Glands

Figure 1 shows the type of gland used to prevent leakage at the points where the rotor shaft passes through the cylinder. The gland consists essentially of a small impeller pump which operates within a case, and suitable labyrinth seals. Water is the only sealing medium used. The principal parts are: the impeller (or runner) consisting of items "11" and "12" and the case "4" and "16". The case is split horizontally to facilitate dismantling and assembly. It should be noted that this gland case is supported on the bearing housing and is connected to the hot cylinder wall by a flexible diaphragm "8". This arrangement reduces to a minimum any gland case distortion which might be caused by the extreme temperature gradient between it and the hot cylinder. As shown in the illustration, this gland case, being bolted to the bearing pedestal, carries also the oil seal for the pedestal.

Each runner consists of four segments which are secured to the rotor by interlocking shoulders together with the restraining ring "9" and the seal strip caulking strip "13" which are rolled into slightly dovetailed grooves. The runners are designed to be capable of pumping to a pressure of about 35 pounds, if supplied with water at the inner radius. Consequently, when water is supplied to the periphery at a pressure of from 5 to 10 pounds gauge, it is unable to flow into the turbine by reason of the pumping action in the opposite direction. Thus, there is maintained at the outer edge of the runner a solid annulus of water at a pressure which is greater than that against which the gland must seal.

As shown in the Figure, the gland case liner "5" separates the runner cavity from the annular chambers "X" and "Y", and the water passes through this liner by means of a series of small holes. This construction distributes the water supply around the entire periphery of the runner and eliminates any undesirable turbulent effect which may tend to break the seal.

This liner "5" also protects the main gland case against any erosive or corrosive action of the water in the runner cavity. It is made in halves and fits in grooves as shown. Hence, if the liner should become eroded or corroded, it can be renewed, thus restoring the gland case to its original condition. For the same reason, the runners are designed to form protective sleeves for the rotor, and they too can be renewed.

Labyrinth seal strips, items "10" and "13", are provided on both sides of the runner to reduce the water leakage to a minimum. An auxiliary drain is provided just inside the outer strip "13" to carry off any water which may leak past the inner strip and in normal operation with the gland functioning properly, there should be no leakage outward along the shaft. These seals consist of very thin flat strips and are held in place by soft steel caulking strips which are rolled into slightly dovetailed grooves. They should fit around the shaft with a small running clearance as shown on the "spindle clearance" drawing.

An additional labyrinth seal (not shown in the illustration) is provided in the cylinder just inside the gland, the number of seal strips and type varying with the pressure in the turbine cylinder against which the gland must seal. This inner labyrinth baffles the flow of steam toward the gland runner, thus reducing the actual pressure difference against which the runner must seal.

As shown in the illustration, a leakoff connection is provided at the top of the gland, and leakoff and drain connections at the bottom, all of which connect to the chamber just inside the main gland. When sealing

against an appreciable back pressure, any one or all of these openings serve as steam leakoffs, and should be connected to a zone of lower pressure as determined by the particular operating conditions (preferably atmospheric or slightly higher). Steam which leaks past the inner labyrinth is led off through the leakoff pipes, thus reducing the pressure in the leakoff chamber. If operating conditions are such that all of these openings are not required as leakoffs, those not used should be plugged. However, a connection must always be made to one lower opening to serve as a drain to carry off any water which may collect in this chamber.

The gland case has two openings to which water lines may be connected. Either connection may be used as the inlet and the other as the outlet. A valve in the outlet line should be adjusted to circulate just enough water thru the runner cavity to prevent boiling. Condensate should be used as a sealing medium so that the leakage can be returned to the system and also to eliminate scale deposit in the gland which would impair the seal. The supply should be maintained at the proper pressure by either an overhead tank or a relief valve.

The water pressure required to seal the gland properly depends largely on the actual pressure existing in the leakoff chamber. If this pressure is below atmospheric, the water supply pressure should be maintained at approximately 5 lbs. gauge at the turbine centerline. If the leakoff chamber pressure is above atmospheric, the water supply pressure should be increased (above 5 lbs.) one pound for every pound above atmospheric pressure which the manufacturer approves carrying in the leakoff chamber. For example, if the approved leakoff chamber pressure is 5 lbs. gauge, the water supply pressure should be approximately 10 pounds gauge.

Any outward leakage from the gland or condensation of vapor will collect in the cavity between the bearing housing oil ring and the gland case. The drain in the bottom of this cavity must be kept clear at all times.

It is important to note that the diaphragm "8" is made in a complete ring. Therefore, this part must be hung on the shaft in its proper position before the rotor is placed in the cylinder base. For the same reason, the diaphragm cannot be removed from the shaft until the rotor is lifted out of the cylinder.

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

Item No.	Name
2	Gasket
3	Tap Bolt (to brg. ped.)
4	Gland Case (upper half)
5	Gland Case Liner (in halves)
6	Tap Bolt (to cyl.)
7	Gasket
8	Gland Case Diaphragm (complete)
9	Gland Runner Restraining Ring
10	Gland Case Seal Strip & Caulking Strip
11	Gland Runner (inner)
12	Gland Runner (outer)
13	Gland Case Seal Strip & Caulking Strip
14	Oil Ring Seal Strip & Caulking Strip
15	Gasket
16	Gland Case (lower half)
17	Tap Bolt
18	Through Bolt
19	Through Bolt
20	Through Bolt (fitted)
21	Through Bolt

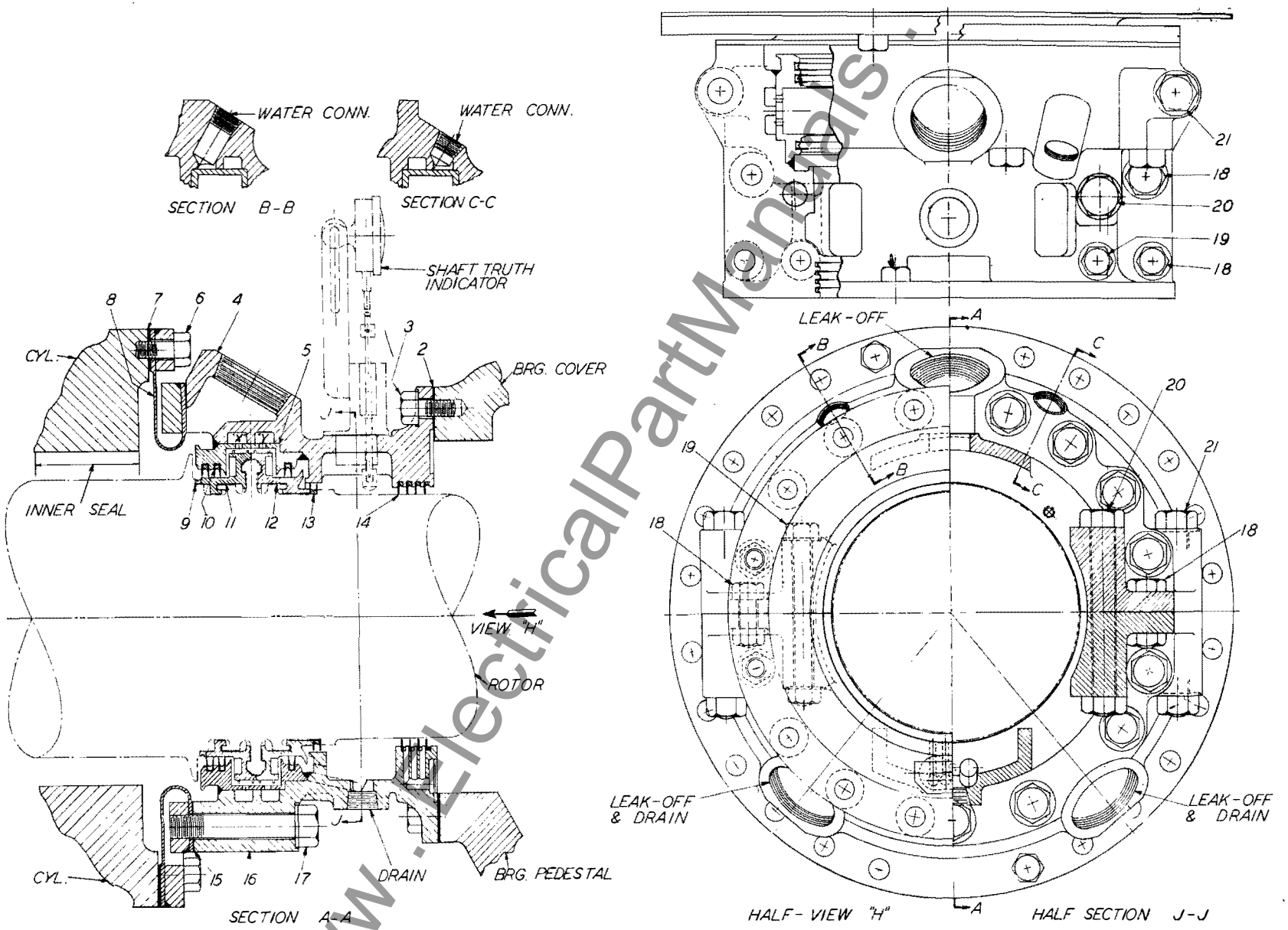

Fig.1- Gland and Oil Ring Assembly

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