W. G. JOHNSTON.

EXPLOSIVE ENGINE.

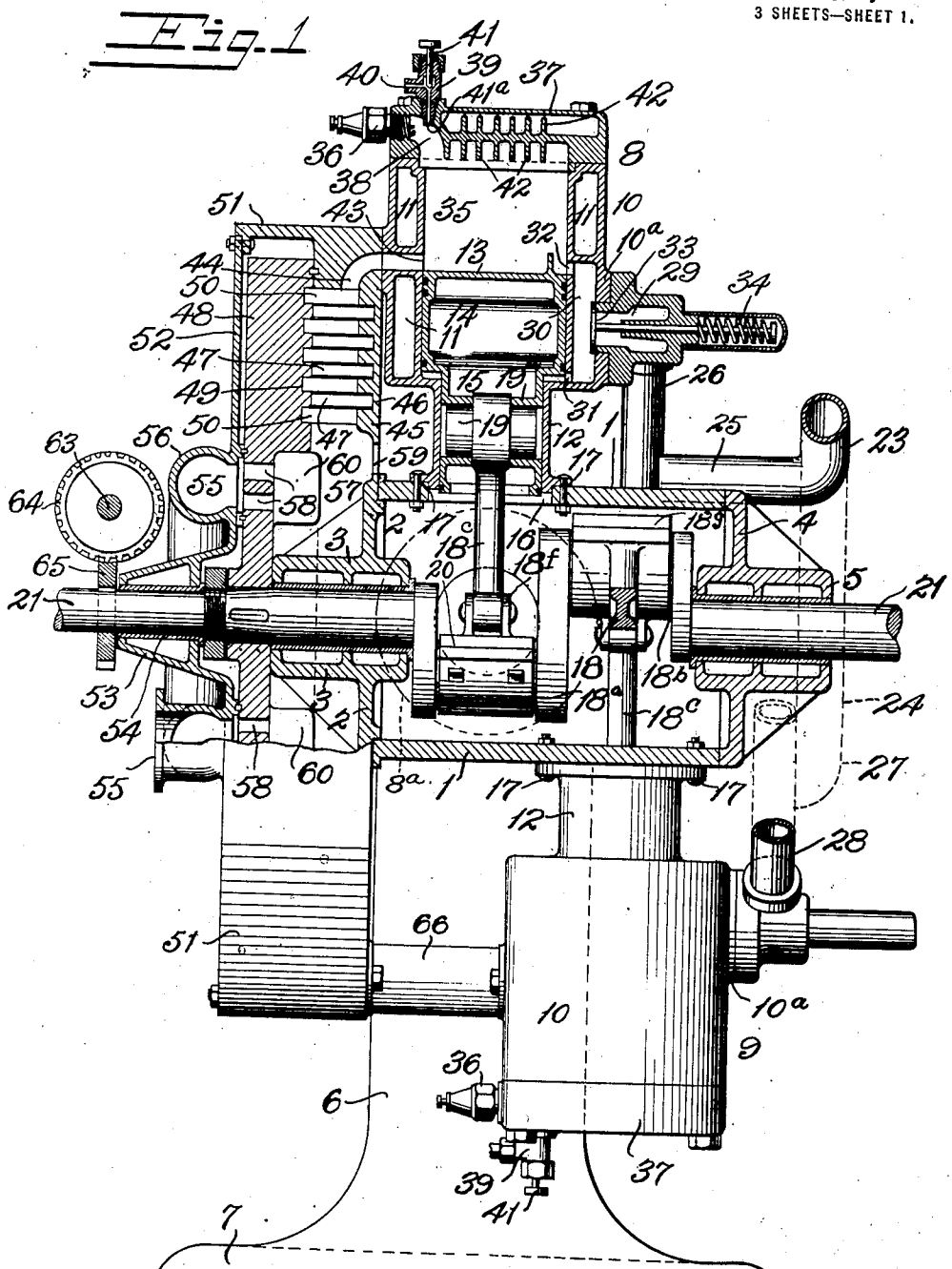
APPLICATION FILED JUNE 21, 1917. RENEWED SEPT. 24, 1920.

1,376,700.

Patented May 3, 1921.

3 SHEETS—SHEET 1.

Fig. 1



Inventor

William G. Johnston

By H. T. Bliss

Attorney

W. G. JOHNSTON.

EXPLOSIVE ENGINE.

APPLICATION FILED JUNE 21, 1917. RENEWED SEPT. 24, 1920.

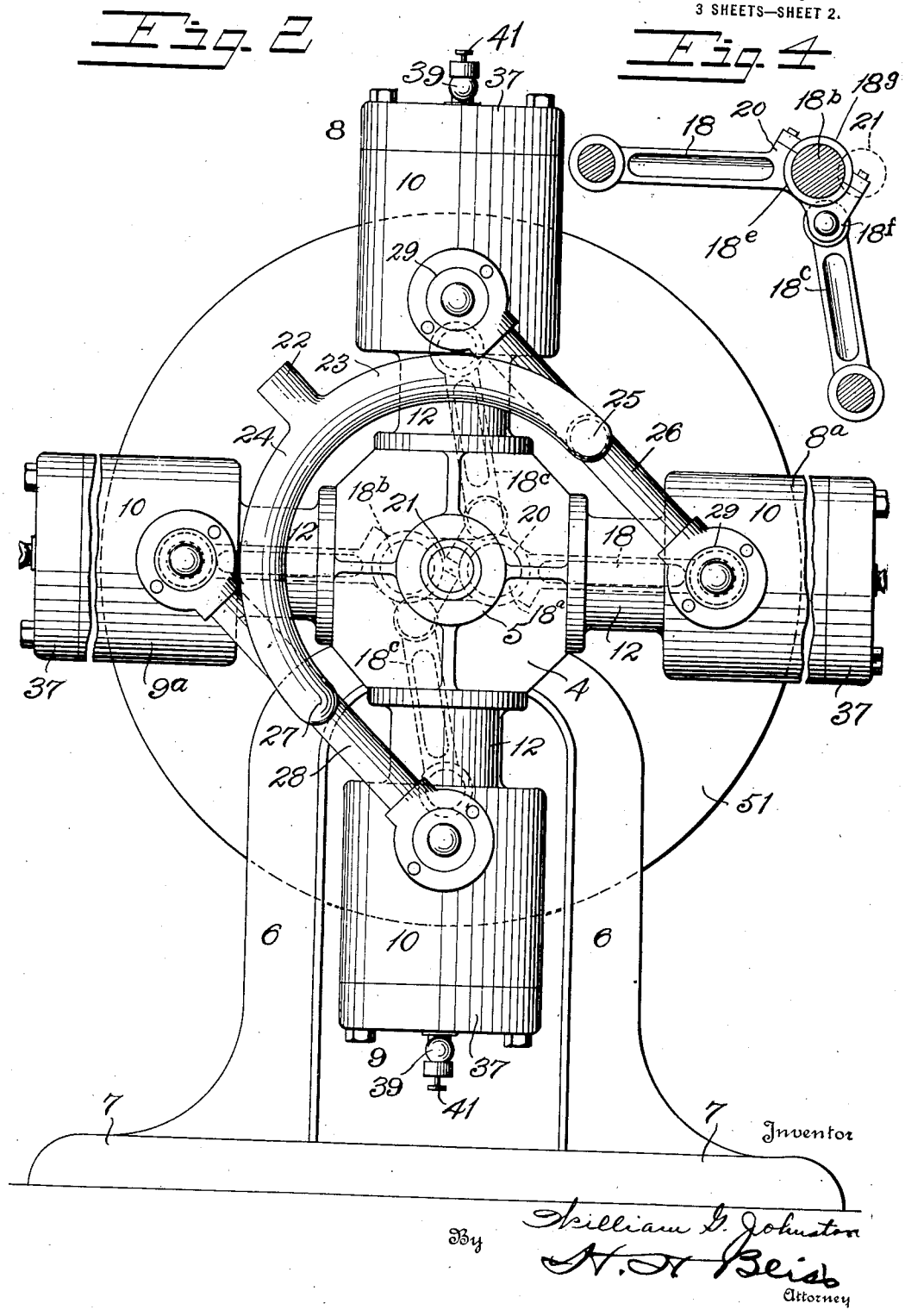
1,376,700.

Patented May 3, 1921.

3 SHEETS—SHEET 2.

Fig. 2

Fig. 4



Inventor

William G. Johnston

By N. H. Beis

Attorney

W. G. JOHNSTON.

EXPLOSIVE ENGINE.

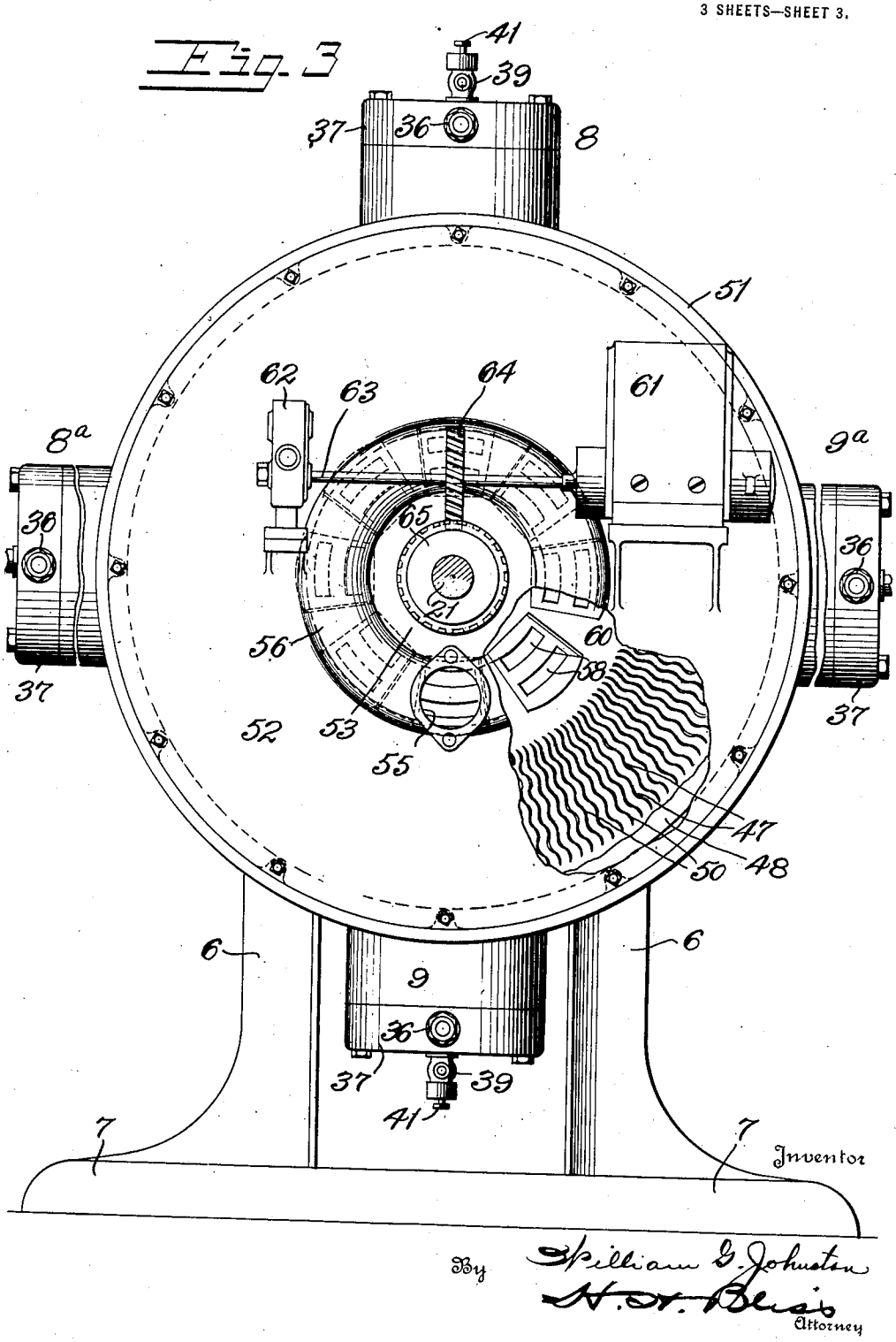
APPLICATION FILED JUNE 21, 1917. RENEWED SEPT. 24, 1920.

1,376,700.

Patented May 3, 1921

3 SHEETS—SHEET 3.

Fig. 3



Inventor

William G. Johnston

By N. O. Blais

Attorney

UNITED STATES PATENT OFFICE.

WILLIAM G. JOHNSTON, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO TIMOTHY O'LEARY, OF PHILADELPHIA, PENNSYLVANIA.

EXPLOSIVE-ENGINE.

1,376,700. Specification of Letters Patent. Patented May 3, 1921.

Application filed June 21, 1917, Serial No. 176,083. Renewed September 24, 1920. Serial No. 412,624.

To all whom it may concern:

Be it known that I, WILLIAM G. JOHNSTON, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Explosive-Engines, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to explosive engines. It has, among its objects, to provide for driving the movable parts by means of either a light hydro-carbon, such as gasolene, or a heavier hydro-carbon, in an improved manner; and also for obtaining from the fuel a greater amount of power than has been heretofore obtained, the present mechanism providing for utilizing the exhaust gases, in an efficient manner, after they have performed their work in driving the reciprocating pistons.

Figure 1 is a view, partly in elevation, partly in vertical section, of an engine embodying my improvement.

Fig. 2 is an end elevation of the engine, looking at it from the right-hand, as the parts are shown in Fig. 1.

Fig. 3 is an end elevation of the engine, looking at it from the left-hand, as the parts are shown in Fig. 1.

Fig. 4 shows two companion-pitmen and the means for pivotally connecting them to a crank.

The framework of the engine comprises a casing structure having the peripheral wall 1 shown to be approximately octagonal, but of any preferred shape in cross section. At its inner end there is a plate 2, cast with a bearing at 3, and extending radially to a considerable distance from the axis. The outer end of the central part is formed with an open end, which is closed, however, by a cap plate 4, carrying a bearing 5. This central part is supported upon standards 6 and a base 7.

To the central part 1 are secured the engine cylinders 8, 8^a, 9, 9^a. Each cylinder has a main section 10 and a relatively reduced or narrower section 12. Suitable water jacket chambers 11 are provided. In each of the cylinders there is fitted a piston 13 having a relatively larger part 14, and at the inner end a narrower part 15. The part 12 of each cylinder is connected to the central element 1, there being an opening 16 and flanges and bolts at 17.

There are four of these cylinders arranged around the axis as shown. The cylinders 8, 8^a are in the same transverse planes and the cylinders 9, 9^a are in planes outside of those of the cylinders 8, 8^a. Each piston has a pitman provided with relatively large pivot trunnions 19, which are fitted in sectional sleeves 19^a, integral with the narrower part 15 of the piston. Each piston in each of the cylinders 8^a and 9^a has a connecting rod or pitman 18; and the piston in each of the cylinders 8 and 9 has a pitman or connecting rod 18^c. Each pitman 18 is connected by a half box or sleeve 18^e and a cap at 20, to one of the crank pins 18^a, 18^b. Each box half 18^e is formed with ears 18^f. The pitman 18^c of each of the pairs extends from its piston to and is pivoted between the ears 18^f of one of the pair of ears. The cylinders of the series, considering the series as an entirety, are each 90 degrees from those adjacent to it, but they are coupled in pairs, as aforesaid, respectively, to the cranks of the shaft.

The cylinders are supplied with an explosive mixture from a carbureter. The latter is connected at 22 to a duct 23, 24. This duct at one end communicates at 25 with a manifold 26, and at the other end communicates at 27 with a manifold 28. The manifold 26 communicates intermittingly with the cylinders 8, 8^a through ducts 29. The manifold 28 in a similar manner has communication with the cylinders 9, 9^a. Ducts 29 are respectively joined to the outer walls of the part 10^a of each cylinder, and at their inner ends communicate with ducts 30 in the cylinder walls. Between duct 30 of each cylinder and the interior of the cylinder, are two ports 31 and 32. The end of the duct 29 is normally closed by a valve 33, which is held in position by a spring 34.

Through the carbureter the ducts 23, 24, the manifolds 26, 28 and the duct at 29, bodies of air and of gas or of vapor commingled together are admitted to the interior of the cylinders or the supply of gas or fuel may be cut off at the carbureter and a regulated body of air can be supplied.

If a light hydro-carbon, such as gasolene, is being admitted, it will, under the conditions to be described, be introduced through the port 32 into the explosion chamber 35.

For igniting it, there is a sparking device at 36, which may be of any preferred form. Each cylinder is closed by a head or cap 37. This is provided with a seat for the spark plug 36, and a passage or chamber 38, through which the spark communicates with the main explosion chamber.

The engine is also designed for the use of heavier hydro-carbon explosive fluid, such as kerosene or crude oil. For the introduction of this, there is a coupling 39, having a nipple at 40 for connection with the oil supply, a needle valve or suitable control device at 41, and a nozzle at 41^a. This nozzle is shown as delivering the heavier hydro-carbon through the passage 38 above referred to. The cap or cylinder head 37 is chambered and provided with a series of metallic points, ribs, or fins, 42, which may be integral with the metal of the cap. The exhaust port of each cylinder is indicated by 43. It communicates with a short duct through the cylinder wall, and this in turn with a duct 44. 45 is a radial extension of the central part 2, 3, it being integral with the latter and with a flange or peripheral part 51. In it are formed seats 46 within which are fitted the vanes or blades 47, which constitute the stationary elements of a turbine. The companion and rotary element of the turbine comprises the disk 48, having in its inner face seats 49 in which are fitted the rotary blades or webs 50. The rotary disk 48 is keyed to the shaft 21.

The chamber which is encircled by a drum or ring 51 is closed by a face plate 52. The latter is formed with an outwardly turned extension 53, fitted tightly, either directly or by a bushing 54, to the shaft 21, and also carrying the wall 56 of an exhaust duct 55. Between the wall 45 and the rotary disk 48 there is a chamber 57 which communicates with the final series of spaces or passages between the rotary blades 50 and the stationary vanes 47, and also communicates through ports 58 in the rotary disk 48 with the exhaust duct 55. This chamber 57 also communicates with the open atmosphere through ports 59. 60 are fan blades secured to the rotary disk 49, so arranged relative to the direction of rotation of the disk 48 that they will tend to draw air through the ports 59 and also draw from the chamber 57 any gas that may escape from the turbine vanes.

The current for the sparks at the plugs 36 is supplied from a magneto 61. The water for supplying the jacket chambers 11 is forced through the ducts by the pump 62. These elements, the magneto and the pump, are actuated by a shaft 63, which in turn is driven by a spiral gear having the driven element 64 and the driver 65 on the shaft 21.

The operation of the parts of the engine above illustrated and described will be readily understood. Assume that the movable elements are to start from the positions shown in Figs. 1 and 2, and that the heavy hydro-carbon at 40, 41 is shut off. The piston 13 of the cylinder 8 is about to commence its upward movement. It immediately closes ports 32 and 43; and causes a suction in the lower part of the cylinder, and this opens the valve 33 and permits the entrance of a charge of gasolene and air. The gases entering the duct 30 and through the port 31 enter the lower part of the cylinder chamber. On the down stroke of the piston there is a preliminary compression of these gases, the valve 33 being held closed. As soon as the port 32 is opened the preliminarily compressed charge is forced through the duct 30 and the port 32 and into the explosion chamber. Immediately thereafter the piston, on its up-stroke, closes the ports 32 and 43 and compresses the mixture in the upper part of the cylinder. Then a spark is caused at 36, the explosion occurs, and the piston is returned downward.

These phenomena occur in each of the cylinders in predetermined sequence around the axis of the shaft.

After a number of explosions of the lighter hydro-carbon have occurred, the metallic points, webs or fins 42 become white-hot. Then the supply of gasolene is shut off by the proper valve and the heavier hydro-carbon is allowed to enter by the opening and adjusting of the needle valve 41 and the opening of the duct at 40. While this fuel is supplied, the spark at 36 can be cut off and the highly-heated points or fins at 42 are relied on for igniting the heavier fuel, air being supplied through the duct 21.

As the piston 13 moves inward it opens the exhaust port 43, and thereupon the burnt gases escape from the cylinder. They do so under a still relatively high pressure. While still highly heated and under pressure they pass through the duct 44 and instantly impinge alternately upon the turbine vanes 50 and 47. Thereupon the disk 48 is compelled to rotate and transmit the force, which it receives from the exhausting gases, under pressure, to the shaft. By the time the gases have passed through the spaces between the rotary and the stationary vanes of the turbine and reach the central chamber 57, they have translated their energy into the rotation of the piston and of the shaft, and finally escape into the chamber 57 at a pressure approximately that of the atmosphere.

In order to prevent a loss of power through reaction, the fans or exhausting devices at 60 are introduced, and these cause drafts of air through the ports 59 and by suction insure that the gases passing through the vanes shall be drawn out and forced through the port 58 into the exhaust duct 30.

The cylinders 9, 9^a being in transverse planes more remote from the stationary disk 51 than are the cylinders 8, 8^a, ducts 66 are provided between the ports 43 in said cylinders 9, 9^a and the ducts 44 in the disk 51. Otherwise the cylinders 9, 9^a are related to the turbine elements of the structure in the same way as are the cylinders 8, 8^a.

I am aware that it has been proposed heretofore to utilize the exhaust gases from explosive engines by causing them to pass through devices which constitute, in one form or another, turbine engines. But I believe myself to be the first to have constructed the parts and to have arranged them in the efficient manner which I here present. I take the exhaust gases practically immediately, before they can lose any of their efficiency through drop in temperature or drop in pressure, to the vanes of a rotary turbine disk positioned close to the parts of a reciprocating explosive engine mechanism; and also the first to have provided means for insuring that the exhaust draft shall be maintained, even though the pressure of the exhaust gases is, in the turbine, reduced practically to that of the atmosphere. I effect this by means of a supplemental current of air brought to bear at the points of final escape of the gases from the turbine vanes.

What I claim is:

1. The combination with the main shaft and its bearings, of a relatively flat, radially-expanded turbine engine having, first, a radially-arranged stationary plate carrying a set of turbine vanes and formed with axially-directed inlet air-passages near said shaft, and, second, a radially-expanded rotary plate carrying turbine vanes and provided at points near the shaft with final gas-exhaust passages, the working paths among the vanes of the turbine extending from points radially remote from the shaft to points relatively near it, a series of reciprocating pistons and pitmen positioned in transverse planes close to those of the stationary plate of said turbine engine, and cylinders respectively holding said pistons and having their exhaust passages axially opposite and close to the outer ends of the aforesaid working paths, and constructed and arranged at their inner ends to permit the free inflow of air through said passages directly into the path of the gases in the turbine engine at the points where they are finally exhausting therefrom.

2. The combination with the main shaft, its cranks, and its bearings, of a framelike device secured to the bearings and spaced radially away from the shaft, a flat, radially-expanded turbine engine having, first, a stationary plate rigidly secured to said framelike device and carrying a set of stationary turbine vanes and formed with axially-directed air-passages near said shaft, and, second, a radially-expanded rotary plate carrying rotary turbine vanes and provided with gas-exhaust passages relatively near said shaft and approximately axially opposite to said air-passages, both said sets of vanes being positioned in the transverse planes of a shaft-bearing, a series of reciprocating pistons and pitmen positioned in transverse planes and close to those of the said stationary plate of the turbine engine, and cylinders respectively holding said pistons and formed with outer, wider parts, and with inner, reduced parts which are secured to the said framelike device, and permit free access of air through the air-passages in the said stationary turbine plate to the interior of the turbine engine.

In testimony whereof I affix my signature, in presence of two witnesses.

WILLIAM G. JOHNSTON.

Witnesses:
GEORGE E. EDELIN,
DORSEY WILKERSON.