Westinghouse

Reduction Gears

I.B. 6028

WESTINGHOUSE REDUCTION GEAR UNIT

General

Figure 1 shows the construction and assembly of the Westinghouse type gear which can be used either as a reduction gear or a step-up gear. The principal parts are:- The housing base "1", the housing cover "8", gear wheel "2", pinion "19", bearings, oil pump and oil cooler. The pinion and gear wheel are each carried in two bearings, thus making the gear a complete, independent unit.

Housing

The housing is split in the horizontal plane through the axes of the pinion and gear wheel, thus forming a base and cover. The entire unit is supported by three accurately machined pads on the bottom of the base. This three point support arrangement eliminates distortion of the housing when bolted down and greatly facilitates alignment.

Gear Wheel and Pinion

For gears with a total tooth face of 5-1/4 inches or less, the gear wheel consists of a solid disc, pressed on and doweled to the gear shaft before machining the gear teeth.

For gears with a total tooth face of 6 inches or more, the gear wheel consists of a shaft on which a cast iron center (or spider) is pressed and doweled, and a steel rim which is shrunk on and doweled to the center before the teeth are cut.

The pinion is made of a single steel forging carefully annealed and heat treated before final machining.

The gear wheel and pinion teeth are of the double helical type accurately cut to the standard involute contour.

Bearings

The gear wheel and pinion bearings are of the same general type differing mainly in size. Each consists of a shell lined with tin base babbitt and provided with passages for oil pressure lubrication. Each shell is split horizontally and the upper and lower halves are held together by the housing cover which is bolted to the base. Oil is supplied through passages machined or cored in the housing and enters each bearing at the horizontal centerline on both sides.

With the double helical gear tooth arrangement, the right and left hand helices, of course, balance each other and thus eliminate axial thrust. However, for gears with total tooth face not over 12 inches, in order to hold the rotating parts in their correct axial position, the inner end of each gear wheel shaft bearing is babbitted to serve as a thrust bearing. As shown in the illustration, the rings formed integrally with the bearing shells fit against the inner faces of the housing and the babbitted ends restrict movement of the gear wheel in either direction. On larger gears, both ends of the bearings are babbitted and one bearing only, fits between shoulders machined on the gear shaft to hold the rotating element within the desired limits.

Bearing Clearances

The correct journal bearing clearances (that is, the clearances between the journals and the babbitt) are as follows:

(a) For pinion bearings, the clearance is .010 inch on sizes up to and including 5 inch diameter.

On larger sizes, the clearance is .002 inch per inch of bearing diameter. For example an 8 inch diameter bearing should have 8 x .002 = .016 inch clearance.

(b) For gear wheel bearings, the clearance is .010 inch on sizes up to and including 8 inch diameter.

On larger sizes, the clearance is .001 inch per inch of bearing diameter + .002 to .004 inch.

Oil Pump and Lubrication

The illustration, figure 1, shows the gear unit equipped with an oil pump to supply lubrication to the bearings and gear teeth. When the gear is connected to a turbine equipped with a pressure circulating system of lubrication, the turbine oil pump supplies the gear lubricating system. In such cases the gear oil pump parts "9" to "16" inclusive are omitted.

The gear oil pump, when used, is of the positive displacement, gear type driven from the gear wheel shaft. It consists of two spur gears, the driver "14" and the driven "13".

A priming cup is provided for priming the pump before starting, after which enough vacuum will be developed to lift the oil from the reservoir to the pump suction. After the initial starting, priming will not be necessary unless the unit has stood idle for a long period of time or has been dismantled. A gauge in the oil line shows at all times whether or not the pump is working properly. If no external reservoir is supplied, the housing base serves as an oil reservoir and is equipped with an oil level gauge. The pump takes oil from this reservoir and discharges through pipe and cored passages to each bearing and to the oil spray which lubricates the gear teeth. If an external oil pump is used, the oil is piped to the same inlets and a drain connection is made from the gear base to the main oil reservoir.

The location of the oil spray which lubricates the gear teeth is determined by the rotation of the pinion. If the pinion teeth enter into mesh from the top, the oil spray is located above the pinion as shown in "Enlarged View A" of the illustration. If the pinion teeth enter into mesh from the bottom, the spray is located below the pinion as shown in dot-dash lines. Several types of oil sprays are used. In some cases, they are supplied with oil through internal passages as shown in "Enlarged View B" of the illustration.

Oil Cooler

In order to keep the oil temperature within the desired limits an oil cooler is connected in the oil supply line. It should be connected to a supply of good water at a pressure not exceeding 50 lbs. per square inch.

When the reduction gear is lubricated from an external oil system having a cooler, the gear oil cooler shown in the illustration is omitted.

Installation and Alignment

If the apparatus is mounted on a bedplate, this should be set at the proper elevation and levelled, after which the couplings (connecting the elements of the unit) should be aligned accurately. If no bedplate is used, set the three pieces of apparatus on the foundation at approximately the

the proper level and definitely locate one of them. Then align the other elements to the one definitely located by accurately aligning their couplings.

If the direction of rotation is such that the normal running position of the pinion is against the upper halves of its bearings, the shaft connected to it should be set high by an amount equal to the clearance in the bearings.

Operation

Before starting a unit which is equipped with an oil pump, it is of course necessary to fill the oil reservoir to the proper level with a pure mineral oil of good quality. I.B. 6200 on the subject of lubrication, gives the recommended oil specifications for various types of units. The oil level should always be kept between the limit marks on the oil gauge with the gear in operation. It is very important not to add too much oil because if the oil level is too high, the revolving wheel will whip it, resulting in loss of power, excessive heating, and possibly gear tooth wear due to the oil breaking down.

Extreme care should be taken to keep the oil system free of water.

Prime the oil pump before the first run following installation or a general overhaul. After initial starting priming will not be necessary unless the unit has stood idle for a long period of time.

After starting, as the temperature of the oil increases, turn on the oil cooler water. Except as noted above the gear requires no manipulation. It should, however, receive the usual attention from the operator such as:-

1. Note that oil pump is functioning properly.

2. Note oil level. Any increase in oil level (without the addition of oil) indicates a leak in the oil cooling coil.

3. Feel bearings occasionally to see that they are running at normal temperatures.

Inspection and Repair

Periodically (about once a year) the unit should be dismantled and thoroughly cleaned and inspected. Dismantling is very simple and requires only a small amount of work. After disconnecting the oil pipes, the oil pump can be removed as a unit by breaking the joint between the pump body and the gear housing. The housing cover should be removed next which gives access to the bearings, gear wheel and pinion.

The bearings should be inspected and if worn excessively they should be renewed. The gear teeth should be examined to see that the contact markings are evenly distributed over both helices. If a feather edge should appear on the tips of the teeth, it should be removed by a fine oil stone. Any burrs or bruised spots should be dressed up with a scraper. DO not file these teeth under any circumstances.

It is of utmost importance that the axes of the pinion and gear wheel be parallel and have the correct center to center distance. The housing bores, bearing shell turns and bearing bores are accurately machined so that the above conditions are fulfilled if the bearings are in good condition. Consequently, if it should become necessary to renew any of the bearings, they should be renewed in pairs; that is, both pinion bearings or both gear wheel bearings. It is advisable to check all bearings to

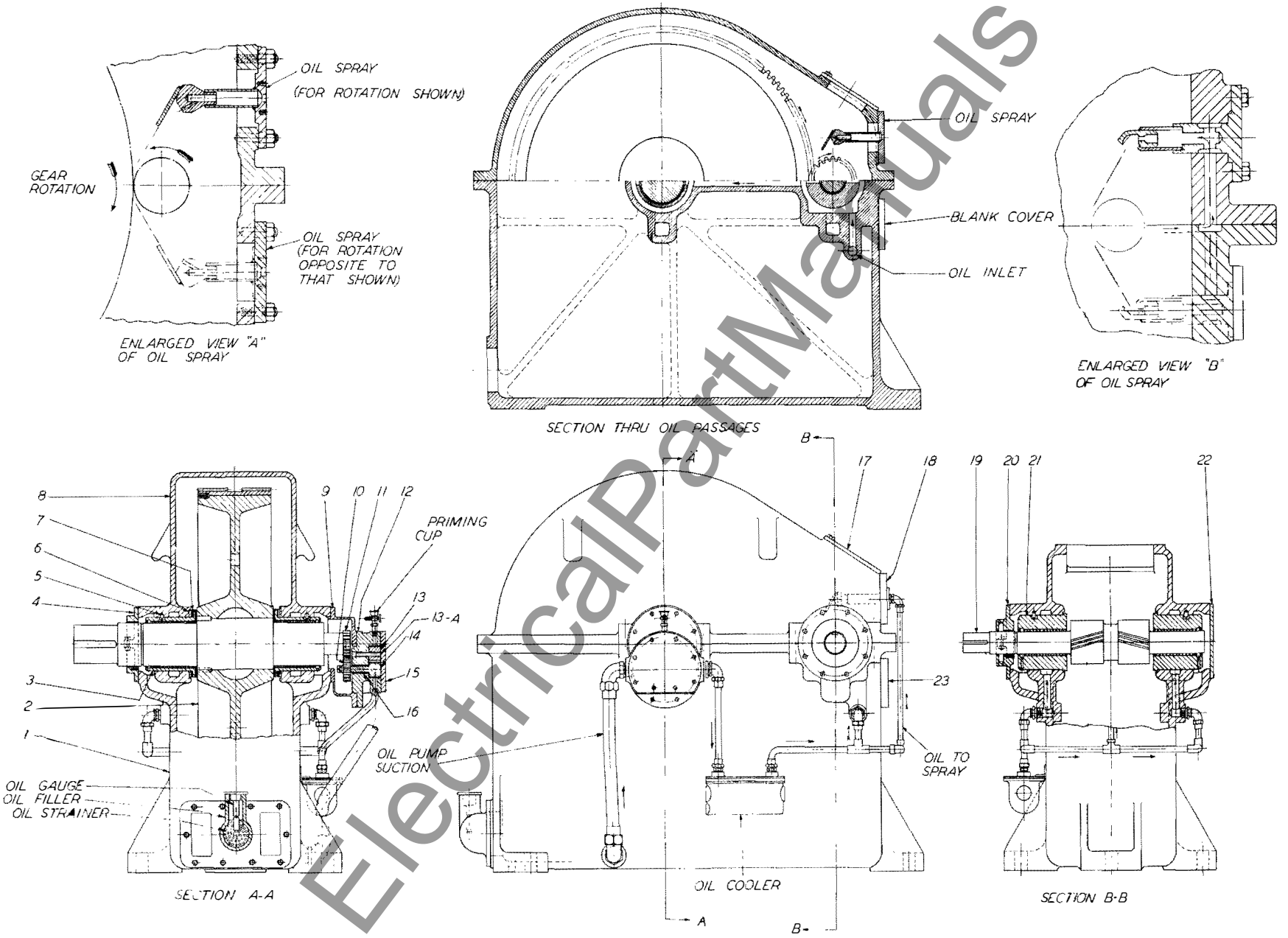

Figure 1

see that the bores are concentric with the outside turn of the shells.

If the bearings are bored central, the alignment of the pinion to the gear will be correct. It is also important to see that the bearing shells fit properly in the housing and that the upper and lower halves fit correctly at the horizontal joint. Errors in these fits may cause oil leaks, thus decreasing the oil supply to the bearings.

When reassembling the housing cover and oil pump body, the joints should be made up with shellac and pulled together tightly before the shellac hardens.

Repair Parts

The following list has been compiled to facilitate ordering spare or renewal parts by item number and name of the part desired. Whenever parts are ordered, it is of utmost importance to give the serial number of the unit on which the parts are to be used.

Item No.	Name of Part
1	Gear Housing Base
2	Gear Wheel Complete
3	Gear Wheel Bearing (Complete)
4	Gear Wheel Shaft Oil Guard
5	Gear Wheel Bearing Stop Pin
6	Gear Wheel Bearing Liner Retainer
7	Gear Wheel Bearing Liners
8	Gear Housing Cover
9	Pump Bracket
10	Pump Driving Gear (Driven)
11	Pump Driving Gear (Driver)
12	Pump Body
13	Pump Gear (Driven)
13A	Pump Gear Shaft
14	Pump Gear (Driver)
15	Pump Body Cover
16	Pump Gear Shaft Bushing
17	Inspection Hole Cover
18	Oil Spray Complete
19	Pinion Complete
20	Pinion Shaft Oil Guard
21	Pinion Bearing (Complete)
22	Gear Housing End Cover
23	Blind Flange

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