

Dec. 27, 1927.

K. ENDERS

1,654,119

INTERNAL COMBUSTION TURBINE WITH ROTARY SLIDE VALVE

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2 Sheets-Sheet 1

Fig. 2.

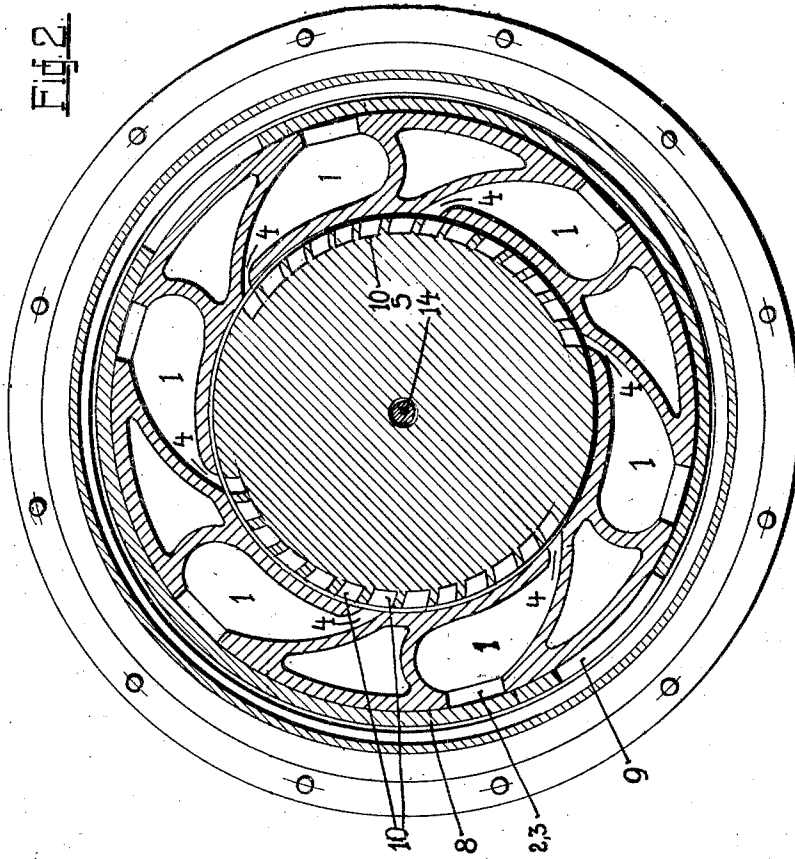
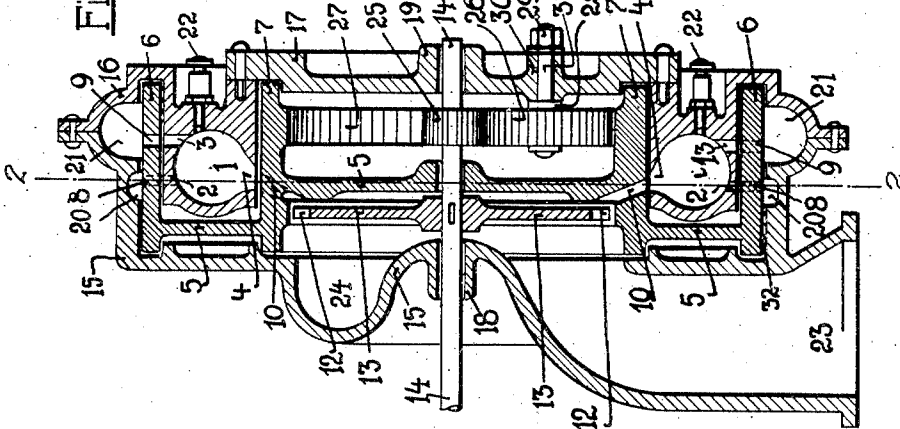


Fig. 1.



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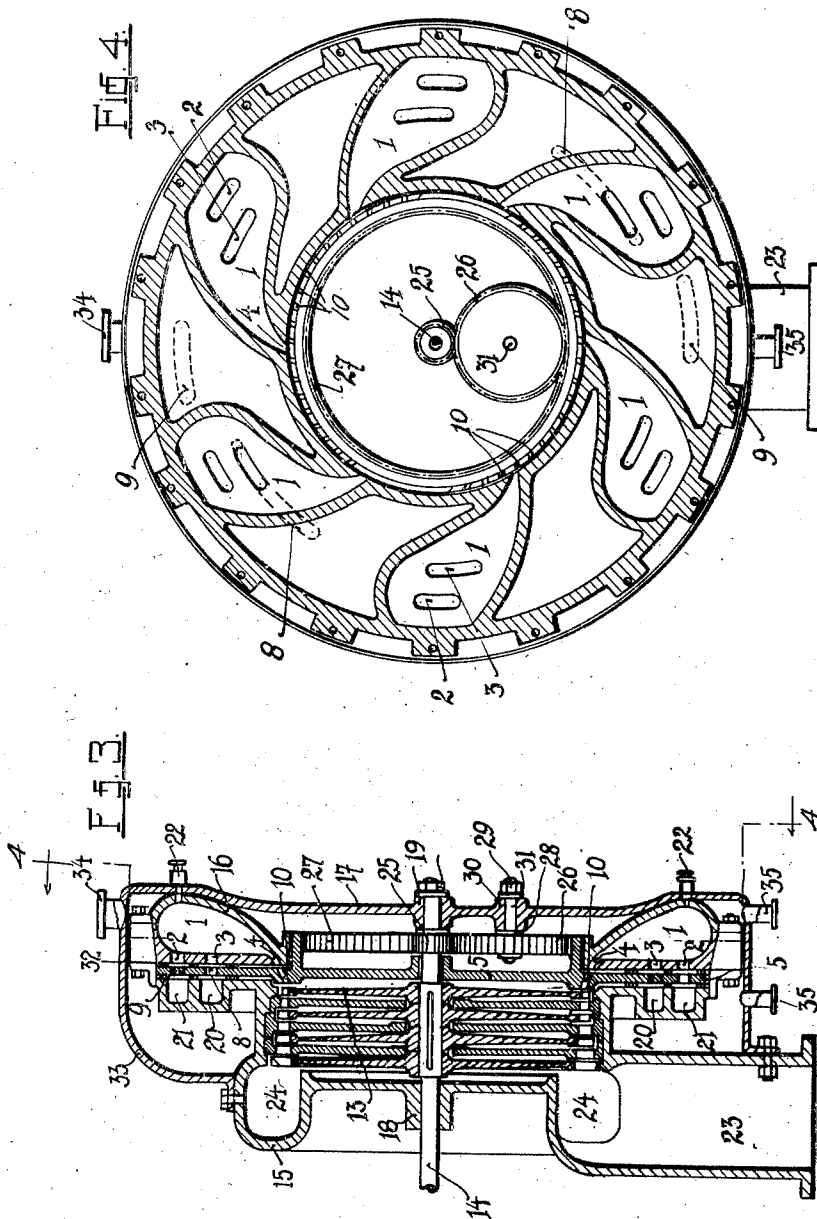
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INTERNAL COMBUSTION TURBINE WITH ROTARY SLIDE VALVE

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

KARL ENDERS, OF DRESDEN, GERMANY.

INTERNAL-COMBUSTION TURBINE WITH ROTARY SLIDE VALVE.

Application filed December 8, 1926, Serial No. 153,243, and in Germany December 5, 1925.

The present invention relates to internal combustion turbines with chambers arranged around the shaft, and its object is to regulate the inlets and outlets of the combustion chambers by means of a rotary slide valve rotatably arranged on the turbine wheel shaft and driven at lower speed than the shaft. This arrangement eliminates all other valves and thus considerably simplifies the construction of turbines.

Another feature of the invention is that the combustion chambers are placed on the outside to obtain a large cooling surface for the casing and the rotary slide valve. According to the invention the outlet of gases from the chambers is regulated by groups of exhaust slots in the rotary slide valve extending over an area equal to the space between the outlet openings of at least two adjacent combustion chambers. In this manner more time than ordinarily is the case is allowed for the exhaust or outlet of the gases which, at the same time, move in the same direction during the exhaust or outlet period.

Several forms of the invention are illustrated in the accompanying drawings and represent a new type of internal combustion turbine showing particularly a very narrow build which makes the utilization of the gases in several steps possible, while the advantages offered by providing the rotary slide valve with internal teeth are not immaterial for construction.

One form of turbine provided with the new rotary slide valve is, for instance, characterized by the fact that the outer one of the two concentric cylindrical valve areas of the rotary slide valve controls the supply of the externally arranged gas and air pipes to the combustion chambers placed between them while the inner one controls the outlet of the latter towards the impeller blades and that the outlet nozzles in the inner cylinder change the path of the working means which, till then, leads from the outside to the inside so that it is now directed axially or nearly axially towards the impeller blades.

The application of this idea can be further extended by providing a thin-walled slide valve for both controls and by arranging the combustion chambers so that the latter are placed on one side of the rotary slide valve and the supply pipes for the working means as well as the impeller sys-

tem on the other. The fuel flows therefore from the annular feeding chamber through the slide into the combustion chambers and thence back again through the slide into the blades. This arrangement makes it possible to have the openings of the concentric combustion chambers which are to be controlled all on one side so that they are easily accessible and the rotary slide valve may be readily adjusted, reground and exchanged. The distribution areas of the combustion chambers too may in this way be easily attended to for finishing etc., and the thin-walled rotary slide valve may be shaped like a disc, cylinder, cone and the like.

Turbines were hitherto completely dependent on the values fixed in the design, i. e., the conditions under which turbines operated could later on be essentially altered only at the expense of efficiency. These drawbacks can be avoided by making the gear ratio between turbine shaft and rotary slide valve variable by means of regulatable gears of the known type. By employing a change gear definitely stepped intermediate gears of the kind used for the various speeds of a motor vehicle may be used one after the other or other known gears that can be varied at will such as friction drives or liquid transformers, it being absolutely immaterial where the drive is taken up by the shaft and to what part of the rotary slide valve the corresponding members are secured which take up the motion from the transmitting medium.

However, it is by no means necessary to obtain the drive from the turbine shaft itself, as a separate electric motor may be used for producing and regulating it in the known manner by means of resistances or the interposition of any known type of change gear. The feeding current may be taken from the main current, an accumulator or generated on the spot. These possibilities offer some choice and thus more liberty of regulating the turbine completely independently of its prevailing number of revolutions. The compressed air generator too may get its drive from the rotary slide valve.

Figure 1 is a vertical sectional view through the turbine showing one form of the invention;

Figure 2 is a section taken substantially on the line 2—2 of Figure 1;

Figure 3 is a view similar to Figure 1,

illustrating another form of the invention; and

Figure 4 is a partial section substantially on the line 4—4 of Figure 3.

1 are the circumferentially arranged combustion chambers having an inner and outer distribution area, the outer one accommodating the inlet openings 2 for gas mixture and 3 for scavenging air and the inner one, the outlet openings 4 for the used gases. The rotary slide valve 5 has two valve areas 6 and 7, 6 being the outer one and containing the inlet slots 8 and 9 which are correspondingly staggered. The inner area 7 is provided with two opposed series of exhaust slots 10 cut through the disc on an arc whose radius borders on that of the combustion chamber outlets so as to guide the burnt gases during the entire outlet period from the chambers in a definite direction to the impeller blades 12 of the impeller 13 on the main turbine shaft 14. The series of slots 10 have been made long so that the gases have sufficient time to leave the chambers. The turbine casing consists of three parts, viz, 15, 16 and 17. 15 contains the bearing 18, and 17, the bearing 19 for the turbine shaft 14. Assembled, the parts 15 and 16 form also the annular channels 20 and 21 serving, respectively, for supplying gas mixture and cooling air. 22 are sparking plugs; and 23 is the discharge channel for the used gases collected in the annular chamber 24.

The shaft 14 carries a toothed wheel 25 in mesh with the intermediate gear 26 which drives the rotary slide valve 5 at a lower speed than the shaft 14 rotates by engaging its internal teeth 27. The intermediate wheel 26 loosely rotates on a shaft 31 secured to the bearing 30 of the part 17 by means of a collar 28 and a nut 29. The two wheels 25 and 26 can be replaced by other wheels showing a different gear ratio. 32 are packing rings.

The modification shown in Figs. 1 and 2 contains six combustion chambers 1. The rotary slide valve is symmetrically arranged showing 2 groups of inlet openings 8, 9 for gas mixture and scavenging air and outlet openings 10 for used gases. If the gear ratio is 6:1 one revolution of the rotary slide valve will be equal to six revolutions of the impeller and 12 ignitions.

In the modification shown in Figs. 3 and 4 the reference characters are the same as those in Figs. 1 and 2, but the rotary slide valve is of the thin-walled disc type. All openings of the chambers that are to be con-

trolled are arranged on the side facing the rotary slide valve. In a turbine of this type all parts subjected to wear and tear can be easily adjusted and refinished. The casing of the turbine is surrounded by a jacket 33 containing a cooling liquid which is supplied and discharged through the connecting pieces 34 and 35.

In operation, the combustible mixture and air are supplied to the channels 20 and 21, respectively, by any well known means (not shown), which forms no part of the present invention. As the valve 5 rotates the combustible mixture is successively admitted to the various combustion chambers 1 through the inlet slot 8 of the valve and the opening 2 of the chamber. Through proper timing mechanism (not shown) the plugs 22 of the respective chambers are operated to ignite the mixture within the chambers. When this occurs the gases pass through the exhaust slots 10 in the valve and are directed thereby in the direction of the impeller blades 12 and from thence outwardly through the chamber 24 and the discharge channel 23 thereof. At the same time, with the valve rotating, an opening 9 in the valve comes into registration with the air inlet opening 3 of the combustion chamber in which the explosion has occurred thereby admitting air from the channel 21 into the combustion chamber to scavenge the same of the remaining gases.

I claim:—

1. In an internal combustion turbine, a shaft, a plurality of combustion chambers arranged about said shaft and each having combustible mixture and air inlets and an outlet therein, a rotary slide valve driven by said shaft at a lower speed than that of the shaft, said valve having series of exhaust slots each of which cooperates with the outlet of each chamber and which extends over an area equal to at least the space between two adjacent chambers, and said slots being arranged to cause the gases to have the same direction during the entire period of their outlet, said valve having internal teeth, and gearing driven from said shaft and engaged with said teeth to rotate the valve.

2. In an internal combustion turbine according to claim 1, wherein said valve is of disc-like formation and is arranged between the combustion chambers and said inlets.

In testimony whereof I have signed my name to this specification.

KARL ENDERS.