I. L. 2057
(Filing No. 25-520)

# Westinghouse

## Gearmotors

## INSTRUCTIONS FOR CORRECT LUBRICATION AND MAINTENANCE

## LUBRICATION

The areas of contact on gear teeth are relatively small and the pressures produced in transmitting the loads are relatively large. It is, therefore, essential to provide a film of lubricant of sufficient strength to withstand the localized pressure during the period of contact. The peripheral speed of the gears governs the period of tooth contact and determines the time during which the film must withstand the pressures. When speeds are high, the time is very short and the loads are usually light, a comparatively light bodied lubricating oil can be used. When speeds are low and the loads heavy, the contact time is considerably longer and a heavier bodied oil should be used. However, the exacting requirements of gear unit lubrication under normal loads demand high grade oils.

Room temperatures or the temperatures of atmosphere surrounding the gear drive also have considerable bearing on the grade of oil that should be used. Mineral oils invariable show a higher viscosity as the temperature is lowered, and in the majority of instances, a heavy grade of oil possesses a higher pour point than a lighter one refined from the same stock of the same brand unless a special treatment has been used to lower the pour. Therefore, a gear drive operating in a surrounding temperature of Zero to plus 70 degrees Fahrenheit should ordinarily be lubricated with an oil of lower viscosity than the same unit operating in a surrounding temperature of from 70 to 120 degrees.

Westinghouse-Nuttall gear drives are designed with as near fool-proof lubrication systems as possible, wherein the gears and bearings are lubricated with the same oil. It is, therefore, obvious that if an oil of high viscosity and a high pour test is used in a gear drive which is subjected to low operating temperatures, the oil will not readily flow and may result in bearing failures. There is included as part of this leaflet a list of a number of reliable refiners and their oil which are recommended for use in Westinghouse-Nuttall units for different classes of service and under different operating temperatures. Any reliable refiners oils for equal grade and viscosity may be used.

We recommend that the unit be filled at the time of its installation with the recommended grade of oil to the proper oil level indicated by the oil level nameplate. For normal operation it is advisable to drain and filter the oil in the gear unit and refill to the specified oil level after one month's initial service, after which changing the oil once every six months will ordinarily be sufficient. Small quantities of oil may be added from time to time to maintain the proper level. However, this is very infrequently required. In no case should the oil level be higher than specified by the oil level nameplate. The oil level should be checked only when the unit is not running.

Each Gearmotor is provided with a breather, located at the top of the gear case. This breather is provided for the specific purpose of reducing the pressure inside the gear case to that of the surrounding atmosphere. Therefore, it is important to check this breather at regular intervals to make sure that the breather holes are not clogged up with dust or dirt. If the Gearmotor is in a dusty location, the breather should be packed with steel wool to prevent dust from entering the interior and mixing with the oil. The steel wool in these breathers should be cleaned in kerosene or gasoline at frequent intervals.

In the case of Gearmotors, the anti-friction bearing at the front end of the motor is grease lubricated and requires only occasional attention. This bearing is properly lubricated at the factory and in ordinary service will run for about a year as received. It is recommended, however, that a small quantity of high quality anti-friction bearing grease be added to the motor bearings about every four or six months to maintain an even lubricating condition.

The maximum temperature (temperature of oil inside the unit) at which a standard Gearmotor or gear unit should be operated is 180 degrees Fahrenheit. For operating temperatures below Zero degrees or higher than 180 degrees Fahrenheit, consult our engineers.

## RECOMMENDED LUBRICANTS FOR ALL GEARED SPEED REDUCERS GEARMOTORS OR SPEED INCREASING UNITS

Lubricating oils for use in Westinghouse-Nuttall gear drives should be of a **high grade,** high quality, well-refined Petroleum oil, filtered and within the recommended viscosity as noted below for duty and temperature.

| Viscosity Range S.U.V. Seconds | | |
|---|---|---|
| Lubricant Number | At 100°F. | At 210°F. |
| 1* | 490–700 | ..... |
| 2 | 700–1000 | ..... |
| 3 | ..... | 75–105 |
| 4* | ..... | 105–125 |
| 5 | ..... | 125–150 |
| 6 | ..... | 150–180 |

| For Operating Room Temperature of | | | |
|---|---|---|---|
| Service Duty | 0° to 70° F. Use Lubricant No. | 70° to 120° F. Use Lubricant No. | 120° to 180° F. Use Lubricant No. |
| Light | 1 | 1 | 2 |
| Medium | 1 | 2 | 3 |
| Heavy | 4* | 5 | 6 |

* Pour test 0°F. Max.

The following are trade names of oils (Refiners names listed in alphabetical order) complying with above specifications, but any reliable refiners oils of equal grade and viscosity may be used:

| Refiner | Lubricant Number | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| The American Oil Co. Baltimore, Md. | Amoco Motor Oil Medium SAE-30 | Amoco Motor Oil Heavy SAE-40 | Amoco Motor Oil Ex. Heavy SAE-50 | Amoco Motor Oil XX Heavy SAE-60 | Amoco Motor Oil Ultra Heavy SAE-70 | American Gear Oil #1504 |

## RECOMMENDED LUBRICANTS FOR ALL GEARED SPEED REDUCERS, GEARMOTORS OR SPEED INCREASING UNITS—Continued

| Refiner | LUBRICANT NUMBER | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Associated Oil Co. San Francisco, Cal. | Cycol SAE-30 | Aoco Penn 50 | Cycol C & T 50 | Vedol 60 | Cycol C & T 70 | Cycol S. G. Gear Oil |
| Atlantic Refining Co. Pittsburgh, Pa. | No. 1234 | No. 1235 | No. 1212 | No. 1168 | No. 1149 | No. 1104 |
| Gulf Refining Co. Pittsburgh, Pa. | Gulf Paramount Oil D | Gulf Parvis Oil A | Gulf Parvis Oil B | Gulfcrown Oil C | Gulf I. C. Oil B | Gulf I. C. Oil C. |
| E. F. Houghton & Co. Philadelphia, Pa. | Vital Medium Motor Oil | Vital Med. Heavy Motor Oil | Vital Heavy Motor Oil | Vital Extra Heavy Motor Oil | Special Vim Cylinder Oil | #800 Vim Cylinder Oil |
| Humble Oil & Refining Co. Houston, Texas | Humble 997 Motor Oil (SAE-30) | Humble 997 Motor Oil (SAE-40) | Humble 997 Motor Oil (SAE-50) | Humble 997 Motor Oil (SAE-60) | Humble 997 Motor Oil (SAE-70) | F.F.F. Cylinder Oil |
| Imperial Oil Ltd. of Canada | Imperial Marvelube Thirty | Imperial Marvelube Forty | Imperial Marvelube Fifty | Imperial Sturbinol-F. | Imperial Capitol Cylinder Oil | Imperial 20th Century Mineral Cylinder Oil |
| Keystone Lubricating Co. Philadelphia, Pa. | SR-3 | SR-2 | SR-2 | (a) SR-1 | SR-1 | # 73-W |
| Marathon Oil Co. Tulsa, Oklahoma | No. 406 | No. 410 | No. 412 | No. 426 | No. 434 | No. 438 |
| The National Refining Co. Cleveland, Ohio | Medium Heavy Enarco Motor Oil SAE-30 | Heavy Enarco Motor Oil SAE-40 | Dual-Heavy Enarco Motor Oil SAE-50 | (c) Extra Heavy Enarco Motor Oil SAE-60 | XX Heavy Enarco Motor Oil SAE-70 | Enarco #600 Gear Oil |
| Phillips Petroleum Co. Bartlesville, Okla. | Condor Heavy | Condor X- Heavy | Condor X- Heavy | (c) Condor XX-Heavy | 66 Tractor X- Heavy | 66 Tractor Super. Heavy |
| The Pure Oil Co. Chicago, Illinois | Klondyke Heavy | Puritan Spec. Heavy | No. 394 | No. 377 | Puritan Super Heavy | C-Mineral |
| Richfield Oil Co. Los Angeles, Cal. | Richfield Elevator Gear Oil 30 | Rioco Elevator Gear Oil 40 | Rioco Elevator Gear Oil 50 | Rioco Elevator Gear Oil 60 | Richlube Elevator Gear Oil 70 | Richfield Elevator Gear Oil Extra Heavy |
| Shell Eastern Pet. Products, Inc. New York, N. Y. | Shell Turbine Oil H-190 | Shell Diesel Eng. Oil #5 | Shell Diesel Eng. Oil #6 | (d) Shell Hi-Duty Oil 60 | Shell Hi-Duty Oil 70 | Cylinder Oil D-10 |
| Shell Petroleum Corp. St. Louis, Mo. | Shell Hi-Duty Oil 30 (d) | Shell High Duty Oil 40 | Shell Hi-Duty Oil 50 | Shell Hi-Duty Oil 60 (d) | Shell Hi-Duty Oil 70 | Shell Cylinder Oil D-10 |
| Shell Oil Co. San Francisco, Cal. | Shell Turbine Oil H-190 | Shell Diesel Eng. Oil #5 | Shell Diesel Eng. Oil #6 | (d) Shell Hi-Duty Oil 60 | Shell Hi-Duty Oil 70 | Shell B Cylinder Oil |
| Sinclair Ref. Co. New York, N. Y. | Opaline Oil Medium Heavy | Rubilene Oil Heavy | Rubilene Oil Extra Heavy | Opaline Oil Aircraft | Rubilene Oil Ultra Heavy | Mineral Valve Oil Dark |
| Socony Vacuum Oil Co. New York, N. Y. Magnolia Pet. Co. Dallas, Texas Gen. Pet. Corp. Los Angeles, Cal. | (a) Gg. DTE Oil Extra Heavy | Gg. DTE Oil—BB | Gg. DTE Oil—BB | (a) Gg. DTE Oil—AA | Gg. Super Cylinder Oil 600-W Mineral | Gg. Super Cylinder Oil 600-W Mineral |
| Standard Oil of California San Francisco, Cal. | Calol Turbine Oil Ex. Heavy (c) | Calol Diesel Eng. Oil Heavy | Calol Low Pressure Cyl. Oil | Calol Cylinder Oil (b) | Calol Cylinder Oil | Calol High Pressure Cylinder Oil |
| Standard Oil Co. 910 S. Michigan Ave. Chicago, Ill. | Superla Gear Oil #3 | Superla Gear Oil #2 | Superla Gear Oil #2 | (d) Superla Gear Oil #1 | Superla Gear Oil #0 | Polarine Transmission Oil #160 Summer |

**September, 1936**

**Supplement to Instruction Leaflets IL-1840 and IL-2057**

**Addition to table of Recommended lubricants for all geared speed reducers, gearmotors or speed increasing units.**

The following are additional trade names of oils (Refiners names listed in alphabetical order) complying with above specifications but **any** reliable refiners' oils of equal grade and viscosity may be used.

| Refiner | LUBRICANT NUMBER | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| Cities Service Oil Co. (Del.) Cities Service Ref. Co. Louisiana Oil Ref. | Cities Service Pacemaker #5 (c) | Cities Service Pacemaker #6 | Cities Service Pacemaker #7 | Cities Service Pacemaker #8 (c) | Cities Service Pacemaker #9 | Cities Service Pacemaker #10 |
| Cities Service Oil Co. (Pa.) | Cities Service Penn- (d) Pacemaker #6 | Cities Service Penn- Pacemaker #7 | Cities Service Penn- Pacemaker #7 | Cities Service Penn- (d) Pacemaker #8 | Cities Service Penn- Pacemaker #9 | Cities Service Penn- Pacemaker #10 |
| Continental Oil Co. Ponca City, Okla. | Dectol Heavy (c) | Dectol HH | Dectol Special Heavy | Dectol X Heavy (c) | Dectol XX Heavy | Transmission Oil SAE 160 |
| Pennzoil Co. Oil City, Pa. | Pennzoil Motor Oil Medium SAE 30 | Pennzoil Motor Oil Heavy SAE 50 | Pennzoil Motor Oil Ex. Heavy SAE 60 | Pennzoil Motor Oil Ex. Heavy SAE 60 (c) | Pennzoil Motor Oil Ex. Ex. Heavy SAE 70 L | Pennzoil Motor Oil Ex. Ex. Ex. Heavy SAE 70 H |
| Skelly Oil Co. El Dorado, Kansas | Tagolene SAE 30 | Tagolene SAE 50 | Tagolene SAE 50 | Tagolene SAE 60 (c) | Tagolene SAE 70 | Tagolene SAE 70 Plus |

(c) Not recommended for operating temperatures below 10° F.
(d) Not recommended for operating temperatures below 15° F.

# GENERAL INSTRUCTIONS FOR INSTALLATION AND MAINTENANCE

## INSTALLATION

The continuous efficient operating of a Gearmotor depends mainly upon five factors:

1. The alignment of the unit with driving and driven equipment.
2. Method of mounting and type of foundation.
3. Type of load and loading conditions.
4. Lubrication.
5. Maintenance.

It is obvious that correct alignment and mounting are necessary to prevent undue stresses on the shafts and bearings, and restricted action of flexible couplings. Frequently the cause of failure of bearings, shaft breakage, broken bases, overheating and noisy operation of equipment is that insufficient consideration was given the alignment and mounting. Therefore, these items should be periodically checked in every maintenance schedule.

The type of load and method of loading is very important in gear unit maintenance because the unit selected for a given service is intended to be operated at close to its rated horsepower capacity for greatest efficiency. Although allowance for a certain amount of overload was made when the unit was designed for the anticipated load conditions, they are frequently severely overloaded after installation due to excessive fluctuations in load, and wear in various parts of the entire installation.

To obtain the best results and bring the maintenance expense down to a minimum, the Gearmotor should be mounted on a solid foundation and properly aligned with the driven equipment.

Where the unit is supported on structural foundations, it is recommended that the supporting base plate thickness be not less than the diameter of the holding down bolts and that sufficient rigidness be provided in the structural members to prevent sway or flexing.

The low speed shaft may be directly coupled to the driven apparatus or connected by chain, belt or pinion. When chain or pinion drive is used it is recommended that the gear unit be doweled to the foundation.

Outboard bearings may sometimes be necessary for giving proper support to the low speed shaft when this shaft is subjected to unusually heavy loads, as would be the case when pulleys, sprockets or pinions of small diameters are used or pulleys with wide faces where the center of the belt extends beyond the center of the low speed shaft extension.

For general convenience, the projecting low speed shaft of gearmotors are made of standard length. This length is often greater than required with a sprocket, pinion, etc., used, but this should not be considered as an invitation to mount the sprocket or pinion at the extreme end of the shaft. Mount them as close to the bearing as possible, as an inch or two of unnecessary overhang may greatly increase the bending stress on the shaft leading to eventual fatigue failure.

## INSTRUCTIONS FOR MOUNTING IN POSITIONS OTHER THAN STANDARD GEARMOTOR MOUNTING

### Type "S" Gearmotors

Figures 1 to 4 show the various positions in which the unit can be mounted.

Figure 1 shows the standard mounting supplied. If it should be desired to change the output shaft to any other position, the following procedure must be followed, depending on the size of the unit.

For units 20-204 and 224-225, remove the six bolts holding the gear housing cover to the gear case, tap the cover lightly to obtain a space between the gear case and cover large enough to insert a screw driver or a similar instrument on each side 180° apart. Use the screw driver as a lever and pry uniformly until the cover leaves the pilot fit. On units equipped with two jack screws in the case cover, the cover can be removed by simply tightening up on the jack screws. It may be necessary to occasionally tap the end of the L.S. shaft so that this remains in the same position as when the unit is assembled. If this is not done, the gear on the L.S. shaft will interfere with the oil thrower located at the end of the high speed pinion. Unscrew the two hex head bolts inside the gear case (for certain ratios the oil thrower and gear will have to be removed, otherwise the bolts cannot be withdrawn) and the two bolts on the outside of the case.

The case can now be changed to the

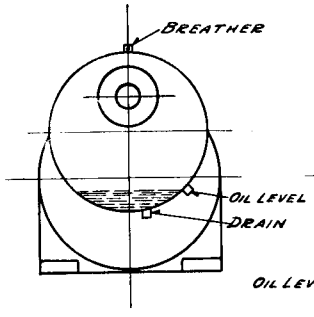


FIG. 1—STANDARD MOUNTING

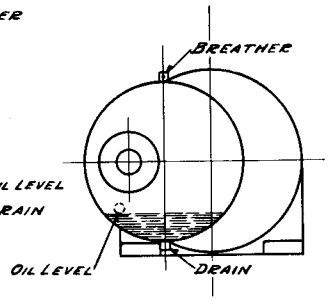


FIG. 2—L. H. HORIZONTAL MOUNTING

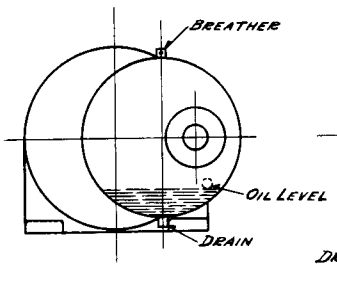


FIG. 3—R. H. HORIZONTAL MOUNTING

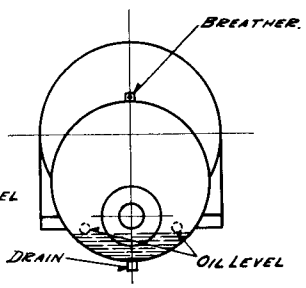


FIG. 4—LOWER VERTICAL MOUNTING

**GEARMOTOR MOUNTING—Continued**

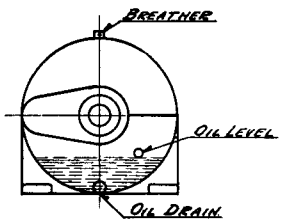


FIG. 5—FLOOR MOUNTING (STANDARD)

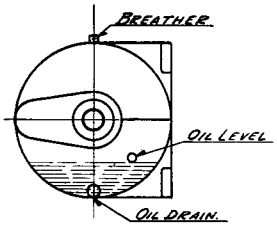


FIG. 6—RIGHT WALL MOUNTING (SPECIAL)

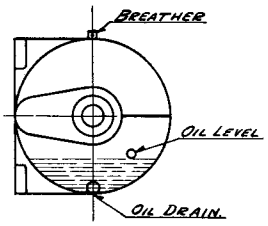


FIG. 7—LEFT WALL MOUNTING (SPECIAL)

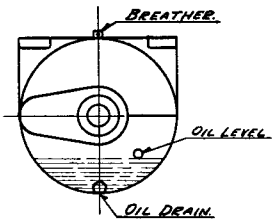


FIG. 8—CEILING MOUNTING (SPECIAL)

desired position 90° in each direction.

If it should be desired to change the position 180°, the bolts must be removed from the front motor bracket bearing cartridge also and the entire gear case and rotor assembly pulled out far enough to clear the motor feet.

When reassembling, be sure to put cement under the bolt heads on the inside of the gear case before tightening. The oil resisting cement should be of a good grade, preferably Westinghouse Cement #672 or an equivalent grade (such as "Princess Metallic"). The pilot fit on the gear case cover and the gear case, as well as the bolts holding the cover to the case, should be thoroughly cleaned and painted with a thin coat of cement to prevent escape of oil.

For units 254 and up, it is only necessary to remove the four bolts or, in some cases, the studs holding the gear case to the motor. The gear case can then be swung to any desired position. In all instances, when pulling out the gear case to rotate to the different positions, care must be exercised not to exert too much pressure or attempt to pull the gear case out more than just sufficient to free the pilot fit. Otherwise, the position of the high speed oil seal may be disturbed. All Type S gear cases are provided with oil level and drain plugs for any of the different positions but care should be taken to interchange the breather plug and the drain plug. Also the oil level nameplate should be changed to the proper position indicated. For any position of the gear unit, the grease reservoir for the front motor bearing should always be mounted downward. This can generally be done by simply removing the four bolts holding the motor bracket to the frame and swing to the desired position.

## Type D Gearmotors (feet on motor)

Figures 5 to 8 show the various positions in which the units can be mounted.

Figure 5 shows the standard mounting supplied. If it should be desired to change to any other mounting, the following procedure should be followed.

Unscrew the four bolts or studs holding the gear case to the motor; swing the motor, in relation to the gear case, to the desired position; insert bolts or studs and tighten gear case securely to the motor. If, for any reason, it should be necessary to remove the gear case top half, the easiest procedure is to remove the bolts holding the low speed end cap to the gear case; unscrew the nuts from the dowel stud bolts at the low speed bearing and push the stud bolts down far enough to clear the lower half gear case; unscrew the hex head bolts at the side of the gear case and finally the two bolts or studs, as the case may be, holding the gear case upper half to the motor; tap the lower half gear case lightly to provide sufficient space between the gear case and the motor to insert a screwdriver or similar instrument and pry the case away from the motor a sufficient distance to clear the pilot fit. The top half can now be removed by simply inserting a wedging instrument between the top and bottom half of the case and lift up. When reassembling, make sure that all joints and surfaces are thoroughly cleaned and free from oily substances, then paint the machined surfaces at the split of the case and the end at the low speed end cap, also the outside diameter of the oil seal with a good grade of oil resisting cement, such as Westinghouse #672. Be sure that no cement gets into the ball bearings.

## Type D Gearmotor (feet on gear case)

Figures 9 to 11 show the various positions in which the units can be mounted.

Figure 9 shows the standard mounting supplied. If it should be desired to

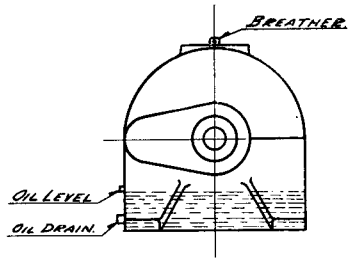


FIG. 9—FLOOR MOUNTING (STANDARD)

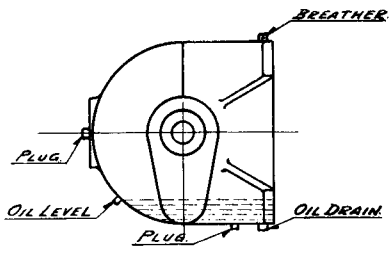


FIG. 10—RIGHT WALL MOUNTING (SPECIAL)

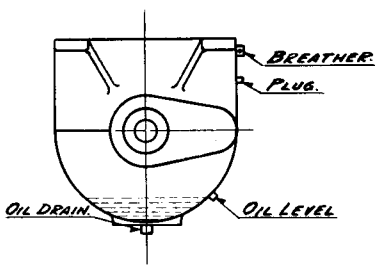


FIG. 11—CEILING MOUNTING (SPECIAL)

## GEARMOTOR MOUNTING—Continued

change to a position as shown on Figure 10, it will be necessary to drill and tap two additional holes; one for the oil level and one for the breather plug. The plug for the oil level may be located anywhere along the side of the case but the position of the plug in the other direction must be fixed. The oil level in the case must be high enough so that the pinion on the intermediate gear assembly dips into the oil a distance approximately equal to the full depth of the tooth.

The breather should preferably be located on the opposite side to the drain plug, as shown in Figure 10. On units 20-204 up to and including 326, the breather plug originally supplied with the unit should be used in the new position and a solid plug should replace the breather.

On Units 364 up to and including the 505, it will be necessary to remove the hand hole cover and thoroughly clean the surfaces and then paint them with a thin coat of an oil resisting cement, such as Westinghouse #672, and reassemble. The breather cap on the pipe nipple should be replaced by a solid cap and a new breather for the new position will be required. This breather may be of a similar type as the one originally supplied.

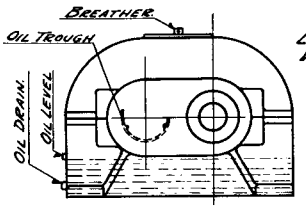


FIG. 12—R. H. UNIT, FLOOR MOUNTED (STANDARD)

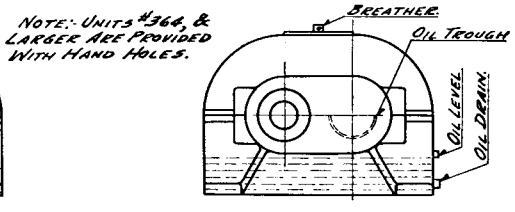


FIG. 15—L. H. UNIT, FLOOR MOUNTED (STANDARD)

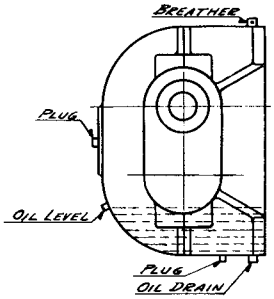


FIG. 13—R. H. UNIT, RIGHT WALL MOUNTING (SPECIAL)

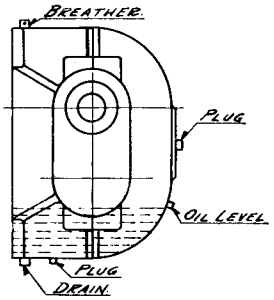


FIG. 16—L. H. UNIT, LEFT WALL MOUNTING (SPECIAL)

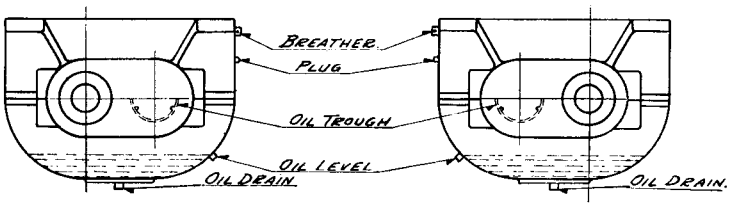


FIG. 14—R. H. UNIT, CEILING MOUNTED (SPECIAL)

FIG. 17—L. H. UNIT, CEILING MOUNTED (SPECIAL)

If it should be desired to invert the mounting as shown in Figure 11, the same procedure as for Figure 10 should be observed in regards to the hand hole cover and in addition four more holes should be drilled and tapped in the cover and top half gear case in order to prevent any possible oil-leakage between the case and hand hole cover, but it will not be necessary to drill a new hole for the breather. It is only necessary to supply a new breather. The hole for the oil level plug must be located at the same distance from the center of the unit as the original plug. Provide oil return drain groove in the top half gear case under the high speed bearing similar to the one originally furnished in the lower half case. When drilling and tapping the holes for the breather and oil level plug in the gear case, the top half of the gear case should be removed.

To remove the top half, proceed as follows:—Unscrew the two top nuts on the stud bolts at the low speed shaft end and push the stud bolts down far enough to clear the lower half of the case; unscrew all the bolts along the sides of the case and the two top bolts holding the motor to the gear case (in some cases the removal of the top half gear case is simplified if the two lower bolts holding the motor to the case is unscrewed approximately one-eighth of an inch); unscrew the bolts holding the low speed end cap to the gear case; tap the top half gear case lightly in a longitudinal direction a sufficient distance to permit the pilot on the gear case to clear the motor. The top half of the gear case is now ready for removal. When reassembling, make sure that all joints and surfaces are thoroughly cleaned and free from oily substances, then paint the machined surfaces at the split of the case and the end at the low speed end cap, also, the outside diameter of the oil seal, with a thin coat of oil resisting cement, such as Westinghouse #672 or equal. Be sure that no cement gets into the ball bearings. For any position of the gear unit, the grease reservoir for the front motor bearing should always be mounted downward. This can generally be done by simply removing the four bolts holding the motor bracket to the frame and swing to the desired position.

## Type FD Gearmotors

Figures 12 to 17 show the various positions in which the units can be mounted.

Figures 12 and 15 are the standard mountings supplied. If it should be desirable to change to a mounting, as shown in Figures 13 and 16, it will be necessary to drill and tap two additional holes, one for the oil level and one for the breather. The new location for the breather should be directly opposite to the location of the drain plug. The new location for the oil level must be accurate and located so that the low speed pinion is dipping in the oil a distance equal to the full depth of the tooth.

To properly lubricate the low speed bearing next to the shaft extension, it

**GEARMOTOR MOUNTING—Continued**

will be necessary to provide an oil scraper. The shape of the scraper should preferably be that of an angle with one of the sides mounted slightly above the split of the case above the bearing and extending out so that it barely touches the gear. The edge of the scraper touching the gear should not be less than three-quarters of an inch and from this point tapered off toward the side of the case where the bearing is located so that the oil will be directed into the bearing. The other side of the angle should be fastened to the inside of the case by either two machine screws or drive screws. The thickness of the scraper should be approximately one-thirty-second of an inch and the material may be either sheet iron, bronze or brass.

The breather plug for units 20-204 up to and including 326 may be used in the new location and a solid ¾" pipe plug put in the location where the original breather was located. For units 364 and up, where hand hole covers are provided, the breather cap must be replaced with a solid cap and a breather similar to the one used on the hand hole cover may be used or the same type as used on the smaller units will be adequate. The hand hole cover and gasket should be removed, thoroughly cleaned and the surfaces painted with a thin coat of a good grade of oil resisting cement, such as Westinghouse #672 or Princess Metallic, and reassembled.

To dismantle the case, the following procedure should be followed:

Remove all bolts holding the upper and lower gear case together; remove all bolts holding the low speed end plate to the gear case and, finally, remove the bolts holding the motor adapter to the upper half gear case. The upper half of the gear case can now be removed by simply lifting up. To completely separate the motor, including the adapter and high speed pinion, the remaining bolts holding the adapter to the lower half gear should be removed. When reassembling, be sure that no chips or metallic particles are left in the case. Also, clean all joints and surfaces thoroughly, paint the machined surfaces at the split of the case, the surface at the adapter pilot fit and the end of the case where the low speed end cap is located with #672 cement. Be sure that no cement gets into the ball bearings.

Figures 14 and 17 show the inverted mounting of the standard unit. If it should be desired to change to this mounting, a new location for the oil level plug must be provided and an interchange of the drain plug and breather. Also, the oil trough should be relocated in the top half of the case as shown and provision should be made for oil return drain groove in the top half under the high speed bearing the same as in the lower half case.

The oil level should be at an equal distance from the center of the unit to that of the standard mounting. The procedure for disassembling and reassembling the gear case will be the same as for Figures 12 and 13 except that it will be necessary to remove the oil trough from the lower half gear case and relocate in the upper half as shown and fasten with Parker Kalon Drive Screws, Type U, #4 x $\frac{5}{16}$.

The hand hole cover should be drilled and the top half gear case drilled and tapped for four additional bolts in order to prevent possible oil-leakage between the top half gear case and the hand hole cover. The surfaces should be thoroughly cleaned and painted with a thin coat of an oil resisting cement, such as Westinghouse #672 cement or equal, or a gasket placed between the hand hole cover and the case. For any position of the gear unit, the grease reservoir for the front motor bearing should always be mounted downward. This can generally be done by simply removing the four bolts holding the motor bracket to the frame and swing to the desired position.

## OIL CAPACITY FOR S-D AND FD GEARMOTORS

### Approximate No. of Quarts Required

| Unit No. | S—Std. Mtg. | S—Ceiling Mtg. | S—Wall Mtg. | D—Feet on Motor | D—Feet On Case | FD—Std. Mtg. |
|---|---|---|---|---|---|---|
| 20–204 | ⅕ | ¼ | ½ | 1 | 2 | 1½ |
| 224–225 | ¼ | ⅜ | ¾ | 1½ | 2½ | 2½ |
| 254 | ⅓ | ½ | 1¾ | 2¼ | 3½ | 4 |
| 284 | ½ | ¾ | 2 | 3¾ | 5½ | 4½ |
| 324–326 | ¾ | 1¼ | 3 | 4¾ | 10 | 7 |
| 364–365 | 1 | 1¾ | 3½ | ... | 14 | 8 |
| 404–405 | 1 | 2½ | 5¾ | ... | 20 | 10 |
| 444–445 | 1¼ | 5 | 8 | ... | 27 | 17 |
| 504–505 | 1¼ | 5½ | 12½ | ... | 40 | 23 |

**Note: Capacities listed above are approximate and will vary with the gear ratios used. Be sure to fill gear unit with oil to level indicated by the oil level nameplate.**

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