

## MOTOR-DRIVEN RHEOSTATS

### APPARATUS REQUIREMENTS AND ADJUSTING PROCEDURES

#### 1. GENERAL

1.01 This section covers KS-5349, KS-5385, KS-5385-01, KS-5445, KS-5501, KS-5713, KS-15571 and KS-15743 rheostats.

1.02 This section is reissued to revise the lubrication requirements, to add a procedure covering the use of petroleum spirits, and, in general, to bring the section up to date. Since this reissue covers a general revision, the arrows ordinarily used to indicate changes have been omitted. 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 *Phi* ( $\phi$ ): Requirements are marked with a phi when they are not required to be checked before turnover.

1.05 *Asterisk* (\*): Requirements are marked with an asterisk when to check for them would necessitate dismantling or dismounting of the 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.

1.06 Reference shall be made to the section giving information and requirements relating to commutators and brushes.

#### 2. REQUIREMENTS

2.01 *Cleaning Contact Surfaces* (KS-5445, KS-5501, KS-5713, KS-15571 and KS-15743 Rheostats): The contact surfaces shall be cleaned when necessary. No lubrication shall be applied to the contact surface of these rheostats.

#### 2.02 Lubrication

(a) *Contact Surfaces* (KS-5349, KS-5385, and KS-5385-01 Rheostats): The contact sur-

faces shall be cleaned and treated when necessary in accordance with the section dealing with this apparatus.

(b) *Knife Switch (KS-5385-01 Rheostat)*:

The KS-5327 knife switch shall be lubricated when necessary in accordance with Section 030-740-701.

(c) The following parts shall be lubricated with 130-190 S100 oil. When lubrication is required, oil shall be applied as follows.

(1) *Shaft Bearings*: Three to four drops of oil in the oil cup of each bearing, applied monthly.

(2) *Waste-packed Bearings*: Waste saturated with oil every 6 months.

(3) *Limit Switch Rollers*: One to two drops of oil applied to the rollers, monthly.

(d) The following parts shall be lubricated with 130-170 S210 oil. When lubrication is required, oil shall be applied as follows.

*Gear Box* [KS-5349, KS-5385, KS-5385-01, KS-5445, and KS-5501 (See Note) Rheostats]

(1) The gear box shall be cleaned and refilled with 130-170 S210 oil every 2 years.

(2) *Gear Box With Overflow Plug*: Oil shall be added every 3 months to maintain the level so that oil will just flow out of the overflow hole when the plug is removed.

(3) *Gear Box Without Overflow Plug*: Oil shall be added every 3 months to keep the gear box 1/3 to 1/2 full of oil.

To check this requirement, insert the KS-6320 orange stick into the oil filling hole so that the end of the orange stick touches the bottom of the gear case. The oil level shall be between 7/8 and 1-1/4 inch from the inserted end of the orange stick.

*Note*: The gear box on the KS-5501 rheostat may be lubricated with grease as covered in requirement 2.02(e) (3), if desired, or lubrication with oil may be continued.

(e) The following parts shall be lubricated with 310-330P grease. When lubrication is required, grease shall be applied as follows.

φ(1) **Ball Bearing:** Cleaned and repacked with grease every 2 years and also when the motor is dismantled for reasons other than lubrication. The bearing at the other end of the motor is lubricated by the oil or grease in the gear box.

(2) **Exposed Gears and Chain:** A film of grease distributed evenly over the working surfaces of the gears and chain.

φ(3) **Gear Box** [~~KS-5501~~ <sup>Gen. J. S. G- EAST</sup> (See Note), ~~KS-5713, (KS-1557)~~ and ~~KS-15743 Rheostats~~]: Cleaned and repacked with grease every 2 years to keep the gear box 1/3 to 1/2 full of grease.

**Note:** While the KS-5501 rheostat gear box was initially lubricated with oil, it may be relubricated with grease.

(f) **Recommended Lubrication Intervals:** The lubrication intervals stated above may be changed, if periodic inspections have indicated that local conditions are such as to insure that the requirements will be met during these intervals.

**2.03 Knife Switch Requirements (KS-5385-01 Rheostat Only):** The KS-5327 knife switch shall meet the applicable requirements covered in Section 030-740-701.

**2.04 Contact Arm and Contact Surface Alignment (KS-5385 and KS-5385-01 Rheostats)**

(a) Throughout its travel the contact arm shall move approximately parallel to the contact surfaces on the resistance plate.

Gauge by eye.

(b) The misalignment of the contact surfaces of adjacent segments shall be

Max .005 inch

Gauge by feel using the No. 74D gauge as follows. Place the .005-inch gauge of the No. 74D gauge nest flat on the contact surface of the segment. Check whether the surface of the adjacent segments are above or below the top of the gauge.

**2.05 Contact Shoe Pressure:** The contact shoe shall press firmly against the surface on which it makes contact.

**\*2.06 Rheostat Resistance:** With the rheostat in the all-resistance-in position, the resistance of each plate shall be within 10 per cent of the value specified on the nameplate.

Use No. 35D or 35F Test Set.

To check this requirement, disconnect the connecting links between the plates. Use the 35-type test set to measure the resistance of each plate.

**\*2.07 Voltage and Current of Motor:** The motor current shall not exceed the value stamped on the motor nameplate by more than 50 per cent when the voltage is within the nameplate limits.

Use Weston dc ammeter, model 281.

To check this requirement, connect the ammeter in series with the motor circuit.

**Caution:** To prevent the ammeter from being damaged, it should be short-circuited during the starting period of the motor.

**\*2.08 Time of Operation:** The time of operation of the rheostat from the all-resistance-in to the all-resistance-out position shall be

	MINIMUM (SECONDS)	MAXIMUM (SECONDS)
KS-5349	40	80
KS-5385	40	80
KS-5385-01	40	80
KS-5445	35	60
KS-5501	40	80
KS-5713	44	76
KS-15571	44	76
KS-15743	44	76

Use KS-3008 stop watch or watch with second hand.

To check this requirement, close the circuit to the motor and observe the time required for the contact arm to rotate from one extreme position to the other. For rheostats having an adjustable limit arm, the time of operation is proportional to the distance traveled. See requirement 2.13 (b).

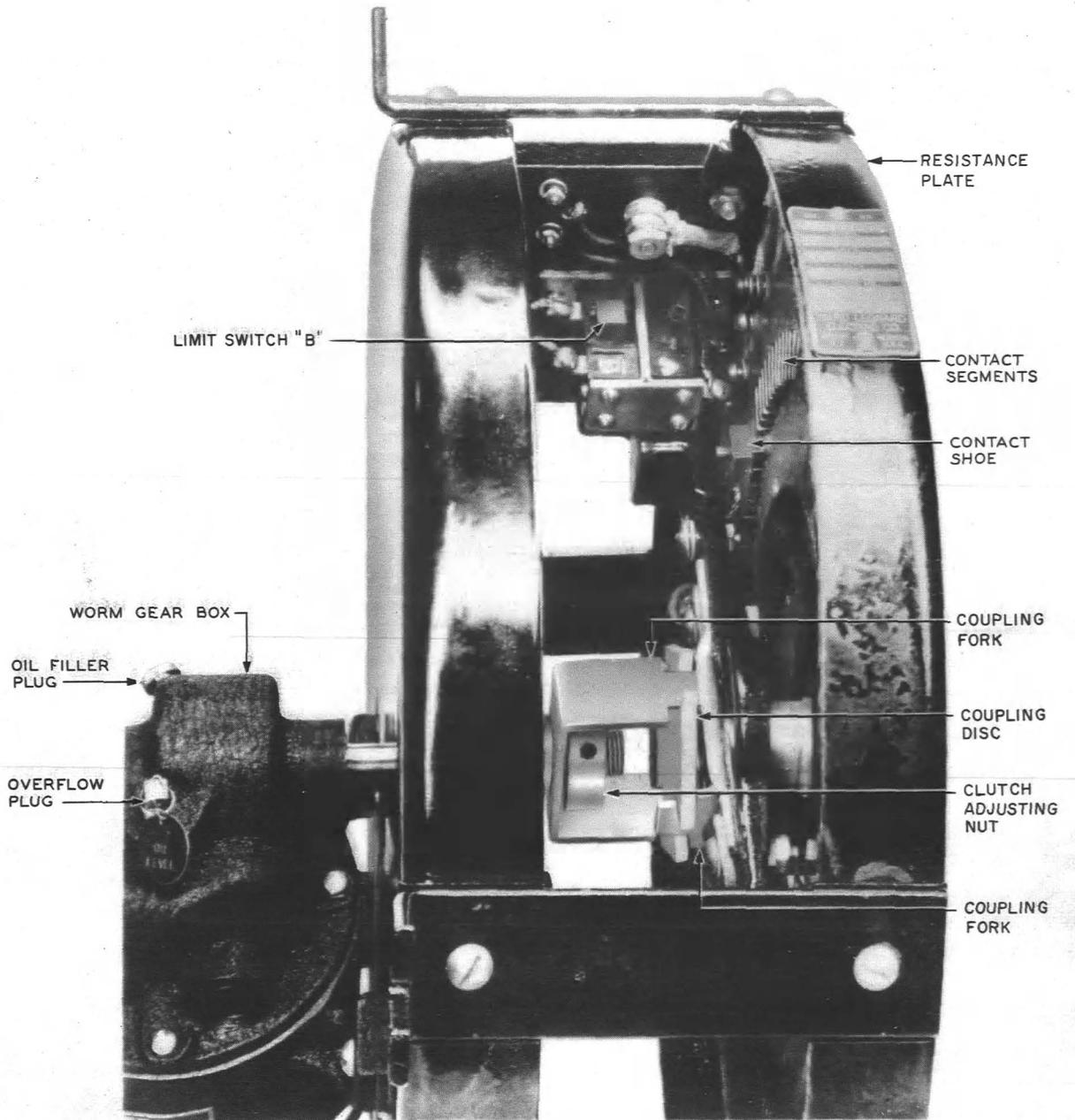


Fig. 1 - KS-5501, KS-5713, KS-15571, and KS-15743 Rheostats

Mem. H-5-6  
EAST

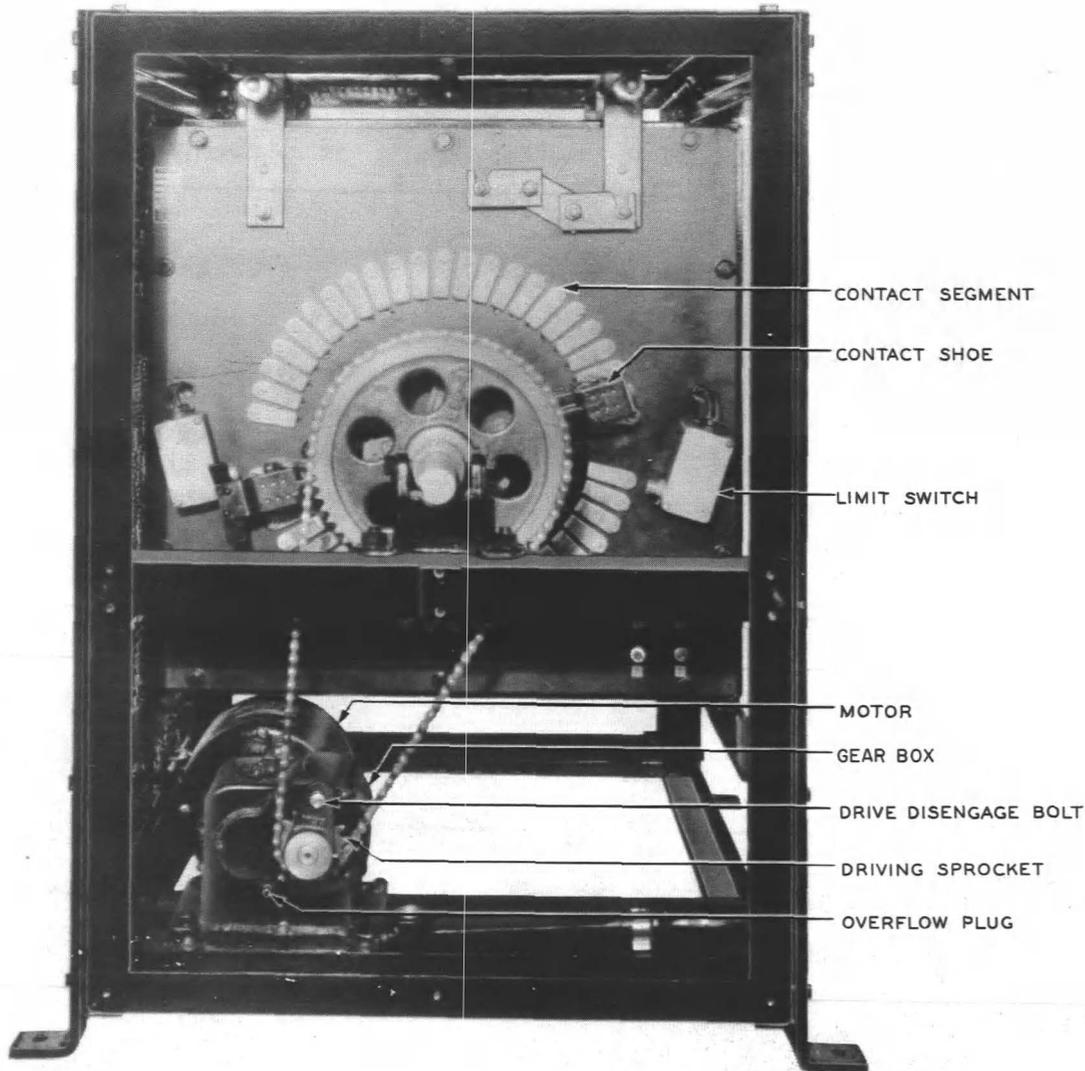


Fig. 2 - KS-5385 Rheostat (200-800 Amperes)

**\*2.09 Motor Brush Requirements:** The motor brushes shall meet the applicable requirements.

**\*2.10 Commutator Requirements:** The commutator shall meet the applicable requirements.

**2.11 Motor Torque:** The motor shall develop sufficient torque to start and move the contact arm from any position.

Gauge by eye.

**2.12 Noise and Vibration:** The noise and vibration of the rheostat while operating under normal conditions shall not be excessive. Gauge by sound and feel.

**2.13 Operation of Limit Switches:** One limit switch shall open the motor circuit when the leading edge of the contact shoe is between the last two contact buttons or segments. The other switch, unless otherwise specified, shall open the circuit when the contact shoe is in the corresponding position at the other end of its travel.

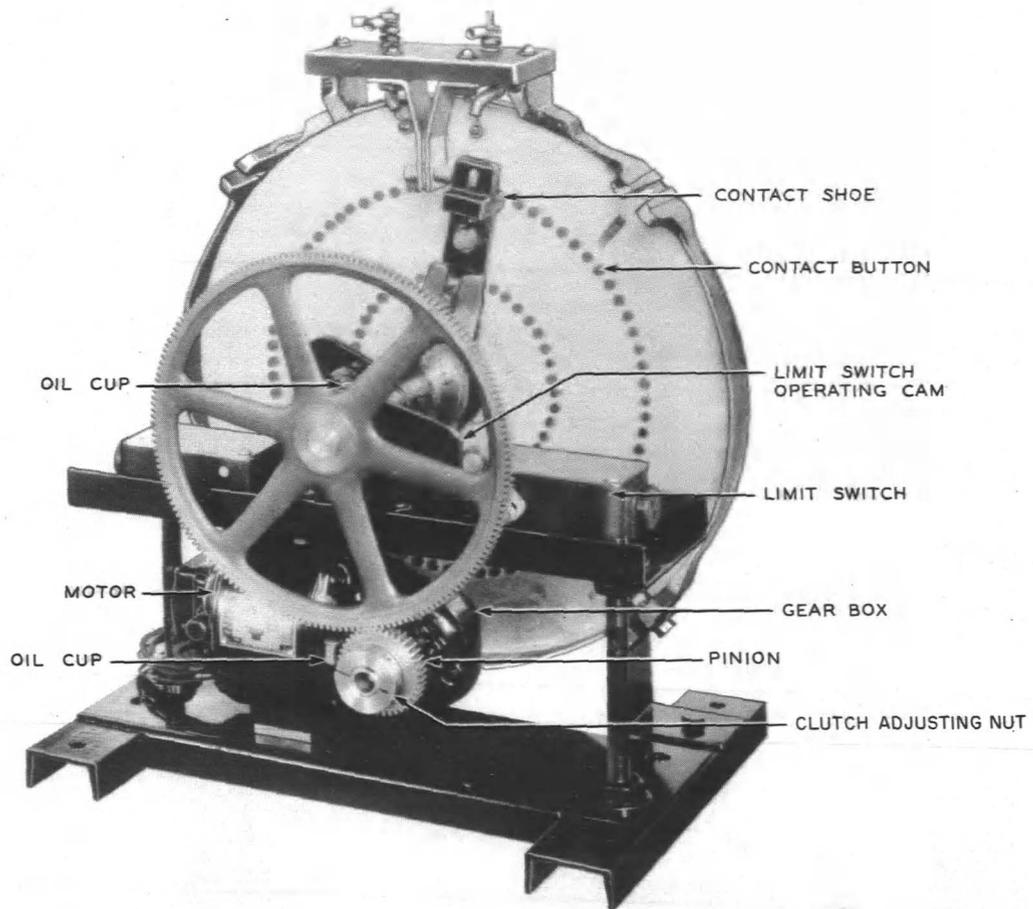


Fig. 3 - KS-5349 and KS-5445 Rheostats (KS-5349 Rheostat Shown)

**Note 1:** For KS-5349, KS-5501, KS-5713, KS-15571, and KS-15743 rheostats, the job information usually requires the setting of one switch at some intermediate position.

**Note 2:** The KS-5445 rheostat has three limit switches. Two of them should open simultaneously as covered above for the position at the counterclockwise end of travel, viewed from the gear end.

**2.14 Operation of Driving Clutch (Except KS-5385 and KS-5385-01, 200-800-ampere, Rheostats)**

(a) The clutch shall drive the contact arm between stops without appreciable slipping.

Gauge by eye.

(b) The clutch shall slip when the contact arm is held by a stop.

Gauge by eye.

**2.15 Temperature:** The temperature of parts of the rheostat shall not exceed the following values.

	MAXIMUM
Motor	90C(194F)
Resistance Plate or Conductor	290C(554F)
Knife Switch (KS-5385-01 Rheostat Only)	70C(158F)
Contact Button or Segment (KS-5385 and KS-5385-01 Rheostats Only)	160C(320F)

Use Thermometer.

To check this requirement, hold the bulb of the thermometer against the part. Cover the portion of the bulb which is not in contact with the part with the asbestos pad. Observe the maximum temperature reading.

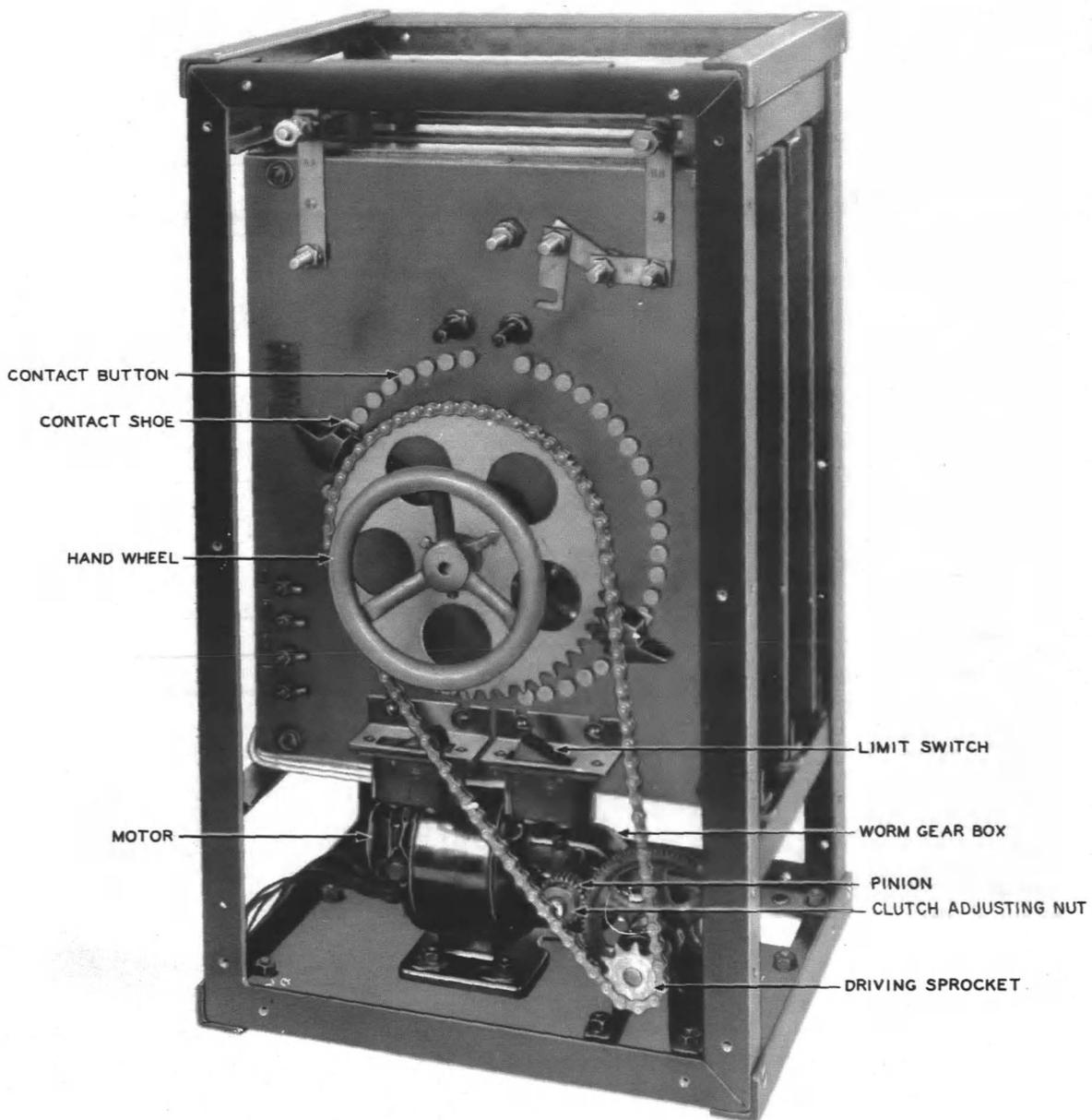


Fig. 4 - KS-5385 Rheostat (50 Amperes)

**3. ADJUSTING PROCEDURES****3.001 List of Tools, Gauges, and Materials**

CODE OR SPEC NC.	DESCRIPTION
<b>TOOLS</b>	
KS-6320	Orange Stick
R-1060	Putty Knife
R-1255	31/32- and 1-1/16-inch Hex. Open Double-end Flat Wrench
R-1770	1/2- and 9/16-inch Hex. Open Double-end Flat Wrench
R-2512	8-inch Adjustable Wrench
R-2966	No. 5 Artists Stiff Brush
—	3-inch Cabinet Screwdriver
—	4-inch Regular Screwdriver
—	11/16- and 25/32-inch Hex. Open Double-end Flat Wrench, J. H. Williams Co, No. 29
—	6-1/2-inch P-Long-nose Pliers
—	Hand Oiler
<b>GAUGES</b>	
35D or 35F	Test Set
74D	Gauge Nest
KS-3008	Stop Watch
R-8550	6-inch Steel Scale
—	Ammeter, DC, Weston Model 281, Range 30/3/1.5 Amperes
—	Voltmeter, DC, Weston Model 931, Range 300/150/75/30 Volts
—	Thermometer, -10° to +400C, Fisher Scientific Co, No. 14-985
<b>MATERIALS</b>	
KS-7860	Petroleum Spirits
KS-8372	Trichloroethylene
KS-13148, L1	Abrasive Paper
KS-14666	Cleaning Cloth
—	Grease, 310-330P
—	Oil, 130-190 S100
—	Oil, 130-170 S210
—	Petrolatum
—	Asbestos Pad
—	Shellac
—	Receptacle for Drained Oil

**3.002** Care should be exercised when using petroleum spirits in the power room where there are dc machines, since commutation may be adversely affected by softening of the commutator film by the fumes. To avoid the need for burnishing the commutators of the dc machines after doing any cleaning operations called for in this section, provide adequate ventilation, use the absolute minimum amount of petroleum spirits required for the cleaning operation, and keep the container closed when not in use.

**3.01 Cleaning Contact Surfaces (KS-5445, KS-5501, KS-5713, KS-15571, and KS-15743 Rheostats)** (Reqt 2.01)

(1) **Contact Buttons, Segments, or Ring:**  
Wrap the KS-13148, List 1 abrasive paper around a block of wood of convenient size. Clean the contact surfaces by wiping the abrasive paper over them while holding the paper squarely and firmly against the surface. Then wipe the surface with a clean KS-14666 cloth-moistened with trichloroethylene, followed by wiping with a clean dry cloth.

(2) **Contact Shoes:** Using the KS-6320 orange stick, raise the contact shoe and insert a strip of KS-13148, List 1 abrasive paper between the shoe and associated contact surface with the abrasive side of the paper toward the shoe. Release the shoe. Then, without applying additional pressure to the shoe, withdraw the paper. Repeat this procedure if necessary. Remove particles which may have been deposited on the contact surfaces using a clean dry KS-14666 cloth.

**3.02 Lubrication** (Reqt 2.02)

(1) **Contact Surfaces (KS-5349, KS-5385, and KS-5385-01 Rheostats):** Clean and treat the contact surfaces.

(2) **Knife Switch (KS-5385-01 Rheostat):** Lubricate the KS-5327 knife switch as covered in Section 030-740-701.

(3) **Bearings Having Oil Cups:** Lubricate the bearings by applying the oil to each cup using the hand oiler.

(4) **Waste-packed Bearings:** To lubricate waste-packed bearings having an overflow hole in the lower part of the bearing housing,

add sufficient oil at the top of the bearing so that a trace of oil will come from the overflow hole some time before the next scheduled oiling. Any excess will probably appear within a day after oiling. Since the amount of oil necessary varies with local conditions, such as the length of time a machine is in operation or the temperature under which it operates, it is necessary to determine by experience the amount of lubricant required in each case. As a trial, it is suggested that about three drops be added initially, although on KS-5349 rheostats the oil hole on the commutator end will probably need about ten drops and the interval for this oiling may have to be decreased to about 4 months.

(5) **Limit Switch Rollers:** Apply the oil to the outer end of the roller pin. Then turn the roller manually a few times to allow the oil to work along the pin.

(6) **Gear Box:** In order to change the oil or grease in the gear box, remove the motor and gear box from the rheostat as covered in (a) or (b). If the gear box is filled with oil, drain and clean the gear box as covered in (c). If the gear box is filled with grease, remove the grease and clean the gear box as covered in (d). Check for leakage of lubricant into the motor frame as covered in (e). Refill the gear box as covered in (f) or (g).

(a) **Removing Motor and Gear Box (KS-5501, KS-5713, KS-15571, and KS-15743 Rheostats):** Loosen the clutch adjusting nut clamp screw and remove the nut and adjacent washer from the shaft. Remove the motor mounting bolts and move the motor away from the mounting plate sufficiently to permit the limit switch operating lever and coupling fork and disc to be removed from the rheostat. Remove the motor and gear box. Remove the remaining washers from the shaft, noting their position on the shaft.

(b) **Removing Motor and Gear Box (KS-5349, KS-5445, KS-5385, and KS-5385-01 Rheostats):** Remove the mounting bolts and remove the motor and gear box from the rheostat.

(c) **Draining Oil From Gear Box:** Remove the filler plug and drain the oil into a receptacle by tilting the gear box as neces-

sary. After draining the oil, remove the gear box from the motor. Clean the interior of the gear box with a KS-14666 cloth moistened with petroleum spirits.

(d) **Removing Grease From Gear Box:** Remove the gear box from the motor. Remove the grease using the R-1060 putty knife. Clean the interior of the gear box with a KS-14666 cloth moistened with petroleum spirits.

(e) **Leakage of Lubricant Into Motor Frame (KS-5501, KS-5713, KS-15571, and KS-15743 Rheostats):** A lubrication seal gland is provided on the motor of these rheostats to prevent leakage of the lubricant into the motor frame. If leakage has occurred at the gland, disassemble the motor and clean the interior of the motor frame with petroleum spirits. To do this, remove the end shield from the motor and withdraw the armature. Check the three screw holes adjacent to the bearing housing on the gear box end of the motor frame to determine whether there is an opening through them to the inside of the motor frame. If necessary, plug these holes from the gear box side with 8-32, 3/8-inch roundhead machine screws. During reassembly of the motor, hold the gland against the bearing with two 20-penny nails or two 4-inch lengths of No. 11 drill rod bent as follows. Bend the nails or drill rod approximately 1 inch from the end (pointed end of nail) at an angle of 45 to 60 degrees. Insert the bent ends between the gland and the fan, on opposite sides of the armature. Insert the armature into the frame, tap the end of the shaft, if necessary, to properly position the bearing in its housing. Tap the ends of the nails or drill rods to position the gland firmly in its seat directly behind the bearing. Remove the nails or drill rods and mount the end shield on the motor frame.

(f) **Lubricating Gear Box With Oil:** Apply a coat of shellac to the mounting surface of the gear box and the associated surface of the motor frame to provide an oil seal. Mount the gear box on the motor frame immediately after applying the shellac. Pour a sufficient amount of oil into the gear box to meet requirement 2.02(d) (2) or (3).

(g) **Lubricating Gear Box With Grease:** Using the R-1060 putty knife, apply a sufficient amount of grease to the gear box to meet requirement 2.02(e) (3). Apply a coat of shellac to the mounting surface of the gear box and the associated surface of the motor frame and immediately mount the gear box on the motor frame.

(h) Remount the motor and gear box in the rheostat in reverse order of removal.

(7) **Ball Bearing:** To repack a ball bearing located at the commutator end of the motor, proceed as follows. Remove the motor and gear box from the rheostat as covered in (6) (a) or (b). Remove the end shield from the motor frame. Remove the washers from the bearing housing. Clean the bearing housing with a KS-14666 cloth moistened with petroleum spirits. Remove as much grease as possible from the bearing with the R-2966 brush moistened with petroleum spirits. Wipe the bearing with a clean dry KS-14666 cloth. Apply the grease around the balls filling the space between the inner and outer race approx-

imately two thirds full of grease. Replace the washers in the bearing housing and mount the end shield on the motor frame.

(8) **Exposed Gears and Chain:** Apply a film of 310-330P grease to the exposed gears and chain using the R-2966 brush.

(9) Remove any excess oil or grease with a clean KS-14666 cloth.

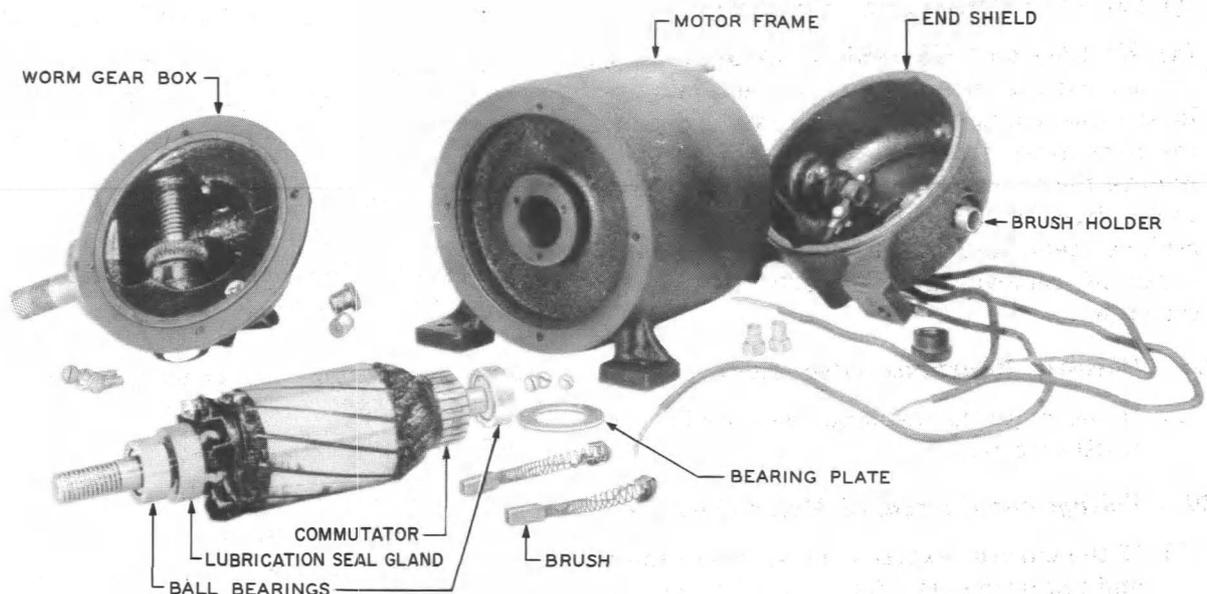
### 3.03 Knife Switch Requirements (KS-5385-01 Rheostat Only) (Reqt 2.03)

(1) Section 030-740-701 covers procedures for maintaining the KS-5327 knife switch.

### 3.04 Contact Arm and Contact Surface Alignment (KS-5385 and KS-5385-01 Rheostats) (Reqt 2.04)

(1) If requirement (a) is not met, reposition the resistance plate by shifting the plate on its mounting or shimming the plate.

(2) If requirement (b) is not met, replace the contact segment.



**Note:** The bearing plate and three screws, shown directly below the end of the motor frame, were furnished on the earlier models but were found to be unnecessary in this application and are no longer furnished. The screw holes in the bearing housing are provided for other applications of the motor end shield.

Fig. 5 - Motor For KS-5501, KS-5713, KS-15571, and KS-15743 Rheostats

**3.05 Contact Shoe Pressure** (Reqt 2.05)

(1) The contact shoe pressure is maintained by springs between the shoe and operating arm. In some rheostats the pressure may be adjusted by changing the distance from the contact arm to the resistance plate as covered in (2). The pressure may also be changed by adjusting the springs as covered in (3) or (4).

(2) **KS-5349, KS-5385, KS-5385-01, and KS-5445 Rheostats:** To reposition the contact arm on the shaft loosen the contact arm setscrews and move the arm along the shaft, or loosen the adjusting collar setscrew and turn the collar as required to reposition the arm. After making the adjustment, securely tighten the setscrews.

(3) **KS-5349, KS-5445, KS-5501, KS-5713, KS-15571, and KS-15743 Rheostats:** To adjust the springs of these rheostats first remove the resistance plate from the rheostat. Remove the collar from the end of the contact arm shaft and remove the arm from the shaft. Remove the springs from the arm and adjust the spring tension as required. If the springs can not be adjusted, replace them. Reassemble the parts in reverse order of removal.

(4) **KS-5385 and KS-5385-01 Rheostats:** To adjust the springs on these rheostats first loosen the contact arm setscrews and move the arm away from the plate sufficiently to remove the springs. Adjust the spring tension as required. If the springs can not be adjusted, replace them. Reassemble the parts in reverse order of removal and securely tighten the setscrews.

**3.06 Rheostat Resistance** (Reqt 2.06)

(1) If the requirement is not met, replace the resistance plate.

**3.07 Voltage and Current of Motor** (Reqt 2.07)

(1) If the current exceeds the specified limits and requirements 2.02, 2.05, 2.09, and 2.10 are met, check the conditions of bearings. Replace the bearings if necessary.

**3.08 Time of Operation** (Reqt 2.08)

(1) If the time of operation is not within the specified limits and requirements 2.02, 2.04, 2.05, 2.07, and 2.14 are met, refer the matter to the supervisor.

**3.09 Motor Brush Requirements** (Reqt 2.09)**3.10 Commutator Requirements** (Reqt 2.10)

(1) Procedures for maintaining brushes and commutators are covered in the section dealing with this apparatus.

**3.11 Motor Torque** (Reqt 2.11)

(1) If the motor does not develop sufficient torque, and requirements 2.02 and 2.07 are met, refer the matter to the supervisor.

**3.12 Noise and Vibration** (Reqt 2.12)

(1) If the requirement is not met, check for tightness of all screws, nuts, and bolts. Tighten them if necessary. If this does not correct the trouble, the bearings may require replacement. Replace worn bearings.

**3.13 Operation of Limit Switches** (Reqt 2.13)

(1) **KS-5349 and KS-5445 Rheostats:** To change the point of operation of the limit switches, first loosen the setscrew of the associated cam. Reposition the cam on the shaft as required and securely tighten the setscrew.

(2) **KS-5501, KS-5713, KS-15571, and KS-15743 Rheostats:** To change the point of operation of limit switch "A", adjust the associated screw on the contact arm. To change the point of operation of limit switch "B", loosen the operating lever setscrews and reposition the lever on the shaft as required. Securely tighten the setscrews.

**3.14 Operation of Driving Clutch (Except KS-5385 and KS-5385-01, 200-800-ampere, Rheostats)** (Reqt 2.14)

(1) To adjust the clutch, loosen the clutch adjusting nut clamp screw. Turn the nut clockwise, as viewed from the end of the shaft, to decrease clutch slip and counterclockwise to increase the slip. Hold the adjusting nut in position and securely tighten the clamp screw.

**3.15 Temperature** (Reqt 2.15)

(1) If the temperature exceeds the specified limits and all other requirements are met, refer the matter to the supervisor.

**REASONS FOR REISSUE**

1. To add paragraph covering phi (1.04).
2. To revise paragraph covering asterisk (1.05).
3. To omit paragraph covering number sign (1.05 of previous issue) and to omit number signs from the section.
4. To omit paragraph covering successful commutation (1.06 of previous issue).
5. To add paragraph covering commutators and brushes (1.06).
6. To add requirement covering cleaning contact surfaces (2.01).
7. To revise requirement covering lubrication (2.01 of previous issue) (2.02).
8. To revise requirement covering the knife switch (2.02 of previous issue) (2.03).
9. To revise requirement covering contact alignment (2.03 of previous issue) (2.04).
10. To revise requirement covering contact pressure (2.04 of previous issue) (2.05).
11. To omit requirement covering condition of bearings (2.08 of previous issue).
12. To revise requirement covering motor brushes (2.09).
13. To revise requirement covering motor commutators (2.11 of previous issue) (2.10).
14. To omit requirement covering commutation (2.12 of previous issue).
15. To revise requirement covering temperature (2.14 of previous issue) (2.15).
16. To revise the list of tools, gauges, and materials (3.001).
17. To add paragraph covering use of petroleum spirits (3.002).
18. To add procedure covering cleaning of contact surfaces (3.01).
19. To revise procedure covering lubrication (3.01 of previous issue) (3.02).
20. To revise procedure covering the knife switch (3.02 of previous issue) (3.03).
21. To revise procedure covering contact pressure (3.04 of previous issue) (3.05).
22. To revise procedure covering rheostat resistance (3.05 of previous issue) (3.06).
23. To revise procedure covering motor voltage and current (3.06 of previous issue) (3.07).
24. To omit procedure covering bearings (3.08 of previous issue).
25. To revise procedure covering motor brushes (3.09).
26. To revise procedure covering motor commutator (3.11 of previous issue) (3.10).
27. To omit procedure covering commutation (3.12 of previous issue).
28. To revise procedure covering noise and vibration (3.13 of previous issue) (3.12).
29. To revise procedure covering operation of clutch (3.16 of previous issue) (3.14).
30. To revise figure showing KS-5501, KS-5713, KS-15571, and KS-15743 rheostats (Fig. 1).
31. To revise figure showing motor of KS-5501, KS-5713, KS-15571, and KS-15743 rheostats Fig. 2 of previous issue (Fig. 5).