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 "6" and "7" and the case "1" and "9". The case is split horizontally to facilitate dismantling and assembling.

Each runner consists of four segments which are secured to the rotor by interlocking shoulders together with the restraining ring "5" and the seal strip caulking strip "8" 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 5 to 10 lbs. 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 "3" 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 "3" 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 "6" and "7" are designed to form protecting sleeves for the rotor and they too can be renewed.

Labyrinth seal strips (items "4" and "8") 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 strips "8" to carry off any water which may leak past the inner strips 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 close running clearance as shown on the "Spindle Clearance Drawing."

When required by the operating conditions, 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 labyrinth baffles the blow of steam toward the gland runner, thus reducing the actual pressure difference against which the runner must seal.

As shown in the Figure, a leak-off connection is provided at the top of the gland and a leak-off and drain connection at the bottom, both of which connect to the chamber just inside the gland. When sealing against an appreciable back pressure, either or both openings serve as steam leak-offs, 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 then led off through the leak-off pipes, thus reducing the pressure in the leak-off chamber. Under these conditions if one leak-off is sufficient, the connection not used

should be plugged. When sealing against a vacuum, the opening at the top should be plugged and the drain at the bottom should be connected to the main exhaust chamber or condenser.

The gland case has two openings to which water lines may be connected. When sealing against pressures below atmosphere, one opening is used as the water inlet and the other is plugged. When sealing against pressures above atmosphere, it is necessary to circulate a small amount of water through the runner chambers "X" and "Y" to prevent boiling. Under these conditions the second opening serves as a water outlet and should be led to a convenient drain.

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

Condensate should be used as the sealing medium so that the leakage can be returned to the system and also to eliminate scale deposits in the gland which would impair the seal. A relief valve is furnished with the turbine to be connected in the water supply line to hold the required pressure constant. If more convenient, the water may be supplied from an overhead tank located at the proper elevation to give the required pressure.

Any outward leakage from the gland or condensation of vapor will collect in the cavity between the bearing housing and the gland case. The drain in the bottom of this cavity must be kept clear at all times, otherwise, water may accumulate and flow from the cavity into the bearing and contaminate the oil supply.

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

Item No.	Name of Part
1	Gland Case (Upper Half)
2	Gasket (1/32 Thick)
3	Gland Case Liner (In Halves)
4	Gland Case Sealing Strip (Inner)
5	Gland Runner Restraining Rings
6	Gland Runner Segments (Inner)
7	Gland Runner Segments (Outer)
8	Gland Case Sealing Strip (Outer)
9	Gland Case (Lower Half)
10	Gland Case Tap Bolt (Vertical Flange)
11	Gland Case Through Bolt (Horizontal Flange)
12	Gland Case Fitted Bolt (Horizontal Flange)

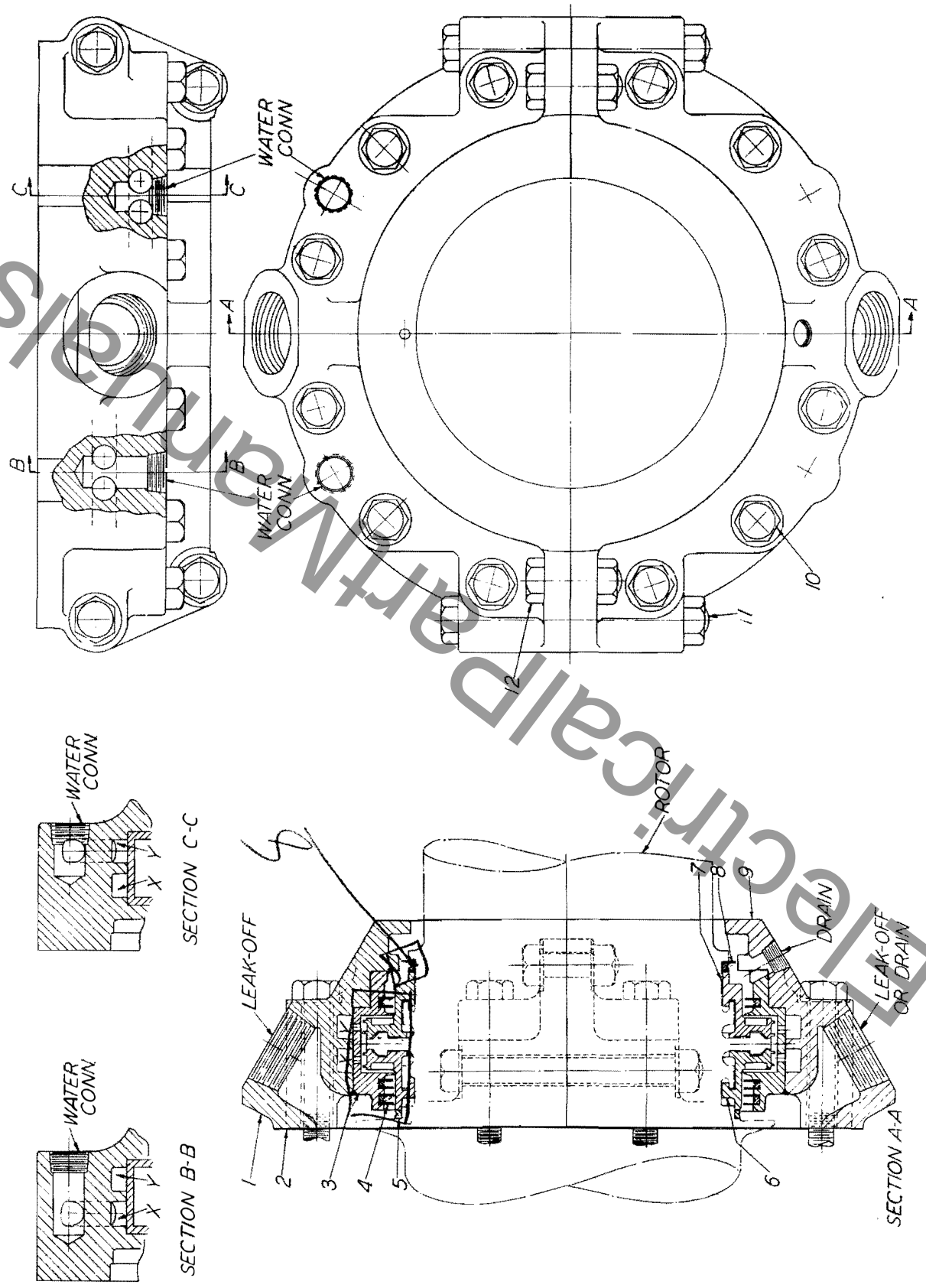

Figure 1

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