BELL SYSTEM PRACTICES
Private Branch Exchange
Inst. and Mtce.

SECTION B461.002
Issue 2-D, 8-16-37
AT&TCo Standard

RELAYS

B AND G TYPES

1. GENERAL

1.01 This section covers B and G type relays and replaces Section B461.002, Issue 1-D.

1.02 It is reissued to add requirements for alignment of bar type contacts, for cover clearance, for clearance between the armature and flexible contact spring and to omit the flashing requirements. Detailed reasons for reissue will be found at the end of the section.

1.03 Reference shall be made to Section B400.001 covering General Requirements and Definitions 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 the 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 break the back contact and to make the front contacts reliable. The stop pin (or pins) or the armature need not touch the core (or removable paper armature stop if equipped) on the operate current.

1.06 Non-operate: A relay is said to non-operate if, when current is connected to its winding, the armature does not move from the unoperated position sufficiently to reduce the front contact separation below .005" or reduce the back contact pressure enough to cause an unreliable contact.

1.07 Release: A relay is said to release if the armature moves from the core sufficiently to break contacts that have been closed and to make contacts that have been broken. On relays having no back contact, the armature need not touch the back stop when the current is reduced to the release value, but the front contact separation shall not be less than .005".

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 contacts that have been made to become unreliable or to make contacts that have been broken.

1.09 A list of coded "B" and "G" type relays together with their armature travel requirements is covered on pages 16 to 24. This list covers the relays which were coded prior to the adoption of armature travel requirements and which may not have the armature travel requirements covered by existing circuit require-

ment tables. Relays with a higher code number will have the armature travel requirements given in the "Arm. Trvl." column of the circuit requirement tables.

2. REQUIREMENTS

2.01 Cleaning: The contacts and other parts shall be cleaned when necessary in accordance with the section covering cleaning of relay contacts and parts.

2.02 Relay Mounting: Relays shall be mounted approximately level and fastened securely to the mounting plate. Gauge by eye and feel.

2.03 Cover Clearance: The clearance between the relay cover and any adjacent apparatus including relay covers, shall be

Min. 1/32"

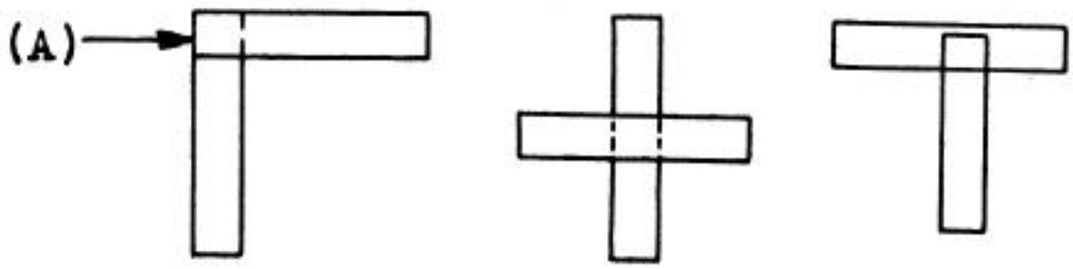
Gauge by eye.

2.04 Cover Cap: The cover cap shall fit snugly but shall not be so tight as to prevent placing or removing it with the fingers. Gauge by feel.

2.05 Contact Alignment

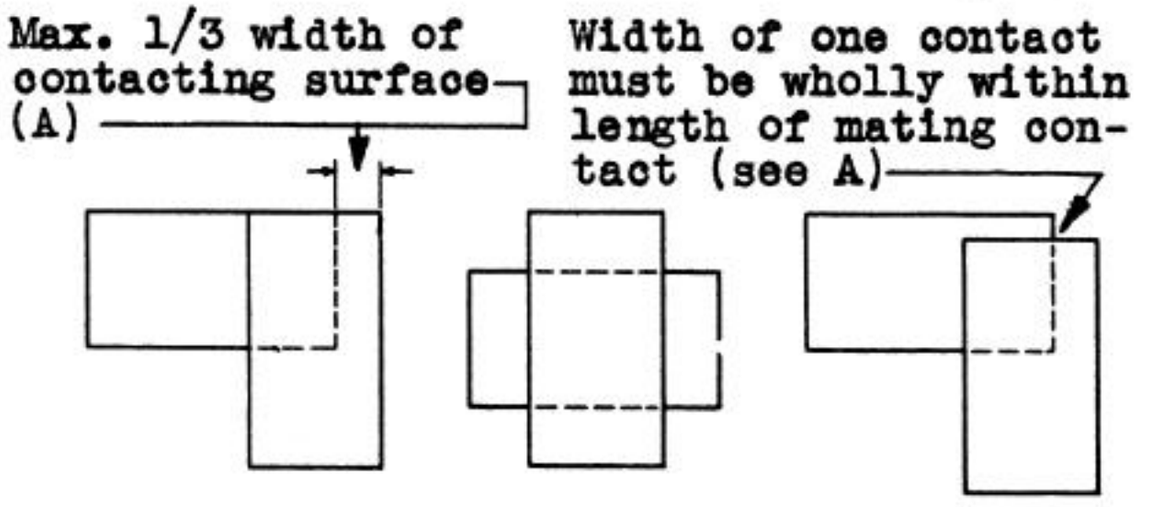
(a) Point and Disc Contacts - Fig. 101 (A): The point of contact shall fall wholly within the boundary of the opposing contact except for contacts having the same diameter, in which case their centers shall not be

Fig. 101 - Alignment of Point and Disc Contacts



Max. Permissible Misalignment | Ideal | Not Permissible

Fig. 102 - Alignment of Standard Bar Contacts Plan View of Contacting Surfaces



Max. Permissible Misalignment | Ideal | Not Permissible

Fig. 103 - Alignment of Heavy Bar Contacts - Plan View of Contacting Surfaces

out of alignment more than 25% of the diameter of the contact points. Gauge by eye.

(b) Standard Bar Contacts - Fig. 102 (A): The contacts shall line up so that the width of the contacting surface of one

contact bar falls wholly within the length of its mating bar. Gauge by eye.

(c) Heavy Bar Contacts - Fig. 103 (A): The contact alignment shall be within the limits indicated in Fig. 103. Gauge by eye.

*2.06 Tightness of Adjusting Screws - Fig. 104: The adjusting screws shall be sufficiently tight to prevent the relay changing its adjustment but shall not be so tight that it is necessary to use undue pressure in turning them. Gauge by feel.

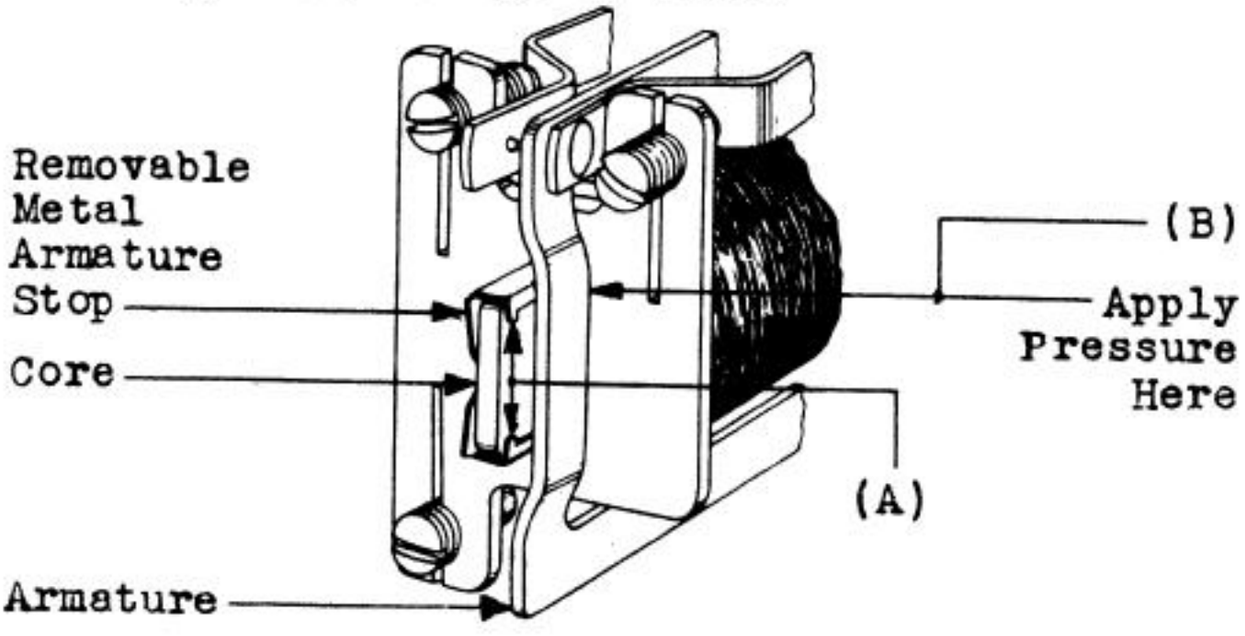


Fig. 104 - Removable Metal Armature Stop Position

2.07 Removable Metal Armature Stop Position - Fig. 104 (A): The flanges on each side of the removable metal armature stop facing the armature shall be flat against the pole face. The armature stop pin shall not strike the removable metal armature stop as the relay operates. Gauge by eye.

2.08 Contact Follow - Fig. 105 (A): (Relays equipped with spring combinations per Fig. 13 and Fig. 14 only)

(a) There shall be a follow at the tip of the flexible front contact spring before the spring strikes the stop spring at the point opposite the contact of approximately .005". This shall be checked when the relay is operated manually and shall be gauged by eye. This requirement is met if the clearance between the flexible spring and the stop spring measured at a point opposite the contact with the relay unoperated does not exceed .010" and there is a perceptible movement of the flexible contact spring when the relay is operated manually.

(b) When the relay is operated manually by applying pressure to the armature at a point opposite the center of the core, the flexible front contact spring shall touch the stop spring at a point opposite the contact before the armature stop pin (or the armature itself if no stop pin is provided) touches the core (or paper armature stop if equipped.) Gauge by eye.

2.09 Flexible Front Contact Spring Position-Fig. 105 (B): (Relays equipped with spring combinations per Figs. 13 and 14 only). The flexible front contact spring shall rest against the shoulder of the stop spring when the relay is unoperated. Gauge by eye.

2.10 Minimum Front Contact Make - Fig. 106 (A): The values of "Front Contact Make" referred to below are tabulated in the figures shown on Pages 14 and 15. The particular value to be used shall be that corresponding to the figure number and the armature travel specified or the circuit requirement table.

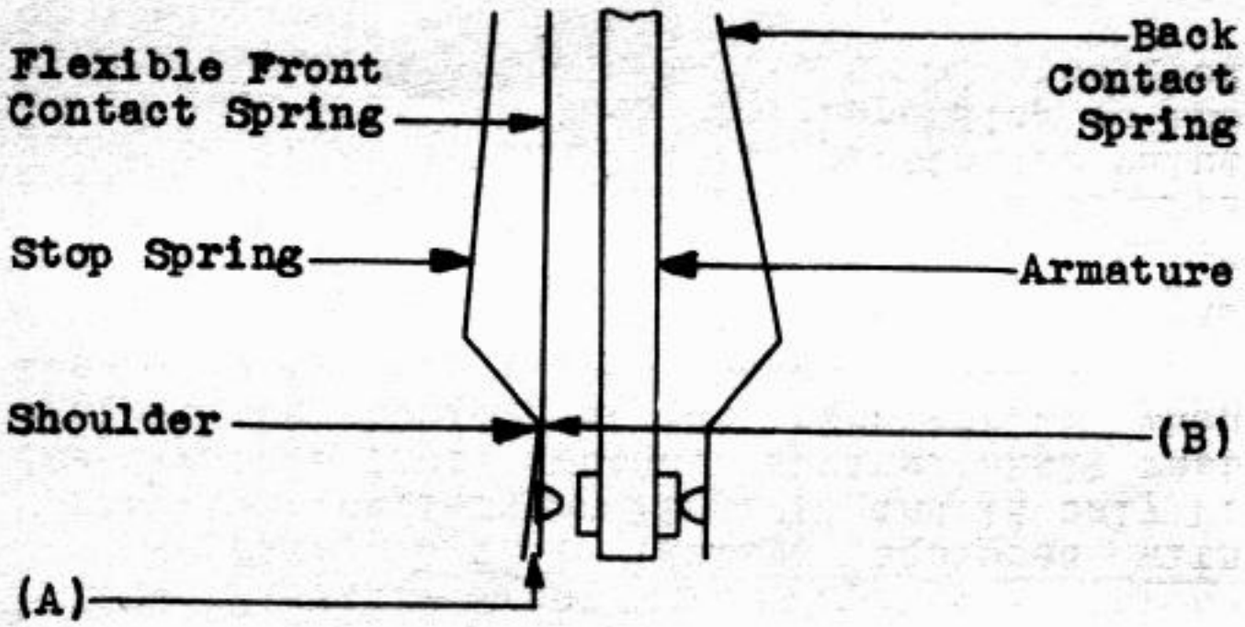


Fig. 105 - Contact Follow

(a) Relays not Equipped with Removable Armature Stops: With the armature held against a gauge of the thickness specified under "Front Contact Make" inserted between the stop pin (or pins) and the core (or between the armature and core when no stop pin is provided), the armature or the traveling contact spring shall touch the front contact or stop. Sufficient pressure shall be applied to the armature directly opposite the lower part of the core to hold it against the gauge but not enough to distort the armature. Use a 100 type gauge. See Note A following requirement 2.12.

(b) Fig. 103 (B) - Relays Equipped with Removable Metal Armature Stops: With the armature held against a gauge of the thickness specified under "Front Contact Make" inserted between the armature and the upper flanges of the removable metal armature stop, the armature or traveling contact spring shall touch the front contact or stop. Sufficient pressure shall be applied to the armature directly op-

2.10 (Continued)

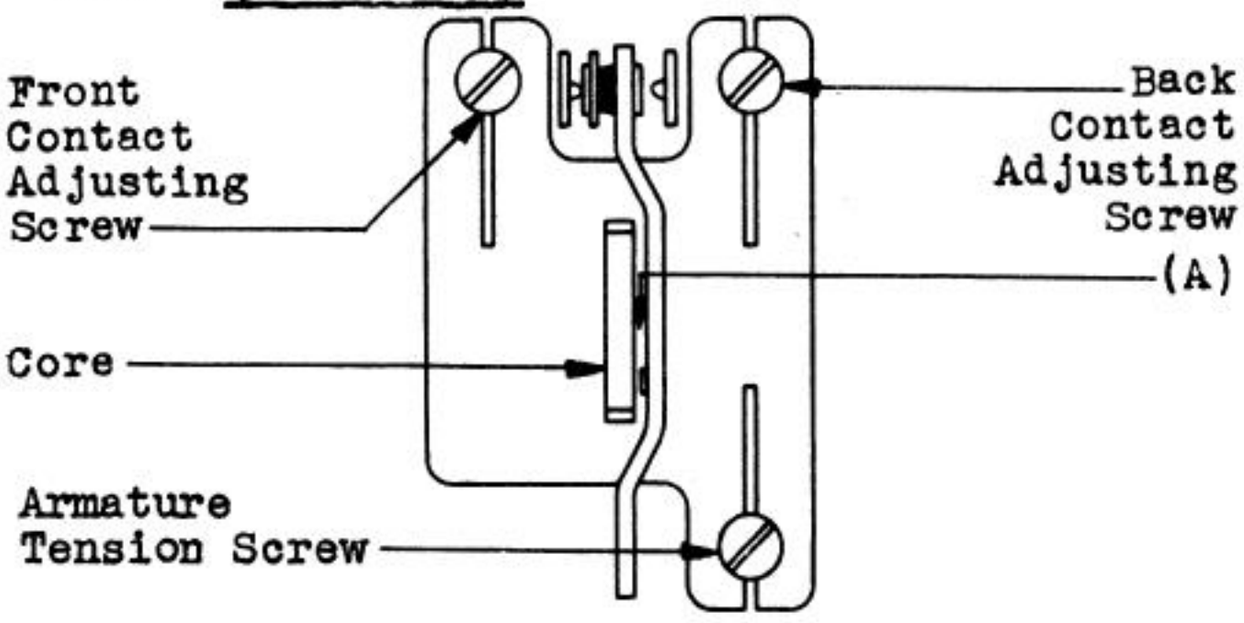


Fig. 106 - Location of Adjusting Screws for Spring Combination Figs. 4, 7, 9 and 10

posite the upper flanges of the removable metal armature stop to hold it against the gauge but not enough to distort the armature. Use the No. 74D gauge. See Note A following requirement 2.12.

(c) Relays Equipped with Removable Paper Armature Stops

(1) Relays Having Values of .005" Specified under "Front Contact Make": When the relay is operated manually by applying pressure to the armature opposite the lower part of the core, the movement of the armature after the armature or traveling contact spring touches the front contact spring or stop, but before the stop pin or pins (or the armature when no stop pin is provided) strikes the paper stop, shall be minimum .005". Gauge by eye. This requirement shall be considered as having been met if the armature or traveling contact

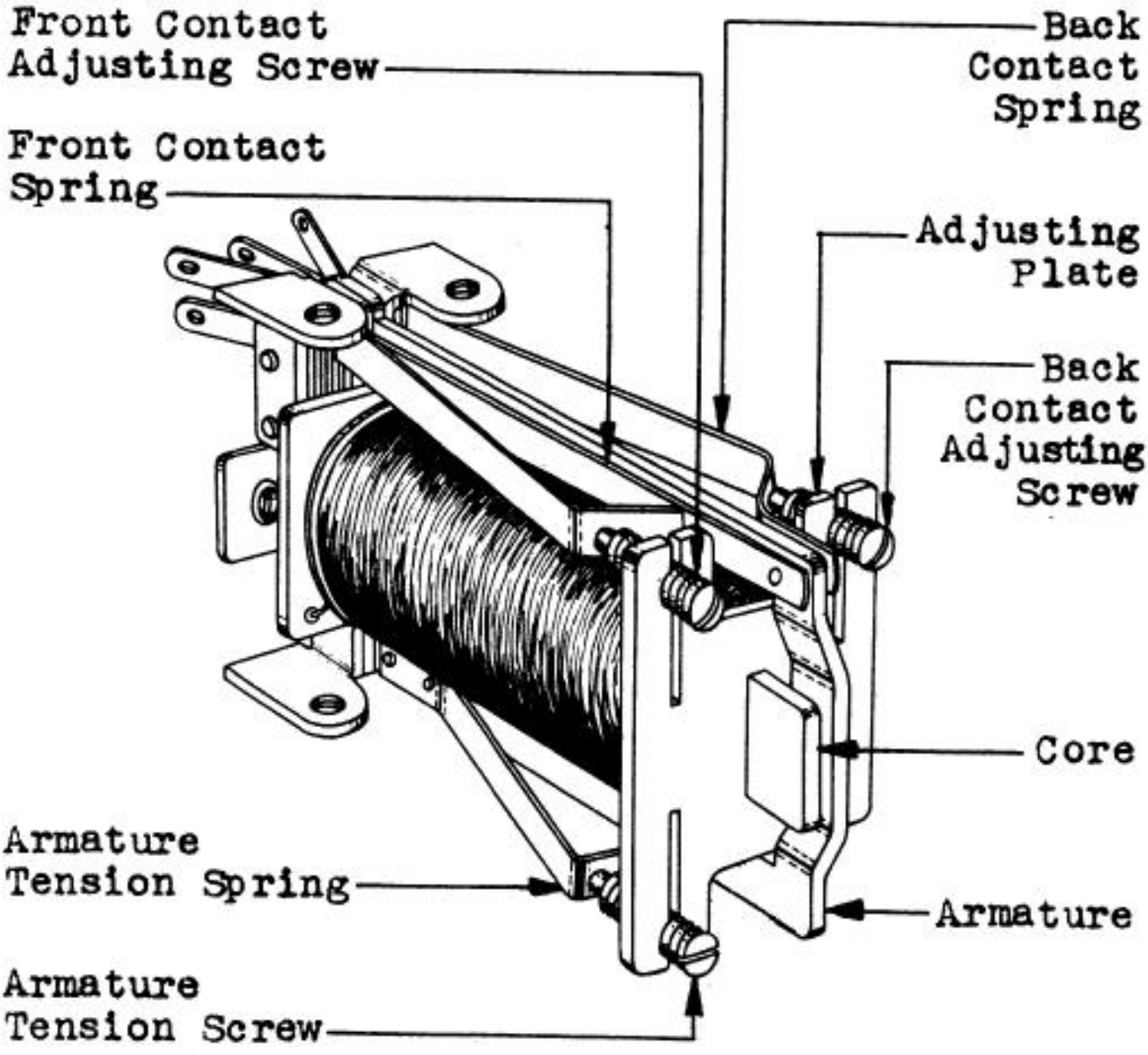


Fig. 107 - "B" Type Relay - Cover Removed

spring touches the front contact or stop with the .007" blade of the No. 74D gauge inserted between the armature stop pin or pins (or the armature where no stop pins are provided) and the core with the paper armature stop removed from the relay. Care shall be taken that the bottom edge of the gauge lines up with the bottom of the core. Sufficient pressure shall be applied to the armature directly opposite the lower part of the core to hold it against the gauge but not enough to distort the armature. See Note A following requirement 2.12.

2.10 (Continued)

(2) Relays Having Values Greater Than .005" Specified under "Front Contact Make": With the removable paper armature stop removed from the relay, the relay shall meet the requirements covered by part (a) of this requirement.

(d) Relays Equipped with Separator (Consisting of a strip of paper wound directly on the core): Relays equipped with a separator shall meet the requirement covered by part (a) except that the gauge shall be inserted between the stop pin (or pins) and the separator, instead of between the stop pin (or pins) and the core. Use a 100 type gauge with the clip bent back.

2.11 Contact Separation - Fig. 108 (A): The separation between contacts normally open or between contacts that are opened when the relay is operated shall be at least .005" except for contact (a) in Fig. 5 which shall be at least .010". This also applies to contact (a) in Fig. 7 for the B136 relay. Use the No. 74D gauge. See Note A following requirement 2.12.

2.12 Maximum Armature Travel - Fig. 108 (B)

(a) Relays Having One or No Stop Pin: The armature travel (unoperated air gap) as measured between the armature and the core with the armature touching the back contact or stop shall not exceed the value specified under "Arm. Trvl." on the circuit requirement table. Use a 101 type gauge. See Note A.

(b) Relays Having Two Stop Pins: The armature travel as measured between the nearer stop pin and the core with the armature

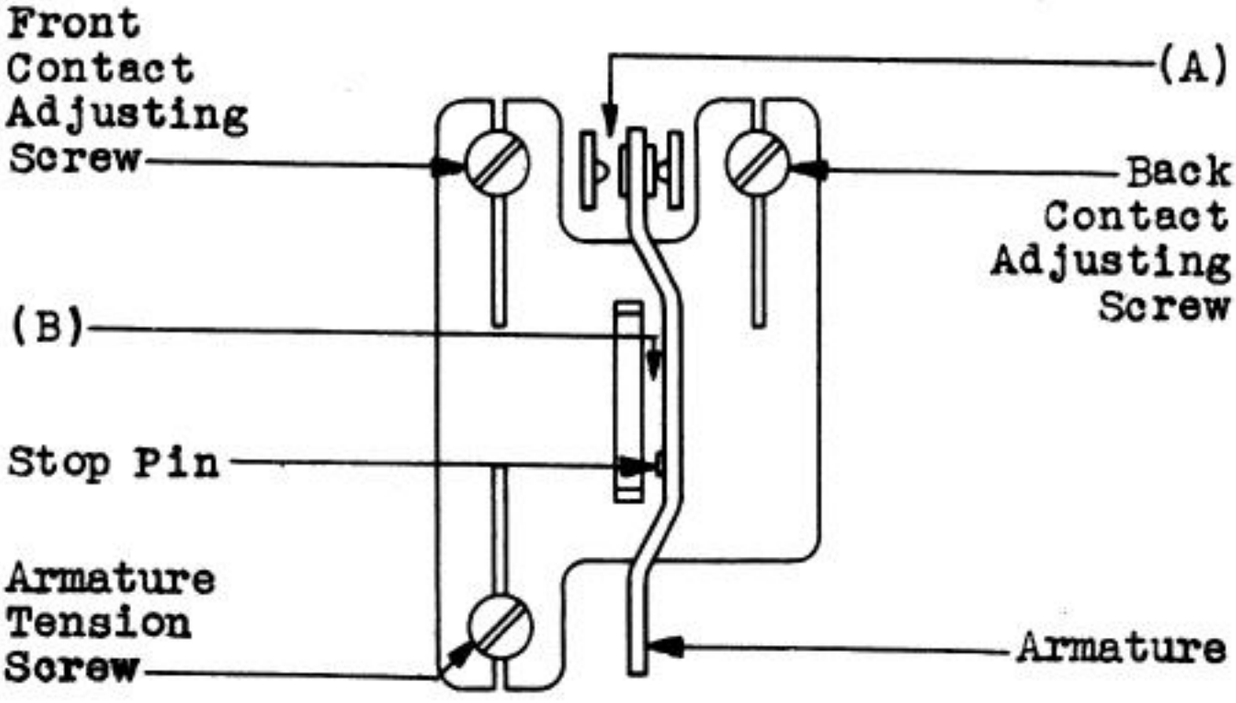


Fig. 108 - Location of Adjusting Screws for Spring Combination Figs. 1, 2, 3, 5, 6, 8, 11, 12, 13, and 14

touching the back contact or stop shall not exceed the value specified under "Arm. Trvl." on the circuit requirement table. Use a 100 type gauge. See Note A.

(c) Relays Equipped with Removable Metal Armature Stops: The armature travel (unoperated air gap) as measured between the armature and the core with the armature touching the back contact or stop shall not exceed the value specified under "Arm. Trvl." on the circuit requirement table. Use a 101 type gauge with the clip bent back. When inserting the gauge make sure that it does not touch the flanges of the removable metal armature stop or the stop pin on the armature. See Note A.

2.12 (Continued)

(d) Relays Equipped with Removable Paper Armature Stops per D-93568: With the armature stop removed from the relay, the relay shall meet the requirements covered by part (a) or (b).

(e) Relays Equipped with Separator (Consisting of a strip of paper wound directly on the core): Relays equipped with a separator shall meet the requirements covered in part (a) or (b) except that the gauge shall be inserted between the armature (or stop pins) and the separator, instead of between the armature and the core. Use a 100 or 101 type gauge with the clip bent back.

Note A: Consistent with meeting the electrical requirements it is desirable when readjusting a relay to keep the "Front Contact Make" and "Contact Separation" near the minimum values specified in order to obtain armature travel that is as small as possible.

2.13 Spring Sequence: Where different values of "Front Contact Make" are specified for the front contacts (a) and (b), contact (b) shall make before contact (a) makes.

*2.14 Straightness of Springs: All springs shall be free of sharp bends or kinks due to adjustment. A gradual bow in the spring is permissible. Gauge by eye.

2.15 Clearance Between Armature and Flexible Contact Spring: (Relays equipped with spring combinations per Figs. 4, 7, 9 and 10). With the relay electrically operated on its soak current when a soak current is specified,

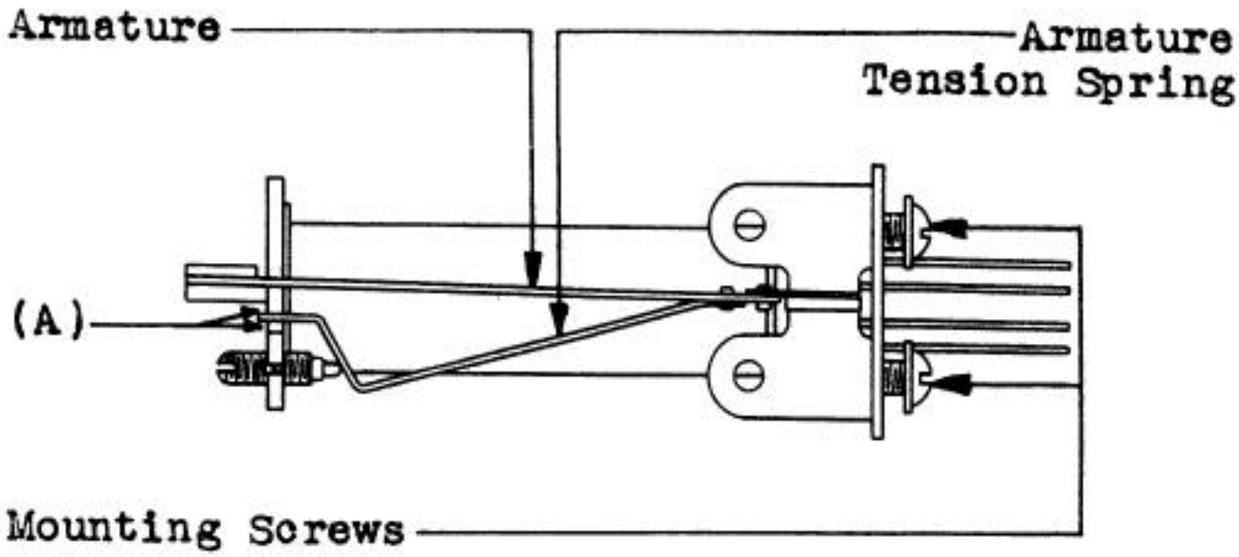


Fig. 109 - Armature Tension Spring Position

or on its test operate current when no soak current is specified, there shall be a clearance between the front end of the No. 2 spring and the armature of

Min. .005"

Gauge by eye.

2.16 Position of Adjusting Screws: At the time of turnover to the Telephone Company, the adjusting screws as finally adjusted shall extend beyond the front of the adjusting plate

Min. 2 threads.

Gauge by eye.

2.17 Electrical Requirements

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

(b) The cover shall be on but the cover cap may be either on or off when applying the electrical requirements.

2.18 Armature Tension Spring Position - Fig. 109 (A): On relays equipped with the type of armature tension spring shown in Fig. 109 there shall be a perceptible clearance (approximately .005") between the armature and the spring and between the spring and the adjusting plate, when the relay is in its operated or unoperated position.

FIG. 1

ARM. TRVL.	FRONT CONT. MAKE
.030	.005
.040	.015
.050	.025
.060	.035

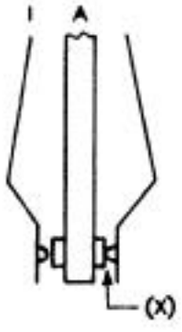


FIG. 2

ARM. TRVL.	FRONT CONT. MAKE
.030	.005
.040	.015
.050	.025
.060	.035

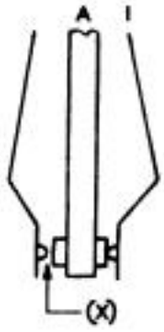


FIG. 3

ARM. TRVL.	FRONT CONT. MAKE
.030	.005
.040	.015
.050	.025
.060	.035

FIG. 4

ARM. TRVL.	FRONT CONT. MAKE
.030	.005
.040	.015
.050	.025
.060	.035

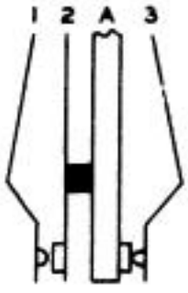


FIG. 5

ARM. TRVL.	FRONT CONT. MAKE	
	SPG. 1	SPG. 2
.030	.005	.010
.040	.010	.015
.050	.020	.025
.060	.030	.035

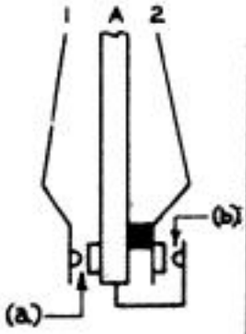


FIG. 6

ARM. TRVL.	FRONT CONT. MAKE
.020	.005
.030	.005
.040	.015
.050	.025
.060	.035

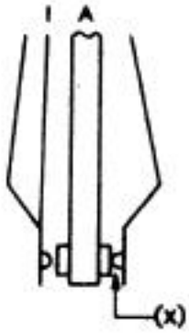
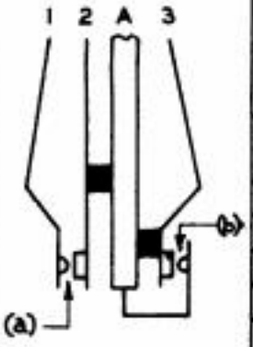


FIG. 7

ARM. TRVL.	FRONT CONT. MAKE	
	SPG. 1	SPG. 3
.025	.010	.010
.030	.005	.005
.035	.010	.010
.040	.015	.015
.050	.025	.025
.060	.035	.035
*.060	.035	.040



* B136 RELAY ONLY

FIG. 8

ARM. TRVL.	FRONT CONT. MAKE
.030	.005
.040	.015
.050	.025
.060	.035

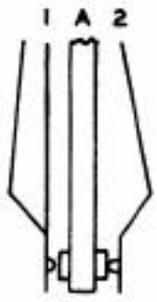


FIG. 9

ARM. TRVL.	FRONT CONT. MAKE
.020	.005
.030	.005
.040	.015
.050	.025
.060	.035

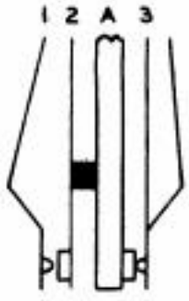


FIG. 10

ARM. TRVL.	FRONT CONT. MAKE
.030	.005
.040	.015
.050	.025
.060	.035

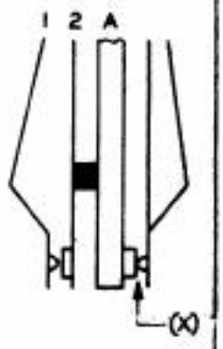


FIG. 11

ARM. TRVL.	FRONT CONT. MAKE
.020	.005
.030	.005
.040	.015
.050	.025
.060	.035

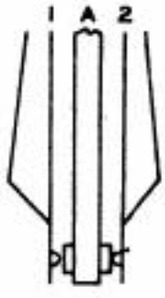


FIG. 12

ARM TRVL	FRONT CONT. MAKE
.030	.005
.040	.015
.050	.025
.060	.035

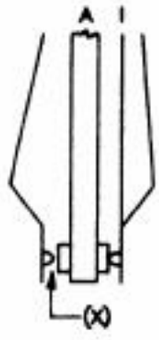


FIG. 13

ARM. TRVL	FRONT CONT. MAKE
.030	.005
.035	.010
.040	.015
.050	.025
.060	.035

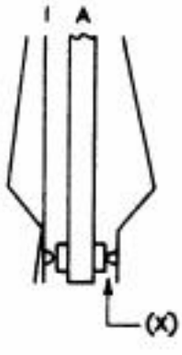
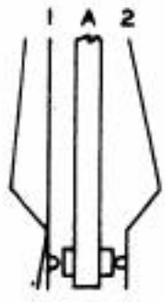


FIG. 14

ARM. TRVL.	FRONT CONT. MAKE
.030	.005
.035	.010
.040	.015
.050	.025
.060	.035



Contacts marked (X) are used for armature stop purposes only and do not form part of the electrical circuit.

Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.
B 1	1	.030"	B31	6	.030"	B61	3	.030"
B 2	2	.030"	B32	1	.030"	B62	1	.030"
B 3	3	.030"	B33	2	.030"	B63	1	.030"
B 4	3	.030"	B34	1	.030"	B64	3	.030"
B 5	2	.030"	B35	5	.040"	B65	3	.030"
B 6	1	.030"	B36	1	.030"	B66	6	.030"
B 7	3	.050"	B37	7	.035"	B67	3	.030"
B 8	4	.030"	B38	1	.030"	B68	3	.030"
B 9	1	.030"	B39	8	.030"	B69	4	.030"
B10	1	.030"	B40	4	.030"	B70	1	.030"
B11	5	.040"	B41	7	.035"	B71	1	.030"
B12	3	.030"	B42	3	.030"	B72	1	.030"
B13	4	.030"	B43	1	.030"	B73	6	.030"
B14	3	.030"	B44	3	.030"	B74	1	.030"
B15	1	.030"	B45	3	.030"	*B75	1	.030"
B16	1	.030"	B46	3	.030"	B76	1	.030"
B17	1	.030"	B47	2	.030"	B77	8	.030"
B18	1	.030"	B48	Recoded G2		B78	3	.030"
B19	3	.030"	B49	6	.030"	B79	1	.030"
B20	3	.030"	B50	5	.040"	B80	3	.030"
B21	1	.030"	B51	1	.030"	B81	1	.030"
B22	3	.040"	B52	7	.035"	B82	3	.030"
B23	3	.030"	B53	2	.030"	B83	1	.030"
B24	1	.030"	B54	1	.030"	B84	3	.030"
B25	5	.040"	B55	3	.030"	B85	2	.030"
B26	1	.030"	B56	1	.030"	B86	6	.030"
B27	3	.030"	B57	3	.030"	B87	6	.030"
B28	3	.030"	B58	1	.030"	B88	1	.030"
B29	1	.030"	B59	1	.030"	B89	1	.030"
B30	Recoded G1		B60	8	.030"	B90	1	.030"

*These relays have two stop pins.

The above data is for use on relays where the "Arm. Trvl." requirement is not given in the "Arm. Trvl." column of circuit requirement tables. All higher coded relays will have this requirement given on the circuit requirement tables.

Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.
B 91	6	.030"	B116	2	.030"	B141	1	.030"
B 92	1	.030"	B117	1	.030"	B142	1	.030"
B 93	3	.030"	B118	7	.035"	B143	1	.030"
B 94	1	.030"	B119	7	.035"	B144	6	.030"
B 95	5	.040"	B120	1	.030"	B145	1	.030"
B 96	1	.030"	B121	2	.030"	B146	4	.030"
B 97	3	.040"	B122	6	.030"	B147	8	.030"
B 98	7	.035"	B123	9	.030"	B148	1	.030"
B 99	1	.050"	B124	1	.050"	B149	2	.050"
B100	3	.030"	B125	7	.035"	B150	3	.040"
B101	7	.035"	B126	2	.050"	B151	5	.040"
B102	1	.030"	B127	1	.030"	B152	1	.030"
B103	3	.030"	*B128	3	.030"	#B153	3	.030"
B104	6	.030"	B129	3	.030"	B154	7	.035"
B105	6	.030"	B130	7	.035"	B155	4	.030"
B106	2	.030"	B131	1	.030"	B156	4	.030"
B107	3	.030"	B132	1	.040"	B157	1	.030"
B108	1	.030"	B133	7	.035"	B158	7	.050"
B109	3	.030"	B134	Not Used		B159	1	.030"
B110	1	.030"	B135	1	.030"	B160	1	.030"
B111	3	.030"	B136	7	.060"	B161	2	.030"
B112	2	.030"	B137	Not Used		B162	7	.035"
B113	5	.040"	B138	1	.030"	B163	1	.030"
B114	1	.040"	B139	1	.030"	B164	3	.030"
B115	5	.040"	B140	1	.050"	B165	3	.030"

*These relays have two stop pins.

#This relay was formerly equipped with two stop pins.

The above data is for use on relays where the "Arm. Trvl." requirement is not given in the "Arm. Trvl." column of circuit requirement tables. All higher coded relays will have this requirement given on the circuit requirement tables.

Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.
B166	1	.050"	B196	4	.030"	B226	1	.040"
B167	1	.030"	B197	3	.030"	B227	1	.030"
B168	3	.040"	B198	1	.030"	B228	1	.050"
B169	1	.050"	B199	1	.030"	B229	1	.030"
B170	1	.030"	B200	2	.030"	B230	1	.060"
B171	3	.030"	B201	1	.030"	B231	1	.030"
B172	7	.035"	B202	1	.050"	B232	1	.030"
B173	5	.040"	B203	3	.030"	B233	1	.050"
B174	2	.030"	B204	1	.030"	B234	2	.030"
B175	2	.030"	B205	1	.030"	B235	7	.050"
B176	7	.035"	B206	1	.030"	B236	1	.030"
B177	1	.060"	B207	6	.030"	B237	3	.050"
B178	1	.030"	B208	1	.030"	B238	7	.035"
B179	3	.030"	B209	6	.050"	B239	6	.030"
B180	6	.030"	B210	7	.035"	B240	1	.030"
B181	4	.030"	B211	1	.030"	B241	1	.030"
B182	2	.030"	B212	1	.030"	B242	1	.040"
B183	1	.060"	B213	1	.030"	B243	1	.050"
B184	Not Used		B214	1	.050"	B244	1	.030"
B185	8	.030"	B215	3	.030"	B245	6	.030"
B186	1	.050"	B216	2	.030"	B246	Not Used	
B187	4	.040"	B217	1	.030"	B247	Not Used	
B188	3	.030"	B218	1	.050"	B248	7	.035"
B189	3	.030"	B219	1	.050"	B249	7	.060"
B190	1	.030"	B220	3	.030"	B250	7	.035"
B191	6	.030"	B221	1	.060"	B251	3	.030"
B192	7	.035"	B222	3	.050"	B252	1	.030"
B193	7	.035"	B223	2	.050"	B253	7	.035"
B194	1	.030"	B224	1	.030"	B254	1	.030"
B195	3	.030"	B225	1	.030"	B255	3	.050"

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Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.
B256	2	.030"	B286	1	.030"	B316	1	.030"
B257	1	.030"	B287	6	.030"	B317	1	.030"
B258	1	.030"	B288	1	.030"	B318	2	.050"
B259	1	.060"	B289	7	.035"	B319	6	.050"
B260	1	.030"	B290	Not Used		B320	1	.030"
B261	1	.030"	B291	Not Used		B321	3	.030"
B262	1	.050"	B292	1	.040"	B322	2	.030"
B263	6	.030"	B293	1	.030"	B323	1	.030"
B264	1	.030"	B294	7	.035"	B324	10	.050"
B265	7	.035"	B295	6	.030"	B325	6	.030"
B266	2	.030"	B296	2	.050"	B326	6	.050"
B267	7	.050"	B297	1	.030"	B327	6	.050"
B268	3	.030"	B298	1	.030"	B328	8	.030"
B269	2	.030"	B299	3	.030"	B329	1	.030"
B270	1	.030"	B300	3	.030"	B330	5	.040"
B271	1	.040"	B301	5	.040"	B331	6	.030"
B272	1	.030"	B302	1	.030"	B332	6	.030"
B273	1	.030"	B303	1	.030"	B333	6	.030"
B274	7	.035"	B304	1	.030"	B334	6	.030"
B275	7	.050"	B305	7	.035"	B335	6	.030"
B276	1	.030"	B306	3	.030"	B336	7	.035"
B277	3	.030"	B307	3	.030"	B337	11	.050"
B278	7	.035"	B308	7	.035"	B338	2	.030"
B279	5	.040"	B309	1	.030"	B339	Not Used	
B280	5	.040"	B310	1	.030"	B340	6	.030"
B281	3	.030"	B311	1	.030"	B341	6	.050"
B282	1	.030"	B312	3	.040"	B342	6	.030"
B283	1	.050"	B313	3	.050"	B343	6	.030"
B284	2	.030"	B314	3	.050"	B344	6	.030"
B285	7	.060"	B315	3	.050"	B345	6	.030"

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Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.
B346	6	.030"	B371	6	.030"	B396	1	.030"
B347	7	.035"	B372	6	.030"	B397	3	.030"
B348	6	.030"	B373	1	.030"	B398	7	.035"
B349	3	.030"	B374	1	.030"	B399	6	.030"
B350	5	.040"	B375	2	.030"	B400	7	.035"
B351	2	.030"	B376	6	.030"	B401	1	.030"
B352	2	.030"	B377	3	.040"	B402	6	.030"
B353	6	.050"	B378	3	.030"	B403	6	.030"
B354	7	.035"	B379	1	.030"	B404	6	.030"
B355	6	.050"	B380	3	.030"	B405	6	.050"
B356	8	.030"	B381	1	.030"	B406	6	.030"
B357	Not Used		B382	1	.030"	*B407	6	.030"
B358	6	.030"	B383	6	.030"	B408	6	.050"
B359	8	.030"	B384	7	.050"	B409	8	.030"
B360	6	.050"	B385	3	.030"	B410	3	.030"
B361	6	.030"	B386	2	.030"	B411	2	.030"
B362	6	.030"	B387	1	.050"	B412	6	.030"
B363	6	.050"	B388	1	.050"	B413	6	.030"
B364	3	.030"	B389	1	.050"	B414	9	.030"
B365	7	.035"	B390	1	.050"	B415	6	.030"
B366	2	.050"	B391	1	.050"	B416	8	.030"
B367	6	.030"	B392	6	.030"	B417	6	.050"
B368	7	.050"	B393	1	.050"	B418	6	.030"
B369	2	.030"	B394	1	.030"	B419	6	.030"
B370	6	.040"	B395	3	.060"	B420	6	.030"

*These relays have two stop pins.

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Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.
B421	6	.030"	B446	6	.030"	B471	1	.050"
B422	6	.030"	B447	6	.030"	*B472	6	.020"
B423	13	.030"	B448	3	.030"	*B473	6	.020"
B424	6	.030"	B449	9	.030"	*B474	7	.025"
B425	7	.035"	B450	12	.030"	*B475	6	.020"
B426	6	.030"	B451	6	.040"	B476	7	.035"
B427	7	.035"	B452	2	.060"	*B477	6	.020"
B428	1	.030"	B453	3	.030"	*B478	7	.025"
B429	6	.050"	B454	1	.030"	*B479	7	.025"
B430	7	.035"	B455	12	.030"	*B480	6	.020"
B431	8	.030"	B456	6	.030"	*B481	6	.020"
B432	4	.030"	B457	10	.030"	*B482	6	.020"
B433	1	.030"	B458	6	.030"	*B483	11	.020"
B434	3	.030"	B459	6	.030"	B484	7	.060"
B435	6	.030"	B460	Cancelled		B485	3	.030"
B436	6	.030"	B461	6	.050"	B486	6	.050"
B437	7	.035"	B462	1	.030"	B487	6	.030"
B438	1	.050"	B463	6	.030"	B488	1	.060"
B439	6	.030"	B464	6	.030"	B489	7	.035"
B440	4	.030"	*B465	6	.020"	B490	6	.030"
B441	8	.030"	B466	6	.050"	B491	7	.035"
B442	3	.030"	B467	7	.035"	B492	2	.030"
B443	3	.030"	B468	7	.035"	B493	6	.030"
B444	6	.030"	*B469	6	.020"	B494	3	.030"
B445	6	.030"	*B470	6	.020"	B495	4	.030"

*These relays have two stop pins.

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Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.
B496	2	.030"	B518	1	.050"	B540	1	.030"
B497	1	.030"	B519	4	.030"	B541	1	.030"
B498	7	.035"	B520	3	.030"	B542	1	.030"
B499	6	.030"	*B521	9	.020"	B543	3	.030"
B500	1	.030"	B522	8	.030"	B544	1	.040"
B501	6	.030"	B523	4	.030"	B545	1	.030"
B502	6	.030"	B524	1	.030"	B546	1	.030"
B503	7	.035"	B525	3	.030"	B547	6	.030"
B504	6	.030"	B526	7	.050"	B548	11	.030"
B505	6	.040"	B527	6	.030"	B549	6	.030"
B506	5	.040"	B528	1	.030"	B550	7	.035"
B507	2	.030"	B529	6	.030"	B551	7	.035"
B508	6	.030"	B530	11	.030"	B552	6	.030"
B509	3	.030"	B531	7	.035"	B553	12	.030"
B510	1	.030"	B532	6	.030"	B554	4	.050"
B511	6	.050"	B533	1	.030"	B555	6	.030"
B512	1	.050"	B534	1	.030"	B556	6	.030"
B513	3	.030"	B535	9	.030"	B557	7	.060"
B514	6	.030"	B536	6	.030"	B558	4	.030"
B515	1	.030"	B537	6	.040"	B559	2	.030"
B516	7	.035"	B538	2	.030"			
B517	1	.030"	B539	6	.030"			

*These relays have two stop pins.

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Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.
B1000	6	.050"	B1015	3	.040"	B1030	3	.030"
B1001	Cancelled		B1016	11	.030"	B1031	7	.035"
*B1002	7	.025"	B1017	3	.060"	B1032	1	.040"
B1003	1	.030"	B1018	3	.030"	B1033	1	.040"
B1004	6	.050"	B1019	6	.030"	B1034	5	.030"
B1005	11	.050"	B1020	7	.060"	B1035	7	.030"
B1006	6	.030"	B1021	2	.050"	B1036	1	.030"
B1007	1	.030"	B1022	1	.050"	B1037	11	.030"
B1008	7	.030"	B1023	6	.030"	B1038	7	.050"
B1009	7	.030"	B1024	7	.035"	B1039	6	.050"
B1010	6	.040"	B1025	7	.035"	B1040	6	.050"
B1011	1	.030"	B1026	8	.030"	B1041	1	.040"
B1012	6	.030"	B1027	11	.030"	B1042	6	.030"
B1013	6	.030"	B1028	1	.030"			
B1014	3	.050"	B1029	7	.035"			

G 1	3	.040"	G11	6	.030"	G21	9	.040"
G 2	3	.030"	G12	7	.050"	G22	6	.040"
G 3	2	.040"	G13	7	.050"	G23	7	.040"
G 4	3	.060"	G14	7	.060"	G24	7	.040"
G 5	1	.030"	G15	6	.040"	G25	6	.040"
G 6	2	.030"	G16	4	.050"	G26	3	.030"
G 7	1	.030"	G17	3	.040"	G27	7	.040"
G 8	8	.040"	G18	7	.060"	G28	2	.040"
G 9	4	.030"	G19	1	.040"	G29	6	.030"
G10	2	.040"	G20	7	.060"	G30	2	.040"

*These relays have two stop pins.

The above data is for use on relays where the "Arm. Trvl." requirement is not given in the "Arm. Trvl." column of circuit requirement tables. All higher coded relays will have this requirement given on the circuit requirement tables.

Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.	Code	Fig. No.	Max. Arm. Trvl.
G31	2	.040"	G45	1	.040"	G59	7	.035"
G32	2	.040"	G46	6	.030"	G60	7	.050"
G33	2	.040"	G47	11	.030"	G61	7	.030"
G34	7	.030"	G48	6	.030"	G62	7	.035"
G35	6	.040"	G49	6	.050"	G63	7	.035"
G36	7	.040"	G50	7	.030"	G64	6	.030"
G37	7	.040"	G51	7	.040"	G65	7	.030"
G38	7	.040"	G52	6	.030"	G66	4	.030"
G39	6	.040"	G53	8	.040"	G67	9	.030"
G40	7	.030"	*G54	6	.020"	G68	6	.040"
G41	12	.040"	G55	2	.030"	G69	5	.040"
G42	1	.060"	G56	11	.040"	G70	6	.030"
G43	2	.040"	G57	4	.030"	G71	1	.050"
G44	4	.050"	G58	6	.030"	G72	7	.040"
						G73	7	.035"

*These relays have two stop pins.

The above data is for use on relays where the "Arm. Trvl." requirement is not given in the "Arm. Trvl." column of circuit requirement tables. All higher coded relays will have this requirement given on the circuit requirement tables.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, Test Apparatus and Materials

Code No.	Description
Tools	
116	Lamp Extractor
259	Spring Adjuster

Code No.	Description
300	Spring Adjuster
319B	Lamp Cap and Number Plate Extractor
363	Spring Adjuster
-	KS-6015 Duck-bill Pliers
-	KS-6854 Screw-driver
-	4" Regular Screw-driver
-	6-1/2" P-Long Nose Pliers
Gauges	
74D	Thickness Gauge Nest
99A	Thickness Gauge Nest Consisting of 100 and 101 Type Gauges
Test Apparatus	
35 Type	Test Set

3.01 Cleaning (Rq.2.01)

(1) Clean the contacts and other parts in accordance with the section covering cleaning of relay contacts and parts.

3.02 Relay Mounting (Rq.2.02)
3.03 Cover Clearance (Rq.2.03)

(1) To align relays so that they are approximately level and also to obtain the necessary clearance between the cover and adjacent apparatus, loosen the mounting screws

3.02-3.03 (Continued)

with the 4" regular screw-driver and shift the relays as required.

(2) To fasten relays securely to the mounting plate, tighten the mounting screws with the 4" regular screw-driver.

(3) If necessary, additional cover clearance may be obtained as follows: Unsolder the leads and remove the relay from the mounting plate using the 4" regular screw-driver.

(4) Loosen the cover screws with the KS-6854 screw-driver and shift the cover with respect to the relay as required. Tighten the cover screws securely, replace the relay on the mounting plate and tighten the mounting screws securely. Exercise care that the relay is mounted approximately level and that the cover clearance requirement is met.

3.04 Cover Cap (Rq.2.04)

(1) If the cover cap does not fit properly adjust the cover prongs as required using the long nose pliers.

3.05 Contact Alignment (Rq.2.05)

(1) If the contacts are out of line from front to rear it will probably be necessary to replace the relay as there is practically no forward or backward movement of the spring.

(2) If the contacts are out of line vertically move heavy springs by applying slight pressure to the free ends of the

springs, exercising care not to damage them. If it is impossible to align the contacts in this manner they may be adjusted as follows:

(3) Unsolder the leads and remove the relay from the mounting plate using the 4" regular screw-driver.

(4) Remove the screws that hold the cover in place with the KS-6854 screw-driver and take off the cover.

(5) Loosen the spring assembly screws with the KS-6854 screw-driver and shift the springs as required, attempting to center the contacts as nearly as possible. Securely tighten the spring assembly screws.

(6) Before replacing the cover and mounting the relay, note that the adjusting screws are in proper adjustment, and that all springs are free from sharp bends or kinks due to adjustment. Also note that the No. 2 spring in Figs. 4, 7, 9 and 10 and the armature tension spring have a tension that will permit a satisfactory adjustment of the armature tension by means of the armature tension adjusting screw. This can usually be determined by noting how the relay functions when the electrical requirements are applied. Also check the position of the armature tension spring. If these requirements are not met adjust in accordance with procedures 3.06, 3.19 and 3.20.

(7) Replace the relay cover and cover screws using the KS-6854 screw-driver. Fasten the relay securely to the mounting plate using the 4" regular screw-driver. Exercise care that the relay is mounted approximately level, and that the cover clearance is satisfactory.

3.06 Tightness of Adjusting Screws (Rq.2.06)

(1) If the adjusting screws are too tight or too loose adjust as follows:

(2) Remove the relay from the mounting plate and the cover from the relay as outlined in 3.05, (3) and (4).

(3) If the screws are too tight, widen the slot in the adjusting plate using the KS-6854 screw-driver.

(4) If the screws are too loose, remove the ones at fault with the KS-6854 screw-driver and then close up the slot in the adjusting plate, using the long nose pliers.

(5) Take care not to loosen the adjusting plate in making this adjustment.

(6) Before replacing the relay cover note whether or not the conditions covered in 3.05, (6) are met and readjust for them if necessary.

(7) Replace the relay cover and cover screws using the KS-6854 screw-driver. Fasten the relay securely to the mounting plate using the 3-1/2" cabinet screw-driver and at the same time make sure that the relay is mounted approximately level, and that the cover clearance is satisfactory.

3.07 Removable Metal Armature Stop Position (Rq.2.07)

(1) If the armature stop pin strikes the lower portion of the removable metal armature stop as the relay operates, thereby preventing the armature itself from striking the removable metal armature stop, reverse the

position of the removable metal armature stop on the core. If this does not clear the trouble, change the armature stop.

3.08 Contact Follow (Rq.2.08)
3.09 Flexible Contact Spring Position (Rq.2.09)
3.10 Minimum Front Contact Make (Rq.2.10)
3.11 Contact Separation (Rq.2.11)
3.12 Maximum Armature Travel (Rq.2.12)
3.13 Spring Sequence (Rq.2.13)

(1) Contact Follow: To adjust for contact follow remove the relay cover as described in procedure 3.05, (3) and (4) and turn the front contact adjusting screw in a counterclockwise direction approximately one complete turn using the KS-6854 screw-driver. This will permit the application of the No. 300 spring adjuster to the stop spring without interfering with the flexible front contact spring. Apply the adjuster to the stop spring just ahead of the first bend viewed from the front end of the spring. Adjust the front portion of the spring to the right to decrease the contact follow and to the left to increase it. Turn the front contact adjusting screw in a clockwise direction to its former position.

(2) If the flexible front contact spring does not rest against the shoulder of the stop spring apply the No. 259 spring adjuster to the flexible spring at the rear and slightly twist it to the left.

(3) Front Contact Make: In order to insure proper front contact pressure where such contacts are used and to aid the armature to release promptly, the front contact spring or stop must be located so that the armature, in travelling to its operated position,

3.08-3.13 (Continued)

will engage with the front contact spring or stop before the stop pin (or pins) or the armature itself when no stop pin is provided, touches the core (or removable paper armature stop if equipped). In the case of relays equipped with a spring combination per Fig. 13 or Fig. 14 adjust the front stop spring towards the right by means of the front contact adjusting screw so that when the relay is manually operated by applying pressure to the armature at a point opposite the center of the core, the flexible front contact spring will touch the stop spring at a point opposite the contact before the armature stop pin (or the armature itself, if no stop pin is provided) touches the core.

(4) Relays without Removable Armature Stops: Insert the proper "Front Contact Make" gauge between the stop pin (or pins) and the core or between the armature and the core when no stop pin is provided. Apply sufficient pressure to the armature opposite the lower part of the core to hold it against the gauge as shown in Fig. 110. Exercise care not to distort the armature as this will provide a different gap under operating conditions. Turn in the front contact adjusting screw with the KS-6854 screw-driver until the front contacts just make or the armature just touches the front stop.

(5) Relays with Removable Metal Armature Stops: Note that the flanges on each side of the removable metal armature stop facing the armature are flat against the core. If they are not, remove the stop, adjust the flanges with the duck-bill pliers and replace the stop on the relay core. Insert the proper "Front

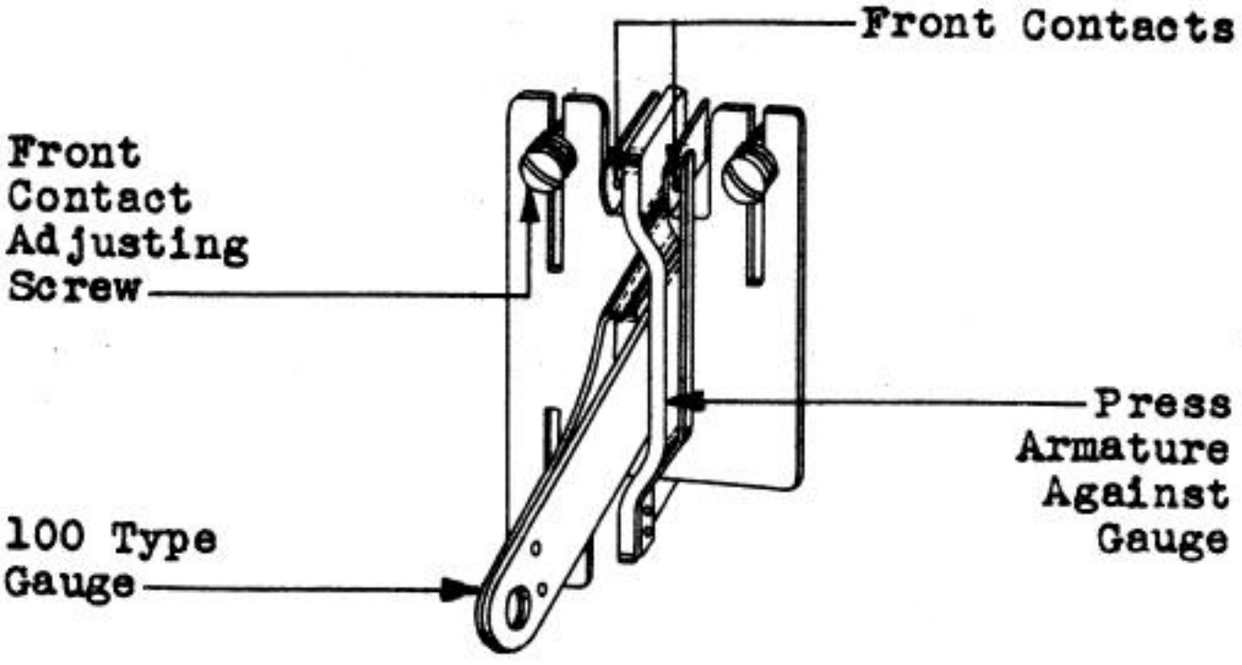

Fig. 110 - Method of Adjusting for Minimum Front Contact Make

Contact Make" gauge between the armature and the upper flanges of the removable metal armature stop as shown in Fig. 111. Apply sufficient pressure to the armature directly opposite the upper flanges of the stop to hold the armature against the gauge. Exercise care not to distort the armature as this will provide a different gap under operating conditions. Turn the front contact adjusting screw with the KS-6854 screw-driver until the front contacts just make or the armature just touches the front stop.

Relays with Removable Paper Armature Stops per D-93568

(6) Relays Having Values of .005" Specified under "Front Contact Make": To adjust for "Front Contact Make" remove the

3.08-3.13 (Continued)

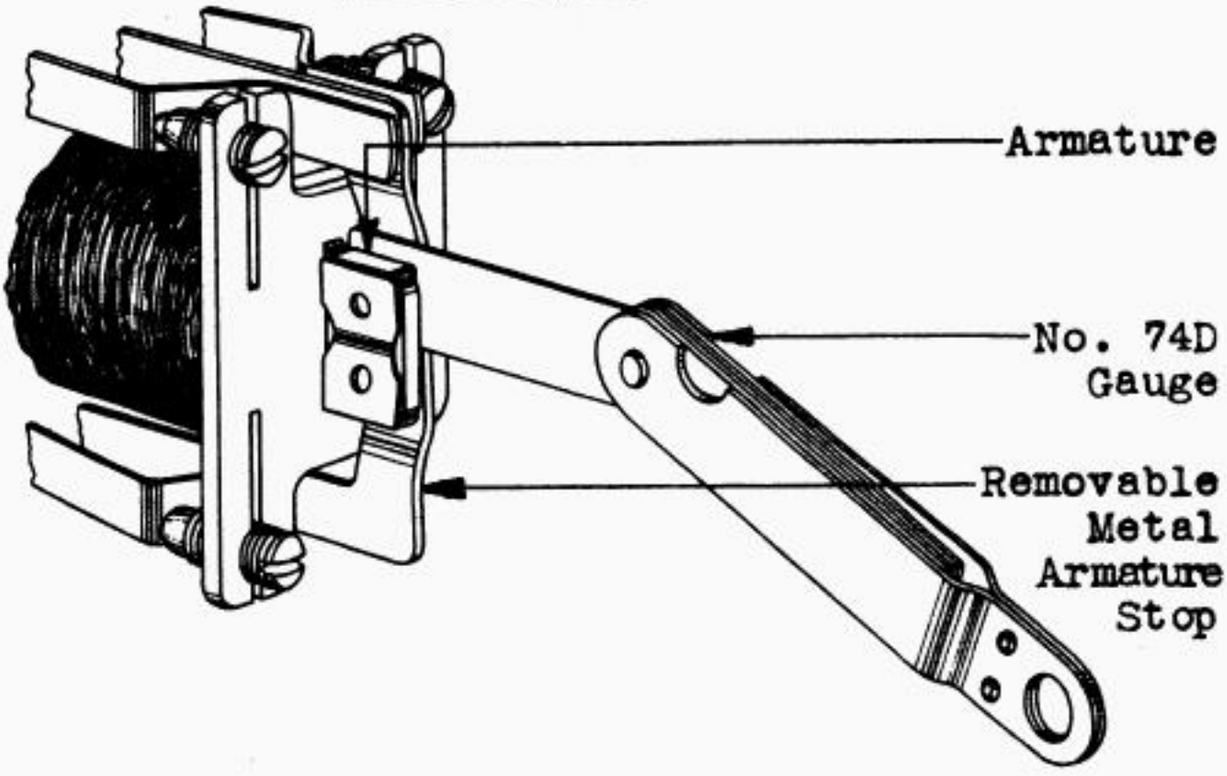

Fig. 111 - Method of Adjusting for Minimum Front Contact Make on Relays Equipped with a Removable Metal Armature Stop

removable paper armature stop, and insert the .007" blade of the No. 74D gauge between the armature stop pin or pins (or the armature when no stop pin is provided) and the core, taking care that the bottom edge of the blade lines up with the bottom edge of the core. Apply sufficient pressure to the armature opposite the lower part of the core to hold it against the gauge as shown in Fig. 110 but exercise care not to distort the armature as this would provide a different gap under operating conditions. Turn the front contact adjusting screw with the KS-6854 screw-driver until the front contacts just make or the armature just touches the front stop. Remount the stop as covered in

the B500 section covering procedures for applying removable paper armature stops, back stops and separators.

(7) Relays Having Values Greater Than .005" Specified Under "Front Contact Make": Remove the removable paper armature stop from the relay. Insert a gauge of the value specified under "Front Contact Make" between the stop pin or pins (or armature when no stop pin is provided) and the core. Apply sufficient pressure to the armature opposite the lower part of the core to hold it against the gauge as shown in Fig. 110, but exercise case not to distort the armature, as this will provide a different gap under operating conditions. Turn the front contact adjusting screw with the KS-6854 screw-driver until the front contacts just make or the armature just touches the front stop. Remount the stop as covered in (6).

Relays Equipped with a Separator, Consisting of a Strip of Paper Wound Direct-on the Core

(8) Inspect the stop and if it is not torn, dirty or otherwise damaged, insert a gauge of the value shown under "Front Contact Make" between the stop pin or pins (or the armature when no stop pin is provided) and the paper on the core, using a 100 or 101 type gauge with the clip bent back. Apply sufficient pressure to the armature opposite the lower part of the core to hold it against the gauge, but exercise care not to distort the armature, as this will provide a different gap under operating conditions. Turn the front contact adjusting screw with the KS-6854 screw-driver until the front contact just makes or the armature just touches the front stop. Make

3.08-3.13 (Continued)

sure that the separator is not torn or otherwise injured by the insertion of the gauge between the armature and the core.

(9) If upon making the armature spring tension adjustment as described in 3.17 (1), (2) and (4), it is not possible due to the characteristics of the particular relay involved to meet the release requirement it will be necessary to adjust the front contact spring so that it makes contact with a gap greater than the minimum gap specified. This gap however should not be such that the contact separation and armature travel requirements cannot be met.

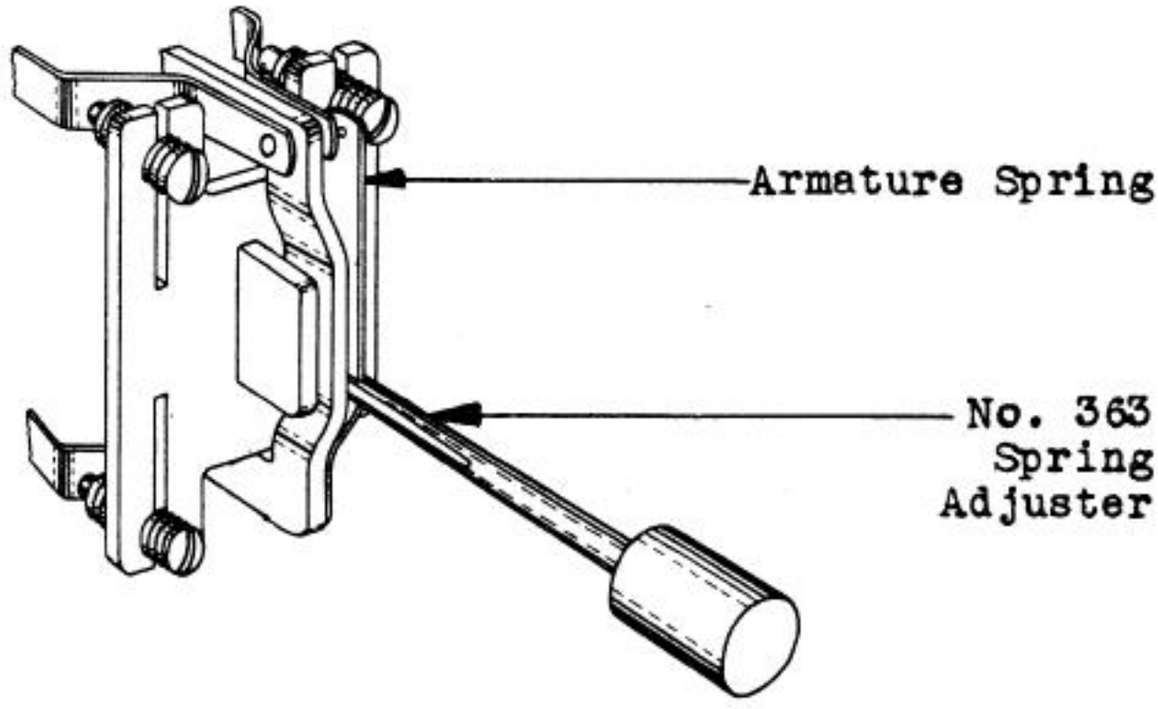

Fig. 112 - Method of Adjusting Armature Spring for Minimum Front Contact Make

(10) The above procedures will not take care of the spring attached to the armature. To position this spring for front contact make, adjust it with the No. 363 spring adjuster until it makes contact with the proper gauge inserted. Apply the spring adjuster slightly above the bend in the spring as shown in Fig. 112.

(11) Contact Separation: Locate the back contact spring or stop so that the separation is at or near the minimum contact separation specified. Do this by turning the back contact adjusting screw with the KS-6854 screw-driver as shown in Fig. 113 until this requirement is met.

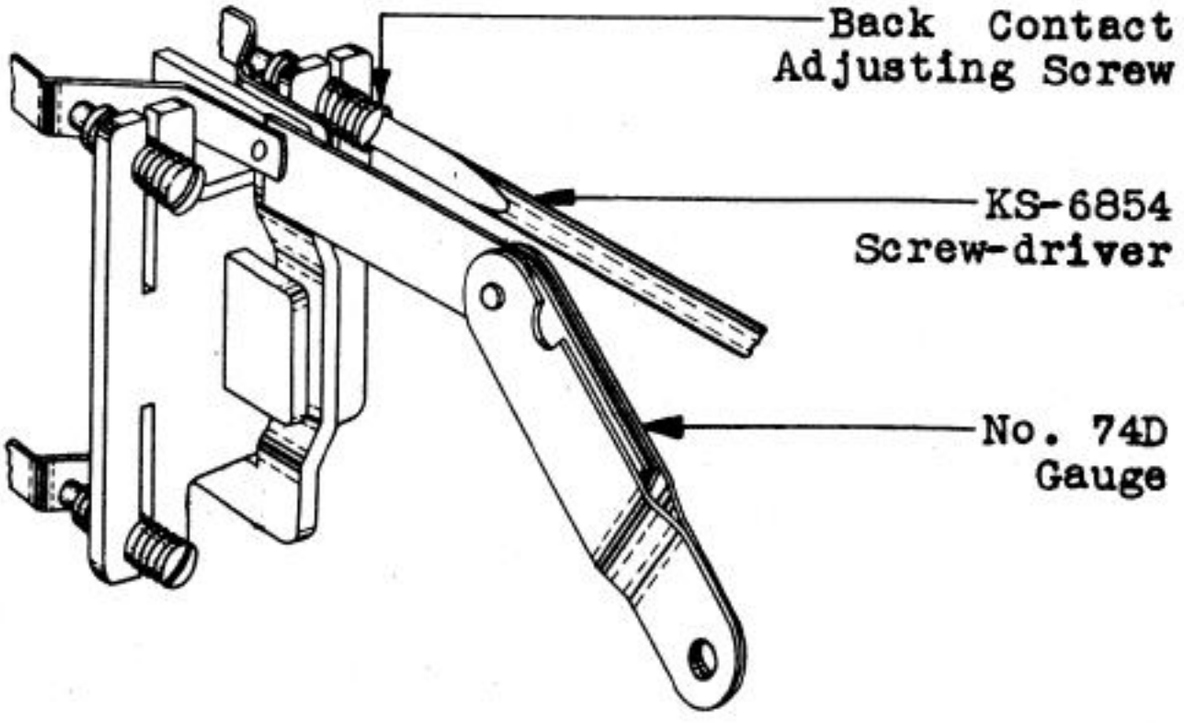

Fig. 113 - Method of Adjusting Contact Separation

3.08-3.13 (Continued)

(12) This adjustment however will not take care of the spring attached to the armature. To adjust this spring for contact separation use the No. 363 spring adjuster applying it slightly above the bend in the spring.

(13) Maximum Armature Travel: In adjusting the "Front Contact Make" and "Contact Separation" as outlined in (3) to (12) inclusive, the armature travel (unoperated air gap) is also established. Check the armature travel with the proper gauge to ascertain that it is within the maximum limit. To do this proceed as follows: Select a gauge of the proper type and thickness specified under armature travel and attempt to insert it in the gap between the armature and the core. (Where a removable paper armature stop is on the relay remove it before inserting the gauge.) If it is found impossible to insert the gauge without distorting the armature due to the gap being smaller than the gauge, the armature travel is satisfactory. If the gauge slides into the gap with any clearance, the armature travel is too great in which case readjust the "Front Contact Make" or the "Contact Separation" closer to the minimum values specified.

The term "armature travel" is used instead of "unoperated air gap" in order to facilitate putting the requirement on the circuit requirement table. It will be given in the column under the heading "Arm. Trvl."

(14) Spring Sequence: Adjust relays on which a definite sequence of contact closure is required so that the contact separation between the contacts required to make

first is .005" less than that between the contacts required to make later. Use the No. 363 spring adjuster applying it slightly above the bend in the spring. Check the adjustment by moving the armature forward manually and noting that the proper sequence is obtained.

3.14 Straightness of Springs (Rq.2.14)

(1) Remove all sharp bends and kinks due to adjustment from the springs using the No. 259 and 300 spring adjusters.

3.15 Clearance Between Armature and Flexible Contact Spring (Rq.2.15) (Relays equipped with spring combinations per Figures 4, 7, 9 and 10).

(1) Apply the soak current if specified or the test operate current if no soak current is specified and note that sufficient clearance exists between the No. 2 (flexible) spring and the armature. If this requirement is not met satisfactorily, reduce the "Front Contact Make" toward the minimum value.

(2) If reducing the "Front Contact Make" to the minimum value does not permit sufficient clearance between the armature and the flexible spring, proceed as follows:

(3) Remove the relay from the mounting plate and remove the cover from the relay as outlined in 3.05, (3) and (4). Adjust the flexible spring so that it is more nearly parallel to the armature in the unoperated position using the No. 259 spring adjuster. Replace the relay cover and mount the relay as outlined in 3.05, (7).

3.16 Position of Adjusting Screws (Rq.2.16)
No procedure.

3.17 Electrical Requirements (Rq.2.17)
3.18 Armature Tension Spring Position (Rq.2.18)

(1) Operate or Hold: If the relay fails to meet the operate or hold requirement, reduce the backward tension of the armature using the KS-6854 screw-driver. On relays having an adjusting plate per Fig. 108 turning the armature tension screw in a counterclockwise direction decreases the backward tension of the armature and turning it in a clockwise direction increases the tension. On relays having an adjusting plate per Fig. 106 turning the armature tension screw in a clockwise direction decreases the backward tension of the armature. In the case of Fig. 108 the armature tension spring opposes the movement of the armature in the operate direction and in the case of Fig. 106 aids the movement of the armature in the operate direction.

(2) Non-operate or Release: If the relay fails to meet the non-operate or release requirements, increase the backward tension of the armature using the KS-6854 screwdriver. If it is impossible to meet the requirement, or if the armature is sluggish in releasing, increase the "Front Contact Make". The maximum armature travel requirement must not be exceeded. Ordinarily it will be possible to regulate the tension by the adjustment of the armature tension screw but in the case of relays having an adjusting plate per Fig. 106 it may be necessary to remove the relay from the mounting plate, remove the cover and tension the No. 2 spring with the No. 259 spring

adjuster against the armature stud sufficiently to permit a satisfactory adjustment of the armature tension.

(3) Increasing the backward tension of the armature to meet a non-operate or release requirement will affect the operate and hold requirements and vice versa in decreasing the tension.

(4) If the relay is required to meet a flashing requirement, adjust the armature tension in accordance with the procedures given for that requirement.

(5) Difficulty in making the adjustment of the relay is sometimes due to the armature tension spring having slipped from its normal position. This condition will be evident in the case of relays having an adjusting plate per Fig. 108 if turning the armature tension screw in a clockwise direction does not seem to force the armature against the back contact or stop. In the case of relays having an adjusting plate per Fig. 106 this condition will be evident if turning the armature tension screw does not affect the tension on the armature. In such cases the tension spring may be restored to its normal position by means of a small improvised hook which can be made from a gem clip or a piece of wire. Turn the armature tension screw in a counterclockwise direction until it clears the spring, slip the hook in so as to catch the spring, move the spring towards the armature, and then turn the screw in a clockwise direction until the armature springs rests against it.

(6) If difficulty is experienced in adjusting the relay it may be that the armature hinge plate is broken. This can usu-

3.17-3.18 (Continued)

ally be determined by holding the armature with the thumb and forefinger and checking to see that it is supported by both the upper and lower hinge plates.

(7) Armature Tension Spring Position: In those cases where the armature tension spring is of such a design that the forward portion of it extends forward between the armature and the adjusting plate note that when the relay is in its final adjustment there is a slight clearance (approximately .005") between the forward portion of the spring and both the adjusting plate and the armature in both the operated and unoperated positions.

(8) If the clearance between the armature tension spring and the adjusting plate or the armature is not met remove the relay from the mounting plate and remove the cover from the relay as covered in 3.05 (3) and (4). Reduce or increase the tension of the tension spring as required with the No. 259 spring adjuster, applying it at the rear of the spring.

(9) Replace the relay and repeat the adjustments to meet the electrical requirements.

(10) Final Check: In all cases after a relay has been adjusted lift the springs controlled by the three adjusting screws slightly away from the screw and allow them to return to the normal position which they will assume in service. Then replace the cover cap and check to insure that the relay meets its electrical and flashing requirements (if specified). This check can generally be made by observing the operation of associated apparatus in the circuit or the lamp in the test set.

REASONS FOR REISSUE

1. To revise the definitions for Operate, Non-operate, Release and Hold, (1.05), (1.06), (1.07) and (1.08).

2. To revise the spring combination figures to indicate back stop springs equipped with contact metal. (Information for W.E. Company covered by CO-115630).

3. To add a requirement for cover clearance (2.03).

4. To revise the requirement covering contact alignment to cover relays having rectangular contacts. (Information for W.E. Company covered by CO-154255). (2.05) (a)

5. To add a requirement for alignment of bar contacts (2.05) (b) and (c).

6. To revise the requirement covering minimum front contact make. (2.12)

7. To revise the requirement covering maximum armature travel. (2.14)

8. To add a requirement covering straightness of springs. (Information for W.E. Company covered by CO-155405). (2.16)

9. To add a requirement covering the clearance between the armature and the flexible contact spring. (Information for the W.E. Company covered by CO-156771). (2.17)

10. To add a requirement covering position of adjusting screws. (Information for W.E. Company covered by CO-115405). (2.18)

REASONS FOR REISSUE (Continued)

11. To revise the electrical requirement to specify that the cover shall be on but the cover cap may be either on or off. (2.19)

12. To omit the flashing requirements.

13. To add procedures for cover clearance. (3.03)

14. To add a procedure for minimum front contact make covering relays equipped with removable paper armature stops. (3.12)

15. To revise procedures for adjusting for maximum armature travel. (3.14)

16. To add procedure for straightness of springs. (3.16)

17. To add a procedure covering the clearance between the armature and flexible contact spring. (3.17)

18. To omit the procedures for flashing requirements.

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