SMALL CROSSBAR SWITCH

REQUIREMENTS AND ADJUSTING PROCEDURES

CONTENTS PAGE

Figures CONTENTS PAGE

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CONTENTS PAGE

1. GENERAL

1.01 This section contains the description, requirements, and adjusting procedures for all codes of small crossbar switches described in the following paragraphs.

1.02 The reasons for reissuing this section are listed below. Since this reissue is a general revision, no revision arrows have been used to denote significant changes. The Equipment Test List is not affected.

(1) To revise paragraph 2.04(c)

(2) To change Fig. 18 to identify the KS-21028 L1 wrench

(3) To add KS-6320 L2 orange stick.

1.03 Nonlatching, 10-level switch codes: CA, CB, CC.

1.04 Nonlatching, 12-level switch codes: CD, CE, CF.

1.05 General requirements and definitions for apparatus are contained in Section 020-010-711.

1.06 ***Description:*** The small crossbar switch is composed of multiple independent vertical unit assemblies mounted within a common switch frame and acted upon by a group of common selecting bar assemblies. Each vertical unit is a self-contained switching module actuated by its hold armature and externally controlled by the action of the selecting bars on the hairpin select wires of the vertical unit. Selecting bar assemblies are common to two adjacent switching levels of all vertical units within a switch frame. All crosspoint levels and holding off-normal assemblies of the small crossbar switch incorporate card release operation of independent wire contact springs. The selecting off-normal assemblies are of a flat spring design having buckle-type operation.

1.07 ***Nonlatching Switches:*** The selecting or holding armature of the nonlatching codes of small crossbar switches shall operate and remain operated when the specified operate current is applied to the winding of the select or hold coil and shall return to its nonoperated position when the operate current is removed from the coil winding.

1.08 ***Selecting Armature:*** For the purposes of this section, a selecting armature may be either the upper or lower half of the double armature attached to a selecting bar.

1.09 ***Crosspoint Level:*** A crosspoint level includes all those crosspoint contacts which close when a crosspoint operate card is actuated by the holding armature of a vertical unit.

1.10 ***Associated contact set,*** as referred to in this section, consists of a fixed contact and two mating movable contacts.

1.11 ***A pair of contacts,*** for the purpose of this section, consists of the fixed contact and one of the two movable contacts of an associated contact set.

1.12 The terms ***contact make*** and ***contact break*** refer to the condition of an electrical circuit controlled by these contacts.

1.13 A ***pretensioned spring*** is a spring which contains machine-controlled bends designed to produce tensioning forces upon specific portions of a spring assembly. These springs should not be altered in an attempt to obtain proper switch operation.

1.14 ***Normal Position of the Holding Armature:*** The holding armature is considered to be in its normal position when it rests against the knife edge, is supported by the support tab, and is held against the stop bracket by the hold armature restoring spring or off-normal assembly.

1.15 ***Normal Position, Selecting Bar Assembly:*** The selecting bar assembly is considered to be in its normal position when the stud of the selecting armature is approximately aligned with the centering spring support tab of the centering unit bracket and the stud is approximately centered between the two centering springs.

1.16 ***Normal Position of the Hairpin Select Wire:*** The hairpin select wire, when installed within a small crossbar switch, is considered to be in its normal position if both legs of the select wire are tensioned against or toward the inner corner of the crosspoint operate card (which is closest to the holding armature) and are tensioned against or toward the paddle of the selecting bar when the selecting bar is in its normal position.

1.17 ***Operate—Selecting Unit:*** A selecting unit is considered to be operated if, when an operating current is connected to its associated coil winding, the selecting armature moves until the stop disc strikes its core, all contacts of an associated off-normal assembly are closed, and the operated select wires are positioned within or toward the trapping zones of the associated operate cards. Positioning of the select wires toward the trapping zone applies only to the preselect option of switch operation as covered by 3.11(d).

1.18 ***Operate—Vertical Unit:*** The application of an operate current to the winding of a holding coil shall produce the following results.

(a) The holding armature shall move toward the hold core until it strikes and rests against it.

(b) All actuated hairpin select wires are trapped between the holding armature and their respective crosspoint operate cards.

(c) Each contact within an operated crosspoint level closes and remains closed until the operate current is removed from the holding coil.

(d) All make contacts of an associated holding off-normal assembly make with their mating fixed contact and remain closed until the operate current is removed from the holding coil.

(e) All break contacts of an associated holding off-normal assembly break with their mating fixed contact and remain open until the operate current is removed from the holding coil.

1.19 ***Dual Level Crosspoint Operation:*** Simultaneous operation of two crosspoint levels of any vertical unit shall occur in the following manner:

Switch Code	Either of the bottom
CC-6	two levels and any
CF-1	other remaining level,
CF-4	excluding the bottom
CF-5	two levels.

1.20 ***The standard point of measurement of the holding armature core gap*** is the point on the armature which coincides with the apex of the holding core face. This point is located 0.215 inch from the right edge of the holding armature and is automatically obtained when the specified 195 gauges are used.

1.21 ***KS-16832 L2 Lubricant:*** This lubricant is provided in both 1-pint storage containers and 2-ounce dispensing containers. Before use or transfer from the storage container to the dispensing container, the lubricant should be thoroughly agitated to insure mixing of the ingredients. Agitation is best accomplished by rapidly inverting and righting the container for approximately 30 seconds. Lubricant should be kept tightly covered when not in use.

1.22 Wherever possible, the small crossbar switch should be removed from service in the approved manner before checking or adjusting for any of the requirements contained within this section. When bench checking loose switches that are to be job mounted, insert small blocks between each end of the switch and the bench (to simulate the slight sag the switch has in its mounted position on the equipment framework) before proceeding with the inspection and/or adjustment procedure.

1.23 The small crossbar switch may be operated manually while checking for the requirements contained within this section. However, if a trouble condition persists, the requirements should be rechecked while operating the switch electrically.

2. APPARATUS

2.01 ***List of Tools, Gauges, and Materials***

TOOLS

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
50B	Spring adjuster
376A	Dental mirror
416B	Spring adjuster (required)
476B	3/16-inch hex offset socket wrench
485A	Smooth-jaw pliers
510C	Test lamp [must be equipped with 561A tool (straight tip) and W2CB (24V) or W2BL (48V) cord]
535A	Spring adjuster
541A	1/4-inch 12-point double-end box wrench
541B	9/32-inch 12-point double-end box wrench
544A	1/4-inch hex offset socket wrench
—	15/16-inch box-end wrench (obtain locally)
549A	Spring adapter
623A	Bracket adjuster
768A	Plastic (toothpick) wedge-type blocking tool
774A	Pliers, paddle adjusting
KS-21028 L1	Wrench, core
KS-6320 L1	Orange stick (wood)
KS-6320 L2	Orange stick (plastic)
KS-19916 L1	Magnifier (headband binocular) 2-1/2 power 8-inch focal length
KS-20476 L1	Nut driver, 12-point 1/4-inch (left-hand screws)
—	4-inch E screwdriver
—	Screw starter, quick-wedge, Kedman Company No. 2356
—	5-inch E screwdriver
R-1324	Screwdriver
R-2670	3/32-inch hex socket screw wrench
—	B scissors or equivalent (for cutting banjo strapping at rear of vertical unit)
—	B long-nose pliers
GAUGES	
68B	70-0-70 gram gauge
70G	50-0-50 gram gauge
70J	0-150 gram gauge
137B	Select armature travel gauge 0.060-, 0.080-inch
172A	0.0015-inch thickness gauge
KS-20650 L1	Select armature travel gauge 0.020-inch
KS-6938	Feeler gauge 0.026- through 0.040-inch thickness in 0.001 increments
139A	Thickness gauge nest 0.005-, 0.006-, 0.010-, 0.015-, 0.020-, 0.022-, and 0.025-inch
193A	Thickness gauge nest (for checking select magnet heel gap) 0.006-, 0.012-, 0.018-, and 0.026-inch
195A-H	Hold armature core gap gauge, 0.008-, 0.010-, 0.026-, 0.050-, 0.072-, 0.027-, 0.034-, 0.044-inch
195J	Hold armature core gap gauge, .050-inch thick, with tab
195K	Hold armature core gap gauge, .055-inch thick, with tab

MATERIALS

KS-14666	Cloth
KS-16832 L2	Lubricant
KS-19578 L1	Trichloroethane
—	Toothpicks, round at one end, flat at the other
—	0.040-inch bare tinned copper wire

3. REQUIREMENTS

CONTACT REQUIREMENTS

3.01 The contact requirements are as follows.

(a) Contacts shall be cleaned when necessary in accordance with Section 069-306-801. After cleaning any pair of contacts, a visual check shall be made to ensure compliance with requirements (b), (c), and (d).

(b) Each wire spring of the movable twin-wire contact springs shall be contained within the proper groove of its associated operate card with respect to its position in the molded twin-wire block.

(c) Both movable contacts of an associated contact set shall make with their associated fixed contact when the actuating armature is operated for make contacts or when the armature is in the nonoperate position for break contacts.

(d) Both movable contacts of an associated contact set shall make or break with their associated fixed contact within 0.006 inch of each other.

Gauge by eye.

3.02 ***Mounting of Switch and Switch Parts:*** Fig. 1—All screws and nuts used to mount the small crossbar switch to the framework and to mount parts within the switch shall be tight.

Check by feel in the direction to tighten the screw or nut.

> ***Note:*** The two screws used to mount each vertical unit to the switch frame have ***left-hand threads.*** These screws are ***identified by a distinctive 12-point head*** and have the ***letter "L"*** stamped into the screwhead.

REQUIREMENTS FOR SELECTING UNITS EXCLUSIVE OF THE SELECTING OFF-NORMAL ASSEMBLY

3.03 ***Selecting Bar Clearance:*** Fig. 2—The clearance between the selecting armature extension and the switch frame shall be measured at the closest point. To insure that the minimum measurement has been taken, the gauge should be inserted both from above and below the armature extension and moved to check the entire airgap.

(a) ***Heel Gap:*** The clearance between the selecting armature extension and the switch frame, with the end play taken up in the direction to give a minimum heel gap, shall be

Min 0.006 inch

Use the 193A gauge.

(b) The end play shall be 0.004 inch minimum. The maximum clearance between the selecting armature extension and the switch frame, with the end play taken up in the direction to give a maximum clearance, shall be

Max 0.026 inch

Use the 193A gauge.

3.04 ***Selecting Bar—Freedom of Rotation:*** With both centering springs of the centering unit or selecting off-normal assembly blocked away from the stud of the selecting armature, the following requirements shall be met.

(a) The selecting bar shall remain in or assume its nonoperated position with its paddles approximately centered between the switching levels it controls.

(b) When the selecting bar is operated manually to either of its operated positions and released, the selecting bar shall return to its nonoperated position.

(c) ***Selecting Bar Tension:*** The selecting bar is not required to rest on the selecting bar center support comb or pad. However, if the selecting bar does rest on the support comb

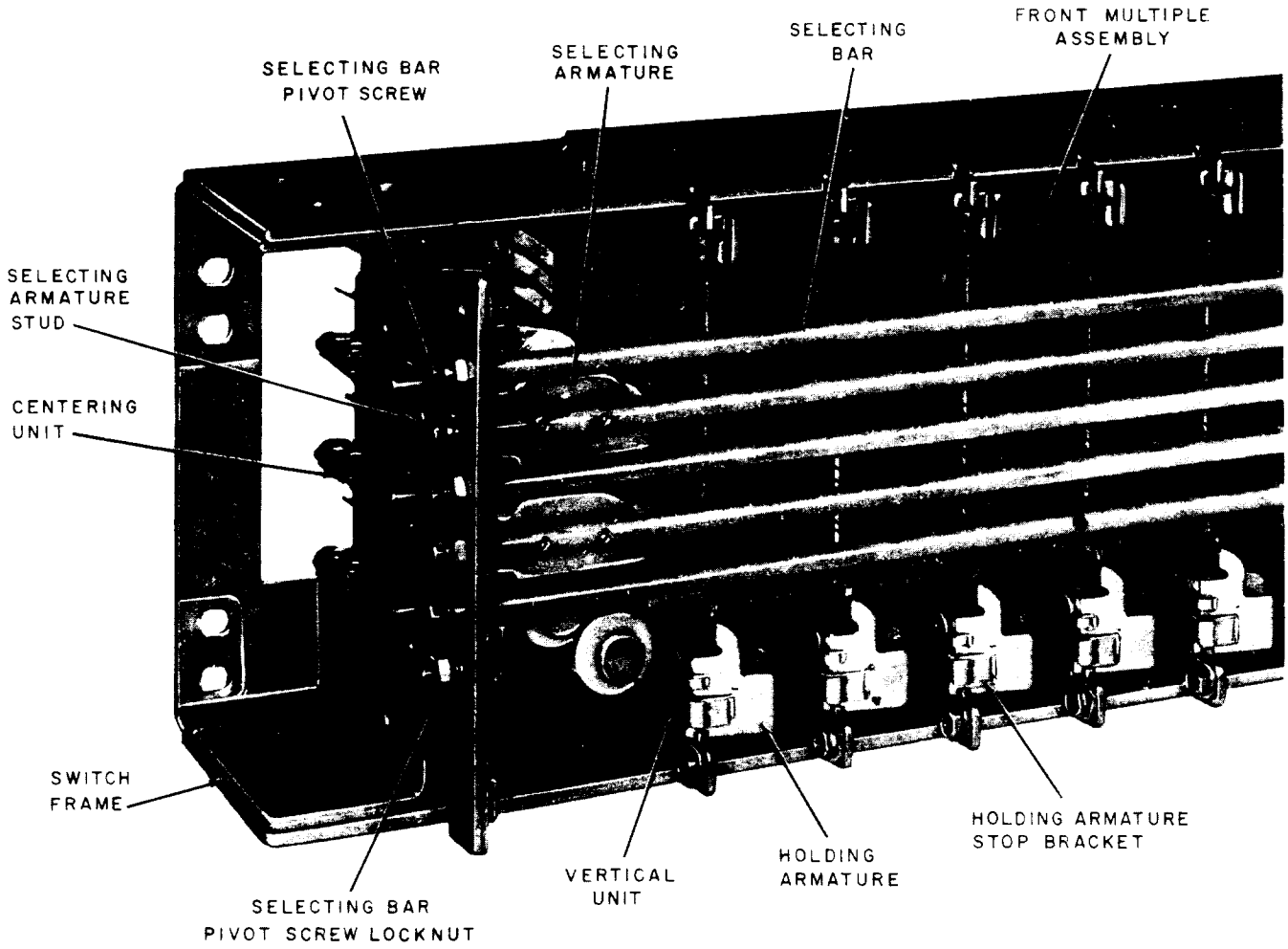


Fig. 1—Front View of Switch With Bottom Selecting Bar Assembly Removed

or pad, the following forces shall lift the bar off the support comb or pad:

CA, CD switches—150 grams max

CB, CE switches—150 grams max

CC, CF switches—100 grams max

Use the 70J gauge.

3.05 ***Tightness of Selecting Bar Pivot Screw Locknuts:*** The locknuts shall be sufficiently tight to hold the respective screws in their adjusted positions.

Gauge by feel in the direction to tighten the locknut.

CENTERING UNIT REQUIREMENTS

3.06 ***Straightness of Centering and Snubbing Springs:*** Operating centering and snubbing springs shall be free from distortion due to adjustment procedures, with the exception of a gradual bow or a slight kink directly in front of the clamping point.

3.07 ***Spring Tensions of Centering and Snubbing Springs:*** Fig. 3—With the selecting bar assembly in its normal position, the following requirements shall be met.

(a) ***Even-Numbered Levels***

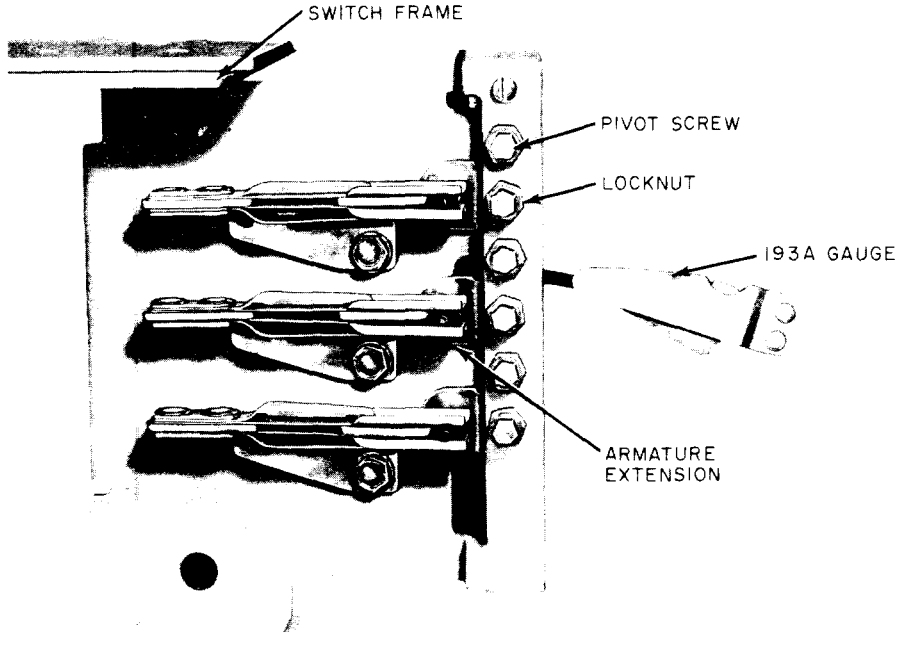


Fig. 2—Method of Checking Selecting Bar Clearance

(1) The snubbing spring shall be tensioned against the centering spring and the centering spring shall rest against its stop.

(2) The combined tension of the snubbing spring and the centering spring against the stop shall be

Min 20 grams

Max 35 grams

Use the 68B gauge.

(3) With the snubbing spring lifted off the centering spring, the centering spring may or may not be tensioned against the centering spring stop. If the centering spring rests against its stop, the tension against the stop shall not exceed

15 grams

(b) ***Odd-Numbered Levels***

Note: Switches having centering units with snubbing springs on odd-numbered levels should be adjusted as indicated in (1) and (2). For later switches having centering units without snubbing springs at odd-numbered levels, (1) may be disregarded and the centering spring adjusted to (2).

(1) The snubbing spring shall be adjusted so it is not deflected by its associated centering spring when the 0.060-inch end of a 137B gauge is inserted between the adjacent centering spring and the selecting armature stud.

(2) The centering spring shall be tensioned against the centering unit stop with a force of

Min 0 grams

Max 10 grams

3.08 ***Clearance Between the Stud of the Selecting Armature and the Centering Springs:*** With the selecting bar assembly in its normal position and the stud resting on one of the centering springs, the clearance between the stud and the other centering spring shall not exceed

0.003 inch

Gauge by eye.

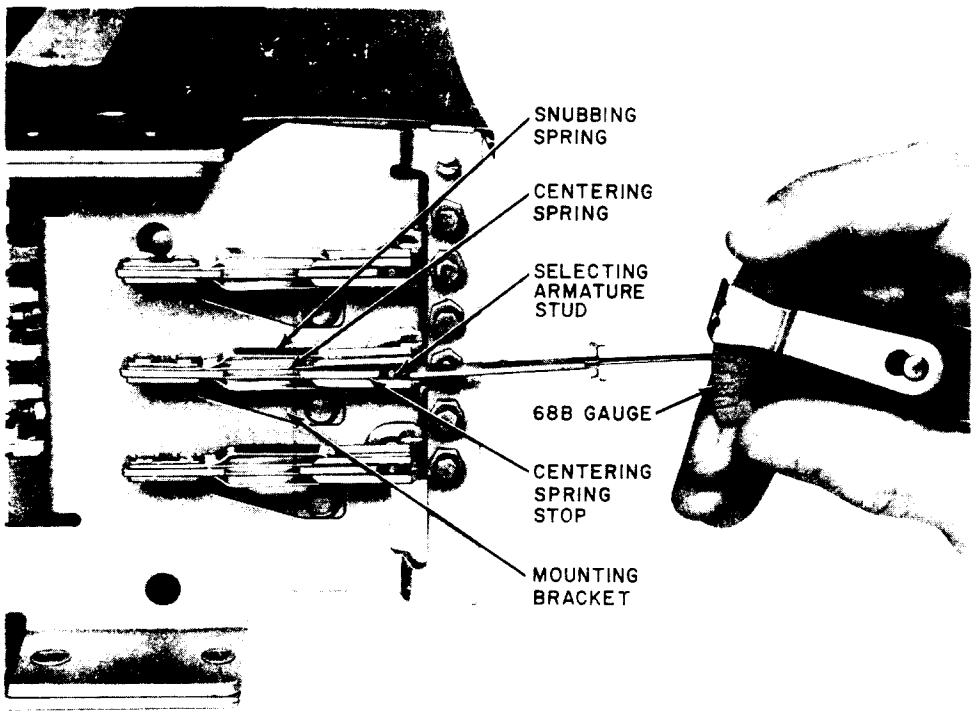


Fig. 3—Method of Measuring, Centering, and Snubbing Spring Tension

3.09 ***Selecting Armature Travel:*** With the selecting unit operated, the clearance between the armature stud and the nonoperated centering spring shall be

Min 0.060 inch

Max 0.080 inch

Use the 137B gauge, as shown in Fig. 4.

3.10 ***Paddle Wire Position—Selecting Bar:*** All paddles of the selecting bar assembly shall be approximately aligned between the associated selecting levels and shall be free from obvious damage or distortion.

3.11 ***Hairpin Select Wire—Requirements***

(a) Each hairpin select wire in its normal installed position shall be straight or slightly bowed between the crosspoint operate cards and the paddle of the selecting bar.

(b) When the selecting bar assembly is in its normal position, both legs of the hairpin select wire shall rest on or be tensioned toward the paddle of the selecting bar, be approximately equidistant from the trapping zones of their respective operate cards, and be tensioned toward the holding armature of the vertical unit.

Displacement of the selecting armature stud by 0.020 inch in either direction shall ***not*** position any hairpin select wire within the trapping zone of its associated operate card.

This requirement shall be checked by inserting the tubular portion of the KS-20650 gauge over the selecting armature stud and between the two centering springs. Check each level by holding the opposite centering spring against the stop surface of the centering unit bracket. Operate each holding armature and check to insure that no crosspoint closures have occurred.

(c) Operation of the selecting bar assembly when all holding armatures are in their normal positions shall position each hairpin select wire of the operated level within the trapping zone of its crosspoint operate card at a selecting armature core gap of

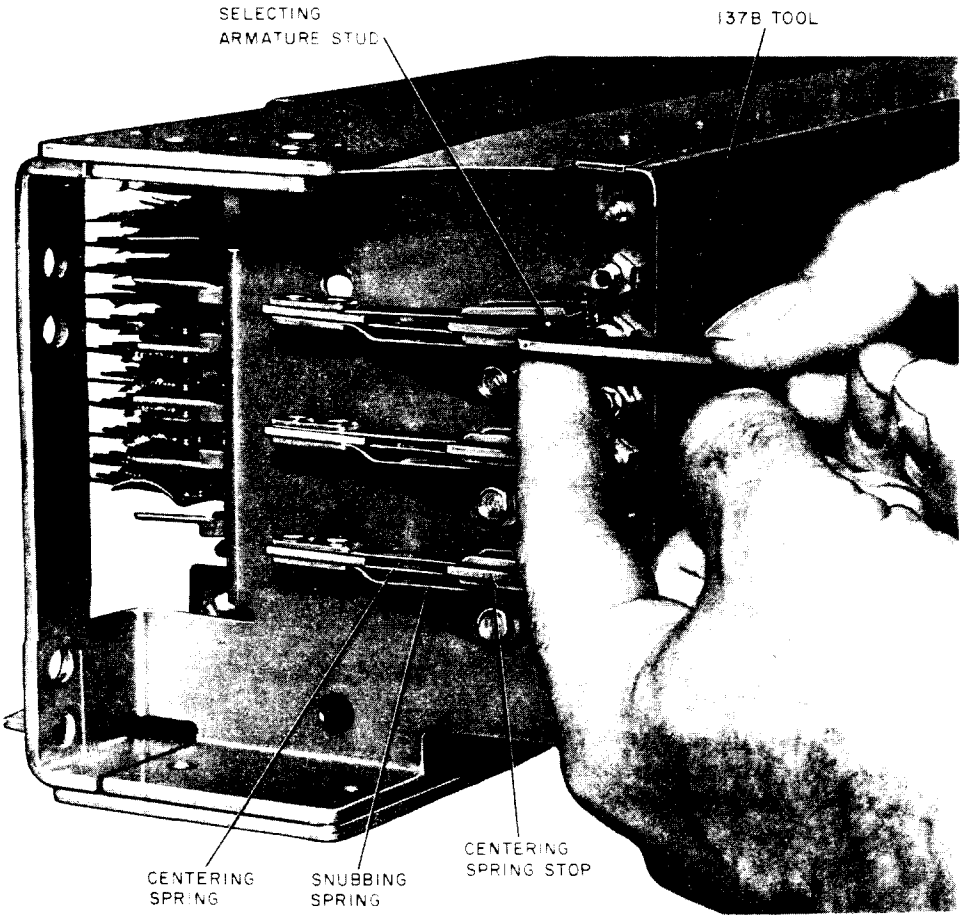


Fig. 4—Method of Checking Selecting Armature Travel

Test 0.005 inch

Readjust 0.006 inch

This requirement shall be checked by inserting the proper leaf of the 139A thickness gauge from above or below the selecting bars so the gauge leaf is between the selecting armature and its associated core and does not rest on the head of either of the two rivets used to attach the armature to the selecting bar. Operate the selecting armatures against the gauge and check for crosspoint closures while operating each holding armature. Failure to obtain crosspoint closure will require adjustment of the selecting bar paddle.

(d) Operation of the selecting bar assembly with any holding armature operated and the operated select wire not trapped shall position the operated select wire for preselection at the operated selecting level.

Subsequent release and reoperation of the holding armature, with the selecting bar assembly remaining in the operated position, shall result in trapping the operated select wire and operation of the crosspoint level.

(e) When adjacent nonassociated select fingers are operated towards each other, either during the "preselect" mode of operation or when adjacent select bars are operated toward each other, the ends of the deflected select fingers may touch, provided that upon subsequent closure of any select crosspoint and release of one select bar the touching ends separate and assume a free standing position.

(f) The position of the hairpin select wire on the working length of the selecting bar paddle shall be limited as follows.

(1) A minimum working length equivalent to two paddle wire diameters shall remain when the select wire is at its maximum travel toward the attached end of the paddle. Maximum travel toward the fixed end of the paddle occurs when only the hold armature is operated.

(2) When the associated operate card is operated, a minimum working length equivalent to a one-paddle wire diameter for a test condition or a two-paddle wire diameter for readjust condition shall remain between the select wire and the free end of the paddle. Maximum travel toward the free end of the paddle occurs when the level is selected and the hold armature is operated.

Gauge by eye.

(g) Both legs of each hairpin select wire shall extend beyond its respective selecting bar paddle by the following minimum dimensions:

(1) 0.060-inch extension for those hairpin select wires having one curved tip

(2) 0.100-inch extension for those hairpin select wires having straight tips.

Note: Failure to comply with requirements 3.11(f) and (g) can result in flipping the hairpin select wire so that both legs rest on the same side of the paddle with the loss of one level of crosspoint operation. In some instances hairpin select wire flipping may occur even though requirements 3.11(f) and (g) are met. When this occurs it is necessary to readjust the holding core to eliminate the flipped hairpin select wire trouble condition which is occurring because the holding armature is buckling the select wire against the vertical unit base. Such undesirable buckling action is caused by the armature seating on the outermost face of the holding core and rocking away from the knife edge at the closed gap position.

(h) With a 0.0015-inch thickness gauge inserted between the stop bracket and the unoperated hold armature, each select wire within a vertical unit, when deflected and released by the aligning selecting bar paddle, shall have freedom of movement into and out of the trapping zone of the associated operate card. Use the 172A 0.0015-inch thickness gauge.

3.12 ***Electrical Requirements—Selecting Bar Assembly:*** The selecting magnets shall meet the electrical requirements specified in the circuit requirements table.

REQUIREMENTS FOR SELECTING OFF-NORMAL ASSEMBLIES WHEN USED IN LIEU OF CENTERING UNITS

3.13 ***Selecting Off-Normal Cover:*** The common selecting off-normal cover shall be securely held against the bearing plate and a minimum clearance of 0.012 inch shall exist at all times between the cover and any operating part of a selecting off-normal assembly.

Gauge by eye.

3.14 ***Contact Alignment***

(a) Spring assemblies equipped with standard contacts shall be aligned so the width of each bar contact falls entirely within the length of its mating contact, as shown on Fig. 5.

(b) Spring assemblies equipped with heavy contacts shall meet the requirements, as shown on Fig. 6.

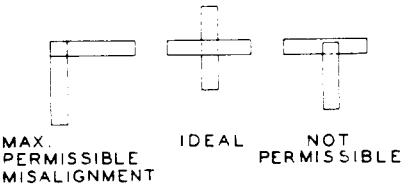


Fig. 5—Alignment of Standard Contacts—Plan View of Contact Surfaces

3.15 ***Straightness of Springs:*** All springs shall be free from sharp bends not common to the spring design. However, a gradual bend or a slight kink adjacent to the clamping point is permissible.

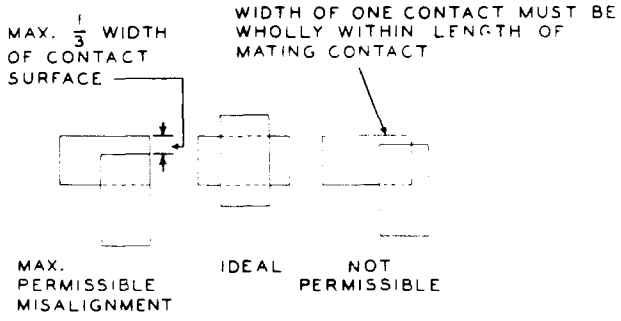


Fig. 6—Alignment of Heavy Contacts—Plan View of Contact Surfaces

3.16 ***Clearance—Contact Springs:*** A minimum clearance of 0.012 inch shall be maintained between the two contact springs and between the contact spring and adjacent snubbing spring.

Gauge by eye.

3.17 ***Clearance—Studs:*** Neither the centering spring nor the contact spring shall rest on or rub against the vertical surfaces of the operating or stationary studs of the selecting off-normal assembly.

3.18 ***Contact Spring Force:*** Fig. 7—With both centering springs in their normal positions, the force required to lift either contact spring off the stationary stud, as measured at the spring tip, shall be

Min 25 grams

Max 35 grams on inside contact spring only

Use 68B or 70C gauge.

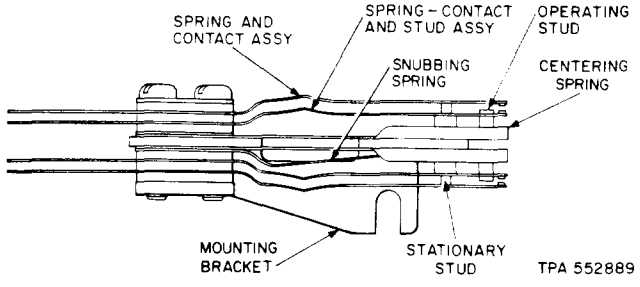


Fig. 7—Point of Tension Measurement—Selecting Off-Normal Spring

3.19 ***Contact Separation:*** With both centering springs in their normal positions, the contact separation shall be

Min 0.030 inch

Use KS-6938 gauge.

3.20 ***Operating Stud Clearance:*** With the centering spring resting against its associated stop, a minimum clearance of 0.026 inch shall exist between the tip of the contact spring operating stud and its associated centering spring. This requirement is considered to be met if no selecting off-normal contacts make when a 0.026-inch thickness gauge is inserted between the select armature stud and the centering spring, with the opposite centering spring held against its stop.

Use the 193A gauge.

3.21 ***Centering and Snubbing Spring Force***

(a) ***Fig. 7—Even-Numbered Levels:*** With the opposite centering spring blocked away from its stop surface, the force required to lift the combined tensions of the centering spring and its associated snubbing spring off of the stop surface, as measured at the tip of the centering spring, shall be

Min 25 grams

Max 35 grams

Use 68B or 70C gauge.

With the opposite centering spring blocked away from its stop surface and the snubbing spring lifted off the centering spring, the centering spring may or may not rest against the stop surface. If the centering spring rests against the top surface, the force required to lift it off the stop surface, as measured at the tip of the centering spring, shall not exceed 10 grams.

(b) ***Fig. 7—Odd-Numbered Levels:*** With the opposite centering spring blocked away from its stop surface, the centering spring shall rest against the stop surface with a force as measured at the tip of the spring.

Min 0 grams

Max 10 grams

3.22 ***Contact Make***

(a) Both contacts on the bifurcated contact springs shall make with their associated contacts when the selecting bar is in its operated position.

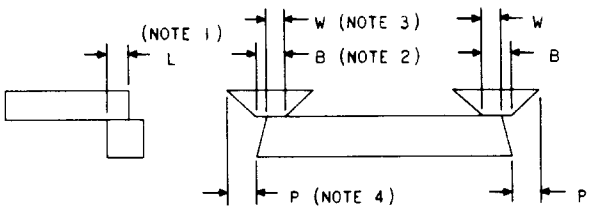
(b) At least one contact of the bifurcated contact spring shall make with its associated contact when the selecting armature is operated with a 0.006-inch 139A thickness gauge inserted between the selecting armature and core.

3.23 ***Selecting Armature Stud Clearance:*** With both centering springs in their unoperated positions and the selecting armature stud resting on one centering spring, the gap between the stud and the opposite centering spring shall not exceed 0.003 inch.

Gauge by eye.

VERTICAL UNIT REQUIREMENTS EXCLUSIVE OF HOLDING OFF-NORMAL ASSEMBLY

3.24 ***Crosspoint Contact Alignment:*** The alignment of crosspoint contacts shall meet the requirements shown on Fig. 8.



NOTES:
1. MINIMUM LENGTH OF ENGAGEMENT "L" FOR EACH TWIN WIRE SHALL BE 0.011 INCHES.
2. DIMENSION "B" IS THE WIDTH OF ONE CONTACT.
3. MINIMUM WIDTH OF ENGAGEMENT "W" FOR EACH TWIN WIRE SHALL BE 2/3 "B" BUT NO LESS THAN 0.0095 INCHES.
4. CONTACT OVERHANG OR PROTRUSION "P" IS ACCEPTABLE IF THE REQUIREMENTS OF 3.25 AND 3.27 ARE MET.

Fig. 8—Alignment of Crosspoint Contacts

3.25 ***Contact Separation:*** The separation between the movable crosspoint contacts and the associated fixed contact shall be

Min 0.008 inch

Gauge by eye.

3.26 ***Contact Spring Position:*** The movable contact springs shall be in their respective groove of the crosspoint operate card as determined by their position in the molded twin-wire block and may be centered or bear lightly on the sides of the groove.

3.27 ***Movable Contact Spring Clearance:*** Fig. 9—The clearance between nonassociated movable contact springs shall be

Min 0.010 inch

Gauge by eye.

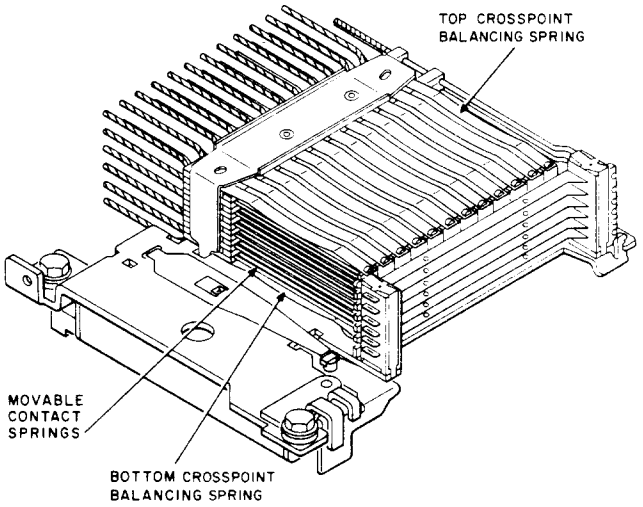


Fig. 9—Vertical Unit Assembly

3.28 ***Crosspoint Contact Gauging:*** With any selecting bar held in the operated position and the proper 195-type armature gauge installed on the holding armature, as shown in Fig. 10, operation of the holding armature shall produce the following results.

(a) At least one contact of each twin-wire pair shall close with an 0.008-inch thickness gauge installed between the armature and core.

Use the 195A gauge.

(b) All switches except CB-1, CB-2, CB-3, CB-4, CB-5, CC-1, CC-5, CD-1, CE-1, CE-2, CF-1

CF-2, and CF-6. No contact shall close with a 0.026-inch thickness gauge installed between the armature and core.

Use the 195C gauge.

(c) CB-1, CB-2, CB-3, CB-4, CB-5, CC-1, CC-5, CD-1, CE-1, CE-2, CF-1, CF-2, and CF-6 switches. No contact shall close with a 0.034-inch thickness gauge installed between the armature and core.

Use the 195G gauge.

3.29 ***Straightness of Crosspoint Balancing Springs:*** Both the top and bottom balancing springs of the twin-wire block shall be free from sharp bends or kinks.

3.30 ***Crosspoint Balance Spring Clearance:*** The clearance between the top and bottom balance springs and the movable contact springs shall be at all times

Min 0.015 inch

Gauge by eye.

3.31 ***Holding Armature Restoring Spring Force:*** The force of the holding armature restoring spring against the stud of the holding armature with the holding armature unoperated shall be

Min 26 grams

Max 70 grams

Use the 70G gauge, as shown in Fig. 11.

3.32 ***Freedom of Movement—Holding Armature—Unoperated Position:*** The holding armature shall not bind during normal rotation, and clearance end play and side play shall exist between the holding armature and all adjacent fixed surfaces.

3.33 ***Holding Armature Core Gap—CA-, CB-, CC-, CD-, CE-, and CF-Type Switches:*** The nonoperated airgap between the holding armature and its core shall be

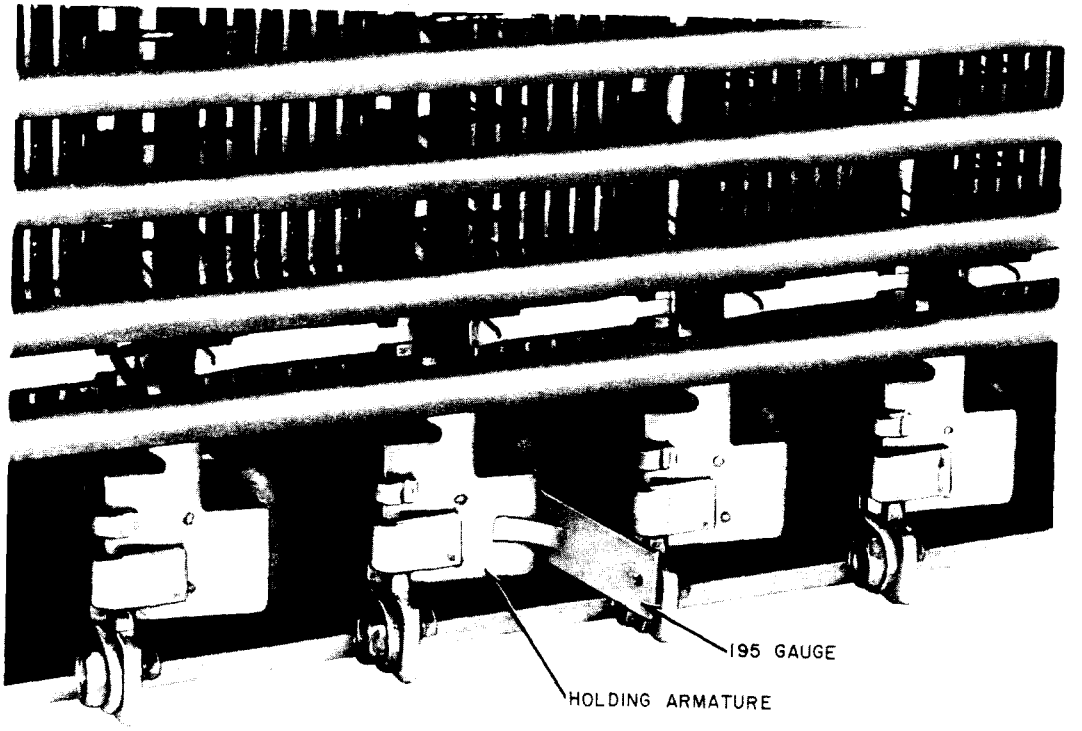


Fig. 10—Contact Gauging

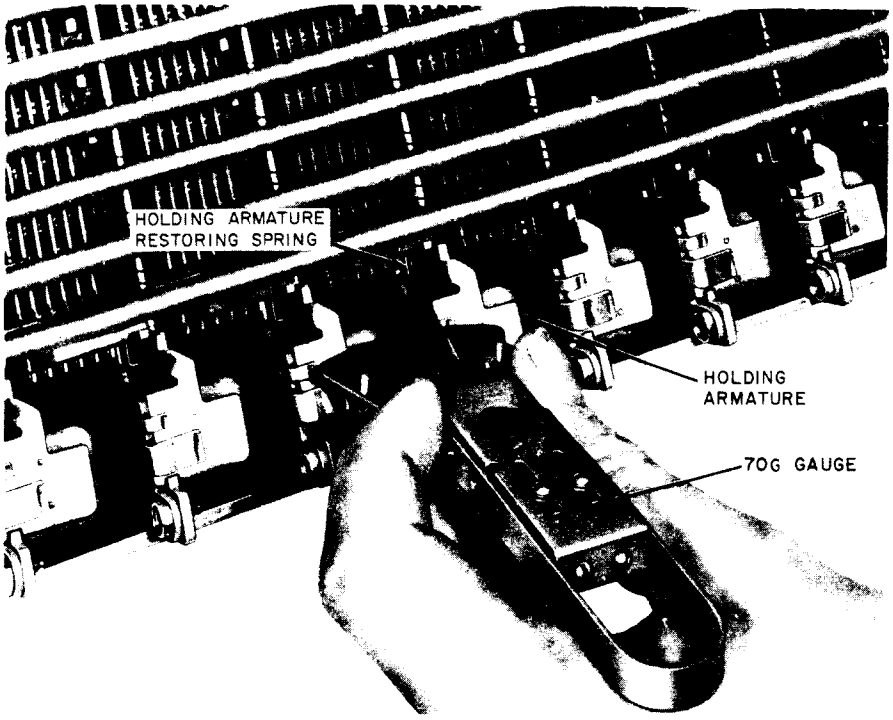


Fig. 11—Method of Measuring Holding Armature Restoring Spring Force

Max 0.072 inch

Measure with the 195D and 195E gauges, holding the armature against the knife edge, as shown in Fig. 12.

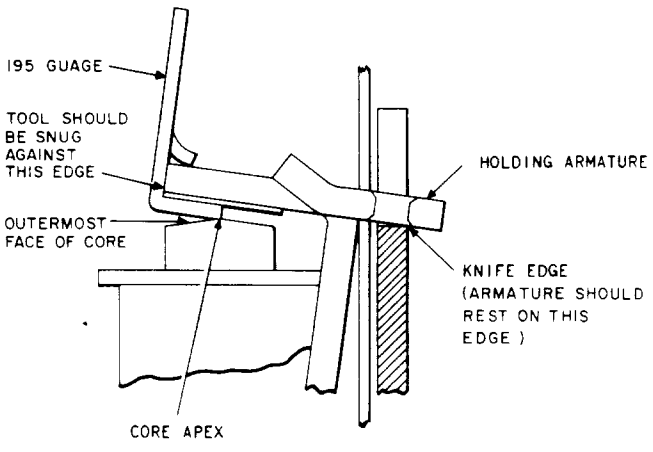


Fig. 12—Method of Measuring Holding Armature Core Gap

ELECTRICAL REQUIREMENTS

3.34 ***Selecting Units:*** The selecting units shall meet the electrical requirements specified on the circuit requirements table.

3.35 ***Holding Armatures:*** All holding armatures shall operate (see 1.18 and 1.19) on the current flow values specified by the circuit requirements table. These values shall apply as specified to all CA through CF switch codes having either single or multiple crosspoint operation. In any case, selecting bar operation required to test for this requirement may be accomplished either manually or electrically.

REQUIREMENTS FOR HOLDING OFF-NORMAL CONTACT SPRINGS (Fig. 13)

3.36 ***Contact Alignment***

(a) Contact alignment shall be in accordance with the values shown on Fig. 14.

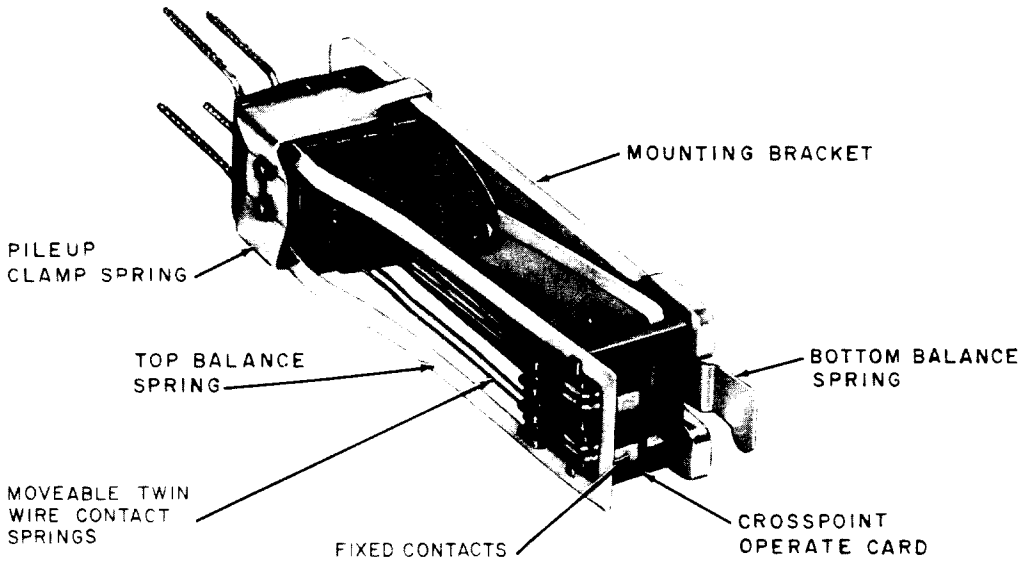
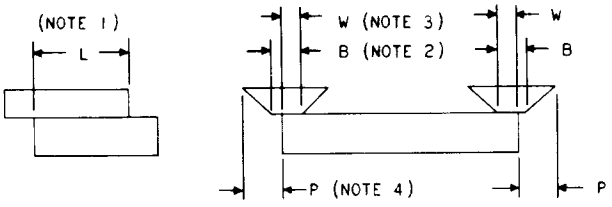


Fig. 13—Holding Off-Normal Spring Assembly

(b) Contact overhang or protrusion "P" is acceptable if the requirements contained in 3.38 are met.



NOTES:
1. MINIMUM LENGTH OF ENGAGEMENT "L" FOR EACH TWIN WIRE SHALL BE 0.032 INCHES.
2. DIMENSION "B" IS THE WIDTH OF ONE CONTACT.
3. MINIMUM WIDTH OF ENGAGEMENT "W" FOR EACH TWIN WIRE SHALL BE 2/3"B."
4. CONTACT OVERHANG OR PROTRUSION "P" IS ACCEPTABLE IF THE REQUIREMENTS OF 3.14 ARE MET.

Fig. 14—Alignment of Holding Off-Normal Contacts

3.37 *Clearances—Contact*

(a) The clearance maintained between associated moving contacts in the open position shall be

Min 0.005 inch

This requirement is considered met if one contact does not ride on the other during three successive manual operations of the hold armature.

(b) The clearance between moving contacts and nonassociated moving wire springs shall be

Min 0.015 inch

Gauge by eye.

(c) The clearance between moving contacts and nonassociated fixed contacts shall be

Min 0.010 inch

Gauge by eye.

3.38 *Clearances—Movable Wire Spring*

(a) The movable twin-wire contact springs shall be located in their proper comb groove relative to their position in the molded block and may be centered or bear lightly on the sides of the groove.

(b) The clearance between a movable wire spring and the bottom of its associated comb groove

when the movable contacts are in their closed position shall be

Min 0.010 inch

Gauge by eye.

3.29 ***Clearance—Single-Wire Block and the Top Balance Spring or Bottom Balance Spring:*** Neither the top balance spring nor the bottom balance spring shall touch the front support block at any point in its travel.

3.40 ***Spring Tension:*** The bottom balance spring of the holding off-normal assembly (when provided in lieu of the restoring spring) shall bear against the hold armature stud with a force of

Min 12 grams

using the 70G gauge.

(a) The top balance spring of the holding off-normal assembly shall position the associated operate card against the holding off-normal bracket with a force of

Min 10 grams

as measured at the tip of the top balance spring with the 70G gauge.

Note: If it is necessary to adjust either of these balance springs, both legs of the springs shall be adjusted evenly as best commercial practices permit.

The tensions of the twin-wire contact springs shall not be adjusted.

3.41 ***Straightness of Balancing Springs:*** Both balancing springs shall be free of sharp bends or kinks. A gradual bow in a spring or a slight kink due to tensioning at a point within 0.250-inch of the rear pileup is permissible.

3.42 ***Contact Gauging:*** Fig. 10

(a) ***Early Make Contacts***

(1) No early make contact shall make when the holding armature is operated with a 0.044-inch thickness gauge inserted between the armature and the core.

Use the 195H gauge.

(2) At least one contact of the early make pair shall make when the holding armature is operated with an 0.008-inch thickness gauge inserted between the armature and the core.

Use the 195A gauge.

(b) ***Make Contacts***

(1) No make contact shall make when the holding armature is operated with a 0.044-inch thickness gauge inserted between the armature and the core.

Use the 195H gauge.

(2) At least one contact of the make pair shall make when the holding armature is operated with an 0.008-inch thickness gauge inserted between the armature and the core.

Use the 195A gauge.

(c) ***Early Break Contacts***

(1) At least one contact of the early break pair shall not break when the holding armature is operated with a 0.044-inch thickness gauge inserted between the armature and core.

Use the 195H gauge.

(2) Both contacts of the early break pair shall be open when the holding armature is operated with an 0.008-inch thickness gauge inserted between the armature and core.

Use the 195A gauge.

(d) ***Break Contacts***

(1) At least one contact of the break pair shall not break when the holding armature is operated with a 0.044-inch thickness gauge inserted between the armature and core.

Use the 195H gauge.

(2) Both contacts of the break pair shall be open when the holding armature is operated with an 0.008-inch thickness gauge inserted between the armature and core.

Use the 195A gauge.

Note 1: Contact continuity requirements for HON units which have ***continuity*** (EMB) contacts shall be considered met if electrical continuity occurs between the specified make and break contacts at some point during manual operation of the hold armature.

Note 2: ***Transfer*** (EBM) sequence requirements shall be considered met if ***no*** electrical continuity occurs between specified movable break and make EMB contacts through the associated fixed contact during manual operation of the hold armature.

4. ADJUSTING PROCEDURES

CONTACT ADJUSTMENT

4.01 The contact adjustment procedures are as follows:

(1) Clean the contacts in accordance with approved procedures described in 4.04 of Section 069-306-801

(2) If one or more of the twin-wire springs should be out of the proper groove of its associated operate card with respect to its position in the molded twin-wire block, it may be gently lifted from the card and moved to its proper position using a KS-6320 L1 or L2 orange stick. The 510C test lamp and the KS-19916 L1 magnifier may be used as aids for repositioning contact springs.

4.02 ***Mounting of Switch and Switch Parts*** (Reqt 3.02)

(1) Tighten the switch mounting screws with the R-1324 screwdriver after starting them with the 2356 screw starter.

(2) Tighten the holding magnets, the holding off-normal spring assembly mounting screws, and the holding armature stop bracket with the 541A wrench.

(3) Tighten the centering unit mounting brackets with the 544A wrench.

(4) Tighten the selecting off-normal spring assembly with the R-2670 hex socket screw wrench.

(5) Tighten the vertical unit mounting ***left-hand screws*** (Fig. 15) and selecting bar support bracket and comb right-hand screws using the 541A wrench or the KS-20476 L1 nut driver.

4.03 ***Selecting Bar Clearance*** (Reqt 3.03)

4.04 ***Selecting Bar—Freedom of Rotation*** (Reqt 3.04)

4.05 ***Tightness of Selecting Bar Pivot Screw Locknuts*** (Reqt 3.05)

(1) ***Freedom of Movement of Selecting Bar:*** A binding selecting bar is attributable to one or more of the following:

(a) Improper clearance

(b) Dirt and grit in the pivot bearings

(c) Defective pivot screws

(d) Bowed selecting bar

(e) Burred or defective selecting bar bearings

(f) Pivot screws improperly adjusted (lack of end play)

(g) Bent switch frame or excessive switch sag.

Generally, the trouble will be due to either or both of conditions (a) or (b) which will usually produce an intermittent binding condition as the selecting bar rotates. When there is excessive selecting bar tension at the center support bracket assembly, it is due to either or both of conditions (d) and (g).

(2) For conditions (b), (c), (d), and (e), the selecting bar must be removed from the switch. The procedure for removing and replacing a selecting bar is covered in Section 030-721-801.

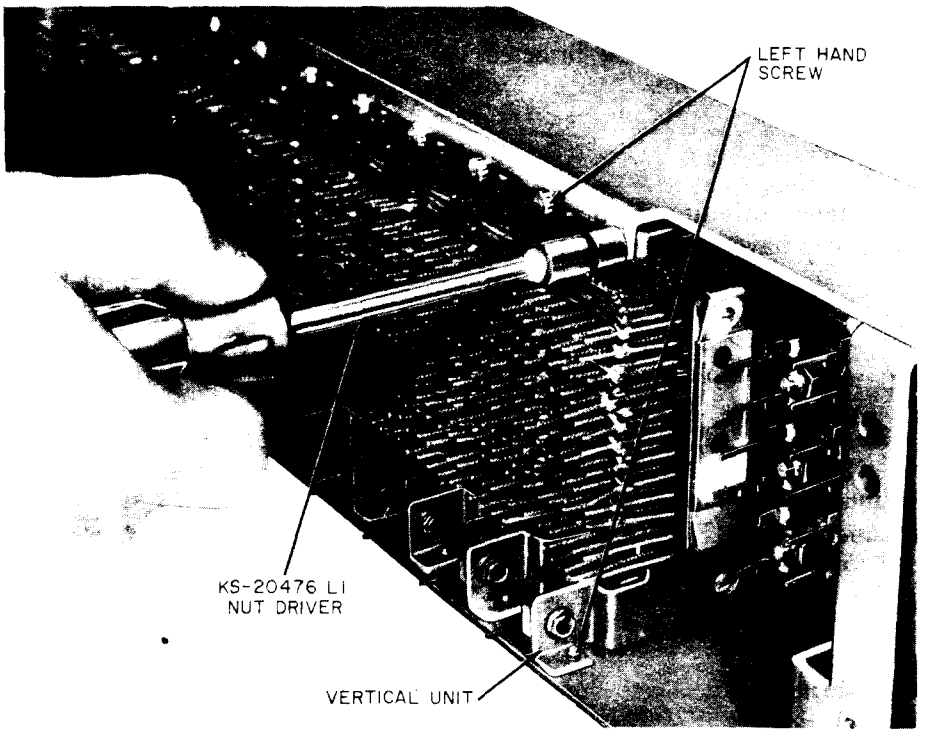


Fig. 15—Mounting the Vertical Unit Assembly

It is satisfactory to prop switch frames at their centers to reduce excessive switch sag to less than 0.100 inch and to eliminate excessive select bar tension at the center support bracket assembly. Switches that meet or can be adjusted to meet all requirements of 3.03, 3.04, 3.05, 3.09, 3.10, 3.11, and 3.34 can be expected to give satisfactory performance and service if they remain propped.

(3) ***Adjustment for Clearance (a) and End Play (f):*** Loosen both locknuts with the 541B wrench and turn the pivot screws out slightly at each end using the 476B wrench. Insert the 0.012-inch blade of the 193A gauge between the wide portion of the selecting armature extension and the side of the switch frame (Fig. 2). Press the armature extension against the blade and then adjust the pivot screw on the opposite end of the select bar to obtain the 0.012-inch clearance and tighten the locknut as covered in (4). Remove the 0.012-inch gauge and hold the selecting bar in the direction to increase the clearance between the armature extension and the switch frame. Adjust the adjacent pivot screw to give 0.018-inch clearance between the armature extension and frame. Tighten the locknut as covered in (4).

(4) ***Tightening of Pivot Screw Locknuts:*** Hold the pivot screw with the 476B wrench and tighten the locknut with the 541B wrench.

(5) ***Rechecking Other Requirements:*** If the selecting bar pivot screw has been adjusted in accordance with (3) or if the select bar has been removed, adjusted, or replaced, check requirements 3.03, 3.04, 3.05, 3.08, 3.09, 3.10, 3.11, and 3.12. If any other adjustments are made, recheck requirement 3.12.

4.06 ***Straightness of Centering and Snubbing Springs:*** (Reqt 3.06)—If the centering spring or snubbing spring is excessively bowed or bent, straighten the spring as shown in Fig. 16 before adjusting to meet the tension requirement. To straighten the spring, apply the 416B spring adjuster to the spring just back of the bow or bend and, while exerting pressure up or down as required, draw the spring adjuster forward the length of the bow. Repeat this operation as required until the spring is approximately

straight. Take care when adjusting the springs to adjust them in line with their movement and to avoid tilting them.

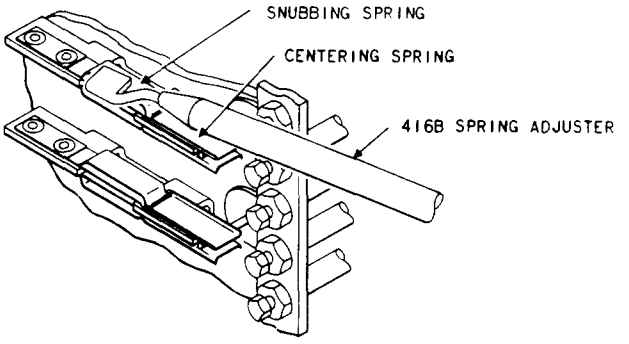


Fig. 16—Method of Adjusting Springs for Straightness and Tension

4.07 ***Spring Tensions of Centering and Snubbing Springs:*** (Reqt 3.07)—If the centering spring tension requirement is not met, apply the 416B spring adjuster near the base of the springs and adjust them up or down as required, taking care not to disturb adjacent springs. Tension the centering spring so it rests against the centering spring stop and meets the requirements. Then tension the snubbing spring so the combined tension requirement is met. Recheck requirement 3.08.

4.08 ***Clearance Between Selecting Armature Stud and Centering Spring:*** (Reqt 3.08)—If necessary to adjust for this requirement, apply the 549A spring adjuster to the spring from the front, as shown in Fig. 17, and adjust the end of the centering spring up or down as required. Any change made in this adjustment may affect the nonoperated position of the selecting bar. Also check requirement 3.07.

4.09 ***Selecting Armature Travel*** (Reqt 3.09)

(1) Operate the selecting armature and check the travel by using the 137B gauge to check the clearance between the stud and the nonoperated centering spring with the spring held against its stop surface. If the travel requirement is not met, adjust the selecting armature core.

(2) The selecting armature travel is adjusted as follows. Place the KS-21028 L1 tool on the select magnet core at the rear of the switch (Fig. 18). Loosen the locknut by turning the forward part of the tool handle in a CCW direction. To reduce the armature travel turn the core CW. To increase the armature travel turn the core CCW. Tighten the locknut to a torque of 27 lb/in while holding the core to prevent rotation.

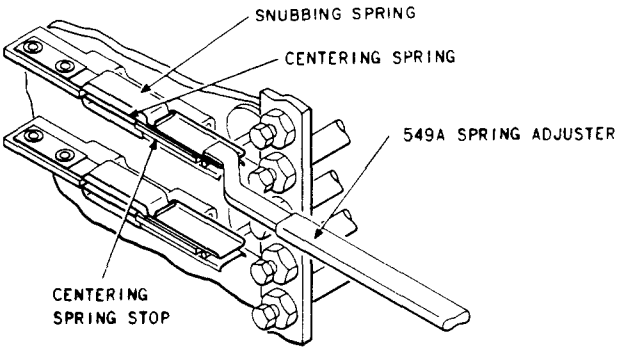


Fig. 17—Method of Adjusting Centering Spring Clearance

Note 1: One revolution of the core will change the core gap by approximately 0.032 inch.

Note 2: A suitable 15/16-inch box-end wrench may be used on the wrenching section of the KS-21028 L1 wrench to loosen select core locknuts. However, the box-end wrench should not be used to tighten the locknuts after core adjustment.

4.10 ***Paddle Wire Position—Selecting Bar*** (Reqt 3.10)

(1) ***Nonoperated Position:*** The selecting armature stud shall, when resting between the centering springs of the centering unit or selecting off-normal assembly, be located so the centerline of the pivot screw, the stud, and the centering unit stop surface lie in a straight line which is parallel to the channels of the switch frame as gauged by eye. This position is obtained by rotation of the centering unit (Fig. 19) or selecting off-normal assembly. Check requirement 3.10.

(2) Individual paddles are adjusted, as shown in Fig. 20, by using 774A tool to position

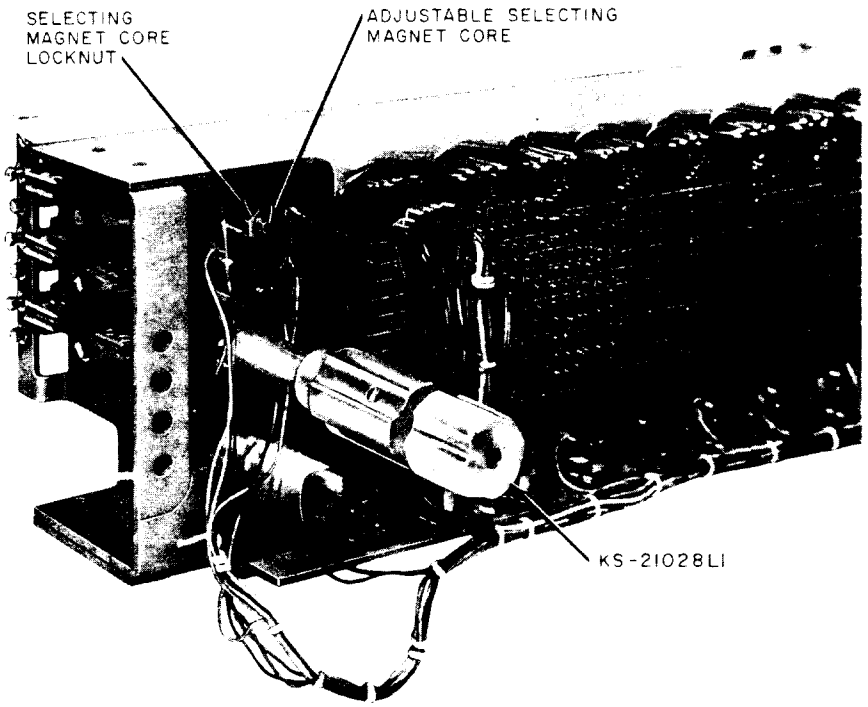


Fig. 18—Method of Adjusting Selecting Magnet Core Gap

the paddles to an approximately centered position which locates each hairpin select wire against or toward the innermost surface of its respective crosspoint operate card. To adjust the paddle upwards, place the long lip on the jaw of the 774A tool under the select bar and close the jaws. Paddle adjustment downwards is accomplished by inverting the tool.

(3) Check requirement 3.11(b) using the KS-20650 gauge.

4.11 *Hairpin Select Wire* (Reqt 3.11)

(1) Select wires which are damaged or do not meet requirement 3.11 must be replaced with a new part.

(2) The replacement select wire must be installed carefully to maintain the orientation and directed tensions of the original part.

(3) Replacement of a hairpin select wire may be accomplished by using the procedure contained in 030-721-801.

(4) If the hairpin select wire fails to meet requirement 3.11(f) and requirements 3.11(a) and 3.28 have been met, the following corrective action may be taken.

(a) Where the nonconformance to requirement 3.11(f) occurs on one end of the paddle and sufficient length exists on the opposite end, reform the paddle with the 50B spring adjuster so its working length more nearly conforms to the selecting wire travel. Care should be taken so the working length of the paddle remains parallel to the selecting bar.

(b) Where the nonconformance to requirement 3.11(f) occurs on both ends of the paddle, replace the selecting bar assembly.

(c) Where a flipped hairpin select wire occurs even though the paddle to select wire positioning conforms to Requirement 3.11(f) readjust the associated vertical unit holding core as follows.

(1) Install the 195J or 195K gauge on the holding armature as shown in Fig. 10.

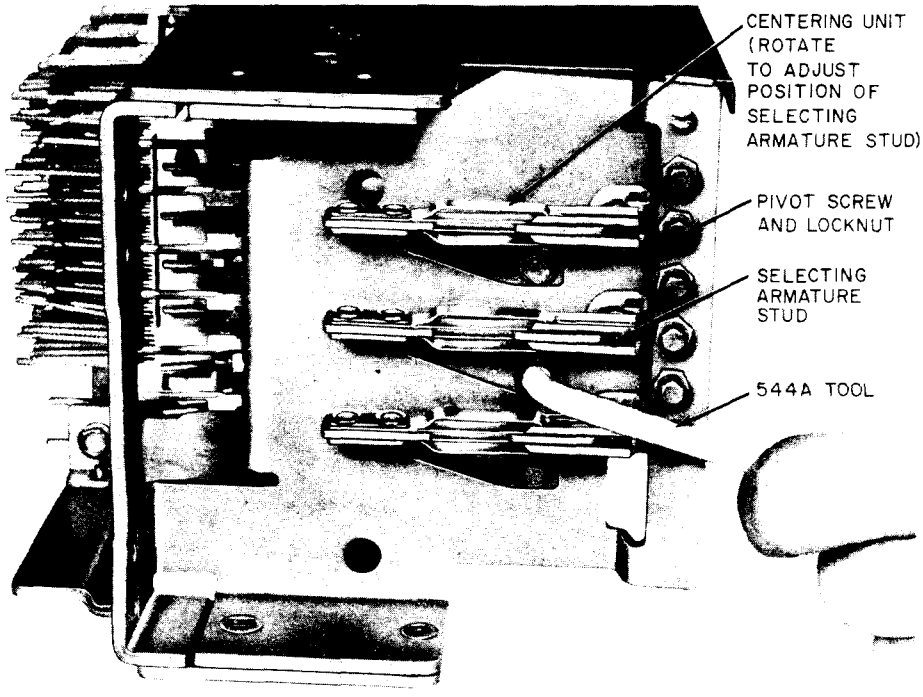


Fig. 19—Method of Adjusting Centering Unit

(2) Loosen the core mounting screw with the 541A wrench and move the core up against the mounted gauge.

(3) Apply a light force to the end of the core with a KS-6320 L1 or L2 orange stick to keep it seated against the mounted armature gauge and retighten the core mounting screw.

(4) Remove the gauge from the armature and with the 376A mirror insure that the armature is not seating on the outermost face of the holding core.

(5) Check for requirement 3.28 and requirement 3.33.

(6) Readjust the core and stop bracket if necessary.

(5) Failure to meet requirement 3.11(g) can be corrected as follows.

(a) If the condition exists on individual hairpin select wires, replace the selecting wire.

(b) If the condition exists on all select wires controlled by a given selecting bar, replace the selecting bar.

(6) Failure to meet requirement 3.11(h) can be corrected as follows.

(a) If the condition exists on vertical units equipped with the double-tabbed hold armature stop brackets, shift the position of the stop bracket to increase the hold armature airgap as described in 4.33 herein. Recheck the requirements of 3.11(h) and 3.33.

(b) If the condition exists on vertical units equipped with single-tabbed hold armature stop brackets, bend the tab upwards with the 623A tool to increase the hold armature airgap. Recheck the requirements of 3.11(h) and 3.33.

4.12 ***Electrical Requirements:*** (Reqt 3.12)—Failure of a selecting unit to meet

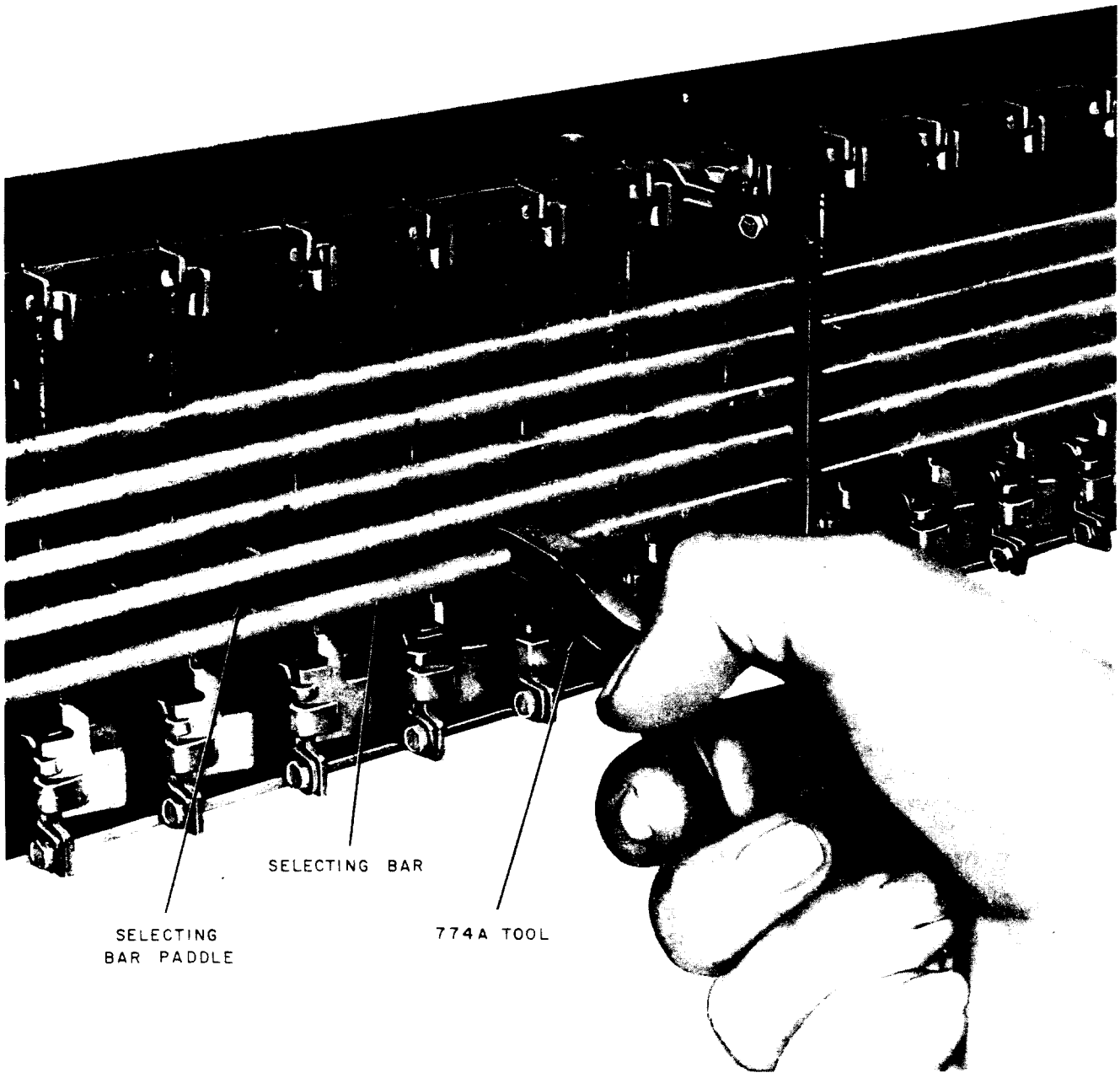


Fig. 20—Method of Adjusting Selecting Bar Paddle

the electrical requirements usually indicates difficulty in the following areas:

(1) Centering spring forces

(2) Selecting armature travel

(3) Selecting bar clearances not properly adjusted.

Check for requirements in the above areas and readjust if necessary.

PROCEDURES FOR SELECTING OFF-NORMAL ASSEMBLIES (WHEN USED IN LIEU OF CENTERING UNITS)

4.13 ***Selecting Off-Normal Cover:*** (Reqt 3.13)—If requirement 3.13 is not met, replace the cover.

4.14 ***Contact Alignment:*** (Reqt 3.14)—If requirement 3.14 is not met, replace the selecting off-normal assembly.

4.15 ***Straightness of Springs*** (Reqt 3.15)

4.16 ***Clearance—Contact Springs:*** (Reqt 3.16)—If requirements 3.15 or 3.16 are not met, the springs can be adjusted as follows.

(1) Apply a 416B spring adjusted to the spring between the spring pileup and the deformed area. Draw the adjuster toward the tip of the spring while exerting a force upward or downward to produce the required spring curvature. Repeat this operation until the spring has been straightened or the required clearance has been obtained.

Care must be taken to avoid tilting of the springs, resulting in unequal contact separation and the possible failure to obtain contact closure of one of the bifurcated contacts.

(2) Kinked springs should not be straightened unless the position of the kink interferes with the operation of the selecting off-normal assembly. The removal of kinks will weaken the spring and reduce its life. A gradual bow in the spring is permissable if requirement 3.16 is met.

4.17 ***Clearance—Stationary and Operating Studs:*** (Reqt 3.17)—If this requirement cannot be met by adjusting the spring, as outlined in 4.16, replace the selecting off-normal assembly.

4.18 ***Contact Spring Force*** (Reqt 3.18)

(1) To adjust the contact spring force, place a 416B spring adjuster on the contact spring just forward of the spring pileup and adjust the spring up or down to obtain the required force. Care should be taken that adjacent springs are not disturbed.

(2) If the required force cannot be obtained without excessive bowing of the contact spring or reducing the clearance below the limits specified by requirements 3.15 and 3.16, draw the 416B spring adjuster along the spring while applying a force so that a bow is formed having its concave side toward the centering spring. Complete the adjustment by using the procedure outlined in (1). A proper combination of the two procedures will produce an increase in spring force while retaining spring straightness and clearance.

4.19 ***Contact Separation*** (Reqt 3.19)

(1) Unequal contact separation of the bifurcated contacts may be corrected by using the 535A spring adjuster to align the two members of the bifurcated spring.

(2) Failure to meet requirement 3.19 and involving both contacts of the bifurcated spring can be corrected in most cases by bending the contact spring with a 416B spring adjuster applied directly behind the stationary stud. If requirement 3.19 cannot be met using the above procedure, hold the contact spring with a 416B spring adjuster placed behind the stationary stud and bend the spring with a second 416B spring adjuster applied in front of the stationary stud. The bending operation should be done carefully to avoid kinking the spring. After completion of these adjustments, check the spring tension as specified by requirement 3.18 and adjust, if necessary.

4.20 ***Operating Stud Clearance:*** (Reqt 3.20)—If the stud clearance does not meet requirement 3.20 and requirement 3.23 has been met, adjust the centering spring and stud assembly by applying the 416B spring adjuster to the spring at a point just behind the stationary stud. Check for compliance with requirement 3.19 and adjust if necessary.

4.21 ***Centering and Snubbing Spring Force:*** (Reqt 3.21)—If requirement 3.21 is not met, adjust as outlined by 4.07.

4.22 ***Contact Make:*** (Reqt 3.22)—If requirement 3.22 is not met, check for compliance with requirements 3.19 and 3.20. When these requirements have been met and the condition persists, replace the selecting off-normal assembly.

4.23 ***Selecting Armature Stud Clearance:*** (Reqt 3.23)—If requirement 3.23 is not met, adjust the centering springs as outlined by 4.07.

VERTICAL UNIT PROCEDURES EXCLUSIVE OF HOLDING OFF-NORMAL ASSEMBLIES

4.24 ***Crosspoint Contact Alignment:*** (Reqt 3.24)—If the requirements are not met, replace vertical unit.

4.25 ***Contact Separation:*** (Reqt 3.25)—If the requirements are not met, replace the vertical unit.

4.26 ***Contact Position:*** (Reqt 3.26)—If one or more of the twin-wire springs should be out of its proper groove of its associated operate card with respect to its position in the molded twin-wire block, it may be gently lifted from the card, moved to its proper position on the card, and forwarded into its proper groove using a KS-6320 L1 or L2 orange stick. After repositioning the twin-wire springs, determine that the springs are not crossed in back of the crosspoint operate card by lifting each spring off the card while observing the other spring. Any movement of the other spring indicates that the springs are crossed and must be repositioned. Use the 510C test lamp and the KS-19916 L1 magnifier as aids for this inspection and/or adjustment.

4.27 ***Movable Contact Spring Clearance*** (Reqt 3.27)

4.28 ***Crosspoint Contact Gauging*** (Reqt 3.28)

(1) Failure to meet the gauging requirements is probably due to misadjustment of the holding core but may be due to wear of the holding armature.

(2) ***Wear of Armature at the Point of Contact With the Selecting Finger:*** Replace the armature if a groove or worn spot is found on the armature at the point of contact with the selecting finger. If inspection reveals that wear does not exist, readjust the core to obtain proper contact gauging.

(3) ***Holding Core Adjustment:*** The holding core is adjusted by loosening the core mounting screw with the 541A wrench and moving the core toward or away from the holding armature by sliding the core mounting screw along the slotted mounting hole in the vertical unit base. When requirement 3.28 has been satisfied, retighten the core mounting screw and check for requirement 3.33. Readjust the stop bracket if necessary.

Note: After holding core adjustment, check the holding armature motion during operation to prevent the armature from seating on the outermost face of the holding core and rocking away from the knife edge at the closed gap position. The unsatisfactory condition described above indicates that the core is positioned excessively behind the knife edge. If the condition exists when requirement 3.33 has been met, the holding armature should be replaced.

4.29 ***Straightness of Crosspoint Balancing Springs*** (Reqt 3.29)

4.30 ***Crosspoint Balancing Spring Clearance:*** (Reqt 3.30)—If the requirements are not met, replace the vertical unit.

4.31 ***Holding Armature Restoring Spring Force*** (Reqt 3.31)

(1) The holding armature restoring spring snaps into punched slots in the vertical unit base. Using two KS-6320 L1 or L2 orange sticks, one may remove the spring by applying a light force against the rear spring tab in the direction to push the tab back through the slot in the base while applying a force to the tip of the spring in a direction toward the back of the switch. This will cause the spring to snap out of the base.

(2) To increase the restoring spring force, remove the spring and increase the pretension bend.

(3) The restoring spring force may be reduced with the spring installed by drawing an orange stick over the spring between the front tab and the tip of the spring. Use a light force to press the spring against the base, repeating the operation until the desired value is obtained.

(4) Installation of the restoring spring is accomplished as follows. With the tip of the spring resting on the holding armature stud, slide the spring back along the base until the front tab drops into the base slot and then move the spring forward to enter the back tab into the base.

(5) When installed, the portion of the spring between the two locking tabs should lie flat against the base. If it does not, replace the spring.

4.32 ***Freedom of Movement of Holding Armature*** (Reqt 3.32)

(1) Vertical play requirement not met per 3.32 is probably due to dirt in the bearing areas or damage to the armature or base. If cleaning does not alleviate the condition, inspect for damage and replace as required.

(2) Lack of clearance between the hinge and the holding armature stop bracket may be due to dirt on the armature and stop bracket or misformed or damaged stop bracket. Clean or replace the stop bracket to correct the condition.

4.33 ***Holding Armature Airgap, CA-, CB-, CC-, CD-, CE, and CF-Type Switches*** [Reqt 3.33 or 3.11(h)]—If the holding armature airgap is not satisfactory, shift the position of the holding armature stop bracket as follows.

(1) On vertical units equipped with double-tabbed stop brackets, loosen the stop bracket mounting screw using the 541A wrench. Insert the 195D (0.050-inch gauge) or the 195E (0.072-inch gauge) between the armature and core of the switch. Rotate the stop bracket against the armature until the gauge is in contact with the core. Tighten the stop bracket mounting screw. Recheck the requirements.

(2) On vertical units equipped with single-tabbed stop brackets, insert the slotted end of the 623A tool over the tab. Bend the tab upwards to increase the airgap or downwards to decrease the airgap. Recheck the requirements.

ELECTRICAL REQUIREMENTS

4.34 ***Selecting Units:*** (Reqt 3.34)—If the electrical requirements are not met, recheck requirements 3.03, 3.04, 3.07, and 3.09.

4.35 ***Holding Armature:*** (Reqt 3.35)—If the electrical requirements are not met, recheck requirements 3.31, 3.32, and 3.33.

PROCEDURES FOR HOLDING OFF-NORMAL CONTACT SPRINGS

4.36 ***Contact Alignment*** (Reqt 3.36)

4.37 ***Contact Clearance:*** (Reqt 3.37)—If the requirements are not met, replace the holding off-normal unit.

4.38 ***Clearance—Movable Wire Spring:*** (Reqt 3.38)—The wire springs may be positioned into their proper grooves in the comb by lifting gently with a KS-6320 L1 or L2 orange stick and allowing them to drop into their respective grooves. Refer to 4.26 to check for crossed wire springs. If this requirement is not met, check the hold armature airgap and gauging. Readjust as covered in 4.33 and 4.42. If travel is satisfactory and requirement 3.38(b) cannot be met, replace the holding-off-normal assembly.

4.39 ***Clearance—Single-Wire Block and the Top Balance Spring or Bottom Balance Spring:*** (Reqt 3.39)—If the requirement is not met, replace the holding-off-normal assembly.

4.40 ***Spring Tension:*** (Reqt 3.40)—If requirement 3.40 is not met, adjust the balance springs as required by increasing or decreasing the offset bend. Care should be taken to tension the two legs of the spring uniformly.

4.41 ***Straightness of Balancing Springs:*** (Reqt 3.41)—If the requirement is not met, replace the holding-off-normal assembly.

4.42 ***Contact Gauging:*** (Reqt 3.42)—If the contact gauging requirements of 3.42 are not met, the tip of the bottom balance spring may be adjusted by bending the spring in front of the offset bend. Use the 485A smooth-jaw pliers. Recheck requirements 3.38, 3.39, and 3.40 after bending.