

1,289,960.

Patented Dec. 31, 1918.
3 SHEETS—SHEET 1.

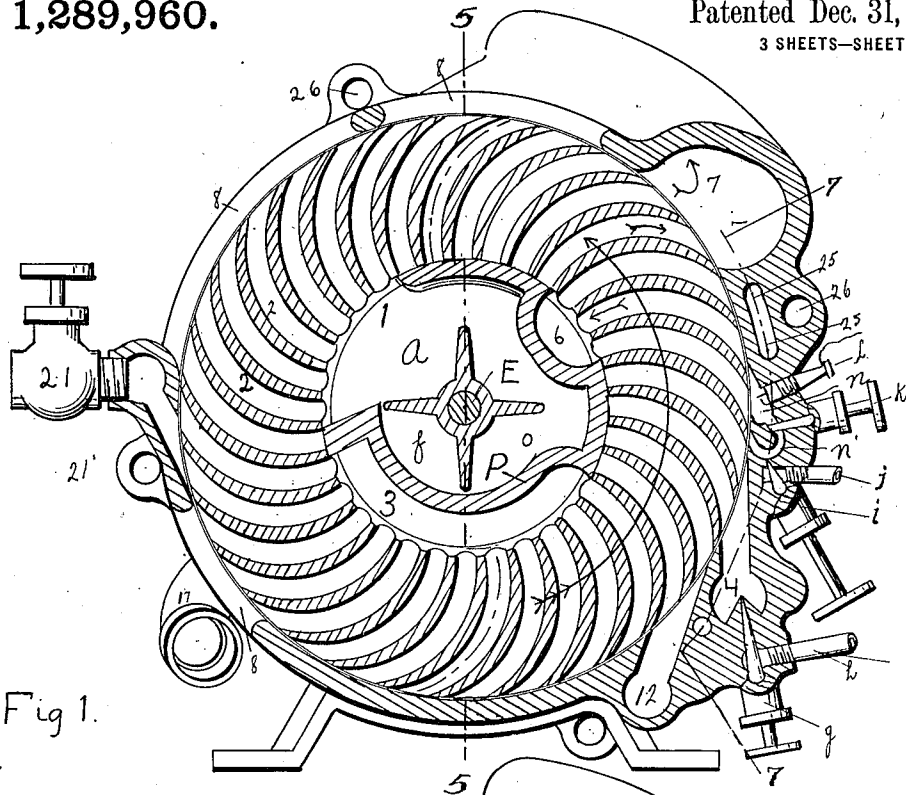


Fig 1.

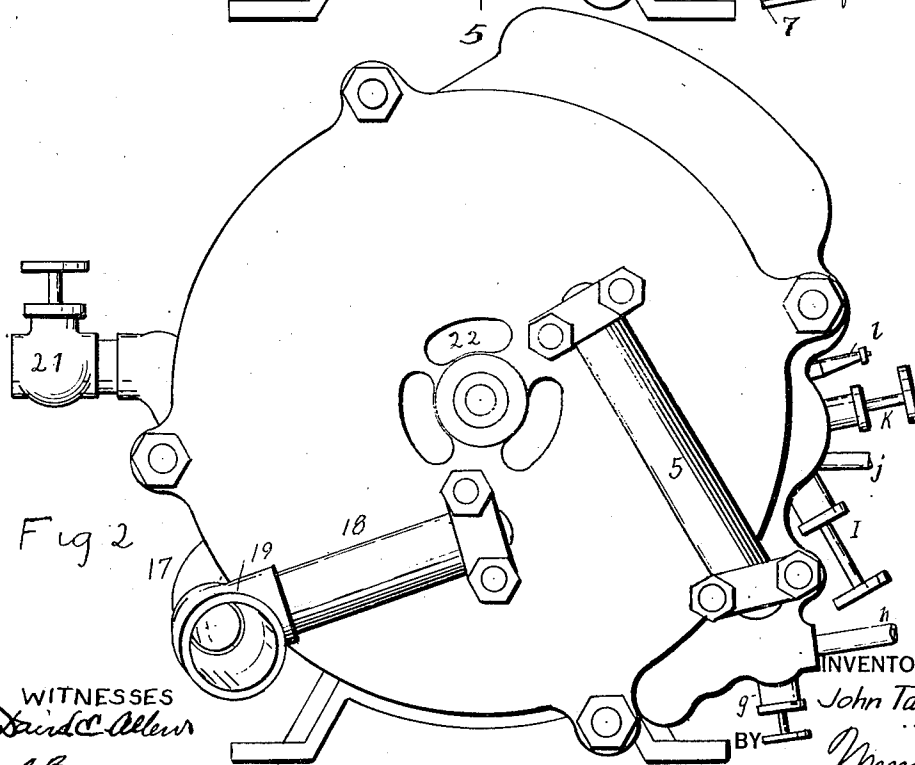


Fig 2

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APPLICATION FILED APR. 13, 1918.

Patented Dec. 31, 1918.

3 SHEETS—SHEET 2.

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Fig 3

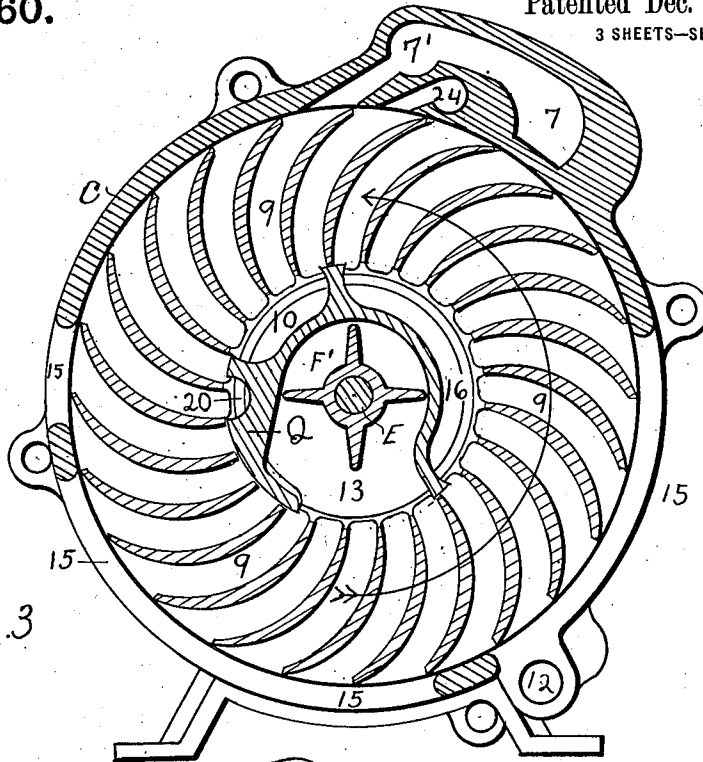
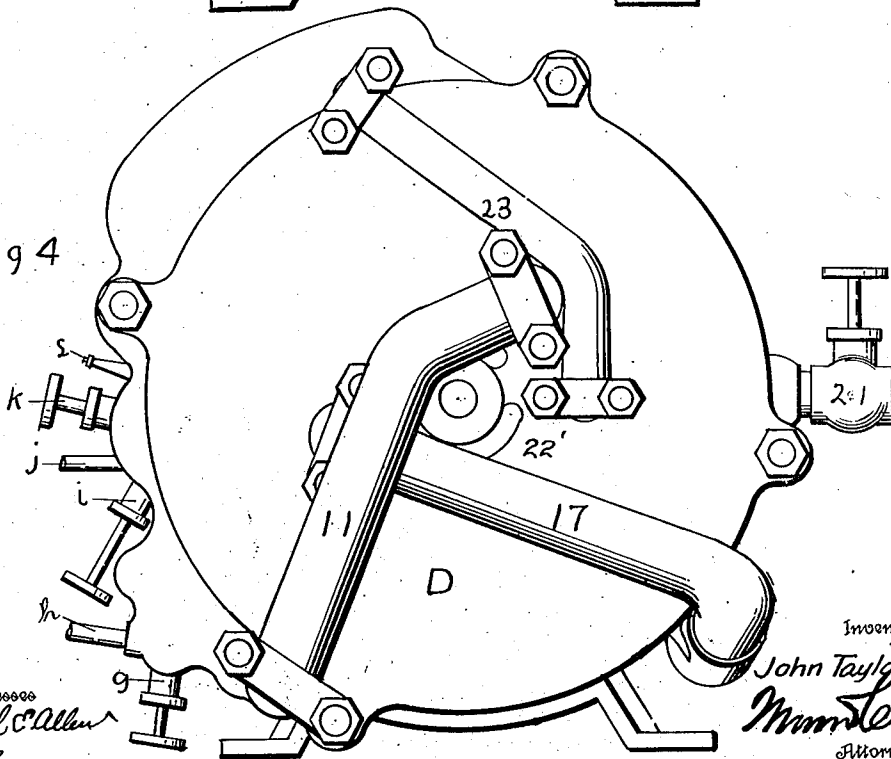


Fig 4



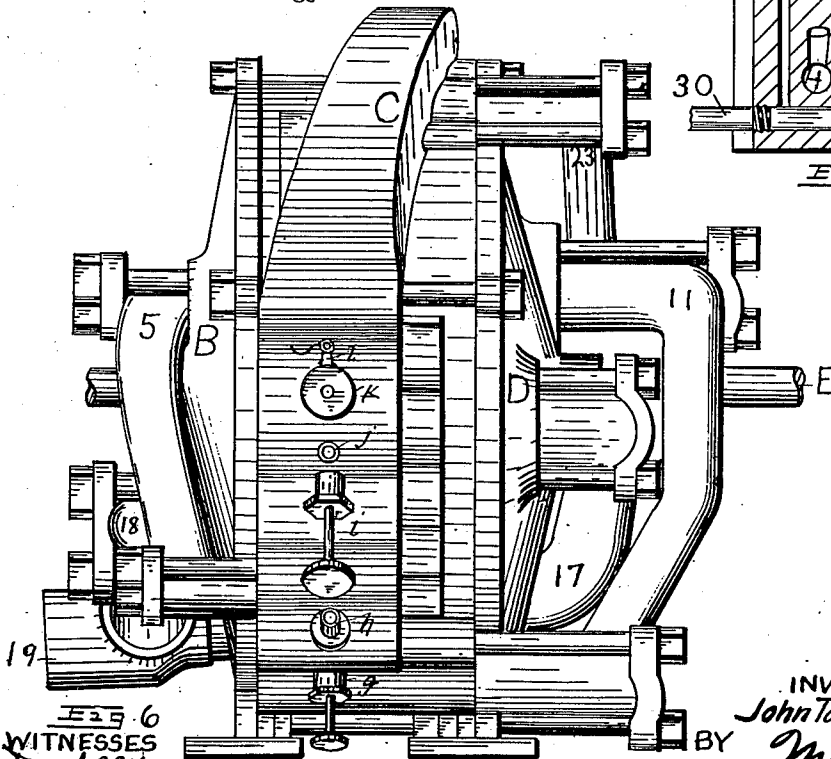
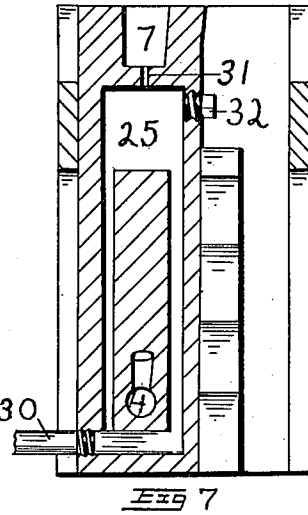
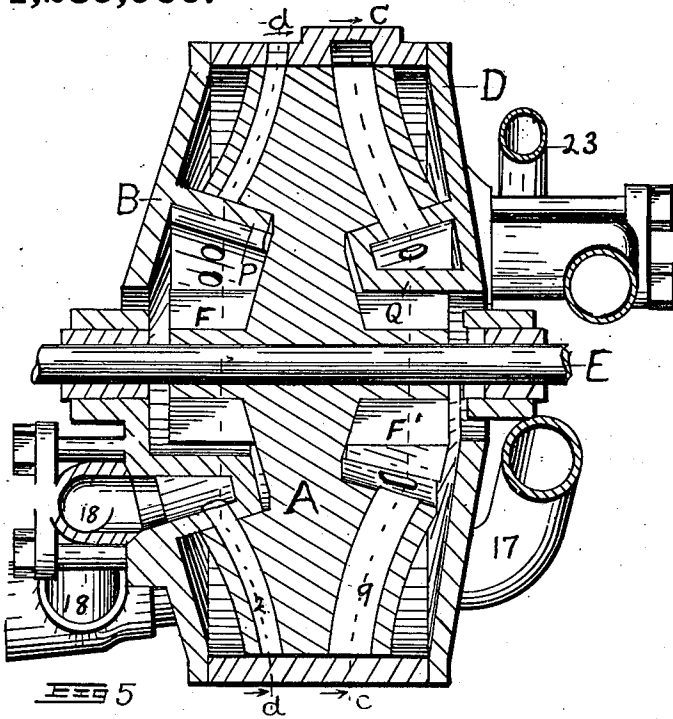
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3 SHEETS—SHEET 3.



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GAS-TURBINE.

1,289,960.

Specification of Letters Patent.

Patented Dec. 31, 1918.

Application filed April 13, 1918. Serial No. 228,472.

To all whom it may concern:

Be it known that I, JOHN TAYLOR, a citizen of the United States, and a resident of Salt Lake City, in the county of Salt Lake and State of Utah, have invented a new and Improved Gas-Turbine, of which the following is a full, clear, and exact description.

This invention relates to gas turbines of that type in which the rotor is driven by the explosive force of a mixture of fuel and air working in the pockets on the rotor.

The invention has for its general objects to provide a novel turbine in which the explosive mixture in each pocket is automatically ignited as the pocket reaches an ignition chamber of such arrangement with respect to the ends of the pocket that flame will propagate from one pocket to the succeeding pocket when the latter approaches the ignition chamber, there being an electric igniter in the said chamber for starting purposes, and also means for supplying a priming fuel for starting.

Another object is the provision of a turbine having approximately radial flow pockets with means for supplying the pockets with air and then for supplying a mixture to the outer ends of the pockets so that when the mixture is ignited the explosive force will act on the air to discharge the same from the inner ends of the pockets to the fuel mixture nozzle, whereby liquid fuel can be utilized for producing the explosive mixture, and at a suitable point in the rotation of the rotor the gases while still under pressure may pass to a second set of pockets for further abstraction of energy, and at a still further point in the revolution the gases are exhausted by a fan forming a part of the turbine and located at the center thereof, or by the use of compressed air supplied from an external compressor.

Another object of the invention is to provide means for assisting in starting the engine by the use of compressed air, and also means for generating saturated steam and utilizing the same for cooling the nozzle and nozzle passage between the first and second set of pockets.

With such and other objects in view, the invention comprises various novel features of construction and arrangement of parts which will be set forth with particularity in the following description and claims appended hereto.

In the accompanying drawings, which

illustrate one embodiment of the invention and wherein similar characters of reference indicate corresponding parts in all the views,

Figure 1 is a vertical section on the line 1—1, Fig. 5, looking in the direction of the arrow;

Fig. 2 is a front view of the turbine;

Fig. 3 is a sectional view on the line 3—3, Fig. 5, looking in the direction of the arrows;

Fig. 4 is a rear view;

Fig. 5 is a vertical section on the line 5—5, Fig. 1;

Fig. 6 is a side view; and

Fig. 7 is a detail sectional view on the line 7—7, Fig. 1, showing the water jacket.

Referring to the drawings, A designates the rotor or wheel which is inclosed in a casing composed of a front head B, a circumferential wall C and a rear head D, and journaled in bearings in the head is a shaft E to which the wheel A is keyed. The wheel has on its front face a plurality of arcuate pockets 2 extending from the circumference inwardly and on the rear wheel are similar pockets 9 of larger cross-sectional area to accommodate the increased volume of the motive fluid which passes from the first set of pockets to the second for doing further work.

At the hub of the wheel at the front side is a fan F, and at the rear is a fan F', the blades of both fans being rigid or integral with the wheel, and surrounding the fans are circular walls P and Q, respectively carried by the heads B and D, there being in the heads ports 22 and 22' for admitting air to the fan chambers. The walls do not entirely surround the fans, so that in the wall P is a discharge port 1 through which air from the fan is blown into the inner ends of the pockets 2, and the wall Q of the rear fan has a port 13 through which the fan discharges air into the inner ends of the pockets 9. In the wall P are arcuate chambers 3 and 6 which communicate with different groups of pockets, the chamber 3 being connected with a pipe 18 for receiving air under pressure from a compressor (not shown) which is connected with a union 19, whereby the pockets are supplied with air under pressure, and the chamber 6 is connected by a pipe 5 with a mixture nozzle 4 formed in the cylindrical wall of the casing. The rear fan wall Q has chambers 16, 10 and 20 in its exterior surface which com-

municate respectively with different groups of pockets 9, the chamber 16 receiving air from a compressor through a pipe 17 and the coupling 19, the chamber 10 discharging air from the pocket 9 through a pipe 11 to an air nozzle 12 located behind the fuel mixture nozzle 4, and the chamber 20 discharging low pressure gas from the pockets to the nozzle 24 through the pipe 23. The cylindrical casing wall C has a plurality of ports 8 through which the pockets 2 exhaust. Through the first or top port 8 the fluid in the pockets 2 exhausts under the residual pressure in the gas and air, and through the next port 8 the pockets exhaust by reason of the air from the fan, and through the third port 8 the pockets exhaust by reason of the air under compression from the chamber 3. A set of ports 15 is arranged in the wall C for the second set of pockets 9 of the rotor. The first port 15, considered in the direction of rotation of the rotor, that is to say, the port at the right, Fig. 3, and the first part of the second port open the pockets 9 to the atmosphere before the fan blows out the gas from the pockets, which occurs when the pockets reach the last part of the second port 15. When the pockets reach the third port 15 they exhaust to the atmosphere by reason of the outflow of air under compression from the chamber 16.

The casing wall C has in addition to the nozzles 4 and 12, another nozzle 21', to which air from the compressor is admitted through a valve 21, when it is desired to start the rotor, this nozzle 21' being used, as are the nozzles 4 and 12, in connection with the first or high pressure set of pockets 2. The mixture nozzle 4 is supplied with oil through a pipe *h*, the quantity being controlled by a needle valve *g*. In advance of the nozzle 4 is an ignition chamber *n* in which is a spark plug *l*, which is used for starting by exploding the mixture which enters the ignition chamber from the pockets 2 as they reach the said chamber. After the first ignition the exploded gases from one pocket will pass over the end of the partition between adjacent pockets by way of the chamber *n* and ignite the gas in the succeeding pocket, and this will continue indefinitely as long as the fuel mixture is supplied. If, under high speed or other conditions, it is desired to explode the gas in the pockets 2 before they reach the ignition chamber *N*, a valve *K* can be opened to permit the flame to by-pass through a passage *N'*, which leads to a point between the nozzle 4 and the chamber *N*. Into this passage *N'* leads a pipe *J* for supplying priming oil for starting, this pipe *J* being controlled by a valve *I*.

The wall C is provided with a water jacket chamber 25 at a point adjacent the ignition chamber 7, and to which water is supplied

through a pipe 30, Fig. 7, and in the wall of the jacket 25 is a port 31 through which saturated steam passes into the nozzle passage 7 to mix with the exhaust gases from the first set of pockets 2, whereby the combined energies of the gases and steam act on the second set of pockets to rotate the wheel.

In operation there is a continuous flow of gas or air through all the conduits, as shown, and this engine differs from others in that explosion takes place in the pockets on the periphery of the revolving rotor A, while air is displaced similar to the method I used in a copending application.

For the initial starting, air from a tank of compressed air (not shown in the drawings) enters through the valve 21 to the nozzle 21', to assist in starting the rotor. When the rotor is in motion the fan F, which is an integral part of the rotor, begins throwing air out of the fan chamber port 1 into the pockets 2. As the pockets travel on the periphery of the rotor, they pass the opening 3, where additional air is supplied through the pipes 18 and 19 from a compressor (not shown on drawing).

For the purpose of illustrating, I assume that compressed air will be delivered to the nozzles 4 and 12 and other functions performed as described until I have finished describing the functions of the pockets 2 directly aid in performing as they revolve on the rotor A.

The first nozzle to aid in the driving of the rotor is the nozzle 12, as this air is changed to work, and the kinetic force of the air under about three times the pressure of that in the pocket 2, as this air strikes against the walls of the pockets 2 as it rushes in. Also additional air is compressed into these pockets as they pass the nozzle 4, which additional air is thrown in against the wall of the pockets, where the momentum of this aids in driving the rotor. The difference in the nozzles 4 and 12, is that air in the former, besides being under higher pressure, is also mixed with gas or oil. This gas may be under combustion. The firing of this oil or gas mixed air commences as soon as the pockets 2 leave the mouth of the nozzle 4. The initial charge is fired by spark plug *L*, and fire is continued by allowing a portion of the burning gases in the pocket fired to shoot back through chamber *N* to the following pocket. A spray of gas is supplied by the valve *I* to insure firing, and there being such a lean mixture that there will be no danger of backfiring. Also the walls between adjacent pockets 2 are thick enough to prevent the flame from shooting back from one pocket to another.

Only the air entering the pockets 2 through the nozzle 4 is mixed with gas, and that portion only is exploded, and as the

inner end of the pockets 2 reaches the opening 6 during this explosion, the unoxidized air on the inner end of pockets 2 is forced into the opening 6 by the explosion of the
 5 burnt gases in the other end of the pocket 2. As the pockets 2 proceed, part of the burned gases leave when they reach the chamber 7, the rest continuing in the pockets 2 until they reach the exhaust openings 8, where
 10 more exhaust air which enters the inner end of the pockets 2, through the openings 1 and 3 displaces the remainder.

The air which is compressed into the opening 6 by the explosion of gas in the pocket
 15 2 is piped to the nozzle 4, by the pipe 5, where it enters pockets 2 as previously described.

The gas which enters the chamber 7 is conducted over to the nozzle 7', which is
 20 directly over row of the pockets 9, and gas which enters helps in revolving rotor A, by striking the walls of the pockets 9.

The gas passing through the nozzle 7' displaces as it compresses the air in pockets 9, driving most of it out into the chamber 10,
 25 where it is conducted through the pipe 11, and the nozzle 12, and enters pockets 2, as earlier described. A portion of the gases left in the pockets 9 can be returned to the
 30 opening 24 through the pipe 23, as there is low pressure on the air in the pockets 9, where the gas returns to the pockets 9 through the nozzle 24.

The purpose of this circuit composed of
 35 parts 22, 23 and 26 is to add pressure to the air in the pockets 9 and to put into the outer end of the pockets a mixture of gas and air. This mixture of gas and air enters between the air in the pockets 9 and gas
 40 from the nozzle 7'. Therefore, most of it comes out pockets 9 at the opening 20, because most of it will not come out until the air in front of it is forced into the opening 10, and by that time the pocket 9 will
 45 have passed the opening 10 and reached the opening 20, and as these mixed gases follow the air they come out at the opening 20, and around the shunt circuit composed of the conduits 20, 23, 24 and the pockets 9
 50 getting through pockets 9 between the air and gas in the pocket 9, which connects up the circuit.

The next step after the pocket 9 passes the opening 20 is the exhausting. This is
 55 done when the pockets reach the openings 15. As the burnt gases in the pockets 9 are under pressure, some will exhaust and the rest will be displaced by the air entering from the fan chamber 13 and the opening 16.
 60 Air entering the opening 16 has sufficient pressure to drive all gases in the pockets 9 out through the exhaust openings 15.

From the foregoing description taken in connection with the accompanying drawings,
 65 the advantages of the construction and

method of operation will be readily understood by those skilled in the art to which the invention appertains, and while I have described the principle of operation, together with the device which I now consider
 70 to be the best embodiment thereof, I desire to have it understood that the device shown is merely illustrative and that such changes may be made when desired as fall within the scope of the appended claims. 75

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

1. A turbine comprising a stator, a rotor having curved pockets extending inwardly
 80 from the periphery, means for supplying an explosive mixture to the pockets, an ignition chamber on the stator by which the explosive mixture in a pocket is fired and through
 85 which the flame propagates from one pocket to a succeeding pocket to cause automatic ignition of the gas in the pockets as they reach the ignition chamber, another set of pockets on the rotor, and means for conducting exploded gases from the first men-
 90 tioned pockets to the second set.

2. A turbine comprising a stator, a rotor having curved pockets extending inwardly
 from the periphery, means for supplying an explosive mixture to the pockets, an ignition
 95 chamber on the stator by which the explosive mixture in a pocket is fired and through which the flame propagates from one pocket to a succeeding pocket to cause automatic
 100 ignition of the gas in the pockets as they reach the ignition chamber, said chamber having a by-pass for the flame to ignite the gas in a pocket before the same reaches a chamber, and a valve controlling the by-
 105 pass, another set of pockets on the rotor, and means for conducting exploded gases from the first mentioned pockets to the second set.

3. A turbine comprising a stator, a rotor having curved pockets extending inwardly
 110 from the periphery, means for supplying an explosive mixture to the pockets, an ignition chamber on the stator by which the explosive mixture in a pocket is fired and through
 115 which the flame propagates from one pocket to a succeeding pocket to cause automatic ignition of the gas in the pockets as they reach the ignition chamber, said chamber having a by-pass for the flame to ignite the
 120 gas in a pocket before the same reaches a chamber, a valve controlling the by-pass, and means for admitting a priming charge of explosive mixture to the pockets through the by-pass, another set of pockets on the
 125 rotor, and means for conducting exploded gases from the first mentioned pockets to the second set.

4. A turbine comprising a stator, a rotor having curved pockets extending inwardly
 130 from the periphery, means for supplying an

explosive mixture to the pockets, an ignition chamber on the stator by which the explosive mixture in a pocket is fired and through which the flame propagates from one pocket to a succeeding pocket to cause automatic ignition of the gas in the pockets as they reach the ignition chamber, means for supplying air to the pockets before the explosive mixture is supplied, another set of pockets on the rotor, and means for conducting exploded gases from the first mentioned pockets to the second set.

5. A turbine comprising a stator, a rotor having curved pockets extending inwardly from the periphery, means for supplying an explosive mixture to the pockets, an ignition chamber on the stator by which the explosive mixture in a pocket is fired and through which the flame propagates from one pocket to a succeeding pocket to cause automatic ignition of the gas in the pockets as they reach the ignition chamber, means located inwardly of the pockets for supplying air to the latter, another set of pockets on the rotor, and means for conducting exploded gases from the first mentioned pockets to the second set.

6. A turbine comprising a stator, a rotor having curved pockets extending inwardly from the periphery, means for supplying an explosive mixture to the pockets, an ignition chamber on the stator by which the explosive mixture in a pocket is fired and through which the flame propagates from one pocket to a succeeding pocket to cause automatic ignition of the gas in the pockets as they reach the ignition chamber, means located inwardly of the pockets for supplying air to the latter, ports in the stator for permitting the pockets to exhaust, another set of pockets on the rotor, and means for conducting exploded gases from the first mentioned pockets to the second set.

7. A turbine comprising a stator, a rotor having curved pockets extending inwardly from the periphery, means for supplying an explosive mixture to the pockets, an ignition chamber on the stator by which the explosive mixture in a pocket is fired and through which the flame propagates from one pocket to a succeeding pocket to cause automatic ignition of the gas in the pockets as they reach the ignition chamber, means located inwardly of the pockets for supplying air to the latter, ports in the stator for permitting the pockets to exhaust, nozzle means for directing gases against the walls of the pocket to rotate the same, another set of pockets on the rotor, and means for conducting exploded gases from the first mentioned pockets to the second set.

8. A turbine of the class described comprising a casing having exhaust ports in its periphery, a rotor having pockets extending inwardly, means for supplying air to

the pockets, means for supplying an explosive mixture to the pockets containing air, and means for igniting the explosive mixture in the pockets, a nozzle for receiving air from the inner ends of the pockets and for supplying it to the pockets at a point in advance of the mixture supplying means, a fan located inwardly from the pockets for directing air through the latter when the same reaches the exhaust ports, another set of pockets on the rotor, and means for conducting exploded gases from the first mentioned pockets to the second set.

9. A turbine of the class described comprising a casing having exhaust ports in its periphery, a rotor having pockets extending inwardly, means for supplying air to the pockets, means for supplying an explosive mixture to the pockets containing air, means for igniting the explosive mixture in the pockets, a nozzle for receiving air from the inner ends of the pockets and for supplying it to the pockets at a point in advance of the mixture supplying means, a fan located inwardly from the pockets for directing air through the latter when the same reach the exhaust ports, means also located inwardly from the pockets for discharging air under pressure into the same, while some of the pockets are open through a port and others are closed, another set of pockets on the rotor, and means for conducting exploded gases from the first mentioned pockets to the second set.

10. A turbine of the class described comprising a casing having exhaust ports in its periphery, a rotor having pockets extending inwardly, means for supplying air to the pockets, means for supplying an explosive mixture to the pockets containing air, means for igniting the explosive mixture in the pockets, a nozzle for receiving air from the inner ends of the pockets and for supplying it to the pockets at a point in advance of the mixture supplying means, a fan located inwardly from the pockets for directing air through the latter when the same reach the exhaust ports, a second set of pockets on the rotor, and means for conducting exploded gases from the first set of pockets to the second set.

11. A turbine of the class described comprising a casing having exhaust ports in its periphery, a rotor having pockets extending inwardly, means for supplying air to the pockets, means for supplying an explosive mixture to the pockets containing air, means for igniting the explosive mixture in the pockets, a nozzle for receiving air from the inner ends of the pockets and for supplying it to the pockets at a point in advance of the mixture supplying means, a fan located inwardly from the pockets for directing air through the latter when the same reach the exhaust ports, a second set of pockets on

the rotor, means for conducting exploded gases from the first set of pockets to the second set, a water jacket on the stator, and means for admitting steam from the water jacket to the gases passing from the first set of pockets to the second.

12. In a turbine, the combination of a stator, a rotor having pockets open at the periphery and extending inwardly, the pockets being arranged in a circle and having open inner ends, a fan arranged on the rotor inwardly of the pockets, a wall on the stator partially surrounding the fan, whereby the latter can discharge air outwardly through the pockets, a chamber in the said wall communicating with the inner end of

some of the pockets, means for supplying air under pressure to the chamber, a nozzle on the rotor for discharging into the outer end of the pockets, a chamber in the said wall for receiving air driven out of the inner ends of the pockets by explosion, means for connecting the last-mentioned chamber with the said nozzle, an explosive mixture nozzle for supplying mixture to the outer ends of the pockets, means for firing the mixture in the pockets, another set of pockets on the rotor, and means for conducting exploded gases from the first mentioned pockets to the second set.

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