

3.17 Replace the core plates as follows.

(1) Remove the core plate as described in 3.08. Remove the armature as described in 3.09. Mount the new armature as described in 3.14 and mount the core plate as described in 3.15.

(2) ***Aluminum Core Plates:*** Obtain a 717B tool and follow the procedure described in 3.47.

Card

3.18 Remove the core plate and armature as described in 3.08 and 3.09. Remove the card as described in 3.10. Mount the new card as described in 3.13. Mount the armature and core plate as described in 3.14 and 3.15.

287- AND 288-TYPE RELAYS

General

3.19 Remove the covers from the relay to be worked on and from the relay in the adjacent position to the right if this position is equipped. Do not remove the cover from any other relay. When working on a lower unit of a relay having a 245-, 254-, 263-, or 264-type relay adjacent at the left, make busy the relay at the left if practicable.

3.20 Before proceeding with the removal of parts, insert a 669A contact separator between the fixed and movable contact springs in both vertical rows of the relay unit to be worked on as follows. Hold the contact separator with the hook portion at the left and carefully insert the tip behind the card and between the fixed and movable contact springs in one of the vertical rows in a manner similar to that shown in Fig. 4. Then place the end of the KS-6320 orange stick so it bears lightly against both the right edge of the separator and the adjacent edge of the card to guide the separator during insertion. Slowly insert the separator while maintaining light pressure on the orange stick. When working on the top unit, insert the separator from the top and, when working on the bottom unit, insert the separator from the bottom. Keep the separator vertical so the springs will remain in their proper horizontal positions and move it downward or upward, as required, until

the hook portion engages the upper or lower fixed contact springs. Take care to avoid separating any contacts of the other unit on the relay. Similarly, insert another contact separator between the fixed and movable contact springs in the other vertical row. When working on a lower unit of a relay having a 245-, 254-, 263-, or 264-type relay adjacent at the left, insert the separators only far enough to separate all contacts in the row. If the separators are fully inserted, difficulty may be encountered in removing them.

3.21 After replacement of parts has been completed, carefully remove the contact separators taking care to keep them in a vertical position while removing them. Check that the movable contact springs lie in the comb grooves which properly position their contact with respect to the associated fixed contacts. Check for this condition as covered in Section 040-272-701. Remount the relay covers which were removed.

Coil

3.22 ***Removing Core Plate:*** Remove the core plate as follows. Place the 666A core plate replacer on the relay unit so the grooves in the tool fit over the sides of the core plate with the thumb nuts at the right in a position similar to that shown in Fig. 5. Tighten the thumb nuts so the replacer firmly engages the core plate. Turn the spindle of the replacer clockwise until the core plate is free of the core and remove the replacer and core plate. Do not remove the core plate from the core plate replacer.

3.23 ***Removing Armature:*** With the KS-6320 orange stick, lift one of the armature hinge springs just enough to remove the armature from under the spring. Then lift the other spring in the same manner and remove the armature from the relay unit.

3.24 ***Removing Card:*** Remove the card as follows. Place the 674A spring lifter against the right side of the cover spring and ends of the balancing spring legs with the bevel toward the card. Move the spring lifter slightly to the left to disengage the balancing spring legs from the card. Then insert the spring lifter between the adjusting lugs and the cover spring and balancing spring legs until the outer edge of the lifter is in line with the outer edge of the cover spring in a position similar to that shown in Fig. 6. Remove the pressure against the card by moving the spring lifter to the left with the left hand. Then grasp the card between the thumb and forefinger and carefully remove the card.

3.25 ***Removing Coil:*** Remove the coil as follows.

(1) Tag, unsolder in the case of soldered connections, and unwrap the leads to the terminals of the coil to be replaced. Remove any lumps of solder remaining on the terminals. Place a KS-2423 cloth under the relay to shield adjacent apparatus from solder drippings while unsoldering the leads.

(2) If the relay has a magnetic shunt mounted on the core (see Fig. 2), remove the shunt as follows. Note the position of the shunt on the core in order to ensure proper remounting of the shunt. Using the ◗B◖ long-nose pliers, alternately grasp the horizontal portion of the upper and lower legs of the shunt and carefully pull the shunt straightforward on the core. Avoid turning the pliers.

(3) Remove the top relay mounting screw with the 6-inch C screwdriver. Screw the short-threaded end of one of the studs of the 665A bridge into the hole from which the relay mounting screw was removed. Remove the lower mounting screw. Screw the short-threaded end of the other stud of the 665A bridge into the hole from which the screw was removed. Start a thumb nut on the end of each of the studs.

(4) Turn the spindle of the 668A coil remover so the inner end of the screw is flush with the inner surface of its mounting. Insert the coil remover at the right of the relay so the hook portion of the remover is above the rear spoolhead of the coil in the case of the upper unit or below the rear spoolhead in the case of the lower unit. If there is sufficient clearance, move the coil remover so the hook is behind the rear spoolhead as shown in Fig. 11. If there is insufficient clearance, remove the coil as covered in (5). If the hook of the remover can be placed behind the spoolhead, position the bar of the bridge on the studs with the end of the bar marked TOP uppermost and with the proper notch in the bar engaging the spindle of the coil remover. While holding the bar against the ends of the studs, shift the bar so, with

the coil remover properly positioned on the spoolhead, the screw of the remover rests against the inner end of the notch in the bar and is perpendicular to the front of the bar. Securely tighten the thumb nuts against the bar. Press against the right side of the coil remover to obtain maximum possible engagement of the hook portion with the rear spoolhead and turn the spindle of the remover clockwise until the coil is loose on the core. Loosen the bridge thumb nuts and remove the bar from the studs. Remove the coil remover and then remove the coil.

Note: If the rear spoolhead breaks while following the above procedure, remove the coil as covered in (5).

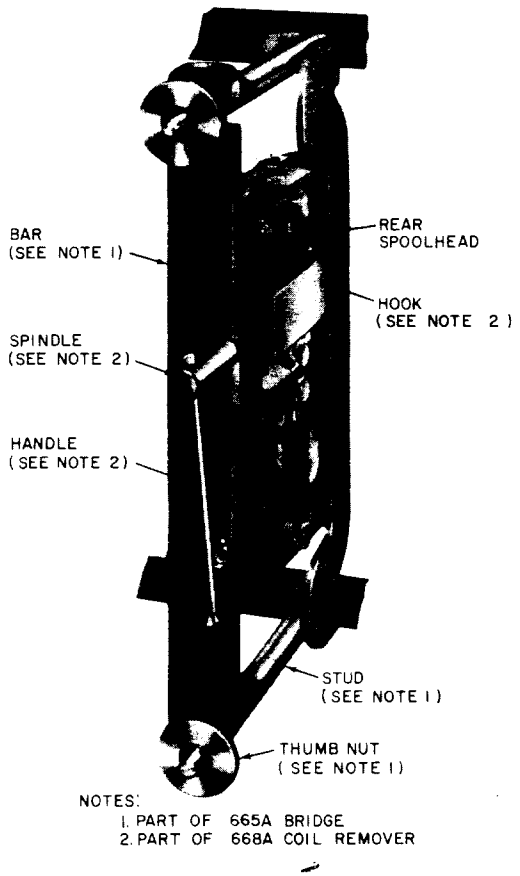

Fig. 11—287- and 288-Type Relays Removing Coil

(5) ***Removing Coil Where There Is Insufficient Clearance to Use Coil Remover or Where the Rear Spoolhead Breaks:*** Place a KS-14666 cloth over any apparatus directly below the relay to be worked on. Also place a KS-2423 cloth over the lower unit on the relay if the upper unit is to be worked on. Loosen the bridge thumb nuts and remove the bar from the studs of the 665A bridge. If the relay has a magnetic shunt mounted on the core, remove the shunt as follows. Using the ◗B◖ long-nose pliers, alternately grasp the horizontal portion of the upper and lower legs of the shunt and carefully pull the shunt straightforward on the core. Avoid turning the pliers. Grasp the front spoolhead across its width with the pliers and attempt to loosen the coil on the core. If the coil cannot be loosened in this way, break the spoolhead with the 532B adjuster by applying the slot in the adjuster to the spoolhead at a number of points around its edge. Remove the spoolhead in sections. Then manually pull the coil from the core, prying it loose, if necessary, with the KS-6320 orange stick.

3.26 ***Mounting Coil:*** Mount the coil as follows.

(1) Manually start the new coil on the core with the coil terminals at the rear and to the left of the core. Make sure the terminals enter the associated slots at the rear of the relay unit. If the terminals do not enter the slots, bend them at their base, as necessary, so they will enter.

(2) Place the hub of the 667A coil positioner on the screw of the positioner with the shoulder of the hub toward the outer end of the screw. Turn the hub on the screw as far as possible. Place the rectangular shell of the coil positioner on the outer end of the core. Position the bar of the 665A bridge on the studs with the end of the bar marked TOP uppermost and with the screw of the coil positioner passing through one of the notches in the bar. While holding the bar against the ends of the studs, shift the bar so, with the coil positioner on the core, the screw of the positioner rests against the inner end of the notch in the bar and is perpendicular to the front of the bar. Securely tighten the thumb nuts against the bar. Turn the hub of the coil positioner counterclockwise until the shoulder of the hub seats in the notch in the bar, as shown in Fig. 12.

(3) Continue to turn the hub counterclockwise until the inner end of the rectangular shell

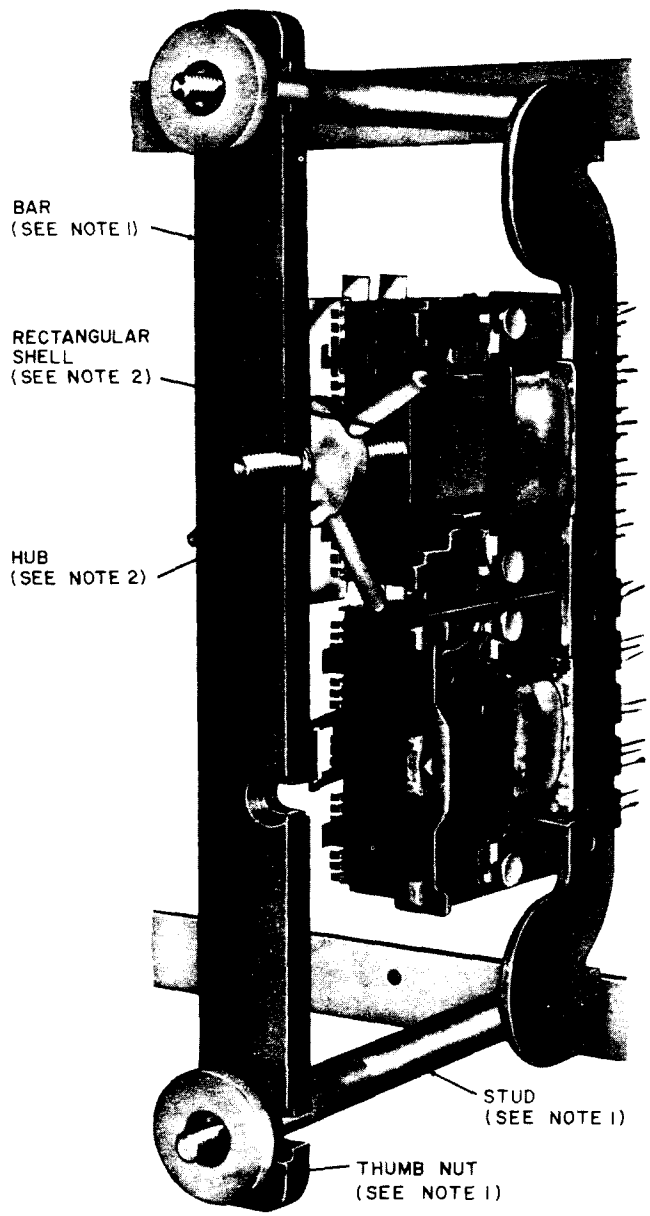

Fig. 12—287- and 288-Type Relays Mounting Coil

butts on the shoulders of the core. This positions the coil on the core properly. Turn the hub clockwise to disengage the coil positioner from the core and remove the positioner.

Caution: To avoid damaging the relay, turn the hub of the coil positioner slowly as soon as the coil starts to drag on the core. Stop exerting torque on the hub as soon as the rectangular shell of the positioner comes into contact with the shoulders of the core. This point may be judged by feel.

(4) If the relay is provided with a magnetic shunt, place the shunt on the core against the coil with the upper and lower legs of the shunt toward the front end of the core and the vertical portion of the legs to the left of the core. If necessary, use the ◆B◆ long-nose pliers to hold the shunt while placing it on the core. Check that the upper and lower legs of the shunt clear their adjacent legs of the core by 1/32 inch minimum. If necessary, remove the shunt and bend the legs with ◆B◆ long-nose pliers to obtain this clearance.

(5) Place the rectangular shell of the coil positioner on the outer end of the core. Turn the hub of the coil positioner counterclockwise until the shoulder of the hub seats in the center notch of the bar. Continue to turn the hub counterclockwise until the magnetic shunt is positioned against the shoulder of the core. Turn the hub clockwise to disengage the coil positioner from the core and remove the positioner. Check that the shunt is not loose on the core by pulling gently on it with the ◆B◆ long-nose pliers. If the shunt is loose, replace it with a new one using the coil positioner as described above.

3.27 ***Mounting Card:*** Mount the card as follows. Loosen the thumb nuts and remove the bar from the 665A bridge. Hold the card between the thumb and forefinger in a manner similar to that shown in Fig. 6 with the surface of the card having recesses toward the relay and the larger rectangular openings in the card toward the left. Place the thumb of the other hand against the right side of the 674A spring lifter which was previously positioned on the relay (3.24). While pushing the spring lifter to the left, insert the card through the gaps between the contacts. Remove the spring lifter. Position the card so the balancing spring legs engage the associated lugs of the card.

3.28 ***Mounting Armature:*** Using the KS-6320 orange stick, successively lift the top and bottom armature hinge springs just enough to insert the armature under these springs. Insert the armature under the springs with the armature stop plate toward the core. Then position the armature

so the U-shaped portion of each hinge spring engages its associated notch in the armature, as shown in Fig. 4. Make sure both hinge springs fully engage the armature by pushing against the U-shaped portion with the orange stick. Position the card so the card lugs engage the associated slots in the armature.

3.29 *Mounting Core Plates*

(a) ***Nickle-Silver Core Plates Only:*** Mount the core plate as follows.

(1) Hold the brace of the 665A bridge with the end marked TOP uppermost and the designation TOP facing the left. If there is sufficient clearance, insert the brace at the right of the relay being worked on and turn it 90 degrees so the designation TOP faces the front. If there is insufficient clearance to insert the brace, increase the clearance as covered in (2).

(2) Make the adjacent relay to the right busy, if this is practicable. Loosen the mounting screws of the relay. Also loosen the studs of the 665A bridge. Spread the relays slightly and tighten the relay mounting screws and the studs of the bridge. Insert the brace as described in (1).

(3) Insert the hook bolts through the holes in the brace and engage the hooks with the studs, as shown in Fig. 13. Position the brace so it is in line with the relay card. The brace limits the lateral strain on the relay during mounting of the core plate. Place the thumb nuts on the hook bolts, hold the brace against the core legs, and then turn the thumb nuts just enough to hold the brace in this position. Do not tighten the thumb nuts further as this would spring the core legs. Place the bar of the bridge on the studs with the end of the bar marked TOP uppermost and the notches in the bar at the right.

(4) Slightly loosen the thumb nuts of the core plate replacer so the core plate which was left in the replacer (3.22) may shift, as required, for proper assembly on the core legs. Hold the replacer with the thumb nuts at the right. Position the replacer on the relay so the slots in the core plate are in line with their associated legs of the core, the armature extends through the center hole in the core plate, and the

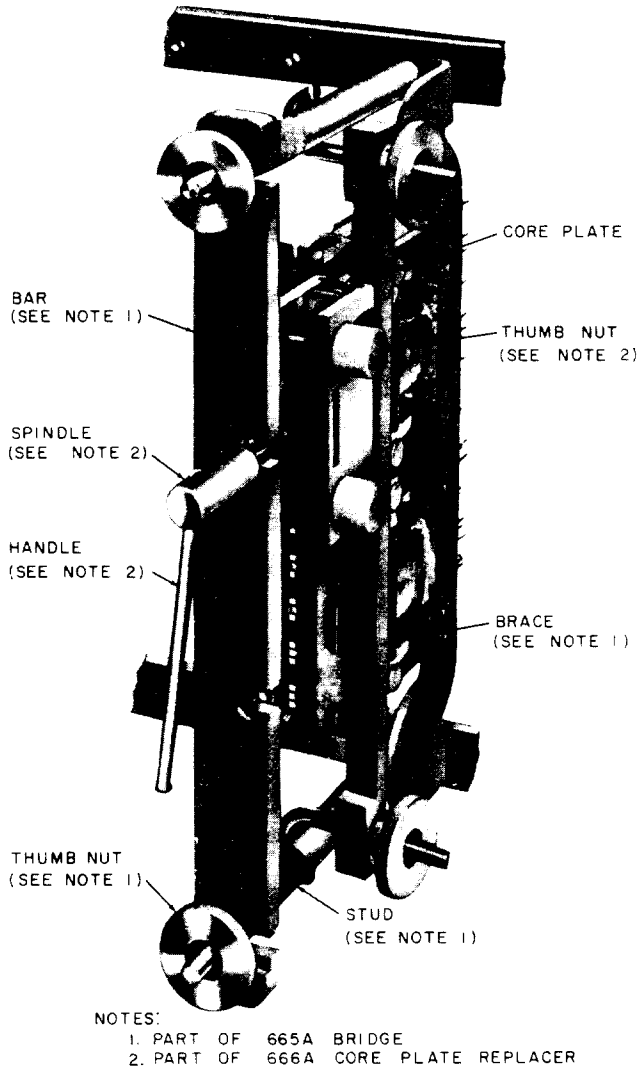

Fig. 13—287- and 288-Type Relays Mounting Core Plate

spindle of the replacer is in the notch of the bridge bar as shown in Fig. 13. While holding the bar of the bridge against the shoulders of the studs, shift the bar so the spindle of the core plate replacer seats in the notch in the bar and is perpendicular to the front of the bar. Securely tighten the thumb nuts against the bar. Turn the spindle of the replacer counterclockwise until the core plate butts on the shoulders of the top and bottom core legs.

Caution: To avoid damaging the relay, turn the spindle of the core plate replacer slowly. Stop exerting torque on the spindle

as soon as the core plate is seated against the shoulders of the core legs.

(5) Relieve the pressure of the core plate replacer spindle on the bridge bar by backing off the spindle slightly. Loosen the thumb nuts on the bridge and remove the bar. Loosen the thumb nuts on the core plate replacer and remove the replacer.

(6) Loosen the thumb nuts on the brace. Remove the bottom bridge stud and remount the bottom mounting screw but do not tighten it. While supporting the brace, remove the upper bridge stud and remount and partially tighten the upper mounting screw. Remove the bridge brace, turning it 90 degrees if the position adjacent to the relay is equipped. If the relays were shifted, reposition them making sure that clearance requirements are met. Securely tighten the relay mounting screws.

(7) Using the R-1640 center punch and the 4-ounce riveting hammer, stake the upper surface of the top and bottom core legs to secure the core plate as shown in Fig. 10.

(8) Reconnect and solder the leads to the coil. Remove the contact separators and remount the covers in accordance with 3.21.

(b) ***Aluminum Core Plates Only:*** Obtain a 717B tool and follow the procedure described in 3.47.

Core Plate

3.30 Replace the core plate as follows.

(1) Remove the core plate from the relay as covered in 3.22. Remove the core plate from the core plate replacer.

(2) Position the new core plate in the core plate replacer so the surface of the plate on which the holes are chamfered (edges not sharp) is outermost, the hole in the plate for the armature is toward the thumb nuts, and the sides of the plate are in the grooves of the core plate replacer. Turn the thumb nuts of the replacer clockwise so the core plate is held loosely in the replacer to permit slight shifting of the plate during mounting on the core.

(3) Mount the core plate on the relay as covered in 3.29.

(4) If the replaced core plate had stamped designations on it, stamp the same designations on the new core plate using the R-2315 lettering and numbering set.

Armature

3.31 Remove the core plate as described in 3.22. Remove the armature as described in 3.23. Mount the new armature as described in 3.28 and mount the core plate as described in 3.29.

Card

3.32 Remove the core plate and armature as described in 3.22 and 3.23. Remove the card as described in 3.24. Mount the new card as described in 3.27. Mount the armature and core plate as described in 3.28 and 3.29.

REPLACEMENT PROCEDURES USING 1014B TOOL KIT

3.33 ***List of Tools and Materials***

CODE OR SPEC NO.	DESCRIPTION	AMT
TOOLS		
1014B	Tool kit (see 3.34) (includes the following)	
	1 20B carrying case containing:	
	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)	

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
	4 718A wedges
	1 P-12B537 container (for terminal guide tubes)
	8 P-12B536 tubings (terminal guide tubes)
	1 P-16A068 container (for contact separators)
KS-6320	Orange stick
R-1640	Center punch
R-2315	Lettering and numbering set
♦AT-7860	B long-nose pliers♦
—	6-inch C screwdriver
—	4-ounce riveting hammer
MATERIALS	
KS-2423	Cloth
KS-14666	Cloth

3.34 ***1014B Tool Kit:*** Figure 14 shows the tools comprising the 1014B tool kit used for replacing coils on wire-spring type relays. The 716B ratchet head and P-12B536 terminal guide tubes furnished with the tool kit are not required for 286-, 287-, and 288-type relays. The guide tubes are used for AF-, AG-, AJ-, and AK-type relays. The 716B ratchet head is used only for AK-type relays. To prepare the ratchet handle and head for use, proceed as follows.

(1) 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 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 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 the teeth face the trigger. In this position the rod may be advanced by pulling the trigger.

(2) To remove the ratchet head from the ratchet handle, rotate the rod so 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.

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

3.36 After making any replacement of parts of a 286-, 287-, or 288-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.

286-, 287-, AND 288-TYPE RELAY

General

3.37 Remove the cover or covers from the relay to be worked on and from the relay in the adjacent position to the right if this position is equipped. Do not remove the covers from any other relays. When working on the lower unit of a 287- or 288-type relay having a 245-, 254-, 263-, or 264-type relay adjacent at the left, make busy the relay at the left if practicable.

3.38 Before proceeding with removal of parts, insert a 669A contact separator between the fixed and movable contact springs in both vertical rows as follows. Hold the contact separator with the hook portion at the left, as shown in Fig. 4, and carefully insert the tip behind the card and between the fixed and movable contact springs in one of the vertical rows. Then place the end of the KS-6320 orange stick so it bears lightly against both the right edge of the separator and the adjacent edge of the card to guide the separator during insertion. Slowly insert the separator while maintaining light pressure on the orange stick. When working on a 286-type relay or the top unit of a 287- or 288-type relay, insert the separators from the top. On the bottom unit of a 287- or 288-type relay, insert the separators from the bottom. Keep each separator vertical so the springs will remain in their proper horizontal positions and move it downward or upward, as required, until the hook portion engages the upper or lower fixed

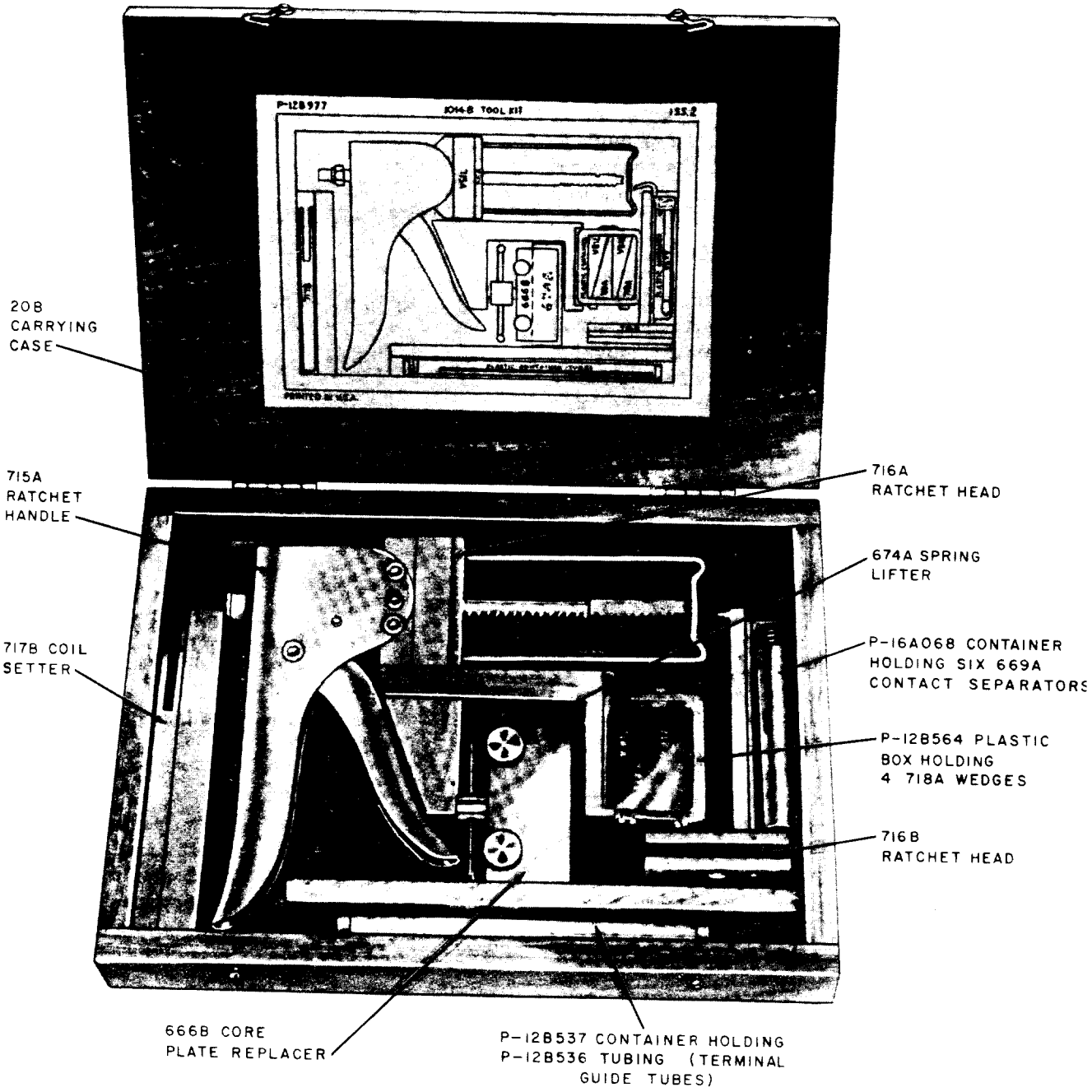

Fig. 14—1014B Tool Kit

contact springs. In the case of 287- and 288-type relays, take care to avoid separating any contacts of the other unit on the relay. Similarly, insert another contact separator between the fixed and movable contact springs in the other vertical row. When working on a lower unit of a relay having a 245-, 254-, 263-, or 264-type relay adjacent at the left, insert the separators only far enough to separate all contacts in the row. If the separators are fully inserted, difficulty may be encountered in removing them.

3.39 After replacement of parts has been completed, carefully remove the contact separators, taking care to keep them in a vertical position while removing them. Check that the movable contact springs lie in the grooves which properly position their contacts with respect to the associated fixed contacts. Check for this condition as covered in Section 040-272-701. Remount the relay covers which were removed.

Coil

3.40 ***Removing Core Plate:*** Remove the core plate as follows. Place the 666B core plate replacer on the relay so the grooves in the tool fit over the sides of the core plate with the thumb nuts at the right, as shown in Fig. 15. Tighten the thumb nuts so the replacer firmly engages the core plate. Turn the spindle of the replacer clockwise until the core plate is free of the core and remove the replacer and core plate. Remove the core plate from the core plate replacer.

3.41 ***Removing Armature:*** With the KS-6320 orange stick, lift one of the armature hinge springs just enough to remove the armature from under the spring. Then lift the other spring in the same manner and remove the armature from the relay.

3.42 ***Removing Card:*** Remove the card as follows. Place the 674A spring lifter against the right side of the cover spring and ends of the balancing spring legs with the bevel toward the card. Hold the card toward the right with the KS-6320 orange stick and move the spring lifter slightly to the left to disengage the balancing spring legs from the card. Then insert the spring lifter between the adjusting lugs and the cover spring and balancing spring legs until the outer edge of the lifter is in line with the outer edge of the cover spring, as shown in Fig. 6. Remove the pressure against the card by moving the spring lifter to the left with the left hand. Then grasp the card between the thumb and forefinger, as shown in Fig. 6, and carefully remove the card.

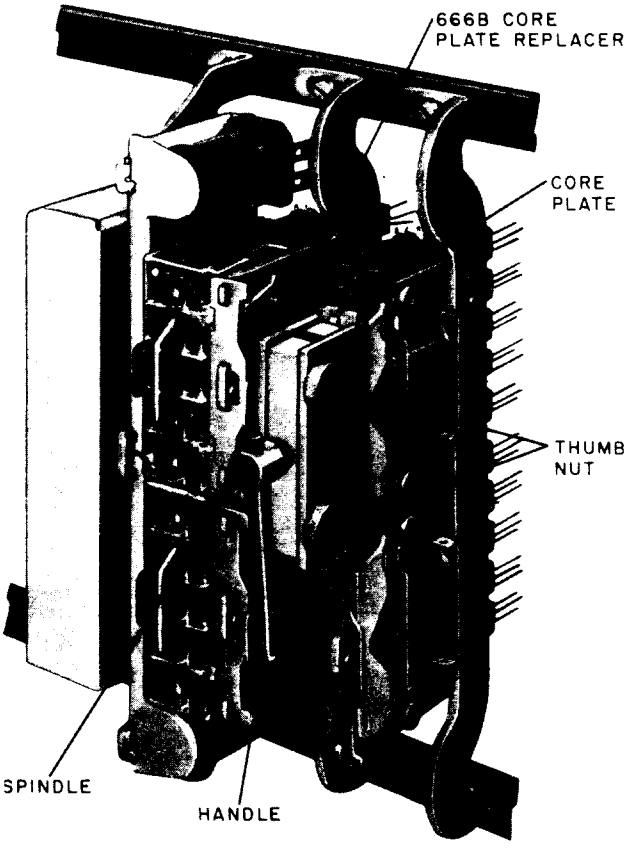

Fig. 15—Removing Core Plate Using 666B Core Plate Replacer

3.43 ***Removing Coil:*** Remove the coil as follows.

(1) Tag, unsolder in the case of soldered connections, and unwrap the leads to the terminals of the coil to be replaced. Remove any lumps of solder remaining on the terminals. Place a KS-2423 cloth under the relay to shield adjacent apparatus from solder drippings while unsoldering the leads.

(2) If it is necessary to obtain greater separation between relays, loosen the mounting screws of the relay and of adjacent relays one full turn using the 6-inch C screwdriver. If the relay has a magnetic shunt mounted on the core (see Fig. 1 and 2), remove the shunt as follows.

Using the ◗B◖ long-nose pliers, alternately grasp the horizontal portion of the upper and lower legs of the shunt and carefully pull the shunt straightforward on the core. Avoid turning the pliers.

(3) Mount the 716A ratchet head on the 715A ratchet handle, as covered in 3.34(1).

(4) Position the rod of the 715A ratchet handle so its end is approximately 3 inches from the end of the loop and the rod teeth are facing the trigger, as covered in 3.34(1).

(5) 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. 16. Make sure 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.

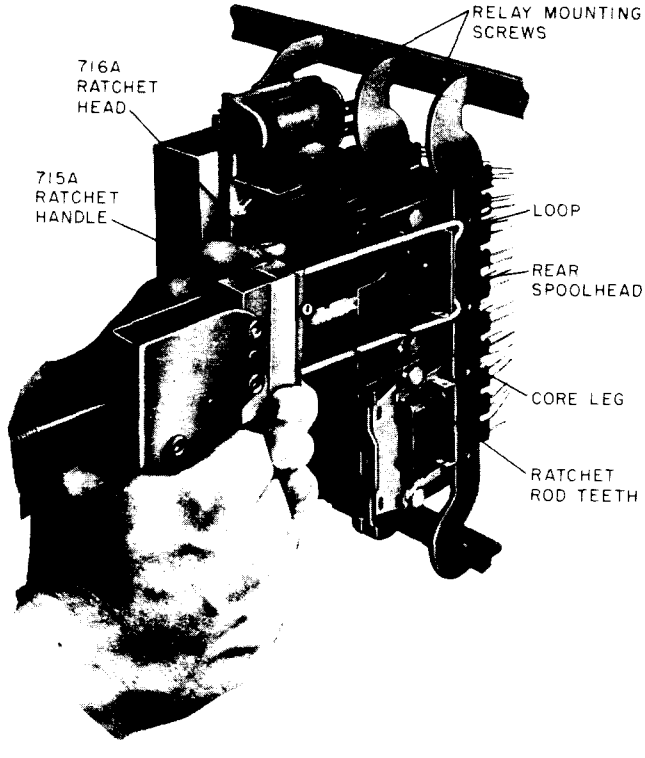

Fig. 16—Removing Coil With 716A Ratchet Head

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

(7) ***Removing Coil With Broken Spoolhead:*** Place a KS-14666 cloth over any apparatus directly below the relay being worked on. If the relay has a magnetic shunt mounted on the core, remove the shunt as follows. Using the ◗B◖ long-nose pliers, alternately grasp the horizontal portion of the upper and lower legs of the shunt and carefully pull the shunt straightforward on the core. Avoid turning the pliers. Grasp the front spoolhead across its width with the pliers and attempt to loosen the coil of the core. If the coil cannot be loosened in this way, break the spoolhead with the 532B adjuster by applying the slot in the adjuster to the spoolhead at a number of points around its edge. Remove the spoolhead in sections. Then manually pull the coil from the core, prying it loose, if necessary, with the KS-6320 orange stick.

3.44 ***Mounting Coil:*** Mount the coil as follows.

(1) Manually start the new coil on the core with the coil terminals at the rear and to the left of the core. Make sure the terminals enter the associated slots at the rear of the relay. If the terminals do not enter the slots, bend them at their base so they will enter.

(2) Place the long slot of the 717B coil setter over the core leg. 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 engages the end of the core leg, as shown in Fig. 17.

(3) If the relay is provided with a magnetic shunt, place the shunt on the core against the coil with the upper and lower legs of the shunt toward the front end of the core and the vertical portion of the legs to the left of the core. If necessary, use the ◗B◖ long-nose pliers to hold the shunt while placing it on the core. Check that the upper and lower legs of the shunt clear their adjacent legs of the core by 1/32 inch minimum. If necessary, remove the shunt and bend the legs with the ◗B◖ long-nose pliers to obtain this clearance. Place the long slot of the 717B coil setter over the core leg, as shown in Fig. 17. Position the magnetic shunt on the

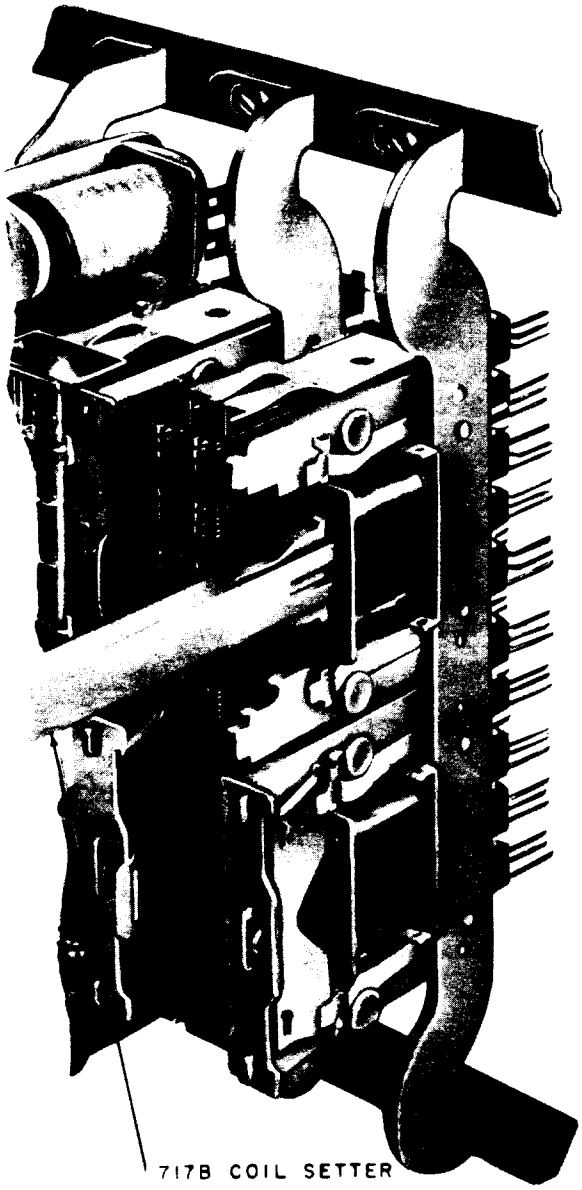

Fig. 17—Positioning Coil With 717B Coil Setter

core leg by tapping the coil setter with the 4-ounch riveting hammer until the magnetic shunt is against the shoulders on the center leg of the core. Check that the shunt is not loose on the core by pulling gently on it with the ◗B◖ long-nose pliers. If the shunt is loose, replace it with a new one using the coil setter as described above.

(4) Remove the KS-2423 cloth. Tighten the screws of the relay and of adjacent relays if they were loosened.

(5) Connect the leads to the coil winding terminals.

3.45 ***Mounting Card:*** Mount the card as follows. Hold the card between the thumb and forefinger, as shown in Fig. 6, with the surface of the card having recesses toward the relay and the larger rectangular openings in the card toward the left. Place the thumb of the other hand against the right side of the 674A spring lifter which was previously positioned on the relay (3.42). While pushing the spring lifter to the left, insert the card through the gaps between the contacts. Remove the spring lifter. Position the card so the balancing spring legs engage the associated lugs of the card.

3.46 ***Mounting Armature:*** Using the KS-6320 orange stick, successively lift the top and bottom armature hinge springs just enough to insert the armature under these springs. Insert the armature under the springs with the armature stop plate toward the core. Then position the armature so the U-shaped portion of each hinge spring engages its associated notch in the armature, as shown in Fig. 4. Make sure both hinge springs fully engage the armature by pushing against the U-shaped portion with the orange stick. Position the card so the card lugs engage the associated slots in the armature.

3.47 ***Mounting Core Plate:*** Mount the core plate as follows.

(1) Position the core plate in front of the core legs so the surface of the plate on which the holes are chamfered (edges not sharp) is outermost and manually start the core plate on the core legs. Then using the 717B coil setter and the 4-ounce riveting hammer, gently tap the core plate into position on the core legs. When tapping the core plate at the center core leg, take care to avoid tapping the armature. Fig. 18 shows the coil setter being used to position the core plate on the upper core leg.

(2) Using the R-1640 center punch and the 4-ounce riveting hammer, stake the upper surface of the top and bottom core legs to secure the core plate as shown in Fig. 10.

(3) Remove the contact separators and remount the covers in accordance with 3.39.

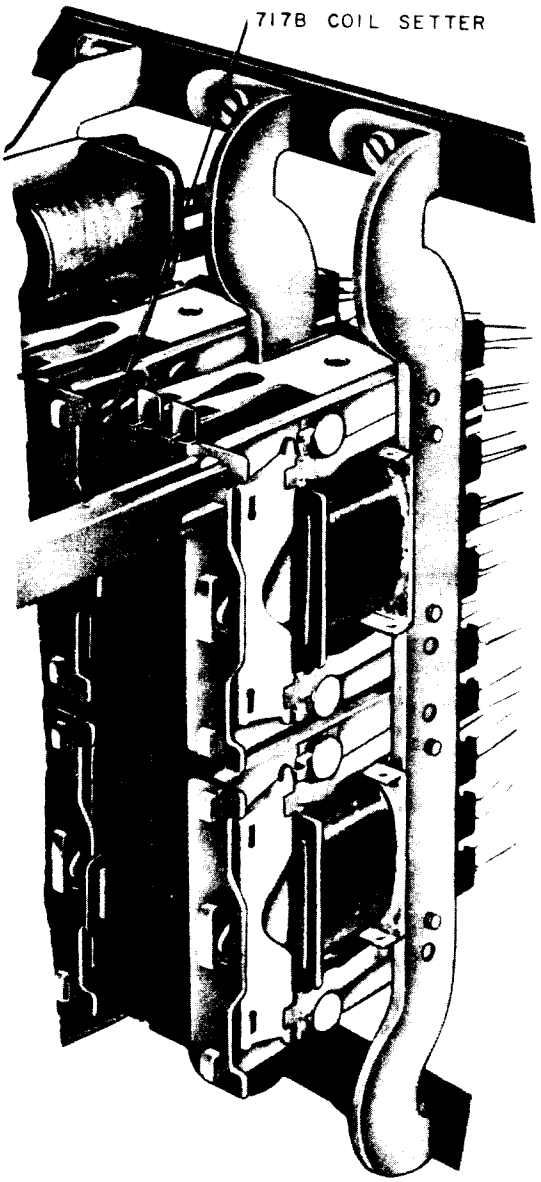

Fig. 18—Positioning Core Plate on Core Leg

Core Plate

3.48 Replace the core plate as follows.

(1) Remove the core plate as covered in 3.40.

(2) Mounting the new core plate on the relay as covered in 3.47.

(3) If the replaced core plate had stamped designations on it, stamp the same designations on the new core plate using the R-2315 lettering and numbering set.

Armature

3.49 Remove the core plate as described in 3.40. Remove the armature as described in 3.41. Mount the new armature as described in 3.46 and mount the core plate as described in 3.47.

Card

3.50 Remove the core plate and armature as described in 3.40 and 3.41. Remove the card as described in 3.42. Mount the new card as described in 3.45. Mount the armature and core plate as described in 3.46 and 3.47.

REPLACEMENT PROCEDURES USING KS-20558 L1 TOOL KIT

3.51 ***List of Tools and Materials***

CODE OR SPEC NO.	DESCRIPTION	AMT
TOOLS		
KS-20558 L1	Tool kit (includes the following)	
	1 KS-20557 L1 carrying case containing:	
	1 565A tool	
	1 417A tool	
	1 wrench flat, 1/2 inch, 6 3/4 inches long, L-116519	
	1 wedge holder, screwdriver, L-116518 (detail 5)	
	2 wedges, screwdriver, L116515-1 (detail 1)	
	2 wedges, screwdriver, L-116515-2 (detail 1A)	
	2 springs, clamping, L-116516 (detail 6)	

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
	2 nuts, wedging, L-116514-1 (detail 2)
	2 nuts, wedging, L-116514-4 (detail 2A)
	2 nuts, wedging, L-116514-2 (detail 3)
	2 nuts, wedging, L-116514-3 (detail 4)
—	6-inch C screwdriver
♦AT-7860	B long-nose pliers♦
MATERIALS	
—	No. 64 rubber bands (2 required)

3.52 Figure 19 illustrates the tools comprising the KS-20558 L1 tool kit which is used when replacing defective halves of 287- or 288-type relays.

3.53 All defective units removed must be replaced by one of the same code.

3.54 Before any operations are made, cover relays or any apparatus below so no solder drippings will fall on them.

3.55 Unsolder and unwrap all electrical connections from the rear of the defective half of relay.

PROCEDURE FOR REMOVING DEFECTIVE HALF OF RELAY—STANDARD SPACING

3.56 Remove wire clip and plastic cover from front of defective unit.

3.57 Slip a clamping spring (detail 6) with the open side facing to the right over the defective unit and push back with screwdriver until clamping spring comes to rest against clamp plate, as shown in Fig. 20.

3.58 Slip a No. 64 rubber band over the unit and the U-shaped portion of the armature spring close to the front spoolhead, as shown in Fig. 21. This will prevent the armature spring from falling off when the unit is removed from its mounting bracket.

3.59 Measure the space between relays and select wedges accordingly.

3.60 Assemble screwdriver wedge (detail 1) to a wedge nut (details 2, 3, or 4) depending on the space between relays. Align the 3/16-inch wide by 1/16-inch deep slots of both details making sure both slots face the same direction.

> ***Note:*** On details 2, 3, or 4 there is a marker on the side opposite the slot. These markers should be aligned with the tapped hole in the screwdriver wedge (detail 1) into which the screwdriver wedge holder (detail 5) fits. See Fig. 19.

3.61 Insert the screwdriver wedge holder (detail 5) into the tapped hole of the screwdriver wedge (detail 1), as shown in Fig. 19.

3.62 Insert the assembled screwdriver wedge and the proper size wedge nut (details 2, 3, or 4) using the wedge holder to guide the tool to the upper clamping screw of the defective unit.

3.63 Place the screwdriver wedge (detail 1) over the head of the upper clamping screw and at the same time with the slotted nut on the left clearing the protruding clamping screw end of the relay to the left. Guide the screwdriver wedge (detail 1) into the slot of the clamping screwhead.

3.64 Using the 1/2-inch open-end wrench, rotate the wedge nut (details 2, 3, or 4) clockwise until it contacts the mounting bracket of the relay to the left. Remove screwdriver wedge holder (detail 5).

3.65 For the lower clamping screw, repeat steps 3.60 through 3.64. See Fig. 22.

> ***Note:*** If there is no backing for the wedging tools to the left of the section of relay to be replaced, the clamping screws of the defective half can be removed with a 344 tool (offset screwdriver).

3.66 On the clamping screw at the top of the defective unit, apply the 1/2-inch flat wrench to the hexagon head of the screwdriver wedge (detail 1) and rotate counterclockwise about one full turn or 360 degrees until the screw loosens. Repeat this procedure on the lower clamping screw.

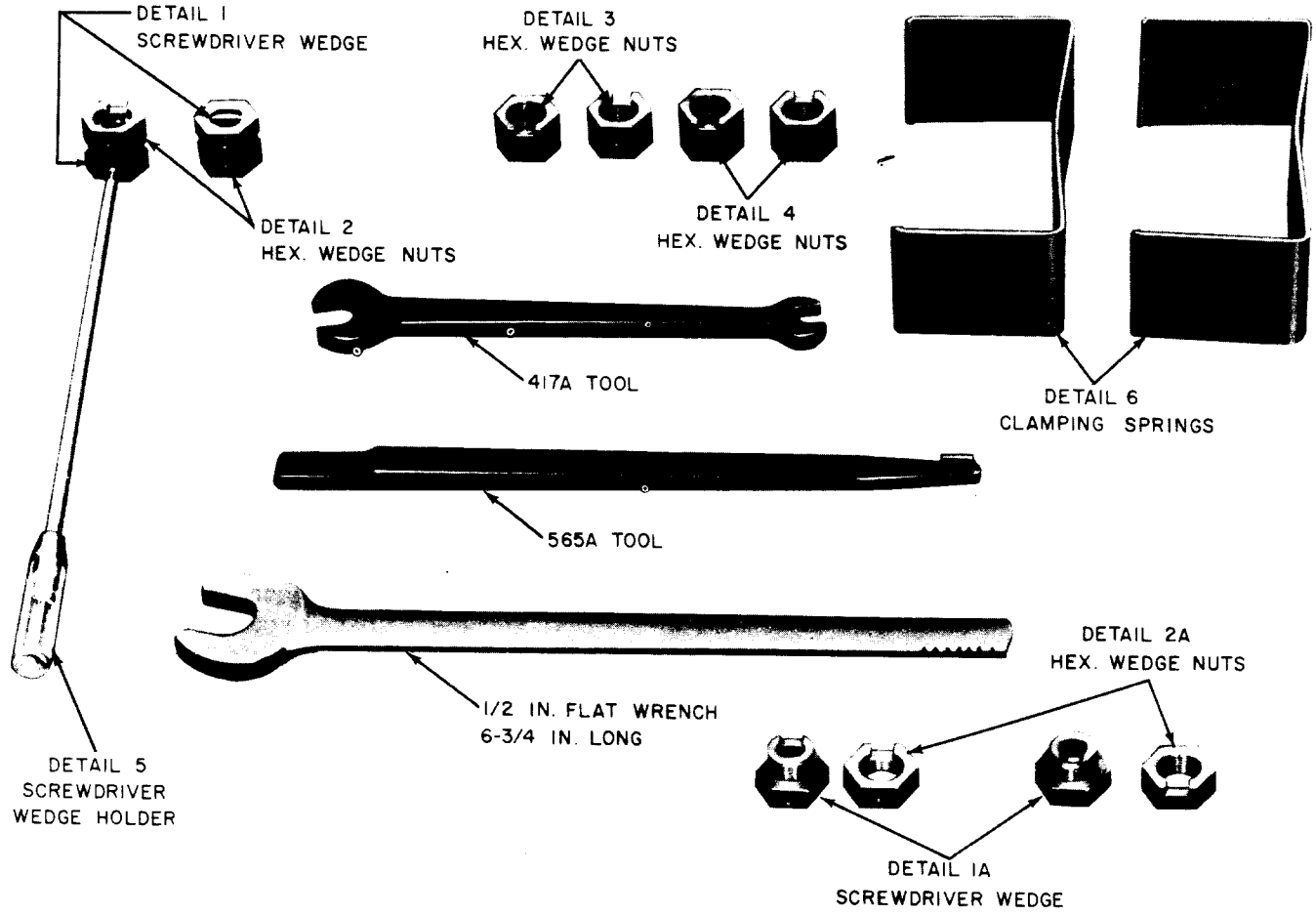

Fig. 19—KS-20558 L1 Tool Kit (KS-20557 L1 Carrying Case Not Shown)

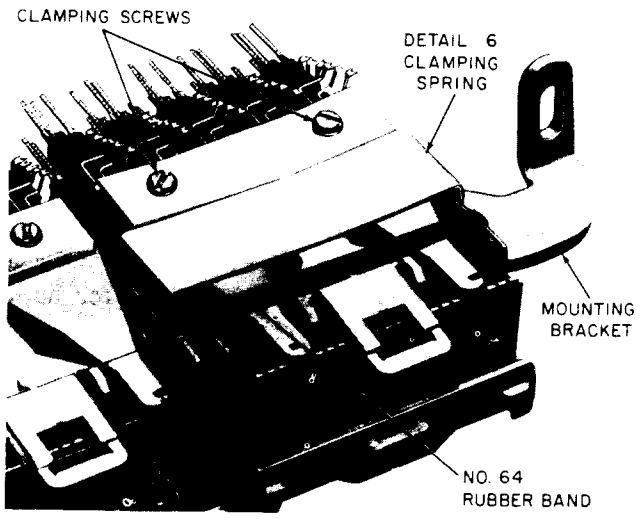

Fig. 20—Clamping Spring and No. 64 Rubber Band in Place on Half of Relay

3.67 Remove wedges from the top and bottom clamping screws.

3.68 Using the 565A tool, unscrew both clamping screws until the unit is free of the mounting bracket and remove the defective unit.

PROCEDURE FOR REMOVAL OF DEFECTIVE HALF OF RELAY—NARROW SPACING

Note: If the spacing between the defective relay and the adjacent relay to the left is very narrow and replacement of the defective half cannot be accomplished, as described in steps 3.60 through 3.68, use the method outlined in 3.69 and 3.70.

3.69 Remove all wiring from the defective half of relay. Unsolder the multiple strap wiring on the other half of relay. Loosen the mounting

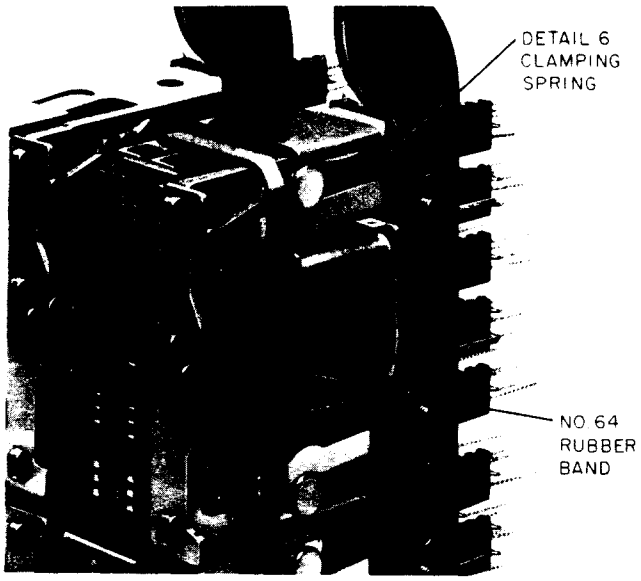

Fig. 21—Proper Position of Rubber Band Across U-Shaped Portion of Armature Spring

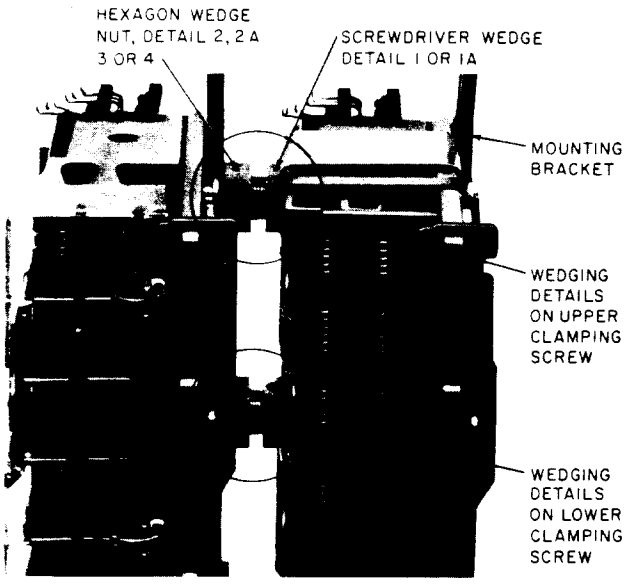

Fig. 22—Wedging Details in Place on Upper and Lower Clamping Screws

bracket screws on both the top and bottom and then shift the complete relay to the right allowing enough room to insert the wedging tools. Details 1A and 2A are provided for this condition.

3.70 Retighten the mounting bracket screws; then follow the procedure outlined in 3.56 through 3.58 and 3.61 through 3.68 using details 1A and 2A.

PLACEMENT OF NEW UNIT

3.71 Replacement unit must be the same code as the defective unit.

3.72 Remove wire clip and plastic cover.

3.73 Slip a clamping spring (detail 6), with the open side facing to the right, over the replacement unit and push back with screwdriver until clamping spring rests against the clamp plate. See Fig. 20.

3.74 Slip a No. 64 rubber band over the unit and the U-shaped portion of the armature spring close to the front spoolhead, as shown in Fig. 21. This will prevent the armature spring from falling off when the new unit is removed from its mounting bracket.

3.75 Using the 3/16-inch 6-inch screwdriver, remove the new unit from its mounting bracket.

3.76 Place the new unit with the holes in rear core plate on the dowel pins of the mounting bracket and hold.

3.77 Apply the 575A tool with the screwdriver in the slot of the top clamping screwhead, exerting pressure against the tapped holes in the mounting bracket. Screw in part of the way. Repeat this procedure for the bottom clamping screw. Then bring up both screws to close the space.

3.78 Assemble the screwdriver wedge with the holder, as described in 3.60, and follow the procedure, as outlined in 3.63 and 3.65, for both the upper and lower clamping screws.

3.79 Follow the procedure as described in 3.64 ***except*** rotate the screwdriver wedge clockwise using the 1/2-inch open-end wrench until the clamping screw is firmly seated. This procedure applies to both upper and lower clamping screws.

3.80 Remove both wedge assemblies, the rubber band, and the clamping spring.

3.81 Replace the plastic cover and wire clip.

3.82 Rewire relay and place back in operation.

3.83 Remove the clamping spring and rubber band from defective half of relay.