

## KEYS 89, 92, 188, 424, 464, 494, 495, AND 527 TYPES REQUIREMENTS AND ADJUSTING PROCEDURES

### 1. GENERAL

- 1.01 This section covers 89, 92, 188, 424, 464, 494, 495 and 527 type keys.

This section is reissued to incorporate material from the addendum in its proper location.

- 1.02 Reference shall be made to Section 020-010-711 covering General Requirements and Definitions for additional information necessary for the proper application of the requirements listed herein.

- 1.03 Part 1, "General" and Part 2, "Requirements" form part of the Western Electric Co. Inc. Installation Department handbook.

- 1.04 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 The normal (unoperated) position of a lever type key is that position in which the lever is perpendicular to the key top with the normally open contacts open and the normally closed contacts closed.

- 1.06 The operated position of a lever type key is that position in which the lever is thrown either to the extreme front or rear and, in the spring assemblies involved, all normally open contacts are closed and all normally closed contacts are open.

- 1.07 The normal (unoperated) position of a plunger type key is that position in which with the plunger at the top of its stroke and the plunger springs resting against the plunger, the normally open contacts are open and the normally closed contacts are closed.

- 1.08 The operated position of a plunger type key is that position in which the plunger is depressed to the limit of its stroke with all normally open contacts closed and all normally closed contacts open.

### 2. REQUIREMENTS

#### Plunger Type Keys

##### 2.01 Cleaning

- (a) Contacts shall be cleaned in accordance with the section covering cleaning procedures for key contacts.
- (b) Other parts shall be cleaned in accordance with approved procedures.

##### 2.02 Plunger Movement - Fig. 1 (A)

- (a) The plungers shall operate freely and shall not be sluggish in restoring to normal. On locking keys this shall apply after the plunger has been released from the operated position. Gauge by eye and feel.

- \*(b) It shall not be possible to operate the contacts by any side thrust of the plunger. Gauge by eye.

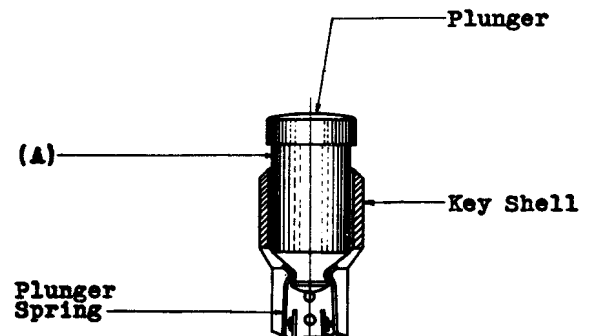


Fig. 1

- \*2.03 Contact Alignment - Fig. 2 (A) - The contacts shall line up so that the point of contact falls wholly within the boundary of the opposing contact. Gauge by eye.

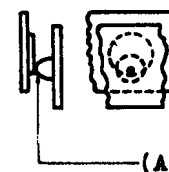


Fig. 2

**\*2.04 Flexible Contact Spring Position - Fig. 3 (A)**

The flexible contact springs shall rest on their respective stop springs when the spring is in the unoperated position for normally open contacts and in the operated position for normally closed contacts. It is not necessary for the spring to rest on the stop spring for its entire length, but it must rest on the end of the stop spring which is nearest the contact. Gauge by eye.

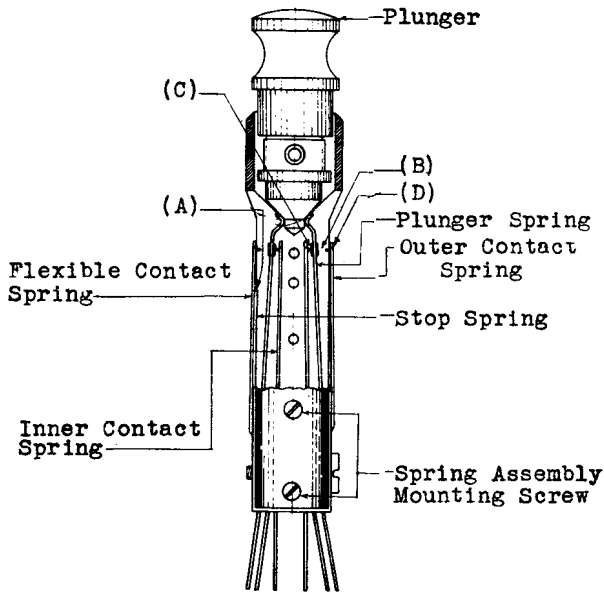


Fig. 3

**\*2.05 Spring Clearance - Fig. 5 (A)**

(a) There shall be a clearance between springs designed never to make contact and between any spring and the frame whether in the operated or unoperated position of the key of:

Test - Min. .014"  
Readjust - Min. .016"

Gauge by eye.

(b) Fig. 4 (A) - On keys not equipped with a plunger retaining screw or clip there shall be a clearance between the crimps of the plunger springs when the plunger is removed of:

Min. .030"

Gauge by eye.

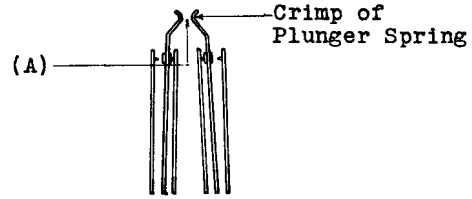


Fig. 4

**\*2.06 Contact Separation - Fig. 3 (B)**

(a) Unless otherwise specified, the separation between any pair of contacts normally open or between any pair of contacts that are opened when the key is operated shall be:

Test - Min. .014"  
Readjust - Min. .016"

Gauge by eye.

(b) Exceptions: On the make-before-break and make-before-make contacts, the separation between any pair of contacts normally open or between any pair of contacts that are opened when the key is operated shall be:

Test - Min. .010"  
Readjust - Min. .012"

Gauge by eye.

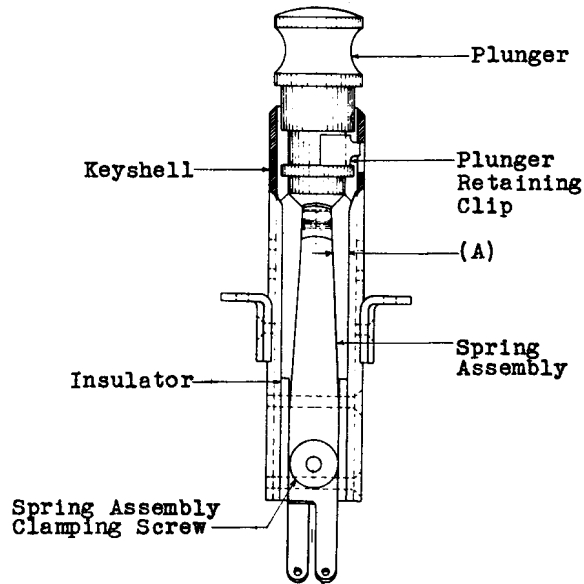


Fig. 5

**\*2.07 Contact Pressure - Fig. 3 (C) -** There shall be a pressure between all closed contacts of:  
Test - Min. 50 grams  
Readjust - Min. 55 grams  
 Use the No. 68-B gauge.

**\*2.08 Contact Follow - Fig. 3 (D) -** There shall be a follow on all contacts of:  
Test - Min. .008"  
Readjust - Min. .010"  
 Gauge by eye.

Exceptions: This requirement shall not apply to the normally closed contacts of the Nos. 92W, 92AA, 92AL, and 527B keys and the normally closed contact of the make-before-break contacts of the No. 92AW key.

**\*2.09 Contact Sequence**

(a) Normal Contact Sequence - Break-Make Combinations - Fig. 6 (A) - Unless otherwise specified, the normally closed contacts operated directly by a plunger spring of an individual spring assembly shall break before the normally open contacts of the same assembly directly associated with the plunger spring make by:  
Test - Min. .005"  
Readjust - Min. .006"  
 Gauge by eye.

(b) Cross Sequence - Break-Make Spring Combinations on Ringing Spring Assemblies - Fig. 7 (A) - Unless otherwise specified all normally closed contacts operated by the depression of the plunger shall break before any of the normally open contacts make by:  
Test - Min. .005"  
Readjust - Min. .006"  
 Gauge by eye.

(c) Other Contact Sequences When specified on the circuit drawing.

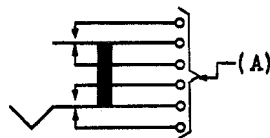


Fig. 6

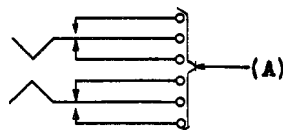


Fig. 7

**2.10 Plunger Operate Pressure - Fig. 8 (A) -** The pressure required to depress the plunger to the limit of its stroke shall

be within the limits specified in the following table. The keys designated (Z) are exceptions to the general type.

Type of Key	Test	
	Min	Max
Nonlocking	575 Grams	2025 Grams
(Z) 464F	300 Grams	1500 Grams
(Z) 527 Type	400 Grams	1500 Grams
Locking	-	2250 Grams

	Readjust	
	Min	Max
Nonlocking	675 Grams	1825 Grams
(Z) 464F	325 Grams	1350 Grams
(Z) 527 Type	450 Grams	1350 Grams
Locking	-	2050 Grams

Use the No. 79B gauge for minimum values and the No. 79F gauge for maximum values.

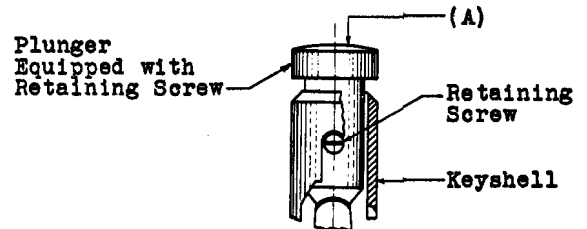


Fig. 8

**2.11 Plunger Release** The pull required to withdraw a plunger from the locked position shall be:  
Test - Min. 100 grams  
Readjust - Min. 115 grams  
 Gauge by feel.

**Lever Type Keys**

**2.12 Cleaning**

(a) Contacts shall be cleaned in accordance with the section covering cleaning procedures for key contacts.

(b) Other parts shall be cleaned in accordance with approved procedures.

**2.13 Lever Movement - Fig. 9 (A) -** The hard rubber rollers and the cam shall turn freely in their bearings. Gauge by eye and feel.

**\*2.14 Relation of Plunger Springs to Rollers and Cam - Fig. 9 (B) -** The plunger springs shall rest against the rollers so that in the normal position, the lever will be held in as nearly a vertical position as can be gauged by eye.

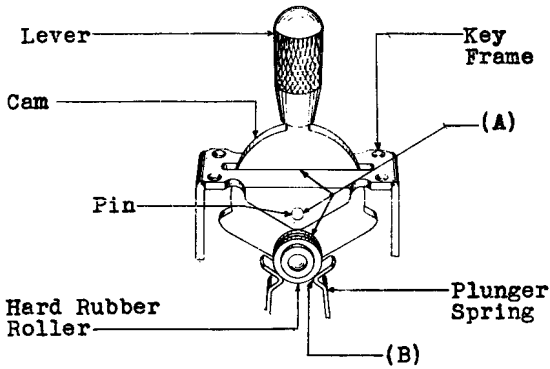


Fig. 9

\*2.15 Relation of Plunger Spring to Cam and Key Frame - Fig. 10(A)

- (a) The plunger springs shall clear the cam by min. 1/32". Gauge by eye.
- (b) The vertical centerline of each spring shall be approximately perpendicular to the key top. Gauge by eye.

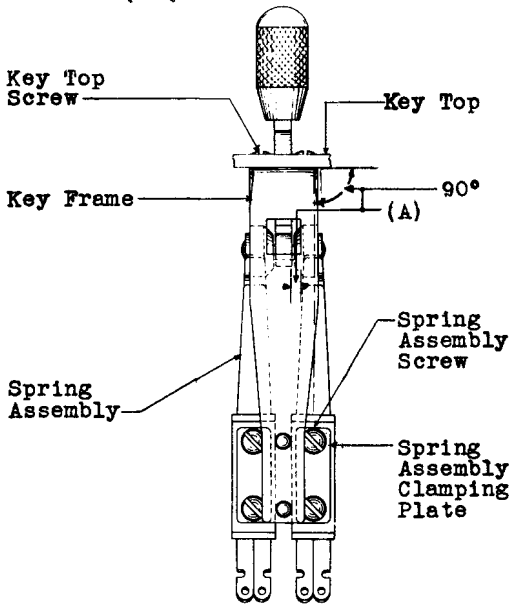


Fig. 10

- \* 2.16 Contact Alignment - Fig. 11 (A) - The contacts shall line up so that the point of contact falls wholly within the boundary of the opposing contact. Gauge by eye.



Fig. 11

- \* 2.17 Contact Separation - Fig. 12 (A) - The separation between any pair of contacts normally open or between any pair of contacts that are opened when the key is operated shall be:

Test - Min. .014"  
 Readjust - Min. .016"  
 Gauge by eye.

- \* 2.18 Spring Clearance - Fig. 12 (B) - There shall be a clearance between springs designed never to make contact and between any spring and the frame whether in the operated or unoperated position of the key of:

Test - Min. .014"  
 Readjust - Min. .016"  
 Gauge by eye.

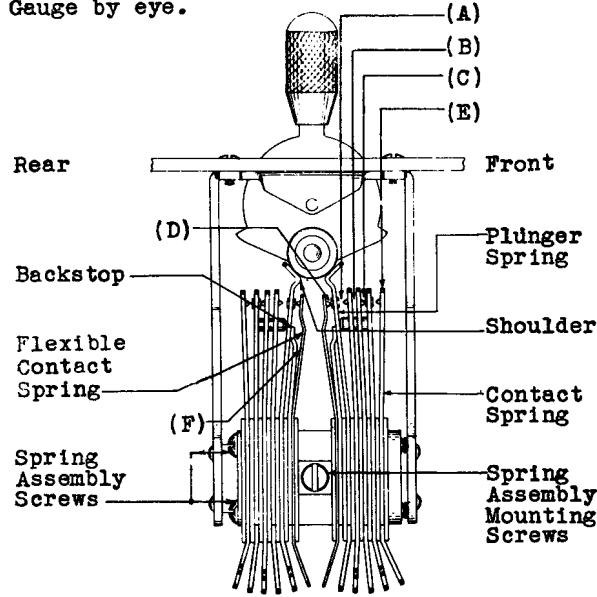


Fig. 12

- \* 2.19 Contact Pressure - Fig. 12 (C) - There shall be a pressure between all closed contacts of:

Test - Min. 50 grams  
 Readjust - Min. 55 grams  
 Use the NO. 68-B gauge.

- \* 2.20 Other Spring Pressures - Fig. 12 (D) - On keys having flexible contact springs, the pressure between the plunger spring and the flexible contact spring with the opposite spring assembly operated shall be:

Max. 225 grams  
 Use the No. 62-B gauge.

- \* 2.21 Contact Follow - Fig. 12 (E)

- (a) There shall be a contact follow on all contacts of:

Test - Min. .008"  
 Readjust - Min. .010"  
 Gauge by eye.

- (b) The follow on two-way keys shall be such that when the lever is operated to one side, the contact springs of the

unoperated spring combination will not change their positions beyond the limits set by the requirements for their normal position. Gauge by eye.

**\*2.22 Flexible Contact Spring Position -**  
Fig. 12 (F) - Flexible contact springs shall rest on their respective stop springs, at least on the end of the spring nearest the contact when the associated plunger spring is in the operated position. Gauge by eye.

**\*2.23 Contact Sequence - Fig. 13 (A)**

(a) Normal Contact Sequence - Break-Make Combinations Unless otherwise specified, the normally closed contacts operated directly by a plunger spring of an individual spring assembly shall break before the normally open contacts of the same assembly directly associated with the plunger spring make by:  
Test - Min. .005"  
Readjust - Min. .006"  
 Gauge by eye.

(b) Other Contact Sequences When specified on the circuit drawing.

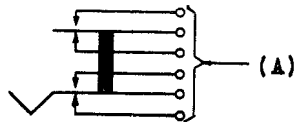


Fig. 13

**2.24 Lever Release - Fig. 14 (A)**

(a) The pressure required to restore the lever from the locked position shall be:  
Test - Min. 50 grams  
Readjust - Min. 55 grams  
 Use the No. 68-B gauge.

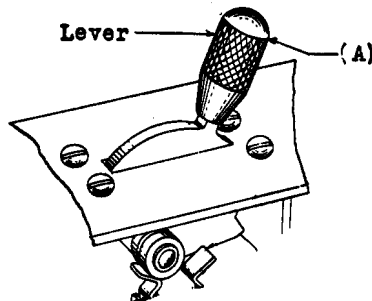


Fig. 14

(b) In checking this requirement the pressure shall be applied at the top portion of the handle, and perpendicularly to it. The lever shall return unaided from the locked position before the lever has travelled 10 degrees (a movement of the top of the handle of about 1/2 of the diameter of the rubber handle) from the extreme locked position. Gauge by feel.

**3. ADJUSTING PROCEDURES**

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

<u>Code No.</u>	<u>Description</u>
<u>Tools</u>	
KS-2348	Cord Repair Screw-driver
KS-2993	Cleaning Brush
KS-6015	Duck-bill Pliers
KS-6854	Screw-driver - 3-1/2" (or the re- placed 35)
R-1572	Hammer - 4 oz.
-	Bell System Cabinet Screw- driver - 3-1/2" per A.T.& T.Co. Dwg. 46-X-40
-	Pin Punch - 4-3/8" x 1/16" Point
-	Bell System P-Long Nose Pliers - 6-1/2" per A.T.& T.Co. Dwg. 46-X-56
<u>Gauges</u>	
62-B	0-700 Gram Gauge
68-B	70-0-70 Gram Gauge
79-B	0-1000 Gram Push Pull Tension Gauge
79-F	0-6000 gram push-pull tension gauge
<u>Materials</u>	
KS-2423	Cloth
KS-6232	Oil
KS-7860	Petroleum Spirits
-	Toothpicks, Hardwood, Flat at one end and pointed at the other
-	No. 22 Bare Tinned Copper Wire

Plunger Type Keys3.01 Cleaning (Rq.2.01)

M-1 Clean the contacts in accordance with the section covering cleaning procedures for key contacts. Clean other parts in accordance with procedures 3.02 M-1 and 3.07 M-8.

3.02 Plunger Movement (Rq.2.02)

M-1 If the plunger fails to operate freely, it is probably due to dirt or a gummy substance forming between the inside of the key shell and the plunger or on the surface of the crimp of the plunger springs. To determine whether or not this condition exists on 494 or 495 type keys remove the screws holding the plunger unit to the key top with the 3-1/2" cabinet screw-driver. To check this condition on 89, 92, 188, 424, 464 and 527 type keys remove the key from the keyshell. If it is necessary to clean the plunger and plunger springs, remove the plunger from the key shell. To do this on a key equipped with a plunger retaining clip, depress the plunger retaining clip toward the plunger very slightly with a screw-driver and, at the same time, exert a slight pull on the plunger. Where the key is equipped with a plunger retaining screw, remove the retaining screw with the KS-2348 screw-driver and then remove the plunger. On keys that are not equipped with either a plunger retaining clip or retaining screw, withdraw the plunger by exerting a slight pull on the plunger. When the plunger has been removed, wipe it with a clean dry KS-2423 cloth, removing all the gummy substance. Then clean the inside of the key shell and the surface of the plunger springs which rest against the plunger by means of a toothpick which has been dipped in petroleum spirits. Do not use the same toothpick for more than one operation. When the plunger springs are thoroughly dry, place the plunger back in the key shell without the plunger retaining screw or clip if equipped. This is done so that a preliminary test may be made. With the plunger in this position, depress it a number of times to determine whether or not it operates freely.

M-2 If the plunger operates freely but is sluggish in restoring to normal after the plunger, key shell and plunger springs have been cleaned in accordance with M-1 it is probably due to the plunger springs not being properly adjusted. Failure of the plunger springs to rest against the plunger when in the normal position, or unequal pressure of the plunger springs may cause this trouble. Since it is not possible to adjust the plunger springs while mounted in the key shell, it will be necessary to remove the

spring assembly. To do this remove the spring assembly mounting screws with the KS-6854 screw-driver and then remove the spring assembly taking care not to lose the insulators. Do not loosen the spring assembly screw. When the spring assembly has been removed from the keyshell examine the plunger springs to determine whether the opposite springs are bent at approximately the same angle. If the requirement is not met after the opposite plunger springs have been adjusted so that they are approximately equal, tension the plunger springs slightly by bending the two springs approximately equal amounts towards each other. At this time make any readjustment that may be necessary to meet requirements 2.03 to 2.11 inclusive. Replace the spring assembly in the key shell and fasten it securely. Recheck for proper plunger movement.

M-3 If any contacts of the key are operated when a side thrust is applied to the plunger, it may be due to a worn or defective plunger. Whenever necessary to replace a plunger, remove it as outlined in M-1.

M-4 If the plunger is neither defective nor worn, the trouble is due to the key failing to meet the contact separation, contact follow, or contact pressure requirements. In this case adjust in accordance with procedures 3.03 to 3.09 inclusive.

- 3.03 Contact Alignment (Rq.2.03)
- 3.04 Flexible Contact Spring Position (Rq.2.04)
- 3.05 Spring Clearance (Rq.2.05)
- 3.06 Contact Separation (Rq.2.06)
- 3.07 Contact Pressure (Rq.2.07)
- 3.08 Contact Follow (Rq.2.08)
- 3.09 Contact Sequence (Rq.2.09)

M-1 When making these adjustments consult the associated circuit drawing and circuit requirement table, and give proper consideration to the maintenance of any requirement for contact sequence which may be specified thereon. Do not straighten kinked springs unless the kink interferes with the proper adjustment of the key. Removing kinks tends to weaken the spring and shorten the life of the key. Adjust the springs so that there will be the specified clearance between springs designed never to make contact and between any spring and the frame on both the operated and unoperated positions of the key. Straightening the springs will usually rectify any trouble that may exist because of springs touching each other which are designed to clear at all times.

M-2 Adjust the springs unless otherwise specified, near the point where the spring leaves the spring assembly clamping block or insulators with the duck-bill pliers, applied as shown in Fig. 15.

In adjusting the spring exercise care to adjust them in line with their movement so as not to twist them off center.

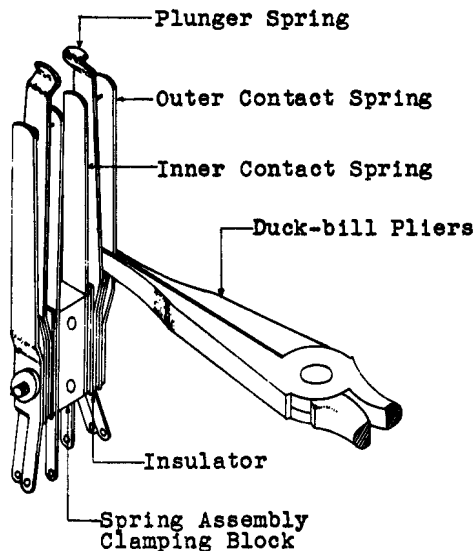


Fig. 15 - Method of Adjusting Contact Springs

**M-3 Contact Alignment** Check the key to determine whether or not the springs are out of alignment. If necessary, remove the spring assembly mounting screws using the KS-6854 screw-driver and then remove the spring assembly. Loosen the spring assembly screw very slightly with the 3-1/2" cabinet screw-driver and shift the springs so that they are all in alignment. Tighten the spring assembly screw and replace the spring assembly in the key shell. Take care not to lose the insulators. When mounted, the sides of the spring shall be approximately equidistant from the sides of the opening in the key shell and the contacts should rest wholly within the corresponding contact discs and as near the center as possible.

**M-4 Flexible Contact Spring Position** If the flexible contact springs do not rest on their stop springs adjust as follows: Take the key apart as covered in M-3. Insert a piece of No. 22 bare tinned copper wire between the flexible spring and stop spring. Place the duck-bill pliers over the stop spring and flexible spring as shown on Fig. 16 and compress the pliers. When the contacts are fully made, the flexible contact springs should be held slightly away from the stop springs. This indicates that the contacts have a follow which insures sufficient contact pressure.

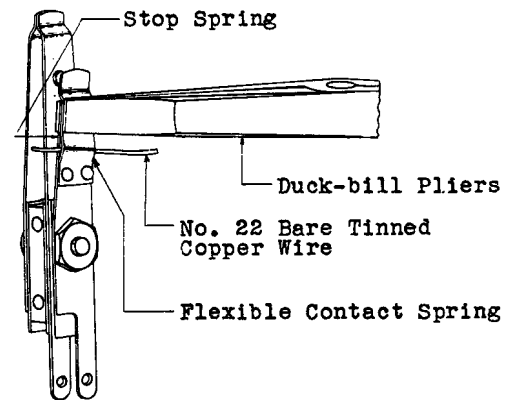


Fig. 16 - Method of Adjusting for Flexible Contact Spring Position

**M-5 Spring Clearance** Trouble due to springs touching each other which are designed never to make contact is caused either by springs being kinked or bowed or by excessive follow. Straighten the springs or reduce the excessive follow as required with the duck-bill pliers.

**M-6 Contact Separation and Contact Follow** The separation on the outside contacts can be gauged visually without removing the spring unit from the key shell, but in order to view the separation for inner contacts of any key, it is necessary to remove the spring assembly from the shell and also the plunger as previously described in procedure 3.02, M-1. While holding the spring assembly at the base, place the plunger between the plunger springs in such a position that the center of the plunger will be approximately in line with the center of base as shown in Fig. 17. This will approximate the actual condition when the key is assembled. Depress the plunger to its operated position and note whether or not the specified contact separation requirement is met.

**M-7** If the separation between either the inside or outside contacts is insufficient, remove the plunger from the plunger springs and adjust the contact springs very slightly away from or toward the center of the key as required, using the duck-bill pliers applied as shown in Fig. 15. Repeat the above test until the proper contact separation has been obtained. Do not reassemble the key until the following tests have been made with the plunger between the springs as described in M-6 in order to approximate actual conditions.

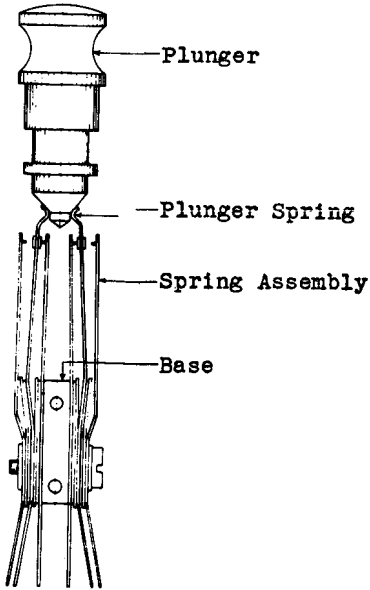


Fig. 17 - Method of Checking for Spring Clearance, Contact Separation, Contact Pressure, Contact Follow or Contact Sequence

**M-8 Contact Pressure** Foreign matter wedged between contact springs may prevent springs making contact when the plunger is in the operated position. Remove the foreign matter with a toothpick which has been dipped in petroleum spirits. Do not use the same toothpick for more than one operation. If the contact pressure requirement is still not met, readjust the springs as required as outlined in M-2.

**M-9 Contact Follow** When readjusting for a proper contact follow, adjust the stationary contact spring as described in M-1 and M-2 exercising care that the minimum contact separation is maintained. If a satisfactory contact follow cannot be obtained by this method, it will be permissible to adjust the spring close to the contact point with the duck-bill pliers as indicated in Fig. 18. This bend should not be sufficiently great to make a visible kink in the spring.

**M-10 Contact Sequence** To adjust for contact sequence, increase or decrease the contact separation, contact pressure, contact follow and spring clearances as required following the methods outlined above.

**M-11** After all of the above requirements have been met, reassemble the key.

**3.10 Plunger Operate Pressure (Rq.2.10)**

**3.11 Plunger Release (Rq.2.11)**

**M-1** If a plunger fails to meet the maximum plunger operate pressure require-

ment, examine the plunger springs to determine whether a gummy substance has formed on them. If necessary take the key apart and clean the plunger and plunger springs as outlined in procedure 3.02 M-1.

**M-2** If, after the cleaning, the key still fails to meet the requirement it may be necessary to reduce the tension of the contact or plunger springs with the duck-bill pliers.

**M-3** Do not use lubricant on the key plunger to facilitate this adjustment.

**M-4** If the key fails to meet the minimum plunger operate pressure requirement it is an indication that the plunger spring tension is insufficient. In this case adjust the springs toward the center of the key.

**M-5 Plunger Release** If a key does not meet the plunger release requirement it is an indication that the plunger springs are too weak. In this case adjust the springs toward the center of the key. Exercise care, however, that the increase in tension of the plunger springs does not, in any way, interfere with the plunger operate pressure requirement.

**M-6** Assemble the key and remount it after all the adjustments have been made.

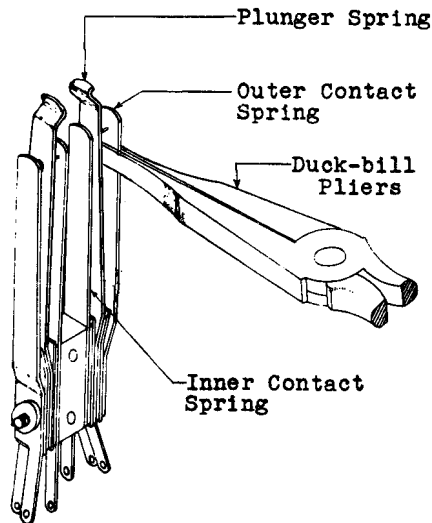


Fig. 18 - Method of Adjusting for Contact Follow

**Lever Type Keys**

**3.12 Cleaning (Rq.2.12)**

**M-1** Clean the contacts in accordance with the section covering cleaning pro-



cedures for key contacts. Clean other parts in accordance with procedures 3.13 M-2 and M-5 and 3.19 M-4.

**3.13 Lever Movement (Rq.2.13)**

M-1 To determine whether a cam binds operate and release the lever slowly and note that the movement is smooth throughout the travel. If when operating the lever, a drag is detected or if the lever does not restore with a uniform pressure, it is an indication that the cam binds.

M-2 A foreign deposit on the surfaces of plunger springs over which the plunger rollers ride will prevent the lever from operating and restoring smoothly. If necessary, clean the springs with a toothpick which has been dipped in petroleum spirits. Do not use the same toothpick for more than one cleaning operation. When cleaning a plunger spring operate the lever so as to operate the opposite spring combination.

M-3 Examine the plunger springs and note if the pressure exerted on the two rollers is approximately equal. If the tension on the two rollers varies excessively, it will produce a torque effect causing the cam to bind on the key top. Correct as necessary by readjusting the plunger springs in accordance with procedure 3.20.

M-4 Loose or missing key top screws may cause the key to shift its position so that the lever unit binds on the key top. Replace missing screws and tighten all loose screws with the 3-1/2" cabinet screw-driver.

M-5 If the cam binds in its bearings, observe whether the cam is tight in the key frame. Do this by moving it from side to side as in the test for side play. If it is tight, loosen the screws holding the lever unit to the key top using the 3-1/2" cabinet screw-driver, remove the lever handle, and finally the entire lever unit. Drive out the pin by means of the R-1572 hammer and the pin punch. Wipe off the cam and the pin with the cloth per KS-2423. Then lubricate the pin sparingly with KS-8232 oil and wipe it off again with the cloth per KS-2423. Replace the pin in the cam. This is usually sufficient to remove the bind.

- 3.14 Relation of Plunger Springs to Rollers and Cam (Rq.2.14)
- 3.15 Relation of Plunger Springs to Cam and Key Frame (Rq.2.15)

M-1 Failure of a lever to be in the vertical position when the key is normal is often due to the plunger springs not

being set in correct relationship with respect to the rollers and the cam. Correct this condition by loosening the spring assembly mounting screws with the 3-1/2" cabinet screw-driver and shifting the spring assemblies until the correct relationship is obtained. Then securely tighten the spring assembly screws.

M-2 If the springs are not in correct relationship with the key frame correct this condition by loosening the spring assembly screws with the 3-1/2" cabinet screw-driver and shifting the plunger springs until the correct relationship is obtained. Then securely tighten the screws.

M-3 If the lever still fails to assume its correct position it may be due to unequal plunger spring tension against the roller. To correct this condition adjust the back stop associated with each plunger spring with the duck-bill pliers close to the point where it leaves the assembly clamping plates and insulators so that the plunger springs will hold the lever in the vertical position. It may also be necessary to tension or weaken the opposite plunger springs in which case take care that the tensions of the opposite plunger springs are as nearly uniform as possible. The tension of the springs should be sufficient to cause the lever to return to the normal position when the lever is being released slowly from the operated position. Make all adjustments on the plunger springs with the duck-bill pliers applied close to the point where the springs leave the assembly clamping plates and insulators as shown in Fig. 19.

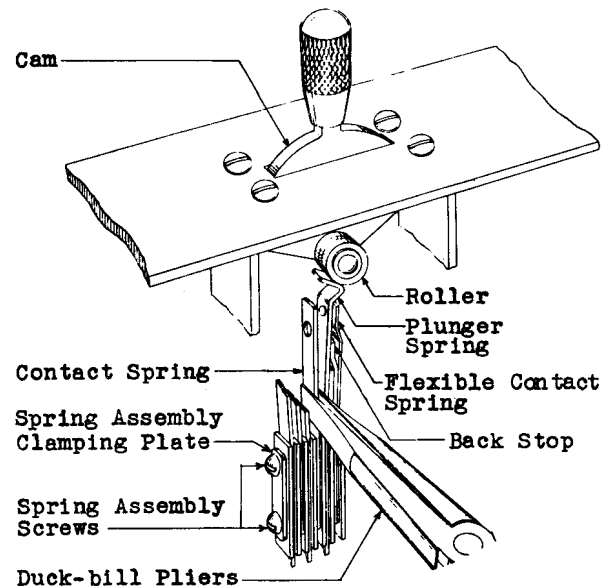


Fig. 19 - Method of Adjusting Contact Springs

- 3.16 Contact Alignment (Rq.2.16)
- 3.17 Contact Separation (Rq.2.17)
- 3.18 Spring Clearance (Rq.2.18)
- 3.19 Contact Pressure (Rq.2.19)
- 3.20 Other Spring Pressures (Rq.2.20)
- 3.21 Contact Follow (Rq.2.21)
- 3.22 Flexible Contact Spring Position (Rq.2.22)
- 3.23 Contact Sequence (Rq.2.23)

M-1 When making these adjustments consult the associated circuit drawing and circuit requirement table and give proper consideration to the maintenance of any requirement for contact sequence which may be specified thereon. Before adjusting the springs, tighten up all the spring assembly screws. In adjusting the springs take care not to kink them. Do not straighten kinked springs unless the kink interferes with the proper adjustment of the key. Removing kinks tends to weaken the spring and shorten the life of the key.

M-2 Adjust the springs unless otherwise specified close to the point where the springs leave the spring assembly clamping plates and insulators with the duck-bill pliers applied as shown in Fig. 19. In adjusting the springs exercise care to adjust them in line with their movement so as not to twist them off center. Adjust the springs so that there will be the specified clearance between any spring and the frame and between springs designed never to make contact. Straightening the springs will usually rectify any trouble that may exist because of springs touching each other which are designed to clear at all times.

M-3 Contact Alignment At the time the other spring adjustments are being made, see that the contact points lie wholly within the periphery of the corresponding discs. If necessary, loosen the spring assembly screws with the 3-1/2" cabinet screw-driver and shift the springs until each contact point lies wholly within the corresponding contact disc preferably as near the center as possible. Then tighten the screws securely. When mounted the springs should be in correct relationship with the cam and key frame.

M-4 Spring Clearance Trouble due to springs touching each other which are designed never to make contact is caused either by springs being kinked or bowed or by excessive follow. Straighten the springs or reduce the excessive follow as required with the duck-bill pliers.

M-5 Contact Pressure Foreign matter wedged between the contact springs may prevent springs from making contact when the lever is operated. Remove the foreign matter with a toothpick which

has been dipped in petroleum spirits. Do not use the same toothpick for more than one operation.

M-6 Contact Separation and Contact Follow

If a follow requirement cannot be met by adjusting the springs close to the point where they leave the clamping plates and insulators, the upper part of the spring just below the contact disc may be given a slight bend toward the moving spring with the duck-bill pliers. This bend should not be enough however, to make a visible kink in the spring. In the case of flexible contact springs, bend the spring slightly at the shoulder with the long nose pliers. However, exercise care that when increasing the follow that the contact pressure between the flexible contact spring and plunger spring is not more than the maximum specified.

M-7 Failure to meet the follow requirement on two-way keys generally results from excessive pressure of the plunger springs against the plunger rollers. Correct by reducing the tension of the plunger springs slightly but not enough to interfere with any of the previous adjustments. Use the duck-bill pliers.

M-8 Flexible Contact Spring Position

If the flexible contact spring does not rest flat against its back stop as specified insert a piece of No. 22 bare tinned copper wire between the two springs close to the point where they are held together. Then place the duck-bill pliers over both the stop spring and the flexible contact spring close to the wire as shown in Fig. 20 and pinch the two springs together with the pliers. It will be satisfactory to have a slight kink in the flexible contact spring near the point where they are held together which may be introduced in making this adjustment.

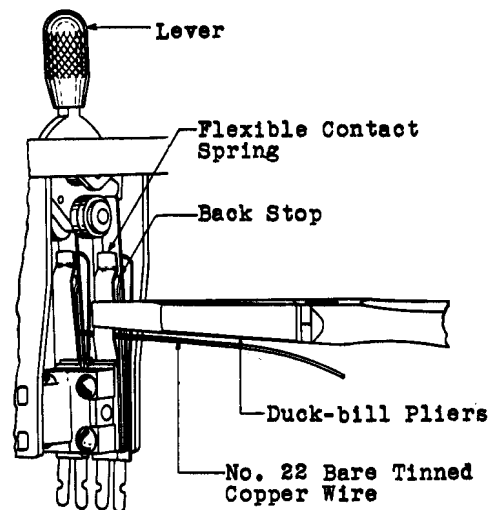


Fig. 20 - Method of Adjusting for Flexible Contact Spring Position

**M-9 Normal and Other Contact Sequences**  
When adjusting for contact sequence increase or decrease the contact separation, contact pressure or contact follow as outlined in M-1 to M-7 inclusive.

### 3.24 Lever Release

**M-1** When making a check for the lever release pressure apply the pressure to the top of the straight portion of the handle and perpendicularly to it.

**M-2** Should the lever restore from the locked position when a pressure of less than the specified value is applied, tension the plunger springs with the duck-bill pliers against the rollers so that the rollers will have a greater drag on the spring.

**M-3** If the key still fails to meet the requirements, adjust the off-set portion of the plunger spring very slightly with the duck-bill pliers as shown in Fig. 21 so as to cause a greater drag on the lever roller when returning to normal. This drag however should not be great enough to prevent the lever from returning unaided from the locked position before the lever has travelled 10 degrees (a movement of the top of the handle of about 1/2 of the diameter of

the rubber handle) from the extreme locked position when the pressure is applied at the top portion of the handle and perpendicularly to it. Do not use lubricant on the key roller to facilitate this adjustment.

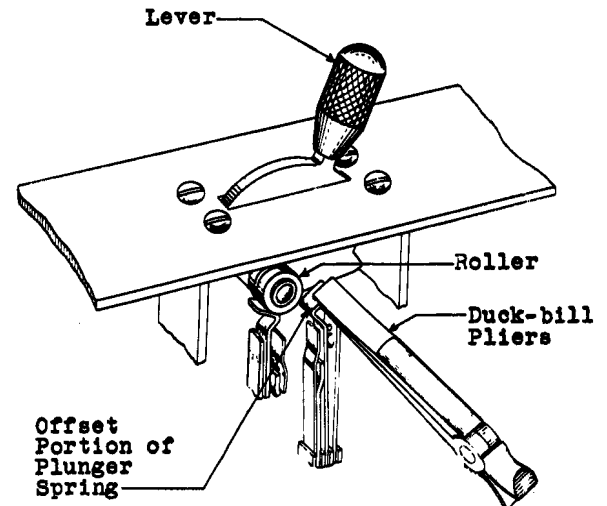


Fig. 21 - Method of Adjusting Plunger Spring for Lever Release