By mounting the wheel in an air-tight casing at some distance above the tail-race and using a discharge pipe or draught tube, delivering below the surface of the tail-race, the difficulty may be overcome. On starting up the turbine the escaping water ejects the air from the casing and creates a partial vacuum. An air valve, actuated by a float in a chamber connected with both casing and draught tube, then admits sufficient air to prevent the water level from rising as high as the wheel.

This method has not been adopted often in the past. In view of the somewhat serious loss due to windage at the speeds necessitated by the high heads now being utilised, there is reason to think that it may again come into use, since windage losses are directly proportional to the density of the air.

In the *Haenel* "limit" turbine, which is essentially the same as the Girard, the buckets were so designed as to run full when working as an impulse turbine, the areas of the wheel passages being approximately the same throughout. The flooding of the turbine does not then affect its efficiency, except in so far as it affects the available head, since the machine then acts as a pressure turbine. It proved fairly good for low falls with a head which does not vary greatly, giving efficiencies varying from about 60 per cent. at half gate to a maximum of about 72 per cent. It is now obsolete.

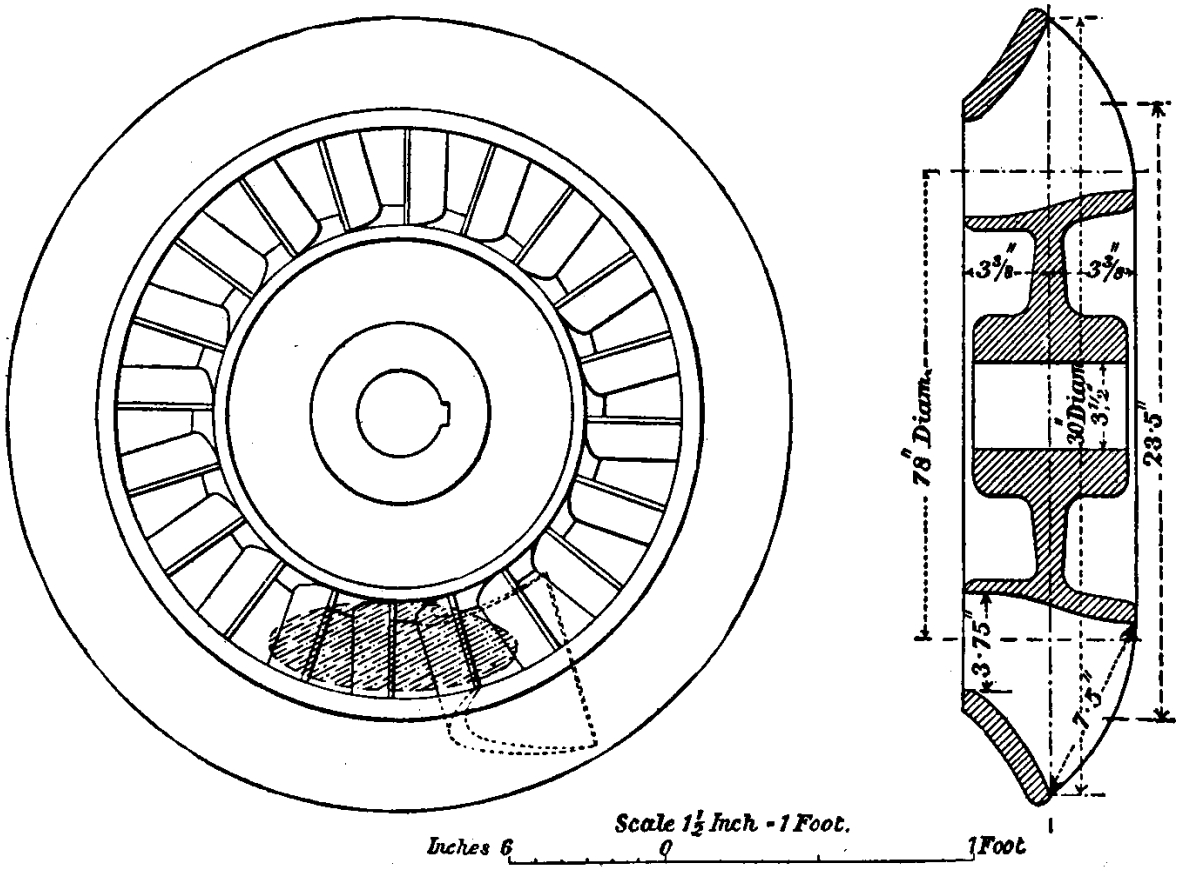

FIG. 208.—Runner for "Turgo" Turbine.