

## GENERATORS RINGING AND COIN CONTROL P TYPE REQUIREMENTS AND ADJUSTING PROCEDURES

### 1. GENERAL

1.01 This section covers the ringing and coin control generators per specifications KS-5028, KS-5028-01, KS-5028-02, KS-5030, KS-5030-01 and KS-5030-02. It also covers the associated high speed and low speed interrupters of the split ring type. Tone alternators and mercury type interrupters are covered in separate sections of these practices. This section is reissued to include requirements on the split-ring type low speed interrupter, to change the requirement on brush holder clearances and to add a requirement for end play with machines having a tone alternator.

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 Successful commutation for the purpose of this section may be said to have been

obtained if neither the brushes nor the commutator is injured in an acceptance test or any normal service to the extent that abnormal maintenance is required. The presence of some visible sparking is not necessarily evidence of unsuccessful commutation.

1.05 Excessively high voltage in the d-c. windings will result should the machine be started with the d-c. brushes but not the a-c. brushes in place.

### 2. REQUIREMENTS

#### 2.01 Lubrication

(a) The bearings and the gear reduction box shall be adequately lubricated with one of the lubricating oils listed under Materials.

(b) The oil in each gauge shall be kept at such a level that the gauge shall be  
Maximum - 3/4 full  
Minimum - 1/2 full  
Gauge by sight.

(c) The amount of lubricant used at any time shall not be sufficient to

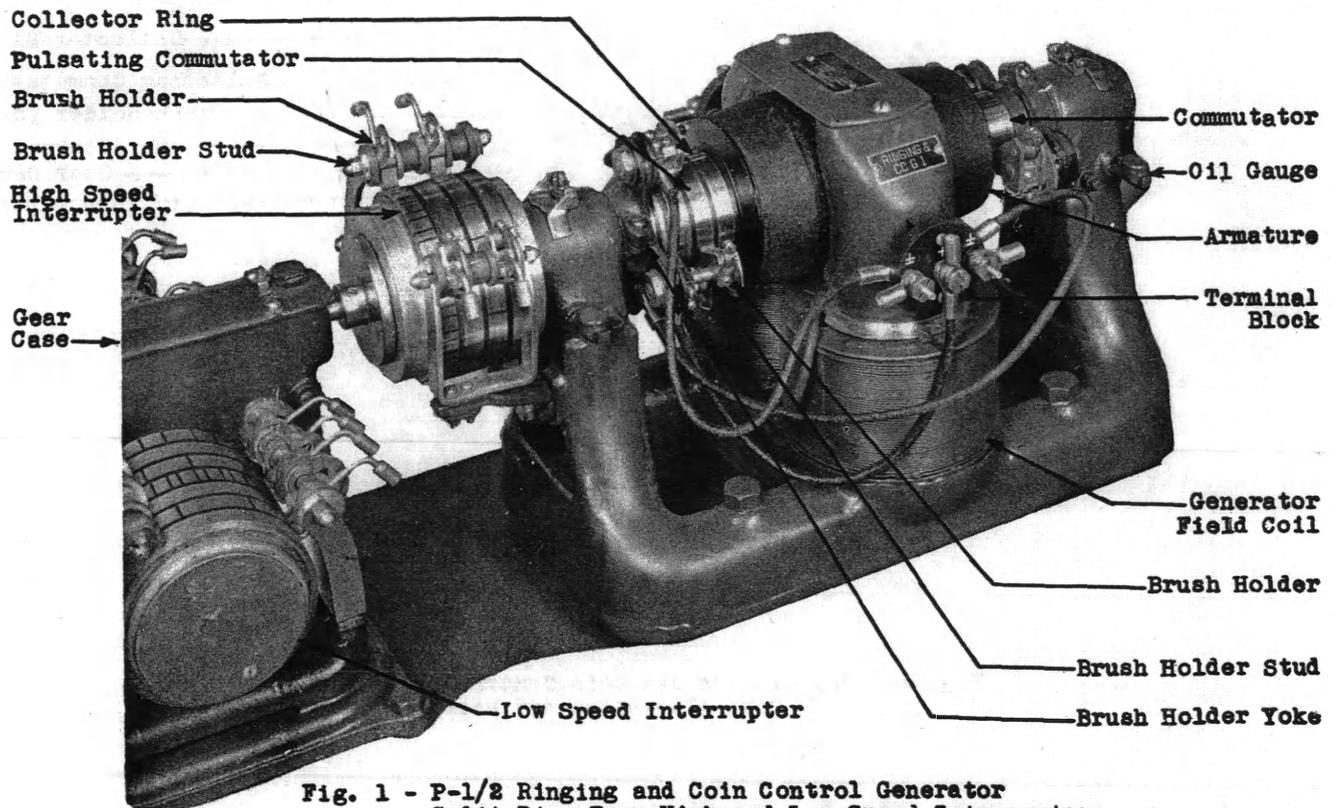


Fig. 1 - P-1/2 Ringing and Coin Control Generator  
Split Ring Type High and Low Speed Interrupters

cause it to run or creep out of the bearing housing.

(d) After turnover it is recommended that the bearings and the gear reduction box shall have the lubricating oil replaced with fresh oil every two years.

(e) Oil gauges shall be free from leaks and glass gauges where provided free from cracks.

**2.02 Voltage:** With a speed within the limits of 1100 to 1200 rpm under all operating conditions of machine temperature and load (no load to full load) the d-c. voltage at the terminals of the commutator shall be between the limits of 200-240 volts and with the primary terminals of the transformer connected to the slip rings of the machine the a-c. voltage at the secondary terminals of the transformer shall be within the limits given in the following table. Use voltmeter.

Note: If the generator is direct connected to a 62.5 cycle a-c. motor the speed shall be within the limits of 1150 to 1250 rpm.

Voltage Range

Trans. Tap	A-C. Unregulated	A-C. Regulated
4-8	101-110	103-108
4-7	96-105	98-103
4-6	81-90	83-88
4-5	73-82	75-80

**2.03 Capacity:** At the voltage specified in requirement 2.02 the generator shall be capable of delivering continuously its rated full load current (amps.) as given in the following table at unity power factor. The current may be taken from one tap or may be the total current of several taps. Use ammeter.

Ampere Output

Trans. Tap	Type P-1/2		Type P-1		Type P-2	
	A-C.	D-C.	A-C.	D-C.	A-C.	D-C.
4-8	1.00	0.25	3.0	0.38	6.0	0.5
4-7	1.00	0.25	3.0	0.38	6.0	0.5
4-6	1.25	0.25	4.0	0.38	8.0	0.5
4-5	1.25	0.25	4.0	0.38	8.0	0.5

Note: The nameplate current data on the generator gives the input to the transformer and is different than the rating given in the above table.

**2.04 Bearing linings** shall be free from excessive wear. If the generator operates satisfactorily under all conditions of load, with end play in both directions and with requirements 2.05, 2.06, 2.07, 2.16 and 2.17 met, the bearings shall be considered to be in a satisfactory condition.

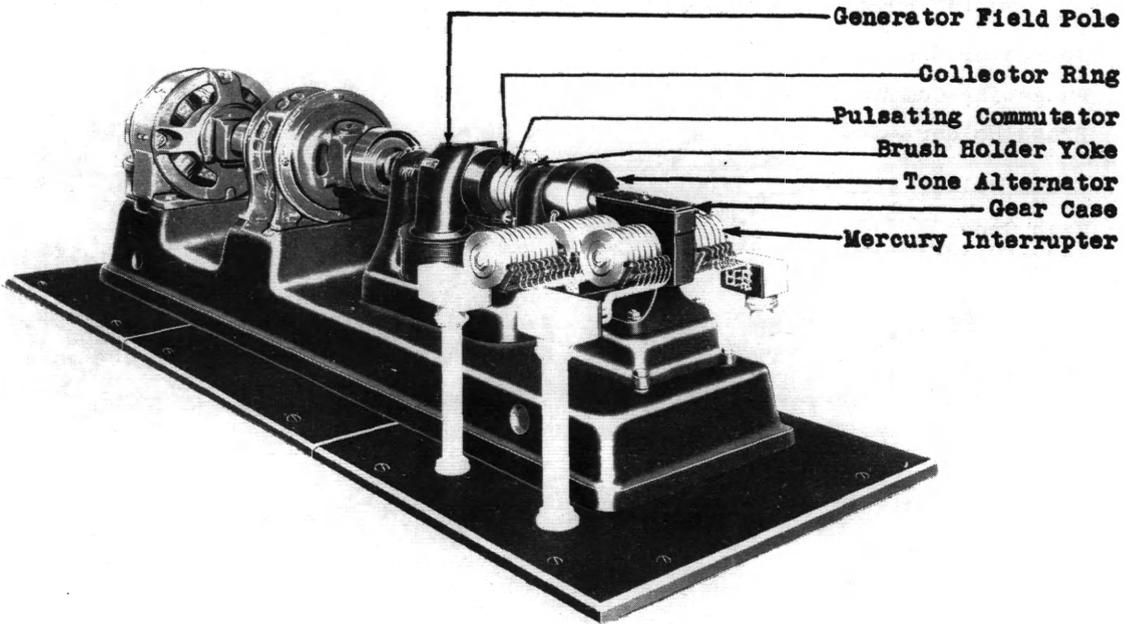


Fig. 2 - P-1 Ringing and Coin Control Generator with Tone Alternator and Mercury Interrupter

**2.05 End Play**

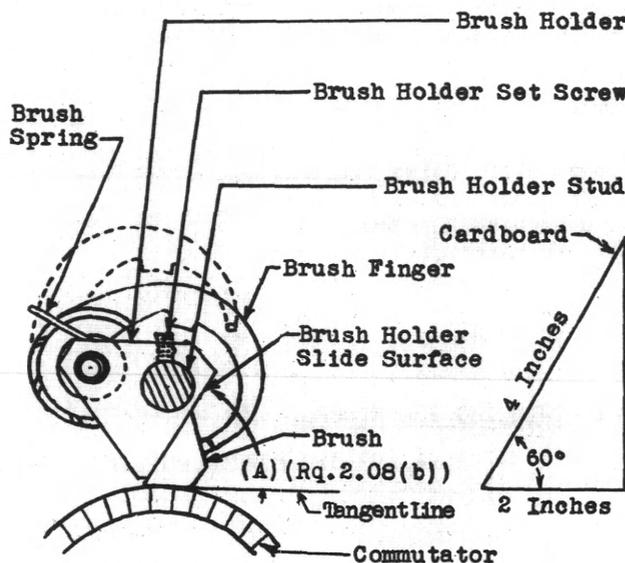
- (a) The end play shall be sufficient to permit the generator armature to run freely under all conditions of load from no load to full load, but shall not be sufficient to permit the brushes to over-ride the commutator groove or the ends of the commutator or to short-circuit the pulsating commutator or collector rings.
- (b) For machines having tone alternators the end play shall conform to the requirements outlined in the section covering that equipment.

**2.06 Freedom of Rotating Parts:** The generator armature shall turn freely in its bearings. Gauge by feel.

**2.07 The air gap at all points between the armature and the pole-faces shall be**  
 Min. - .010 inch  
 Use feeler gauge.

**2.08 Brush Holder**

- (a) The distance from the commutator, pulsating commutator, collector ring or interrupter to the edges of the adjacent brush holders shall be  
 Minimum - 3/64 inch  
 Maximum - 5/32 inch  
 An effort shall be made in readjusting to work to the minimum limit as far as the mechanical design of the brush holder and associated arm will permit.  
 Use scale.



**Fig. 3 - Brush Holder Assembly and Template**

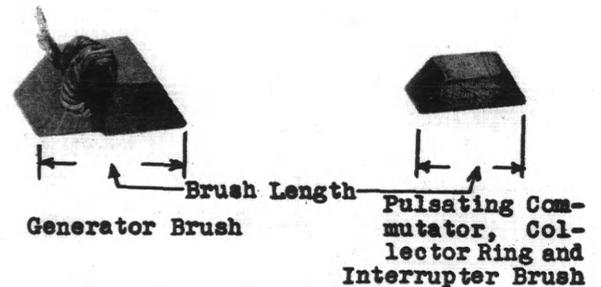
- (b) The angle between the brush holder slide surface and a line tangent to the commutator, pulsating commutator, collector ring or interrupter surfaces shall be as near as practicable to 60 degrees. See Fig. 3 (A). Use Template.

- (c) The slide surface of the commutator brush holder shall be parallel to the commutator bars and the slide surfaces of the pulsating commutator, collector ring and interrupter brush holders shall be parallel to the axis of the generator or interrupter shafts. Gauge by sight.

**2.09 Brush Length**

**Generator D-C. Brushes**

- (a) At the time of turnover, the length of the generator brushes measured on the long side shall be  
 Min. 15/16 inch  
 Use scale.



**Fig. 4 - Illustrating Brush Length**

- (b) After turnover the length of the generator brushes measured on the long side shall be  
 Min. 11/16 inch  
 Use scale.

**Pulsating Commutator, Collector Ring and Interrupter Brushes**

- (c) At the time of turnover, the length of the pulsating commutator, collector ring and interrupter brushes measured on the long side shall be  
 Min. - 5/8 inch  
 Use scale.
- (d) After turnover the length of the pulsating commutator, collector ring and interrupter brushes measured on the long side shall be  
 Min. - 7/16 inch  
 Use scale.

**2.10 Brush Fit:** Brushes shall be so fitted as to insure successful commutation.

**2.11 Brush Pressure**

- (a) The brush pressure on the commutator shall be  
 Min. 8 ounces - 227 grams  
 Max. 16 ounces - 454 grams  
 Use spring balance or gram gauge.
- (b) The brush pressure on the collector rings, interrupter surfaces or pulsating commutator shall be  
 Min. 6 ounces - 170 grams  
 Max. 12 ounces - 340 grams  
 Use spring balance or gram gauge.

**2.12 Brush Alignment**

- (a) The d-c. 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 sight.

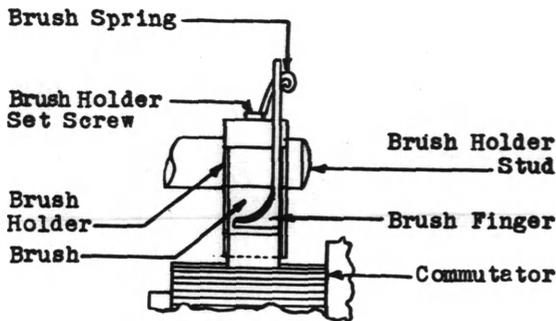


Fig. 5 - Illustrating Brush Alignment

- (b) The brush holders of the collector rings and high and low speed interrupters shall be so located that with the machine operating normally, the brushes shall be approximately centered with respect to the collector ring or interrupter ring. Gauge by sight.
- 2.13 The brush holder yoke of the d-c. end shall be set so that the painted marks on the yoke and bearing pedestal are in line. Gauge by sight.

**2.14 Commutating Surfaces**

- (a) The surfaces of all commutators, collector rings and interrupters shall be clean and free from scoring, pitting

or other deformation of the surface or structure save that caused by normal wear. Gauge by sight or by feel.

- (b) All commutators, collector rings and interrupters shall have no high, low or loose segments or flat spots. The eccentricity of the commutator shall not be enough to cause poor commutation or poor operation of the machine.

- (c) If satisfactory commutation cannot be obtained with smooth mica on a high speed interrupter, it is recommended that the mica be undercut not to exceed 1/32 inch. Gauge by sight.

2.15 Commutation: Without altering the position of the brushes, the generator shall commute successfully at any current between no-load and rated nameplate current (amps.) at any voltage within the limits specified in requirement 2.02: and with the machine at any temperature within the limits specified in requirement 2.17. Gauge by sight.

2.16 The noise and vibration of the set under any normal operating condition shall not be excessive at any load from no-load to full load. Gauge by sound and feel.

2.17 Temperatures: When the generator is operating continuously within its voltage and current range a rise in temperature above the room temperature immediately adjacent to the machine (ambient temperature) within the limits of 10° and 40° C., shall not exceed the following values:

Windings, Poles and Core .....	50° C
Bearings and Machine Frame .....	40° C
Commutator, Collector Rings, Interrupters, Pulsating Commutator and Brushes .....	55° C
Transformer .....	55° C

Use thermometer.

**3. ADJUSTING PROCEDURES**

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

**Tools**

Bellows, hand

Pliers, P-long nose, 6-1/2 inch  
 A. T. & T. Co. Std. Dwg. 46-X-56  
 Screw-driver, 4 inch (regular) A.T.&T.  
 Co. Std. Dwg. 46-X-34  
 Wire, Copper, bare tinned, No. 18 or  
 smaller (short length)  
 Wrench, Adjustable, Flat 6 inch

#### Gauges

Gauge, feeler, Starrett No. 66 or equivalent  
 Scale, 6 inch - R8550  
 Balance, Spring 0-6 lbs., Gauge, Gram  
 Tension, 0-1000 grams, 79B Gauge, or  
 equivalent

#### Materials

Abrasive, Cloth or Paper  
 KS-7860 Petroleum Spirits  
 Cloth KS-2423 or equivalent  
 Felt, or equivalent  
 Lubricating oil (one of the following)  
 Western Electric KS-2245  
 Texas, Regal Oil B  
 Standard Renown Engine Oil  
 Gulf Security Grade A  
 Sinclair Speed Engine and Dynamo Oil  
 Squires Brand Royal Dynamo Oil  
 Vacuum Oil "DTE" light  
 Measure 1 qt. (funnel attached) or  
 equivalent  
 Pail, or equivalent receptacle for oil  
 Sealing compound KS-6824  
 Wooden block

#### Test Apparatus

Ammeter, - A-C, Weston Model 528, 1  
 Ampere Scale with 539 Transformer  
 (or lamps included in 3.03)  
 Indicator, Speed, Foxboro or equivalent  
 Thermometer, 0 to 200° C, R-1032  
 Voltmeter, A-C, Weston Model 528,  
 Scales 300-150 volts  
 Volt-Ammeter, D-C, Weston Model 280,  
 Scales 150-60-3 volts, 30-6-.06  
 amperes

#### 3.01 Lubrication (Rq.2.01)

(1) To add oil to a bearing or the gear reduction box pour oil slowly into the oil filler of the bearing chamber or gear chamber until the proper level is indicated in the oil gauge. The oil should be added with the generator stopped except in the case of hot bearings. The oil should be added slowly to permit the level to rise in the gauge at the same rate as in the bearing chamber. If the oil does not rise in the gauge, it is an indication that the air vent or passage to the gauge is blocked and should be cleaned. A small bare copper wire will be found advantageous in cleaning the passage. Any of the oils listed under Materials are satisfactory for the lubrication of the generator. A quart measure with funnel attached may

be found very convenient for adding the oil.

(2) To replace the oil in a bearing remove the drain plug in the bottom of the bearing chamber and drain the old oil into a pail or other receptacle. Clean the drain plug and associated threads in the casting, coat with KS-6824 sealing compound, and replace. Refill the bearing chamber to the proper level with fresh oil.

(3) Remove dirt or sludge from the ring by wiping with a KS-2423 cloth. If the oil ring is bent or damaged, it should be replaced.

(4) If an oil gauge leaks, the oil should be drained from the bearing chamber into a pail or other receptacle by removing the drain plug at the bottom of the bearing chamber. If the leak occurs at the point where the gauge is screwed into the machine casting, the gauge should be removed, the screw threads on the gauge and in the casting cleaned and coated with KS-6824 sealing compound and the gauge replaced. After the gauge has been replaced, clean the drain plug and the associated threads in the casting and coat the plug with KS-6824 sealing compound and replace. Refill the bearing chamber to the proper level with fresh oil.

#### 3.02 Voltage (Rq. 2.02)

(1) To determine the voltage use may be made of the switchboard voltmeter if one is available. If the voltage is not within the proper limits, examine the brush setting, resistor unit, auxiliary resistance, voltage regulator and the transformer for possible injury or loose connections and replace or repair if necessary. Examine the generator windings for possible trouble or loose connections and repair if necessary. If the voltage is still outside the limits, check the motor for the proper speed and correct. If the voltage remains outside the limits after the above checks, it may be necessary to replace the generator or replace the armature with a new or reconditioned one.

#### 3.03 Capacity (Rq.2.03)

(1) For the purposes of this section if it is not convenient to place meters in the circuit and test the machine under office load, full load on the P-1/2, P-1 or P-2 machine may be said to have been obtained if standard 115 ± 5 volt mazda lamps of the capacities and arrangement given in the table below are connected across the total secondary winding of the transformer (taps 4 & 8) with a voltage at these

terminals between the limits of 103-108 volts.

Note: When loading the machine as outlined above the effect of the d-c. load is negligible. Use standard 25 (A-19), 50 (A-21) and 100 (A-23) watt, Mazda lamps.

Type	Mazda Lamps Across
<u>P</u>	<u>Secondary Winding of Transformer</u>
1/2	Parallel (1)-100 and (1)-25 Watt
1	Parallel (3)-100, (1)-50 and (1)-25 Watt
2	Parallel (7)-100 and (1)-50 Watt

### 3.04 Bearings (Rq.2.04)

(1) Replace any worn bearings.

### 3.05 End Play (Rq.2.05)

(1) A slight amount of end play can be taken up by loosening the bearing housing bolts and moving the bearing housings toward each other as a clearance of approximately 1/16" total is allowed between the diameters of the holes in the pedestals and bearing housing bolts to permit of adjustment.

(2) When a tone alternator is added it will generally be necessary to add spacing washers which are furnished with the tone alternator to reduce the end play to the specified amount. To do this it will be necessary to remove the generator bearings.

(3) To remove the bearings on the collector ring end it will be necessary to mark and remove all leads connected to the low speed interrupter and high speed interrupter or tone alternator brush holders. Remove the cap screws at the base of the gear case of the low speed interrupter. Lift off the gear case, observing the position of any shims.

(4) Remove the high speed interrupter by loosening with a wrench the cap screws which support the brush rigging and supporting bracket to the bearing pedestal and remove the supporting bracket. Loosen the set screw which secures the high speed interrupter to the shaft extension and slide off the interrupter. If the machine is provided with a tone alternator, remove the alternator as outlined in the section covering that particular equipment.

(5) Drain the oil from the bearing chamber. Remove the bolt which secures the bearing housing to the bearing pedestal and remove the housing from the shaft. Place the necessary washers on the shaft, sliding them up to the shoulder of the shaft. The ringing machine ro-

tor should be supported accurately before removing the bearing housing. After inserting the washers reassemble in reverse order.

(6) A similar adjustment may be made to the bearing on the commutator end by disconnecting the coupling, removing the holding down bolts for the ringing generator, and swinging the generator out of line, first marking the position of the frame on the sub-base. Take care not to disturb any shims. Remove the coupling half and then the bearing housing. Add the necessary washers and reassemble in the reverse order.

### 3.06 Freedom of Rotating Parts (Rq.2.06)

(1) Examine the generator and remove any foreign objects which might interfere with rotation. Also check to see that all mounting bolts are firm and tighten if necessary. Examine the generator for brushes binding and adjust or replace if necessary. If the bearings are worn excessively they should be replaced.

### 3.07 Air-Gap (Rq.2.07)

(1) With the armature in any position, measure the air-gap between the armature and each pole-face with a feeler gauge. Particular care should be taken in measuring the air-gap between the armature and the pole-faces in the lower-half of the generator frame as this is where the maximum bearing wear will be most noticeable. Rotate the armature approximately a quarter of a turn and repeat the above. Checks should be made with the armature in at least four different positions.

(2) If the air-gap is too small remove any dirt or dust which may have become lodged in the gap or, if necessary, new bearings should be installed.

### 3.08 Brush Holder (Rq.2.08)

(1) To adjust the distance between a brush holder and a commutator, pulsating commutator or collector ring loosen the hexagonal nut holding the brush holder stud in place and slide the stud in the slotted jaw of the rocker arm as found necessary.

(2) The brush holder mountings for the low and high speed interrupters are of various designs, depending upon the diameter of the rings, whether the brush holders are single or double decked and the location of the brush holder with respect to the mounting bracket. The "U" shaped details for holding the brush holder studs having slots in the ends of the detail parallel to the arm of the

detail provide no means of moving the brush holder stud radially. "U" shaped details with the brush holder stud slot on the side of the arm permit slight radial adjustment of the stud with respect to the interrupter. Some additional adjustment may be obtained by loosening the screws holding the mounting bracket to the worm gear case housing or bearing pedestal and shifting the position of its bracket, or by loosening the mounting screws which hold the "U" shaped detail to the mounting bracket and shifting the position of the detail or by a combination of these adjustments.

(3) In adjusting the clearance it is desirable to work toward the minimum limit. Where the interrupter rings are worn to such an extent that the clearance with all possible adjustment made exceeds the maximum limit, the only remedy recommended is the replacing of the interrupter drum by a new drum. However, if the commutation is satisfactory and the brushes do not chatter, or are not forced off of the brush holder surface, no harm will come to the equipment if the maximum limit is exceeded slightly. Brush pressures should not be exceeded, however, in an endeavor to overcome brushes jumping off of their holder slides or chattering.

(4) To set the brush holder at the correct angle, cut a piece of paper or cardboard to conform to the angle as specified and use as a gauge or template to measure the angle. See Fig. 3. To make a template take a piece of cardboard having at least one right angle and measure 2 inches along one side. From this point measure 4 inches to the adjacent side. The angle will be 60°. Loosen the set screws holding the brush holder to the brush stud, place the template on the brush holder slide surface against which the brush bears and turn the holder on the stud until the desired angle is obtained. Tighten the set screw firmly. If there is danger of the lug of the brush holder grounding against the "U" shaped detail or its mounting bracket, a thin fibre sheet may be mounted beneath the mounting screws of the "U" shaped detail and placed between the lug and the detail or bracket.

### 3.09 Brush Length (Rq.2.09)

(1) Replace any short brushes. Where there is any tendency for the brushes to chatter and the brush holder clearance is near the maximum, it is recommended that the brushes be replaced before they reach the minimum length. With the brush holder clearance at maximum, it is suggested that the brushes be

replaced when they become less than 9/16 inch in length. If the operation is satisfactory they may be used to the minimum length specified.

### 3.10 Brush Fit (Rq.2.10)

(1) If a considerable amount of fitting of a brush is required cut a strip of No. 00 sandpaper slightly wider than the width of the brush and preferably as long as the circumference of the commutator, pulsating commutator, collector ring or interrupter. 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 or ring surface as practical. Draw the sandpaper back and forth under the brush until the brush has the same curvature as the commutator or ring surface. The final cuts shall be made with a piece of No. 0000 sandpaper. The last stroke shall be made in the direction of rotation.

(2) After sanding, mark and remove the brushes and clean the commutator, pulsating commutator, collector rings, interrupters and coils with air and wipe the brushes and commutating surfaces with cloth wet with carbon tetrachloride. In replacing the brushes see that they are put back in the same holders and in the same position in which they were originally.

### 3.11 Brush Pressure (Rq.2.11)

(1) The brush pressure may be determined by looping a piece of cord under the brush finder as near the point where it touches the brush as possible. Exert a pull parallel to the brush holder slide surface on this finger by means of a spring balance or gram gauge hooked into the looped cord. The reading of the spring balance, just as the finger starts to move away from the brush, gives the total brush pressure. See Fig. 6.

(2) The pressure may be adjusted by increasing or decreasing the tension of the brush spring.

### 3.12 Brush Alignment (Rq.2.12)

(1) To realign a brush loosen the associated brush holder set screw and slide the brush holder on its stud as desired. Tighten the set screw and check the brush angle.

### 3.13 Brush Holder Yoke (Rq.2.13)

(1) To adjust a brush holder yoke loosen the clamping screw and move the yoke by hand to the desired position. Care should be taken to tighten the clamping screw after moving the arm.

The correct position for the d-c. brush holder yoke is marked by means of a painted mark on the arm and on the bearing pedestal. These marks should be together. Painted marks are also placed on the a-c. brush holder yoke and bearing pedestal, but it will often be necessary to shift these marks to get the desired intensity for the audible ringing circuit and for most installations these marks will not be together. Shifting the a-c. brush holder yoke will not affect the ringing current.

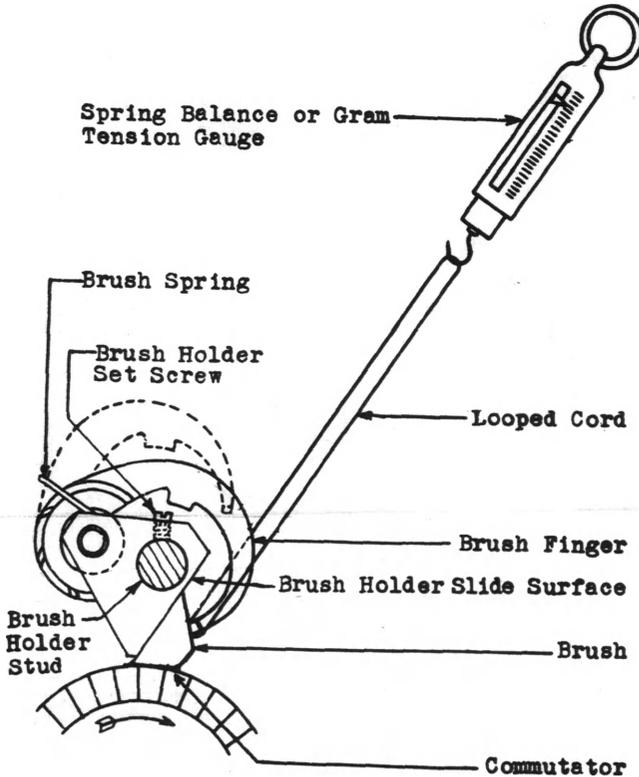


Fig. 6 - Method of Measuring Brush Pressure

### 3.14 Commutating Surfaces (Rq.2.14)

(1) The commutator, pulsating commutator, collector rings or interrupters should be cleaned as necessary by rubbing with a clean KS-2423 cloth or other hard non-linting cloth. If these surfaces become smutted with oil, the cloth may be moistened with petroleum spirits before wiping. After using petroleum spirits wipe the surfaces with a clean dry cloth.

Note: A bronze colored highly polished commutator is very desirable and it 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.

(2) If these surfaces show burned spots after cleaning with petroleum spirits, they should be sanded. The brushes should be removed before sanding and marked in such a manner that they may be replaced in the same position and in the same holder from which they were removed. The sanding may be done by wrapping No. 0000 sand paper around a small rectangular block of wood at least as long as the drum and holding the paper against the drum while the machine is running at normal speed. Where there is considerable roughness quicker results may be obtained by using No. 0 or No. 00 sand paper first, followed by No. 0000 sand paper. After sanding, clean with air and wipe with a clean dry cloth.

(3) Experience in the field has indicated that undercutting the mica between segments of the high speed interrupter drum has materially reduced the maintenance on these drums and also improved the quality and uniformity of the high and low tones. A knife edge commutator slotting file may be used for the undercutting although a piece of tool steel, 3/64 inch thick and 1 inch wide with the end grooved to give a hook shaped cutting edge has been found to work satisfactorily and has the advantage that it facilitates confining the slot to the insulation between the segments without extending into the insulation between rings. The slots should preferably be made square rather than "V" shaped.

(4) If loose, high or low commutator segments or rough spots 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.

### 3.15 Commutation (Rq.2.15)

(1) If the commutation is not satisfactory, see that requirements 2.08 to 2.14 inclusive are met. With the above conditions met the commutation should be satisfactory.

(2) Slight visible sparking is not necessarily an indication of unsatisfactory commutation.

### 3.16 Noise and Vibration (Rq.2.16)

(1) Where excessive noise and vibration is present, see that all holding down bolts and coupling bolts for the motor, ringing generator and low speed

interrupter are drawn up firmly, that the worm and gear wheel mesh properly and that the worm shaft is in alignment with the gear wheel.

(2) If necessary realign the motor, ringing generator and low speed interrupter by loosening the holding down bolts, shifting the machines on the sub-base or adding or removing shims between the machines and sub-base.

(3) If the worm becomes worn, the set screw in the hub of the worm may be loosened and the worm slid along its shaft until a fresh section of the worm is in contact with the gear wheel. The set screw should be firmly tightened after each adjustment.

(4) To line up the center of a worm shaft with a gear wheel remove the interrupter assemblies and the cover of the gear case. Loosen the set screws in the low speed shaft bearings. This will permit the gear wheel and its shaft to which it is secured by two set screws registering in holes in the shaft to be moved slightly as a unit one way or the other to bring the center of the gear wheel directly beneath the center line of the worm shaft. With the gear wheel and shaft held in this position, push in the low speed shaft bearings until they just touch the face of the gear wheel and then tighten the bearing set screws.

(5) Three set screws in each worm shaft bearing provide the required vertical adjustment to make the worm and gear wheel mesh properly. Two screws on the top of the bearing at each side of the shaft serve to raise or lower the bearing which is clamped in the desired position by a third screw through the gear case cover. End play of the worm shaft is adjusted by a set screw in each end of the gear case. The worm shaft should turn freely but should not have more than 1/32 inch end play. In replacing the interrupter gear case cover, the bearing surface of the cover on the gear case should be sealed with KS-6824 compound taking care not to get any compound inside the gear case.

(6) If the noise and vibration continues to be excessive after the above adjustments have been made, the trouble may be caused by worn bearings which should be replaced.

### 3.17 Temperatures (Rq.2.17)

(1) The temperature of the bearings should be taken in one of two ways outlined below with the machine running. One method is to place the bulb of a thermometer in the lubricating oil of the bearing for at least 5 minutes, if the oil well opening is large enough to permit this, taking care that the thermometer does not strike the shaft or interfere with the proper operation of the oil ring. This method is to be preferred but where the bearing construction makes this method impractical the second method may be used.

(2) The second method is to hold the bulb of the thermometer 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 by a piece of felt or the equivalent and observe the highest temperature indicated.

(3) The temperature of the commutator, collector rings, pulsating commutator or interrupters should be taken immediately after stopping the machine. The bulb of the thermometer should be held against the commutator or ring surface by means of a piece of felt or equivalent, covering the exposed surface of the bulb not in contact with the commutator or ring surface and the highest temperature noted.

(4) The windings, brushes, machine frame and transformer may be measured for temperature rise in a similar manner. If the temperature exceeds the specified limits see that the other requirements of this section are met. If these requirements are met and the temperature is still outside the specified limits, replace the generator or refer the matter to the supervisor.