GEAR REDUCTION DRIVES, HORIZONTAL CONNECTING SHAFTS, AND ASSOCIATED BEARINGS REQUIREMENTS AND ADJUSTING PROCEDURES

1. GENERAL

1.01 This section covers gear reduction drives, horizontal connecting shafts, and associated bearings.

1.02 This section is reissued to revise the requirements covering lubrication and flushing, to add check methods to requirements, to revise the list of tools, gauges, and materials, to revise the procedure covering leakage of sealed joints, and to amplify the procedure for cleaning the interrupter drum. Detailed reasons for reissue will be found at the end of the section.

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 Asterisk: Requirements are marked with an asterisk (*) when to check for them would necessitate 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 Freedom From Bind: A drive or motor shall be considered free from bind when it turns smoothly and evenly without excessive torque.

1.06 Excessive vibration is that vibration which is audible or which is perceptible in the ironwork of the frame, and which may interfere with the proper operation of apparatus mounted on the frame.

1.07 Requirements and adjusting procedures for aligning the vertical shaft of the drive and the vertical drive shaft are covered in Section 159-735-701.

1.08 Successful commutation for the purpose of this section may be said to have been attained if neither the brushes nor commutator are burned or injured in any acceptance test or in normal service to the extent that abnormal maintenance is required. The presence of visible sparking is not necessarily evidence of unsuccessful commutation.

1.09 One discharge of oil for the purpose of this section is the amount of oil discharged from the No. 431A oil gun when the plunger is depressed to the limit of its stroke.

1.10 KS-16326 oil is an inhibited oil, whereas KS-2245 oil does not contain an inhibitor. The inhibitor will retard the formation of organic acids, which would react with the oil to produce soapy compounds, or sludge, and impair lubrication. While the formation of acids is accelerated in the presence of copper or copper alloys, the inhibitor in KS-16326 oil is sufficient to give a service life of 5 years. To insure the 5-year interval when first changing to KS-16326 oil, it is important that the gear cases and bearing boxes be drained and flushed as covered in the requirements to eliminate acids and residues from the old oil.

2. REQUIREMENTS

GENERAL REQUIREMENTS

2.01 Cleaning: The exterior surfaces of the gear cases, bearing housings, couplings, and adjacent surfaces of the shafts shall be cleaned when necessary in accordance with approved procedures.

2.02 Leakage at Sealed Joints: Fig. 1(A), 2(A), and 3(A)

(a) All seals shall be unbroken and leakproof to the extent that the total accumulation of oil which leaks or seeps from all sealed joints of the gear case or a bearing housing shall not be sufficient to form one drop in 24 hours. When there is any question as to whether or not this requirement is being met, the gear case or bearing housing may be observed over a period of several days. If the accumulation of oil for the entire period averages one drop or more per day, the sealed joints shall be considered unsatisfactory.

(b) When necessary the joints shall be resealed with KS-6824 sealing compound.

(c) Shaft guards associated with 2-type or No. 10A shafts shall be sealed at the time of turnover, although they may not be sealed at the time the drive is assembled in the shop.

2.03 Leakage at Oil Closures: Figs. 1(B), 2(B), and 3(B)

(a) Oil closures shall not leak for at least 24 hours after cleaning. After an interval of 24 hours, an inspection shall be made of the cleaned oil closures to determine whether or not they are leaking. Those found to be leaking shall be cleaned. If the leaking is not due to dirt accumulating between the shaft and the oil closure lips, as determined by cleaning and inspection, the oil closure shall be considered unsatisfactory.

(b) On 31-type drives and 5-, 6-, 8-, 9-, and 12-type bearings this may be caused by lack of clearance as covered in requirequirements 2.07 and 2.43, respectively.

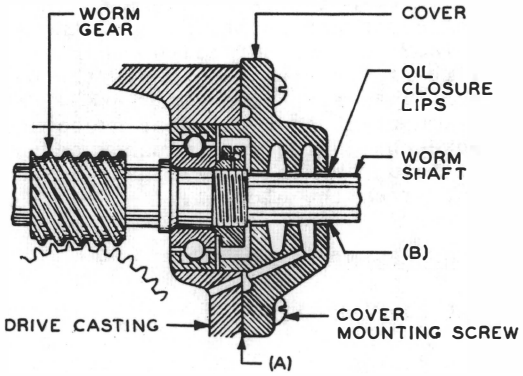

Fig. 1 - Sealed Joints and Oil Closures (All Drives Except No. 31A Drive)

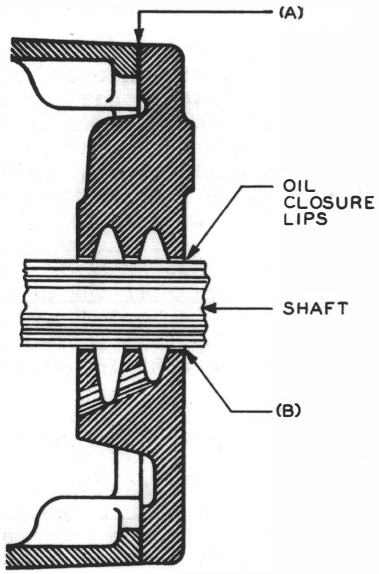

Fig. 2 - Sealed Joints and Oil Closures (No. 30A and 31A Drives)

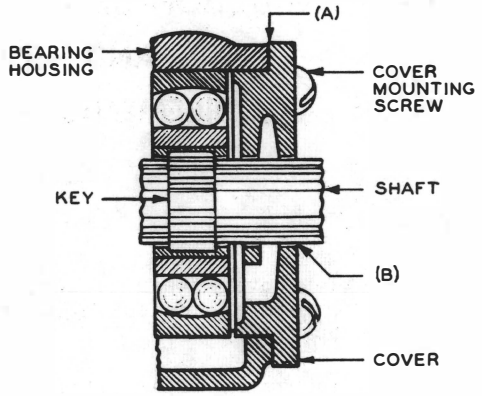

Fig. 3 - Sealed Joints and Oil Closures (5-, 6-, 8-, 9- and 12-type Bearings)

DRIVE REQUIREMENTS

2.04 Lubrication

→ (a) The drive shall be filled with KS-16326 oil to within the following limits.

(1) 6- and 7-type [except as covered in (a2)] 8-, 30-, 34-, 1034-, and 1134-type Drives: Fig. 4 - With the drive in operation, the level of the oil shall not be higher than the center of the oil sight glass, and shall not be lower than the bottom of the oil sight glass.

Gauge by eye.

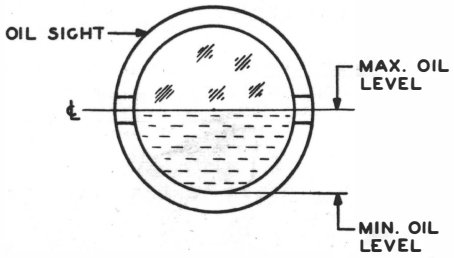

Fig. 4 - Oil Level Limits 6-, 7-, 8-, 30-, 34-, 1034-, and 1134-type Drives (Except No. 6B, 6D, 6F, 6G, and 7D Drives)

(2) No. 6B, 6D, 6F, 6G, and 7D Drives Manufactured With the Center Line of the Oil Sight Glass Coinciding With the Center Line of the Plate Cover: Fig. 5 - With the drive at rest, the oil level shall not be higher than 1/32 inch above the bottom of the oil sight glass, and not lower than the bottom of the oil sight glass.

Gauge by eye.

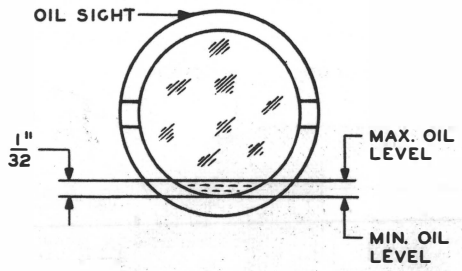

Fig. 5 - Oil Level Limits
No. 6B, 6D, 6F, 6G, and 7D Drives
(with center lines of oil sight glass and plate cover coinciding) (See Fig. 7)

(3) 28-, 31-, 32-, and 33-type Drives:
Fig. 6 - With the drive in operation, the oil level shall not be higher than the center of the oil sight glass, and not lower than 1/4 inch above the bottom of the oil sight glass.

Gauge by eye.

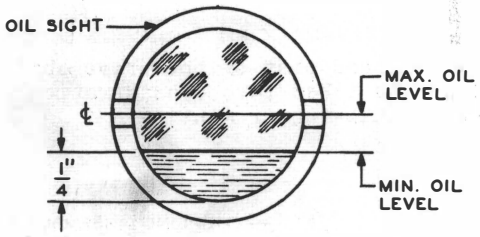

Fig. 6 - Oil Level Limits
28-, 31-, 32-, and 33-type Drives

(b) Recommended Lubrication Intervals

(1) Periodic inspections shall be made to insure that the oil level is kept within these limits.

Note: Where drives are operating with KS-2245 oil, either KS-2245 or KS-16326 oil may be added as necessary to maintain the oil level until the changeover to KS-16326 oil has been made.

Caution: Exercise care while replenishing the oil to prevent the oil level being above the maximum level specified after it has had time to reach its true level.

(2) After turnover, it is recommended that the oil be drained off, examined, and the gear cases filled with KS-16326 oil to the levels covered in (a) at the following intervals.

Drives operating with KS-2245 oil 2 years
Drives operating with KS-16326 oil 5 years

Note: For a mixture of KS-2245 and KS-16326 oils, the oil change interval shall be 2 years.

When first changing to KS-16326 oil for drives previously operating with KS-2245 oil or a mixture of KS-2245 and KS-16326 oils, the gear cases shall be flushed with KS-16326 oil as covered in requirement 2.05.

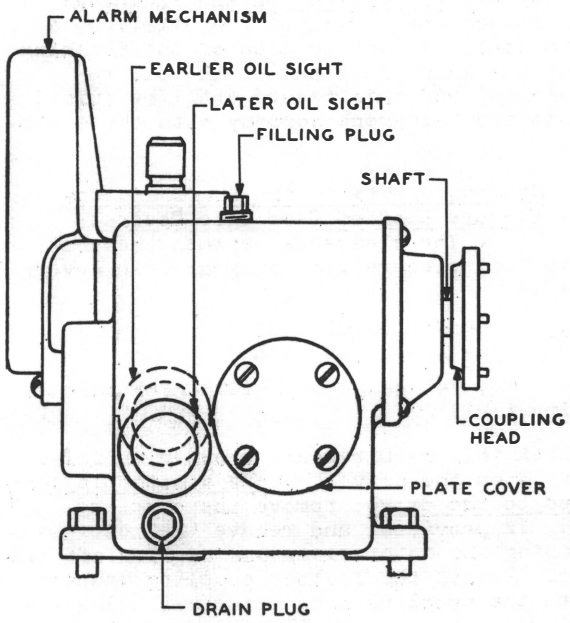

Fig. 7 - Gear Case - Earlier and Later Oil Sight Levels

2.05 Flushing

(a) Before Turnover: The gear case shall be drained and refilled with KS-16326 oil. Following this, the drive shall be operated under power for a minimum of 5 minutes, the gear case drained, and again refilled with KS-16326 oil as covered in requirement 2.04.

(b) After Turnover

(1) Where KS-2245 oil or a mixture of KS-2245 and KS-16326 oils has been in use, the gear case shall be drained and refilled with KS-16326 oil. Following this, the drive shall be operated under power for a minimum of 15 minutes, the gear case drained and again refilled with KS-16326 oil as covered in requirement 2.04.

(2) Where KS-16326 oil has been in use, the gear case shall be drained and the oil examined. The gear case shall then be refilled with KS-16326 oil as covered in requirement 2.04, unless conditions, such as excessive dirt and sediment, which give

evidence of impaired lubrication, are observed. In such instances only, it will be necessary to refill the gear case with KS-16326 oil, and operate the drive under power for a minimum of 15 minutes, following which the oil shall again be drained, and the gear case refilled with KS-16326 oil.

(3) If the oil is drained from the gear case and immediately refilled, it will not be necessary to stop the drive.

2.06 Record of Lubrication and Flushing: During the period of installation, a record shall be kept by date of the flushing out of the gear cases and of the oil replacements, and this record shall be turned over to the telephone company with the equipment.

2.07 Clearance Between the Shaft and the Oil Closure Lips of Gear Case Covers: Fig. 8(A) - The clearance between the shaft and the oil closure lips of gear case covers shall be

Test - Min 0.003 inch
Readjust - Min 0.005 inch

Use the No. 74D gauge or R-1026 gear case setting tool.

To check this requirement, proceed as follows. Stop the drive. Where a motor is connected to the drive, remove the coupling guard, if provided, and remove the motor by loosening the motor clamp and backing off the motor. Remove the leather coupling washer. Loosen the coupling head setscrews using the proper wrench. Remove the coupling head. Where a 2- or 10-type shaft is connected to the drive, remove the guard mounting screws with the 4-inch regular screwdriver, or loosen the screws with the No. 344 screwdriver and remove them with the 3-inch cabinet screwdriver, and slide the guard back on the shaft. When checking with the No. 74D gauge, rotate the shaft slowly by turning either the shaft or the motor coupling by hand. At the same time attempt to insert the 0.003-inch blade of the gauge between the shaft and the oil closure lips at four points 90 degrees apart around the shaft. When checking with the R-1026 gear case setting tool, slide the tool over the end of the shaft into the space between the shaft and the oil closure lips. When checking the clearance where the drive shaft is connected to a connecting shaft, remove the shaft coupling as covered in 3.01. After checking the requirement, reassemble the parts, unless readjustment is required.

2.08 Freedom of Operation of Gearing: Fig. 8(B) - The gearing shall be free from bind in any position of the gears about their axes.

2.09 Freedom of Operation of Motor: The motor shall be free from bind in the bearings due to poor alignment with the worm shaft.

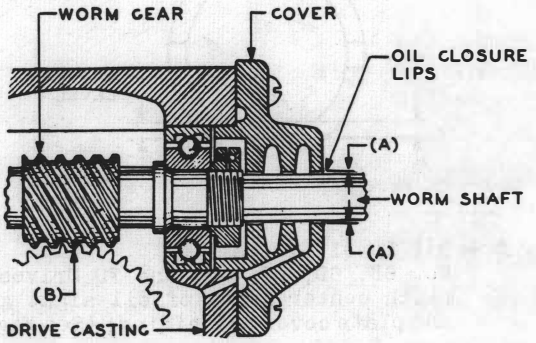

Fig. 8 - Clearance Between Shaft and Oil Closure Lips

2.10 Location of Coupling Assembly on Drive Shaft: Fig. 9(A) - With the motor stopped, the clearance between the coupling assembly on the drive shaft and the gear case cover shall be

Min 1/8 inch

Gauge by eye.

Note: The end play of the drive shaft need not be taken into consideration when checking this requirement.

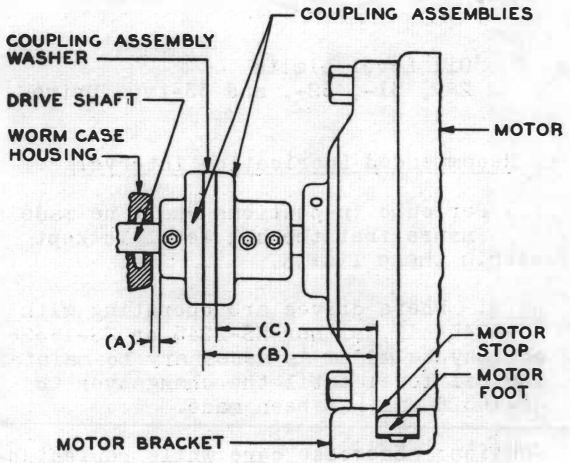

Fig. 9 - Relationship Between Motor and Coupling Assembly

2.11 Horizontal Distance Between Coupling Assembly on Drive Shaft and Motor Stop: Fig. 9(B) - The finished surface of the motor stop shall be 2-23/32 inches ±3/64 inch in a horizontal line from the face of the coupling assembly mounted on the drive shaft.

Use the 12-inch combination square.

To check the requirement, loosen the motor clamp and remove the motor. Remove the leather washer from the coupling head. Loosen the clamp of the combination square, place the long side of the head on a flat surface, and adjust the position of the blade in the slot so that the end is flush with the long side of the head. Then tighten the blade securely in place. Place the long side of the head against the face of the coupling and check the distance from the face to each motor stop as shown in Fig. 10. Revolve the coupling a half turn and recheck the distance. After checking the requirement, remount the motor, unless readjustments are required.

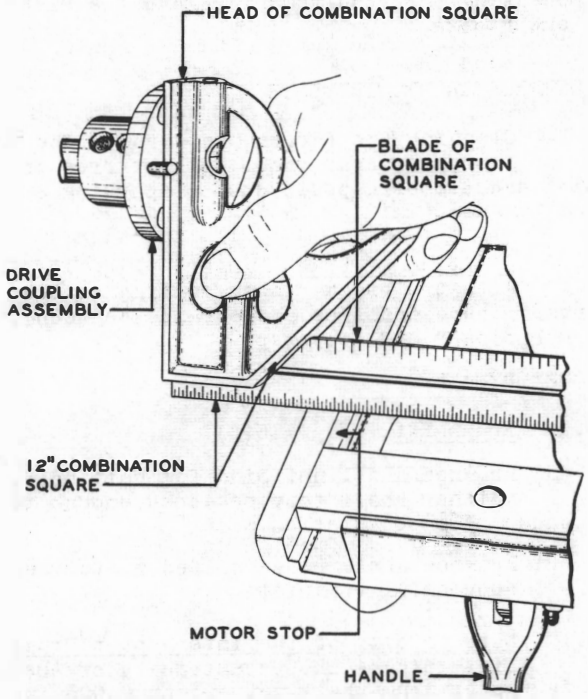

Fig. 10 - Method of Checking Horizontal Distance Between Coupling Assembly and Motor Stop

2.12 Motor Coupling Assembly Location:

Fig. 9 (C) - The face of the coupling assembly on the drive motor shaft shall be set with its face located 2-7/16 inches ±1/64 inch from the finished end of the motor feet.

Use the 12-inch combination square.

To check the requirement, loosen the motor clamp and remove the motor from the bracket, place the long side of the head of the combination square against the face of the coupling, and slide the blade of the square through the slot of the head until the end of the blade touches the finished surface of the motor foot as shown in Fig. 11. Revolve the coupling a half turn and recheck the distance. After checking the requirement, remount the motor, unless readjustments are required.

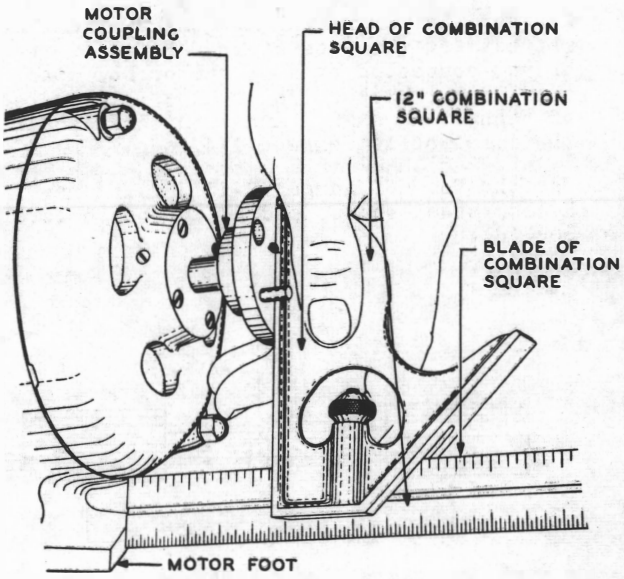

Fig. 11 - Method of Checking Motor Coupling Head Location

2.13 Horizontal Shaft Alignment

(a) All Drives: The horizontal connecting shafts of the drives shall be approximately parallel to the front of the frame and approximately level.

Use the No. 66D gauge, the No. 74D gauge, R-1313 fishline, R-8550 steel scale, and R-1258 bench level. See (d).

(b) Drives Connected by a 3- or a 6-type Shaft (High-speed Shafts): Fig. 12(A) - Neither the horizontal nor the vertical offset between the ends of the shafts of two drives or of a drive and a motor connected by a 3- or a 6-type shaft shall exceed 1/32 inch per linear foot of connecting shaft and in no case shall the total offset exceed 1/8 inch.

Use the No. 66D gauge, the No. 74D gauge, R-1313 fishline, R-8550 steel scale, and R-1258 bench level. See (d).

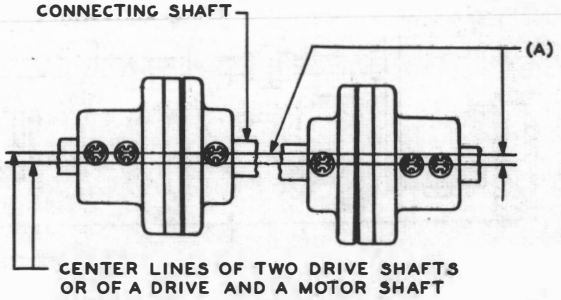

Fig. 12 - Relationship Between 3- and 6-type Shafts

(c) Drives Connected by a 2-type or No. 10A Shaft (Low-speed Shafts): Fig. 13(A) - Neither the horizontal nor the vertical offset between the ends of the shafts of two drives connected by a 2-type or No. 10A shaft shall exceed 1/8 inch per linear foot of connecting shaft, and in no case shall the total offset exceed 1/4 inch.

Use the No. 66D gauge, R-1313 fishline, R-8550 steel scale, and R-1258 bench level. → See (d).

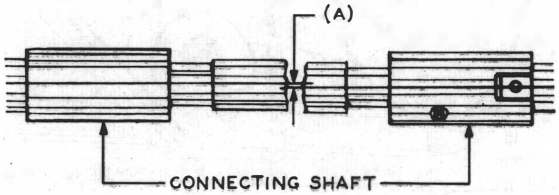

Fig. 13 - Relationship Between 2-type or No. 10A Shafts

(d) When checking shafts of 6-, 7-, and 8-type drives connected by a 3- or a 6-type connecting shaft, place the R-1258 bench level on the top side of the connecting shaft and note the position of the bubble. If it is centered the shaft shall be considered level. If the bubble is not centered place under one end of the level, the 0.015-inch blade of the No. 66D gauge for shafts 4 feet or less in length, the 0.012-inch blade of the No. 74D gauge for shafts 5 feet in length, or the 0.010-inch blade of the No. 74D gauge for shafts 6 feet in length. When checking shafts of drives connected by 2-type and No. 10A shafts, follow the same methods, except that the 0.062-inch blade of the No. 66D gauge is used for shafts 2 feet or less in length; the 0.040-inch blade for 3-foot shafts; the 0.031-inch blade for 4-foot shafts; the 0.025-inch blade for 5-foot shafts; and the 0.020-inch blade for 6-foot shafts. If the bubble is centered, the shaft is satisfactorily leveled. Then fasten a piece of R-1313 fishline around the side cover of the end drive and stretch it around the front of the frame so that it will be at the same level as the connecting shaft, fastening the other end to the motor. Place two wooden blocks (2 by 6 inches) or two condenser dummies of the same cross section, between the two end channels so that the lines will clear the protruding ends of the drives. See Fig. 14. Measure the horizontal distance from the fishline to the connecting shaft by using the R-8550 steel scale. If the distances are within those specified, the shafts shall be considered parallel to the front of the frame. After checking the requirement remove the fishline and blocks.

INTERRUPTER REQUIREMENTS

2.14 Cleaning the Interrupter Drum: The interrupter drum shall be kept free of dirt and oil or deposit due to sparking at the brushes.

2.15 Position of Brush Finger: Fig. 15(A) - With the brush finger resting on the brush, there shall be a clearance between the brush finger and its stop.

Gauge by eye.

2.16 Brush Fit: Fig. 15(B)

(a) Brushes shall not bind in their holders, neither shall they be loose enough to cause poor commutation.

(b) Brushes shall be so fitted as to insure successful commutation.

2.17 Eccentricity of the Interrupter Drum: Fig. 15(C) - The eccentricity of the interrupter drum shall not exceed 0.005 inch.

Gauge by eye.

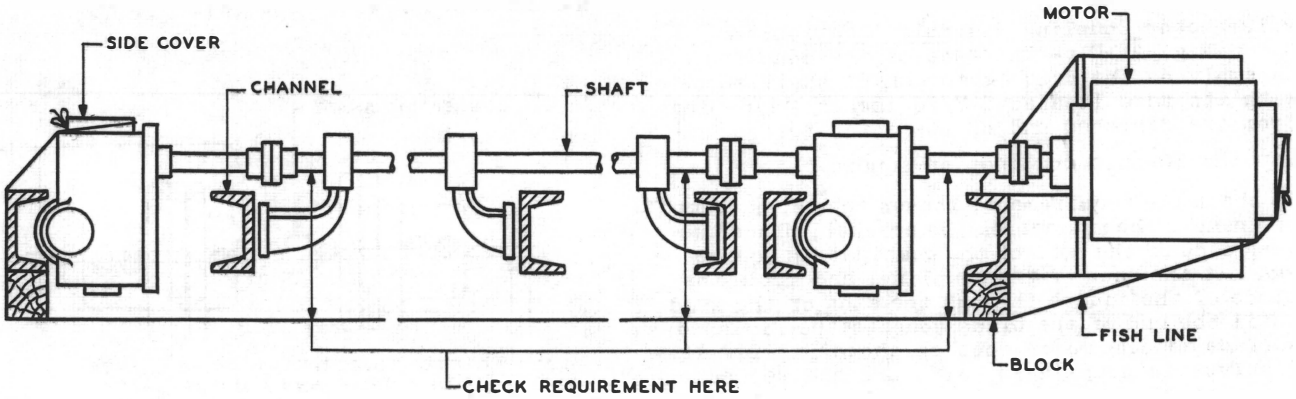

Fig. 14 - Method of Checking Alignment of Shaft Connected Drives

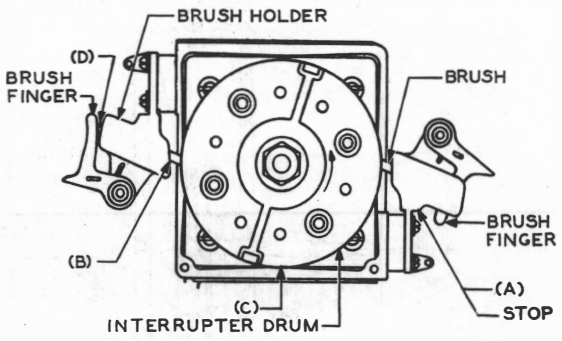

Fig. 15 - Location of Interrupter Brush

2.18 Brush Finger Tension: Fig. 15(D) - When the inside edge of the brush finger coincides with the upper corner of the brush holder, as gauged by eye, the tension of a brush finger, measured parallel to the length of the brush at a point in line with the face of the brush nearest the end of the brush finger, shall be

Min 87.5 grams
Max 137.5 grams

Use the No. 70J gauge.

ALARM MECHANISM REQUIREMENTS

2.19 Run and Stop Alarm Operation: With the associated motor at rest, the stop alarm contact shall make, and with the motor running up to speed, the run alarm contact shall make. In the midposition, it is permissible for the two contacts to overlap, but only for a small range of speed.

Cast Weight-type Alarm Mechanism Requirements

2.20 Contact Pressure

(a) Fig. 16(A) - With the motor running up to speed, the pressure between the run alarm contact and the operating spring contact shall be

Test - Min 35 grams, Max 60 grams
Readjust - Min 40 grams, Max 60 grams

Use the No. 68B gauge.

(b) Fig. 16(B) - With the motor stopped, the pressure between the stop alarm contact and the operating spring contact shall be

Test - Min 35 grams, Max 70 grams
Readjust - Min 40 grams, Max 70 grams

Use the No. 68B gauge.

2.21 Spring Tension: Fig. 16(C) - With the run alarm contact open, the contact spring shall rest on its associated stop spring as close as practicable to the end of the spring nearest the contact with a tension of

Test - Min 75 grams
Readjust - Min 87.5 grams

Use the No. 70J gauge. This tension shall be measured at the contact.

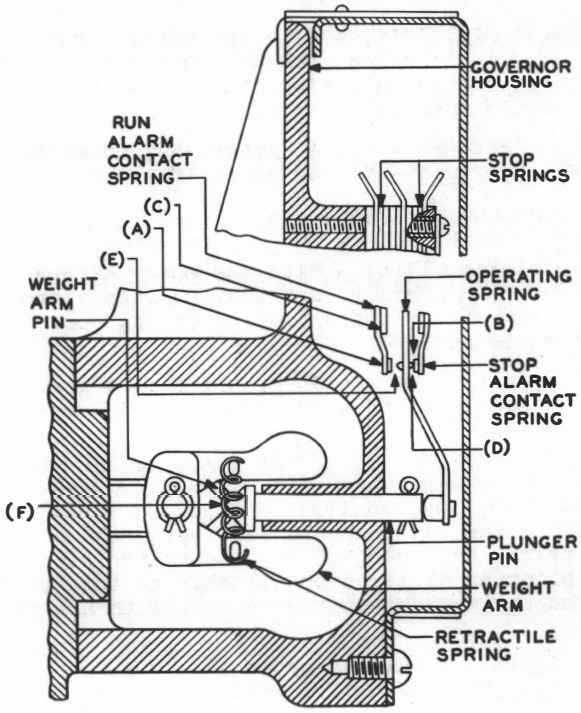

Fig. 16 - Cast Weight-type Alarm Mechanism

2.22 Contact Follow: Fig. 16(D) - With the motor stopped and with the end play of the motor worm taken up toward the motor coupling, there shall be a follow of the stop alarm contact of 0.005 inch.

Gauge by eye.

2.23 Contact Separation

(a) Fig. 16(E) - With the motor running up to speed, the separation between the stop alarm contact and the operating spring shall be 0.010 inch.

Gauge by eye.

(b) With the motor stopped, the separation between the run alarm contact and the operating spring shall be

Min 0.015 inch

Gauge by eye.

The thickness of the contact spring is 0.018 inch.

2.24 Plunger Pin Pressure: Fig. 16(F) - With the motor running up to speed the plunger pin shall not touch the pins on the weight arms with sufficient pressure to cause it to rotate.

Gauge by eye.

Link-type Alarm Mechanism Requirements

*2.25 Contact Pressure

(a) Fig. 17(A) - With the motor running up to speed, the pressure between the run alarm contact and the operating spring contact shall be

Test - Min 35 grams, Max 60 grams
Readjust - Min 40 grams, Max 60 grams

Use the No. 68B gauge.

(b) Fig. 17(B) - With the motor stopped, the pressure between the stop alarm contact and the operating spring contact shall be

Test - Min 35 grams, Max 70 grams
Readjust - Min 40 grams, Max 70 grams

Use the No. 68B gauge.

*2.26 Spring Tension: Fig. 17(C) - With the run alarm contact open, the contact spring shall rest on its associated stop spring as close as practicable to the end of the spring nearest the contact with a tension of

Test - Min 75 grams
Readjust - Min 87.5 grams

Use the No. 70J gauge. This tension shall be measured at the contact.

*2.27 Contact Follow: Fig. 17(D) - With the motor stopped and with the end play of the motor worm taken up toward the motor coupling, there shall be a follow of the stop alarm contact of 0.005 inch.

Gauge by eye.

*2.28 Contact Separation

(a) Fig. 17(E) - With the motor running up to speed the separation between the stop alarm contact and the operating spring shall be 0.010 inch.

Gauge by eye.

(b) With the motor stopped, the separation between the run alarm contact and the operating spring shall be

Min 0.015 inch

Gauge by eye.

The thickness of the contact spring is 0.018 inch.

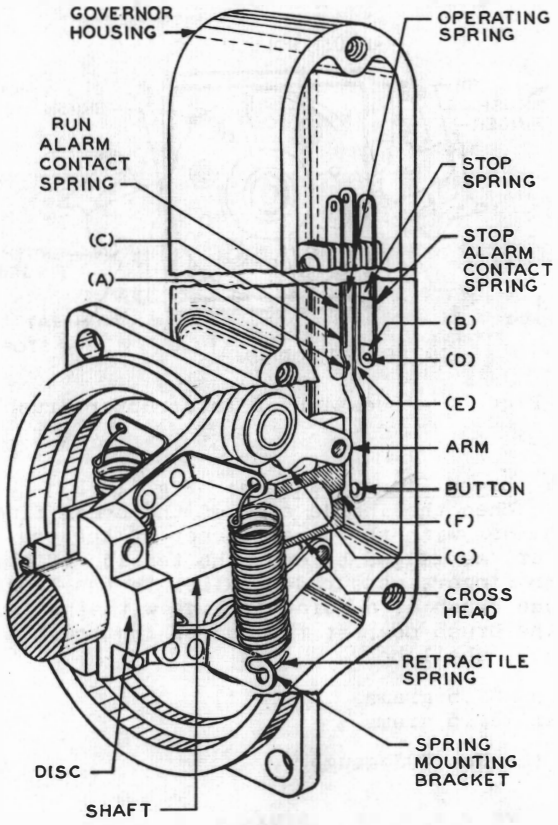

Fig. 17 - Link-type Alarm Mechanism

*2.29 Cross Head Position With Motor Running: Fig. 17(F) - With the motor running up to speed, the cross head shall rest against the end of the shaft, and there shall be a perceptible clearance between the button and the cross head.

Gauge by eye.

2.30 Position of Arms With Motor Stopped: Fig. 17(G) - With the motor stopped, the arms shall rest on the cross head.

Gauge by eye.

SHAFT AND BEARING REQUIREMENTS

2.31 Lubrication of Bearings: Fig. 18(A)

(a) The bearing shall be filled with KS-16326 oil to within the following limits. With the shaft at rest the oil shall not be higher than 1/32 inch below the top of the oil sight glass and with the drive in operation the oil shall not be lower than 1/32 inch above the bottom of the oil sight glass.

(b) Recommended Lubrication Intervals

(1) Periodic inspections shall be made to insure that the oil level is kept within these limits.

Note: Where drives are operating with KS-2245 oil, either KS-2245 or KS-16326 oil may be added, as necessary, to maintain the oil level until the changeover to KS-16326 oil has been made.

Caution: Exercise care while replenishing the oil to prevent the oil level being above the maximum level specified after it has had time to reach its true level.

(2) After turnover, it is recommended that the oil be drained off, examined, and the bearing housing filled with KS-16326 oil to the levels covered in (a) at the following intervals.

Drives operating with KS-2245 oil 2 years
Drives operating with KS-16326 oil 5 years

Note: For a mixture of KS-2245 and KS-16326 oils, the oil change interval shall be 2 years.

When first changing to KS-16326 oil for drives previously operating with KS-2245 oil or a mixture of KS-2245 and KS-16326 oils, the bearing housing shall be flushed with KS-16326 oil as covered in requirement 2.32.

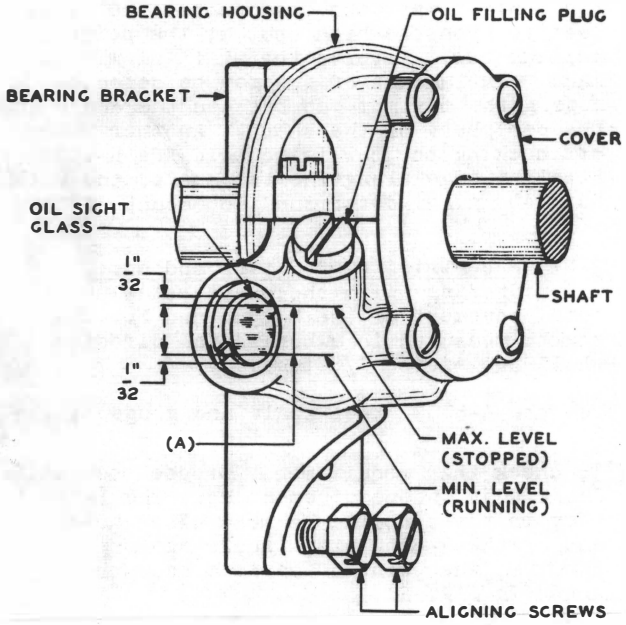

Fig. 18 - Oil Level Limits of Bearing Housing

2.32 Flushing Bearing Housing

(a) Before Turnover: The bearing housing shall be drained and refilled with KS-16326 oil. Following this the drive shall be operated under power for a minimum of 5 minutes, the bearing housing drained, and again refilled with KS-16326 oil as covered in requirement 2.31.

(b) After Turnover:

(1) Where KS-2245 oil or a mixture of KS-2245 and KS-16326 oils has been in use, the bearing housing shall be drained and refilled with KS-16326 oil. Following this, the drive shall be operated under power for a minimum of 15 minutes, the bearing housing drained, and again refilled with KS-16326 oil as covered in requirement 2.31.

(2) Where KS-16326 oil has been in use, the bearing housing shall be drained and the oil examined. The bearing housing shall then be refilled with KS-16326 oil as covered in requirement 2.31, unless conditions such as excessive dirt and sediment, which give evidence of impaired lubrication, are observed. In such instances only, it will be necessary to refill the bearing housing with KS-16326 oil and operate the drive under power for a minimum of 15 minutes, following which the oil shall again be drained and the bearing housing refilled with KS-16326 oil.

(3) If the oil is drained from the bearing housing and immediately refilled, it will not be necessary to stop the drive.

2.33 Lubrication of 2-type Shaft Couplings

(a) Couplings shall be adequately lubricated with No. 1 Marfak grease applied to the following coupling parts.

Bearing Surfaces of the Coupling Pins - Fig. 19(A)

All Surfaces of the Coupling Blocks - Fig. 19(B)

Slots of Coupling Head - Fig. 19(C)

The couplings shall be taken apart, the parts cleaned, and then lubricated by applying a film of the grease to the specified surfaces.

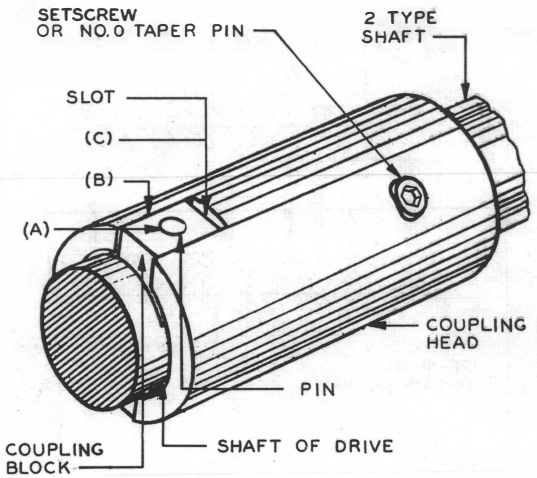

Fig. 19 - 2-type Shaft Coupling

(b) Recommended Lubrication Intervals: After turnover, it is recommended that the parts listed in requirement (a) above be lubricated at 2-year intervals. 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.

2.34 Lubrication of No. 10A Shaft Couplings

(a) Before assembling the coupling in place on the shaft, the parts shall be thoroughly cleaned and then coated with a film of KS-6438 oil.

(b) Fig. 20(A) - The felt oil retaining pads shall be saturated with KS-6438 oil.

(c) After turnover and with the shaft stopped the following points shall be adequately lubricated with KS-6438 oil.

Bearing Surfaces of the Coupling Pin - Fig. 20(B)

Coupling Blocks - Fig. 20(C)

Slots of Coupling Head - Fig. 20(D)

When lubrication is necessary, two discharges of oil shall be applied to each coupling block.

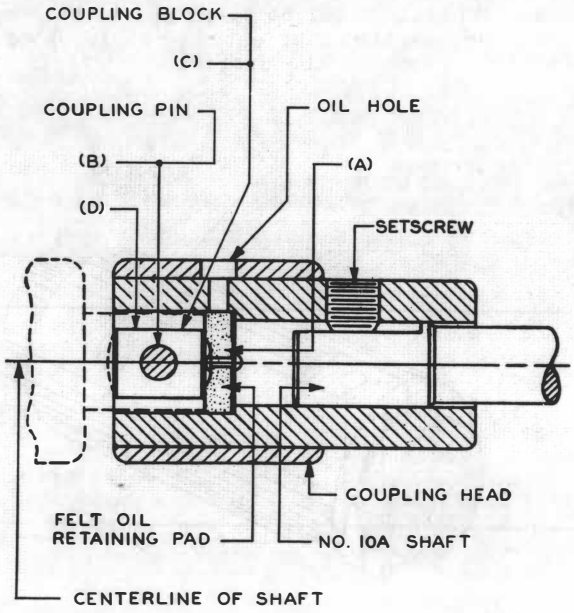

Fig. 20 - No. 10A Shaft Coupling

(d) Recommended Lubrication Intervals: After turnover, it is recommended that the parts listed in requirements (b) and (c) be cleaned and relubricated at intervals of one year. This interval may be extended if periodic inspections have indicated that local conditions are such as to insure that requirements (b) and (c) will be met during the extended interval.

2.35 Record of Lubrication and Flushing: During the period of installation, a record shall be kept by date of flushing of the bearing housings, of oil replacements, and the lubrication of 2-type and No. 10A shaft couplings, and this record shall be turned over to the telephone company with the equipment. If no lubrication or flushing has been done it shall be so stated.

*2.36 Straightness of 3- and 6-type Shafts: Shafts shall be straight within .005 inch throughout their entire length. Any bow shall be at least 2 feet in length.

Use the R-8550 steel scale or the R-1653 straight edge and No. 74D gauge.

To check this requirement, hold the R-8550 steel scale against a fixed surface and move the scale toward the shaft until the scale just touches the high spot at the point of maximum bow. Revolve the shaft slowly by hand. The amount of bow may be detected by noting the maximum gap between the scale and the periphery of the shaft. Another method of checking the bow is to hold the R-1653 straight edge alongside the shaft, and with a No. 74D gauge, determine the amount of bow.

2.37 Eccentricity of 2-type and No. 10A Shafts: With the shaft rotating, the total movement of the 2-type and No. 10A shafts measured in a horizontal direction shall not exceed 1/8 inch.

Use the R-8550 steel scale and gauge by eye.

To check this requirement, proceed as follows. Check that the requirement covering lateral play in the coupling is met. Then hold the end of the R-8550 steel scale against the shaft at the point of maximum eccentricity as shown in Fig. 21.

2.38 End Play of 2-type and No. 10A Shafts: Fig. 22(A) and 23(A) - The coupling heads shall be so mounted on the shaft that with all the end play of the associated apparatus taken up in a direction towards the coupling, the gap between the coupling blocks and the slots shall be

Min 0.005 inch
Max 0.010 inch

Use the No. 74D gauge.

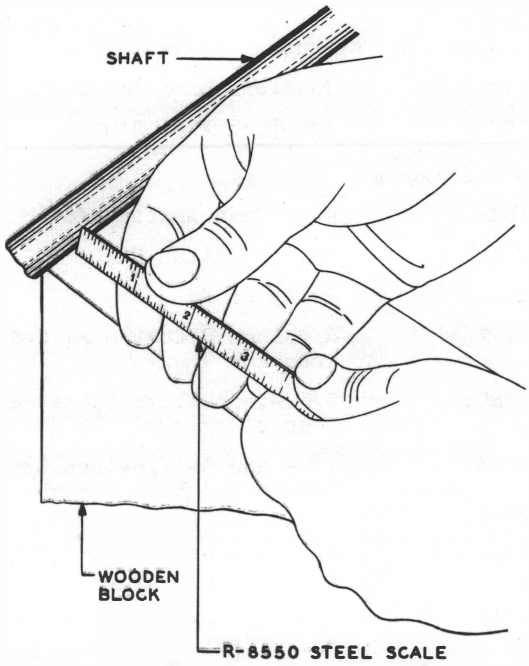

Fig. 21 - Method of Checking Eccentricity of 2-type and No. 10A Shafts

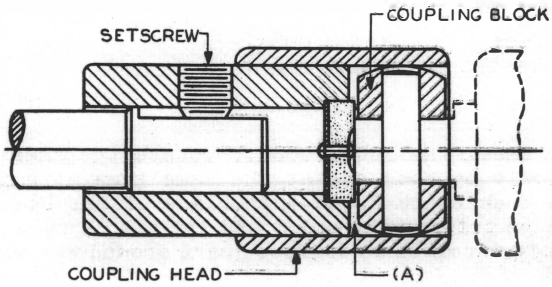

Fig. 23 - Location of No. 10A Shaft Coupling

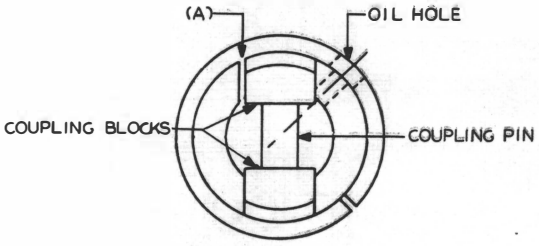

Fig. 24 - Lateral Play of No. 10A Shaft Coupling

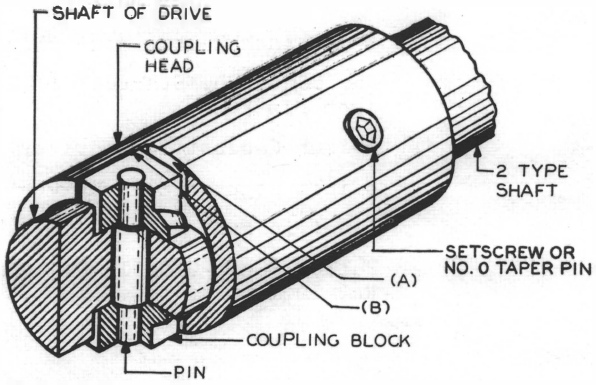

Fig. 22 - Location of 2-type Shaft Coupling

2.39 Lateral Play of Couplings: Fig. 22(B) and 24(A) - There shall be some lateral play of the coupling in any direction at right angles to the length of the shaft but this lateral play shall be

At Turnover - Max 0.010 inch
After Turnover - Max 0.020 inch

Gauge by eye and feel.

2.40 End Play of 3- and 6-type Shafts: Fig. 25(A) - The coupling heads shall be so mounted on the shaft that there shall be some end play, but this end play shall be

Max 3/64 inch

Gauge by eye and by feel.

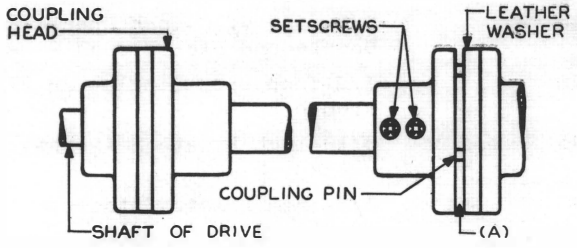

Fig. 25 - Location of Shaft Couplings of 3- and 6-type Shafts

2.41 Mounting of Bearings: Bearings shall be rigidly fastened to the frame.

Gauge by feel.

2.42 Alignment of Bearings: Bearings shall be so aligned that the associated shaft shall be free from bind and excessive vibration.

Gauge by feel.

2.43 Oil Closure Clearance: Fig. 26(A) - The clearance between the oil closure lips and the shaft shall be

Test - Min 0.003 inch
Readjust - Min 0.005 inch

Use the No. 74D gauge.

To check the requirement, rotate the shaft slowly by hand and at the same time attempt to insert the 0.005-inch blade of the No. 74D gauge between the shaft and the oil closure lips at four points 90 degrees apart around the shaft.

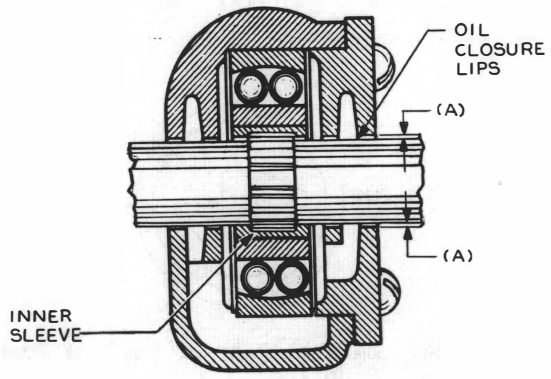

Fig. 26 - Oil Closure Clearance of Bearings

3. ADJUSTING PROCEDURES

3.001 List of Tools, Gauges, and Materials

Code or Spec No.	Description
Tools	
245	3/8- and 7/16-inch Open Double-end Flat Wrench
→246	1/2-inch Open Single-end Flat Wrench
295	5/16-inch Bristo Setscrew Wrench
296	3/8-inch Bristo Setscrew Wrench
344	Offset Screwdriver
358	Cleaning Tool
388A	3/16- and 1/4-inch Open Double-end Offset Wrench
431A	Oil Gun
453A	Swivel Spanner Wrench
485A	Smooth Jaw Pliers
KS-6367	7/16- and 5/8-inch Open Double-end Flat Wrench
KS-6737	1/4-pint Screened Funnel
KS-7782	Parallel Jaw Pliers
KS-8097	7/16- and 5/8-inch Offset Box Wrench
→KS-14164	Brush
R-1005	Jewelers Screwdriver
R-1021 (or replaced 1/4-inch round)	1/2-inch Flat Brush
→R-1026	Gear Case Setting Tool
R-1051	6-inch Pillar File
R-1060	Putty Knife
R-1317	5/8-inch Offset Hex. Socket Wrench
R-2485	5/32-inch Allen Socket Screw Wrench
→R-2593 (or replaced R-2382)	7/8- and 1-1/16-inch Open Double-end Flat Wrench
R-2812	3/16-inch Allen Socket Screw Wrench
R-5850	5/8- and 3/4-inch Open Double-end Offset Wrench
R-6440	3/8-inch Square Box Wrench
R-8950	Rubber Syringe
-	Small Stiff Brush (typewriter brush)
-	Impact Goggles
-	4-ounce Riveting Hammer
-	6-1/2-inch P-long-nose Pliers
-	No. 565 L. D. Starrett 5/32-inch Pin Punch
-	3-inch Cabinet Screwdriver
-	4-inch Regular Screwdriver
→-	Electric Fan
→-	Puller, Grip-O-Matic Owatonna No. 1001
Gauges	
66D	Thickness Gauge Nest
68B	70-0-70 Gram Gauge
→70J (or replaced 70E)	0-150 Gram Gauge
74D	Thickness Gauge Nest
R-1258	6-inch Adjustable Bench Level
R-1653	3-foot Steel Straightedge
R-8550	6-inch Steel Scale
-	12-inch Combination Square

Code or Spec No.	Description
Materials	
KS-2423	Cloth
KS-6438	Oil
KS-6824	Sealing Compound
KS-7860	Petroleum Spirits
KS-8372	Stabilized Trichloroethylene
KS-14666 (or replaced D-98063)	Cleaning Cloth ←
KS-16326	Oil ←
P-29094	Washer (0.005-inch thick)
P-29095	Washer (0.010-inch thick)
R-1313	Fishline
-	Flat Piece of Hardwood (for stirring sealing compound)
-	Marfak No. 1 Grease
-	Pro-tek (E. I. DuPont de Nemours & Co., Inc.) or Practi-Kreme (Practi Laboratories)
-	Receptacles (for drained oil)
-	No. 0000 Sandpaper or Equivalent Abrasive Cloth
-	Shellac
-	Toothpicks, Hardwood, Flat at One End and Pointed at Other
-	Touch Up Paint (to match apparatus)
-	Wire and Block (for supporting drive shaft)
- (2 required)	Wooden Blocks (2 by 6 inches) or Condenser Dummies (See 3.13)
-	Wooden Block (for supporting the hands) (See 3.37)

3.002 Before stopping a drive to make any of the inspections or readjustments specified herein, ascertain whether it is necessary to make any of the associated circuits busy. Make busy circuits so affected, in the approved manner. If two corresponding sides of adjacent frames are run by the same motor, and it is necessary to remove the horizontal shaft from one frame, or to have the shaft at rest for an extended period so that adjustments may be made, the horizontal shaft may be uncoupled and the side of the frame not affected by the adjustment restored to service. If, on adjacent bays of unassociated apparatus connected by a horizontal shaft, it is necessary to stop the motor to work upon either a shaft or a drive, the horizontal shafts may be uncoupled and those bays not affected by the adjustments restored to service.

3.003 When removing the KS-6824 sealing compound from a sealed part, it is advisable to use the goggles to prevent flying particles of the compound getting in the eyes.

3.004 If, for any reason, it is necessary to remove the oil sight, remove it with the No. 453A wrench and replace the gaskets by new gaskets as covered in Section 159-725-801.

GENERAL PROCEDURES

3.01 Cleaning (Rq 2.01)

(1) Gear Cases and Bearing Housings: Remove oil and dust from the gear cases and bearing housings with a KS-14666 cleaning cloth moistened with KS-7860 petroleum spirits.

Couplings

(2) General: Clean all moving parts as follows. Wrap a KS-2423 cloth tightly around the No. 358 cleaning tool in a spiral manner so that one end of the tool is completely covered with the cloth. In this way the cloth will cover about one half the length of the tool, and the loose end can be held in the hand or tied with a piece of string. Moisten the cloth with KS-7860 petroleum spirits and hold the tool so that the flat portion of the cloth covered end of the tool presses firmly against the surface to be cleaned.

(3) 2-type and No. 10A Shaft Couplings: With the shaft at rest, remove the guard over the coupling and loosen the setscrews with the No. 295 Bristo setscrew wrench or R-2485 Allen socket screw wrench, or where the coupling head is pinned to the shaft, drive out the tapered pin using the 4-ounce riveting hammer and the 5/32-inch pin punch. Place a piece of wire around the shaft and fasten the wire to the frame, or place a wooden block under the shaft in order to support it and prevent strain on the other coupling, and then shift the coupling head back on the shaft. If more convenient, the shaft may be removed. Clean the parts of the coupling with a KS-14666 cleaning cloth saturated with KS-7860 petroleum spirits. Immediately after cleaning a part, dry it with a clean, dry KS-14666 cleaning cloth. Lubricate the coupling as covered in 3.33 and 3.34, and reassemble the parts, making sure that requirements 2.38 and 2.39 are met.

3.02 Leakage at Sealed Joints (Rq 2.02)

(1) General: Do not break the seals unless it is absolutely necessary. When it is necessary, however, stop the drive, if this can be done without interfering with service. If the drive cannot be stopped due to service reactions, make a special effort to arrange the work so that it can be completed in the shortest time possible so that the bearings will not overheat.

(2) Gear Case: Allow the oil in the gear case to drain into a suitable receptacle. To do this, remove the drain and filling plugs with the No. 245, No. 388A, KS-6367, KS-8097, or R-6440 wrench, depending on the size of the plug and shape of the plug head.

(3) Bearings: See 3.32 for procedures to be followed in draining the oil from the bearings.

(4) Remove the screws from the part or parts to be resealed with the No. 344 screwdriver, or 4-inch regular screwdriver. Take care not to burr the screws. Remove any sealing compound from the screws by first soaking them in a small container of KS-8372 trichloroethylene and then applying a small stiff typewriter brush to the coated parts. In some cases it may be more economical to replace screws that have been removed from the sealed joints with new screws rather than clean old screws.

(5) By tapping the part lightly, it may be readily loosened and then removed. If the coupling head of the horizontal shaft prevents moving a cover sufficiently to gain access to the surfaces to be resealed, remove the coupling head as covered in 3.01.

(6) See that all oil is removed from the bearing, gear case, and assembled parts where there is any possibility of the oil coming in contact with the surfaces to be sealed. This may be accomplished by squirting KS-7860 petroleum spirits on the oil covered parts by means of the R-8950 syringe, and then wiping them with the KS-14666 cleaning cloth. In filling the syringe it is better to press in the end of the rubber bulb rather than press in the sides. If this operation is performed on a drive which is running, exercise care in applying the petroleum spirits to keep as much of it away from the bearing surfaces as possible, and in wiping with the KS-14666 cleaning cloth, to prevent the cloth from catching in the rotating parts. It is very important that every trace of oil be removed from the vicinity of the surfaces to be sealed, as well as from the surfaces themselves. In the case of bearings it may be necessary to stop the drive operating the shaft and slide the bearing out of the housing in order to remove all of the oil from the vicinity of the surfaces to be sealed. Make sure that all the petroleum spirits are removed from the syringe after using it to retard deterioration of the rubber.

(7) Thoroughly coat the hands and wrists with "Pro-tek" or "Practi-Kreme," rubbing the cream into the pores of the skin and under and around the nails of both hands. One application of "Pro-tek" or "Practi-Kreme" will last 3 to 4 hours. After coating the hands, proceed as follows.

(8) The sealing compound used in the old seals must be thoroughly removed. This old compound may be washed off more readily if KS-8372 trichloroethylene is applied immediately after the seal is broken. However, in some cases it may require scraping with the R-1060 putty knife. Remove any burrs on the surfaces to be sealed with the R-1051 file. Be sure that the sealing compound is also removed from the screw holes in the covers and blind holes in the gear case. To remove the sealing compound from the blind holes, insert the R-1005 screwdriver in the hole and, while holding the screwdriver in place, rotate the screwdriver blade in order to cut the compound loose. Take care in doing this not to damage the screw threads. Flush the loosened compound from the hole with KS-7860 petroleum spirits using the R-8950 syringe as covered in (6).

Caution: When using KS-8372 trichloroethylene, exercise care to avoid the use of excessive amounts. To avoid excessive evaporation, the cloths used with KS-8372 trichloroethylene may be thrown into a suitable closed container. If considerable usage of KS-8372 trichloroethylene is to be made at one location, use a fan to dissipate the fumes. Locate the fan so that it will direct a current of air toward the part being cleaned. The fumes from the cleaning fluid are heavier than air and the use of the fan avoids the accumulation of the fumes in a sufficient quantity to be objectionable.

(9) After all work using the trichloroethylene has been completed, thoroughly wash the hands and wrists with soap and warm running water to remove the "Pro-tek" or "Practi-Kreme."

(10) If leaking is due to a porous casting, it may be advisable to shellac the interior of the gear case with the R-1021 brush. In some cases it may not be possible to perform this operation with the drive running. Take care to prevent the shellac from getting on the gear teeth and bearing surfaces. The gear case must not be resealed until the shellac is dry.

(11) Stir the KS-6824 sealing compound thoroughly with a flat piece of hard smooth wood just before using it. Make sure that the surfaces to be sealed are thoroughly dry and free from oil before applying a liberal coat of the sealing compound. Apply the compound with the R-1021 brush. When the sealing compound is of such a consistency that it cannot be applied easily with the brush, thin it with KS-8372 trichloroethylene. Make up the joints as soon as the compound has been applied to the surfaces to be sealed. When using the compound, it is not necessary to leave an interval of time between applying the compound and the making of the joints. The pigment or thicker part of the compound does the sealing, and the thinner part of the compound is only

used as an aid in conveying the sealing material to the surfaces to be sealed. At this time check that the oil closure clearance requirement is met.

Caution: When sealing the lower half of the cover of link-type alarm mechanisms, take care not to get the sealing compound on the fracture between the upper and lower halves of the cover, as the sealing compound will cause interference when reassembling the parts.

Caution: The covers of 32-type drives are not interchangeable. Take care when remounting them that they are mounted in their proper positions and that the bearings in the covers and gear case are aligned.

(12) Apply the sealing compound to the screw threads with the KS-14164 brush taking care not to get too much on the threads, and taking care not to get the compound on the end of the screw. When setting up the screws, make sure that the part bears uniformly throughout its entire contact surface. This can be accomplished by making several rounds of the screws in tightening. Do not tighten completely the first time around.

(13) If the top portion of the bearing housing has been removed, set up the four screws, securing the cover fairly tight, before the screws securing the top of the housing are retightened, in order to line up the finished surfaces of the two portions of the housing.

Caution: When remounting the bearing cover, be sure that the rectangular opening on the inside of the cover is down.

(14) After sealing the drive and securing the cover with the screws, fill the gear case or bearing with the KS-16326 oil to approximately the maximum limit specified in requirements 2.04 and 2.31. If leakage is noted, the joint will have to be broken and resealed in accordance with the foregoing procedures.

(15) If the shaft guard has been removed, reseal and remount it as covered above.

(16) After the sealing compound has hardened, touch up the joint with a quick drying paint that matches the original finish.

(17) Where oil leaks are noticed between the oil guard associated with the eccentric coupling and the gear case, the condition may be corrected as follows. Stop the drive as covered in (1). Without removing the eccentric coupling guard, raise the oil guard as high as possible and thoroughly clean the bottom surface of the guard and top surface of the gear case with a KS-14164 ← brush dipped in KS-7860 petroleum spirits and wipe the parts dry with a KS-14666 cleaning cloth. Make sure that the oil guard rests evenly on the gear case. Then, with another KS-14164 brush, apply a thick ← coating of KS-6824 sealing compound to the underside of the oil guard and the surface of the gear case on which the guard rests.

Note: The consistency of the sealing compound should be as heavy as application with the KS-14164 brush will permit and ← shall be liberally applied.

(18) Rotate the guard several times against the gear case to insure the sealing compound being distributed evenly all around the surfaces to be sealed. Then position the guard on the top of the gear case to insure that the oil guard does not touch the lugs of the eccentric coupling in any position and that the clearance between the oil guard and the eccentric coupling guard is satisfactory. Hold the guard in this position until the sealing compound has set.

(19) With the oil guard satisfactorily positioned, build up a bead of sealing compound around the sealed joint by additional applications of the sealing compound as shown in Fig. 23. Take care in doing this not to disturb the position of the oil guard.

Caution: Take care after sealing the joint between the oil guard and gear case that the position of the oil guard is not disturbed for approximately 24 hours, as the heavy application of the sealing compound requires a long period to harden, and shifting the oil guard will break the seal.

(20) After the sealing compound has thoroughly dried, the sealed joint may be painted with a quick drying paint that matches the finish of the parts.

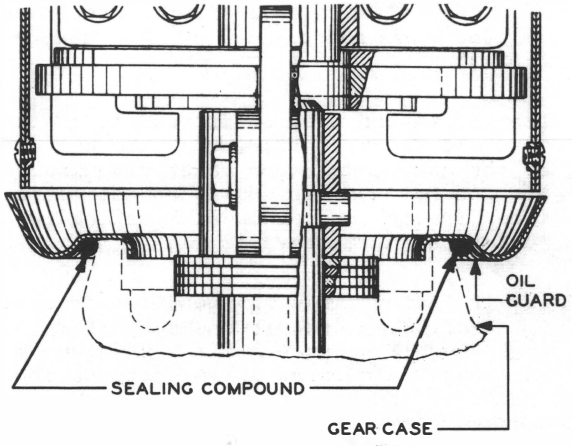

Fig. 27 - Sealing Oil Guard and Gear Case

3.03 Leakage at Oil Closures (Rq 2.03)

(1) If there is evidence of oil leaking out of an oil closure, it is usually due to dirt accumulating in the clearance between the shaft and the oil closure lips. It may also be due to a lack of clearance between the oil closure lips and the shaft or the oil groove in the oil closure lips being plugged.

(2) To gain access to the oil closure of a worm shaft of a drive connected by a 2-type or No. 10A shaft, remove the shaft guard mounting screws with the No. 344 and 4-inch regular screwdriver and remove the guard.

(3) To remove the dirt from an oil closure and oil groove, wipe off the outside of the gear case and associated coupling or bearing and associated shaft with the KS-14666 cleaning cloth. Do not use waste or cheesecloth for this purpose.

(4) Force KS-7860 petroleum spirits into the closure using the R-8950 syringe, after which observe that all dirt or lint has been removed. If dirt or lint is still present, again force the mineral spirits into the closure and inspect. Repeat this operation until all dirt or lint has been removed.

(5) Immediately after flushing with the petroleum spirits, empty the syringe and use it to force air into the closure. The purpose of this blowing operation is to effect the rapid evaporation of the petroleum spirits to prevent its acting as a conveyor of the oil inside the oil closure.

(6) It is not necessary to stop the drive to apply the above methods for cleaning, provided precautions are taken to prevent the cloth from catching between the drive and the moving parts.

(7) After cleaning the oil closure, remount the shaft guard, sealing it as covered in 3.02(15).

(8) If, in the case of drives, it is found that there is leaking at the oil closure of the gear case cover after cleaning, check the gap between the shaft and the oil closure lips as covered in 3.07 making readjustments where necessary.

(9) If, after cleaning the oil closure of a bearing as described above, it is noted that the oil closure still leaks, check that the proper clearance exists between the shaft and the oil closure lips, and, if necessary, make the required adjustments as covered in 3.43.

DRIVE PROCEDURES

3.04 Lubrication (Rq 2.04)

(1) When the oil foams excessively in the drive, it is usually an indication that the oil is too low and that air is being forced through the pump with the oil.

(2) If, upon inspection through the oil sight glass, it is found necessary to replenish the oil in the gear case, remove the filling plug with a No. 245, No. 388A, KS-6367, KS-8097, or R-6440 wrench, depending upon the size of the plug and the shape of the plug head. Then, with the motor running, pour in KS-16326 oil through the KS-6737 screened funnel until the gear case fills to approximately the maximum level specified. The screened funnel is used to prevent foreign matter being carried into the drive with the oil.

(3) Exercise care while replenishing the oil to prevent the oil level being above the maximum level specified when it has had time to reach its true level.

(4) Insert the filling plug finger tight to prevent subsequent difficulty in removing it.

(5) Wipe off any oil that may have been spilled with the KS-14666 cleaning cloth.

3.05 Flushing (Rq 2.05)

(1) When it is found necessary to flush the gear case, remove the filling and drain plugs with a No. 245, No. 388A, KS-6367, KS-8097, or R-6440 wrench, depending upon the size of the plug and the shape of the plug head, and allow the oil to drain from the gear case into a receptacle.

(2) Then insert the drain plug and with the drive operating, pour a small amount, (approximately 1/2 pint) of KS-16326 oil into the gear case through the filling hole at the top. Remove the drain plug and allow the oil to drain off.

(3) After flushing, insert and seal the drain plug as covered in 3.02. When the drain plug is a taper plug, insert the plug 1/4 of its length into the gear case. Then paint the remaining threads with KS-6824 sealing compound and tighten the plug in place. Where the plug is not a taper plug, do not apply the sealing compound to either plug or gasket. Take care in tightening the plug not to tighten it too tight. Where a gasket is used, an effective seal will not be obtained when the plug is excessively tightened due to the gasket tending to be squeezed out of place.

This is particularly true where parapene gaskets are used. Parapene gaskets may be recognized as such by a strong sulphur odor when the gaskets are new. Refill the gear case as covered in 3.04 and insert the filling plug finger tight.

3.06 Record of Lubrication and Flushing (Rq 2.06)
(No procedure)

3.07 Clearance Between the Shaft and the Oil Closure Lips of Gear Case Covers (Rq 2.07)

(1) If the clearance is not satisfactory, proceed as follows. Remove the cover as covered in 3.02. Clean and reseal the screws and the surfaces of the cover and drive as covered in 3.02. If difficulty is experienced in cleaning the screws, replace them. Remount the cover and insert and tighten the cover mounting screw finger tight. Before the sealing compound is set, shift the cover, as required, to meet the specified clearance. If the cover cannot be satisfactorily located, refer the matter to a supervisor. With the cover satisfactorily located, tighten the mounting screws securely. Tighten the assembly screws as covered in 3.02.

(2) If the coupling was removed, remount it as covered in 3.38 and 3.39. Remount and seal the shaft guard as covered in 3.02.

3.08 Freedom of Operation of Gearing (Rq 2.08)

(1) Before checking the drive gears for bind, isolate the drive as follows. Loosen the motor clamp and slide the motor back. ← Disconnect the vertical drive shaft as covered in Section 159-735-701. ← Using the 4-inch regular screwdriver, remove the shaft guard, if furnished, from the horizontal shaft. If the shaft is a 2-type or No. 10A shaft, loosen the setscrew in the coupling head with the No. 295 Bristo setscrew wrench or the R-2485 Allen socket screw wrench, or drive out the taper pin with the hammer and 5/32-inch pin punch. Place a piece of wire around the shaft and fasten the wire to the frame, or place a wooden block under the shaft in order to support it and prevent strain on the other coupling, and then slide the coupling head back on the shaft and remove the blocks and coupling pin, and either support or remove the shaft from the frame. If the shaft is a No. 3A or 6-type shaft, loosen the setscrews in each of the coupling assemblies and slide them back on the shaft and remove the leather washer.

(2) With the associated shaft disconnected, turn the coupling assembly of the drive by hand and note whether or not the gears turn smoothly and without excessive torque.

(3) If excessive bind is noted, refer the matter to the supervisor.

(4) If the gears turn smoothly, remount the parts that were removed as follows. Reassemble the eccentric coupling between the vertical drive shaft and vertical shaft of the drive as covered in Section 159-735-701. If the horizontal shaft is a 2-type or No. 10A shaft, remount the blocks and pins and check that requirements 2.38 and 2.39 are met. Then slide the coupling head over the blocks and pin and secure it in place with either the setscrews or taper pin. If the horizontal shaft is a No. 3A or 6-type shaft, relocate and engage the coupling assemblies on the shaft. Check that requirement 2.40 is met and tighten the setscrews securely in place. Remount the motor. ←

3.09 Freedom of Operation of Motor (Rq 2.09)

(1) To remove a bind caused by poor alignment of the motor with the worm shaft, change the relative position of the motor coupling head and the drive coupling head either by shifting the position of motor coupling, by shifting the motor bracket, or by shifting the position of the drive.

(2) To shift the position of the motor coupling, loosen the motor clamp and slide the motor back. Turn the motor shaft 1/3 turn. This shifts the relative position of the coupling assemblies. Slide the motor back into place and tighten the motor clamp. Start the drive and check that the requirement is met. If bind is still present, repeat the above operation.

(3) If the bind cannot be removed as covered in (2) and the motor and drive are mounted on separate brackets, shift the motor bracket to a position in which the bind is removed. If the bracket is pinned, refer the matter to the supervisor. If the bracket is not pinned, loosen the bracket mounting screws as covered in Section 159-725-801 and adjust the setscrews with the No. 296 Bristo setscrew wrench or the R-2812 Allen socket screw wrench until the best position is obtained. Tighten the bracket mounting screws and check the drive for bind by rotating the motor coupling slowly by hand.

(4) Where the drive and associated motor are mounted on the same bracket, the drive may be shifted so as to bring it into alignment with the motor, providing this does not throw the drive out of alignment with the adjacent drive, if there is any, and with the vertical drive shaft. To do this, loosen the drive mounting screws as covered in Section 159-725-801 and shift the drive until the bind has been removed. Check the alignment of the drive as covered in requirement 2.13 and the alignment of the drive and shaft as covered in Section 159-735-701. Tighten the mounting screws.

3.10 Location of Coupling Assembly on Drive Shaft (Rq 2.10)

3.11 Horizontal Distance Between Coupling Assembly on Drive Shaft and Motor Stop (Rq 2.11)

(1) Location of Coupling Assembly on Drive Shaft: If the clearance between the coupling assembly on the drive shaft and the cover is not satisfactory, loosen the setscrews in the coupling assembly with the No. 295 Bristo setscrew wrench or the R-2485 Allen socket screw wrench, and shift the assembly as required. Take care in doing this that requirement 2.11 is met. Securely tighten the setscrews.

(2) Horizontal Distance Between Coupling Assembly on Drive Shaft and Motor Stop: If the mean distance is not within the specified limits, and the clearance between the coupling assembly on the motor shaft and the cover is satisfactory, proceed as follows. On 1034- and 1134-type drives, loosen the drive mounting bolts with the KS-6367 wrench and shift the drive as required. Then tighten the bolts securely. Take care in making this adjustment that requirements 2.13 and 2.38 are still being met. On other drives, the motor bracket is pinned and the matter should be referred to the supervisor.
→ After making the necessary adjustments, re-
→ mount the motor.

3.12 Motor Coupling Assembly Location (Rq 2.12)

(1) If the location of the motor coupling assembly is not satisfactory, loosen the setscrews with the No. 295 wrench or the R-2485 Allen socket screw wrench, and shift the motor coupling assembly as required. Tighten the setscrews securely. After mak-
→ ing the necessary adjustments, remount the motor.

3.13 Horizontal Shaft Alignment (Rq 2.13)

(1) If the connecting shaft is not level, or if the connecting shaft does not line up with the R-1313 fishline, loosen the drive mounting screws with one of the wrenches provided for the purpose and shift the drive until the requirement is met, making sure that the drive is approximately level. Tighten the drive mounting screws sufficiently to maintain this adjustment. To shift the drive sufficiently it may be necessary to remove the pins, in which case refer the matter to the supervisor.

(2) After making the above adjustments, the drive must be checked for its proper alignment with respect to its associated motor as specified in requirement 2.09, and with the vertical drive shaft as covered in Section 159-735-701.

INTERRUPTER PROCEDURES

3.14 Cleaning the Interrupter Drum (Rq 2.14)

(1) To gain access to the interrupter, loosen the cover mounting screws with the 4-inch regular screwdriver and remove the cover.

(2) Inspect the drum for evidences of oil, dirt, or foreign matter on the drum surface or surfaces adjacent to the drum, which might interfere with the proper operation of the interrupter.

(3) If oil is detected on the surface of the drum, it is probably due to an accumulation of dirt in the oil closure causing the
↱ oil closure to leak. To correct the condition, remove the drum mounting nut using the No. 246 wrench. Remove the washer and drum. Normally the drum can be removed from the shaft without difficulty, but occasionally the drum binds on the shaft. In such cases, use the Grip-O-Matic puller to remove the drum. Do not attempt to pry it off the shaft, as this might bend the shaft and
↳ cause eccentricity. Clean the oil closure as covered in 3.03.

(4) Clean the interrupter drum and adjacent surfaces with a folded, clean, dry KS-2423 cloth wrapped around the end of the No. 358 cleaning tool.

Caution: Wrap the KS-2423 cloth around the cleaning tool in such a direction that the action of the drum rubbing against it tends to wrap it tighter. This is to prevent fouling of the cloth in the interrupter parts.

(5) Other than as specified above, no cleaning of the interrupter drums is necessary. Ordinarily, do not use sandpaper as this removes the burnish and, unless carefully done, may cause the brushes to cut.

↱ (6) Mount the interrupter drum on the shaft. Mount the washer and nut over the end of the shaft and tighten securely, using the
↳ No. 246 wrench. Check requirement 2.17.

(7) Remount the cover and securely tighten the cover mounting screws.

3.15 Position of Brush Finger (Rq 2.15)
3.16 Brush Fit (Rq 2.16)

(1) Remove the interrupter cover mounting screws with the 4-inch regular screwdriver and remove the cover.

(2) If a brush has become worn so that the brush finger touches its stop, replace it as covered in Section 159-725-801.

(3) If a brush binds in the brush holder, remove the brush from the holder marking its position in the holder, and wipe it with a KS-14666 cleaning cloth moistened with KS-7860 petroleum spirits. If there are any rough projections, the edges of the

brush may be smoothed with No. 0000 sandpaper or equivalent abrasive cloth before wiping.

(4) In remounting the brush, see that it is put back in the same holder and in the same position in which it was originally. Replace brushes that are too loose in their holders as covered in Section 159-725-801.

(5) If the commutation is not satisfactory, cut a strip of No. 0000 sandpaper or equivalent abrasive cloth slightly wider than the width of the brush, and preferably as long as the circumference of the commutator. Place the strip under the brush with the sanded side next to the brush, and hold it so that it will bear on as much of the commutator surface as practical. Draw the strip back and forth under the brush until the brush has the same curvature as the commutator. The last stroke shall be made in the direction of rotation.

(6) After sanding, clean the commutator with air using the R-8950 syringe, and then wipe the commutator with the KS-14666 cleaning cloth.

3.17 Eccentricity of the Interrupter Drum (Rq 2.17)

(1) Refer the matter to the supervisor when the inspection and installation of new drums is required.

3.18 Brush Finger Tension (Rq 2.18)

(1) If the brush finger tension is not within the specified limits, loosen the brush holder mounting screws with the 3-inch cabinet screwdriver and replace the brush holder as covered in Section 159-725-801. Reseat the brush as covered in 3.16.

ALARM MECHANISM PROCEDURES

3.19 Run and Stop Alarm Operation (Rq 2.19)

Procedures for Cast Weight-type Alarm Mechanism (3.20 to 3.24, Incl.)

3.20 Contact Pressure (Rq 2.20)
3.21 Spring Tension (Rq 2.21)
3.22 Contact Follow (Rq 2.22)
3.23 Contact Separation (Rq 2.23)
3.24 Plunger Pin Pressure (Rq 2.24)

Procedures for Link-type Alarm Mechanism (3.25 to 3.30, Incl.)

3.25 Contact Pressure (Rq 2.25)
3.26 Spring Tension (Rq 2.26)
3.27 Contact Follow (Rq 2.27)
3.28 Contact Separation (Rq 2.28)
3.29 Cross Head Position With Motor Running (Rq 2.29)
3.30 Position of Arms With Motor Stopped (Rq 2.30)

(1) Run and Stop Alarm Operation: If the alarm does not operate on or off at the proper speeds, proceed as follows.

(2) General: To check for contact pressure, spring tension, contact follow, contact separation, plunger pin pressure, cross head position with the motor running, and the position of the arms with motor stopped, of both cast weight- and link-type alarm mechanisms, it will first be necessary to remove the cover. On cast weight-type alarm mechanisms the cover is not sealed. Remove the cover mounting screw with the 3-inch cabinet screwdriver and remove the cover. On link-type alarm mechanism, either the whole cover or, if the cover is split into two parts, the lower part of the cover, is sealed. Where the entire cover is sealed, remove the cover mounting screws with the No. 344 or 4-inch regular screwdriver and remove the cover. Where only the lower part of the cover is sealed, remove the upper mounting screw with the 4-inch regular screwdriver and remove the cover. In some cases, however, it may be necessary to remove the entire cover to check and adjust for the requirements. After the contacts are satisfactorily adjusted, remount the cover. If, on the link-type alarm mechanism, the cover is in one piece, split the cover as covered in Section 159-725-801.

(3) Contact Pressure, Spring Tension, Contact Follow, and Contact Separation: Foreign matter wedged between the springs may prevent the springs from making contact. Remove the foreign matter with a clean toothpick which has been dipped in KS-7860 petroleum spirits. If the requirement is still not met, proceed as follows. Place the KS-7782 pliers on both the stop and contact springs just above the bend in the contact spring and slide it up to where the springs leave the clamping plates and insulators and adjust the springs to the right or left as required.

(4) If the desired pressure can not be obtained by adjusting as covered in (3), place the KS-7782 pliers on the contact spring just above the bend in the spring and slide them back to where the spring leaves the clamping plates and insulators. Draw the pliers downward the length of the straight portion of the spring, meanwhile applying pressure as required so that the spring is formed into a slight gradual bow with the concave surface facing the associated spring. The magnitude of the bow to be formed in the spring must be learned by experience, and should be such that when the final adjustment is made at the base, the spring will be approximately straight. Place the pliers on the stop and contact springs as covered in (3) and adjust as required.

(5) Do not straighten kinked springs unless the kink interferes with proper adjustment of the springs. Removing kinks tends to weaken the spring and to shorten its life. Normally, straight springs that have been adjusted should have no sharp bends

due to adjustment. A gradual bow not exceeding the thickness of the spring over its entire length is permissible.

(6) If, after the above adjustments have been made, it is necessary to change the contact separation or contact follow, bend the spring slightly at the shoulder with the No. 485A pliers. In adjusting for contact follow of the stop alarm contact, take up the end play of the motor worm toward the motor coupling and spread the governor arms slightly. However, exercise care that when increasing the follow, the contact pressure is not more than the maximum specified. In no case should the bend be enough to make a visible kink in the spring. In making this adjustment it may be necessary to readjust as covered in (4).

(7) Plunger Pin Pressure (Cast Weight-type Alarm Mechanism): If the plunger pin touches the weight arm with sufficient pressure to cause it to rotate with the motor running up to speed, the retractile springs are tensioned too stiffly. Adjust them as follows.

(8) Remove one end of each of the two springs with the P-long-nose pliers and weaken each spring uniformly by stretching it with the pliers. Remount the springs and recheck the requirement.

(9) Cross Head Position With Motor Running (Link-type Alarm Mechanism): If the cross head does not rest against the end of the shaft with the motor running up to speed, it is an indication that the retractile springs are tensioned too stiffly. To decrease the tension of the retractile springs, adjust the brackets uniformly away from the cross head with the P-long-nose pliers.

(10) Position of Arms With Motor Stopped (Link-type Alarm Mechanism): If the arms do not rest against the cross head with the motor stopped, it is an indication that the tension of the retractile spring is insufficient. To increase the tension of the retractile springs, adjust each of the four spring mounting brackets uniformly toward the cross head with the P-long-nose pliers.

SHAFT AND BEARING PROCEDURES

3.31 Lubrication of Bearings (Rq 2.31)

(1) If, upon inspection through the oil sight glass, it is found necessary to replenish the oil in the bearing housing, remove the filling plug with the No. 344 → offset screwdriver and pour in KS-16326 oil through the KS-6737 screened funnel until the housing fills to approximately the maximum level specified with the shaft running. The funnel is used to prevent foreign matter being carried into the bearing housing with the oil.

(2) Insert the filling plug finger tight to prevent subsequent difficulty in removing it.

(3) Wipe off any oil that may have been spilled with a KS-14666 cleaning cloth.

3.32 Flushing Bearing Housing (Rq 2.32)

(1) Bearings Not Equipped With Drain Plugs: To drain off the old oil and to flush out the bearing housing on these bearings, remove the cover.

(2) Loosen the cover mounting screws with the No. 344 offset screwdriver. Place a receptacle under the bearing to catch the drained oil. Break the sealed joint and remove the cover and the top portion of the bearing housing.

(3) Slide the bearing out of its housing and examine the drained oil for excessive dirt and sediment. Also inspect the interior of the bearing housing. If dirt and sediment are found in the drained oil, and if the bearing housing appears dirty, wipe it out with a KS-14666 cleaning cloth. If necessary, KS-7860 petroleum spirits may be used to loosen the dirt.

(4) Examine the inside of the housing and ball race to insure that all dirt and sediment have been removed.

(5) If any dirt or sediment is still present, repeat the above operation until the ball race, bearing, and inside of housing appear to be clean.

(6) Bearings Equipped With Drain Plugs: To drain off the old oil and to flush out the bearing housing on these bearings, remove the drain plug with the R-5850 or the R-1317 wrench and allow the oil to drain from the bearing housing into one of the receptacles provided.

(7) Then insert the drain plug and pour a → small amount of KS-16326 oil into the bearing housing through the filling hole at the top. Remove the drain plug and allow the oil to drain off. The bearing should be run while this flushing operation is being performed.

(8) Do not remove the oil sight for cleaning purposes. If it is removed for any other reason, it will be necessary to renew the oil sight gasket. When replacing the gaskets, the paraprene-type cork gaskets shall be used for the inner gasket and the outer gaskets. The paraprene gaskets may be recognized when new by a strong sulphur odor.

(9) All Bearings: Clean the surfaces to be sealed, and reseal the bearing housing or the drain plug as covered in 3.02.

(10) Refill the housing as covered in 3.31 and wipe off any oil that may have been spilled on the outside of the bearing housing and adjacent surfaces with a KS-14666 cleaning cloth.

3.33 Lubrication of 2-type Shaft Couplings (Rq 2.33)

(1) Before assembling a coupling in place on the shaft, thoroughly clean the shaft extension, coupling blocks, pins, and coupling head with a KS-14666 cleaning cloth saturated with KS-7860 petroleum spirits. This is done to remove any protecting film that the part may have been coated with during manufacture. Immediately after cleaning the part, dry it with a clean cloth and thoroughly lubricate it, as covered in (2).

(2) To lubricate a coupling, proceed as follows. Support the shaft and clean the parts as covered in 3.01. Dip the parts into the Marfak No. 1 grease and spread a film of the grease over all the surfaces of each part with the fingers and reassemble the parts, making sure that requirements 2.38 and 2.39 are met.

3.34 Lubrication of No. 10A Shaft Couplings (Rq 2.34)

(1) Before assembling a coupling in place on the shaft, thoroughly clean the shaft extension, coupling blocks, pins, and coupling head with a KS-14666 cleaning cloth saturated with KS-7860 petroleum spirits. This is done to remove any protecting film that the part may have been coated with during manufacture. Immediately after cleaning the part, dry it with a clean cloth and thoroughly lubricate it with KS-6438 oil.

(2) To lubricate a coupling after assembly on the shaft, stop the shaft and turn it so that the oil hole in the coupling head is on the top side. Then lubricate the parts using the No. 431A oil gun as follows.

(3) To Lubricate the Felt Pad: Insert the nozzle of the oil gun in the oil hole in the coupling head and press very slowly on the plunger until it is depressed to the limit of its stroke. Lubricate the pad as specified. Allow approximately a half minute to elapse between the application of the charges to permit absorption of the oil by the felt pad.

(4) To Lubricate the Coupling Parts: Rest the oil gun against the outside surface of the part to be lubricated and proceed as covered above.

(5) Wipe off any lubricant that may have been spilled in lubricating the coupling with a KS-14666 cleaning cloth moistened with KS-7860 petroleum spirits.

(6) In all cases, however, make an inspection after the shaft has been operated 24 hours after the application of the lubricant, and remove any lubricant that has leaked out as covered in 3.01.

3.35 Record of Lubrication and Flushing (Rq 2.35)
(No Procedure)

3.36 Straightness of 3- and 6-type Shafts (Rq 2.36)

(1) Where the bow of the shaft exceeds the specified limits, and where it is responsible for excessive vibration, refer the matter to the supervisor.

3.37 Eccentricity of 2-type and No. 10A Shafts (Rq 2.37)

(1) If the lateral play in the coupling is satisfactory, and the eccentricity of the shaft exceeds the specified amount, refer the matter to the supervisor.

3.38 End Play of 2-type and No. 10A Shafts (Rq 2.38)

(1) If the end play of a No. 2C, 2D, or 10A shaft is not satisfactory, loosen the two setscrews in the coupling head with the No. 295 Bristo setscrew wrench or the R-2485 Allen socket screw wrench and slide the coupling head on the shaft until the requirement is met. Securely tighten the setscrews.

(2) No adjustment is provided for end play for the No. 2A and 2B shafts.

3.39 Lateral Play of Couplings (Rq 2.39)

(1) If the lateral play of the coupling exceeds the specified amount, remove the guard and loosen the setscrews with the No. 295 Bristo setscrew wrench or the R-2485 Allen socket screw wrench and slide the coupling head on the shaft until the blocks are exposed. In the case of 2-type shafts, remove the blocks and mount as many P-290294 (0.005-inch thick) or P-290295 (0.010-inch thick) washers over the ends of the pin as required. In mounting the washers over the pin, make sure that washers of the same thickness are used at each end of the pin. For example, if the excess play is 0.010 inch, install two P-290294 washers, one over each end of the pin. Do not use one 0.010-inch washer as this would tend to unbalance the shaft and cause it to become more eccentric. If a part is excessively worn, replace the part. In the case of the 10A shaft, replace those coupling parts which are causing the excessive play. If the hole in the shaft is excessively worn, proceed as covered in Section 159-720-811.

3.40 End Play of 3- and 6-type Shafts (Rq 2.40)

(1) If the end play is not satisfactory, loosen the setscrews in the coupling head on the shaft with the No. 295 Bristo wrench or the R-2485 Allen socket screw wrench and shift it until the requirement is met.

(2) Make an effort to apportion this end play equally to each end of the shaft. Tighten the setscrews securely after the coupling is satisfactorily adjusted.

3.41 Mounting of Bearings (Rq 2.41)
3.42 Alignment of Bearings (Rq 2.42)
3.43 Oil Closure Clearance (Rq 2.43)

(1) If the shaft does not revolve freely in its bearings, it is probably due to poor alignment of the bearings or lack of clearance between the shaft and the oil closure lips. To correct for either of these conditions proceed as follows.

(2) All Bearings Except No. 12A Bearings: Loosen the bracket mounting screws slightly with the KS-8097 wrench and adjust the aligning screws with the 4-inch regular screwdriver as required.

(3) No. 12A Bearings: Loosen the bracket mounting screws slightly with the R-2593 wrench and adjust the aligning screws with the No. 295 Bristo setscrew wrench or the R-2485 Allen socket screw wrench as required.

(4) Make an attempt in shifting the bracket to maintain a uniform clearance between the shaft and the oil closure lips at all points around the periphery of the shaft. Take care in making this adjustment not to change the alignment of the shaft with respect to the shafts of the associated drive, as any misalignment may cause bind and excessive vibration.

(5) If, in checking the gaps between the oil closure lips and the shaft, as covered in requirement 2.43, the gauge does not enter in all four positions, refer the matter to the supervisor.

(6) Retighten the mounting screws and recheck the shaft to see that a bind has not been introduced in the tightening operation. Also check the shaft and bearing for oil closure clearance as covered above.

REASONS FOR REISSUE

1. To revise and amplify the requirements for lubrication, to specify KS-16326 oil, and to change the recommended lubrication interval after turnover (2.04 and 2.31).

2. To revise the requirements for flushing before and after turnover (2.05 and 2.32).

3. To revise the requirement for clearance between the shaft and the oil closure lips of gear case covers to add a check method (2.07).

4. To revise the requirement for horizontal distance between coupling assembly on drive shaft and motor stop to add a check method (2.11).

5. To revise the requirement for motor coupling assembly location to add a check method (2.12).

6. To revise the requirement for horizontal shaft alignment to add check methods (2.13).

7. To revise the requirement for bow to add a check method (2.36).

8. To revise the requirement for eccentricity of 2-type and No. 10a shafts to add a check method (2.37).

9. To revise the requirement for oil closure clearance to add a check method (2.43).

10. To revise the list of tools, gauges, and materials (3.001).

11. To amplify the procedure covering leakage at sealed joints (3.02).

12. To amplify the procedure covering freedom of operation of gearing (3.08).

13. To amplify the procedure covering horizontal distance between coupling assembly on drive shaft and motor stop (3.11).

14. To amplify the procedure covering motor coupling assembly location (3.12).

15. To amplify the procedure covering cleaning the interrupter drum (3.14).