No. 867,419. PATENTED OCT. 1, 1907.

C. ROLLIN.

TURBINE ADAPTED FOR THE USE OF COMBUSTIBLE GASES AT VERY HIGH TEMPERATURES.

APPLICATION FILED JAN. 16, 1907.

2 SHEETS—SHEET 1.

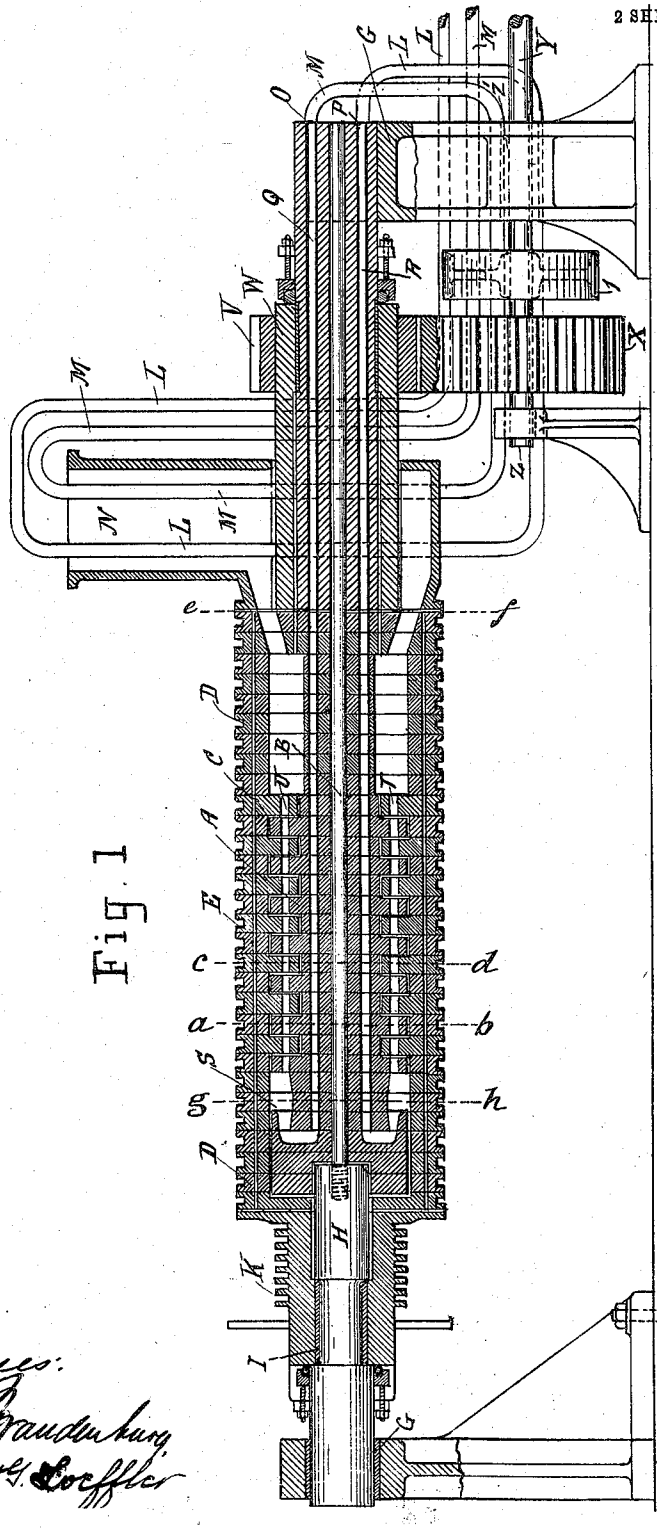


Fig. 1

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2 SHEETS—SHEET 2.

Fig. 2.

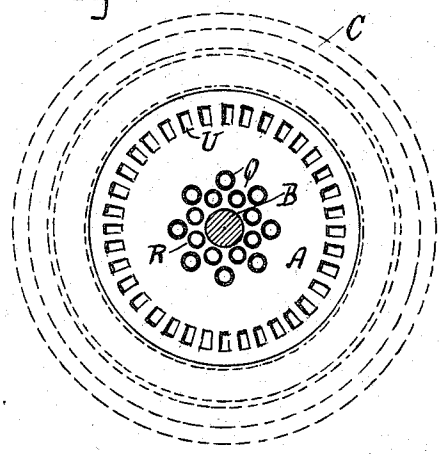


Fig. 3.

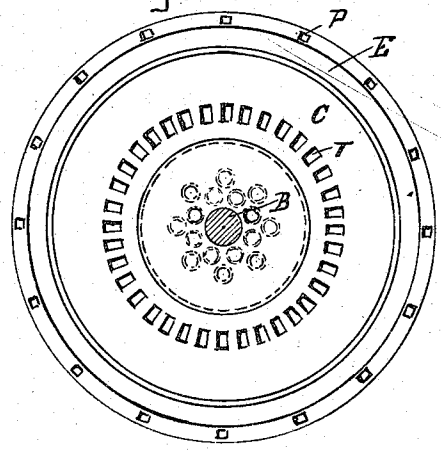


Fig. 4.

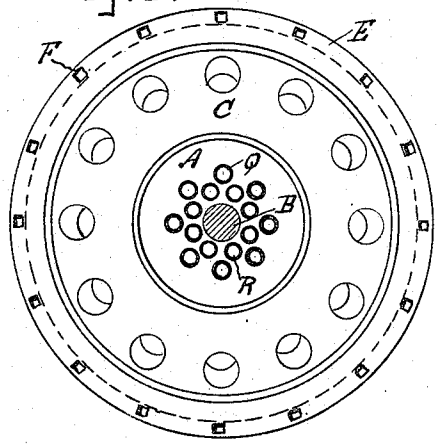


Fig. 5.

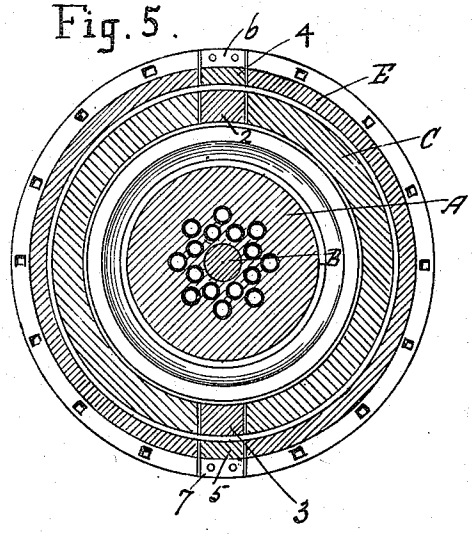
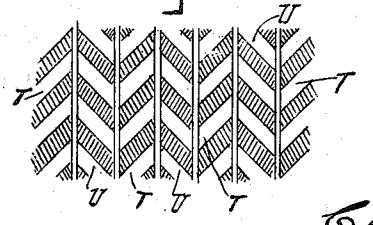


Fig. 6



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UNITED STATES PATENT OFFICE.

CHARLES ROLLIN, OF NEWCASTLE-UPON-TYNE, ENGLAND.

TURBINE ADAPTED FOR THE USE OF COMBUSTIBLE GASES AT VERY HIGH TEMPERATURES.

No. 867,419. Specification of Letters Patent. Patented Oct. 1, 1907.

Application filed January 16, 1907. Serial No. 352,612.

To all whom it may concern:

Be it known that I, CHARLES ROLLIN, B. Sc., F. G. S., of No. 1 St. Nicholas Buildings, Newcastle-upon-Tyne, England, a subject of the King of Great Britain and Ireland, have invented certain new and useful Improvements in Turbines Adapted for the Use of Combustible Gases at Very High Temperatures, of which the following is a specification.

This invention relates to improvements in turbines adapted to be driven by combustible gases at very high temperatures, the objects of the invention being to modify or do away with the difficulty hitherto experienced in turbines actuated by combustible gases, owing to the destruction of the materials used in the construction of the turbines. Such a turbine should have a very even torque, and should be arranged so that a regenerator should be used to save the heat, and adapted to allow of a great range of temperature, and this is where the present method of constructing gas turbines fails. The highest temperatures of the materials in a prime motor as used at present have been reached in certain gas engines where the outlet valve has been allowed to reach the faintest possible red heat, but this occasions difficulty and trouble, and causes the parts to wear out quickly. The obvious remedy is to use refractory materials, such as oxid of alumina or other refractory oxid or compound of oxids, but a great difficulty here arises from the fact that no refractory mixture of oxids or silicates has sufficient tensile strength to withstand the tangential strains imposed when the turbine is revolving at several thousand revolutions per minute. This obstacle has hitherto prevented the successful construction and working of any turbine having a refractory lining and designed to work to very high temperatures. In this invention, this difficulty is completely avoided, and to carry out the invention, I cause the inner spindle to remain stationary, so that not being disturbed by centrifugal or tangential strains caused by rapid revolution, I can construct it with an inner core of steel and an outer part of fireclay material.

To provide the necessary moving part (or "rotor") I arrange for the outer case of the turbine to revolve, and line the same with fireclay or other fire resisting material, molded or cut to shape. The centrifugal strains in the rotor are sustained by the outer steel casing which has at least two and a half inches of fireclay or other fire resisting material between the plates and the flame in the interior. From experience with small furnaces it is found that steel so protected is quite safe, although the temperature inside the refractory material is up to an orange heat. This improved construction has the additional advantage that while the outer casing is rapidly revolving in the manner described, it is in immediate contact with the air and thereby gains an additional cooling effect.

In the construction to be hereinafter set forth and described, reference will be made to what is known as "a parallel flow" turbine. The exhaust chamber is placed at one end, and the gas and air are pumped either by turbine or reciprocating pumps into a reservoir, and thence in pipes or tubes into and down the said exhaust chamber in the opposite direction to that of the motion of the waste gases. These pipes pass out and travel along the inside of the stationary portion of the turbine, which may be termed the "stator" still going against the direction of the flame and gaining heat therefrom, till the pipes reach a space or clearance which may be called the "combustion chamber". Here the gases mix and are fired from the outside on starting by any convenient means, and the pressure generated thereby drives the machine. This use of regeneration is rendered possible solely by the fact that the gas and air do not meet or mix until the said gases arrive at the combustion chamber, so that no harm can result from premature ignition. When the turbine is in running condition the walls of this said combustion chamber should be at least at bright red heat, or may be up to orange heat.

For the better working of the machine considerable clearance is provided in the working parts, and therefore several rows of blades are put in. These said blades and their "guide blades" are formed by openings or channels molded or cut in firebrick or other fire resisting slabs, and are constructed so as to be not quite at the periphery of their respective disks, this plan is adopted for strength. The whole body of the interior of the turbine is built up of disks, and rings (which may be in segments). The outer casing of steel is also constructed in a similar way. The outer steel rings forming the outer casing are threaded on rods, which act as tie rods to keep the said rings even and compact together, and each steel ring incloses one or more fireclay rings. The inner disks exactly correspond to the said outer rings and are threaded on the steel core and on tubes and rods in a similar manner.

In order that this invention may be readily understood reference is made to the accompanying drawings in which

Figure 1, is a longitudinal section of the apparatus, Fig. 2 a cross section to an enlarged scale on line *a—b*, showing the stator disk in full, and the rotor in dotted lines, Fig. 3 is a cross section also to an enlarged scale on line *c—d* showing the rotor disk in full and the stator disk in dotted lines. Fig. 4 is a cross section to an enlarged scale on line *e—f* showing the holes or channels for the exhaust gases into the exhaust chamber, Fig. 5 is a cross section at *g—h*, through the combus-

tion chamber, and Fig. 6 is an enlarged sectional view showing the arrangement of blades and passages for the flow of the gases used in driving the turbine.

In these several views A is the inner portion of the turbine or "stator", built up on the rod or spindle B, in disks and rings (which may be in segments).

C is the outer portion of the turbine or "rotor", which is built up in a similar manner to the inner portion in disks and segments D, (see Fig. 1) and cased in by steel rings E, which are bolted together by rods F passing through the flanges of the said steel rings E.

The central portion or "stator" of the turbine rests on bearings G G, which may be square or rectangular in shape or the central portion may be securely fixed in any convenient manner to prevent the said "stator" revolving.

The central rod or spindle B, continues from the inlet end of the turbine to the enlarged shaft H to which it is screwed or otherwise fixed.

The "rotor" or outer casing C revolves on brass or other metal bearings I and J and may be further supported by collar oil bath bearings as shown at K.

L is the inlet pipe for conveying the air from the pump and reservoir, and M is the inlet pipe for conveying the gas from the gas producer through the pump and reservoirs, and which said pumps may be driven by the turbine itself.

The gas and air pipes respectively are preferably arranged to circulate through the turbine exhaust chamber N, for the purpose of gradually heating the air and gas before entering the turbine. The pipes join the inlet end O for the air, and P for the gas, and the inflowing gases are conveyed along the steel tubes Q and R through the respective holes in the refractory material to the combustion chamber S, where the air and gas are mixed and fired. The products of the firing rush along the angled openings or channels T, and every alternate channel being stationary, forming part of the "stator" rings or segments, the rushing gases impinge on the blades forming the inclined channels U of the "stator" rings, causing the rings of the "rotor" to revolve, and thus motion is imparted to the outer rings or "rotor" of the turbines.

V is the toothed pinion keyed on to the revolving shaft W which is a continuation of the "rotor". This said pinion V gears into the toothed wheel X, fixed on the shaft Y which revolves in bearings Z and Z'—power is therefore communicated by this means from the "rotor" C to the driving shaft Y, for driving the pulley 1, or any other means may be utilized for receiving motion from the said driving shaft, or the rotor may be continued to form a shaft 8 at the opposite end of the said rotor, and may be used as a driving shaft for driving machines or apparatus such for instance as a dynamo.

9, 9, are flanges on the rotor casting for assisting in keeping the end of the rotor cool by radiation of the surfaces of said flanges.

In firing the apparatus, the covers 2 and 3 are removed. These covers consist of segments of the ring of fire clay cut out of the ring, and the steel segments 4 and 5 are likewise removable. The light is applied through these openings, and when the mixed gases are well lighted, the sections are replaced, and the steel segments bolted to the flanges at 6 and 7.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In gas turbines used for producing motion from the combustion of gas and air, the combination of an outer revolving structure or "rotor", consisting of refractory material, with an outer metallic casing, and an inner stationary structure or "stator" formed of refractory material.

2. In gas turbines used for producing motion from the combustion of gas and air, the combination of an outer revolving structure or "rotor", consisting of refractory material, with an outer casing of steel framing, an inner stationary structure or "stator" consisting of rings and segments of fireclay or other refractory material, and a central steel rod or spindle on which said "stator" is built up.

3. In gas turbines used for producing motion from the combustion of gas and air, the combination of an outer revolving structure or "rotor", an inner stationary structure or "stator", said structures having a combustion chamber at one end and an exhaust at the other end, and fuel ducts passing longitudinally through the body of the "stator" from the exhaust end and opening into the combustion chamber.

4. In gas turbines used for producing motion from the combustion of gas and air, the combination of an outer revolving structure or "rotor", an inner stationary structure or "stator", said structures having a combustion chamber at one end and an exhaust chamber at the other end, and fuel ducts passing first through the exhaust chamber and then longitudinally through the body of the "stator" and opening into the combustion chamber.

5. In gas turbines used for producing motion from the combustion of gas and air, the combination of an outer revolving structure or "rotor", an inner stationary structure or "stator", said structures having a combustion chamber at one end and an exhaust at the other end, ducts passing longitudinally through the body of the "stator" from the exhaust end and opening into the combustion chamber, and means for supplying certain of said ducts with fuel and other of said ducts with air.

In witness whereof I have hereunto set my hand in presence of two witnesses.

CHARLES ROLLIN.

Witnesses:
ALEXANDER WARDLAW,
WILLIAM HUDSON NIXON.