BLADING

(RATEAU STAGE)

A Rateau stage, as described in this leaflet, consists of a steam tight diaphragm, provided with nozzles, and a rotating disc, carrying a single row of blades, which immediately follows it in the steam path. Several such stages are usually used in sequence, the number depending on the steam conditions and the work required of the turbine.

DIAPHRAGMS

The diaphragm may be either of two types, namely, the welded diaphragm or the cast diaphragm. For convenience, the illustration (Figure 1) is arranged to show both types with the welded construction shown in the lower half and the cast construction in the upper half. Needless to say, only one type of construction is used in a single diaphragm. When completed, both types function and are handled in exactly the same manner. The principal difference is in the method of manufacture and this difference is described below, merely as a matter of interest.

In the welded diaphragm, the nozzles are formed by curved vanes (or partitions which form the steam passages) secured within an outer and an inner ring. These parts are assembled in jigs and electrically welded to form the completed diaphragm. The nozzle vanes are made of stainless steel and are machined to sections approximating those of actual blades.

In the cast diaphragm, the nozzle vanes are inserted in grooves cut in the inner ring, and secured by welding. The outer ring is then formed by casting metal on the outer tips of the vanes. The bolts shown (in dotted lines) in the illustration serve as additional anchors and are surrounded entirely by cast metal in the finished piece.

These nozzles may be provided entirely around the diaphragm, for what is known as one hundred per cent admission, or they may be provided around only a part of the circle, the number being dependent on the design conditions. In case nozzles are provided in only one half, the other half is made in the form of a blank.

Each diaphragm is split in the horizontal centerplane and the joint faces are carefully finished to form a steam tight joint. The halves are kept in accurate alignment by means of keys which are secured in the lower half and engage keyways provided in the upper half.

The upper and lower halves are fitted in grooves machined in the cylinder cover and base respectively. A small radial clearance is allowed between the diaphragm and the bottom of the groove, and crushing pins spaced around the outer circumference, maintain the accurate position of the diaphragm and absorb the differential expansion between the diaphragm and the cylinder. Accurate finish of the outlet face of the diaphragm and groove prevents steam leakage at this point. Leakage at the inner bore along the shaft is reduced to a minimum by a labyrinth seal described in a separate leaflet.

The two halves of the diaphragm are held in the cylinder by retaining screws at the horizontal joint. When raising the cover of the turbine it should be borne in mind that the diaphragms will be raised with it, and it is important that the lift be straight upward to avoid damage to the adjacent blades.

DISCS

The discs are assembled on the shaft with heavy shrink fits and keys. Each disc is further secured against axial movement by a shrink ring on each side.

BLADES

The blades used may be either of two types; namely, the "T-root" or "Dovetail". The type used depends mainly on the steam conditions encountered and other design factors.

The T-root blades are manufactured by either of two methods; namely, milled from bar stock or formed by brazing a conventional type packing piece to a rolled blade section. The type used is determined by the blade size and design conditions. In either case, the roots are machined to form a "Straddle T" fastening which straddles and holds in the sides of the disc groove, thus resisting the tendency of the blade pull to spread the sides of the groove. The blades are held against the top of the groove by half round segments caulked in place at the bottom. The shroud strip is fitted over tenons on the ends of the blades and secured by rolling (or riveting) the tenons over the shroud.

The dovetail blade is likewise made from a rolled section. The root is machined to fit a dovetail shaped groove in the disc, and a soft steel packing piece, placed between each pair of blades, spaces them to give the correct area for steam passage. Each row is shrouded in the same manner as described above for the T-root blades. This shroud serves to space the outer ends (or tips) of the blades correctly and prevents spilling of the steam.

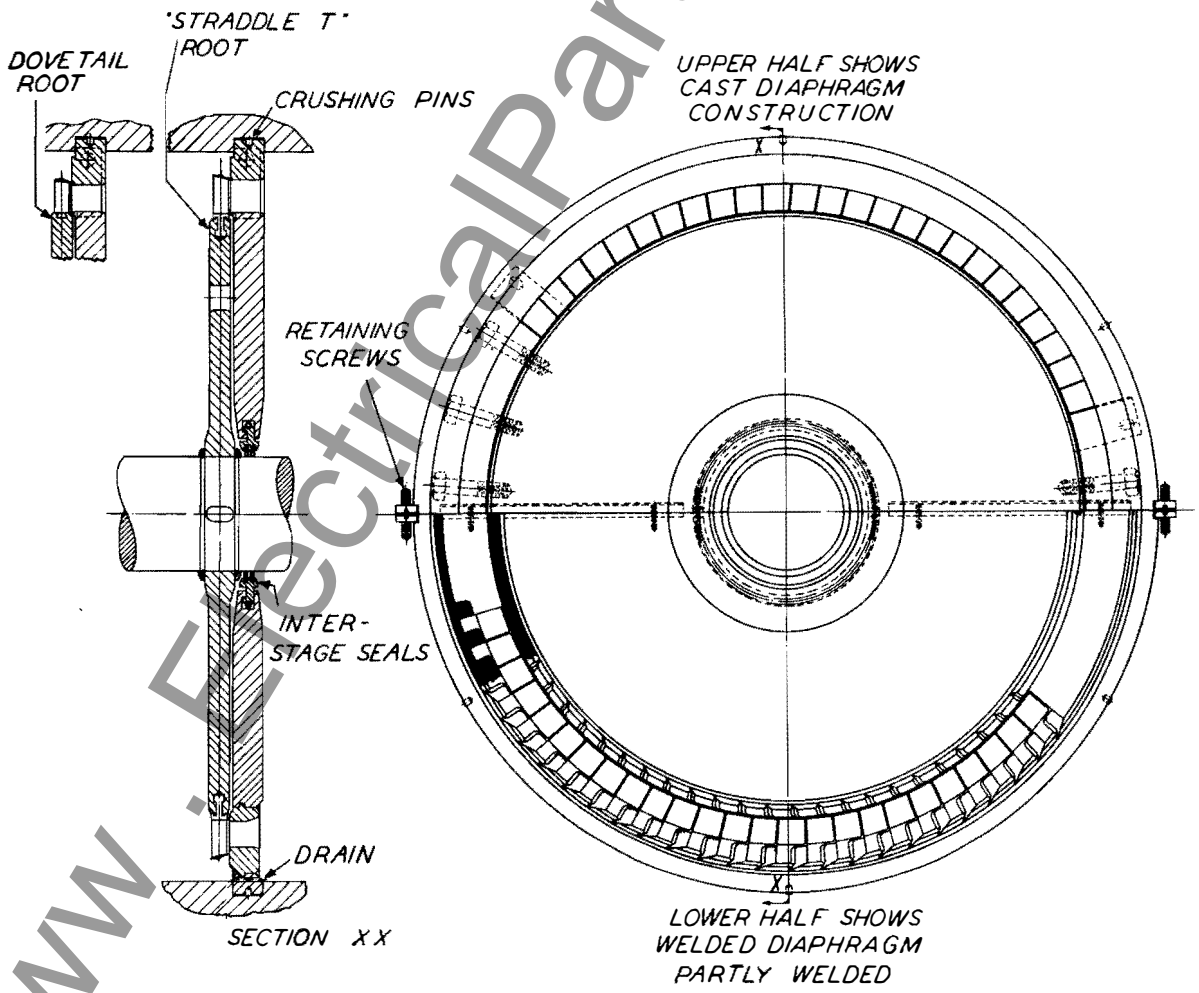

Fig. 1