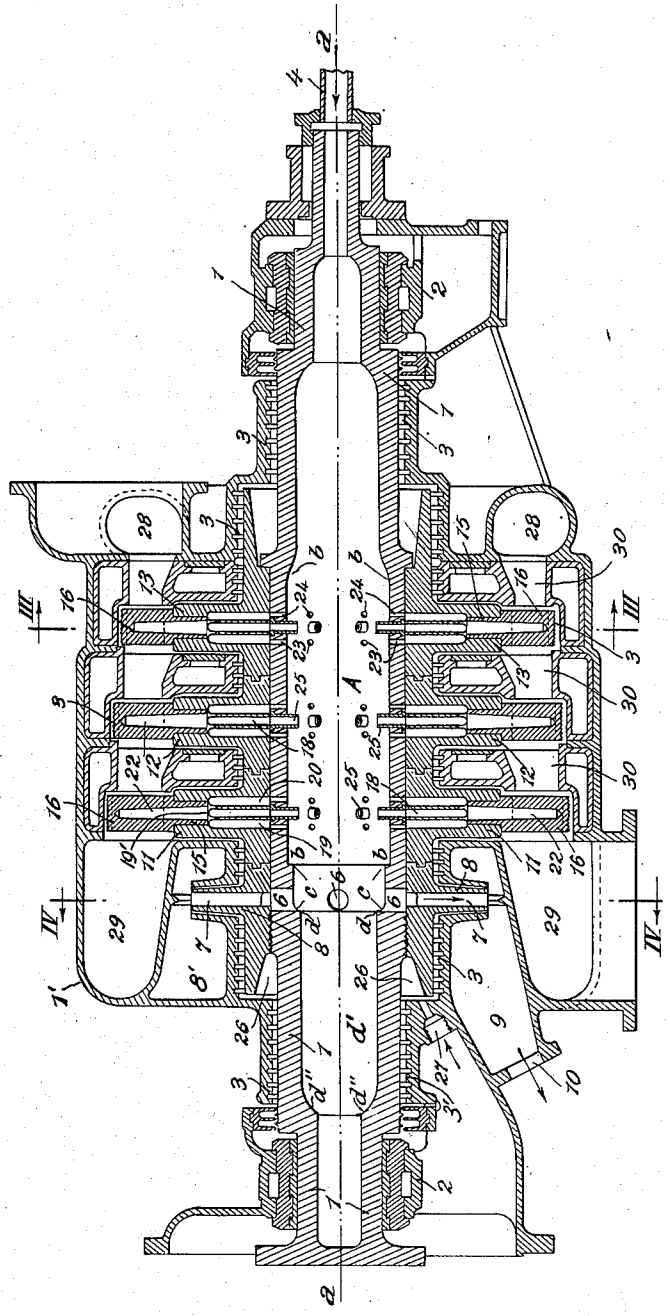
March 16, 1937. G. BELLUZZO 2,073,605

CONSTRUCTION OF INTERNAL COMBUSTION TURBINES

Filed March 29, 1935 2 Sheets-Sheet 1

Fig. 1



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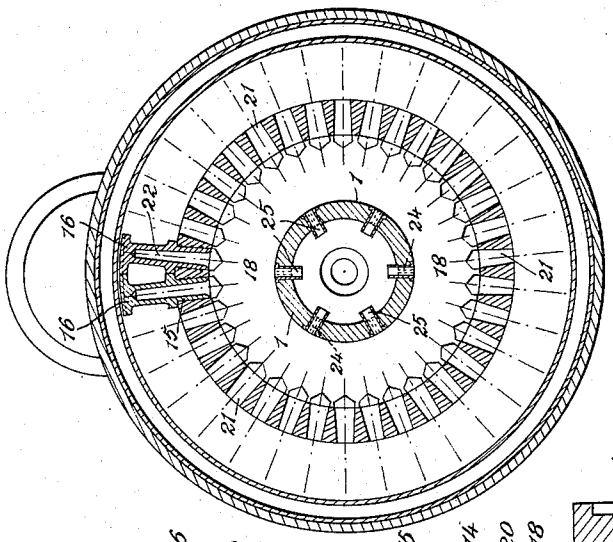

Fig. 3

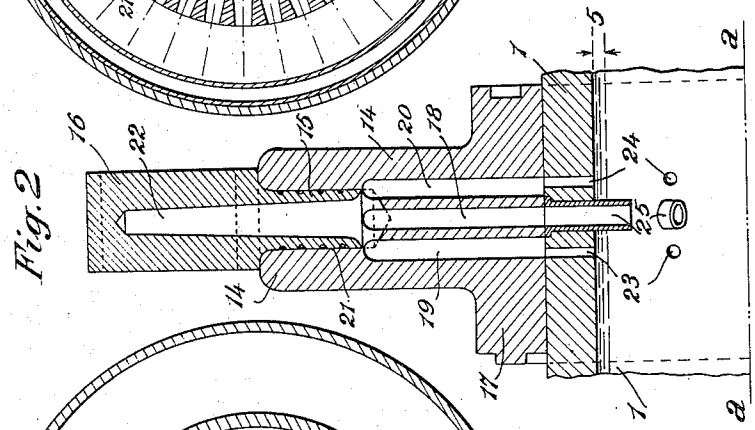

Fig. 2

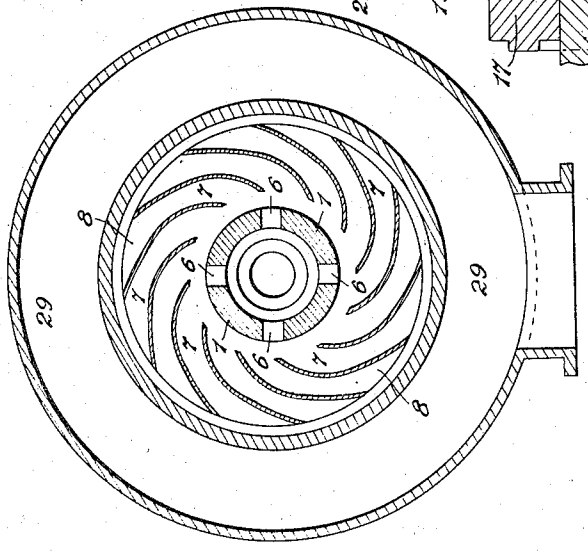

Fig. 4

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CONSTRUCTION OF INTERNAL COMBUSTION TURBINES

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Application March 29, 1935, Serial No. 13,775
In Italy February 21, 1935

4 Claims. (Cl. 60—41)

My invention relates to internal combustion turbines and more particularly to improvements in rotors therefor.

The principal object of my invention is to equip a turbine with an efficient rotor including impellers and novel means for rendering the latter proof against the action of hot driving gases to which they are exposed.

Other and subordinate objects will presently appear when the following description and claims are read with reference to the drawings accompanying and forming a part of this specification.

In said drawings:

Figure 1 is a view in longitudinal vertical section of a turbine embodying my invention,

Figure 2 is a fragmentary view in vertical section of one of the impellers and a part of the rotor shaft drawn to an enlarged scale.

Figure 3 is a view in transverse section taken on the line III—III of Fig. 1 looking in the direction indicated by the arrows, and

Figure 4 is a similar view taken on the line IV—IV of Fig. 1 looking in the direction indicated by the arrows.

Referring now to the drawings the numeral 1 designates the rotor, or drive, shaft journalled adjacent its opposite ends for rotation about the axis *a—a*, and in suitable bearings 2 in the turbine casing 1'. The rotor shaft 1 is hollow and opens at one end only at which end it is coupled, as by coupling 4' to a pipe 4 by means of which water is admitted to the interior of said shaft from any suitable source of supply not shown. Labyrinth packing 3 located at suitable points provide for sealing said casing around said shaft for a purpose which will be apparent.

The rotor shaft 1 is formed internally with a median bore A of maximum diameter terminating at its ends in inwardly extending shoulders *b, b*. At one end of said bore A is a bore portion *c* of reduced diameter opening into a bore portion *d'* of still smaller diameter forming at its inner end an inwardly extending shoulder *d, d* around the outer end of the bore *c* and a shoulder *d'', d''* at its outer end. The bore *c* is provided with outlet ports 6 opening into conduits 7 formed in a wheel 8 fast on the shaft 1 and forming a centrifugal pump discharging into a chamber 9 provided in the casing 1' said chamber having a discharge outlet 10.

The impellers of which three are shown 11, 12 and 13, are grouped around the bore A of the shaft 1 and are constructed as follows:

Fast on said shaft 1 are hub members 17 each comprising a radial circular flange 14 provided with radial bores 21 into which the inner root ends 15 of radially extending impeller blades 16 are pressed or otherwise suitably secured. The hub members 17, in each instance, are formed in their median plane with a radially extending chamber 18 surrounding the shaft 1, and a pair of similar chambers 19 and 20 at opposite sides of the chamber 18. The chambers 18, 19 and 20 extend to the inner end of the blades 16 and communicate at this point as indicated at 19' with each other and also with an outwardly tapering longitudinal bore 22 formed in each blade 16. The axis of each bore 22 is in the plane of the chamber 18, the chambers 19 and 20 being laterally offset from said axes for a purpose presently apparent. The chambers 18 communicate with the bore A by means of nipples 25 disposed radially in the shaft 1 and extending inwardly to a depth substantially in line with the wall of the bore *d'* for a purpose presently seen. The chambers 19 and 20 communicate with the bore A by way of ports 23 and 24 formed in the shaft 1.

In operation, the hot gases are introduced into a chamber 28, provided in the casing 1' subsequently expanding in distributors 30, for operation of the blades 16 in the usual manner and discharging by way of the exhaust chamber 29.

Water introduced into the shaft 1, under centrifugal action of the rotor forms a film or layer around the wall of the bore A between the shoulders *b, b*, and enters the bores 22 of blades 16 by way of ports 23 and 24 and chambers 19 and 20 any excess of water being discharged by way of bore *c*, ports 6 and wheel 8 into chamber 9. Since the nipples 25 extend beyond the shoulders *b, b*, no water enters therein. Under the action of the hot gases the water in the bores 22 generates steam which is discharged therefrom by way of chamber 18 and nipples 25 through the film of water back into the bore A and is exhausted therefrom by wheel 8 by way of ports 6 through the conduits 7 into chamber 9. Excess water exhausted by way of bore *c* and ports 6, may be conveyed to a cooling apparatus, not shown, for recirculation through circuit described.

In order to prevent leakage of water or steam back into the casing 1' the wheel 8 is suitably enclosed, partially, in a chamber 8' and sealed by labyrinth packing as at 3'. One side of said wheel is chambered as at 26 for the introduction of compressed air thereto, by way of a port 27 in the casing 1', whereby any leakage of steam and excess water past the packing 3' between

said wheel and the casing is stopped. The compressed air may be introduced from a suitable source not shown.

The foregoing is a detailed description of a preferred embodiment of my invention but right is herein reserved to changes and modifications within the scope of the appended claims.

What I claim is:

1. In a turbine driven by high temperature combustion products, a rotor comprising a hollow shaft communicating with a source of cooling liquid, said shaft having a median bore and bore of smaller diameter at opposite ends of said median bore respectively, means for forcing said cooling liquid axially into one of said smaller bores whereby a thin layer thereof will be formed under centrifugal action around the median bore of said shaft, means in the opposite one of said smaller bores for discharging excess liquid from said shaft, a series of impellers mounted on said shaft and comprising respectively a hub portion, and impeller blades projecting radially from the hub portions, each blade having a longitudinal central bore therein, and said hub portion having therein three circular chambers extending side by side radially of said shaft around the same, the two outer circular chambers being laterally offset from said longitudinal bores and communicating at their outer edges with said bores and at their inner edges with the interior of said shaft, whereby cooling liquid may be forced from said shaft into said longitudinal bores through said chambers, and a plurality of nipples projecting from the inner wall of said shaft toward the axis thereof and establishing communication between the central one of said chambers and the interior of said shaft beyond the layer of liquid therein, said central chamber being in the axis of the longitudinal bores and communicating at its outer edge with said bores, whereby steam generated within said bores by said high temperature combustion products may be discharged into the interior of said hollow shaft through said central chamber.

2. A turbine according to claim 1, in which the hollow shaft is provided with radial through ports establishing communication between said two outer chambers and the interior of said shaft.

3. A turbine according to claim 1, in which said impellers being grouped around said median bore, said shaft having radial through ports therein opening into one of said bores of smaller diameter for discharging steam and excess liquid from said shaft.

4. A turbine according to claim 1, in which said shaft has a median bore and bores of smaller diameter at opposite ends of said median bore, respectively, said impellers being grouped around said median bore, said shaft having radial through ports therein opening into one of said bores of smaller diameter, and a centrifugal pump arranged on said shaft and with which the last mentioned ports in said shaft communicate for discharging steam and excess water from said shaft.

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