CHARGING SETS
DIVERTER POLE TYPE
REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

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1.01 This section covers apparatus requirements and adjusting procedures for diverter pole-type charging motor-generator sets KS-5500, KS-5500-01, and KS-5547.

1.02 This section is reissued to incorporate material from the addendum in its proper location. In this process marginal arrows have been omitted.

1.03 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.

1.04 Requirements and associated procedures marked with a number sign (#) need not be checked by the installer unless it is thought that the requirement is not being met or performance indicates that such a check is advisable.

1.05 Requirements and associated procedures marked with an asterisk (*) need not be checked during maintenance unless the apparatus or part is made accessible for other reasons, or performance indicates that such a check is advisable.

1.06 Successful commutation for the purpose of this section may be said to have been obtained if neither the brushes nor the commutator is burned or injured to the extent that abnormal maintenance is required. The presence of some visible sparking is not necessarily evidence of unsuccessful commutation.

1.07 Normal operation may be defined as a condition in which the generator is carrying any load from no load to full load, with the output voltage within the limits stamped on the nameplate.

1.08 Hunting, as applied to motors, may be defined as a condition in which the speed of the motor is periodically rising and falling. This condition may be present continually or intermittently.

2. REQUIREMENTS

2.01 Lubrication

(a) Bearings on older machines equipped with grease pressure fittings but no grease drain plugs shall be relubricated with 260-300 P grease after every three years of operating service, when being put into service after one year or more of storage, or after having been dismantled.

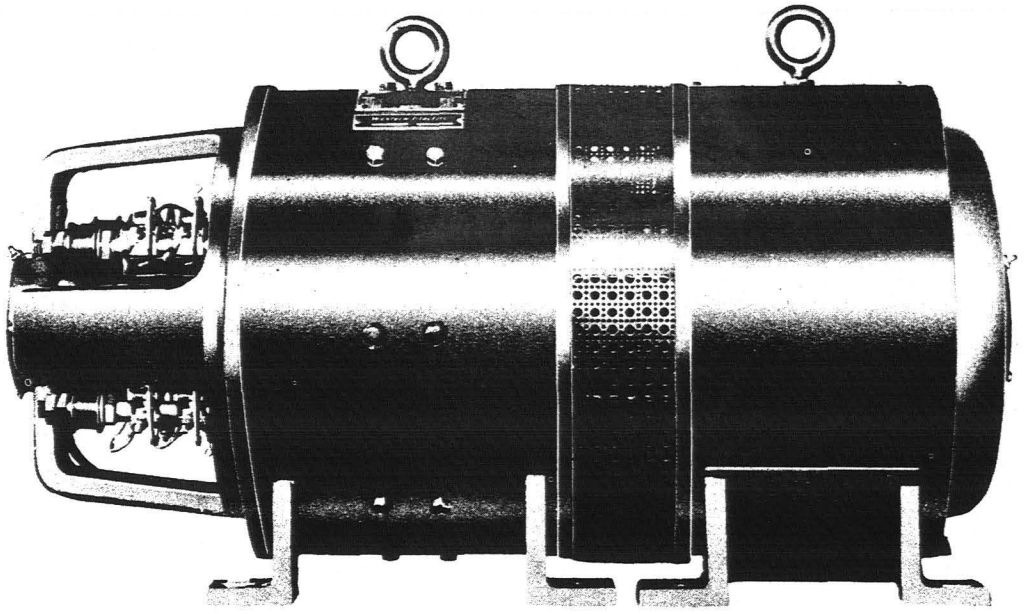

Fig. 1 - Motor-Generator Set KS-5500-01

(b) Bearings on older machines equipped with both grease pressure fitting and grease drain plugs shall be relubricated with 260-300 P grease annually in service, when being put into service after one year or more of storage, or after having been dismantled.

(c) New type machines not equipped with either grease pressure fittings or grease drain plugs are provided with permanently sealed cartridge-type bearings which cannot be relubricated. Replace these bearings only when they become noisy. These bearings are expected to last at least three years.

*2.02 Voltage: It shall be possible to adjust the voltage of the generator by means of the field rheostat, with the set hot and carrying any available office load not exceeding full load, within the limits given in the following table.

Rated Voltage	Volts Min.	Volts Max.
KS-5500		
25 volts	22	33
50 volts	44	63
KS-5500-01		
25 volts	22	33
50 volts	44	56
KS-5547		
55 volts	44	55

Use switchboard or portable voltmeter.

*#2.03 Capacity: With the power service voltage within ±10 per cent of the value marked on the nameplate and the frequency, if a-c, within 60 cycles ±2 per cent, the set shall be capable of supplying continuously the available office load, not exceeding rated full load. Use switchboard or portable instruments.

*#2.04 Speed

(a) The speed of an a-c driven set is fixed by the design of the motor and is not adjustable. At full load, it will be approximately 1750 or 1167 rpm instead of 1800 or 1200 rpm which will be found stamped on the nameplate.

(b) The speed of a d-c driven set under normal operating conditions shall be

Rated	Rpm Min.	Rpm Max.
1800	1650	1800
1200	1050	1200

Use speed indicator.

(c) A d-c motor shall not hunt.

*#2.05 The bearings shall be free from excessive wear. If the set operates satisfactorily under all conditions of load and with the other requirements of this section met, the bearings shall be considered to be in a satisfactory condition. Gauge by sound.

Note: Abnormal noise from a ball bearing is an indication of damage or excessive wear.

*#2.06 The end play shall be sufficient to permit the rotating element to run freely under all conditions of load but shall not be so great as to produce noise or unsatisfactory operation of the set.

*#2.07 Commutator

(a) Commutators shall be clean, smooth, and free from cuts, flat spots, or other deformation of the surface or structure except that caused by normal wear.

(b) The commutator shall have no high, low, or loose segments. The mica shall be undercut. Gauge by eye.

(c) The diameters of the generator commutators shall not be less than the minimum shown in the following table. Use calipers and scale.

KS-5500 KS-5500-01 List Nos.	Min. Commutator Diam. in Inches
02,12,101,102, 201,202, 1011,1012,1202	3-1/8
03,14,31,103, 1014,1031,1203	3-5/8
04,41,104, 1041,1204	4-5/8
06,07,61,71, 106,1061	5
107,1071	5-7/8
KS-5547 List Nos.	
01,10,101	3-5/8
20,201	4-5/8
30,301	5

#2.08 Commutation: Without altering the position of the brush-holder yoke, the generator or d-c motor shall commutate successfully at any available office load not exceeding rated nameplate current (amperes), at any voltage within the limits specified in 2.02 for a generator, or in 2.03 for a motor. Gauge by eye.

*#2.09 Brush Holders and Yokes

(a) The clearance between the commutator and the lower edge of the brush holder shall be

Min - 1/32 inch
Max - 1/8 inch

Use scale.

(b) For Baylis-type brush holders (see Fig. 2), the angle between the brush holder slide surface and a line tangent to the commutator surface at

the mid-point of the brush arc, shall be as near as practicable to 60 degrees. Use template.

Note: For box-type brush holders, used in the 5-, 10- and 25-ampere, 50-volt sets and the 10- and 25-ampere, 25-volt sets per KS-5500, the angle of the brush is approximately 75 degrees but is not critical.

(c) The brushes shall not bind or stick in their holders, neither shall they be loose enough to cause poor commutation.

#2.10 Brushes

(a) Except as tabulated below, brushes shall have a length, measured along the long side of the brush, of 7/8" minimum.

Exceptions	Min. Length
KS-5500, List Nos. 02,12,101,102,201, 202,1011, 1012,1202	1/2"
107,1071	1-1/4"

Use scale.

(b) The contact surfaces of the brushes shall be fitted to the commutator so as to insure successful commutation. They shall have 100 per cent arc of contact and, minimum, 75 per cent of their area in contact with the commutator. Gauge by eye.

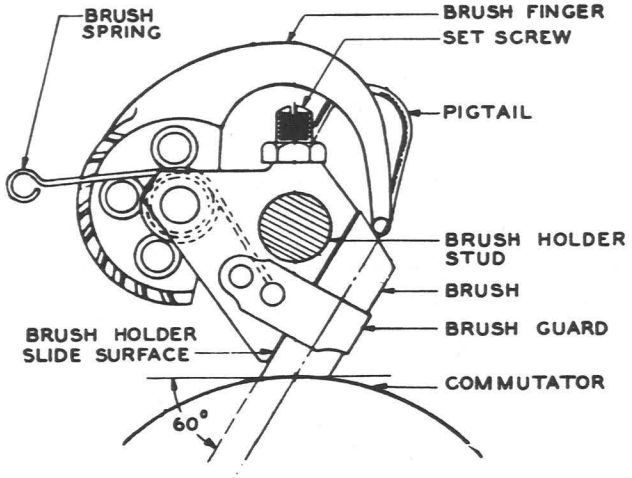

Fig. 2 - Baylis-type Brush Holder

(c) For brushes in box-type or Baylis-type holders, the pressure per square inch of contact area shall be:
Min. - 2 lbs (907 grams)
Max. - 3 lbs (1361 grams)
The following table gives the calculated total pressure for each size of brush used. Use tension gauge or spring balance as applicable.

Size in Inches	Total Pressure Min. Lbs.	Min. Oz.	Max. Lbs.	Max. Oz.	Min. Grams	Max. Grams
3/4 x 1/2	0	12	1	2	340	510
1 x 3/8	0	12	1	2	340	510
1 x 1/2	1	0	1	8	454	681
1-1/2 x 1/2	1	8	2	4	680	1020
1-3/4 x 1/2	1	12	2	10	794	1191

(d) There is no specific requirement for the pressure of brushes in tubular holders. However, the compression on the spring shall be sufficient to give successful commutation.

*2.11 Brush Alignment

(a) The brush holders shall be so located that the brushes do not overlap the end of the commutator (or groove) or ride upon that part of the commutator used for connection to the armature conductors, under any condition of normal operation. Gauge by eye.

(b) When possible, brushes on two adjacent studs shall cover the same portion of the commutator and the brushes on the next two studs shall cover the space between the brushes on the first two studs. Gauge by eye.

Note: Brush alignment in sets having tubular-type holders is not adjustable.

*#2.12 Brush Spacing: The brushes shall be spaced evenly around the commutator, so that the variation in the spacing between brushes on adjacent brush-holder studs shall be
Max. - 1/32"
Use scale.

Note: If the machine commutates successfully it will not be necessary to check this requirement.

Note: Brush spacing in sets having tubular-type holder is not adjustable.

*#2.13 Speed Regulator Starting Contacts

(a) The regulator starting contact surfaces shall be clean, parallel, and free from high spots. Gauge by eye.

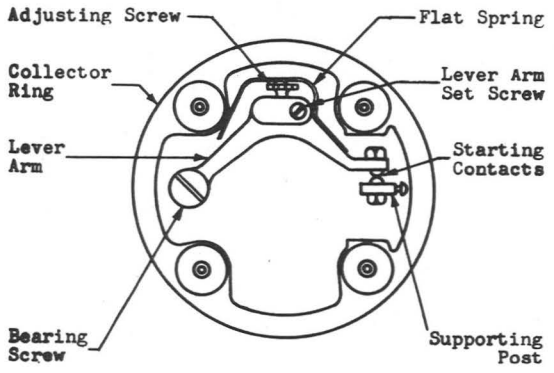

Fig. 3 - Regulator Starting Contacts

(b) The regulator starting contacts shall make good contact when the machine is at rest and open before the machine reaches operating speed.

#2.14 Speed Regulator Main Contacts

(a) The clearance between the regulator main contacts, with the main lever arm resting against the shoulder of the collector ring, shall be as close as practicable to, but not less than
Min. - 0.005"
Use thickness gauge.

(b) The regulator main contact surfaces shall be clean, parallel, and free from high spots. Gauge by eye.

(c) The regulator main contacts shall function to maintain the speed of the associated motor within the required limits for the particular installation. Use speed indicator.

#2.15 Speed Regulator Collector Rings

(a) The regulator collector rings shall be clean, free from scoring, pitting, or other deformation of the surface or structure save that caused by normal wear.

(b) The eccentricity of the collector rings shall not be enough to cause sparking or poor operation of the machine. Gauge by eye.

*#2.16 Temperature: Under normal operations, the temperature shall not exceed

	Max.
Bearings	80C (176F)
Windings and Frame	90C (194F)

If the temperature is thought to be excessive, measure by thermometer.

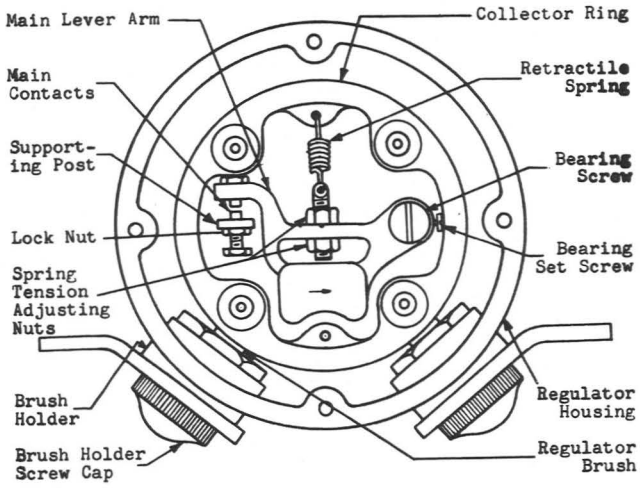

Fig. 4 - Regulator Main Contacts

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, and Materials (Equivalents may be substituted if desired.)

Tools

Bellows, hand, 10"
Brush, typewriter, toothbrush type
Gun, Grease, push type, Lincoln #5950
Screwdriver, cabinet, 3"
Screwdriver, regular, 4"
Test Set, 81A

Gauges

Ammeter, Weston model No. 280, d-c, range as required
Balance, spring, John Chattilon and Sons, 6 lbs.
Calipers, outside, 8"
Gauge, push-pull tension, 79B, 0-1000 grams
Gauge-nest, thickness, KS-6909
Indicator, speed, Jones 5B, Hasler, or equivalent
Scale, 6", R-8550
Thermometer, R-1032, Detail 1
Voltmeter, a-c, Weston model 528, ranges 300-150 volts
Voltmeter, d-c, Weston model no. 280, ranges 150-60-3 volts

Materials (See Sections 065-330-101 and 065-370-101)

Cloth, cleaning, twill jean, D-98063
Felt Pad
Grease, 260-300P
Sandpaper, 4/0 and 8/0
Spirits, Petroleum
Wooden Block

#3.01 Lubrication (Rq. 2.02)

(1) To relubricate a ball bearing which is not equipped with a drain or the bearing of a set which has been dismantled for other reasons, remove the plate covering the bearing and wipe away excess grease with a new cleaning cloth and, with the typewriter brush or a cleaning cloth dipped in petroleum spirits, remove all hardened grease. After the hard grease has been removed, remove the excess of petroleum spirits, apply a small amount of light mineral oil and, in turn, remove it. For this purpose it will be found convenient to blot up the spirits or oil with a cleaning cloth. Then apply grease around the balls, making no attempt to force grease in the spaces between the balls. Fill the bearing chamber about one-third full of grease and replace the plate. This procedure may also be followed when relubricating a bearing equipped with a drain.

(2) To relubricate a ball bearing equipped with a drain plug and pressure fitting, clean the areas around the plug and fitting and remove the plug. With a clean 3" screwdriver free the opening of any hardened grease and remove whatever grease may be obtained by this means. With the generator running, add grease with the Lincoln gun through the pressure fitting until soft grease comes from the drain hole. Allow the set to continue running until all excess grease has been expelled. Stop the set, remove grease from the drain hole to clear the space to be occupied by the plug, and replace the plug. This type of bearing may be relubricated in accordance with (1) above if desired.

(3) A bearing equipped with a grease cup instead of a pressure fitting may be relubricated by the above procedure except that the grease would be added by means of the grease cup. The cup should be left turned down and no grease added until the next periodic relubrication. If desired, the grease cup may be permanently replaced with a pressure fitting. This type of bearing may be relubricated in accordance with (1) above, if desired.

(4) In instances of excessive heating, a bearing should be examined and relubricated in accordance with (1) above.

*3.02 Voltage (Rq. 2.02)

(1) To determine the generator voltage, use may be made of the switchboard voltmeter if one is available. Where no switchboard meter is provided a portable voltmeter may be connected in circuit. Vary the voltage of the generator by manually operating the rheostat and then leave the rheostat on the factory mark. If voltage at this setting is within limits the setting should be marked on the front of the panel. If the voltage is not within the proper limits, examine the rheostat for possible injury and repair or replace if necessary. Check the generator windings for possible trouble or loose connections and repair or replace. The diverter-pole shunt is very carefully adjusted at the factory when the set is tested and this adjustment should not be changed by the installer and, if changed by the plant attendant, should be done only as a last resort, and with the approval of the supervisor. Poor commutation, improper brush fit, or incorrect brush pressure, as well as roughened contacts in the generator contactor, may be the cause of failure to meet voltage requirements. All of these requirements should be checked, together with the speed of the set, before any attempt is made to adjust the diverter-pole shunt. For information on the generator contactor, see Section 026-356-701. If the voltage is still outside the limits after the above checks, it may be necessary to replace the generator.

#(2) After the office is in normal operation, observe the highest and lowest voltage at the battery once every 24-hour day for 3 successive days, but disregard voltages when the generator output is less than 10 per cent or more than 75 per cent of its rating. The average of the three high and the three low readings thus obtained gives the mean voltage. Readjust the field rheostat slightly as necessary to make the office mean voltage equal to the voltage specified for the particular office. (Usually the float voltage).

#(3) The purpose of the above is to arrive at an average voltage as near the specified value (usually the float voltage) as feasible without the use of recording or integrating instruments or resorting to 24-hour voltage peg counts. Slight changes in rheostat setting may be made if it is thought that such changes will tend to bring the average voltage closer to the specified value. It is anticipated that such changes will be so small that re-marking of the rheostat will seldom be necessary. The voltage at any particular instant, however, cannot be expected to be at exactly the specified value and a machine once set should not require resetting for load changes.

#(4) The factory marking of the reostat and the adjustment of the diverter-pole shunt are established at the factory for a specified number of cells. Where a set is reapplied in the field to a different number of cells it should be referred to the manufacturer for readjustment.

*#3.03 Capacity (Rq. 2.03)

(1) To determine the current output of the generator, use may be made of the switchboard ammeter. If none is provided a portable instrument of suitable range should be connected into the circuit. If the generator does not deliver its rated output, check the speed, commutation, brush holders, and brushes. Adjust as required.

*#3.04 Speed (Rq. 2.04)

(1) If the speed of the set is not within the specified limits, check the supply voltage and freedom of rotation. In the case of a d-c driven set, check the condition of the brushes, the commutator, and the speed regulator. If a d-c set hunts, check the speed regulator. If these requirements are met and the speed is still outside the limits, the matter should be referred to the supervisor.

*#3.05 Bearings (Rq. 2.05)
*#3.06 End Play (Rq. 2.06)

(1) Excessive end play or worn bearings will require new bearings. To replace the bearings it will be necessary to dismantle the set and the matter should be referred to the supervisor.

*#3.07 Commutator (Rq. 2.07)

(1) A bronze-colored, highly-polished commutator is very desirable and should not be mistaken for a burned commutator. If a commutator presents this condition, is smooth, and the commutation satisfactory, it should be left alone. Threading may appear, but if the commutator surface soon becomes polished, and raw copper does not continue to be exposed, it may be let alone, but if exposure of raw copper continues the commutator should be polished with the commutator polisher (see (2) below) and the contact faces of the brushes should be rubbed with a new cleaning cloth in a direction crosswise to the threading.

(2) If oily, the commutator should be cleaned with the set stopped, by rubbing with a clean, hard, nonlinting cloth, moistened with petroleum spirits, followed by a dry cloth. After being so cleaned, it may be polished, with the machine running, by the use of a commutator polisher. See Fig. 5. The polisher should be made up locally and consists of a hard wood stick covered at one end, for approximately 6", with several layers (6 or 8 are suggested) of hardwoven canvas or duck (8 oz.) suitably secured. The following approximate dimensions are suggested for the smaller sets: length 15", width 1", thickness 3/16". They should be modified as required. The polisher is applied "end on" to the commutator with heavy pressure to remove surface deposits and to produce a polish on the surface of the metal. When the outer layers of canvas become too dirty for effective use, they can be cut away successively, near the cord binding and removed.

(3) If the commutator shows tarnished spots after cleaning and polishing, it should be sanded.

(4) Never allow a commutator to become more than slightly rough before endeavoring to correct the condition by the use of the commutator polisher. If a commutator becomes excessively rough or develops flat spots, 4/0 sandpaper folded sanded side out on a wooden block shaped to fit the commutator surface may be used for smoothing. Before smoothing, mark and remove the brushes.

Caution: When smoothing a commutator one or more brush studs should be removed to give sufficient space for the safe manipulation of the sandpaper or sanding block.

(5) After smoothing the commutator, the surface and coils shall be cleaned with air or wiped with a clean cloth and the commutator polished. In replacing the brushes, see that they are clean and put back in the same holders and in the same position in which they were originally.

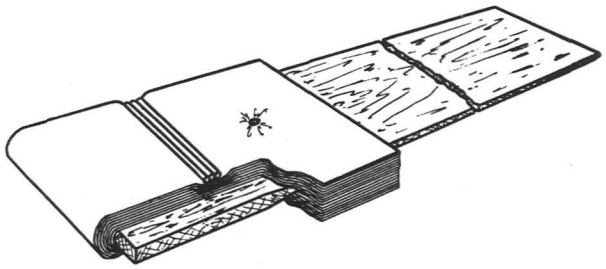

Fig. 5 - Typical Commutator Polisher

(6) If loose, high, or low segments, rough spots, or serious eccentricity appear on the commutator, it will be necessary to remove the armature for repairs or replacement in which case the matter should be referred to the supervisor.

(7) In general, the undercutting given the mica in a commutator is sufficient until the commutator itself requires turning down, but a commutator which has run for a long period without having been turned should be checked for mica projecting above the bars. For turning and resurfacing information, see Section 171-110-801.

(8) When the commutator reaches the minimum diameter specified, the machine should be taken down and the armature returned to the shop for the installation of a new commutator, or a complete new armature should be installed. For measuring the diameter of a commutator, use the 6" scale and the 8" calipers.

(9) Polish with 8/0 sandpaper, followed by the commutator polisher (see (2) above), new commutators not already run in, commutators that have been turned down or sanded, and any commutator having serious threading. See also (1) above. The sandpaper is held in the hand and moved back and forth across the width of the commutator with the machine running but all brushes removed.

Caution: Avoid injury to the hand and do not allow the sandpaper to get away.

#3.08 Commutation (Rq. 2.08)

(1) If the commutation is not satisfactory, see that 2.07 and 2.09 to 2.12, inclusive, are met. With these requirements met the commutation should be satisfactory.

*#3.09 Brush Holders and Yokes (Rq. 2.09

(1) Brush-holder studs, except on the largest sets, are mounted in holes drilled in the yokes and are not adjustable radially with respect to the commutator. Where box-type holders are involved, clearance may be adjusted by loosening the stud and rotating it, with all the holders attached, until the desired clearance is obtained. It should then be tightened securely. If desired, the holders may be adjusted individually by loosening the set screw. Baylis-type holders may not be rotated, since the angle is critical and their clearance, in the smaller sets, is therefore not adjustable. Here the clearance may be permitted to go to maximum 1/4", unless poor commutation, chattering of brushes, or other trouble develops earlier. To correct this condition, order from the manufacturer a brush-rigging which will provide means for making the necessary adjustment of the clearance. In the order, the present diameter of the commutator should be given, in addition to the usual data.

(2) To adjust the brush-holder clearance in the largest size sets, loosen the hexagonal nuts holding the brush-holder stud in place in the brush-holder yoke. Slide the stud in the slotted jaw of the yoke as found necessary. Inasmuch as the brush angle on these sets is very critical, any adjustment of the brush-holder clearance should be made by sliding the brush stud up or down in the slots in place of turning the brush holders on the studs or turning the studs. In adjusting the clearance it is desirable to work toward the minimum limit.

(3) To set a Baylis-type brush holder at the correct angle, cut a template, proceeding as follows: Reproduce Fig. 6 on a piece of stiff cardboard, making the radius of the arc equal to the radius of the commutator. The radius is one-half of the diameter which may be obtained by measurement. Draw a radius and where it crosses the arc (point A) draw a line at a right angle to it. This will be tangent to the arc. From point A measure 2" along this line and draw another line at a right angle. From point A measure 4" to the last line drawn and mark the point B. A line drawn between A and B will be at an angle of 60 degrees to the tangent. Draw another line parallel to and to the left of line A-B, at a distance from it equal to one-half the thickness of the brush. Cut the template as shown and, in addition, cut a narrow opening upward from the curved edge, to permit the template to fit down over the brush guard. Loosen the set screw which holds the brush holder to its stud, place the template against the commutator surface and the slide surface of the brush holder, and rotate the holder to obtain the required angle. Tighten the set screw firmly before leaving.

(4) Remove the brushes from their holders and wipe them with a clean, hard nonlinting cloth. Wipe the holders. If brushes bind in their holders after cleaning, rub the edges gently with sandpaper. Replace the brushes in the same holders and in the same positions in the holders as they were before

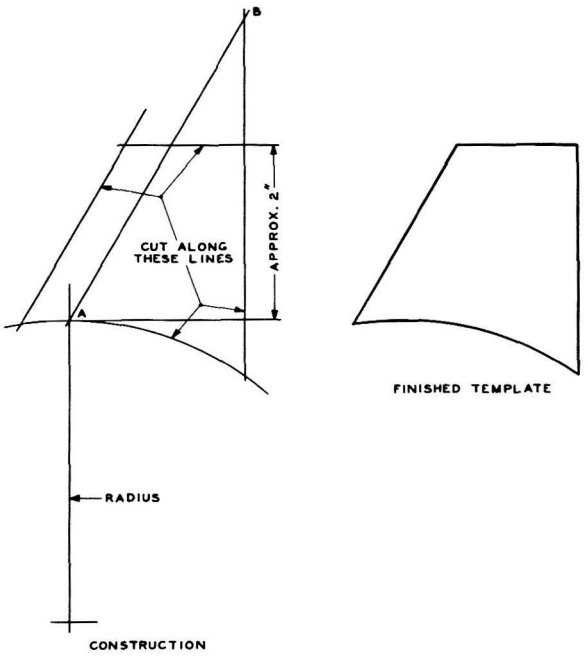

Fig. 6 - Template for Setting Baylis-type Brush Holder

removal. In replacing a brush-holder cap over a brush with a coil spring and pigtail, see that the inside of the cap and the contact on the pigtail are clean and smooth so that there is no possibility of the pigtail becoming twisted as the cap is screwed on.

(5) If brushes are too loose in their holders, they shall be replaced with new brushes.

#3.10 Brushes (Rq. 2.10)

(1) Replace any short brushes.

(2) To fit a brush to a commutator, cut a strip of 4/0 sandpaper slightly wider than the width of the brush and preferably as long as the circumference of the cummutator. Place the strip of sandpaper under the brush with the sanded side next to the brush and hold the paper so that it will bear on as much of the commutator surface as practicable. Draw the sandpaper under the brush until the brush has the same curvature as the commutator surface. The final cuts shall be made in the direction of rotation.

(3) On sets having a brush-holder yoke and brush-holder studs, where a single brush is to be fitted, the adjacent brushes on the same stud and the corresponding brushes on each of the adjacent studs shall be removed.

(4) Where a complete set of brushes is to be sanded in, a piece of sandpaper as wide as the commutator shall be used, and all of the brushes on the stud sanded in at one time. The brushes on the adjacent studs shall be removed while sanding the brushes of any one stud.

(5) After sanding, remove the brushes and clean the commutator and the armature windings with air, and wipe the brushes and commutator surfaces with cloth. In replacing brushes see that they are put back in the same holders and in the same position in which they were originally. If possible, operate the set at rated speed at light load until the brushes have become polished by the friction with the commutator surface.

Note: The fit of the contact surfaces of the brushes to the commutator is very important since the correct operation of the machine depends upon a good fit of its brushes. It is also essential that only approved brushes be used as, otherwise, the operation of the machine may be unsatisfactory.

(6) The brush pressure may be determined by looping a piece of cord under the brush finger as near the point where it touches the brush as possible. Exert a pull on this cord by means of a spring balance or tension gauge, parallel to the brush-holder slide surface. The indication just as the finger starts to move away from the brush gives the total brush pressure. The pressure may be adjusted by increasing or decreasing the tension of the associated spring.

(7) Brush surface trouble such as threading and picking up copper from the commutator is more likely to occur with new brushes than with old, and also more likely to occur at the lower than at the upper approved pressures. When required, it should be treated as outlined below. "Threading" is the formation of fine annular rings on the commutator and corresponding scoring of the contact faces of the brushes. Before and after polishing, check for irregularities on the commutator, feather edges of mica at the edge of the slot, or other high mica, and foreign matter in the commutator slots.

(8) Brush surface smoothing should be begun with 8/0 sandpaper, following procedures 2 to 5, above. Follow

this with a small piece of worn 8/0 sandpaper on the finger, rubbing gently crosswise of the brush, that is at right angles to the direction of rotation of the commutator. The purpose of this is to remove particles of abrasive in the surface of the brush and to eliminate the scoring which may have been formed during the earlier operations. Finally rub crosswise of the brush with a cleaning cloth.

(9) After returning the set to regular service, watch the commutator and brush surfaces. If threading appears, look for and remove particles of abrasive in the contact surfaces of the brushes or on the face of the commutator. Check again for high mica. Polish the surface of the commutator with the polisher. If the deformations in the surface of the commutator show a polished surface it should be let alone, but if raw copper continues to show, the commutator should be sanded.

*3.11 Brush Alignment (Rq. 2.11)

(1) To realign a brush, loosen the clamping screw and shift the brush holder along the brush-holder stud. Tighten the clamping screw. After changing the position of a box-type brush holder, check to see that the brush holder has the proper clearance from the commutator and the brush fits properly. Check a Baylis-type brush holder for angle.

*#3.12 Brush Spacing (Rq. 2.12)

(1) To space the brushes evenly around the commutator, place a strip of paper closely around the commutator, marking the point at which it overlaps. Remove the paper and divide this distance equally into as many parts as there are brush studs, setting each brush holder so that with the brush in position on the brush-holder slide, fitted to the commutator and resting against the commutator, the toe of each brush will fall on one of the equal divisions. See that 2.09 (b) is met.

*#3.13 Speed Regulator Starting Contacts (Rq. 2.13)

(1) If necessary, the contacts should be smoothed with No. 4/0 sandpaper and then wiped with a clean cloth to remove all particles of dust or dirt.

(2) To check the speed at which the starting contacts open, disconnect the leads from the regulator brushes, connecting them together to short circuit the field rheostat and connect a buzzer test set or equivalent to these brushes. The buzzer will operate to indicate good contact of the starting contacts. Start the motor in the usual manner. As its speed increases, the buzzer will cease to operate before the motor comes to its final speed. Since this is necessarily less than the operating speed, the requirement is satisfied. Stop the motor. Be sure that the lever arm moves freely on its bearing screw before attempting to make any adjustments. To adjust the speed at which the starting contacts open, loosen the set screw in the lever arm and turn the associated adjusting screw out to increase or in to decrease the tension of the flat spring, which in turn increases or decreases the speed at which the contacts will open. Tighten the set screw and retest, repeating this procedure until the adjustment is satisfactory. Disconnect the buzzer test set and reconnect the original leads.

#3.14 Speed Regulator Main Contacts (Rq. 2.14)

(1) To adjust the regulator main contacts, remove the cover which is secured to the regulator case. Loosen the locknut and screw the contact, which is adjustable, in or out, as necessary, until the specified clearance is obtained. Tighten the locknut and again check the clearance.

(2) If necessary, the regulator main contacts should be smoothed with No. 4/0 sandpaper and then wiped with a clean cloth to remove all particles of dust or dirt.

(3) Be sure that the lever arm moves freely on its bearing screw before attempting to make any adjustments to the retractile spring which controls the main lever arm. To adjust the motor speed, adjust the tension of the retractile spring by means of the spring tension adjusting nuts. The speed at which the motor operates is increased by increasing the tension of the spring. The spring tension adjusting nuts should be tightened after each adjustment. Remount the cover on the regulator case.

#3.15 Speed Regulator Collector Rings (Rq. 2.15)

(1) The collector rings may be cleaned by removing the regulator brushes and the cover plate or housing as necessary and wiping the surface of the rings with a piece of cloth moistened with petroleum spirits with the machine stopped. If the surfaces show scratches or rough spots, smooth the collector

ring surfaces with 4/0 sandpaper. If the surfaces are very rough or the eccentricity excessive, the collector ring assembly should be dressed down. For this operation the regulator must necessarily be left in place on the shaft and the rings dressed, either by the use of a stone or a lathe-tool, suitably supported, to a total variation not exceeding 0.005". For this operation the set should be driven by its motor, with the regulating resistor short-circuited by connecting the regulator brush leads together.

*#3.16 Temperature (Rq. 2.16)

(1) Hold the bulb of the termometer against the hottest spot on the outside of the bearing housing as near as possible to where the bearing is located, covering that part of the bulb which is not in contact with the housing with a piece of felt or the equivalent and observe the highest temperature indicated.

(2) The windings and machine frame may be measured for temperature in a similar manner. If the temperature exceeds the specified limits, see that 2.04 to 2.15 are met. If these requirements are met and the temperature is still outside the specified limits, refer the matter to the supervisor as the motor may have to be replaced.