

PORTABLE MOTOR EQUIPMENT FOR BASE METAL CONTACT MAINTENANCE REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers portable motor equipment for base metal contact maintenance consisting of a No. 433-A motor floor stand and swivel yoke, a KS-5402 motor, a KS-6851 flexible shaft and a No. 435-A vacuum head. It also covers the No. 434-A motor ladder bracket, which may be used to support the swivel yoke portion of the No. 433-A tool in place of the motor floor stand, and the KS-6852 hand-piece.

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 are marked with an asterisk () when to check for them would necessitate the dismantling or dismounting of apparatus, or would affect the adjustment involved or other adjustments. No check need be made for these requirements unless the apparatus or part is made accessible for other reasons or its performance indicates that such a check is advisable.

1.05 One discharge of Superla 4X grease for the purpose of this section is the amount of grease that is ejected from the nozzle of the KS-5000 oil and grease gun with one third of one turn of the handle.

1.06 One discharge of veedol medium cup grease for the purpose of this section is the amount of grease that is ejected from the nozzle of the No. 353-B lubricator when the piston is depressed to the limit of its stroke.

1.07 One discharge of KS-6438 oil for the purpose of this section is the amount of oil that is ejected from the nozzle of the No. 431-A oil gun when the piston is depressed to the limit of its stroke.

1.08 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.

1.09 Full load for the purpose of this section may be said to have been met if the motor drives the apparatus to which it is connected under normal operating conditions.

1.10 Requirements and adjusting procedures on brushes, brush holders and commutators apply only to the DC motor.

2. REQUIREMENTS

2.01 Cleaning The exteriors of the various parts shall be kept free of oil and dust.

Motor Floor Stand and Swivel Yoke

2.02 Lubrication - Fig. 1 (A)

(a) The swivel and the roller bearings of the castors shall be adequately lubricated with KS-6438 oil. When lubrication is necessary, one discharge of oil from the No. 431-A oil gun shall be applied in each bearing. The amount of lubricant used at any time shall not be sufficient to cause it to run or creep out of the bearings.

(b) It is recommended that the 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 requirement (a) will be met during the extended interval.

2.03 Tightness of Screws All screws shall be tight. Gauge by feel.

2.04 Castor Movement The floor stand shall roll freely on the castors. Gauge by feel.

2.05 Locking Spring Tension The locking spring shall rest firmly against the bottom of the slot in the tube and lock the yoke supporting shaft in the tube. Gauge by feel.

2.06 Yoke Supporting Shaft Movement The yoke supporting shaft shall rotate freely in the tube. Gauge by feel.

2.07 Motor Pivot Screws - Fig. 1 (B) - The motor pivot screws shall move freely in the yoke. Gauge by feel.

Motor

2.08 Lubrication

(a) The ball bearings shall be adequately lubricated with Superla 4X grease. When lubrication is necessary one discharge of grease from the KS-5000 oil and grease gun shall be applied in each bearing chamber. The amount of lubricant used at any time shall not be sufficient to

2.08 (Continued)

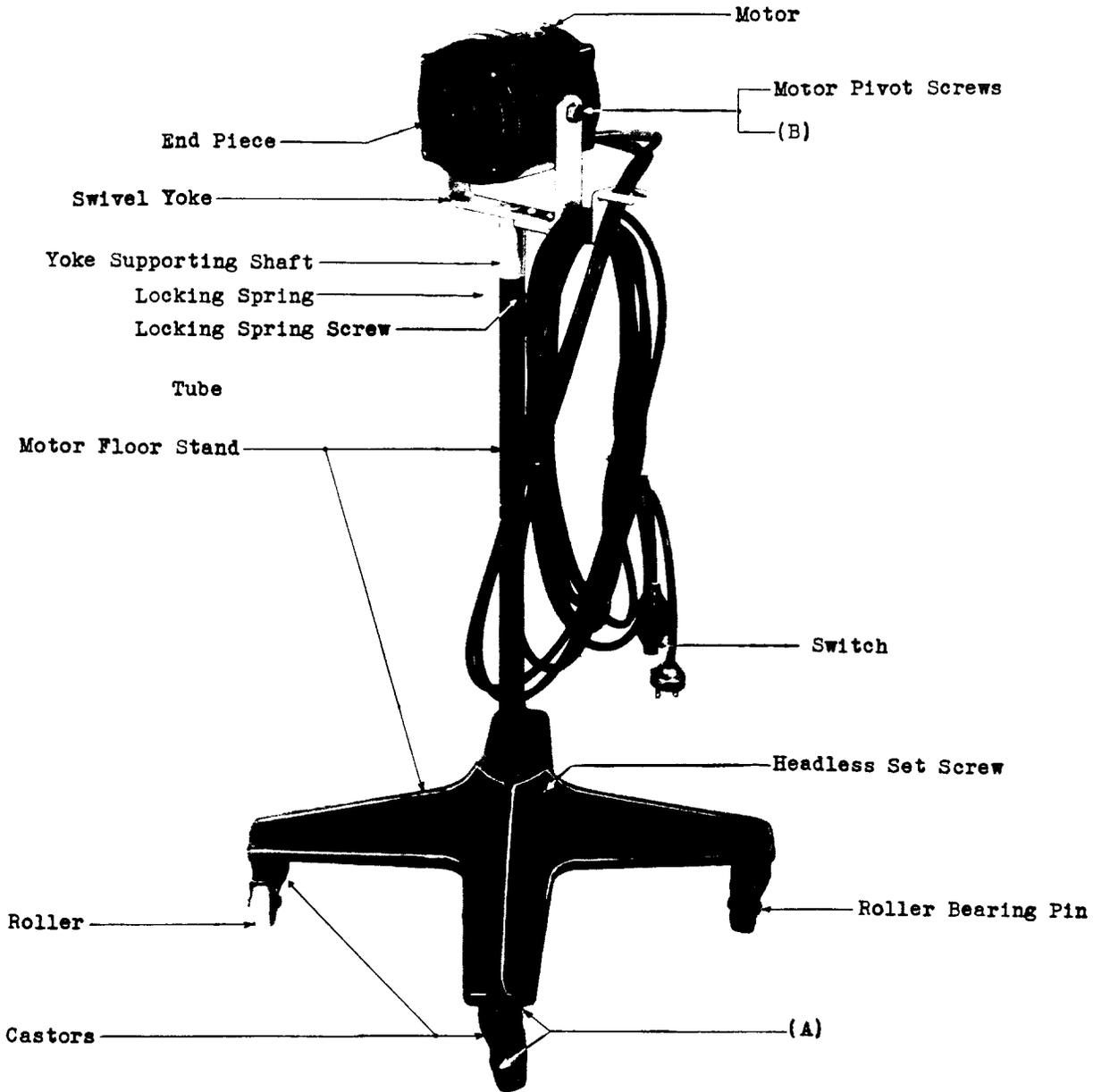


Fig. 1

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

(b) It is recommended that the bearings be lubricated at intervals of 9 months. This interval may be extended if periodic inspections have indicated that local conditions are such as to insure that requirement (a) will be met during the extended interval.

(c) It is recommended that the bearings be cleaned and repacked with lubricant every 18 months.

2.09 Ball Bearings The condition of the bearings shall be such as to allow the motor to operate satisfactorily under all conditions of normal load. If requirements 2.10, 2.13, 2.15, 2.16 and 2.17 are met the bearing shall be considered to be in a satisfactory condition.

2.10 Freedom of Rotating Parts The rotating elements shall turn freely in their bearings. Gauge by feel.

2.11 Brush Length During service, the length of the brushes outside of the

2.11 (Continued)

spring shall be
Min. 5/16"
Use the 6" steel scale.

2.12 Brush Pressure With the brush holder screw cap removed and the brush in its holder and resting against the commutator, the brush spring shall extend outside of its holder
Min. 1/8"
Gauge by eye.

2.13 Brush Fit Brushes shall be free but not too loose in their holders and shall fit so as to insure successful commutation. Gauge by feel.

***2.14 Commutator Surface** The commutator shall be clean and free from scores, pits or other deformation of the surface or structure save that caused by normal wear. Gauge by eye.

2.15 Motor Speed The motor speed under all conditions of voltage as stamped on the nameplate and of load, no load to full load, shall be

(a) AC Motor
Min. 3294 rpm
Max. 3600 rpm

(b) DC Motor
Min. 3000 rpm
Max. 4000 rpm

Use the speed indicator.

2.16 Noise and Vibration The noise and vibration of the motor under any normal operating condition shall not be excessive. Gauge by sound and feel.

2.17 Temperatures The temperatures of the motor windings and machine parts shall not rise more than 55° C. above the room temperatures immediately adjacent to the machine (ambient temperature) within the limits of 10° to 40° C. Use Centigrade Thermometer.

Motor Ladder Bracket

2.18 Tightness of Screw The locking spring screw shall be tight. Gauge by feel.

2.19 Locking Spring Tension The locking spring shall rest firmly against the bottom of the slot in the tube and lock the yoke supporting shaft in the tube. Gauge by feel.

2.20 Yoke Supporting Shaft Movement The yoke supporting shaft shall rotate freely in the tube. Gauge by feel.

Flexible Shaft**2.21 Lubrication**

(a) The bearing on the split end piece shall be adequately lubricated with Veedol medium cup grease. When lubrication is necessary the bearing shall be cleaned and repacked with the lubricant.

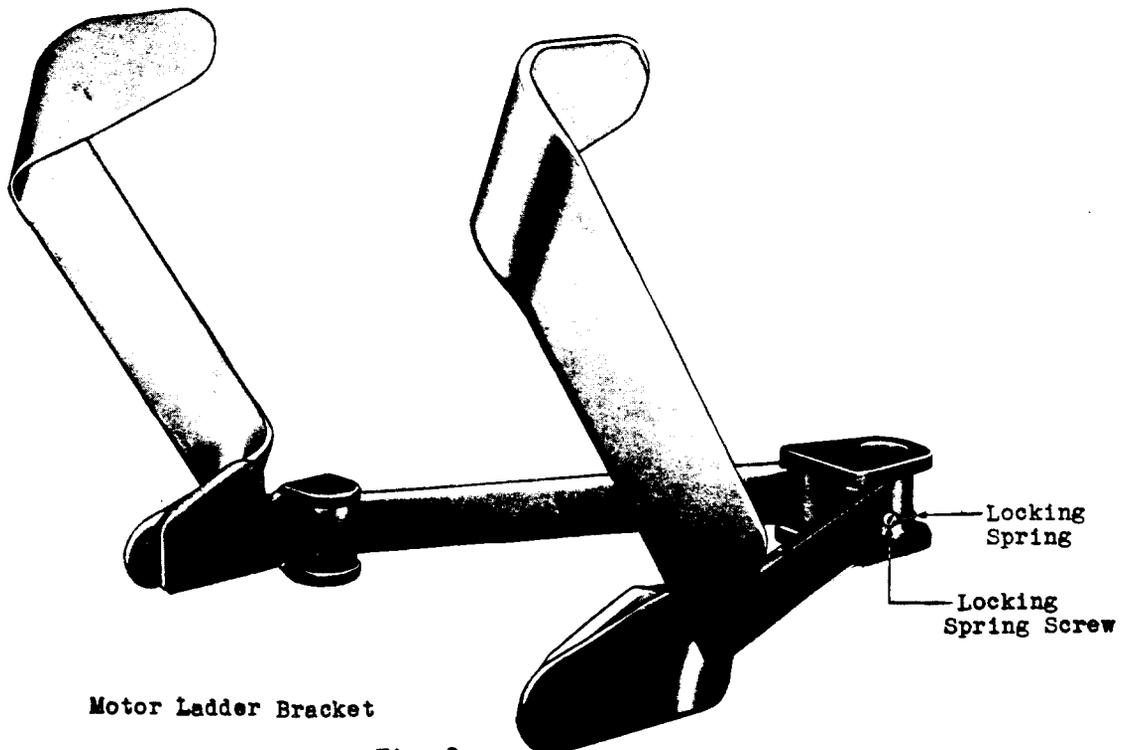


Fig. 2

2.21 (Continued)

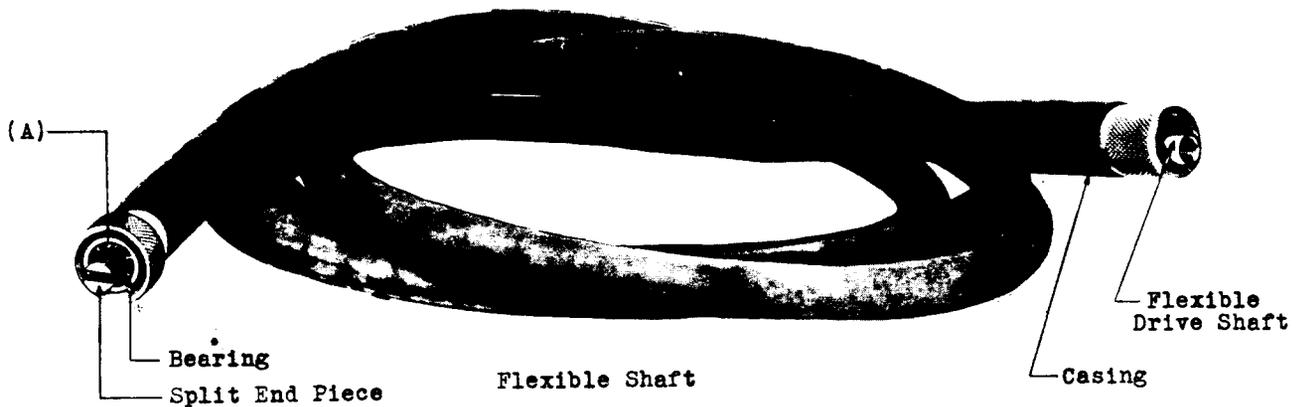


Fig. 3

(b) The flexible drive shaft shall be adequately lubricated with Marfak No. 3 grease. When lubrication is necessary, the flexible drive shaft shall be generously coated with the lubricant.

(c) It is recommended that the parts listed in requirements (a) and (b) be lubricated at intervals of one month. This interval may be extended if periodic inspections have indicated that local conditions are such as to insure that these requirements will be met during the extended interval.

2.22 Freedom of Movement The flexible drive shaft shall rotate freely in the casing. Gauge by feel.

2.23 Bearing Movement - Fig. 3 (A) - The bearings shall operate freely. Gauge by feel.

Vacuum Head2.24 Lubrication

(a) Fig. 4 (A) - The spindle bearings shall be adequately lubricated with Veedol medium cup grease. When lubrication is necessary five discharges of grease from the No. 353-B Lubricator shall be applied in each chamber. The amount of lubricant used at any time shall not be sufficient to cause it to run or creep out of the bearing chamber.

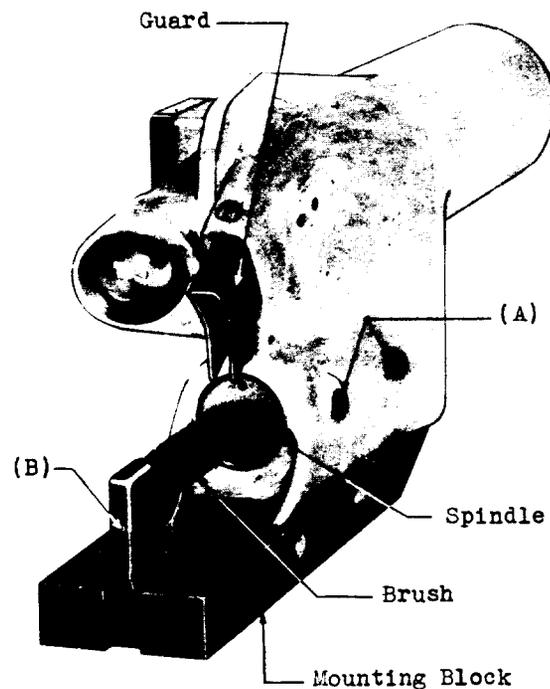
(b) Fig. 4 (B) - The brush bearing shall be adequately lubricated with Veedol medium cup grease. When lubrication is necessary two discharges of grease from the No. 353-B Lubricator shall be applied in the bearing chamber. The amount of lubricant used at any time shall not be sufficient to cause it to run or creep out of the bearing chamber.

(c) It is recommended that the parts listed in requirements (a) and (b) be lubricated at the following intervals:

(a) - 1 month.

(b) - The beginning of each day of service.

These intervals may be extended if periodic inspections have indicated that local conditions are such as to insure that these requirements will be met during the extended intervals.



Vacuum Head

Fig. 4

2.25 Spindle Movement The spindle shall rotate freely in its bearings. Gauge by feel and ear.

2.26 Brush Bearing Movement The brush bearing shall rotate freely on its bearing pins. Gauge by feel and ear.

2.27 Tightness of Screws All screws shall be tight. Gauge by feel.

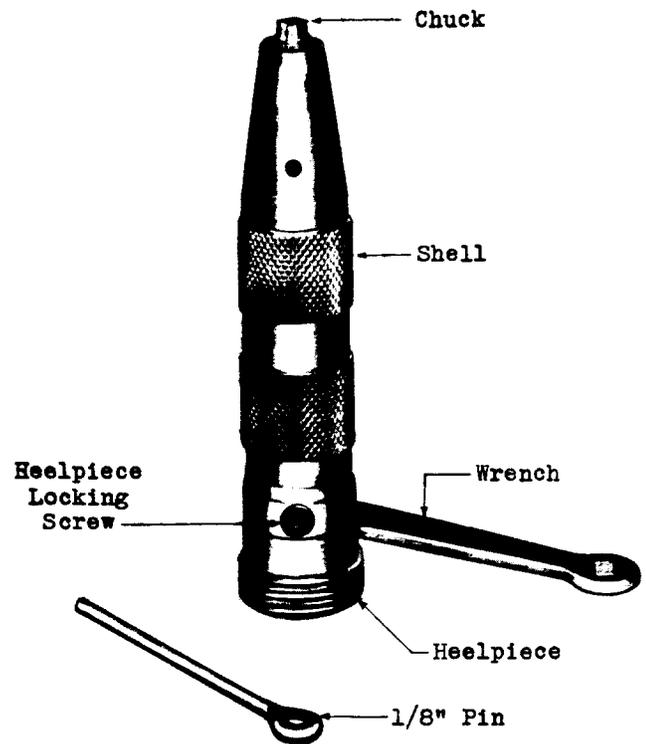
Handpiece

2.28 Lubrication

(a) The spindle bearings shall be adequately lubricated with Veedol medium cup grease. When lubrication is necessary the handpiece shall be cleaned and repacked with grease.

(b) It is recommended that the spindle bearings be lubricated at intervals of three months. This interval may be extended if periodic inspections have indicated that local conditions are such as to insure that requirement (a) will be met during the extended interval.

2.29 Freedom of Movement The spindle shall rotate freely in its bearings. Gauge by feel and ear.



Handpiece

Fig. 5

3. ADJUSTING PROCEDURES3.001 List of Tools, Gauges, Materials and Test Apparatus

<u>Code Number</u>	<u>Description</u>
<u>Tools</u>	
245	Wrench 3/8" and 7/16" Hex. Open Double-End Flat
309	Threaded Stud
353-B	Lubricator
431-A	Oil Gun
KS-5000	Oil and Grease Gun
KS-6367	Wrench - 7/16" and 5/8" Hex. Open Double-End Flat
-	Bell System 3-1/2" Cabinet Screw-Driver per A.T. & T.Co. Drawing 46-X-40
-	Bell System 4" Regular Screw-Driver per A.T. & T.Co. Drawing 46-X-34
-	Typewriter Brush
<u>Gauges</u>	
-	6" Steel Scale
<u>Materials</u>	
KS-2423	Cloth
KS-6232	Oil
KS-6438	Oil
KS-7860	Petroleum Spirits
-	Felt Pad or Equivalent
-	Sandpaper, No. 0000
-	Paper (For supporting core of flexible shaft)
-	Superla 4X Grease
-	Veedol Medium Cup Grease
-	Marfak No. 3 Grease (Product of The Texas Co. - Texaco)
-	Toothpicks, Hardwood, Flat at One End and Pointed at the Other
<u>Test Apparatus</u>	
-	Hasler or Foxboro Speed Indicator

<u>Code No.</u>	<u>Description</u>
-	Thermometer, 0-200° C. in 5° Graduations
-	Voltmeter, Weston, D.C., Model 280, Scale 150-60-3
-	Voltmeter, Weston, A.C., Model 528, Scale 300-150

3.01 Cleaning (Rq.2.01)

M-1 When necessary wipe off the exteriors of the various parts with a KS-2423 cloth which has been moistened with petroleum spirits, with the exception of the flexible shaft which shall be cleaned with a dry KS-2423 cloth.

Motor Floor Stand and Swivel Yoke3.02 Lubrication (Rq.2.02)

M-1 General When lubrication is necessary use the No. 431-A oil gun. Before lubricating, examine the oil gun to see that it is filled and working properly. If the oil gun fails to eject oil properly when the piston is depressed it is an indication that either the gun is empty or there is an air pocket beneath the plunger. In this case it will be necessary either to refill the gun or to follow M-3 below.

M-2 To Fill the Oil Gun Remove the barrel by turning it in a counter-clockwise direction. Fill the barrel with KS-6438 oil and replace and securely tighten it on the gun. Wipe off any oil that may have been forced out of the barrel with a KS-2423 cloth moistened with petroleum spirits. Depress the plunger several times to make certain that all air is expelled from the nozzle before lubricating the castors.

M-3 To Remove Air Pocket Depress the plunger several times to expell the air from the nozzle until the oil begins to flow again.

M-4 Lubricating the Castors In order to lubricate the swivel bearings insert the end of the nozzle under the apron of the castor and depress the piston to the end of its stroke at the same time rotating the roller pivot bracket. Then release the piston. In removing the oil gun draw the end of the nozzle across the bearing surfaces of the roller and pivot bracket so that excess lubricant will be deposited on the bearings of the roller.

3.03 Tightness of Screws (Rq.2.03)

M-1 If the castor mounting screws or the headless set screw are not tight, tighten them, using the 4" regular screw-driver.

3.03 (Continued)

M-2 If the locking spring screw is not tight, tighten it using the 3-1/2" cabinet screw-driver.

M-3 If the motor pivot screws are not tight, tighten them with the KS-6367 wrench.

3.04 Castor Movement (Rq.2.04)

M-1 If the floor stand does not roll freely the roller bearings are probably dirty. Remove the roller pivot nut using the No. 245 wrench and remove the bearing pin. Remove the roller and wipe off the bearing pin, the roller sides and the pivot bracket arms with a KS-2423 cloth. Wipe the pin with a KS-2423 cloth which has been moistened with KS-6232 oil. Reassemble the parts and lubricate as outlined in procedure 3.02.

3.05 Locking Spring Tension (Rq.2.05)

M-1 If the locking spring does not rest firmly against the bottom of the slot in the tube and lock the yoke supporting shaft in the tube, remove the locking spring screw with the 3-1/2" cabinet screw-driver and adjust the spring as required with the fingers. Replace the spring and the locking spring screw, tightening the screw securely.

3.06 Yoke Supporting Shaft Movement (Rq.2.06)

M-1 If the yoke supporting shaft does not rotate freely in the tube it is probably due to dirty bearing surfaces. Lift the locking spring out sufficiently to permit the removal of the yoke supporting shaft. Remove the yoke supporting shaft assembly and wipe the bearing surfaces of the yoke supporting shaft and the tube with a KS-2423 cloth moistened with petroleum spirits. After permitting the parts to dry thoroughly wipe the yoke supporting shaft with a KS-2423 cloth which has been moistened with KS-6232 oil. Replace the parts.

3.07 Motor Pivot (Rq.2.07)

M-1 If the motor does not pivot freely it may be due to the improper positioning of the yoke arms or to dirty bearing surfaces. Remove the motor pivot screws with the KS-6367 wrench and remove the motor. If the trouble is due to improper positioning of the yoke arms, pry them apart slightly so as to permit the motor to move freely.

M-2 If the trouble is due to dirty bearings wipe the bearing surfaces of the yoke and the pivot screws with a

KS-2423 cloth which has been moistened with petroleum spirits. After permitting the parts to dry thoroughly wipe them with a KS-2423 cloth which has been moistened with KS-6232 oil.

Motor**3.08 Lubrication (Rq.2.08)**

M-1 To lubricate the bearings remove the screw cap in the top of each bearing housing with the 4" regular screw-driver, insert the nozzle of the KS-5000 grease gun in the hole as shown in Fig. 6 and force lubricant into the bearings. The bearings are packed with grease when shipped and should not require lubrication for nine months.

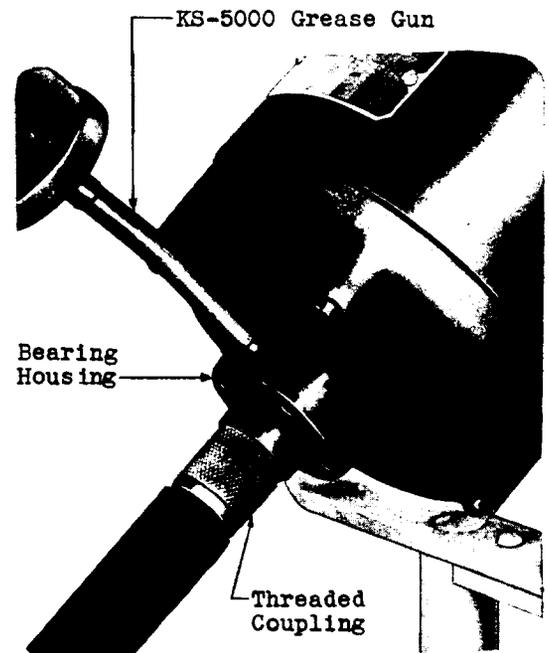


Fig. 6 - Method of Lubricating the Motor Bearings

M-2 See that no dust or dirt gets into the bearings and that the screw caps are replaced in the holes after lubricating the bearings. Do not place any lubricant on the commutator.

M-3 To clean and repack a bearing remove the motor from service. Before taking down the motor, insert one of the 1/8" pins furnished with the equipment through the hole in the end piece of the motor and the hole in the motor shaft to lock the motor shaft from rotating. Unscrew the threaded coupling which holds the flexible shaft to the end piece. Pull back the casing of the flexible shaft enough to expose the hole in the

3.08 (Continued)

threaded coupling which connects the flexible drive shaft to the motor shaft. Then, while supporting the end of the casing to prevent kinking of the flexible drive shaft, place the other 1/8" pin in the hole in the coupling of the flexible drive shaft and unscrew the flexible drive shaft as shown in Fig. 7.

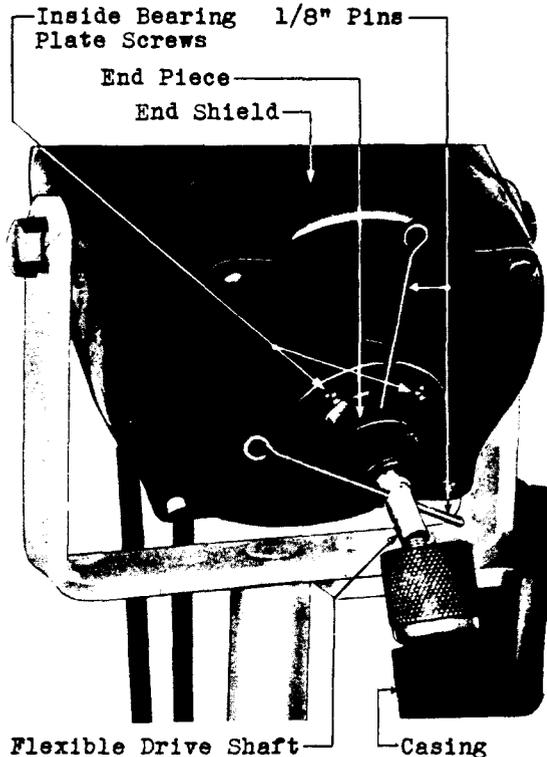


Fig. 7 - Method of Disconnecting Flexible Shaft from Motor

M-4 To take down the motor remove the brush holder screw cap with the 4" regular screw-driver and remove the brush. Remove the screws from the bearing housing which secure the inside bearing plate to the end shields using the 3-1/2" cabinet screw-driver. Remove the end shield screws with the 4" regular screw-driver and remove the end shields. If they stick, pry them off by inserting a screw-driver in the small opening on the side between the frame and the end shield.

M-5 Remove the outer ball race, felt washer retaining ring and felt washer from one end shield and the outer ball race, spring retaining washer, thrust spring, felt washer retaining ring and felt washer from the other end shield. Wipe off the grease and clean

the bearings and bearing housing with a cloth which has been moistened with petroleum spirits. If the grease is caked or sticks in the bearings or bearing housings use a typewriter brush which is wet with petroleum spirits.

M-6 Fill the space between the inner and outer ball races with Superla 4X grease to insure thorough lubrication of the ball races. Reassemble the parts in the reverse order from that in which they were taken down making certain that all parts are assembled in their same relative positions. The inside bearing plate screws may be replaced more readily if a No. 309 threaded stud is used in reassembling the motor. Introduce this threaded stud through one of the holes in the copper washer and screw it into one of the holes of the inside bearing plate. In replacing the end shield, pass this stud through one of the holes in the end shield provided for the inside bearing plate screws, thereby aligning the four holes in each of the three parts (bearing housing, copper washer and bearing plate). Replace three of the inside bearing plate screws and set them nearly tight. Then remove the No. 309 threaded stud and replace the fourth screw. Replace the end shield screws tightening them securely. Tighten the inside bearing plate screws securely.

M-7 Attach the flexible shaft to the motor reversing the operations outlined in M-3.

Caution There is no need of replacing the felt washer between the copper washer and the inside bearing plate with a new felt washer unless lubricant is escaping from the bearing chamber along the shaft to the armature. If for any reason the inner ball race is replaced, replace the felt washer at this time.

3.09 Ball Bearings (Rq.2.09)

M-1 Replace any worn ball bearings.

3.10 Freedom of Rotating Parts (Rq.2.10)

M-1 Check to see that all screws are firm. Tighten them if necessary with the 3-1/2" cabinet or 4" regular screw-driver, as required.

M-2 See that the brushes are free in their holders and that the holders do not rub on the commutator. If the holders rub on the commutator loosen the brush holder locking screw and shift the brush holder so that there is approximately 1/16" between the brush holder and the commutator. Tighten the locking screw securely.

3.10 (Continued)

M-3 Binding may also be due to short brushes, pitted or dirty commutator surfaces, damaged bearings or gummed or caked grease in the bearings. Remove roughened or pitted commutator surfaces as outlined in procedure 3.14. Remove gummed or caked grease in the bearings as outlined in procedure 3.08.

M-4 If after the above procedure, the armature continues to bind the trouble is probably due to worn bearings which should be replaced.

3.11 Brush Length (Rq.2.11)

M-1 Replace any short brushes.

3.12 Brush Pressure (Rq.2.12)

M-1 Stretch the brush spring if necessary to give the desired spring extension. Usually a shortened spring is the result of a twisted pig tail and the desired spring extension may be obtained by untwisting the copper pig tail. The spring will then follow up and give the desired length in the brush holder.

3.13 Brush Fit (Rq.2.13)

M-1 When a brush sticks in its holder remove the brush holder screw cap with the 4" regular screw-driver and remove the brush. Wipe it off with a clean cloth moistened with petroleum spirits. Any rough projection may be removed with fine sandpaper before wiping. Take care to mark each brush so that it may be replaced in the same position and in the same holder from which it was removed. Clean out the holders with a cloth moistened with petroleum spirits. Never use oil on the brushes. Shaping of the brush bearing surface should be acquired in actual service.

M-2 Replace brushes which are too loose in their holders.

3.14 Commutator Surface (Rq.2.14)

M-1 A rough or pitted commutator surface will necessitate the dismantling of the motor and the removal of the armature for the refacing of the commutator. Detach the flexible shaft from the motor and take down the motor as outlined in procedure 3.08.

M-2 Slide the armature out taking care not to lose any parts of the ball bearing assemblies. If the commutator needs refacing take care of it at this time through the established routines. Wipe off the end shields, bearings, and bearing housing with a cloth moistened with petroleum spirits. Clean the armature, the interior of the housing

and the field coils with a dry cloth. Minor cleaning or resurfacing may be done by using No. 0000 sandpaper. Reassemble the motor as outlined in procedure 3.08.

3.15 Motor Speed (Rq.2.15)

M-1 If the motor speed is not within the required limits check the supply voltage to the motor, the condition of the brushes and the temperature and test for freedom of rotation. If these conditions are met and the motor speed is still outside the specified limits the matter should be referred to the supervisor or the motor replaced.

3.16 Noise and Vibration (Rq.2.16)

M-1 See that all nuts and screws are tightened securely. If brushes chatter replace them with new brushes and springs.

M-2 If excessive noise and vibration continues, the trouble is probably due to worn bearings which should be replaced or the matter referred to the supervisor.

3.17 Temperatures (Rq.2.17)

M-1 To measure the temperature of a bearing (with the motor running) hold the bulb of a thermometer against the outside of the bearing housing as near as possible to where the bearing is located and, with a felt pad or equivalent, cover that portion of the bulb which does not touch the bearing housing. Observe the maximum temperature reading.

M-2 If the bearing temperature is not satisfactory, the trouble is either due to the bearings lacking lubrication or to worn bearings. Attempt to correct the trouble by lubricating the bearings as outlined in procedure 3.08. If this does not correct the trouble replace the worn bearings.

M-3 To measure the temperature of the motor frame or winding hold the bulb of a thermometer against the surface of the part to be measured as near to the hottest spot as possible covering any exposed portion of the thermometer bulb with a felt pad or equivalent. Observe the maximum temperature reading.

M-4 If the temperature of the motor frame or winding is not satisfactory the trouble may be due to the associated apparatus not working satisfactorily or to short-circuited turns in the motor winding. If a check of the associated apparatus shows it working satisfactorily, replace the motor.

3.17 (Continued)

M-5 The temperature of the commutator should be taken immediately after stopping the machine. The bulb of the thermometer should be held against the commutator surface by means of a felt pad or equivalent covering the exposed surface of the bulb not in contact with the commutator and the highest temperature noted. To obtain a temperature reading on the commutator will necessitate that the end shield on the commutator end be removed as outlined in procedure 3.08, M-3 and M-4.

M-6 If the commutator temperature is not satisfactory the brushes or commutator surfaces are probably in poor condition. Correct these as outlined in procedures 3.11 to 3.14 inclusive.

Motor Ladder Bracket**3.18 Tightness of Screw (Rq.2.18)**

M-1 If the locking spring screw is not tight, tighten it using the 3-1/2" cabinet screw-driver.

3.19 Locking Spring Tension (Rq.2.19)

M-1 If the locking spring does not rest firmly against the bottom of the slot in the tube and lock the yoke supporting shaft in the tube, remove the locking spring screw with the 3-1/2" cabinet screw-driver and adjust the spring as required with the fingers. Replace the spring and the locking spring screw, tightening the screw securely.

3.20 Yoke Supporting Shaft Movement (Rq.2.20)

M-1 If the yoke supporting shaft does not rotate freely in the tube it is probably due to dirty bearing surfaces. Lift the locking spring out sufficiently to permit the removal of the yoke supporting shaft. Remove the yoke supporting shaft assembly and wipe the bearing surfaces of the yoke supporting shaft and the tube with a KS-2423 cloth moistened with petroleum spirits. After permitting the parts to dry wipe the yoke supporting shaft with a KS-2423 cloth which has been moistened with KS-6232 oil. Replace the parts.

Flexible Shaft**3.21 Lubrication (Rq.2.21)**

M-1 When lubrication of the bearing is necessary clean the bearing thoroughly with KS-6232 oil and repack it with lubricant.

M-2 When lubrication of the flexible

drive shaft is necessary, disconnect the flexible shaft from the motor as outlined in procedure 3.08, M-3. Draw the flexible drive shaft out of the casing from the bearing end over paper which has been spread on the floor. Coat the flexible drive shaft generously with lubricant and insert it into the casing. Attach the flexible shaft to the motor reversing the operations outlined in procedure 3.08, M-3.

3.22 Freedom of Movement (Rq.2.22)

M-1 If the flexible drive shaft binds in the casing, lubricate the flexible drive shaft as outlined in procedure 3.21, M-2.

3.23 Bearings (Rq.2.23)

M-1 If the bearing does not operate freely it is probably dirty. Pull the flexible drive shaft out of the casing enough to expose the hole in the threaded coupling and insert one of the 1/8" pins furnished with the equipment, through the hole. Insert the other 1/8" pin in the slot of the split end piece and unscrew the split end piece and bearing as shown in Fig. 8. Clean the bearing and lubricate it as outlined in procedure 3.21. Reassemble the split end piece and bearing in the reverse order from that outlined above.

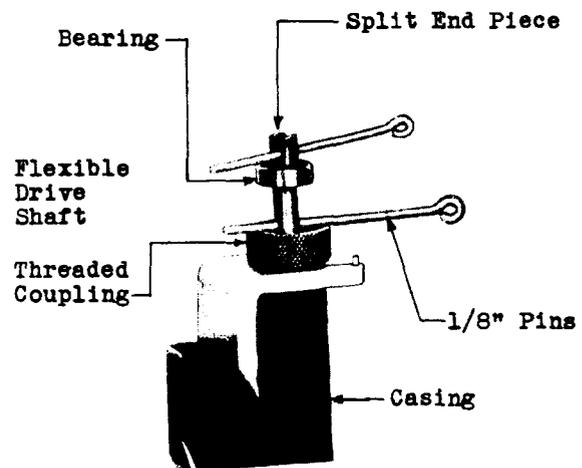


Fig. 8 - Method of Removing Split End Piece and Bearing from Flexible Drive Shaft

Vacuum Head**3.24 Lubrication (Rq.2.24)****General**

M-1 When lubrication is necessary, use the No. 353-B Lubricator. Before

3.24 (Continued)

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-7 below.

To Fill the Lubricator

M-2 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 long nose pliers and exert a pull on the plug to withdraw it from the reservoir.

M-3 The Veedol medium cup grease should be in a container having a minimum depth equal to the length of the reservoir of the lubricator. Take care that the air bubbles have been worked from the grease and that the top surface is approximately flat.

M-4 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 screw hole at the top and the grease starts to come out.

M-5 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-6 Replace the cap and tighten it against the plug.

To Remove Air Pocket

M-7 Remove the cap and apply pressure to the plug as covered in M-5, at the same time operating the plunger until grease begins to flow again.

Lubricating Spindle Bearings

M-8 In order to lubricate the spindle bearings remove the oil hole plugs with the 3-1/2" cabinet screw-driver, insert the nozzle of the No. 353-B lubricator in the oil hole as far as possible without forcing as shown in Fig. 9 and force lubricant into the bearing.

M-9 See that no dust or dirt gets into the bearings and that the oil hole plugs are replaced in the holes after lubricating the bearings.

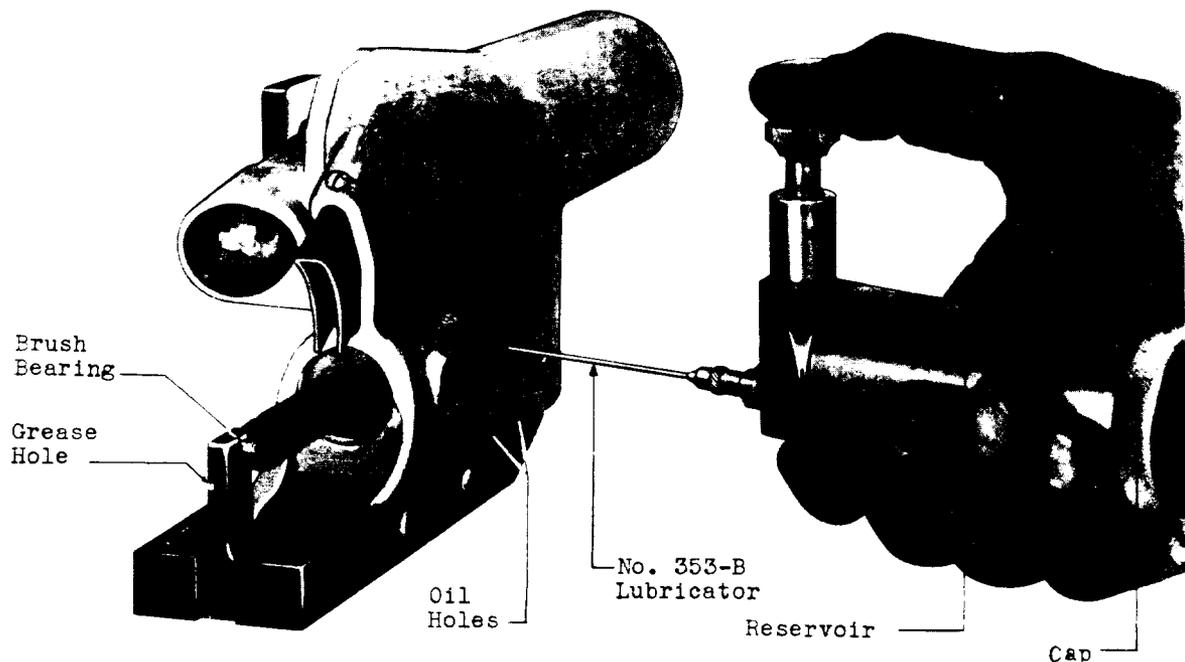


Fig. 9 - Method of Lubricating Vacuum Head with No. 353-B Lubricator

3.24 (Continued)

Lubricating Brush Bearing

M-10 In order to lubricate the brush bearing insert the nozzle of the No. 353-B lubricator in the grease hole and force lubricant into the bearing.

3.25 Spindle Movement (Rq.2.25)

M-1 If the spindle does not move freely in its bearings lubricate the bearings as outlined in procedure 3.24, M-8, in an attempt to correct the trouble. If this does not correct the trouble the bearings are either worn or dirty in which case the matter should be referred to the supervisor.

3.26 Brush Bearing Movement (Rq.2.26)

M-1 If the brush bearing does not move freely on its bearing pins, lubricate the brush bearing as outlined in procedure 3.24, M-10 in an attempt to correct the trouble. If this does not correct the trouble the brush bearing is either worn or dirty in which case the brush bearing assembly should be replaced.

3.27 Tightness of Screws (Rq.2.27)

M-1 Tighten any screws that are loose using the 3-1/2" cabinet screw-driver.

Hand Piece

3.28 Lubrication (Rq.2.28)

M-1 When lubrication is necessary take

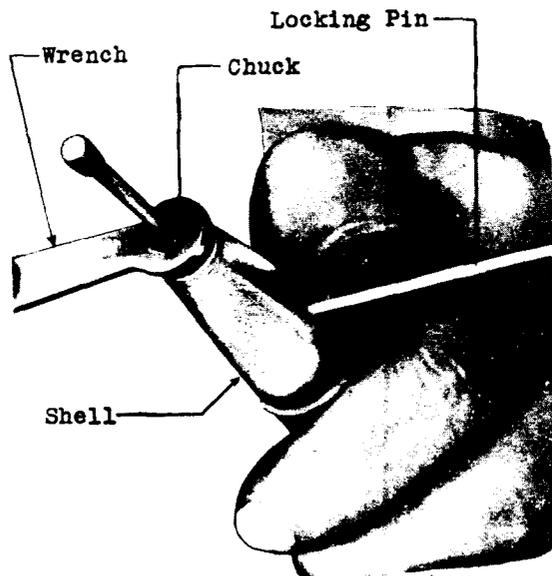


Fig. 10 - Method of Removing Chuck from Hand Piece

the hand piece apart as follows: With the wrench, which is furnished with the hand piece, turn the chuck and spindle until it is possible to insert the locking pin, which is also furnished, through the shell and spindle. This will prevent the spindle from turning. Then remove the chuck by turning it in a counter-clockwise direction with the wrench as shown in Fig. 10. Remove the locking pin.

M-2 Remove the heel piece locking screw with the 3-1/2" cabinet screw-driver and unscrew the heel piece from the shell.

M-3 Make a spanner wrench from a heavy clip as shown in Fig. 11 and remove first the lock nut and then the inner nut noting the order and position in which they were assembled so that they will be replaced in the same order and position.

M-4 Withdraw the spindle from the shell. Clean the bearings thoroughly with KS-6232 oil. Pack the bearings with lubricant and rub lubricant on the other portions of the spindle.

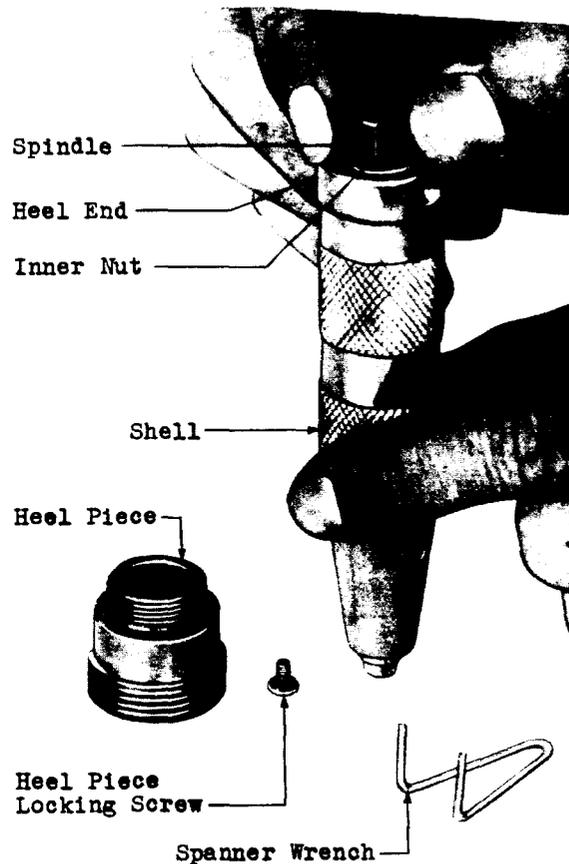


Fig. 11 - Method of Replacing Inner and Lock Nuts in Hand Piece

3.28 (Continued)

M-5 Replace the spindle in the shell. Exercise care that the ball bearings are not damaged but seat properly. If the outer ball race of the heel end ball bearing does not seat properly at first tap it lightly with the 3-1/2" cabinet screw-driver until it does.

M-6 Hold the hand piece with the heel end up and replace the inner nut. To do this hold the nut against the top of the hand piece as shown in Fig. 11 and turn the hand piece slowly in a counter-clockwise direction until the threads drop into mesh. Then turn the hand piece in a clockwise direction until the nut is well started. Then turn the nut into place with the spanner wrench. Turn the nut until it is tight against the ball bearings and then turn it in a counter-clockwise direction approximately 1/16 of a turn.

M-7 Replace the lock nut in the same manner as outlined in **M-6**. Tighten the lock nut against the inner nut. Check that the spindle does not bind nor have excessive endplay. If either of these conditions exists turn the

lock nut in a counter-clockwise direction until the spanner wrench can be applied to both the inner and lock nuts at the same time. Then if the spindle binds turn the nuts slightly in a counter-clockwise direction; if there is excessive endplay turn the nuts in a clockwise direction as required. Then lift the spanner wrench so that it will turn the lock nut only and tighten the lock nut.

M-8 Replace the heel piece on the shell and replace the heel piece locking screw. Tighten the screw securely but take care not to strip the threads.

M-9 Insert the locking pin through the shell and spindle. Replace and tighten the chuck.

3.29 Freedom of Movement (Rq.2.29)

M-1 If the spindle does not rotate freely in its bearings, lubricate the bearing as outlined in procedure 3.28 in an attempt to correct the trouble. If this does not correct the trouble the bearings are probably worn in which case the matter should be referred to the supervisor.