ROTOR TURNING GEAR

This turning gear is used to rotate the rotor at a very low speed (about 3 RPM.) while the turbine is shut down, so as to reduce to a minimum the distortion of the rotor due to uneven cooling of the turbine parts. Its use will vary, depending on the size and type of turbine and the local operating conditions. In general, it is recommended that the turning gear be used continuously during shutdown periods. If the shutdown period is to be of long duration, the turning gear should be operated for a sufficient period to prevent distortion, before the rotor is brought to rest.

If for any reason the turning gear stops while the turbine is cooling, the rotor should be allowed to stand and the turbine cooled without rotation unless the turning gear can be restored to normal operation within ten minutes. Obviously, following such an occasion, the entire unit must be allowed to cool to quite a low temperature before it can be started again.

In every case the turning gear should be operated for a short time before starting the turbine by steam. The best procedure for any particular unit can be determined only by actual operating experience and the shaft deflection shown by the truth indicators adjacent to each gland.

Figure 1 shows a sectional assembly of this mechanism. It is mounted on the coupling cover and drives the rotor by engaging gear teeth which are cut in the coupling spacer ring. Its principal parts are a driving motor, a train of spur gears to reduce the speed and a hand lever with the necessary linkage for engaging and disengaging the gear.

Referring to the Figure, the motor shaft carries the pinion "67", rotation of which is transmitted through two idler gears "62" to the gear wheel "60" which is mounted on the pinion shaft "35". The motor pinion and gear wheel "60" are of different diameters, thus giving an initial speed reduction. From this point on, the gear train is of conventional design in which the speed is reduced in four steps. Rotation of the pinion "35" is transmitted to the gear "34" and pinion "9", thence to the gear "14" and pinion "29", thence to gear "27" and pinion "16", thence through the idler gear "57" to the pinion "52" which engages teeth cut in the coupling spacer ring.

Each pinion shaft bushing is lubricated by oil, under pressure. This oil is supplied from the main bearing system and is led through machined and drilled passages as shown in "Section E-E-E-E" and "Section B-B-B". The discharge from the shaft bushings is directed onto the gear wheels to lubricate the gear teeth.

The 4th reduction pinion "52" is carried by the two arms "51" and "54" which are, in turn, fulcrumed on the shaft "59". The inner ends of the arms "51" and "54" are connected by the rod "73" to the hand lever "38". Therefore, raising the lever "38" moves the pinion "52" into mesh with the coupling teeth, and lowering the lever "38" moves the pinion out of mesh with the coupling teeth. Due to the direction of rotation and the position of the pinion "52" relative to the fulcrum point of the arms "51" and "54", as long as the pinion is exerting torque on the coupling its torque holds it in mesh. The two struts "49" limit its movement toward the coupling and thus limit the depth to which the teeth can mesh. If the speed of the turbine rotor increases sufficiently to drive the turning gear, the torque exerted by the coupling teeth automatically throws the pinion "52" out of mesh and thus disengages the mechanism.

To Engage the Turning Gear

1. Do not, under any circumstances, attempt to engage the turning gear while the turbine rotor is in motion. Wait until the turbine rotor stops.
2. Be sure that the auxiliary oil pump is running and that normal oil pressure is established on the turbine and generator main bearings.
3. Turn on the oil to the turning gear.
4. The hand lever "38" should be latched in its lowest position.
5. Start the motor, just enough to give it a spin.
6. Just before the motor stops, raise the hand lever "38", which brings the pinion "52" into mesh with the coupling teeth. Latch the lever "38" in its highest position.
7. Start the motor.

To Disengage the Turning Gear

(a) When the turbine is to remain shut down:
1. Stop the motor. It is impossible to disengage the turning gear by hand while the motor is running.
2. Move the hand lever "38" downward which moves the pinion "52" out of mesh. Latch the lever in its lowest position.
3. Shut off the oil to the turning gear and stop the auxiliary oil pump.

(b) When the turbine is being started up:
1. As the speed of the turbine increases, the turning gear will be disengaged automatically.
2. See that the lever "38" is latched in its lowest position.
3. Stop the motor.
4. Shut off the oil to the turning gear only.

The following list has been compiled to facilitate ordering spare or renewal parts by name and number together with the serial number of the turbine:

Item No.	Name
9	2nd Reduction Pinion and Shaft
10	2nd Reduction Pinion Shaft Bushing (Pinion End)
11	3rd Reduction Pinion Shaft Thrust Plate
12	3rd Reduction Pinion Shaft Bushing (Gear End)
13	2nd Reduction Gear Key
14	2nd Reduction Gear
15	4th Reduction Pinion Shaft End Cover
16	4th Reduction Pinion and Shaft (Upper)
17	4th Reduction Pinion Shaft Bushing
18	4th Reduction Pinion Shaft Arm Spacer
19	4th Reduction Pinion Shaft Arm Spacer Bolt
20	Taper Dowel
21	Bolt Locking Plate
22	4th Reduction Pinion Strut Nut
23	4th Reduction Pinion Strut Nut Lock Plate
24	4th Reduction Pinion Strut Nut Lock Plate Tap Bolt
25	Drive Shaft Bushing (Pulley End, in Halves)
26	Drive Shaft Bushing Retaining Bolt
27	3rd Reduction Gear
28	3rd Reduction Gear Key
29	3rd Reduction Pinion and Shaft
30	3rd Reduction Pinion Shaft Bushing (Pinion End)
31	2nd Reduction Pinion Shaft Bushing (Gear End)

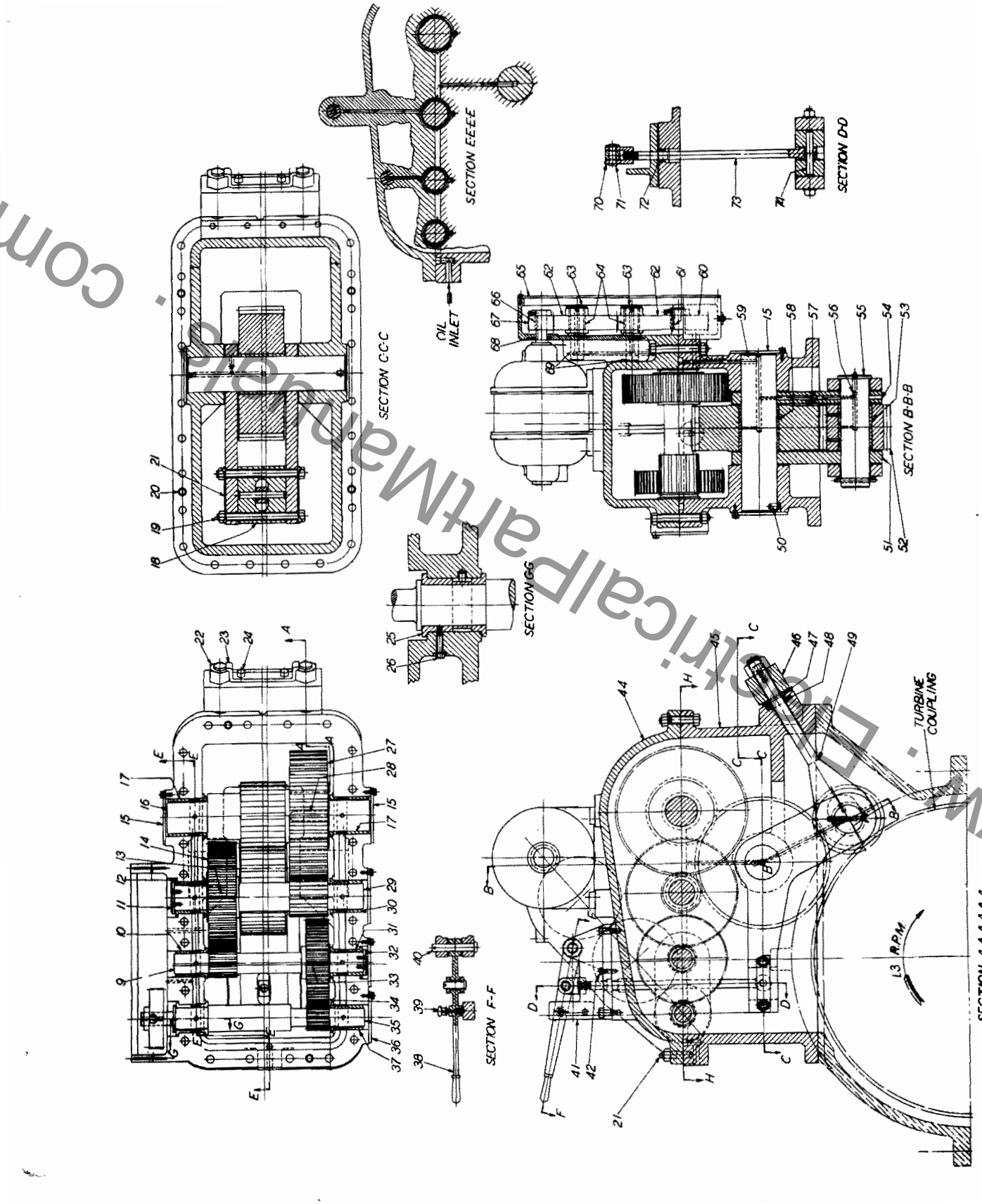

Figure 1

Item No.	Name
32	2nd Reduction Pinion Shaft Thrust Plate
33	1st Reduction Gear Key
34	1st Reduction Gear
35	1st Reduction Pinion and Shaft
36	Drive Shaft End Cover
37	Drive Shaft Bushing (Pinion End)
38	Engaging Lever
39	Engaging Lever Latch
40	Engaging Lever Fulcrum Pin
41	Engaging Lever Fulcrum Bracket
42	Taper Dowel
44	Housing Cover
45	Housing Base
46	4th Reduction Pinion Strut Equalizing Bar
47	4th Reduction Pinion Strut Packing Cover
48	4th Reduction Pinion Strut Packing
49	4th Reduction Pinion Strut
50	Idler Gear Shaft Dowel Pin
51	4th Reduction Pinion Shaft Arm (Without Oil Hole)
52	4th Reduction Pinion (Lower)
53	4th Reduction Pinion Bushing
54	4th Reduction Pinion Shaft Arm (With Oil Hole)
55	4th Reduction Pinion Shaft (Lower)
56	4th Reduction Pinion Shaft Dowel Pin
57	Idler Gear
58	Idler Gear Bushing
59	Idler Gear Shaft
60	Motor Drive Gear Wheel
61	Motor Drive Gear Wheel Key
62	Motor Drive Idler Gears
63	Motor Drive Idler Gear End Plate
64	Motor Drive Idler Gear Key
65	Housing Cover Plate
66	Motor Shaft Pinion Key
67	Motor Shaft Pinion
68	Motor Shaft Oil Retainer
69	Motor Drive Idler Gear Shafts
70	Engaging Lever Conn. Rod Crosshead
71	Engaging Lever Conn. Rod Pin (Upper)
72	Engaging Lever Conn. Rod Packing
73	Engaging Lever Conn. Rod
74	Engaging Lever Conn. Rod Pin (Lower)