May 30, 1950 J. PHILLIPS 2,509,577

MULTIPLE COMBUSTION PRODUCTS OPERATED TURBINE

Filed May 2, 1946 3 Sheets-Sheet 1

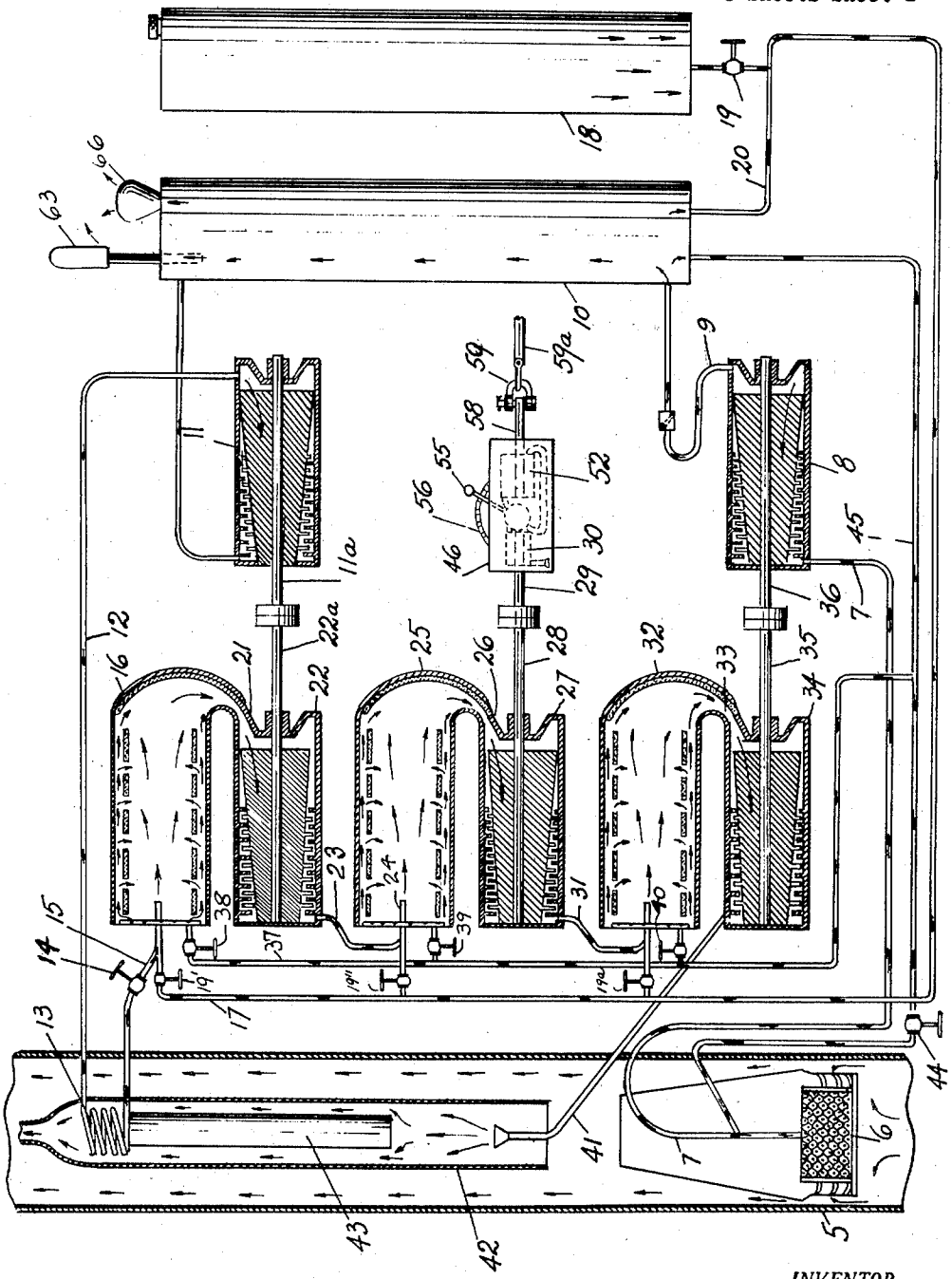


Fig. 1

INVENTOR.
John Phillips
BY
Carl Miller
ATTORNEY

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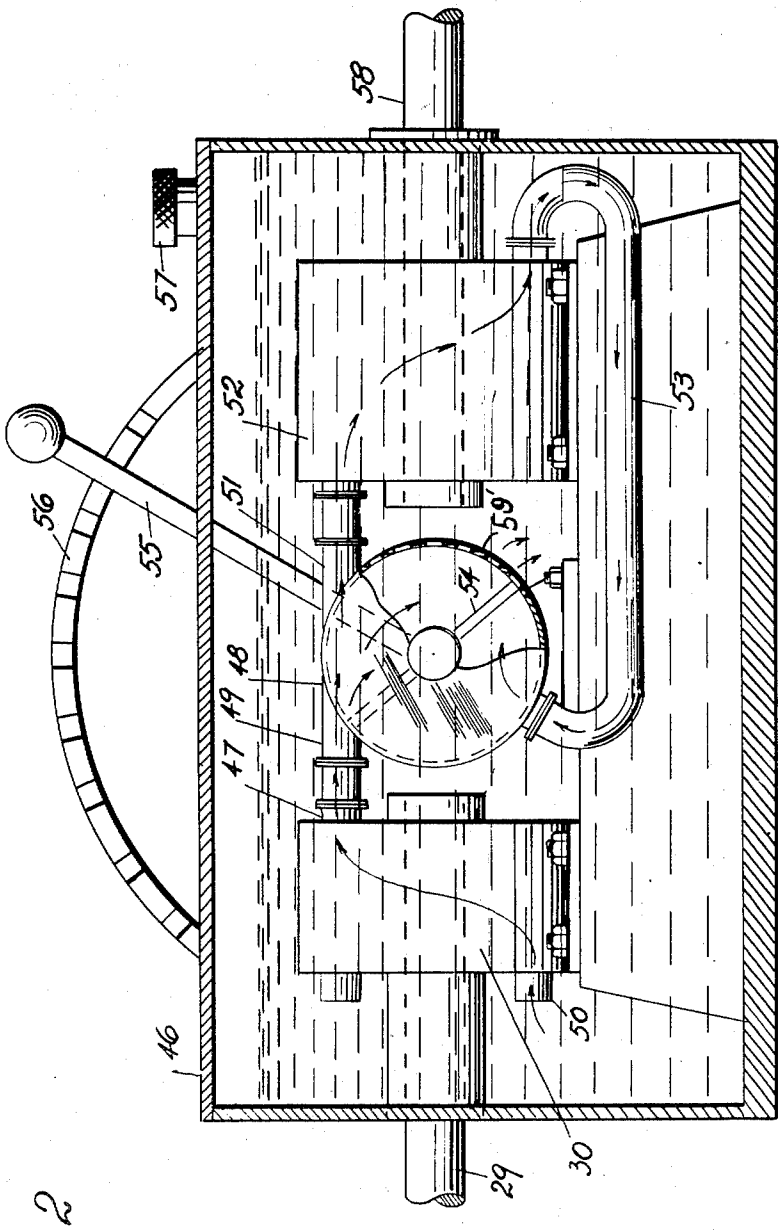


Fig. 2

INVENTOR.
John Phillips
BY
Carl Miller
ATTORNEY

May 30, 1950 J. PHILLIPS 2,509,577

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Fig. 3

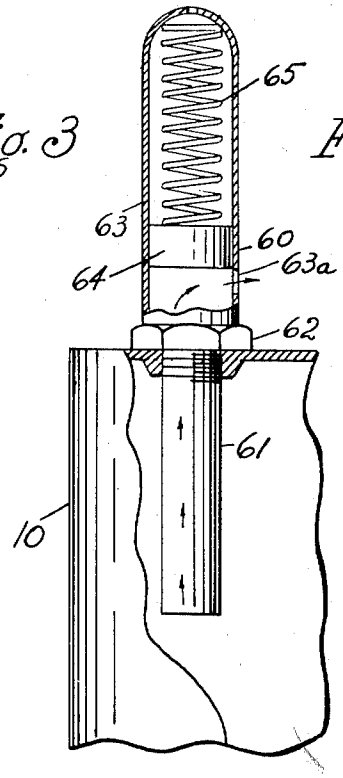


Fig. 4

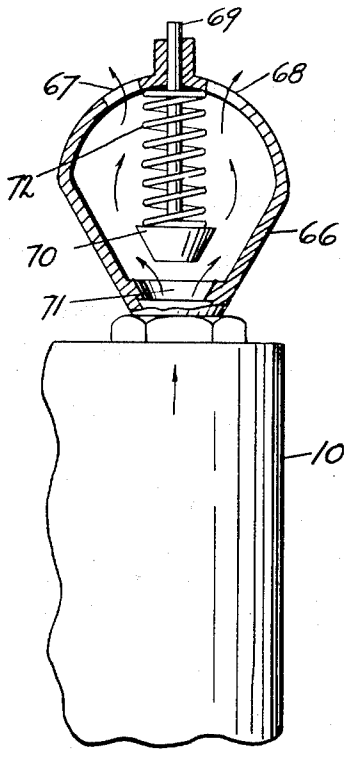
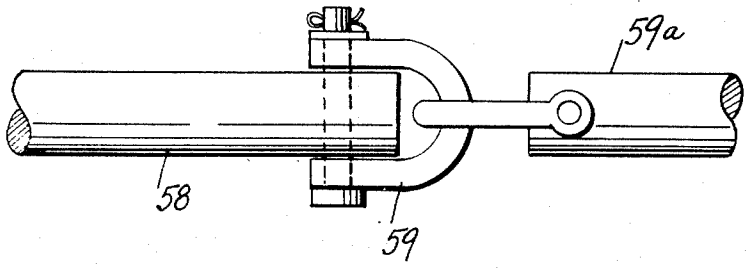


Fig. 5



INVENTOR.
John Phillips
BY
Carl Miller
ATTORNEY

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UNITED STATES PATENT OFFICE

2,509,577

MULTIPLE COMBUSTION PRODUCTS OPERATED TURBINE

John Phillips, New York, N. Y.

Application May 2, 1946, Serial No. 666,547

4 Claims. (Cl. 60—41)

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This invention relates to an improved power generating system, and one of its objects is to provide means for generating power from rotating turbine units, and a power transmission means consisting of coupled turbine pumps, one of which is driven by the turbine unit means, and the other of which is a driver for any mechanism or vehicle driving means coupled therewith.

Another object of the invention is to provide a power generating system, which includes a series of combustion chambers, a turbine engine connected with each combustion chamber, an air tank, and a turbine compressor connected with the air tank, together with connections between the air tank and a fuel supply for charging the combustion chambers with a fuel mixture.

With the above and other objects in view, the invention comprises certain new and useful constructions, combinations, and arrangements of parts, clearly described in the following specification, and fully illustrated in the drawings, in which:

Fig. 1 is sectional view through the main units of the system, showing the conduits connecting the units to each other.

Fig. 2 is a view through the housing for the turbine pump units.

Fig. 3 is a vertical sectional view showing one form of a safety valve for the air receiver tank.

Fig. 4 is a similar view, showing another form of a safety valve for the air receiver tank.

Fig. 5 is a detail plan view of a drive shaft coupling.

Referring to the drawings, which illustrate the practical embodiment of the invention, 5 designates a main air conduit or pipe, in which an air filter 6 is installed. From this filter the air conduit 7 extends to the rotary or turbine compressor 8, and the air from this compressor is delivered by the pipe 9 to the air receiver tank 10.

The air supply of the tank 10 is supplied to another compressor 11, of the rotary or turbine type, and the air discharge from this compressor is conducted by the pipe 12 to heating coil 13, arranged in the large pipe 5. The coil 13 is connected to the manual valve 14, which is again connected with the feed pipe 15, which discharges into the primary combustion chamber 16. This combustion chamber is supplied with fuel from the pipe 17, which is connected with the fuel tank or source 18, through the valve 19, and is also connected by the branch pipe 20 with the air tank 10.

The combustion chamber 16 discharges through

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the duct 21 to the turbine engine 22, the shaft 22a of which is coupled to the shaft 11a of the turbine compressor 11. The discharge from the turbine engine 22 is conducted by the pipe 23 to the fuel feed pipe 24 of the combustion chamber 25, and this chamber discharges by the duct 26 to the turbine engine 27. The shaft 28 of the engine 27 is coupled to the shaft 29 of the hydraulic transmission pump 30. Combustion chamber 25 is also provided with a control valve 19''.

The turbine engine 27 discharges by the pipe 31 to the combustion chamber 32, which discharges by the duct 33 to the turbine engine 34, the shaft 35 of which is coupled to the shaft 36 of the turbine compressor 8.

Additional air is supplied to the combustion chamber 16 by means of the pipe 37, which is equipped with a valve 38, and to the combustion chamber 25 by means of the valved pipe 39, and to the combustion chamber 32 by means of the valved pipe 40, from the pipe 37, which is supplied by the tank 10 with pressure air. Combustion chamber 32 is likewise provided with a control valve 19a.

The discharge from the turbine engine is conveyed by the exhaust pipe 41 to the heating tube or pipe 42, within the main air tube 5, and in this heating tube a baffle 43 is arranged below the heating coil 13, so that the coil 13 is thus supplied with exhaust heat.

When the air filter 6 becomes clogged up with dirt the valve 44 may be opened, on the air pipe 45, and a blast of scavenging air supplied to the discharge side of the filter.

The hydraulic transmission pump 30 is enclosed by a housing 46, which is filled with pressure oil or other fluid, and one side opening 47 of this pump is coupled to the valve housing 48 by means of the conduit 49, and the other side opening or port 50 is normally open. The valve housing 48 is also coupled by means of the conduit 51 with a liquid operated motor 52 to be driven by liquid delivered under pressure from the pump 30. The valve 54 controls the amount of liquid passed from the pump 30 to the motor 52. The other port of this motor 52 is connected by the conduit 53 with the valve housing 48. In the valve housing a rotary valve 54 turns on the operation of the lever 55, which extends above the housing 46 and swings on the curved rack bar 56. A filler plug 57 is provided. The shaft 58 of the liquid operated motor 52 is coupled by the universal coupling joint 59 with the driven mechanism combined with the power plant system, and not

here shown. The outlet port 59' is controlled by rotary valve 54 which is operated by lever 55 moving along the rack bar 56.

The capacity of the pump 30 may be increased by increasing the capacity of the motor 52.

The waste heat of one combustion chamber is utilized to raise the temperature developed in the second stage combustion chamber, and the waste heat thus produced in the second stage combustion chamber is utilized to raise the temperature in the third stage combustion chamber. The waste heat from the third stage combustion chamber is utilized to raise the temperature of the compressed air and fuel supplied to the primary turbine engine 22, through the primary combustion chamber 16.

My system thus combines a series of combustion chambers, discharging into each other, and a series of turbine engines operating from these combustion chambers, and again operating primary and secondary turbine compressors.

The tank 10 is equipped with a safety blow off or pressure responsive relief valve 60, which comprises an intake tube 61, the coupling nut 62, and the valve housing 63, which is formed with a side port 63a, which is normally closed by means of the cylindrical valve 64, acted on by the compression spring 65. When the pressure in the tank exceeds the resistance offered by the spring 65, the valve 64 will be raised above the port 63a and the pressure will be relieved through venting through this port.

The tank 10 is also equipped with a second pressure responsive relieving valve which comprises the housing 66, which is formed with ports 67 and 68, on the upper end thereof. In this housing the valve stem 69 slides, and carries the conical valve 70, to engage the conical seat 71, under the pressure of the coil spring 72. When the pressure in the tank 10 exceeds the resistance of the spring 72 the valve 70 will be lifted from its seat, and the pressure will be reduced until the resistance of the spring is sufficient to force the valve to its seat. One of these safety relief valves is to be provided with a weak spring and the other with a strong spring, so that one will yield when the minimum excess pressure is reached, and the other will yield when there has been a sudden rise in pressure beyond the capacity of the weaker valve.

All of the waste heat is utilized for a useful purpose to increase the efficiency of combustion. The power generated is transmitted to the driven mechanism, whether this be a vehicle or a stationary plant, by means of a hydraulic coupling, involving a large and a small pump.

Having described the invention, I claim as new the combination and arrangement of parts shown, and it is understood that various changes in the adjustment and details of construction, and their combination may be carried out, within the scope of the invention, as defined by the claims hereof.

Having described the invention, I claim as new:

1. A power generating system, comprising a turbine compressor, a turbine engine for driving the same, an air tank receiving the discharge from the compressor, a turbine compressor receiving the discharge of the air tank, a turbine engine driving the last-named compressor, a combustion chamber for each turbine engine, means for conducting the discharge from one turbine engine to the combustion chamber of the other turbine engine, means for supplying fuel to each combustion chamber, and means for utilizing the waste heat from the last turbine engine to the heating of the fuel supplied to all engines.

2. A power generating system comprising a main air conduit, an air filter in the conduit, a turbine compressor connected to the air filter to receive air therefrom, an air receiver tank for receiving air from the compressor, a second air compressor receiving air from the air receiver tank, a heating coil in the main air conduit, conduit means connecting the discharge end of the second compressor with the heating coil, a primary combustion chamber and means connecting the heating coil with the chamber, means for supplying fuel under pressure to the primary combustion chamber, a turbine engine connected with the primary combustion chamber, a shaft connecting the turbine engine to the second mentioned air compressor to drive the same, a second combustion chamber, means connecting the turbine engine with the second combustion chamber, a second turbine engine connected with the second combustion chamber, a hydraulic transmission pump connected to the second turbine engine to be driven by the same, a third combustion chamber connected to the second turbine engine to receive the products of combustion therefrom, a third turbine engine connected to the third combustion chamber, and said first mentioned air compressor connected to the third turbine engine to be driven by the same.

3. A power generating system as defined in claim 2, a heating tube lying within the main air conduit surrounding the heating coil, an exhaust pipe leading from the third turbine engine to deliver the exhaust products of combustion to the heating tube, a baffle within the heating tube and concentric therewith and arranged below the heating coil to divide the exhaust gases within the heating tube and extend the same over the exterior of the heating coil.

4. A power generating system as defined in claim 2, and valve controlled means extending from the air receiver tank to the respective combustion chambers to provide additional air supply to the respective combustion chambers.

JOHN PHILLIPS.

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