GLANDS
(Carbon)

Figure 1 shows the type of gland used to prevent leakage at the points where the rotor shaft passes through the cylinder. When the pressure inside the gland is below atmospheric, the gland must, of course, seal against leakage of air inward, while when the pressure within the cylinder is above atmospheric, the glands must seal against the leakage of steam outward into the atmosphere.

These glands are of the conventional carbon ring type, and are used either with or without auxiliary labyrinth seals. The case is split in the horizontal plane to facilitate dismantling and assembling. The carbon rings are made in three segments to insure a good fit around the shaft. It is essential that the joints at the ends of these segments be perfectly square and radial in order to prevent leakage of steam at these points. Each complete ring fits in a separate groove in the gland case and is held around the shaft by a garter spring and saddle arrangement which also serves to keep the joints at the ends of the segments tight. The ring is prevented from turning by a pin secured in the saddle which engages a slot in the gland case. If the gland is dismantled, it is important to re-assemble each segment in the same position as found originally. Scribe marks made on the rings at the time of dis-assembly will be found useful in this connection.

When fitting the carbon rings, every precaution must be taken to see that they are free to move radially in their individual grooves. If the rings are tight in the grooves, they will wear rapidly and in extreme cases may injure the shaft. The axial clearance necessary to insure this freedom of movement is approximately .032 inches. After squaring and fitting the ends of the segments, the complete ring should be bored to give .003 to .004 inch clearance on the diameter between the ring and shaft when cold. No oil should be used in fitting these rings.

When the pressure difference across the gland is large, a labyrinth seal is used in addition to the carbon seal and a leak-off connection is provided from the chamber between the labyrinth seal and the carbon seal. This labyrinth baffles the flow of steam toward the gland, thus taking a portion of the pressure drop and reducing the pressure difference against which the carbon rings must seal. The labyrinth leak-off should be connected to a zone of lower pressure, not greater than 100 lb. in^{2}g. When the labyrinth is used in the #1 gland only, this leak-off is usually connected to the exhaust.

The labyrinth seal consists of a number of very thin, steel strips, held edgewise in a grooved retaining ring by means of locking strips which are rolled into the grooves. The retaining rings are split on the horizontal plane and are inserted in grooves provided in the cylinder base and cover. The rings are held in place by garter springs and are prevented from rotating by locking pins. After assembly, a very small running clearance normally exists between the sealing strips and the shaft, although any rubbing that might occur is negligible.

The illustration shows a labyrinth seal at the #1 gland only. It should be borne in mind that the use of these inner labyrinth seals depends entirely on the operating steam conditions. In some cases they are omitted altogether and in cases of high exhaust pressure, they are used at both ends. Likewise, the number of carbon rings used in each gland may vary to suit the operating conditions. The exact arrangement of carbon rings and labyrinth seals for each particular turbine is given on the Title Page of its Instruction Book.

As shown in the illustration, there are two openings for pipe connections in each gland case. These should be connected as follows:

<u>For Non-Condensing Operation:</u>

1. The opening at the bottom of the gland case serves as a steam leak-off and drain and should be connected to some point at atmospheric pressure, where a slight amount of escaping steam is not objectionable.

2. When sealing against moderate pressures, the opening in the top of the gland case should be plugged. When sealing against high pressures, this upper

opening may be used as an additional leak-off and should be connected in accordance with special instructions supplied in each case.

For Condensing Operation:

1. The opening at the bottom serves as a drain and steam leak-off and should be connected to some point at atmospheric pressure where a slight amount of escaping steam is not objectionable.

2. The opening at the top of the gland case serves as a steam inlet and should be connected to a supply of low pressure steam which serves as the sealing medium.

Note:- When the top and bottom openings connect to the same gland case chamber, the top opening can be plugged and the low pressure sealing steam admitted through the bottom opening. Valves must be provided to control the admission of sealing steam and also to allow drainage of condensation from the gland case cavity.

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
1	Gland Case, Upper Half, Coupling End
2	Gland Case, Lower Half, Coupling End
3	Gland Case, Lower Half, Thrust End
4	Gland Case, Upper Half, Thrust End
5	Retaining Ring (in halves)
6	Labyrinth Seal Retainer Complete
7	Labyrinth Seal Retainer Springs
8	Carbon Seal Ring Complete
9	Carbon Seal Ring Spring Saddle
10	Saddle Pin
11	Carbon Seal Ring Spring

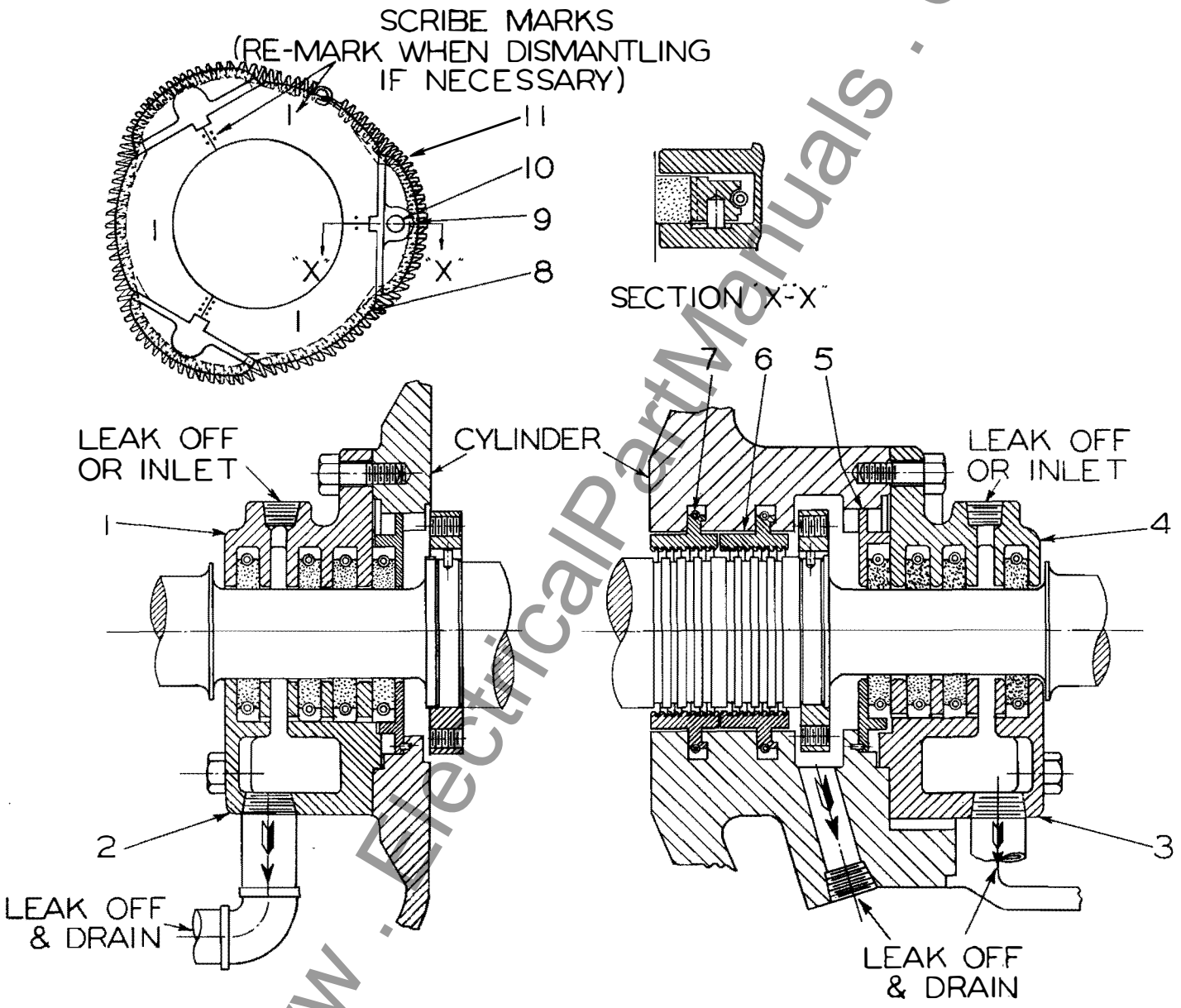

Fig.-1 Gland Assembly