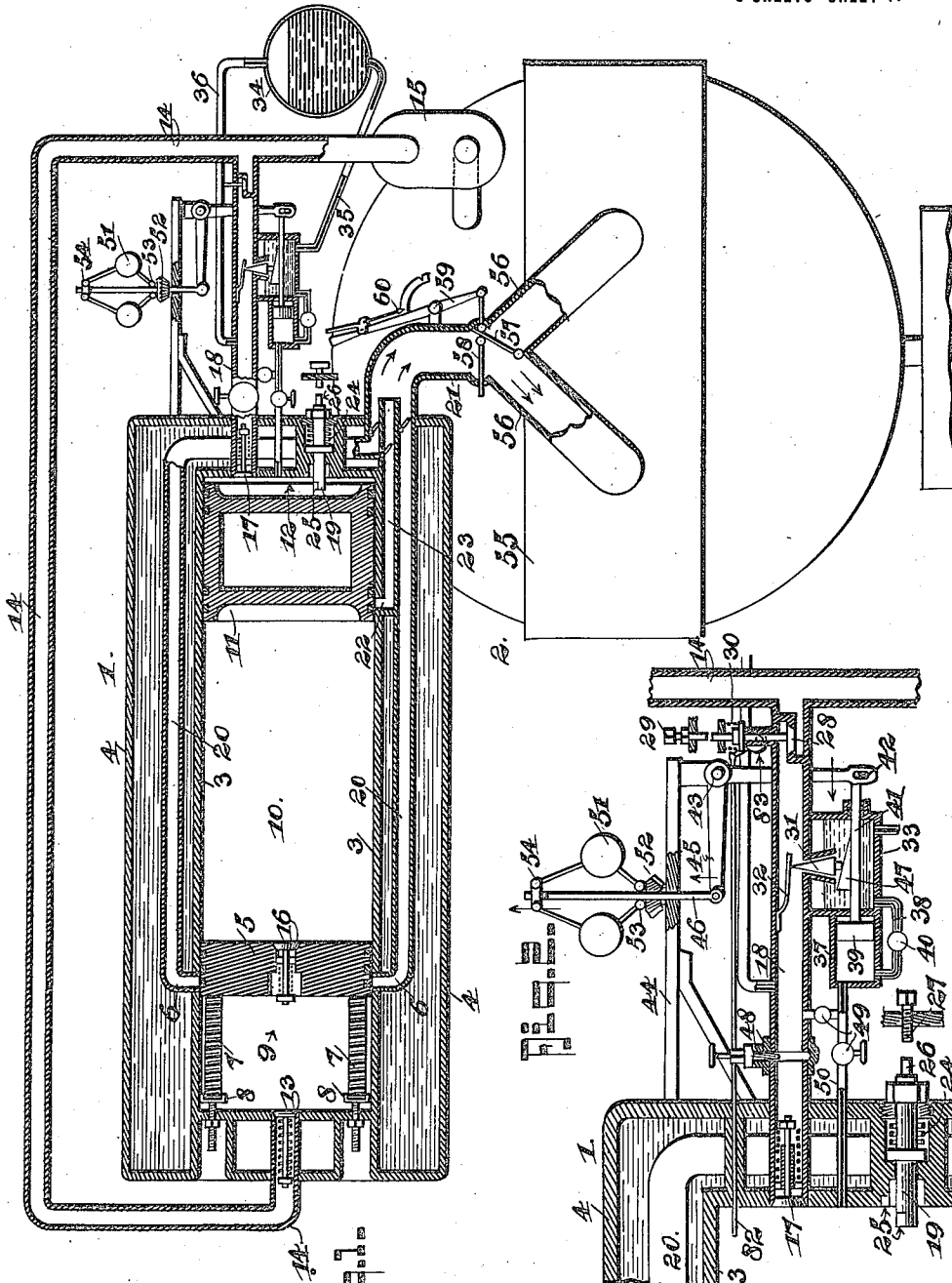


I. L. SLAWTER.
GAS TURBINE.
APPLICATION FILED MAY 27, 1916.

1,242,057.

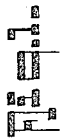
Patented Oct. 2, 1917.

3 SHEETS—SHEET 1.



WITNESSES:

John C. Schrott



INVENTOR

Ira L. Slawter

BY

Fred J. Dietrich & Co

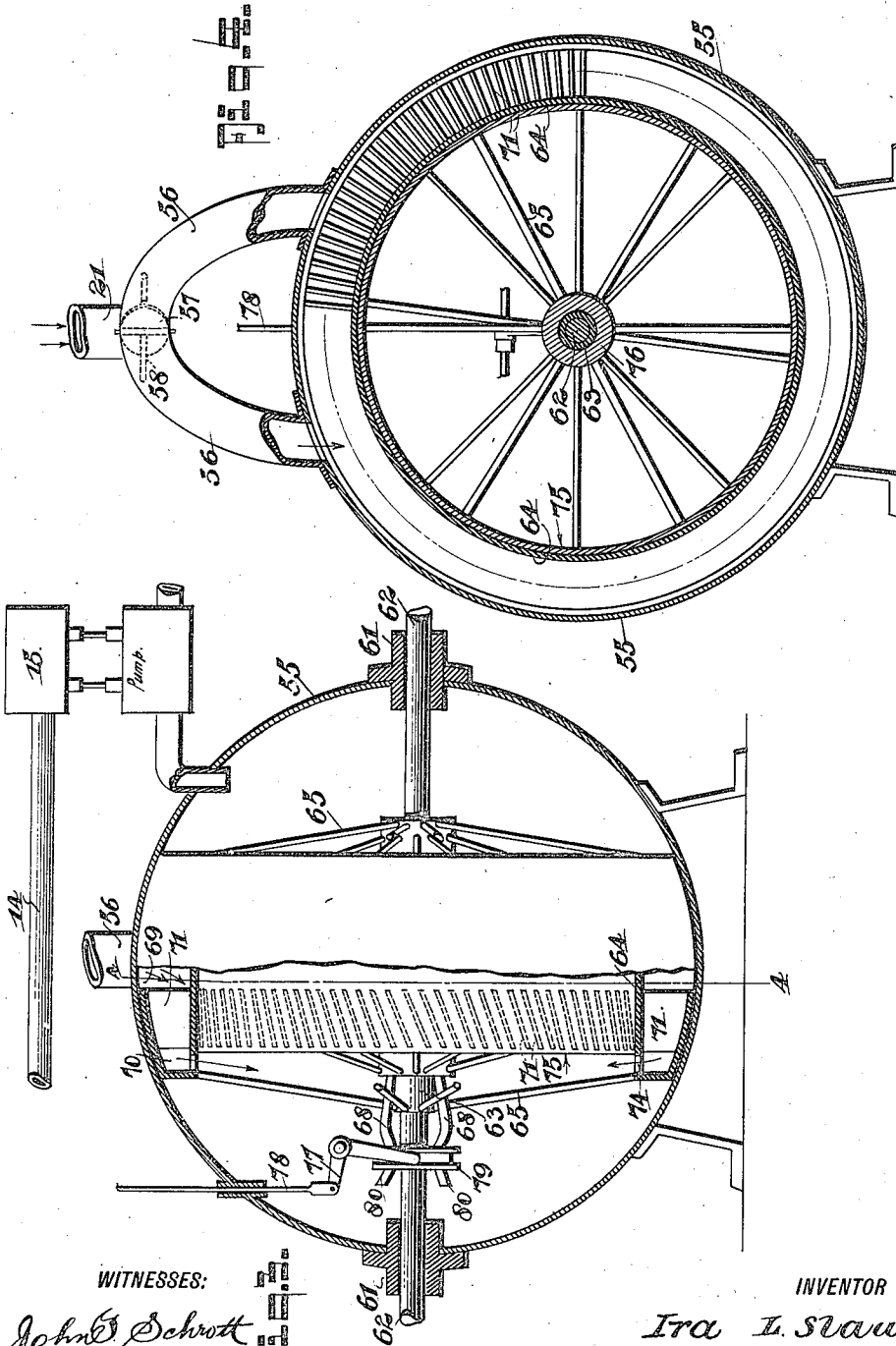
ATTORNEYS

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3 SHEETS—SHEET 2.



WITNESSES:

John Schrott

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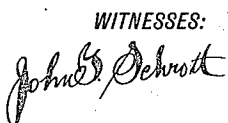
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GAS TURBINE.

1,242,057.

3 SHEETS—SHEET 3.



Ira L. Stawtor

BY
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UNITED STATES PATENT OFFICE.

IRA LEON SLAWTER, OF GRANDE PRAIRIE, ALBERTA, CANADA, ASSIGNOR OF ONE-THIRD TO EDWARD ROGERS, OF BELLINGHAM, WASHINGTON, AND ONE-THIRD TO EARL SLAWTER, OF GRANDE PRAIRIE, ALBERTA, CANADA.

GAS-TURBINE.

1,242,057.

Specification of Letters Patent.

Patented Oct. 2, 1917.

Application filed May 27, 1916. Serial No. 100,418.

To all whom it may concern:

Be it known that I, IRA L. SLAWTER, a citizen of the Dominion of Canada, residing at Grande Prairie, in the Province of Alberta, Dominion of Canada, have invented certain new and useful Improvements in Gas-Turbines, of which the following is a specification.

My invention relates to an improvement in that class of internal combustion engines, known as gas turbines of the circulating type and it consists in the construction, combination and arrangements herein described and claimed.

An object of my invention is to provide an engine embodying a turbine unit and a motive fluid generator therefor which includes a working piston adapted to be projected by explosive force to compress air ahead of it, the subsequently combined compressed air and exploded gases being directed against the vanes of the turbine rotor.

Another object of the invention is to provide an automatic fuel feeding mechanism for the motive fluid generator whereby the action of its piston is maintained independently of manual attention.

Other objects and advantages will appear from the following specification, reference being had to the accompanying drawings forming a part of this application and in which:—

Figure 1 is a diagrammatic view, the motive fluid generator being shown in section and the turbine in plan.

Fig. 2 is a detail view of the automatic fluid generator fuel feeding mechanism.

Fig. 3 is a section of the turbine, parts being shown in elevation.

Fig. 4 is a cross section of the turbine on the line 4—4 of Fig. 3.

Fig. 5 is a section of the turbine showing more particularly the port band and the adjusting devices therefor.

Fig. 6 is a detail view of a part of the turbine showing the vanes and escape ports.

Fig. 7 is a detail view of the port band adjusting device, the parts being in a different position from that shown in Fig. 5.

Attention is directed more particularly to Fig. 1 of the drawings in which the motive fluid generator is indicated generally by 1

and the turbine by 2. The purpose of the generator 1 is to create a motive fluid of intense activity for driving the rotor of the turbine 2. The generator 1 includes a cylinder 3 which is water jacketed as at 4. The water jacket is useful in absorbing excessive heat from the cylinder walls but may be dispensed with in some instances. The heat of the water may be utilized in a manner to be explained.

Disposed within the cylinder 3 at one end is a cushion piston 5 which normally covers the relatively cool air outlet ports 6 of the cylinder 3. The piston 5 is normally held in the position shown in Fig. 1, by a plurality of cushion springs 7 which are arranged between the back of the piston and stirrups 8.

The stirrups 8 are provided with threaded studs and adjusting nuts by which the stirrups 8 may be moved inwardly or outwardly at will and thereby adjust the tension of the springs 7.

The piston 5 acts as a partition forming an air chamber 9 of relatively small dimensions at the back and another air chamber 10 of relatively large dimensions, at the front. Movable within the chamber 10 is a projectile or working piston 11 which is loosely disposed in the cylinder 3. The piston 11 has no rod such as is usual in engines but is projected rearwardly by explosions in the explosion chamber 12 independently of other guidance than that of its contact with the walls of the cylinder 3. The explosion chamber 12 is formed between the head of the piston 11 and the front of the cylinder 3, as shown in Fig. 1. When an explosion occurs in the chamber 12, the piston 11 is violently projected rearwardly toward the cushion piston 5, the air in the chamber 10 undergoing compression in the transit.

As the piston 11 is projected under an explosive impulse the air compression within the chamber 10 forces the piston 5 rearwardly and compresses the air contained within the chamber 9, and by reason of the peculiar coöperative arrangement of the chambers 9 and 10, the pistons 5 and 11, and the cushion springs 7 that are interposed between the pistons 5 and the solid head or

end of the chamber 9, the impact of the working piston is modulated, since the piston chamber 9 and the spring 7 act as a cushioning means for the said piston 11.

5 Air is led through a pipe 14, in the delivery end of which is located a control valve 13 which, when the feed fluid pressure is up to the desired point, opens against the action of a closing spring.

10 Compressed air is charged into the pipe 14 under suitable air compressing means.

In the drawing, I have indicated a combined compressor and pump which, for example, may be the type of compressor 15 known as the "New York air pump" which, in practice, is of a duplex character, the upper portion, with which the pipe 14 connects, acting as an air compressor, while the lower portion, which connects with the turbine casing 55, acts as a pump for exhausting the gases from the said casing as hereinafter again referred to.

The operation of the fluid generator 1 as described thus far is as follows: Let it be 25 assumed that the working piston 11 has been driven forwardly as just stated by the force of the compressed air entering the chamber 10 through the valve 16. The forward transit of the piston 11 compressed a 30 charge of combined air and gasoline or other liquid fuel vapor which had been injected into the chamber 12 through a valve 17 of the mixing tube 18.

When the limit of the compression of the 35 charge is reached, the charge is exploded by a specially devised spark plug 19. The working piston is thereupon impelled rearwardly and the air in the chamber 10 which is under initial compression, is further compressed. The valve 16 is closed at this time 40 and the cushion piston 5 is forced rearwardly, in turn compressing the air in the chamber 9.

The piston 5 will continue rearwardly 45 by the force of the compressed air ahead of the working piston 11, until the ports 6 are uncovered. The compressed air thereupon rushes into the connected pipes 20 which merge with the conduit 21 of the 50 turbine 2. Arranged at a suitable place near the front of the cylinder 3, is an exhaust port 22 which is provided with a pipe 23 leading to the conduit 21. As soon as the piston 11 uncovers the port 22, when 55 traveling its rearward stroke as just explained, the gases of the combustion of the exploded charge will exhaust through the port 22 and enter the conduit 21 at a great velocity. The exhaust gases are led through 60 the conduit 21 into the turbine casing where they strike the vanes of the rotor and undergo further expansion. The stream of compressed air flowing toward the conduit 21 through the pipes 20 and around the 65 pipe 23, acts as a siphon on the residue of

the gases in the chamber 12 and serves to thoroughly scavenge it preparatory to the reception of a fresh charge.

The air compressed in the chamber 10 having now exhausted through the ports 6, 70 the working piston 11 will immediately be driven forwardly again. This is accomplished by the air compressed in the chamber 9. The combined action of the compressed air in the chamber 9 and the springs 75 7 drives the piston 5 forwardly until the ports 6 are again covered. The valve 16 then opens and the piston 11 is impelled forwardly when the air in the chamber 9, which is initially under greater pressure 80 than that in the pipe 14, has exhausted through the valve 16, the valve 13 will then open and the chamber 10 will be filled.

At the time the piston 11 starts forwardly, the fuel valve 17 will open and a 85 charge of gaseous fuel will be injected into the chamber 12. This gaseous fuel enters the chamber 12 under compression and the valve 17 will therefore remain open during a considerable portion of the stroke of the 90 piston 11 before the increasing pressure will cause it to close. The increasing force of the compression of the gas in the chamber 12 acts on the automatic spark plug 19 and a spark is produced which explodes the 95 compressed charge. The action of the piston 11 is then repeated.

The automatic spark plug consists of a porcelain or other insulating material body 19 which is slidable in a suitable recess in the 100 head of the cylinder 3. The plug 19 has a shoulder against which a spring 24 presses and holds the electrodes 25 normally out of range. The spark plug 19 has a terminal 26 which coöperates with a fixed terminal 27. 105 Suitable battery connections are provided, but are not shown in the drawings. The increasing pressure in the chamber 12 acts on the head of the plug 19 forcing it out against the tension of the spring 24. When 110 the terminals 26 and 27 engage, the primary circuit is closed and a spark occurs between the electrodes 25 causing the explosion of the compressed charge in the cylinder 12.

The fuel feeding mechanism consists of a 115 mixing tube 18 which, as shown in Figs. 1 and 2, connects with the compressed air pipe 14 from which air under pressure is obtained for the purposes of creating the gaseous mixture for the chamber 12. The 120 air is admitted to the tube 18 through the reducing valve 28 which may be regulated to admit the air in various amounts. To this end, an adjustable stud 29 is arranged to coact with the stem of the valve 28. When 125 the stud 29 is lowered, the valve 28 can open only a small distance and vice versa. A spring 30 tends to keep the valve 28 normally closed.

A needle valve 31 is arranged in the mix- 130

ing tube 18, the valve piece being supported by a leaf spring 32 which also normally holds the valve piece from the valve seat. The valve 31 communicates with a gasolene chest 33 which is supplied with gasolene from a reservoir 34 by a pipe 35. The gasolene may be conducted to the chest 33 by gravity but I provide a pressure pipe 36 which communicates with the tube 18 and the reservoir 34 to lead, a part of the pressure in the tube, into the reservoir to force the gasolene into the chest 33.

A cylinder 37 adjoins the gasolene chest 33 and a pipe connection 38 conducts some of the gasolene into the cylinder 37 when the piston 39 in the cylinder 37 moves forwardly and performs a suction stroke. The quantity of gasolene thus drawn into the cylinder 37 is variable since the stroke of the piston 39 is variable. A back check valve 40 in the pipe 38 prevents the gasolene in the cylinder 37 from being forced back into the gasolene chest 33.

The rod 41 of the piston 39 extends through the chest 33 and is connected at its end to one arm 42 of a bell crank which is fulcrumed at 43 to an extension of a supporting bracket 44. The arm 45 of the bell crank is connected to the governor rod 46. The piston rod 41 is provided with a wedge 47 which engages the valve piece of the needle valve 31, as shown in Fig. 2. The wedge 47 holds the needle valve 31 open to a greater or lesser degree. The mixing tube 18 is provided with a gate valve 48 while pressure regulating valves 49 are provided in the pipe 50 which communicates with the chamber 12 and the cylinder 37.

The operation of the fuel feeding device as just described is as follows: The balls 51 of the governor are rotated by suitable gears 52 from a moving part of the machine. Under normal conditions of operation, the parts will be positioned substantially as shown in Fig. 2. If for any reason the working piston 11 should be thrown with insufficient force for the proper operation of the turbine 2, the insufficiency will be denoted by a lessening of the speed of rotation of the governor balls 51. They will consequently drop a proportional distance and since the lower pivots 53 are relatively fixed, the upper pivots 54 will be caused to move upwardly. The governor rod 46 is thereupon moved upwardly and the corresponding action on the bell crank will move the piston 39 rearwardly and inject a small quantity of gasolene into the chamber 12, thus enriching the explosive mixture.

The rearward movement of the piston 39 also causes the wedge 47 to recede from the valve piece 31 and cause the needle valve to open a corresponding distance. The explosive charge is thus also enriched in the mixing tube 18 and the combined effect is to

increase the violence of the explosion in the cylinder 12 and bring the operation of the turbine to the desired degree of efficiency.

The governor balls 51 will fly outwardly again with the increase in speed of the turbine and act oppositely on the bell crank and piston 39. The piston 39 in moving forwardly again, draws a quantity of gasolene into the cylinder 37 from the chest 33 to be utilized when the turbine slows down again. The speed of the engine may be increased by adjusting the stud 29 of the reducing valve 28 so that it will open wider and admit a greater amount of air under pressure from the pipe 14. The operation of the engine may be stopped entirely by closing the valves 48 and 49. In starting the engine, the chamber 12 may be primed by moving the piston 39 back and forth by hand. This serves to pump a sufficient quantity of gasolene into the chamber 12 to produce an explosive charge.

The gases from the cylinder 3 are directed into the casing 55 of the turbine 2 by either one of a pair of divergent ducts 56 which communicate with the conduit 21, as shown. A gate valve 57 is hingedly disposed at the juncture of the ducts 56 and pipe 21 so as to direct the gases into one or the other of the ducts. The rotation of the rotor of the turbine is dependent on the position of the valve 57. The valve 57 is actuated by a plunger 58 which has a suitable connection with an actuating lever 59. A quadrant and tooth connections 60 holds the valve 57 to its adjustments.

The turbine casing 55 is shown spherical in the present embodiment although it may be constructed in any other suitable form. The casing 55 includes bearings 61 at diametrically opposite sides in which the rotor shaft 62 is journaled. Keyed to the shaft 62 is the rotor hub 63 which supports the rotor 64 by the means of the spokes 65. The hub 63 is provided with a series of notches 66 which are engaged by the detents 67 of shifting arms 68, the purpose of the arms 68 being presently explained.

The rotor 64 includes a base band which merges with the side walls of the rotor. The exterior portion of the rotor is formed with the same curvature as the spherical body 55 of the turbine and this part of the rotor runs very close to the body 55, as shown. The curved exterior portion of the rotor 64 is formed with a central annular opening 69 which is in constant communication with the openings of the ducts 56 to receive the gases from the cylinder 3. It will be seen that the rotor comprises annular pockets 70 at each side and these are fitted with vanes 71 and 72 which when impacted by the gases, serve to impart rotation to the rotor.

The base band of the rotor has an annular

series of exhaust ports 73 and 74 adjacent to each side wall, as shown. The gases exhaust through one or the other of these series of ports into the casing 55. The
 5 ports are governed by a port band 75 which is supported by spokes on a sleeve 76. The sleeve 76 is slidably mounted on the hub 63 of the rotor. The arms 68 are fulcrumed in the sleeve 76, as shown in Figs. 5 and
 10 7 and the engagement of the detents 67 on the ends of the arms 68 with the registering notches 66 in the hub 63, holds the port band to whatever adjustment desired.

The port band is adapted to cover one or
 15 the other of the series of ports 73, 74. The drawing shows the ports 73 closed by the port band 75 and, in this case, that portion of the gases which impacts the vanes 72 will be confined in the pocket 70 by reason of
 20 the closure of the ports 73 and will be caused to make another circuit of the rotor, finally escaping by eddy action through the open ports 74.

The port band 75 is shifted through the
 25 medium of a bell crank 17 of which one arm is connected to an operating rod 78 and the other arm engages a shifting collar 79. The collar 79 encircles the curved ends 80 of the arms 68 and normally rests in the
 30 trough of the curve, as shown in Fig. 5. In shifting the port band, the first action of the collar 79 is to engage one or the other side of the curved ends 80, depending on the direction in which it is desired to shift the
 35 band. The collar 79 thus depresses the ends of the arms 68 against the tension of leaf springs 81 raising the detents 67 from the notches 66. The continued movement of the collar 79 then causes the bodily displacement of the port band 75 until the desired ports 73 or 74 are closed. The band
 40 75 is shifted in accordance with the shifting of the gate valve 58. The pump 15 exhausts the gases from the chamber 55.

From the foregoing description, the operation of the device will be fully understood; it may, however, be desirable to point out the advantages more fully. In some instances, the duplex pump 15 may be dispensed with thus giving the engine great
 50 advantage as a sub-marine engine. The principle of the operation of the engine consists in combining the power of the velocity of the exploded charges in the chamber 12 with the pressure of the compressed air in the chambers 9 and 10. The comparatively cool air of the compression chambers 9 and 10 serves to absorb the heat from the metal parts of the cylinder and pistons and serves
 60 to increase the force of the air, the accumulated forces being spent against the rotor 75.

An important advantage lies in the automatic spark plug 19 in that the charge of gaseous fuel in the chamber 12 is always
 65 compressed to a given degree regardless of

the altitude of the engine, the temperature or the density of the air, before the explosion occurs. This enables the operation of the engine at any depth in the sea or any height in the air.

While I have shown and described one specific embodiment of the invention, it is obvious that numerous modifications of the construction may be made without departing from the spirit of the invention or the
 75 scope of the claims.

Should compression fail in the chamber 12 ahead of the piston 11, a charge of compressed air and gas may be injected by the opening of the valve 28. This is accomplished by a light rod 82 which projects
 80 into the cylinder 3 a short distance, as shown in Fig. 2. When the piston 11 strikes the end of the rod 82, as it will do when there is no compressed charge ahead
 85 of the piston acting as a cushion to prevent the piston ordinarily from striking the rod, an eccentric 83 will be rotated on its pivot and lift the valve 28. While this arrangement just described may ordinarily be dispensed with, yet as a precautionary measure
 90 against failure of compression, it will have its value.

What I claim is:

1. In a gas turbine; the combination of a
 95 rotor, a fluid generator cylinder having normally closed air and gas ports, a projectile piston in the cylinder between an explosion chamber at one side and an air compressor chamber at the other, a cushion piston forming
 100 a yielding partition in the compressor chamber, means for causing an explosion in the explosion chamber to project the projectile piston rearwardly compressing the air and opening the gas and air ports, and
 105 conduits directing the exploded gases and compressed air against the rotor.

2. In a gas turbine; the combination of a rotor, a fluid generator cylinder having air and gas ports, a projectile piston in the cylinder between an explosion chamber at one side and an air compressor chamber at the other, the piston being adapted to cover the
 110 gas exhaust port, a cushion piston forming a yielding partition in the compressor chamber and adapted to close the air exhaust port, means for causing an explosion in the explosion chamber to project the projectile piston rearwardly, opening the gas port, compressing
 115 the air and displacing the cushion piston; and conduits directing the exploded gases and compressed air against the rotor.

3. In a gas turbine; the combination of a rotor, a fluid generator cylinder having air and gas outlet ports and an inlet for compressed air, a cushion piston arranged to normally close the air outlet port, the piston being disposed adjacent to the air inlet to act as a partition and form a lesser and
 125 greater chamber for the compressed air, a
 130

projectile piston in the greater chamber, means for causing an explosion at one side of the projectile piston to throw the piston rearwardly to supercompress the air in the greater chamber displacing the cushion piston to open the air ports and supercompressing the air in the lesser chamber, and conduits directing the combined exploded gases and supercompressed air against the rotor.

4. In a gas turbine; the combination of a rotor, a cylinder having a gas and air outlet port and an opening for compressed air, ducts from the outlet ports to the rotor, a cushion piston covering the air exhaust port and forming a lesser chamber adjacent the air inlet opening and a greater chamber at the other side, a projectile piston in the greater chamber adapted to be projected toward the cushion piston simultaneously supercompressing the air in the greater and lesser chambers and displacing the cushion piston to relieve the pressure in the greater chamber, and a valve in the cushion piston adapted thereupon to open and direct the supercompressed air in the lesser chamber against the projectile piston to perform the return stroke.

5. In a gas turbine; the combination of a rotor, a cylinder having a gas and air outlet port and an opening for compressed air, ducts from the outlet ports to the rotor, a cushion piston covering the air exhaust port and forming a lesser chamber adjacent the air inlet opening and a greater chamber at the other side, a projectile piston in the greater chamber adapted to be projected toward the cushion piston simultaneously supercompressing the air in the greater and lesser chambers and displacing the cushion piston to relieve the pressure in the greater chamber, a valve in the cushion piston adapted thereupon to open and direct the supercompressed air in the lesser chamber against the projectile piston to perform the return stroke, and means for forming and forcibly injecting a charge ahead of the advancing projectile piston for compression.

6. In a gas turbine; the combination of a rotor, a cylinder having a gas and air outlet port and an opening for compressed air, ducts from the outlet ports to the rotor, a cushion piston covering the air exhaust port and forming a lesser chamber adjacent the air inlet opening and a greater chamber at the other side, a projectile piston in the greater chamber adapted to be projected toward the cushion piston, simultaneously supercompressing the air in the greater and lesser chambers and displacing the cushion piston to relieve the pressure in the greater chamber, a valve in the cushion piston adapted thereupon to open and direct the supercompressed air in the lesser chamber against the projectile piston to perform the return stroke, means for forming and forcibly

injecting a charge ahead of the advancing projectile piston for compression, and a pressure controlled spark plug adapted to form a spark when the compressed charge reaches a predetermined amount.

7. In a gas turbine; the combination of a rotor, a fluid generator cylinder having supercompressed air exhaust ports and a compressed air inlet opening at one end, a cushion piston adapted to cover the air exhaust port and dividing the cylinder into greater and lesser chambers, cushion springs abutting the cushion piston and end of the cylinder, a valve in the air inlet for admitting compressed air to the lesser chamber, a valve in the cushion piston for admitting air to the greater chamber, a projectile piston in the greater chamber adapted to cover the gas exhaust port, a mixing tube communicating with the greater chamber ahead of the projectile piston, a pressure controlled spark plug, and conduits connected with the exhaust ports and directed against the rotor.

8. In a gas turbine; the combination with a rotor, vanes on the rotor, a rotor casing, a fluid generating cylinder, a pump for delivering compressed air to the cylinder at one end, a charge forming device at the other end of the cylinder operated by the air from the pump, a pressure actuated spark plug for exploding a charge, a projectile piston adapted to be projected to supercompress a charge of air for delivery, conduits for receiving the supercompressed air, a conduit for receiving the exploded gases, a cushion piston for supercompressing a charge of air as the projectile piston is projected, a valve in the cushion piston adapted to subsequently open and return the projectile piston, and divergent ducts communicating with the conduits and the rotor casing.

9. In a gas turbine; the combination with a rotor, vanes on the rotor, a rotor casing, a fluid generating cylinder, a pump for delivering compressed air to the cylinder at one end, a charge forming device at the other end of the cylinder operated by the air from the pump, a pressure actuated spark plug for exploding a charge, a projectile piston adapted to be projected to supercompress a charge of air for delivery, conduits for receiving the supercompressed air, a conduit for receiving the exploded gases, a cushion for supercompressing a charge of air as the projectile piston is projected, a valve in the cushion piston adapted to subsequently open and return the projectile piston, divergent ducts communicating with the conduits and the rotor casing, and a gate valve for directing the combined fluids into one or the other of the divergent ducts.

10. In a gas turbine; the combination of

a working cylinder, a piston operable within the cylinder, an air compressor, a mixing tube that communicates with the explosion end of the working cylinder and receives
 5 air from the compressor, a fuel tank associated with the mixing tube, a governor controlled needle valve between the fuel tank and the tube and a valve at the entrance of the mixing tube to the explosion chamber
 10 adapted to open as the piston traverses a part of its compression stroke.

11. In a gas turbine, the combination of a working cylinder, a working piston within the cylinder, an air compressor, a mixing
 15 tube communicating with the explosion chamber and receiving air from the compressor, a gasolene chest associated with the mixing tube, a needle valve therebetween, a valve at the entrance of the mixing tube
 20 into the explosion chamber adapted to open as the piston traverses a part of its compression stroke, and a pressure reducing valve in the mixing tube.

12. In a gas turbine; the combination of
 25 a working cylinder, a working piston within the cylinder, an air compressor, a mixing tube communicating with the explosion chamber and receiving air from the compressor, a gasolene chest associated with the
 30 mixing tube, a needle valve therebetween, a priming cylinder communicating with the explosion chamber, a priming piston therein, the piston having a rod passing through the gasolene chest, and means on the rod associated with the needle valve for opening the
 35 valve as the priming piston performs a compression stroke.

13. In a gas turbine; the combination of a working cylinder, a working piston operable therein, an air compressor, a mixing
 40 tube communicating with the explosion chamber and receiving air from the compressor, a gasolene chest associated with the mixing tube, a needle valve therebetween, a
 45 priming cylinder communicating with the explosion chamber, a priming piston therein, the piston having a rod passing through the gasolene chest, and means on the rod associated with the needle valve for closing
 50 the valve as the priming piston performs a suction stroke.

14. In a gas turbine; the combination with a working cylinder and piston, an air compressor, a mixing tube communicating with
 55 the explosion chamber and receiving air from the compressor, a gasolene chest associated with the mixing tube, a needle valve therebetween, a priming cylinder communicating with the explosion chamber, a priming
 60 piston therein, the piston having a rod passing through the gasolene chest, a wedge on the rod associated with the needle valve for regulating the valve as the priming piston is moved, and a governor for moving
 65 the priming piston.

15. In a gas turbine; the combination with the motive fluid generator having an explosion chamber, an air compressor, a mixing tube communicating with the explosion chamber and receiving air from the compressor, a pressure reducing valve for regulating the pressure of the air, a gasolene chest associated with the mixing tube, a
 70 needle valve therebetween, a gasolene reservoir having communication with the gasolene chest, and a pressure pipe between the mixing tube and the top of the fluid in the reservoir.

16. In a gas turbine; the combination with the motive fluid generator having an explosion chamber, a projectile piston adapted to perform a compression stroke, a mixing tube adapted to inject a compressed charge into the explosion cylinder as the piston
 80 traverses a portion of its stroke, a spark plug including electrodes within the explosion chamber and separated electric terminals outside the explosion chamber, a spring for holding the terminals separated, said spring being adapted to yield as the pressure in the explosion chamber increases to
 85 cause the terminals to engage.

17. In a gas turbine; the combination with a rotor, of a working cylinder having normally closed air and gas inlet ports and
 90 air and gas outlet ports, a working piston within the cylinder that divides the cylinder into an explosion chamber at one end and an air compressing chamber at the other end, a yieldable abutment in the air compressor chamber that normally closes the
 95 air exhaust port, the said working piston normally closing the gas exhaust port, and means for causing explosion in the explosion chamber whereby to compress an air charge and effect the opening of the air and gas
 100 exhausts, and a duct for conveying the exploded and compressed fluid charges to the rotor.

18. In a gas turbine; the combination
 110 with a rotor, of a working cylinder having normally closed air and gas inlet ports and air and gas outlet ports, a working piston within the cylinder that divides the cylinder into an explosion chamber at one end and an
 115 air compressing chamber at the other end, a yieldable abutment in the air compressor chamber that normally closes the air exhaust port, the said working piston normally closing the gas exhaust port, and means for
 120 causing explosion in the explosion chamber whereby to compress an air charge and effect the opening of the air and gas exhausts, and a duct for conveying the exploded and compressed fluid charges to the
 125 rotor, and means for deflecting the said fluid charges to engage the rotor from opposite directions.

19. In a gas turbine, the combination with a rotor; a fluid generator cylinder having
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normally closed air and gas ports and which includes an explosion chamber at one end and an air compressing chamber at the other end, a piston within the cylinder located between the two chambers and which is arranged to cover the gas exhaust port, a yielding partition in the compressing chamber arranged to close the air exhaust port, means for causing an explosion in the explosion chamber to thereby move the piston to open the gas exhaust port and compress the air in the air compressing chamber and simultaneously shifting the yielding partition and opening the air and gas ports, and a duct for conveying the exploded gas and compressed air charges against the rotor.

20. In a gas turbine, the combination with a rotor that includes radial vanes and a casing; of a fluid generator comprising a working cylinder having an air compressing chamber at one end and an explosion chamber at the other end, an air pump in communication with the said air compressing chamber, a gaseous charge forming device in connection with the explosion end of the cylinder, a pressure actuated sparking device for exploding the gaseous charges, a working piston in the cylinder between the explosion and air compression chambers, said piston being arranged to be projected to supercompress the charged air in the compression chamber, a conduit for receiving the exploded gases, a cushion member in the cylinder, a valve in the said cushion member adapted to open at predetermined times, to open the compressed air charge against the

working piston to thereby return it to its gas exhaust port closing position.

21. In a gas turbine; the combination with the motive fluid generating cylinder, a projectile piston at one end of an explosion chamber therebetween, an air compressor, a mixing tube communicating with the explosion chamber and receiving air from the compressor, a gasolene chest associated with the mixing tube, a needle valve therebetween, a valve at the entrance of the mixing tube into the explosion chamber adapted to open as the projectile piston traverses a part of its compression stroke, and means associated with the generator cylinder engageable by the piston to open the pressure reducing valve upon failure of compression.

22. In a gas turbine; the combination with the motive fluid generating cylinder, a projectile piston at one end of an explosion chamber therebetween, an air compressor, a mixing tube communicating with the explosion chamber and receiving air from the compressor, a gasolene chest associated with the mixing tube, a needle valve therebetween, a valve at the entrance of the mixing tube into the explosion chamber adapted to open as the projectile piston traverses a part of its compression stroke, and means associated with the generator cylinder engageable by the piston to open the pressure reducing valve upon failure of compression, said means including rod and eccentric devices associated with the pressure reducing valve.

IRA LEON SLAWTER.