RELAYS
114, 124, 126, 174, AND 198 TYPES
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers 114-, 124-, 126-, 174-, and 198-type relays.

1.02 This section is reissued to revise the method of checking the hinge gap requirement, to revise Table A in the requirement covering retractile spring tension, and to revise the list of tools. Detailed reasons for reissue will be found at the end of the section.

1.03 Reference shall be made to Section 020-010-711 for additional information necessary for the proper application of the requirements listed herein.

1.04 *Asterisk (*):* Requirements are marked with an asterisk when to check for them would necessitate dismantling or dismounting of apparatus, or would affect the adjustment involved, or other adjustments. No check need be made for these requirements unless the apparatus or part is made accessible for other reasons, or its performance indicates that such a check is advisable.

1.05 *Operate:* A relay is said to *operate* if, when current is connected to its winding, the armature moves sufficiently to cause the back contact to break, and the front contact to make sufficiently to cause the associated relay or relays to function.

1.06 *Nonoperate:* A relay is said to *nonoperate* if, when current is connected to its winding, the armature does not move sufficiently to close the front contact, or to reduce the back contact pressure sufficiently to cause the associated relay or relays to function.

1.07 *Release:* A relay is said to *release* if the armature moves from the core sufficiently to break the front contact and make the back contact.

1.08 *Hold:* A relay is said to hold if, after the relay has operated and the current is either reduced abruptly or is interrupted momentarily, the armature does not move sufficiently to cause the front contact to become unreliable or to make the back contact.

1.09 *The electrical requirements* given in Tables B, C, and D apply only to relays used as trip relays. The electrical requirements for relays not used as trip relays are given on circuit requirement tables.

1.10 *Fig. BX, FB, and FBX:* These figures, formerly specified on circuit requirement tables, are covered by the requirements on pages 1 to 7.

1.11 *Fig. 1 to 10 Inclusive:* These figures, formerly specified on circuit requirement tables, are covered by the requirements on pages 1 to 14 inclusive.

2. REQUIREMENTS

2.01 *Cleaning:* The contacts and parts shall be cleaned when necessary, in accordance with Section 069-306-801.

2.02 *Relay Mounting:* Fig. 1(A) — Relays shall be fastened securely to the mounting plate. This shall be checked by applying a vertical and a horizontal pressure to the relay, and not by attempting to turn the relay.

Gauge by feel.

2.03 *Cover Spring Pressure*

(a) The cover spring shall have sufficient pressure against the cover to hold the cover securely in place.

Gauge by feel.

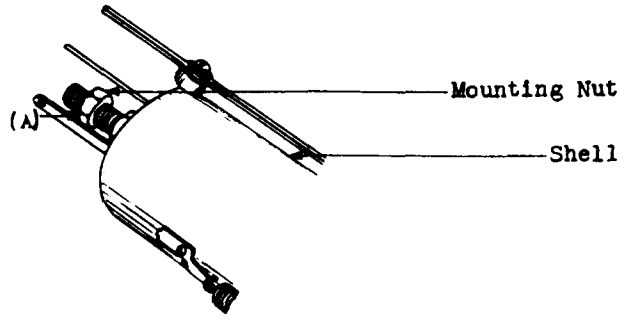

Fig. 1 – Relay Mounting

(b) (Relays equipped with the No. 1A relay covers only — Fig. 2) The studs on the cover spring shall rest against the relay shell when the cover is removed.

Gauge by eye.

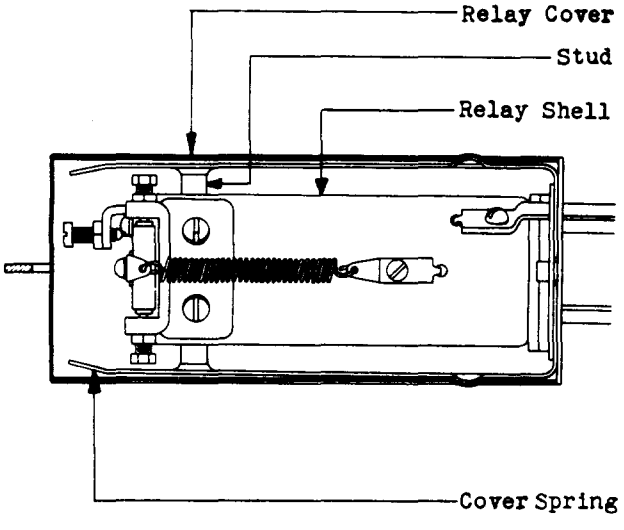

Fig. 2 – Relay Equipped with No. 1A Relay Cover

2.04 ***Contact Alignment:*** Fig. 3(A) — The contacts shall line up so that the point of contact falls wholly within the boundary of the opposing contact.

Gauge by eye.

*2.05 ***Tightness of Adjusting Nut:*** Fig. 4(A) and Fig. 9(A) — The adjusting nut shall exert sufficient pressure on the adjusting stud to retain it in any adjusted position.

Gauge by feel.

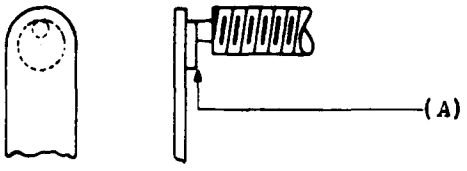

Fig. 3 – Contact Alignment

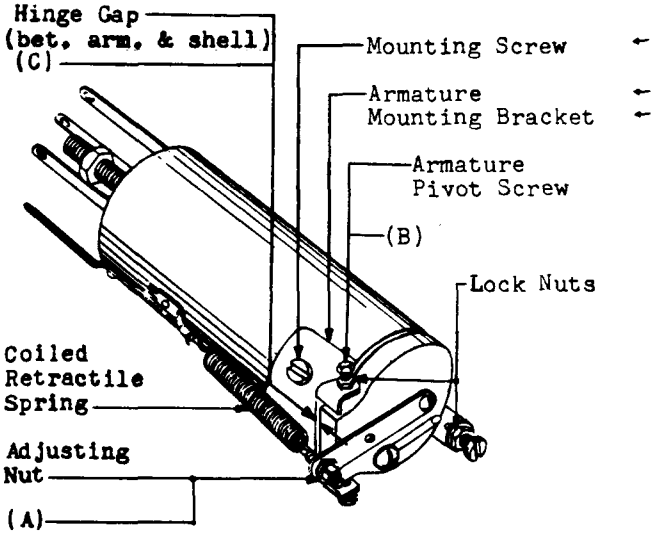

Fig. 4 – Adjusting Nut Tightness and Hinge Gap

*2.06 ***Tightness of Locknuts and Screws:*** The locknuts on the contact and armature pivot screws, and the feather spring and adjusting slide screws shall be sufficiently tight to retain their adjusted position.

Gauge by feel.

2.07 ***Bonding Strap Position:*** Fig. 5(A) — On relays equipped with a coiled retractile spring, the bonding strap, when provided, shall be free from any kinks or knots and shall be placed in position, as shown in Fig. 5A, 5B, and 5C.

Gauge by eye.

2.08 ***Armature Movement:*** Fig. 4(B) — The armature shall move freely in its bearings, but the sideplay shall not exceed

Max. 0.005 inch

The sideplay shall be measured when the armature is moved from side to side in line with the axis of the pivot screws.

Gauge by eye and feel.

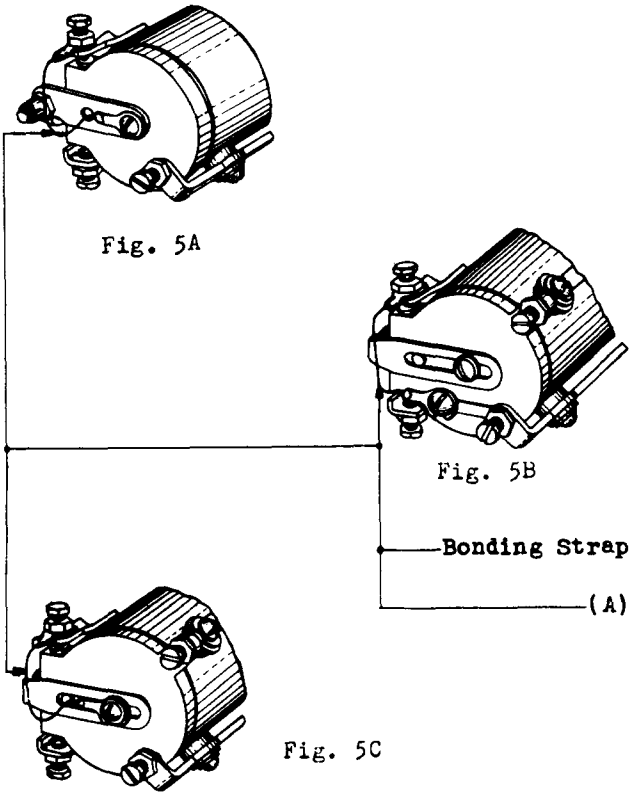

Fig. 5 – Bonding Strap Position

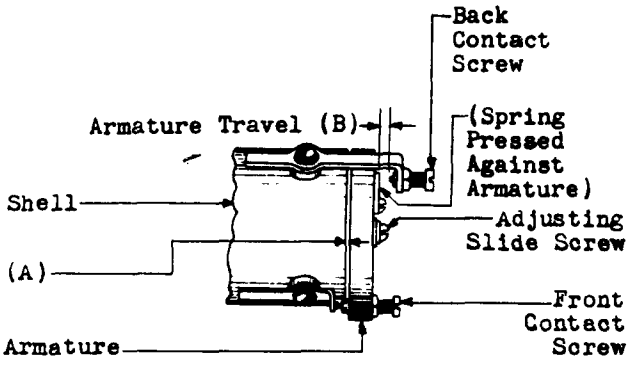

Fig. 6 – Armature Airgap and Armature Travel

2.09 ***Operated Armature Airgap:*** Fig. 6(A)

(a) On relays having a front contact, and for which a definite armature travel is specified, the operated armature airgap shall be

Min. 0.002 inch
Max. 0.005 inch

The gap shall be measured between the shell and the armature at the point diametrically opposite the hinge.

Use the No. 74D gauge.

(1) To check the operated armature airgap, insert the 0.002-inch blade of the gauge between the armature and shell at a point diametrically opposite the hinge, as shown in Fig. 7, and operate the relay manually. The blade shall pass freely between the armature and shell. In a similar manner, check the maximum limit with the 0.005-inch blade of the gauge. The blade should bind between armature and shell. If, due to mounting conditions, it is not possible to insert the gauge, as shown in Fig. 7, use the P-220366 dental mirror and No. 510C portable lamp equipped with a No. 561A straight tip, as shown in Fig. 8. The requirement is met if, with the relay manually operated, there is a perceptible clearance between the armature and shell at a point diametrically opposite the hinge, as gauged by eye.

Note: When manually operating a relay equipped with a flat retractile spring, the pressure on the armature shall be sufficient to eliminate any play there may be in the armature pivots.

(b) On relays having a front contact, and for which no definite armature travel is specified, the operated armature airgap shall be

Min. 0.002 inch

The gap shall be measured between the shell and the armature at the point diametrically opposite the hinge.

Use the No. 74D gauge.

(1) Check the operated armature airgap, as outlined in (a)(1) above, except that the 0.005-inch check need not be made.

2.10** ***Hinge Gap: Fig. 4(c)

(a) With the armature in the unoperated position, the hinge gap (measured at a point approximately midway between the armature pivots) shall be

Max. 0.007 inch

Gauge by eye.

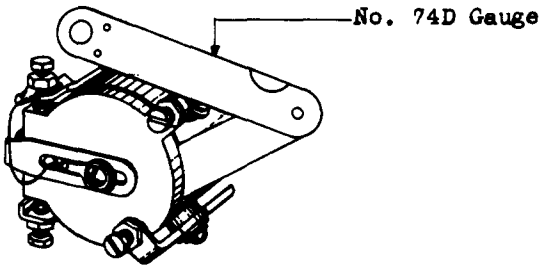

Fig. 7 – Method of Gauging Operated Armature Airgap with a Gauge

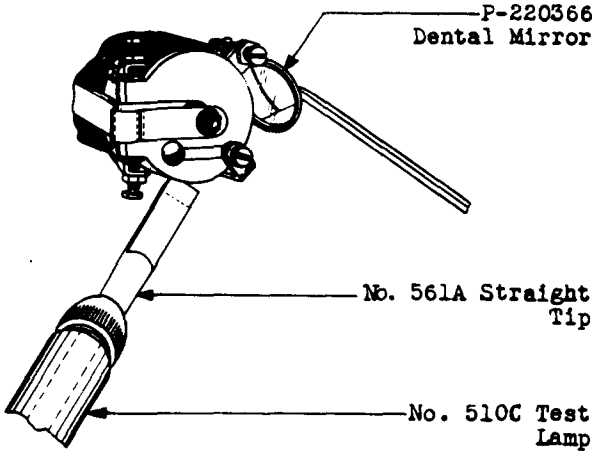

Fig. 8 – Method of Gauging Operated Armature Airgap by Eye

(b) With the armature in the operated position, relays which have a front contact shall have a hinge gap of

Min. 0.002 inch

Use the No. 92S gauge.

To check the requirement, manually operate the armature and insert the blade of the No. 92S gauge between the armature and shell at a point diametrically opposite the center of the hinge gap until it extends to this gap. The blade should pass through the entire length of the gap.

2.11 *Armature Travel:* Fig. 6(B)

(a) The armature travel, where specified, shall be in accordance with the value specified for the relay in the "Armature Travel" column on the circuit requirement table or in part (b) below.

Use the No. 41, 42, 90, and 95A gauges.

(b) The armature travel for the following relays, which are equipped with feather springs, measured between the contact point of the back contact screw and the feather spring when the spring is pressed against the armature and the armature is touching the relay shell or the front contact, shall be as follows.

114R, 114BP, 114CC, 114CD, and 198B	0.030" ±0.003"
114AK, 114AY, 114AW, and 198A	0.034" ±0.003"
114BL	0.015" ±0.003"
114BR, 114BS, 114BT, 114BU, 114BW, 114BY, 114EA, 114EB, 114KA, 198C, 198F, 198G, 198H, 198J, 198K, and 198L	0.020" ±0.003"

Use the No. 41, 42, 90, and 95A gauges.

(c) Unless otherwise specified, the tolerance shall be ±0.003 inch.

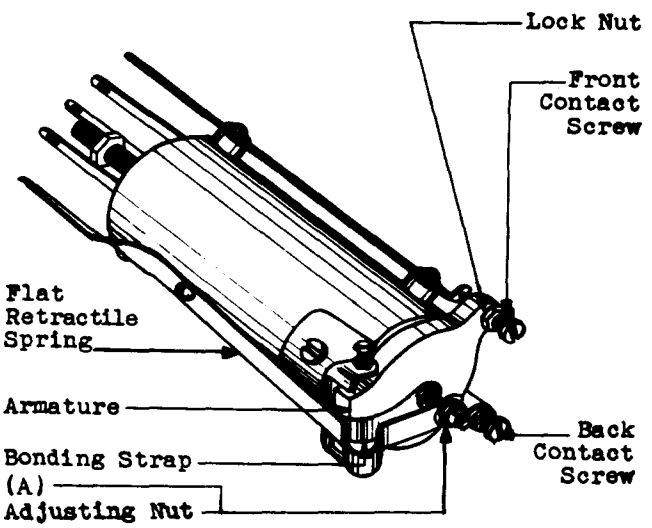

Fig. 9 – Adjusting Nut Tightness

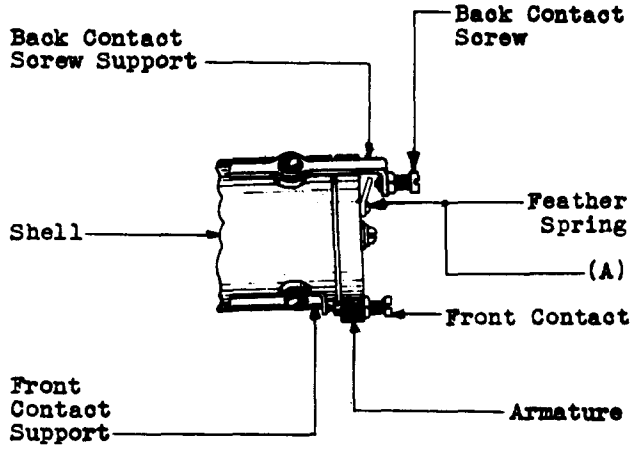

Fig. 10 – Feather Spring Clearance

2.12 ***Contact Separation:*** When no definite armature travel is specified, the separation between contacts normally open or between contacts that are opened when the relay is operated, shall be

Min. 0.005 inch

Gauge by eye.

2.13 ***Feather Spring Clearance:*** Fig. 10(A) — The end of the feather spring, on relays so equipped, shall lie approximately halfway between the armature and the contact point of the back contact screw when the armature is against the shell or the front contact is closed.

Gauge by eye.

(a) The P-220366 dental mirror may be used in checking this requirement.

2.14 ***Retractile Spring Tension:*** Fig. 11A, 11B, and 11C (A) — Where specified in Table A, the tension of the retractile spring measured against the end of its adjusting stud or against the head of the adjusting slide or clip screw just as the normally closed contact is opened, shall be as indicated.

Use the No. 79C gauge.

After turnover, this requirement shall apply as a readjust requirement only.

TABLE A

RELAY CODE	RINGING SYSTEM INFORMATION				MINIMUM TENSION IN GRAMS
	TYPE OF RINGING CURRENT	VOLTAGE LIMITS AC	VOLTAGE LIMITS DC	FREQUENCY IN CYCLES	
114AK	AC-DC	95-103	16-19	16-2/3 20	35
	AC	75-87		16-2/3 20	24
		80-92.5		16-2/3 20	24
		85-98.4		16-2/3 20	27
		90-104.2		16-2/3 20	30
		95-110		16-2/3 20	32
	Super-imposed	64-80	42-46	20	45
		72-88	30-34		40
114BP	AC-DC	95-103	16-19	16-2/3 20	35
	AC	75-87		16-2/3 20	24
		80-92.5		16-2/3 20	24
		85-98.4		16-2/3 20	27
		90-104.2		16-2/3 20	30
		95-110		16-2/3 20	32
	Super-imposed	72-80	42-46	20	45
		80-88	30-34		40
114CD	AC-DC	95-103	16-19	16-2/3 20	35
114EA	AC-DC	95-103	16-19	16-2/3 20	24
	Super-imposed	72-88 80-88	30-34	16-2/3	35
		72-88 80-88	30-34	20	30
		64-80 72-80	42-46	16-2/3	40
		64-80 72-80	42-46	20	35
		64-80 72-80	42-46	16-2/3 20	30
		72-88 80-88	30-34	20	20
114EB		64-80 72-80 84-88	42-46 37-40	20	28
		72-80 80-88	30-34		25
114KA	AC-DC	95-103	16-19	20	30
	Super-imposed	80-88 84-88	46-52	20	30
		80-88 84-88	42-52		
		80-88 84-88	37-40		

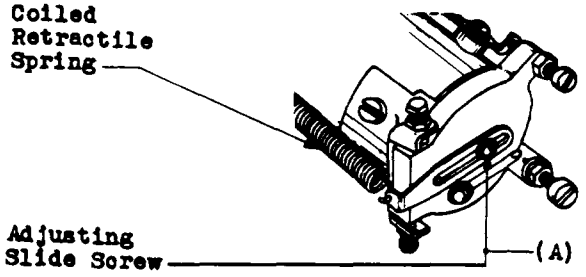

Fig. 11A

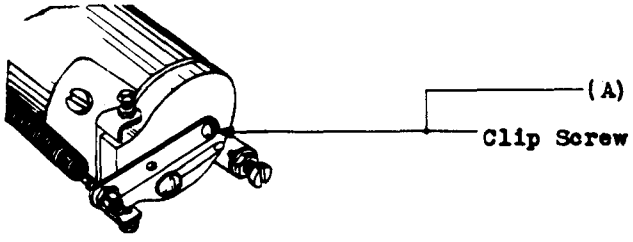

Fig. 11B

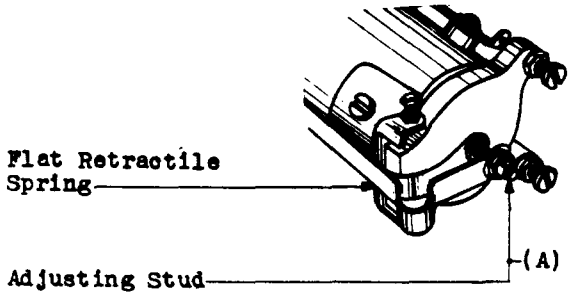

Fig. 11C

Fig. 11 – Retractile Spring Tension

2.15 ***Electrical Requirements***

(a) The relay shall meet the electrical requirements specified on the circuit requirement table.

(b) When the circuit requirement table specifies the electrical test and readjust requirements to be in accordance with the BSP, RAP, or X specification, the requirements given in Tables B, C, and D shall apply. The particular requirements that are to be applied shall be determined by the code of the relay and the type of ringing current, voltage, frequency, and district involved, or as specified by item number.

(c) The cover of the relay may be either on or off when applying the electrical requirements.

2.16 ***Adjusting Slide Position:*** Fig. 12(A) — (Before turnover only.) The travel of the slide in either direction shall be

Min. 1/32 inch

Gauge by eye.

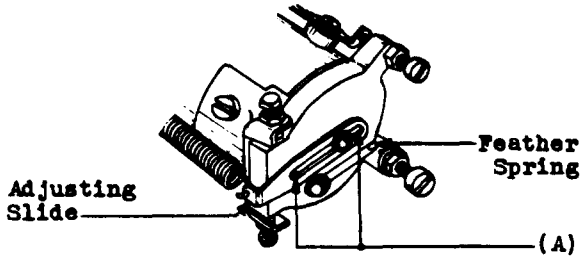

Fig. 12 – Adjusting Slide Position

2.17 ***Adjusting Stud Position:*** Fig. 13(A) — (Before turnover only.) The position of the nut on the adjusting stud shall be as follows.

(a) Fig. 14(A) — On relays equipped with a 13/64-inch length nut, the adjusting stud shall extend beyond the end of the adjusting nut.

Min. 1 thread

Max. 5 threads

This nut has four slots.

Gauge by eye.

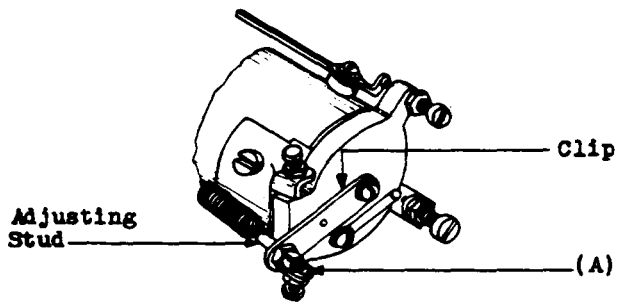

Fig. 13 – Adjusting Stud Position

Fig. 14 – Adjusting Stud Nut — 13/64 inch

(b) Fig. 15(A) — On relays equipped with a 9/64-inch length nut, the adjusting stud shall extend beyond the end of the adjusting nut.

Min. 1 thread

Max. 8 threads

This nut has two slots and is used only on relays equipped with a coiled retractile spring.

Gauge by eye.

Fig. 15 – Adjusting Stud Nut — 9/64 inch

(c) Fig. 16(A) — On relays equipped with a 7/64-inch length nut, the adjusting stud shall extend beyond the end of the adjusting nut.

Min. 1 thread

Max. 12 threads

This nut has two slots and is used only on relays equipped with a flat retractile spring.

Gauge by eye.

Fig. 16 – Adjusting Stud Nut — 7/64 inch

TABLE B — ELECTRICAL REQUIREMENTS FOR 114-TYPE RELAYS WHEN USED AS TRIP RELAYS (SEE TABLE C FOR ADDITIONAL VOLTAGE RANGES)

RELAY CODE	TYPE OF RINGING CURRENT	RINGING SYSTEM INFORMATION				SEE NOTES	ELECTRICAL REQUIREMENTS					
		VOLTAGE LIMITS		FREQUENCY IN CYCLES	TYPE OF DISTRICT		NONINDUCTIVE RESISTANCE VALUES				DC VALUES	
							OPERATE		NONOPERATE		OPERATE	NONOPERATE
		AC	DC				TEST	READJ	TEST	READJ	READJ	READJ
114R	AC	110-125		20		1,9,10					0.114	0.108
	Pulsating	80-90		16-2/3		1,3,4,9	940		1800		0.108	0.100
				20			900		1700		0.108	0.100
114AK	AC-DC	95-103	16-19	16-2/3		1,2,16	900	1010	1450	1310		
				20			800	900	1300	1180		
	AC	75-87		16-2/3		1,2,6,16	550	650	1000	880		
		80-92.5										
		85-98.4										
		90-104.2										
		95-110										
		95-110		16-2/3		1,2,16						
	AC	75-87		20		1,2,6,16	450	540	850	740		
		80-92.5										
		85-98.4										
		90-104.2										
		95-110										
		95-110		20		1,2,16						
	Superimposed	64-80	42-46	20	See Note 7	1,3,16	1000	1220	1910	1590		
		72-88	30-34				820	1010	1590	1300		
114BL	Superimposed	64-80	42-46	20	42A and 42A Inv	1,3,8	970	1050	1320	1220		
		72-80										
		84-88	37-40									
		72-88	30-34		Mixed	1,3,8	790	850	1140	1060		
		80-88										
114BP	AC-DC	95-103	16-19	16-2/3		1,2,16	900	1010	1450	1310		
				20			800	900	1300	1180		
	AC	75-87		16-2/3		1,2,6,16	550	650	1000	880		
		80-92.5										
		85-98.4										
		90-104.2										
		95-110										
		95-110		16-2/3		1,2,16						
	AC	75-87		20		1,2,6,16	450	540	850	740		
		80-92.5										
		85-98.4										
		90-104.2										
		95-110										
		95-110		20		1,2,16						
	Superimposed	72-80	42-46	20	See Note 7	1,3,16	1200	1360	2000	1770		
		80-88	30-34				1000	1180	1700	1630		

16-2/3 Cycles = Rated Speed of 950 to 1050 rpm.
20 Cycles = Rated Speed of 1100 to 1200 rpm.

See Page 12 for Notes referred to above.
See Page 13 Fig. 17, 18, and 19 for Explanation of "Type of District."

TABLE B (Contd) — ELECTRICAL REQUIREMENTS FOR 114-TYPE RELAYS WHEN USED AS TRIP RELAYS (SEE TABLE C FOR ADDITIONAL VOLTAGE RANGES)

RELAY CODE	RINGING SYSTEM INFORMATION					SEE NOTES	ELECTRICAL REQUIREMENTS					
							NONINDUCTIVE RESISTANCE VALUES				DC VALUES	
							OPERATE		NONOPERATE		OPERATE	NONOPERATE
	TYPE OF RINGING CURRENT	VOLTAGE LIMITS AC	VOLTAGE LIMITS DC	FREQUENCY IN CYCLES	TYPE OF DISTRICT		TEST	READJ	TEST	READJ	READJ	READJ
114BR	Superimposed	72-88 80-88	30-34	16-2/3	Mixed	1,3,8,17	600	630	810	780		
114BS	Superimposed	64-80 72-80	42-46	16-2/3	42A	1,3,8,17	670	700	910	870		
114BT	Superimposed	64-80 72-80	42-46	20	42A Inv	1,3,8,17	860	940	1260	1160		
114BU	Superimposed	72-88 80-88	30-34	20	Mixed	1,3,8,17	700	760	960	890		
114BW	Superimposed	64-80 72-80	42-46	20	42A	1,3,8,17	800	880	1120	1030		
114BY	Superimposed	64-80 72-80	42-46	16-2/3	42A Inv	1,3,8,17	830	910	1220	1120		
114CC	Superimposed	80-88	30-34	20	See Note 7	1,3,16	1000	1180	1700	1630		
114CD	AC-DC	95-103	16-19	16-2/3 20		1,2,16	900 800	1010 900	1450 1300	1310 1180		
114EA	AC-DC	95-103	16-19	16-2/3 20		1,2,17	900 800	1010 900	1450 1300	1310 1180		
	Superimposed	72-88 80-88	30-34	16-2/3	Mixed	1,3,8,17	600	630	810	780		
	Superimposed	64-80 72-80	42-46	16-2/3	42A	1,3,8,17	670	700	910	870		
	Superimposed	64-80 72-80	42-46	20	42A Inv	1,3,8,17	860	940	1260	1160		
	Superimposed	72-88 80-88	30-34	20	Mixed	1,3,8,17	700	760	960	890		
	Superimposed	64-80 72-80	42-46	20	42A	1,3,8,17	800	880	1120	1030		
	Superimposed	64-80 72-80	42-46	16-2/3	42A Inv	1,3,8,17	830	910	1220	1120		
	Superimposed	72-88 80-88	30-34	20	See Note 7	1,3,17	950	1090	1740	1530		
114EB	Superimposed	64-80 72-80 84-88	42-46 37-40	20	42A and 42A Inv	1,3,8	970	1050	1320	1220		
		72-88 80-88	30-34		Mixed	1,3,8	790	850	1140	1060		

16-2/3 Cycles = Rated Speed of 950 to 1050 rpm.
20 Cycles = Rated Speed of 1100 to 1200 rpm.

See Page 12 for Notes referred to above.
See Page 13 Fig. 17, 18, and 19 for Explanation of "Type of District."

TABLE C — ELECTRICAL REQUIREMENTS FOR 114-TYPE RELAYS IN OFFICES WHERE THE POWER PLANT IS CONVERTED TO NEW RINGING VOLTAGES FOR USE IN INCREASING SUBSCRIBER LOOP RANGE

RELAY CODE	TYPE OF RINGING CURRENT	RINGING SYSTEM INFORMATION			TYPE OF DISTRICT	SEE NOTES	ELECTRICAL REQUIREMENTS					
		VOLTAGE LIMITS		FREQUENCY IN CYCLES			NONINDUCTIVE RESISTANCE VALUES				DC VALUES	
							OPERATE		NONOPERATE		OPERATE	NONOPERATE
		AC	DC				TEST	READJ	TEST	READJ	READJ	READJ
114AK, 114KA	Semiselective	80-88 84-88	46-52	20		1,3,7,12, 16	1500	1650	2200	2000		
114AK, 114CC, 114CD, 114EA, 114BP, 114KA	Semiselective	80-88 84-88	42-52	20		1,3,7,13, 14,16	1300	1550	2200	1900		
114BL, 114EB, 114KA	Full-selective	80-88 84-88	37-40	20	Tube Sets	1,3,12,15	1200	1350	1900	1700		
114BR, 114BS, 114BT, 114BU, 114BW, 114BY, 114EA 114KA	Full-selective	80-88 84-88	37-40	20	Tube Sets	1,3,13, 15,17	1200	1350	1900	1700		

16-2/3 Cycles = Rated Speed of 950 to 1050 rpm.
20 Cycles = Rated Speed of 1100 to 1200 rpm.

See Page 12 for Notes referred to above.
See Page 13 Fig. 17, 18, and 19 for Explanation of "Type of District."

TABLE D — ELECTRICAL REQUIREMENTS FOR 198-TYPE RELAYS WHEN USED AS "TRIP" RELAYS

RELAY CODE	RINGING SYSTEM INFORMATION					SEE NOTES	ELECTRICAL REQUIREMENTS						
	TYPE OF RINGING CURRENT	VOLTAGE LIMITS AC	VOLTAGE LIMITS DC	FREQUENCY IN CYCLES	TYPE OF DISTRICT		TEST WDG	NONINDUCTIVE RESISTANCE VALUES OPERATE TEST	OPERATE READJ	NONOPERATE TEST	NONOPERATE READJ	DC VALUES OPERATE READJ	DC VALUES NONOPERATE READJ
198A	Pulsating	80-90		16-2/3		1,3,4,5,9,17	P/S	750		1380		0.060	0.054
				20				700		1300		0.060	0.054
198B	Superimposed	72-88 and 80-88	30-34	16-2/3	Mixed	1,3,8,11,17	S	550	590	810	760		
							P	550		810			
				20			S	570	610	840	790		
							P	570		840			
		64-80 and 72-80	42-46	16-2/3	42A		S	600	650	910	850		
							P	600		910			
					42A Inv		S	750	860	1220	1100		
							P	750		1220			
				20	42A		S	640	690	950	890		
							P	640		950			
					42A Inv		S	790	900	1260	1140		
							P	790		1260			
198C	Superimposed	72-88 and 80-88	30-34	16-2/3	Mixed	1,3,8,11,17,18	S	600	630	810	780		
							P	600		810			
				20			S	700	760	960	890		
							P	700		960			
		64-80 and 72-80	42-46	16-2/3	42A		S	670	700	910	870		
							P	670		910			
					42A Inv		S	800	880	1120	1030		
							P	800		1120			
				20	42A		S	800	880	1120	1030		
							P	800		1120			
					42A Inv		S	800	880	1120	1030		
							P	800		1120			
198F	Superimposed	64-80 72-80	42-46	16-2/3	42A Inv	1,3,8,11,17,18	S	800	880	1120	1030		
							P	800		1120			
198G	Superimposed	64-80 72-80	42-46	16-2/3	42A	1,3,8,11,17,18	S	670	700	910	870		
							P	670		910			
198H	Superimposed	64-80 72-80	42-46	20	42A	1,3,8,11,17,18	S	800	880	1120	1030		
							P	800		1120			
198J	Superimposed	72-88 80-88	30-34	16-2/3	Mixed	1,3,8,11,17,18	S	600	630	810	780		
							P	600		810			
198K	Superimposed	64-80 72-80	42-46	20	42A Inv	1,3,8,11,17,18	S	800	880	1120	1030		
							P	800		1120			
198L	Superimposed	72-88 80-88	30-34	20	Mixed	1,3,8,11,17,18	S	700	760	960	890		
							P	700		960			

16-2/3 Cycles = Rated Speed of 950 to 1050 rpm.
20 Cycles = Rated Speed of 1100 to 1200 rpm.

See Page 12 for Notes referred to above.
See Page 13 Fig. 17, 18, and 19 for Explanation of "Type of District."

NOTES FOR TABLES B, C, AND D

1. The resistance values specified are based on the ac and dc voltages within the limits specified, and do not apply unless the voltages are within these limits. No test shall be made during the silent period. It is necessary to apply the operate and nonoperate test only once.

2. The electrical requirements for these relays apply only when the test lines and readjust sets are arranged for the "Particular Part of Wave" method of testing and adjusting. See Fig. 20 for P.P.W. method.

3. Resistance testing and readjusting shall be done only during the ringing period and not during the silent or battery tripping period. Testing shall be done with the testing circuit or its equivalent (and readjusting with the adjusting box or its equivalent if ac readjust requirements are given) when the office is equipped with this apparatus. Otherwise, connect the specified resistance in series with the relay during the ringing period. No test is required during the silent period.

4. An ac meter shall be used in checking the pulsating ringing voltage at the bus bar.

5. The ringing machine brushes may be set anywhere between 45 degrees leading and 45 degrees lagging from the neutral point on the frame indicated by prick punch marks on the frame and the brush holder.

6. These requirements apply to offices having 75- to 110-volt ringing machines, and the voltage band used shall be that specified for the office. The voltage band employed determines the resistance value in series with the line winding of the differential relay in the testing and adjusting circuits.

7. These requirements are for use in single, 2-party selective, and 4-party semiselective ringing districts.

8. The test requirements apply for ringing machines having an ac range of 64 to 80, 72 to 80, 72 to 88, and 80 to 88 volts. No readjusting shall be done, however, while the 64- to 80- and 72- to 88-volt machines are outside the limits of 72 to 80 and 80 to 88 volts, respectively.

9. These requirements are for use in a special ringing system.

10. The relay shall meet the test requirements imposed by the test line installed in the office.

11. When the 198C, F, G, H, J, K, or L relay is used in the same office with the 198B relay, the requirements specified for the 198B relay shall apply.

12. For relays installed in panel offices.

13. For relays installed in manual offices.

14. Test and readjust only when the dc voltage is 45 to 50.

15. These requirements apply to 4-party full-selective, and 8-party semiselective ringing districts.

16. ***114AK, 114CC, and 114CD Relays:*** (Manual Offices Only) When any relay of the above codes is used under ringing conditions other than those specified for the relay in Table B, or when two or more of the above codes are used in the same office, adjust the relay or relays to the particular adjustment for the 114BP relay which is applicable to the ringing condition used in the office. This shall apply whether or not the 114BP relay is one of the relays involved.

17. ***114BR, 114BS, 114BT, 114BU, 114BW, and 114BY Relays:*** When any relay or group of relays of the above codes is used under ringing conditions other than those which are specified for the relay or relays in Table B, adjust the relay or relays to the particular adjustment of the 114EA relay which is applicable to the ringing condition used in the office, except where any code of 198-type relays are used in the office, in which case use the adjustment for the 198C relay. This shall apply whether or not the 114EA or 198C relay is one of the relays involved.

18. ***198F, 198G, 198H, 198J, 198K, and 198L Relays:*** When any relay or group of relays of the above codes is used under ringing conditions other than those which are

specified for the relay or relays in Table D, adjust the relay or relays to the particular adjustment for the 198C relay which is applicable to the ringing condition used in the office. This shall apply whether or not the 198C relay is one of the relays involved.

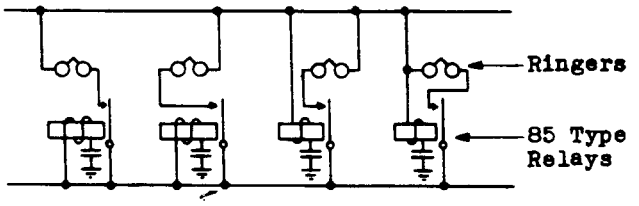

Fig. 18 – 42A Inverted Districts

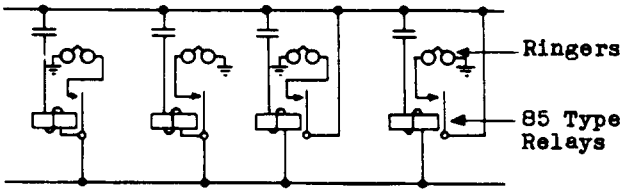

Fig. 17 – 42A and Mixed Districts

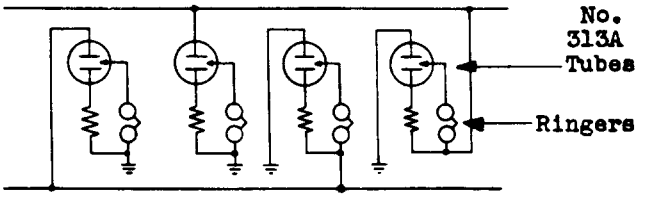

Fig. 19 – Tube Set Districts

Note: Differential relays in Fig. 20A and 20B are operated through dotted wiring which is then cut out of circuit. X indicates contacts of intermediate relays.

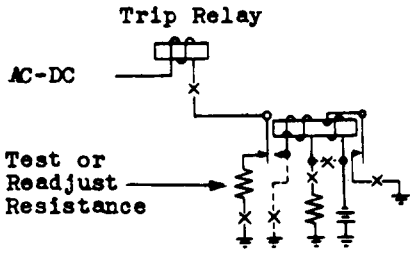

Fig. 20A

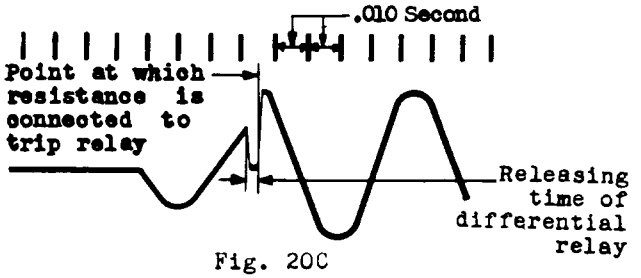

Fig. 20C

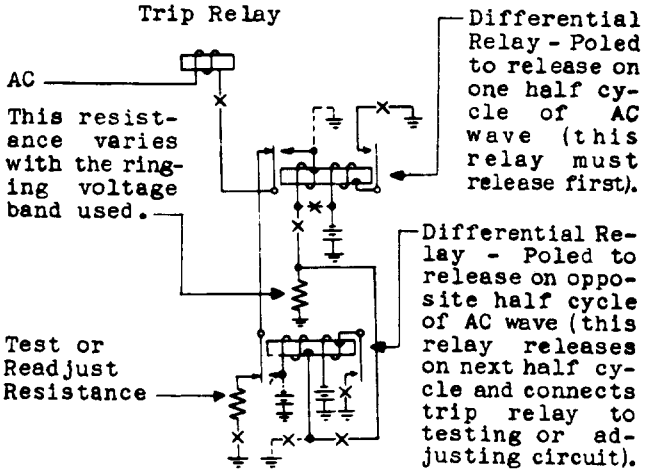

Fig. 20B

Fig. 20 – Particular Part of the Wave Method of Testing Trip Relays

NOTES FOR FIG. 20

1. Trip relays operating on ac or ac-dc ringing current can, in general, be more reliably adjusted and subsequently tested by closing the circuit at a particular part of the wave to allow ringing current to pass through the relay in series with noninductive resistances.

   In the case of standard superimposed ringing system (64 to 80 or 72 to 80 volts ac with 42 to 46 volts dc, 72 to 88 or 80 to 88 volts ac with 30 to 34 volts dc, and 80 to 88 or 84 to 88 volts ac with 37 to 40 volts dc) or ac-dc ringing system (80 to 88 or 84 to 88 volts ac with 46 to 52 volts dc and 80 to 88 or 84 to

88 volts ac with 42 to 52 volts dc), the dc component is of such a value that the effect of closing at a particular part of the ac wave is overcome and the particular part of the wave method is not required.

2. Test line circuits and readjust test sets, which are used to test or readjust trip relays by means of the particular part of the wave method of testing, must be designed with the proper relays and resistances embodying the following arrangement, which illustrates the principle involved. The standard circuits are arranged with other additional features to provide for testing through the operate and nonoperate values of resistance, for applying current during a definite interval of time and opening the circuit before the silent battery period, for resetting the circuit, for starting the test, etc. The differential relays and the associated circuit arrangements have been carefully determined by test to function with the proper time intervals to connect the trip relay in the testing circuit at the proper point of the wave, and only a properly designed circuit arrangement shall be used in applying this method of testing.

3. Fundamentally, closing at the particular part of the wave is accomplished by the use of a differentially wound relay or relays which are operated and which are then held through one winding on local battery. Ringing current is applied through the trip relay and through the other winding acting differentially, and in a circuit of high enough resistance so as not to operate the trip relay. When the half-cycle of the ac wave, which is in a direction to act differentially, flows through the winding, the differential relay releases and connects the trip relay to the proper test resistance on its back contact.

4. This release action of the differential relay, in conjunction with its releasing time, is such that the trip relay is connected in the test circuit at the point of the wave as shown by a reproduction of an oscillogram in the circuit in Fig. 20C.

5. Only one relay, as covered by Fig. 20A, is required for ac-dc ringing current since, due to the superimposed effect of the dc component, there is a higher negative peak than the positive peak of the wave in the case of offices with the positive side of the battery grounded. The differential relay is poled to release only during the negative cycle and under that condition, if it releases after the peak of the wave, the trip relay will not operate during the positive cycle, and a steady state condition equivalent to the particular part of the wave condition is established when the negative cycle is reached.

6. In the case of alternating current, two relays are used, as covered by Fig. 20B, one poled positively, the other negatively. This insures that the relay which acts to connect the current at the particular part of the wave will always function at the beginning of the half-cycle for which it is poled, since the circuit arrangement is such that the relay ahead needs to release first and it will only release during the opposite half-cycle.

3. ADJUSTING PROCEDURES

3.001 *List of Tools, Gauges, and Test Apparatus*

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
45B	5/16-inch Hex. Single-end Socket Wrench
72	Combination 5/32-inch and 3/16-inch Hex. Double-end Socket Wrench and Screwdriver
206	30-degree Offset Screwdriver
207	90-degree Offset Screwdriver
474A	3/16-inch and 1/4-inch Hex. Closed Double-end Offset Wrench
510C	Portable Lamp [must be equipped with No. 561A straight tip and W2CB (24 volts) or W2BL (48 volts) cord]
KS-6015	6-inch Duck-bill Pliers
P-220366	Dental Mirror
⌜—	3-inch C Screwdriver (or the replaced 3-inch cabinet screwdriver)
—	Long-nose Pliers (or the replaced P-Long-nose pliers)
⌞ —	5-inch Diagonal Pliers

CODE OR SPEC NO.	DESCRIPTION
GAUGES	
41	0.034-inch Thickness Gauge
42	0.015-inch Thickness Gauge
74D	Thickness Gauge Nest
79C	0 to 200 Gram Push-pull Tension Gauge
90	0.030-inch Thickness Gauge
92P	0.003-inch Nonmagnetic Offset Thickness Gauge ← ←
92S	0.002-inch Nonmagnetic Offset Thickness Gauge
95A	0.020-inch Thickness Gauge
TEST APPARATUS	
35C	Test Set
—	Trip Relay Adjusting Set Arranged for "Particular Part of the Wave" Method of Adjusting "Trip" Relays

3.01 ***Cleaning*** (Reqt 2.01)

(1) Clean the contacts and parts in accordance with Section 069-306-801.

3.02 ***Relay Mounting*** (Reqt 2.02)

(1) To tighten loose mounting nuts, use the No. 45B wrench.

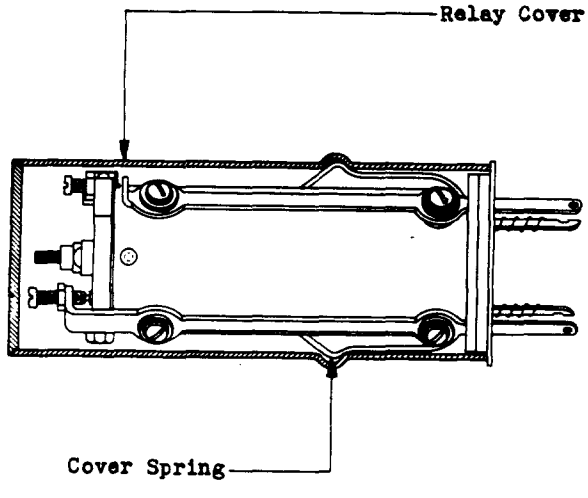

Fig. 21 – Cover and Cover Springs Used on 126- and 174-Type Relays

3.03 ***Cover Spring Pressure*** (Reqt 2.03)

(1) If the cover springs, as shown in Fig. 21, for 126- and 174-type relays do not have sufficient tension against the cover, increase the tension by adjusting the spring away from the coil, applying a lateral pressure against the spring with the 3-inch C screwdriver inserted inside the spring. If the tension is excessive, decrease it by adjusting the spring toward the coil with the long-nose pliers.

(2) If the cover springs, on relays equipped with No. 1A relay covers, do not have sufficient pressure against the relay cover, increase the tension by adjusting the front end of the spring with the long-nose pliers. Bend the spring outward, and then bend the tip inward to facilitate slipping off the cover. If the cover springs have excessive tension, decrease the tension by adjusting the springs toward the coil with the long-nose pliers.

(3) If the studs of the cover spring, on relays equipped with No. 1A relay covers, do not rest on the relay shell, remove the mounting nut with the No. 45B wrench and then remove the relay from the mounting plate. Remove the cover spring from the relay and bend the rear of the spring inward. Reassemble the cover spring on the relay, replace the relay on the mounting plate, and tighten the mounting nut securely.

3.04 ***Contact Alignment*** (Reqt 2.04)

(1) ***Back Contacts:*** If the back contacts do not line up properly, loosen the feather spring screw, on relays equipped with a feather spring, and shift the spring as required. If it is impossible to shift the spring sufficiently, align the contacts by slightly bending the back contact screw support with long-nose pliers. In those cases where the relay is equipped with a solid back contact (no feather spring), align the contacts by slightly bending the back contact screw support with long-nose pliers.

(2) ***Front Contacts:*** If the front contacts do not line up properly, align them by slightly bending the front contact support with long-nose pliers.

3.05 ***Tightness of Adjusting Nut*** (Reqt 2.05)

(1) If the adjusting nut is loose, back off the nut with the wrench portion of the No. 72 combination wrench and screwdriver until the slotted portion is free of the stud, and then force the slotted parts together with the long-nose pliers.

3.06 ***Tightness of Locknuts and Screws*** (Reqt 2.06)

(1) To tighten the locknuts on contact screws, use the wrench portion of the No. 72 combination wrench and screwdriver, holding the screw in position with the screwdriver portion of the same tool.

(2) To tighten the locknuts on armature pivot screws, use the No. 474A wrench holding the screw in position with the long-nose pliers.

(3) To tighten the feather spring and adjusting slide screws, use the screwdriver portion of the No. 72 combination wrench and screwdriver.

3.07 ***Bonding Strap Position*** (Reqt 2.07)

(1) If the bonding strap is not formed properly, reform it manually by freeing it from any kinks or knots and place it in position, as shown in Fig. 5A, 5B, and 5C.

3.08 ***Armature Movement*** (Reqt 2.08)

(1) If the armature binds or the sideplay is excessive, loosen the locknut on one of the pivot screws with the No. 474A wrench. Use the long-nose pliers to turn the screw. One quarter turn of the screw back from finger-tight provides approximately 0.005-inch sideplay. Securely retighten the locknut holding the screw in position with the pliers. On relays equipped with counterbored armatures, care should be taken to center the armature on its pivot screws so that it does not strike the core in the operated position. On relays not employing a front contact, this condition may be checked for by manually operating the relay and noting that the armature strikes the shell. Centering the armature on its pivot screws will also avoid difficulty in aligning the contacts.

(2) If the armature moves sluggishly, even though provided with appreciable sideplay, check the pivot screws to see if they are rounded, burred, or dirty. Replace defective pivot screws, or clean dirty pivot points in accordance with 3.01. On relays equipped with a flat-type bonding strip, it is possible that sluggishness of the armature may be caused by the bonding strip rubbing on the edge of the armature. Correct this condition by reforming the bonding strip to clear the armature.

3.09 ***Operated Armature Airgap*** (Reqt 2.09)

(1) If the gap between the armature and the shell is not satisfactory, adjust the front contact screw on relays having a front contact and a definite armature travel specified, so that with the front contact made, the 0.002-inch blade of the No. 74D gauge will pass freely between the armature and the shell when inserted at the point diametrically opposite the hinge. Check this gap with the 0.005-inch blade of the same gauge to see if it is within the maximum limit. Use the screwdriver portion of the No. 72 combination wrench and screwdriver to turn the screw, and the wrench portion to loosen and tighten the locknut.

(2) On relays having a front contact and no definite armature travel specified, adjust the operated airgap as given under (1), except that the 0.005-inch check need not be made.

3.10 ***Hinge Gap*** (Reqt 2.10)

(1) If the requirement is not met, slightly loosen the armature mounting bracket mounting screws, using the 3-inch C screwdriver. Insert the blade of the No. 92P (0.003-inch) gauge between the armature and shell at a point diametrically opposite the center of the hinge gap until the gauge extends through the center of the hinge gap. Hold the armature tightly against the gauge and tighten the armature bracket mounting screws. Remove the gauge and recheck the requirement.

3.11 ***Armature Travel*** (Reqt 2.11)
3.12 ***Contact Separation*** (Reqt 2.12)

(1) If the armature travel is not satisfactory on those relays having a definite travel specified, adjust as follows. With the armature against the shell, or where the relay has

a front contact, the front contact screw touching the front contact, loosen the locknut on the back contact screw and insert the proper thickness gauge (No. 41 for 0.034 inch, No. 42 for 0.015 inch, No. 90 for 0.030 inch, and No. 95A for 0.020 inch) between the contact of the feather spring and the contact point of the back contact screw. With the gauge inserted, turn the back contact screw in a clockwise direction until the feather spring is pressed against the armature, then tighten the locknut. If the gap is within the specified limits, it should now be possible to remove and insert the proper gauge with some, but very little, friction.

(2) To change the armature travel on those relays where no definite value is specified, loosen the locknut on the back contact screw, and turn the screw in a clockwise or counterclockwise direction, as required. Correct the contact separation, if necessary, at the same time. Turning the screw in a clockwise direction decreases the travel and contact separation, and aids in meeting the operate electrical requirement; whereas turning it in a counterclockwise direction increases the travel and contact separation, and aids in meeting the nonoperate electrical requirement. In making this adjustment, provide a margin for future adjustments by means of the retractile spring.

(3) Use the screwdriver portion of the No. 72 combination wrench and screwdriver to turn the screw, and the wrench portion to loosen and tighten the locknut.

3.13 ***Feather Spring Clearance*** (Reqt 2.13)

(1) If the feather spring lies too close to the armature, insert one of the blades of the No. 74D gauge between the armature and the spring, and move it towards the feather spring retaining screw until the spring is approximately centered between the armature and the back contact screw.

(2) If the feather spring lies too close to the back contact screw, remove the feather spring screw with the screwdriver portion of the No. 72 combination wrench and screwdriver, and remove the spring. Straighten the spring manually or with pliers so that, when the spring is replaced and the screw securely tightened, the spring will be approximately centered between the armature and back contact screw. If, when the spring is replaced, it lies too near the armature, correct in accordance with (1) above. In bending the spring, take care not to damage it.

(3) When replacing the screw, align the back contacts in accordance with 3.04.

3.14 ***Retractile Spring Tension*** (Reqt 2.14)
3.15 ***Electrical Requirements*** (Reqt 2.15)

General

(1) If the relay does not meet its electrical requirements, change the tension of the retractile spring, as outlined under (3) to (15). Then check the retractile spring tension, when specified, using the No. 79C gauge. Apply the gauge in a horizontal position against the end of the adjusting stud, as shown in Fig. 22.

(2) If the relay cannot be made to meet the electrical requirements by this means and no definite armature travel is specified, change the armature travel in accordance with 3.11 and then make the final adjustment by means of the retractile spring. Difficulty in meeting the electrical requirements on relays equipped with a coiled retractile spring may be due to the retractile spring being in poor condition, or the spring touching the relay shell or support for the pivot screws. If the rear support for the spring is bent toward the shell, pry it out with the 3-inch C screwdriver. If the part of the adjusting slide that holds the spring is bent, straighten it with the long-nose pliers.

Relays Equipped With a Flat Retractile Spring

(3) If the relay fails to meet the nonoperate or release requirement, increase the tension of the retractile spring by turning the adjusting nut in a clockwise direction. Use the wrench portion of the No. 72 combination wrench and screwdriver.

(4) If the relay fails to meet the operate or hold requirement, decrease the tension of the retractile spring by turning the adjusting nut in a counterclockwise direction.

Relays Equipped With a Coiled Retractile Spring and Adjusting Stud

(5) If the relay fails to meet the nonoperate or release requirement, increase the tension of the retractile spring by turning the

adjusting nut in a clockwise direction with the wrench portion of the No. 72 combination wrench and screwdriver. Failure to release, on relays not having front contacts, may also be due to the armature striking the core. If necessary, this condition on the 114W, 114AK, 114AW, 114AY, 114BL, and 198D relays may be corrected by the use of a counterbored armature.

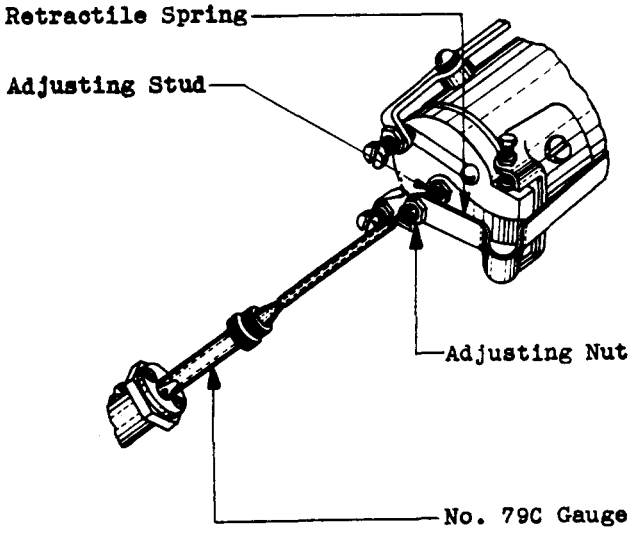

Fig. 22 – Method of Checking the Retractile Spring Tension

(6) If the relay fails to meet the operate or hold requirement, decrease the tension of the retractile spring by turning the adjusting nut in a counterclockwise direction.

(7) In some cases, it may be impossible to increase the tension of the spring sufficiently to meet the electrical requirements by turning the adjusting nut in a clockwise direction on the stud. If the spring is so weak that the required tension cannot be obtained by turning the adjusting nut in a clockwise direction to the limit of its travel, remove the screw that holds the clip to the armature with the screwdriver portion of the No. 72 combination wrench and screwdriver, and pull the clip forward until it is possible to grasp the first full coil of the spring with the duck-bill pliers. Grip the coil so that the end of the jaws of the pliers just halves the coil. Disconnect the adjusting stud from the spring. Cut the spring with the diagonal pliers at the top of the coil which extends in front of the duck-bill pliers, as shown in Fig. 23, that is, so that only one-half a coil will remain at the end of the spring in front of the pliers. Bend this one-half coil of the spring out with the long-nose pliers so that a semicircular loop will be formed at right angles to the spring. Hook this loop to the adjusting stud and replace the clip on the relay. Attempt to adjust the relay by changing the tension of the retractile spring as outlined in (5) and (6), and if necessary, repeat the above operation.

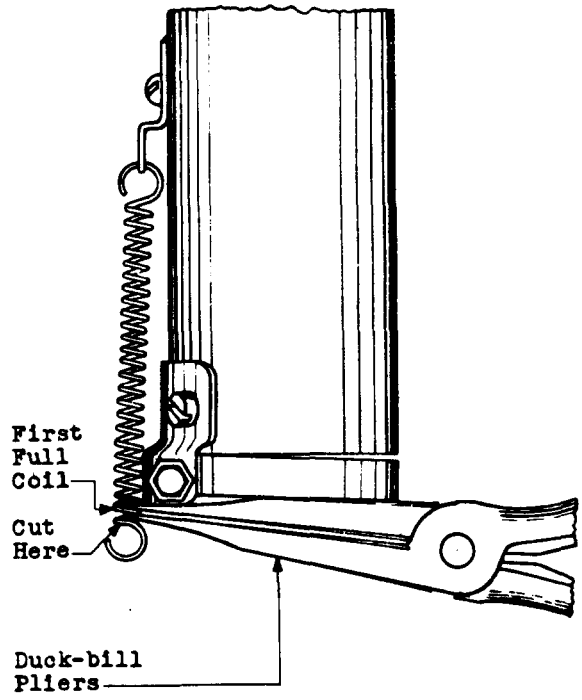

Fig. 23 – Method of Clipping Retractile Spring

(8) If the retractile spring is so stiff that the tension cannot be decreased sufficiently by turning the adjusting nut in a counterclockwise direction to the limit of its stroke on the stud, remove the clip with the screwdriver portion of the No. 72 combination wrench and screwdriver, and stretch the spring slightly by pulling the clip forward until the tension of the spring is such that the electrical requirements can be met.

(9) If it is necessary to replace a spring, exercise care that the proper spring for the relay is used, as the springs vary with the code

number of the relays. Although the proper spring is used, it may be necessary, in order to adjust the relay, to shorten the spring in accordance with (7) or stretch it in accordance with (8).

Relays Equipped With a Coiled Retractile Spring and Adjusting Slide

(10) If the relay fails to meet the nonoperate or release requirement, increase the tension of the retractile spring by loosening the adjusting slide screw, and moving the spring adjusting slide so that its bent portion is farther away from the pivoted side of the armature. Tighten the adjusting slide screw securely. Failure to release, on relays not having front contacts, may also be due to the armature striking the core. If necessary, this condition on the 114W, 114AK, 114AW, 114AY, 114BL, and 198D relays may be corrected by the use of a counterbored armature.

(11) If the relay fails to meet the operate or hold requirement, decrease the tension of the retractile spring by loosening the adjusting slide screw, and moving the spring adjusting slide so that its bent portion is closer to the pivoted side of the armature. Tighten the adjusting slide screw securely.

(12) In some cases, it may be impossible to increase the tension sufficiently by moving the adjusting slide. If the spring is so weak that the required tension cannot be obtained by moving the adjusting slide away from the pivoted side of the armature to the limit of its travel, remove the adjusting slide screw with the screwdriver portion of the No. 72 combination wrench and screwdriver, and follow the procedure outlined in (7), except that in this case the spring is removed from the slide instead of the stud.

(13) If the spring is so stiff that the tension cannot be decreased sufficiently by moving the adjusting slide toward the pivoted side of the armature, remove the adjusting slide screw with the screwdriver portion of the No. 72 combination wrench and screwdriver, and stretch the spring slightly by pulling the slide forward until the tension of the spring is such that the electrical requirements can be met.

(14) If it is necessary to replace a spring, exercise care that the proper spring for the relay is used, as the springs vary with the code number of the relays. Although the proper spring is used, it may be necessary in order to adjust the relay to clip the spring in accordance with (12) or stretch it in accordance with (13).

(15) On relays equipped with adjusting slides, the springs are longer than those required on relays equipped with a retractile spring stud and adjusting nut.

3.16 ***Adjusting Slide Position*** (Reqt 2.16)
3.17 ***Adjusting Stud Position*** (Reqt 2.17)
(No Procedures)

REASONS FOR REISSUE

1. To revise Fig. 4.
2. To revise the method of checking the hinge gap requirement [2.10(b)].
3. To revise the ringing system information (Table A) referred to in the retractile spring tension requirement (2.14).
4. To revise the list of tools and gauges (3.001).
5. To revise the procedure covering the hinge gap (3.10).