SEQUENCE SWITCHES

"A" AND "B" TYPES

1. GENERAL

1.01 This section covers "A" and "B" type sequence switches and replaces Specification X-70126-02, Issue 1.

1.02 Reference shall be made to Section A400.001 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 One drop of oil for the purpose of this section is the amount of oil that may be released from a piece of No. 22 bare tinned copper wire after it has been dipped into KS-2245 oil to a depth of 1/4" and slowly removed.

1.05 One discharge of grease for the purpose of this section is the amount of Veedol medium cup grease discharged from the No. 353-B lubricator when the piston is fully depressed once.

1.06 Position 1 of 20 position sequence switches having no "A" cams is that position in which the outer springs on all cams except the "B" cam are within .024" of their theoretically correct location with respect to their associated cams, measured at the center lines of the springs.

1.07 To facilitate the inspection and adjustment of the driving discs and drive magnet, the vertical drive shaft guard may be removed from the frame by removing the guard mounting screws with the 4" regular screw-driver. If, however, the guard is mounted on rotating brackets it may be shifted out of the way without removing it from the frame.

2. REQUIREMENTS

2.01 Cleaning The sequence switch frame, driving and driven discs, and the cams shall be free from oil and dust.

2.02 Drive Pull There shall be no appreciable slip between the driving and driven discs when the drive magnet is energized. Gauge by eye and feel.

2.03 Operation of "A" Cam Roller - Fig. 1 (A) - The "A" cam roller shall be free from bind and shall make a partial revolution at each high spot of the "A" cam. Gauge by eye and feel.

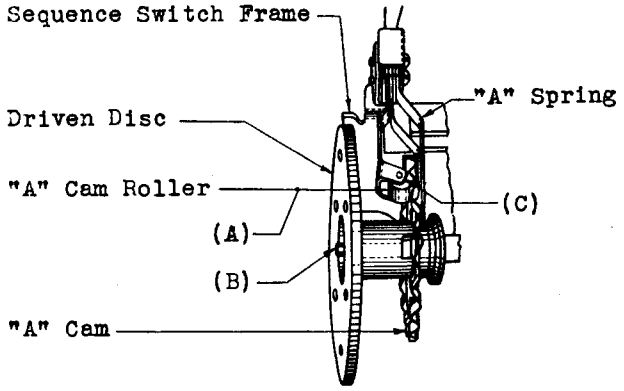

Fig. 1

2.04 Lubrication

(a) Figs. 1 (B) and 2 (A) - The Cam Shaft Bearings shall each be adequately lubricated with Veedol medium cup grease. When lubrication is necessary, one discharge of grease shall be applied.

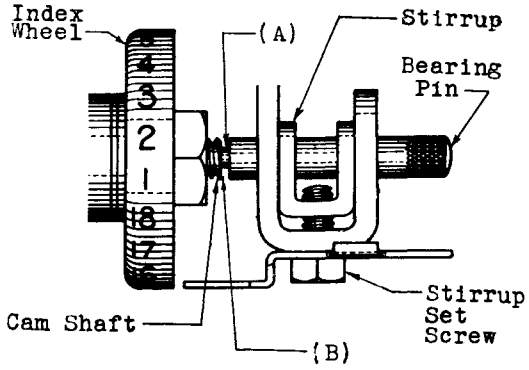

Fig. 2

(b) Fig. 1 (C) - The "A" Cam Roller Bearings shall be adequately lubricated with KS-2245 oil. When lubrication is necessary, one drop of oil shall be applied. The convex surface of the roller and the "A" spring shall be kept free from oil.

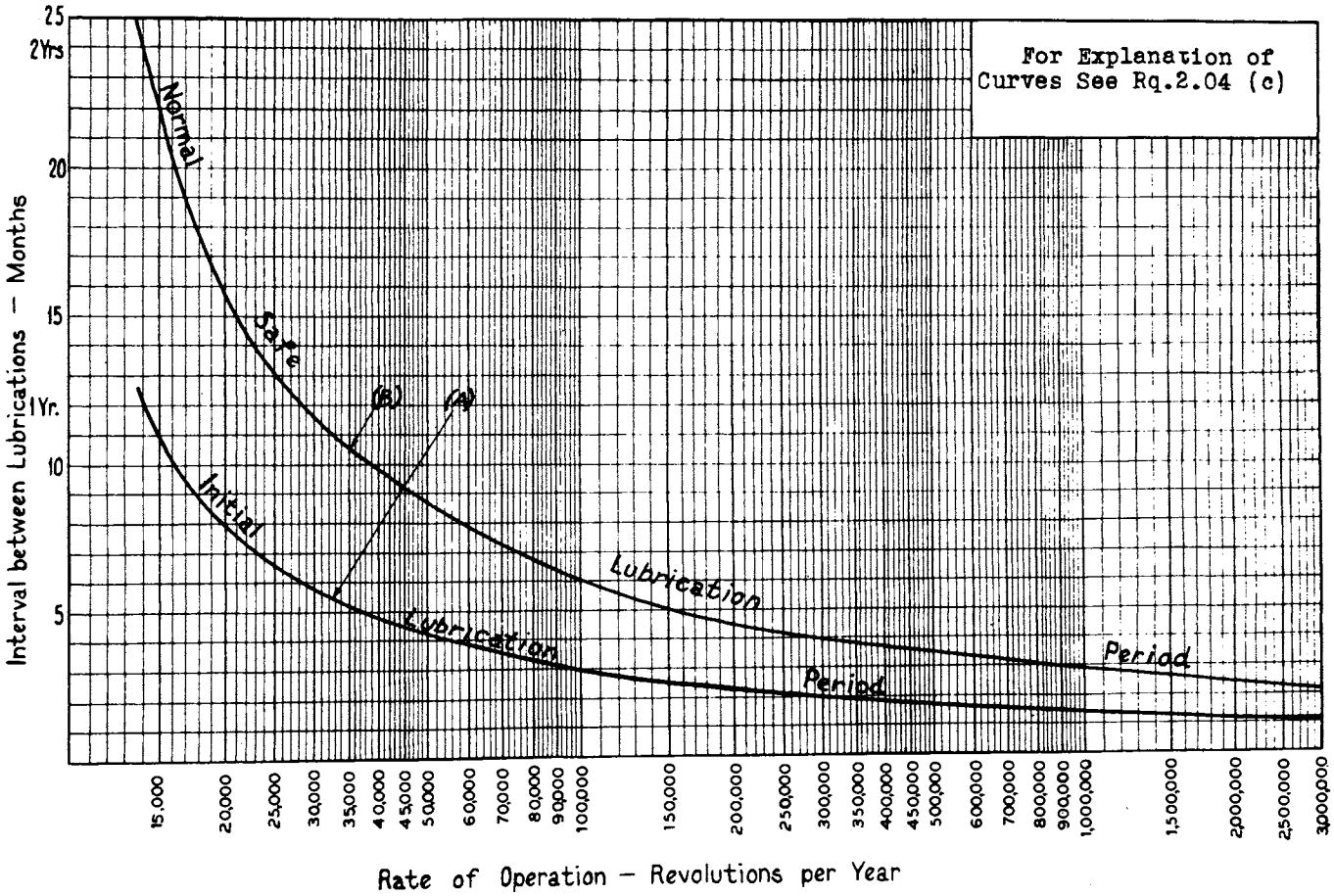

Fig. 3 - Chart Showing Lubrication Intervals for Sequence Switch Cam Shaft Bearings

2.04 (Continued)

(c) After turnover, it is recommended that sequence switch cam shaft bearings be lubricated initially in accordance with curve (A) of Fig. 3 and thereafter in accordance with curve (B). For example, the cam shaft bearings of sequence switches which operate at 100,000 revolutions per year should be lubricated initially three months after turnover and every six months thereafter.

It is recommended, also, that the "A" cam roller bearings be lubricated at intervals of six months. These intervals may be extended if periodic inspections have indicated that local conditions are such as to insure that requirements (a) and (b) will be met during the extended interval.

2.05 Record of Lubrication During the period of installation a record shall be kept, by date, of the lubrication of the cam shaft bearings and the "A" cam roller bearings and this record shall be turned over to the Telephone Company with the equipment. If no lubrication has been done the record shall so state.

2.06 End Play of Cam Shaft - Fig. 2 (B) - The sequence switch cam shaft shall have some end play in its bearings but this end play shall be:

Max. .005"

Gauge by eye.

2.07 Gap Between Driving and Driven Discs - Fig. 4 (A) - With the driving disc and the sequence switch cam shaft in any position about their axes, the gap between the driving and the driven discs shall be:

Test - Min. Discs shall not touch
- Max. .020"

Readjust - Min. .005", Max. .020"

The maximum limit shall be measured when the shafts are in the positions which bring the two discs farthest apart. Use the Nos. 85-A and 85-C gauges.

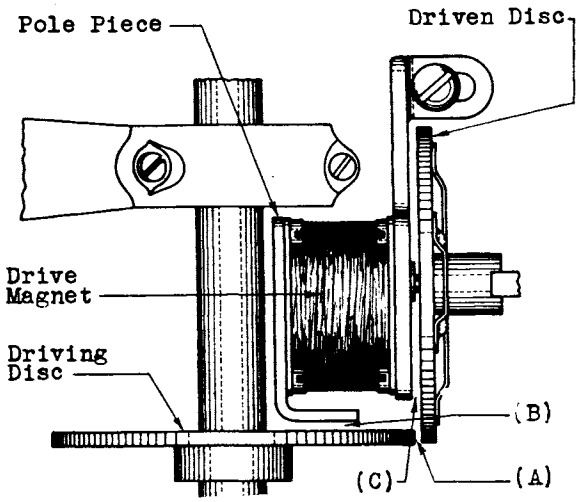

Fig. 4

2.08 Gap Between Driving Disc and Pole-Piece - Fig. 4 (B)

(a) With the drive magnet deenergized, and with the driving disc in the position where it is nearest to the pole-piece, the gap between the driving disc and the pole-piece of the drive magnet shall be:
Max. .010"
Use the No. 85-B gauge.

(b) The driving disc shall not touch the pole-piece with the drive magnet energized. Gauge by eye.

2.09 Gap Between Driven Disc and Sequence Switch Frame - Fig. 4 (C)

(a) With the drive magnet deenergized, the gap between the driven disc and the frame of the sequence switch shallbe:
Test - Max. .040"
Readjust - Min. .024"
- Max. .034"
Use the Nos. 85-D and 85-E gauges.

(b) With the drive magnet energized, and with the disc in any position of rotation, the gap between the driven disc and the frame of the sequence switch shall be:
Min. .004"
Gauge by eye.

2.10 "A" Cam Roller Pressure - Fig. 5 (A) - With the end play of the cam shaft within the specified limits the pressure of the "A" Cam roller against the "A" cam measured at a point approximately 1/4" back from the center of the roller, with the roller seated in a crimp of the "A" cam, shall be:
Test - Min. 400 grams,
Max. 600 grams
Readjust - Min. 425 grams,
Max. 575 grams
Use the No. 62-B gauge.

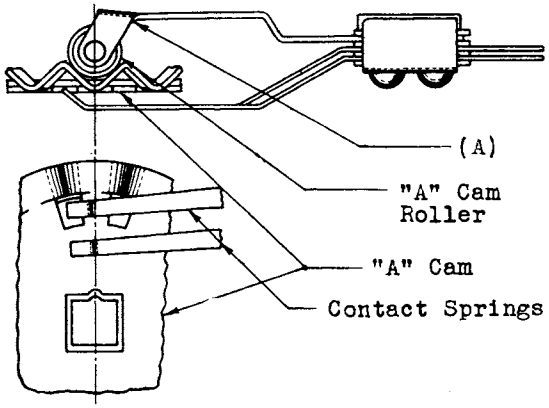

Fig. 5

2.11 Contact Spring Pressure - Fig. 6 (A)

(a) When the springs are resting on the metal part of the cams, the pressure of the contact springs against the cams, measured where the springs bend in to make contact with the cam shall be:
Test - Min. 25 grams,
Max. 70 grams
Readjust - Min. 30 grams,
Max. 60 grams
Use the No. 68-B gauge.

(b) After turnover, as an optional check when the springs are resting on the insulation, the pressure of the contact springs on the cams shall be:
Min. 15 grams
Max. 60 grams
measured where the springs bend in to make contact with the cam. Use the No. 68-B gauge.

2.12 Parallelism of Contact Portion of Contact Spring With Face of Cam - Fig. 6 (B) - The ends of the contact springs shall rest approximately (within .005") flat against the metal surface of the cams. Gauge by eye.

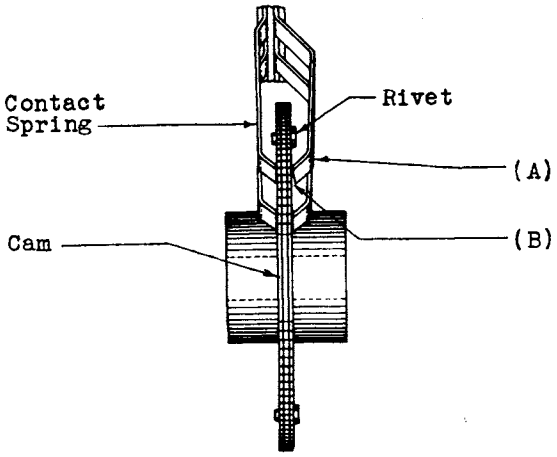

Fig. 6

2.13 Clearance Between Adjacent Contact Springs and Between the Springs and Framework - Fig. 7 (A) - There shall be a clearance of:
Min. 1/64"
under any condition, between adjacent contact springs and between the springs and any part of the framework. Gauge by eye.

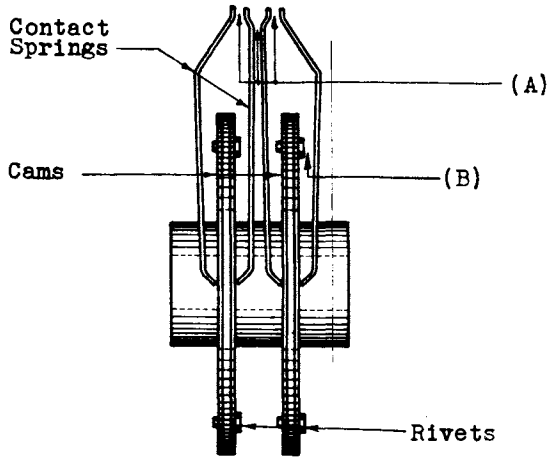

Fig. 7

2.14 Clearance Between the Inner Surface of the Contact Springs and the Heads of the Rivets - Fig. 7 (B) - There shall be a clearance of:
Min. approximately 1/32"
between the inner surface of the contact springs and the heads of the rivets when the contact springs are resting on the insulation. Gauge by eye.

2.15 Clearance Between Contact Spring Edges and Adjacent Edges of Notched Out Portions of Cams - Figs. 8 (A) and 9 (A) - There shall be a clearance in a radial direction between the edges of the contact springs and the adjacent edges of the notched out portions of the cams of:
Test - Min. .005"
Readjust - Min. .010"
Gauge by eye.

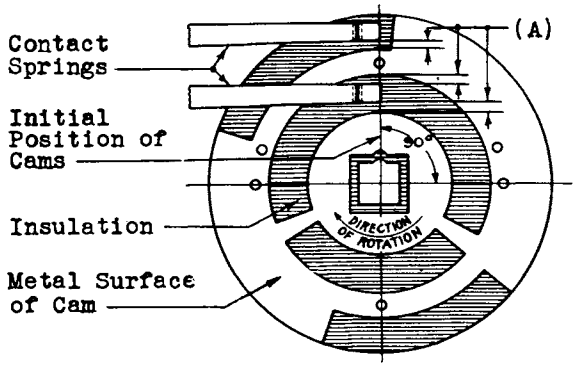

Fig. 8

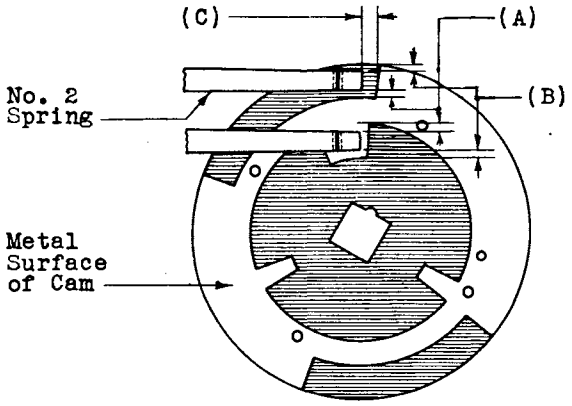

Fig. 9

2.16 Position of Contact Springs with Respect to the Edges of Cams - Fig. 9 (B)
Test - The top edge of the outer contact springs shall not extend beyond the outer edge of the cam and the bottom edge of the inner contact springs shall not extend below the inner edge of the cam. Gauge by eye.
Readjust - There shall be a clearance of:
Min. .005"
between the top edge of the outer contact springs and the outer edge of the cam and between the bottom edge of the inner contact springs and the inner edge of the cam. Gauge by eye.

2.17 "A" Spring Clearance - Fig. 10 (A) - With the "A" cam roller centered manually in a notch of the "A" cam at a stop position, (Fig. 10 (B)) the clearance between the contact end of the "A" cam contact spring and the contact edge just left shall be approximately (± .010") 1/32". Gauge by eye.

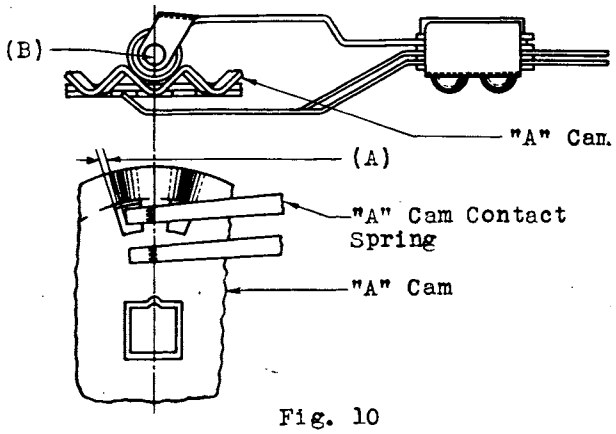

Fig. 10

2.18 "B" Spring Clearance - 20 Position Sequence Switches Having no "A" Cams
Figs. 9 (C) and 11 (A) - When the sequence switch is at rest in position 1 as defined in paragraph 1.06, the end of the contact spring on the "B" cam through which the

2.18 (Continued)

sequence switch is controlled (left outer No. 2, or right outer No. 3, as the case may be) shall be:
Min. .035"
Max. .055"
from the contact edge of the cam just left. Gauge by eye.

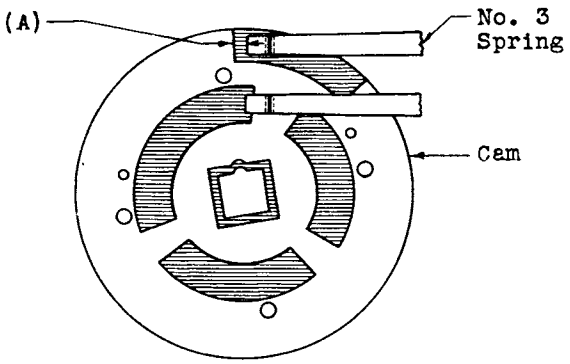

Fig. 11

2.19 Special Contact Adjustment When specified on Circuit Requirement Tables special contact adjustments shall be made.

2.20 Pointer Adjustment - Fig. 12 (A)

(a) The end of the pointer shall:
Test - Not touch its index wheel
Readjust - Clear its index wheel by approximately 1/16"
Gauge by eye.

(b) The pointer shall center approximately on any number of the index wheel when the "A" cam roller is seated in a crimp of the "A" cam. Gauge by eye.

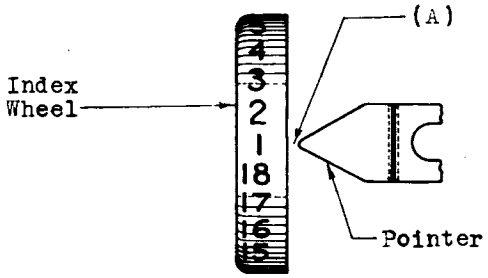

Fig. 12

2.21 Condition of Spider Springs - Fig. 13 (A) - At the time of turnover to the Telephone Company the spider springs shall be free of sharp bends or kinks due to adjustment. A gradual bow is permissible. Gauge by eye.

2.22 Clearance Between Mounting Screws and Right Hand End of the Slots in Sequence Switch Frame - Fig. 14 (A) and (B) - At the

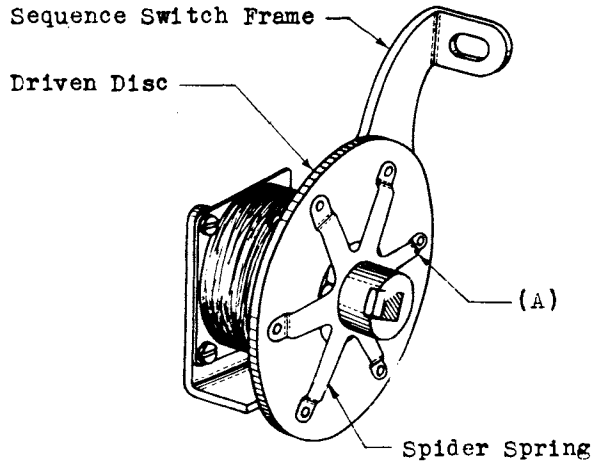

Fig. 13

time of turnover to the Telephone Company, there shall be a clearance between the sequence switch mounting screws and the right-hand end of the slots in the sequence switch frame of:
Min. 1/32"
with the sequence switch adjusted to meet the above requirements. Gauge by eye.

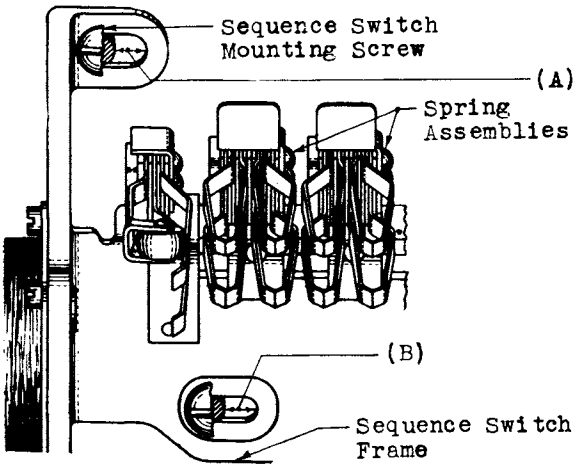

Fig. 14

REASONS FOR ISSUE - CHANGES IN REQUIREMENTS

1. To revise requirement covering lubrication (2.04).

2. To revise requirement covering Gap Between Driven Disc and Pole-Piece (2.08).

3. To revise the requirement covering Gap Between Driven Disc and Sequence Switch Frame (2.09).

4. To make requirements 2.09, 2.11, 2.13 and 2.14 apply as both test and readjust limits.

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges and Materials

Code No.	Description
Tools	
203	Index Wheel Holder
206	Screw-driver - 30° Offset
207	Screw-driver - 90° Offset
215	Spring Adjuster
218-B	"A" Cam Short-Circuiting Tool
235	Spring Adjuster
236	Wrench - 9/16" Hex. Open-end Offset
253-B (or the replaced 253)	Brake Plate
256	Spring Adjuster
267-B	Contact Spring Insulator
352	Spring Separator
353-B (or the replaced 353)	Lubricator
354	Cam Locating Tool
357	Spring Contact Clip and Insulator
378-A	Friction Surface Restorer
419-A	Test Connector and WlM Cord Equipped with No. 360 Type Tool
433-A	Motor Floor Stand
434-A	Motor Ladder Bracket
435-A	Vacuum Head
KS-5402	Motor
KS-6098	Wrench - Bristo Set Screw
KS-6263 (or the replaced R-1977)	Wrench - 9/32" Hex. Socket
KS-6851	Flexible Shaft
-	No. 5 Sturtevant Vacuum Cleaner (or its equivalent)
-	No. 4 Artists' Sable Rigger Brush
-	Bell System Cabinet Screw-driver - 3-1/2" per A. T. & T. Co. Drawing 46-X-40
-	Bell System Regular Screw-driver - 4" per A. T. & T. Co. Drawing 46-X-34
-	Bell System P-Long Nose Pliers - 6-1/2" per A. T. & T. Co. Drawing 46-X-56
-	Bastard Flat File
Gauges	
62-B (or the replaced 62)	0-700 Gram Gauge
68-B (or the replaced 68)	70-0-70 Gram Gauge
85-A	.005" Thickness Gauge
85-B	.010" Thickness Gauge
85-C	.020" Thickness Gauge
85-D	.024" Thickness Gauge
85-E	.034" Thickness Gauge
Materials	
KS-2245	Oil
KS-2423	Cloth
KS-6815	C.P. Carbon Tetrachloride
-	Veedol Medium Cup Grease
-	No. 22 Bare Tinned Copper Wire
-	Spare Cleaning Brushes

3.002 Make all circuits associated with the sequence switch to be inspected or adjusted busy according to the authorized methods before the work is started.

3.003 Before checking or readjusting to meet the requirements specified herein which require that the switch be rotated, isolate the registers operated through sequence switch cams by insulating the springs controlling their operation with a No. 357 or a No. 267-B tool. Methods for using these tools are covered in procedures 3.23 and 3.24 respectively.

3.004 When necessary to prevent interference due to the energizing of the drive magnet while checking or readjusting to

3.004 (Continued)

meet the requirements specified herein, remove the battery fuse which supplies current to the drive magnet.

3.005 Methods of Rotating Sequence Switches Electrically

(a) The No. 218-B "A" cam short-circuiting tool may be used to cause the sequence switch to rotate except when cleaning "A" cams as covered in procedure 3.01 M-10 or in the case of 20 position sequence switches. Apply the tool between the "A" cam and the "A" springs to cause the switch to rotate as shown in Fig. 15.

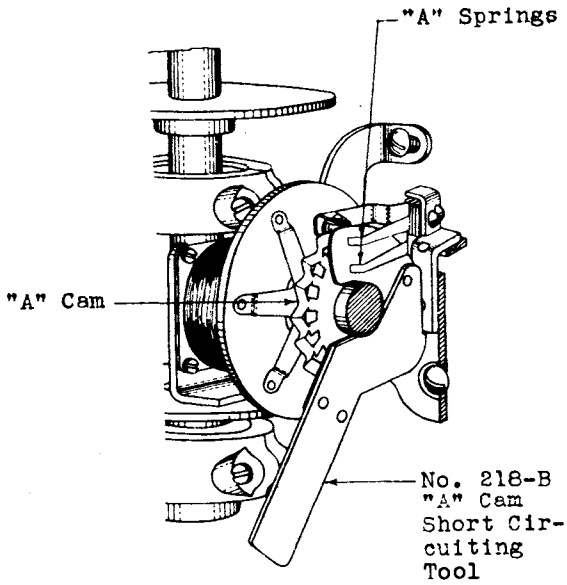

Fig. 15 - Method of Rotating Sequence Switches Electrically by Means of the No. 218-B "A" Cam Short Circuiting Tool

(b) To rotate the sequence switch by means of the No. 419-A Test Connector and the W1M Cord equipped with a No. 360 type tool, connect the No. 419-A Test Connector to the "A" cam roller spring and connect the suspender clip of the W1M cord to ground as indicated in Fig. 16. In the case of 20 position sequence switches having no "A" cam rollers, connect the No. 419-A Test Connector to the contact spring on the "B" cam through which the sequence switch is controlled (left outer No. 2 or right outer No. 3 as the case may be).

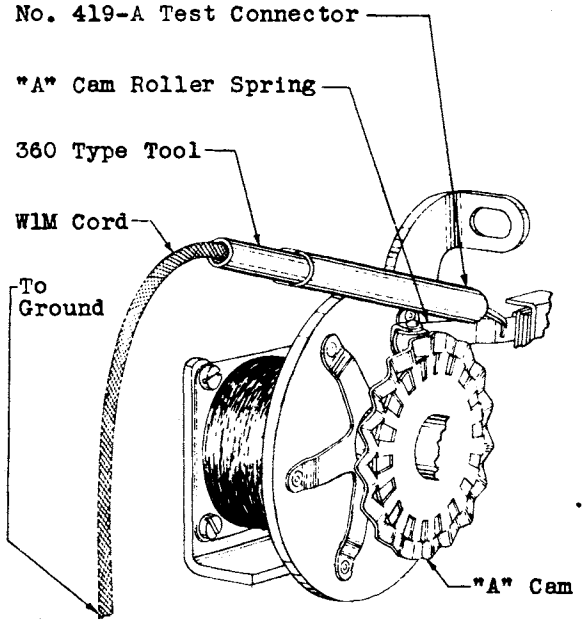

Fig. 16 - Method of Rotating Sequence Switches Electrically by Means of the No. 419-A Test Connector and the W1M Cord Equipped with No. 360 Type Tool

3.01 Cleaning (Rq.2.01)

M-1 Sequence Switch Frame Clean the frame of the sequence switch with a moistened KS-2423 cloth before cleaning the cams. Moisten the cloth by dipping a small portion (about 1") of it in water and then crumpling it up in the hands until the moisture has been distributed to all sections of the cloth.

M-2 Check requirement 2.02 and, if necessary, clean the driving and driven discs in accordance with procedure 3.02 M-3 to M-5 inclusive.

M-3 Cams Before cleaning the cams, first clean the rest of the sequence switch as covered in M-1. Then proceed as follows:

M-4 Assemble the sequence switch cam cleaning equipment as follows: Pull out the threaded coupling, which is inside of the flexible shaft on the motor end, and screw the flexible shaft onto the motor shaft. With the fingers, turn the coupling and motor shaft to a position such that it is possible to insert one of the 1/8" pins (furnished with the equipment) through the hole into the end piece of the motor to lock the motor shaft from rotating. By means of the other 1/8" pin tighten the coupling. Remove the 1/8" pins and, with the fingers, screw the knurled coupling casing onto the motor. Connect the No. 435-A

3.01 (Continued)

vacuum head to the other end of the flexible shaft, being sure that the split end piece of the flexible shaft properly engages the vacuum head shaft. Insert the nozzle of the suction hose of the No. 5 Sturtevant vacuum cleaner into the vacuum head, using the standard adapter. The motor may be set on the No. 433-A motor floor stand, or it may be mounted on a rolling ladder by means of the No. 434-A motor ladder bracket. In either of these methods, the motor must be placed in a position such that, when the cleaning operation is in progress, there will be no sharp bends or kinks in the flexible drive shaft. Connect the drive motor plug to a receptacle in the lighting circuit. Plug the flexible lamp cord into the receptacle on the vacuum head and connect the clips on the other end to the 24 volt battery and ground terminals on the battery supply connecting block.

M-5 Mount a cleaning brush in the vacuum head by inserting the flat end of the brush into the hole in the driving element as shown in Fig. 17 and turn the brush with the fingers until it engages inside of the shaft. Push the brush in far enough so that the extreme end clears the bearing post and then release the brush, being sure that its extreme end rests in the bearing in the bearing post.

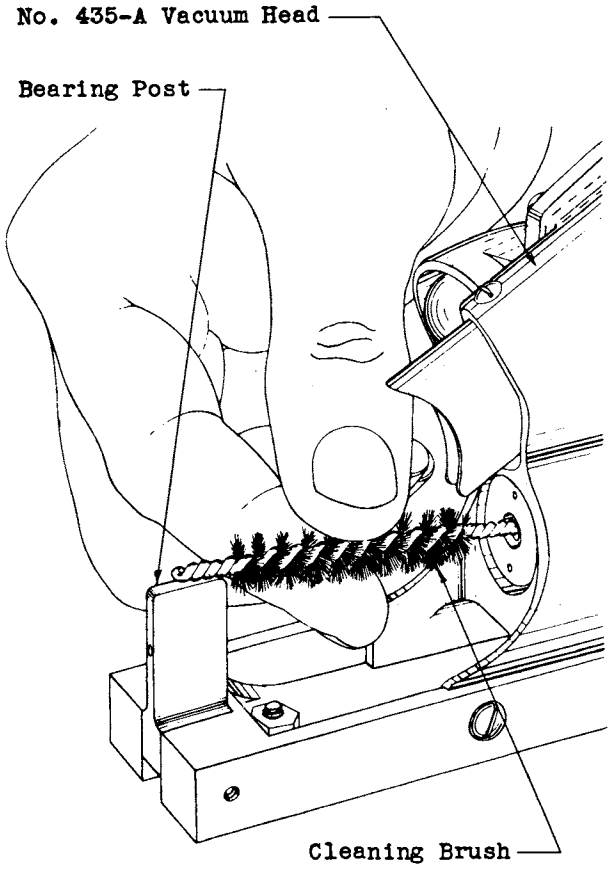

Fig. 17 - Method of Mounting Cleaning Brush in the No. 435-A Vacuum Head

M-6 Start and stop the drive motor and ascertain that the cleaning brush rotates smoothly and that none of the parts bind. Should any of the parts appear to require cleaning, lubrication or adjusting, refer to the section covering portable motor equipment for base metal contact maintenance.

M-7 Wrap the short 7/8" strap of the leather supporting belt twice around the vacuum hose, flexible drive shaft, flexible lamp cord and motor control lead about 3 to 5 feet from the vacuum head and fasten the buckle, thus making these parts a single unit. Slip the large strap over the left shoulder so that the parts held together by the 7/8" strap will be supported on the right side of the operator's body, and adjust the straps as required. The switch in the motor control lead should be in a position convenient to the operator.

M-8 If a number of sequence switches in a bay are to be cleaned, begin with the topmost switch and work downward. While the cleaning operation is in progress on a sequence switch, rotate the switch electrically as covered in 3.005.

M-9 With the cleaning brush and the vacuum cleaner both operating, begin with the cams on the extreme right of the switch. Slowly insert the revolving brush horizontally between the lower halves of the cams, as shown in Fig. 18, till the bearing post touches the sequence switch frame. Do not insert the brush upward from the bottom of the cams, or press the brush upward against the cam separators, or sideways against the cams (except as covered below in M-10) as these operations tend to destroy the bristles of the brush. Hold the cleaning equipment so that the shaft of the brush is parallel to the surfaces of the cams. The amount of cleaning required will depend upon the condition of the cams, but for average conditions five to ten revolutions of the switch will be sufficient, although on switches which are in fairly good condition the cams will be cleaned sufficiently during three revolutions. Clean all of the cams in succession from right to left till the "A" cam is reached. If more than one switch is to be cleaned, it will be more economical to proceed with the cleaning of the cams on the next switches, leaving the "A" cams till the brush is worn down and then using the worn brush to clean the dirty "A" cams. When this procedure is followed a new brush will clean about six sequence switches under average conditions.

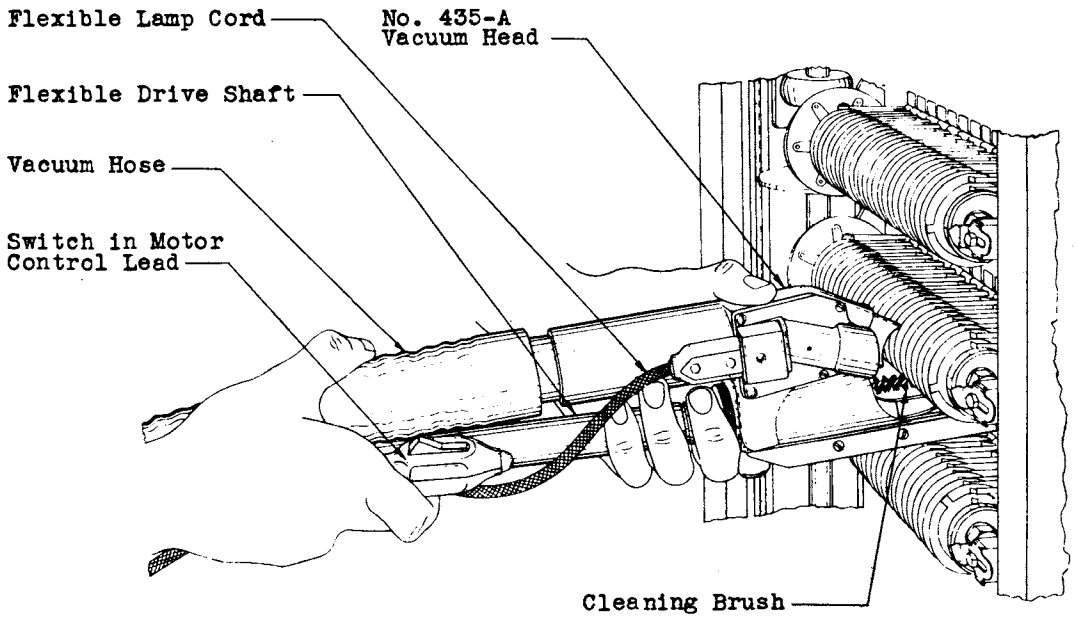

Fig. 18 - Method of Inserting Cleaning Brush
Between Two Sequence Switch Cams

3.01 (Continued)

M-10 Cleaning "A" Cams It is desirable to use a worn brush for cleaning the "A" cams because if a new brush is used for cleaning these cams the sequence switch drive may slip, and also because the "A" cam cleaning operation destroys the bristles on the cleaning brush. Insert the brush from the bottom of the cams instead of from the front. After the "A" cams have been cleaned, insert a new cleaning brush as covered in M-5 and proceed to the next group of switches.

3.02 Drive Pull (Rq.2.02)

M-1 To determine whether or not a sequence switch is slipping proceed as follows:

Sequence Switches Which Restore to Normal Test the sequence switch by grasping the index wheel with the thumb and the forefinger and turning it far enough to move the switch to a position from which it will automatically restore to normal. Exert a slight pressure against the index wheel as the switch returns to normal and check for slipping by sight and by feel.

Caution Exercise care in applying pressure to the index wheel as excessive braking will cause the switch to slip, resulting in worn and polished surfaces on the driving and driven discs. See whether the sequence switch and associated equipment has restored to normal.

Sequence Switches Which Do Not Restore to Normal Energize the drive magnet as covered in 3.005. As the sequence switch rotates, exert a slight pressure against the index wheel with the thumb and the forefinger and check for slipping. Note the caution covered above.

M-2 If an appreciable slip between the driving and driven discs is noted make sure that the discs are free from the slightest traces of oil or grease. To clean the discs of oil or grease, proceed as follows:

M-3 With the drive shaft revolving, clean the shaft directly above the driving disc, the top surface of the driving disc and the driving surfaces of the driving and the driven discs using KS-2423 cloth saturated with C.P. carbon tetrachloride. Shift the cloth as required so as to present a clean spot for each disc. When cleaning a driven disc, hold the cloth against the disc with some pressure while the cam shaft assembly is revolved by hand six or more revolutions. This pressure must not be enough to change the disc gap adjustments.

M-4 Since carbon tetrachloride dissolves asphaltum paint exercise care that the cloth does not come in contact with any part of the iron framework as the dissolved paint will be absorbed by the cloth and may be carried to the disc driving surfaces.

M-5 Take the necessary precautions to prevent the grease or oil cleaned from one disc being transferred to other discs.

M-6 If is found that there is an ap-

3.02 (Continued)

preciable slip between the driving and the driven discs after the above cleaning operation has been performed, it will be necessary to apply the No. 370-A friction surface restorer to the driving disc as shown in Fig. 19 employing the following methods.

M-7 Grasp the stone on the 1/4" sides close to the holder and remove both the cloth and the stone simultaneously from the holder by working the stone gently from side to side to prevent breakage and at the same time exerting an outward pull. Immerse the stone in water to saturate it and fill the tube approximately 2/3 full of clean water. Place the narrow side of the cloth over the end of the stone to be inserted in the tube so that the ends of the cloth can be folded down over the wide sides of the stone. Pull over the superfluous cloth on the long narrow sides of the stone and insert the stone and the cloth in the tube. Shake the tube in a lengthwise direction to work the water out over the stone. After the entire stone has been wet in this manner, clean the end of the stone to be applied to the disc with moistened KS-2423 cloth. Always keep the stone cleaned in this manner while using it.

M-8 To keep the stone in proper condition and obtain the best results do not permit oil or grease to come in contact with the stone. Always use the stone wet as the water prevents oil and grease collecting in and filling the pores of the stone. Clean the used surface of the stone frequently and when necessary dress it flat on a bastard flat file.

M-9 Rotate the switch as covered in 3.005. Apply the friction surface restorer very lightly to the friction surface of the driving disc for one or two revolutions of the disc as shown in Fig. 19. This is usually sufficient to make the sequence switch rotate.

M-10 The moisture aids the grit of the stone in adhering to the surfaces of the discs and also starts the rusting. Care should be exercised to prevent an excessive deposit of the stone on the disc as this may produce less pull by preventing the driving surfaces of the discs making proper contact with each other.

M-11 Allow the switch to rotate and check for slip from time to time as covered in M-1.

M-12 If, after revolving several minutes, the switch fails to develop sufficient pull for prompt operation or has a tendency to falter or hesitate in any position, clean the driving and the driven discs again thoroughly in the manner indicated under M-3 above. Then apply the friction surface restorer lightly to

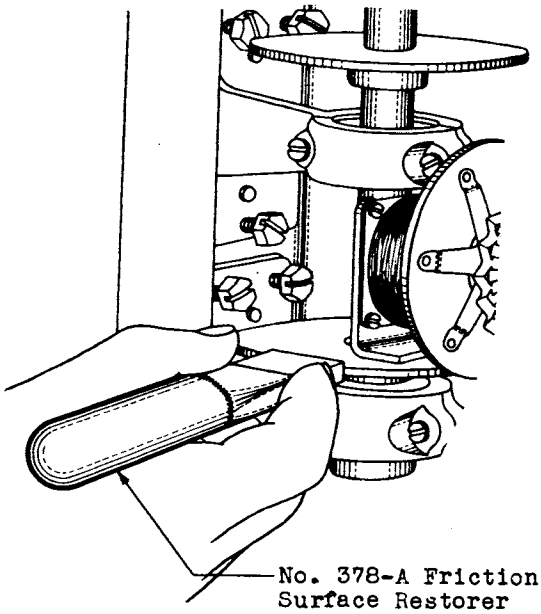

Fig. 19 - Method of Using the No. 378-A Friction Surface Restorer in Restoring Friction Surfaces of Discs

the driving surface of the disc as in M-9. Allow the switch to rotate until assured that it will operate satisfactorily.

M-13 Do not leave the position while the switch is energized, for should the switch stop or hesitate, steps should be taken immediately to eliminate the trouble and not allow the discs to rub, thereby preventing smooth spots being worn in the driven disc.

M-14 After the switch has been ground in satisfactorily and while it is still revolving check the clearance between the driven disc and the sequence switch frame during at least one complete revolution, and if necessary, readjust the driven disc as covered in procedure 3.09.

M-15 In some cases, after the friction surface restorer has been applied as outlined above and the switch fails to rotate properly, it may be necessary to take the switch out of service for a period of time to allow rusting to take place.

M-16 Caution Empty the water from the case of the friction surface restorer when its use is no longer required.

3.03 Operation of "A" Cam Roller (Rq.2.03)
3.04 Lubrication (Rq.2.04)

"A" Cam Roller

M-1 Before attempting to clean or lubri-

3.03-3.04 (Continued)

cate the "A" cam roller bearings make a nest of KS-2423 cloth for the cam roller so that there will be no possibility of the liquid being flipped elsewhere. This can be done by folding the cloth several times lengthwise and inserting one side of the folded cloth between the cam roller and the cam. Loop the cloth under the cam roller and, holding the cam roller free, work the cloth to the back of the switch and at the same time work it upward so that the roller is in the bottom of the loop.

M-2 If the "A" cam roller binds, and dust or a gummy substance adheres to the bearings, flush the bearings thoroughly with C.P. carbon tetrachloride applied with the No. 4 Artists' Sable Rigger brush. Take any additional precautions as may be required to prevent the carbon tetrachloride from splattering on the adjacent apparatus. After the bearings have been thoroughly cleaned with carbon tetrachloride they should be allowed to dry and then be relubricated as follows:

M-3 Apply one drop of KS-2245 oil to the top of the roller with a piece of No. 22 bare tinned copper wire. Immerse the wire about a quarter of an inch into oil, held in a suitable container and then withdraw the wire slowly and apply the drop of oil to the top of the roller.

M-4 Wipe off any excess oil that may have crept onto the outer surface of the roller or the "A" cam, with KS-2423 cloth.

M-5 Remove the nest of cloth from beneath the "A" cam roller.

Cam Shaft Bearings

M-6 When the cam shaft bearings require lubrication, use the No. 353-B lubricator. Before doing any lubricating, examine the lubricator, see that it is filled and working properly. If the lubricator fails to eject the lubricant properly when the piston is depressed, it is an indication that the tool is either empty or that there is an air pocket beneath the plunger. In this case it will be necessary either to refill the tool or to follow M-12 below.

To Fill the Lubricator

M-7 Unscrew the nozzle from the reservoir. Then, with the 3-1/2" cabinet screw-driver remove the screw immediately above. Remove the cap from the rear of the reservoir, grip the rib in the center of the plug in the reservoir with the P-long nose pliers and exert a pull on the plug to withdraw it from the reservoir.

M-8 The Veedol Medium Cup Grease should be in a container having a minimum depth equal to the length of the reservoir of the lubricator. Care should be taken to see that the air bubbles have been worked from the grease and that the top surface is approximately flat.

M-9 Place the rear end of the reservoir on top of the grease and depress the lubricator until all of the air has been forced from the reservoir through the screwhole at the top and the greese starts to come out.

M-10 Replace the screw and the nozzle and withdraw the lubricator from the grease and wipe off the excess lubricant. Place the plug in the reservoir with the rib out and while applying pressure to the plug operate the plunger repeatedly. This will eject enough lubricant to allow space for the plug as well as remove any air bubbles that may be trapped at the nozzle end of the lubricator.

M-11 Replace the cap and tighten it against the plug.

To Remove Air Pocket

M-12 Remove the cap and apply pressure to the plug as covered in M-10 at the same time operating the plunger until grease begins to flow again.

Application of Lubricant to Cam Shaft Bearings

M-13 In order to lubricate the disc end of the cam shaft assembly, loosen the stirrup set screw with the 4" regular screw-driver or with the KS-6263 Hex. socket wrench, depending on whether or not the set screw has a slotted or a hexagonal head, and shift the cam shaft assembly to the right just sufficiently to allow the insertion of the nozzle of the No. 353-B lubricator. Then slightly retighten the stirrup set screw. Rest the end of the nozzle against the bearing surface of the cam shaft and depress the piston to the end of its stroke. Then release the piston.

M-14 In removing the lubricator draw the nozzle over the bearing surface of the cam shaft so that the lubricant will be deposited on the bearing surface.

M-15 Exercise care in lubricating the disc end of the switch to make sure that the lubricant does not reach the driving or the driven discs.

M-16 Apply the lubricant also to the bearing surfaces of the bearing pin at the stirrup end of the sequence switch in the manner shown in Fig. 20.

M-17 After the cam shaft bearings have been lubricated, reset the bearing pin and tighten the stirrup set screw making sure that the cam shaft assembly

3.03-3.04 (Continued)

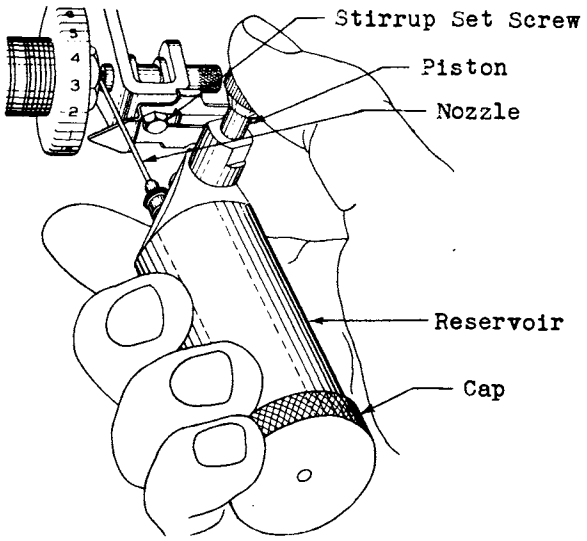

Fig. 20 - Method of Lubricating Sequence Switch Cam Shaft Bearing at the Stirrup End with the No. 353-B Lubricator

is left with the specified amount of end play.

3.05 Record of Lubrication (Rq.2.05)
(No Procedure)

3.06 End Play of Cam Shaft (Rq.2.06)

M-1 To check the end play of the cam shaft grasp the index wheel and attempt to move the cam shaft sidewise.

M-2 If no end play is perceptible, apply the tip of the 4" regular screw-driver or the KS-6263 wrench to the edge of the lug directly behind the knurled end of the bearing pin and, while pressing toward the cam shaft assembly, permit the tool to slip off and strike against the sequence switch frame with a snap. Check to see whether or not the bind has been removed and, if necessary, repeat the aforementioned operation.

M-3 If more than the maximum allowable end play is found, loosen the stirrup set screw and press the bearing pin toward the left and then tighten the screw. This will probably remove all end play and if so, it will be necessary to proceed as in M-2.

3.07 Gap Between Driving and Driven Discs (Rq.2.07)

M-1 To check the gap between the driving and driven discs, with the vertical drive shaft revolving, rotate the sequence switch slowly by hand and observe whether or not the gap is within the specified limits. To use the No. 85-C gauge insert it between the ground surfaces of the driving and driven discs and hold it lightly between the fingers. If in any position the gauge is not felt to bind and drops down suddenly, it is an indication that the gap is too large.

M-2 Readjust for this gap in the following manner with the vertical drive shaft revolving.

M-3 Loosen the sequence switch from the mounting screws with the 4" regular screw-driver sufficiently to allow the sequence switch to rest on the mounting screws if it does not already rest on them; then tighten the three mounting screws to a point where it is just possible to move the sequence switch frame when using the screw-driver as a lever and the frame angle at the right-hand of the switch as a fulcrum. In case of a short frame (type "A") switch, it may be necessary to move the frame by tapping it with a screw-driver.

M-4 Force the sequence switch slowly towards the left until the gap between the two discs at the closest point is at least the minimum specified. The screws being friction tight, the switch will stay put in this position. Make this adjustment by sight, using the top mounting ear of the switch next below as a reflector or by using a piece of white cardboard or paper. Generally the sight method results in quicker and better work, but it is advisable to check the sight adjustments occasionally with the Nos. 85-A and 85-C gauges. Take care to keep the gauges within the ground portion of the driven disc.

M-5 Revolve the driven disc by means of the index wheel, and if the gap is more than the maximum specified at any point, correct it in one of the following way

M-6 If the requirement cannot be met, due to a wabbly driven disc, adjust the spider to correct the gap. Revolve the driven disc to the point of smallest gap and then, with the index finger and thumb on the periphery in the manner shown in Fig. 21 force the top of the disc towards the left and the bottom of the disc towards the right. Revolve the disc to check for the maximum and minimum gaps and, if necessary, repeat the adjusting operation until the wabble is reduced sufficiently to meet the requirements.

M-7 Do not take out the cam shaft assembly to adjust for a wabbly disc or for any other reason unless it is absolutely necessary. Wabbly driven discs can usually be corrected by the method described in M-6. If necessary to remove the driven disc for any reason how-

3.07 (Continued)

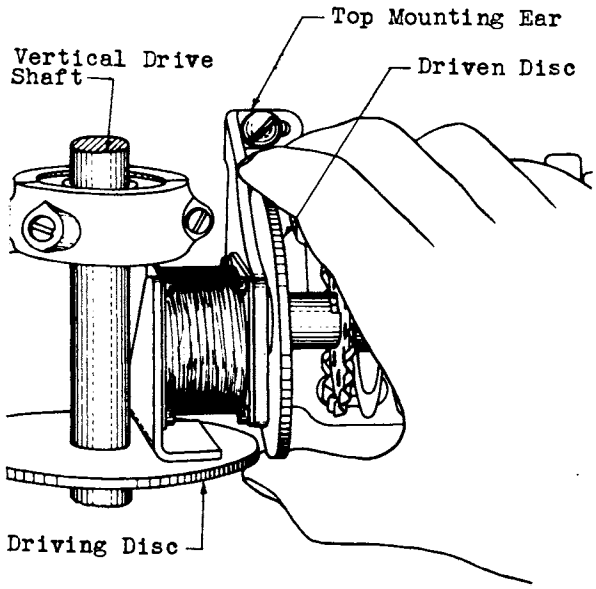

Fig. 21 - Method of Correcting Wabbly Driven Disc

ever, follow the procedures outlined in the section covering piece part data and replacement procedures for "A" and "B" type sequence switches. If the spider is bent so as to cause an eccentric motion, straighten it at this time.

M-8 If it is necessary to correct for a wabbly driven disc, check the gap between the driven disc and the frame and readjust, if necessary, in accordance with procedure 3.09.

M-9 If the requirement cannot be met due to either a bowed vertical drive shaft or an accentric driving disc, or both, refer to the section covering vertical drive shafts and associated apparatus.

M-10 When the disc gap is satisfactory, tighten the sequence switch mounting screws in the following order: First, bottom left hand screw; second, bottom right-hand screw; third, top screw. This order causes the least disturbances of the adjustments.

3.08 Gap Between the Driving Disc and Pole-Piece (Rq.2.08)

M-1 Check or readjust for the gap between the driving disc and pole piece, if possible, when no other magnets associated with the same vertical drive shaft are energized.

M-2 Check the gap between the driving disc and the pole-piece, with the shaft revolving, by inserting the No. 85-B gauge between the pole-piece and the driving disc. With the sequence switch magnet deenergized, there must be a decided drag on this gauge in at least one position, but the gap should be large enough to receive it without forcing. Then remove the gauge and energize the sequence switch magnet and make sure that the disc does not touch the pole-piece.

M-3 If the clearance between the driving disc and the pole-piece is not within the specified limits, observe whether or not the driving disc has slipped down on the vertical drive shaft. If the disc has slipped down on the vertical drive shaft, or the vertical drive shaft has dropped, adjust the disc in the manner indicated under M-6 and M-7 below, but if it has not slipped or the vertical drive shaft has not dropped proceed with the adjustments in the following manner.

M-4 Stop the drive shaft and turn it to the position in which the driving disc set screw is under the magnet. Experience has shown that this is the position in which the gap between the driving disc and the pole-piece is the smallest. Then loosen the three pole-piece mounting screws with the No. 206 and the No. 207 off-set screw-drivers and raise or lower the pole-piece as required. Then tighten the screws.

M-5 If the gap is still too large or too small and the holes in the spoolhead will permit of no further movement of the pole-piece, loosen the four magnet mounting screws with the No. 206 and the No. 207 off-set screw-drivers and raise or lower the magnet as required to meet the specified limits. Then tighten the screws.

M-6 In case the clearance is still not within the specified limits, loosen the driving disc set screw with a 4" regular screw-driver or with the KS-6098 Bristo set screw wrench depending on whether the screw is a filister head set screw or a Bristo set screw and raise or lower the disc to a position where the gap between the driving disc and the pole-piece is within the specified limits. Then tighten the set screw. Check the gap as covered in M-2.

M-7 Should the gap still fail to meet the requirements it will be necessary to repeat the readjustments. With the driving disc set screw only lightly tightened it is permissible to tap lightly on the top surface of the disc with the handle of the screw-driver when adjusting for the minimum requirement, but the disc should never be tapped upward to meet the maximum requirement as this will groove the shaft and hence the disc will not hold its adjustment.

3.09 Gap Between Driven Disc and Sequence Switch Frame (Rq.2.09)

M-1 If the gap between the driven disc and the sequence switch frame is not within the specified limits, readjust the gap as follows:

M-2 The minimum requirement may usually be met by the methods given in procedure 3.07 M-6 and M-7 for adjusting a wabbly driven disc. Use the No. 235 spring adjuster as shown in Fig. 22 when it is necessary to adjust an individual spider spring, exercising extreme care not to kink or damage the spider spring.

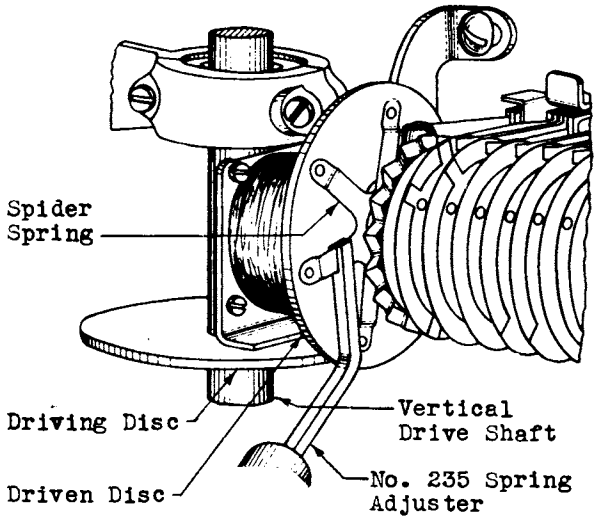

Fig. 22 - Method of Using the No. 235 Spring Adjuster to Adjust the Spider Spring

M-3 If the requirement cannot be met as outlined in M-2, use the No.235 spring adjuster and adjust each of the spider springs an equal amount to increase or decrease the gap, as required.

M-4 If the requirement still cannot be met, it is probably due to a worn bearing. Replace the bearing as outlined in the section covering piece part data and replacement procedures for "A" and "B" type sequence switches.

M-5 When any change is made in the adjustment of the driven disc the gap between the driving and driven discs should be rechecked as covered in procedure 3.07.

3.10 "A" Cam Roller Pressure (Rq.2.10)

M-1 If the "A" cam roller pressure is not within the specified limits apply the No. 215 adjuster to the "A" cam roller spring as shown in Fig. 23 and retension the roller spring to meet the readjust pressure limits.

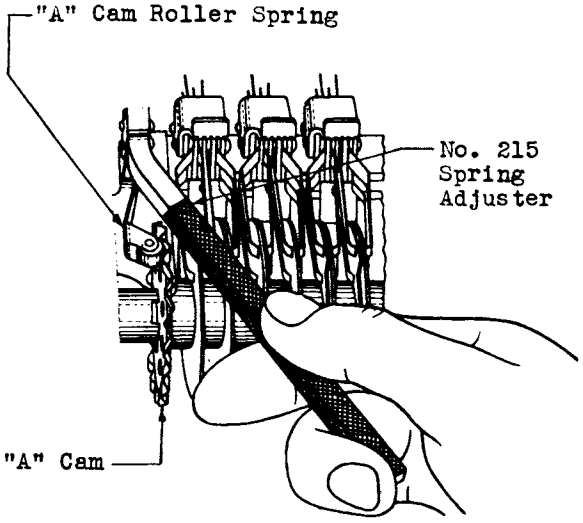

Fig. 23 - Method of Using the No. 215 "A" Cam Roller Spring Adjuster

3.11 Contact Spring Pressure (Rq.2.11)

M-1 If the contact spring pressure is not within the specified limits readjust the springs as follows: Rotate the cam shaft assembly until the spring or springs at fault rest on the metal part of the cam.

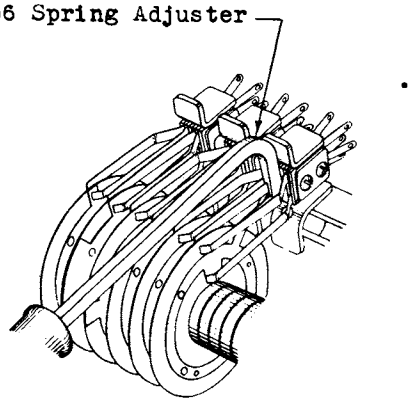

Fig. 24 - Method of Using the No. 256 Spring Adjuster in Adjusting Outer Contact Springs

3.11 (Continued)

M-2 Readjust the outer springs with the No. 256 spring adjuster applied as shown in Fig. 24 and the inner springs with the No. 235 spring adjuster applied as shown in Fig. 25. Adjust close to the point where the spring leaves the assembly clamping plates and insulators.

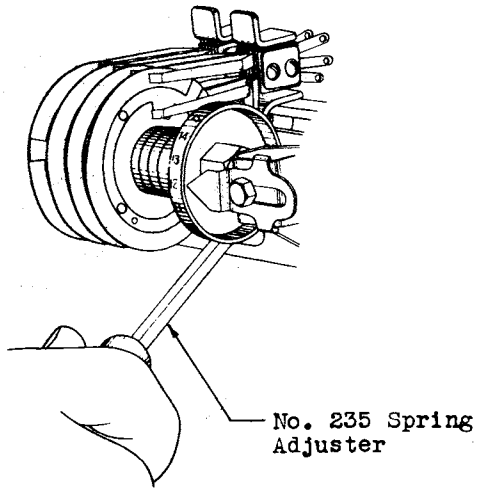

Fig. 25 - Method of Using the No. 235 Spring Adjuster in Adjusting Inner Contact Springs

M-3 In readjusting springs take care not to alter the effective length of the spring or to alter the angle at which the spring meets the cam sufficiently to change the relative position of the contacting edge of the spring with respect to the associated cam. See Fig. 26.

3.12 Parallelism of Contact Portion of Contact Spring with Face of Cam (Rq.2.12)
3.13 Clearance Between Adjacent Contact Springs and Between the Springs and Framework (Rq.2.13)
3.14 Clearance Between the Inner Surface of the Contact Springs and the Heads of the Rivets (Rq.2.14)

M-1 Inspect the springs for parallelism and clearance and make any corrections necessary by readjusting the outer spring with the No. 256 spring adjuster and the inner spring with the No. 235 spring adjuster taking care not to put an excessive crimp in the springs. Apply these spring adjusters as shown in Figs. 24 and 25.

M-2 In making these readjustments, take care not to disturb the relation between the contact portion of the springs and their respective cam cuttings.

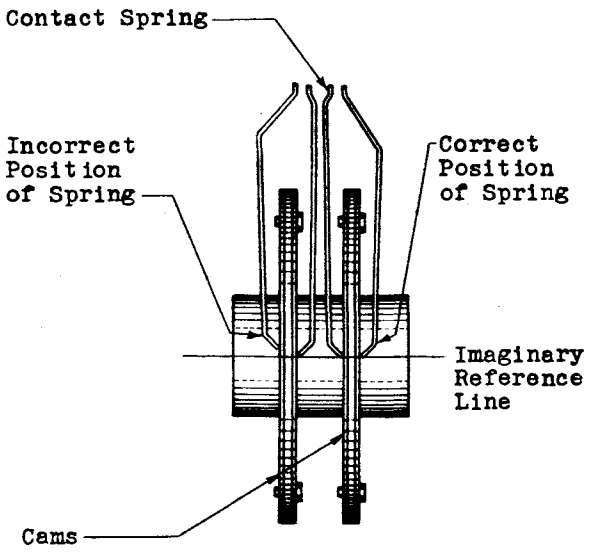

Fig. 26 - Relative Position of the Contacting Edge of the Spring with Respect to the Associated Cam

3.15 Clearance Between Contact Spring Edges and Adjacent Edges of Notched Out Portions of Cams (Rq.2.15)
3.16 Position of Contact Springs with Respect to the Edges of the Cams (Rq.2.16)

M-1 To readjust the springs for their proper clearance and position, it will be necessary to shift the spring assembly. To do this loosen the screw which holds the assembly to the frame with the 4" regular screw-driver, shift the assembly as required and then retighten the screw.

M-2 To shift an individual spring loosen the screw at the rear of the frame which holds the spring assembly to the sequence switch frame with the 4" regular screw-driver and slide the spring assembly toward the magnet end of the sequence switch to gain access to the assembly clamping screws. Slightly loosen these screws with the No. 206 and No. 207 offset screw-drivers. If in some instances the assembly cannot be shifted far enough to the left to allow the No. 206 and No. 207 screw-drivers to engage the slots of the assembly clamping screws it will be necessary to remove the screw or the screw and washer at the rear of the frame and lift the assembly until the screw-drivers can be engaged in the slots of the assembly clamping screws.

M-3 Move the spring in the assembly as required with the long nose pliers and securely tighten the assembly clamping screws and the mounting screw at the rear of the frame. Check the spring to

3.15-3.16 (Continued)

insure that the adjustment has not been disturbed during the tightening operation.

M-4 If, in readjusting the springs for clearance and position as covered in the above methods, the spring assembly has been shifted, recheck requirements 2.11, 2.12, 2.13, 2.14, 2.15 and 2.16.

M-5 In readjusting the contact portion of the spring for its proper relation to the adjacent edges of the notched out portion of the cam it may be necessary to shift the cam. To do this turn the cam shaft assembly so that the cam reference hole is directly above the shaft, hold the cams on both sides of the cam under adjustment and insert the projecting lug at the end of the driving rod of the No. 354 cam locating tool into this reference hole and, by means of the sliding hammer, tap the cam in a forward or backward direction as desired. Hold the cams and the tool in the manner shown in Fig. 27. In some cases it may be necessary to loosen the clamping nut of the cam shaft assembly very slightly using the No. 236 wrench and the No. 203 index wheel holder as shown in Fig. 28.

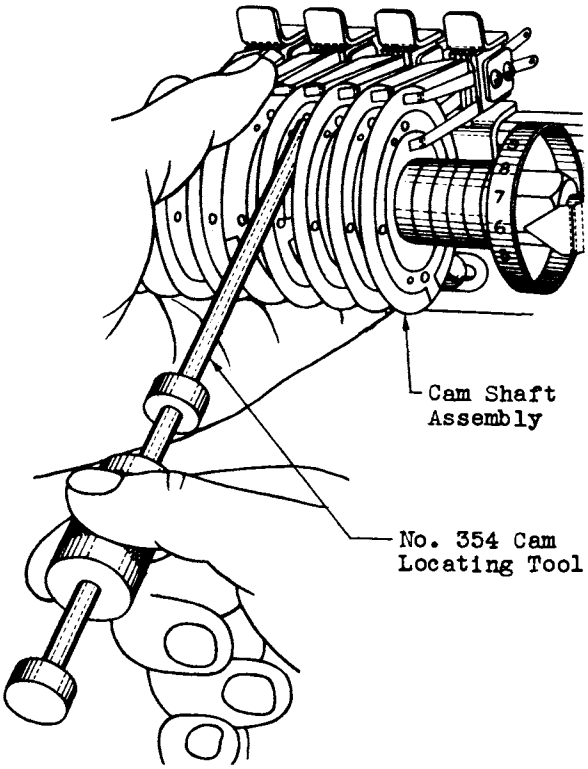

Fig. 27 - Locating Cams with the No. 354 Cam Locating Tool

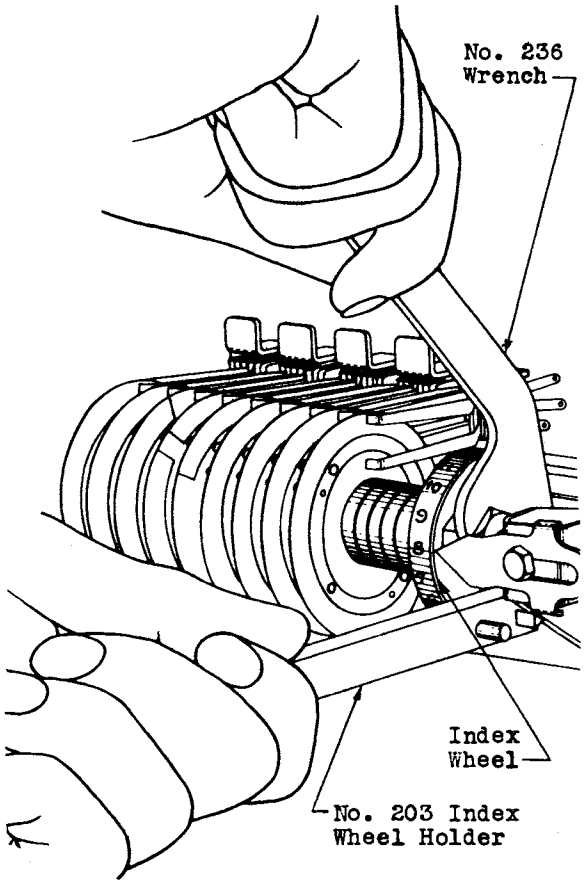

Fig. 28 - Loosening the Clamping Nut of the Cam Shaft Assembly

3.17 "A" Spring Clearance (Rq.2.17)

M-1 If upon inspection it is found that the position of the spring with respect to the contact edge of the "A" cam is not in accordance with the requirement, correct the clearance by readjusting the spring with the No. 256 spring adjuster at the bend of the spring near the clamping plate so as to increase or decrease its length as required.

M-2 Check the springs at this time to insure that requirements 2.12, 2.13 and 2.14 are being met and make any corrections necessary as covered in procedure 3.12, 3.13 and 3.14.

3.18 "B" Spring Clearance (Rq.2.18)

M-1 If it is necessary to make readjustments for "B" spring clearance adjust the springs in the manner specified in procedure 3.16.

3.19 Special Contact Adjustment (Rq.2.19)

M-1 If, upon inspection, it is found that the position of a contact spring with respect to the contact edge of a cam is not in accordance with that specified on the circuit requirement tables, make corrections by readjusting the contact portion of the spring according to the methods given in procedure 3.16.

3.20 Pointer Adjustment (Rq.2.20)

M-1 If readjustment for the location of the pointer is necessary, loosen the stirrup set screw with the 4" regular screw-driver or with the KS-6263 wrench, depending on whether the set screw has a slotted or a hexagonal head, and center the pointer on a number of the index wheel.

M-2 Readjust the clearance between the end of the pointer and the index wheel to meet the specified limits and then tighten the stirrup set screw.

3.21 Condition of Spider Springs (Rq.2.21)
No procedures.

3.22 Clearance Between the Mounting Screws and the Right Hand End of the Slots in Sequence Switch Frame (Rq.2.22)
No procedures.

3.23 Procedure for Using No. 357 Contact Clip

M-1 Make use of the No. 357 contact clip when it is desired to make contact with the springs for testing purposes. With this tool, the springs may or may not be insulated from the cams.

M-2 To apply this tool place it over the spring with the metal tip front and so that the bent end of the spring enters the notch in the shield as shown in Fig. 29. Press the back of the tool down so that the spring jaws of the tool engage the spring sufficiently to hold the tool in place. With the tool in this position, it does not insulate the spring from the cam. If this is desired pull forward on the tool at the same time holding the jaws down over the spring. Do not pull with sufficient force to disturb the spring adjustment or to damage the tool.

3.24 Procedure for Using No. 267-B Contact Insulator

M-1 Make use of the No. 267-B contact insulator as shown in Fig. 30 when it is desired to insulate the springs from the cams without interference with the normal operation of the sequence switch.

M-2 To use this tool, place it under and between the cam and the springs halfway between the contact end of the springs and the spring nest. Make sure that the

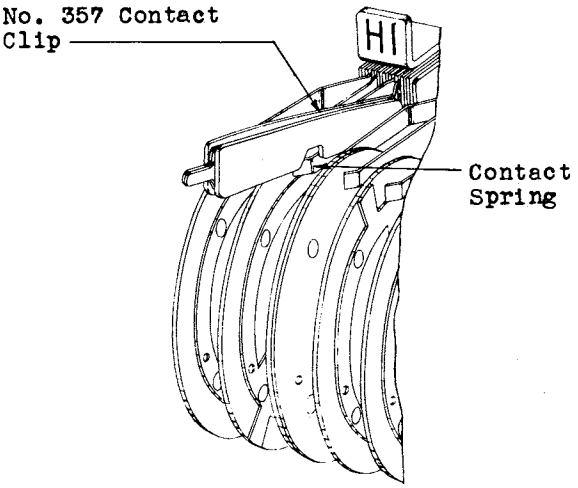

Fig. 29 - Method of Using the No. 357 Contact Clip

insulating separator is between the springs and the cam before forcing the handle of the tool down as far as it will go. Pull the tool forward in a horizontal plane so that the bent ends of the upper set of springs are engaged by the tool. Pull the tool with sufficient force to lock it in place but do not pull with enough force to throw the springs out of adjustment.

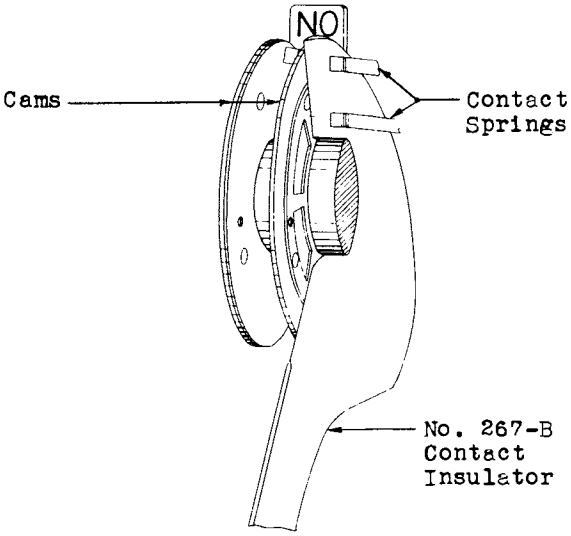

Fig. 30 - Method of Using the No. 267-B Contact Insulator

3.25 Procedure for Using the No. 253-B Brake Plate

M-1 Make use of the No. 253-B brake plate when it is necessary to hold the sequence switch in a given position with the drive magnet energized. Do not use any substitute for this brake and do not attempt to hold the sequence switch in a fixed position by hand or by any other than the approved method with the magnet energized.

REASONS FOR ISSUE - CHANGES IN ADJUSTING PROCEDURES

1. To revise the list of Tools, Gauges and Materials (3.001).

2. To revise the procedure covering Cleaning of Cams (3.01).

3. To cover use of No. 353-B Lubricator (3.04).

4. To revise and amplify the procedure covering Gap Between Driven Disc and Sequence Switch Frame (3.09).

5. To omit procedures on mounting and removal of parts since this information is now covered in the A500 division.

6. To add figure illustrating use of No. 357 Contact Clip (3.23).

7. To add figure illustrating use of No. 267-B Contact Insulator (3.24).

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