

June 30, 1931.

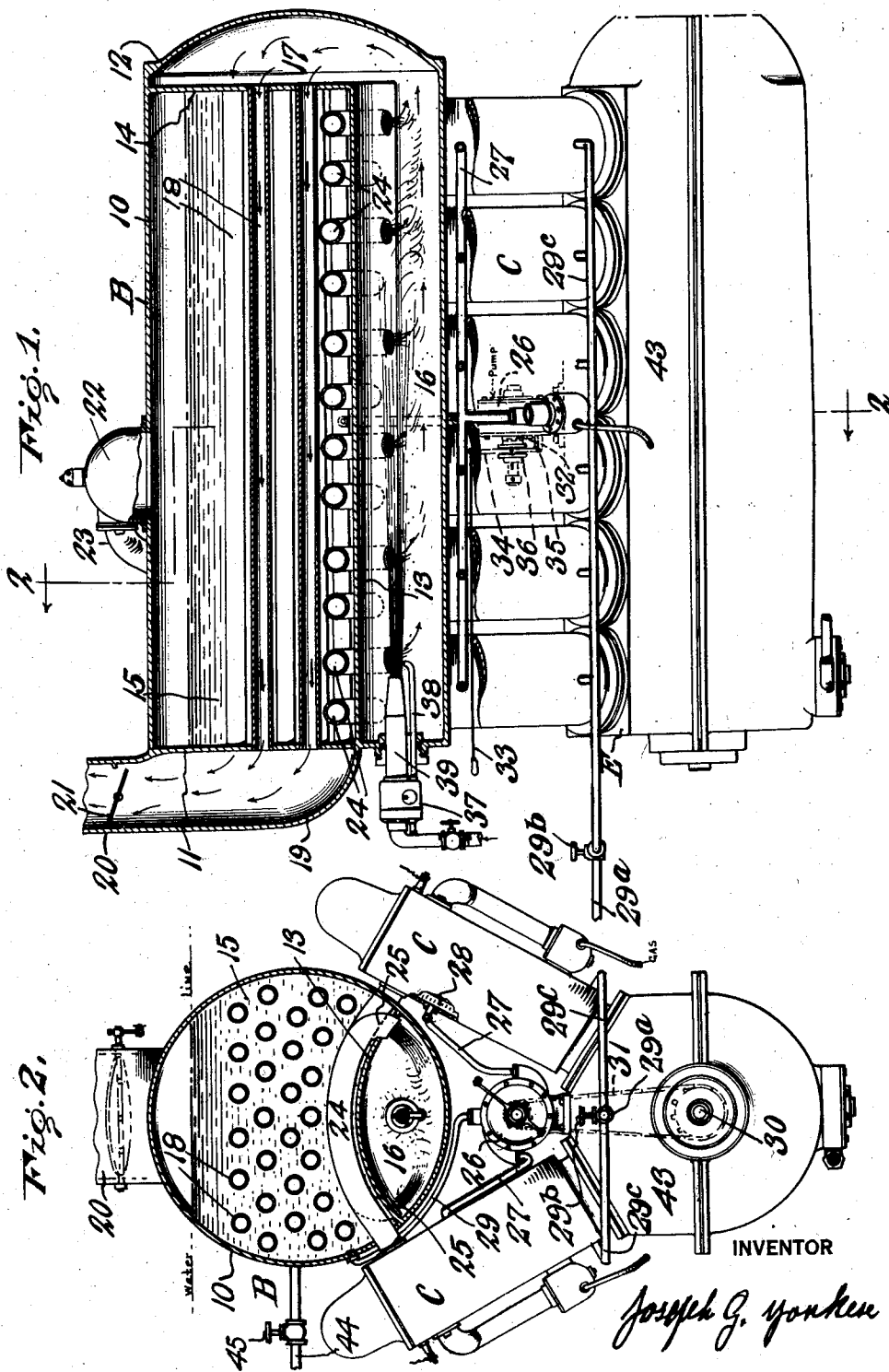
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APPARATUS FOR GENERATING MOTIVE FLUIDS

Filed Jan. 22, 1927

2 Sheets-Sheet 1



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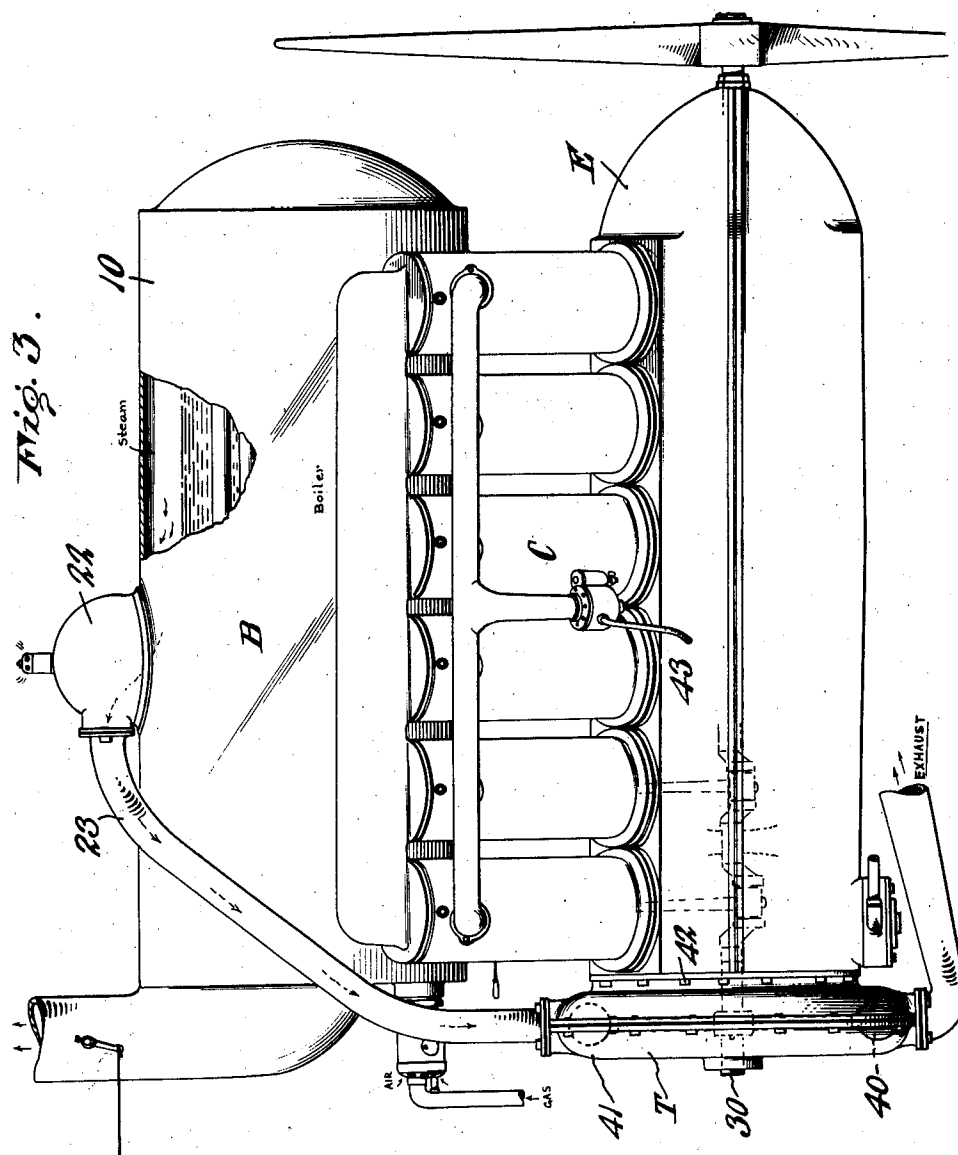
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APPARATUS FOR GENERATING MOTIVE FLUIDS

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My invention relates generally to apparatus for generating motive fluids and more particularly to an apparatus which in one of its adaptations is capable of being associated with a prime mover such as an internal combustion engine in such manner that the heat contained in gases exhausted by the engine when in operation, can be utilized to generate a motive fluid such as for instance, steam, so that the heat from the exhaust gases which is ordinarily discharged into the atmosphere and wasted, is converted into a motive fluid for performing useful work.

It is a further purpose of my invention to provide an apparatus of the above described character having means by which the power of the motive fluid as generated can be employed to aid in driving the prime mover with which the apparatus is associated, thus increasing the efficiency of the prime mover to a maximum.

It is another purpose of my invention to provide an apparatus for generating a motive fluid which is capable of use in generating the fluid from the heat of a flame emanating from a suitable burner, so that should the engine with which the apparatus is associated, fail, the motive fluid can be generated by the apparatus from an independent source of heat.

I will describe only one form of apparatus for generating motive fluids embodying my invention and will then point out the novel features in claims.

In the accompanying drawings,

Fig. 1 is a view showing in vertical longitudinal section one form of apparatus for generating motive fluids, embodying my invention, associated with an internal combustion engine of the well known V type particularly adapted for airplane use;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1 and looking in the direction of the arrows; and

Fig. 3 is a view illustrating the apparatus in side elevation and the manner in which it is associated with an internal combustion engine when the motive fluid generated by the apparatus is to be employed as an aid in driving the engine.

Referring specifically to the drawings and particularly to Figs. 1 and 2, my invention in its present embodiment is shown associated with an internal combustion engine E of the airplane V type having two banks or rows of cylinders C in angular relation, although it is to be understood that my invention can be applied to different type engines. My apparatus in the particular embodiment illustrated is designed for the generation of steam as the motive fluid, and to this end I provide a boiler, designated generally at B and comprising a shell 10 of cylindrical form having closed ends 11 and 12, the boiler being supported in any suitable manner to occupy a horizontal position longitudinally of the engine E and between the two banks of cylinders C.

The boiler is divided interiorly by a horizontal longitudinally extending partition 13 of arched cross-section, and a vertical partition 14 adjacent to and spaced from one end wall 12 of the boiler, co-operating to provide a water space 15 and a firebox 16 below the water space communicating at one end with a transverse passage 17, which latter in turn communicates with one of the open ends of a plurality of tubes 18 spanning the water space 15 and secured at their ends in suitable openings formed in the vertical partition 14 and the remote end wall 11 of the boiler. The other of the open ends of the tubes 18 communicates with a manifold 19 terminating in a stack 20 provided with a valve 21 manually operable in any suitable manner to control the outlet from the stack. It will be clear that heat from the firebox 16 will be free to discharge from the latter into the passage 17 and thence through the tubes 18 to effect by conduction, the heating and conversion into steam of water contained in the water space 15, after which any heat and the products of combustion remaining from the fuel used will discharge into the manifold 19 and thence into the stack 20 to the atmosphere. The steam generated in the boiler is free to enter a steam dome 22 from which leads a pipe 23 for conveying the steam to the desired point of use.

To provide the necessary heat to generate

the motive fluid in the boiler B, the heat of the exhaust gases resulting from the operation of the engine E is utilized, and to this end, the cylinders C of the engine, instead of exhausting into a common manifold as is the common practice, are provided with individual exhaust pipes 24 which project through the side walls of the boiler at a point immediately above the partition 13 so as to be disposed in the water space 15 and extend transversely of the boiler in side by side relation. The free ends of the pipes 24 are downturned as at 25 and project through the partition 13 so as to discharge the exhaust gases directly into the firebox 16 at intervals along its length. It will be clear that due to the presence of the pipes 24 within the water space 15, a portion of the heat of exhaust gases traversing the pipes will be conducted to the water in the water space so as to initially heat the water, while the remaining heat in the gases will accumulate in and discharge from the firebox 16 through the tubes 18 to further raise the temperature of the water, thus insuring that practically all the heat units available in the exhaust gases will be utilized before the gases are finally discharged from the stack 20.

To aid in the conversion of the water in the boiler into steam, water from the cooling system of the engine, which is in a heated state as a result of the operation of the engine, can be pumped from the latter into the boiler, and to this end I provide a conventional form of pump 26 supported on the engine between the banks of cylinders C and having two inlets connected by pipes 27 to the water jackets 28 of the two rows of cylinders, while the discharge side of the pump is connected to the water space 15 in the boiler by a pipe 29. The pump is adapted to be driven from the crankshaft 30 of the engine E by a sprocket and chain connection 31, and is capable of being thrown into or out of operation at will, by means of a conventional jaw clutch 32 manually operable by means of a rod 33 connected to a yoke 34 pivotally mounted at 35 and engaging the clutch collar 36 of the clutch 32. The supply of water to the jackets of the engine can be replenished from a suitable source (not shown) through a pipe 29^a controlled by a valve 29^b, and from which pipe lead branches 29^c to the jackets of the respective cylinders.

Should the operation of the engine E fail, steam can be generated in the boiler independently of the engine, by the provision of a conventional form of burner 37 mounted on the end wall 11 of the boiler and having nozzles 38 and 39 projecting into the firebox 16 and adapted respectively for connection to sources of fuel supply and air supply under pressure. It will be clear that with the burner 37 in operation, the flame emanating from the nozzle thereof will traverse the firebox 16 and

will travel in the same path through the boiler as exhaust gases from the engine discharged into the firebox from the exhaust pipes 24 so that heating of the water and the conversion thereof into steam will be effected.

In the event that it is desired to employ the power from the steam generated in the boiler, to aid in driving the engine E and thus increase its efficiency to a maximum, the pipe 23 leading from the steam dome 22 is connected to the intake side of a conventional form of turbine T, the rotor 40 of which is fixed to the crankshaft 30 of the engine while the stator 41 thereof is secured by bolts 42 to one end of the engine crankcase 43, all of which is clearly shown in Fig. 3. The steam generated in the boiler from the heat of the gases exhausted from the engine when in operation can thus be directly used to drive the turbine T and as a result materially aid in driving the engine. The steam after being used by the turbine is free to discharge therefrom through a pipe 44. The supply of water to the boiler can be replenished from a suitable source (not shown) through a pipe 44 communicating with the water space of the boiler and provided with a valve 45.

Although I have herein shown and described only one form of apparatus for generating motive fluids embodying my invention, it is to be understood that various changes and modifications may be made therein without departing from the spirit of the invention and the spirit and scope of the appended claims.

I claim:

1. In combination, a motive fluid generating apparatus comprising a boiler having a water space and a firebox in heat conducting relation to the water space, and an internal combustion engine having an exhaust conduit from its cylinders extending through said water space so as to be exposed to water in the latter, and opening into said firebox, so that when the engine is in operation, heat from the exhaust gases of the engine traversing the exhaust conduit will be directly absorbed by the water in the water space from that portion of the exhaust conduit disposed in the water space, and the heat remaining in the exhaust gases as discharged into the firebox, absorbed by water in the water space from the heated wall of the firebox, to thereby effect a maximum removal of heat units from the exhaust gases and convert the water in the water space into steam.

2. The combination as embodied in claim 1 wherein the internal combustion engine is of the water cooled type, and means including a pump driven by the engine and conduits connecting the pump with the cooling system of the engine and the water space of the boiler by which water from the cooling system of the engine, heated as a result of the operation of the engine, can be supplied

to said water space to aid in raising the temperature of water in the latter and hence expedite the conversion of the water into steam.

3. In combination, a motive fluid generating apparatus comprising a boiler having a water space and a firebox in heat conducting relation to the water space, an internal combustion engine having an exhaust conduit from its cylinders extending through said water space so as to be exposed to water in the latter and discharging into said firebox, so that when the engine is in operation, heat from the exhaust gases of the engine traversing the exhaust conduit will be directly absorbed by the water in the water space from that portion of the exhaust conduit disposed in the water space, and the heat remaining in the exhaust gases as discharged into the firebox, absorbed by water in the water space from the heated wall of the firebox, to thereby effect a maximum removal of heat units from the exhaust gases and convert the water in the water space into steam, a steam operated power unit operatively connected to the engine, and means for conducting steam as generated by the boiler to said unit, whereby the latter will be operated and will aid in driving the engine.

4. In combination, an internal combustion engine of the V type, a boiler supported between the rows of cylinders of the engine and having a water space and a firebox below the water space, heat conduits traversing the water space, having their inlet ends communicating with the firebox, and a manifold common to the discharge ends of the heat conduits, the cylinders of the engine having individual exhaust pipes projecting through said water space and having their discharge ends communicating with the firebox.

5. In combination, an internal combustion engine having cylinders arranged in rows inclined with respect to each other, a boiler of elongated form horizontally disposed and extending longitudinally between the rows of engine cylinders, partitions in the boiler dividing the latter into a longitudinally extending elongated water space, a longitudinally extending elongated firebox below the water space and a passageway at one end of the boiler communicating with one end of the firebox, open ended tubes extending longitudinally through the water space and communicating at their inlet ends with said passageway, a manifold with which the outlet end of each of the tubes communicates, and exhaust conduits communicating with the engine cylinders and extending transversely through the water space with their outlet ends opening into the firebox.

6. In combination, an internal combustion engine having cylinders arranged in rows inclined with respect to each other, a boiler of elongated form horizontally disposed and extending longitudinally between the rows of

engine cylinders, partitions in the boiler dividing the latter into a longitudinally extending elongated water space, a longitudinally extending elongated firebox below the water space and a passageway at one end of the boiler communicating with one end of the firebox, open ended tubes extending longitudinally through the water space and communicating at their inlet ends with said passageway, a manifold with which the outlet end of each of the tubes communicates, exhaust conduits communicating with the engine cylinders and extending transversely through the water space with their outlet ends opening into the firebox, and a pump driven by the engine and having inlet conduits communicating with the water jackets of the engine cylinders and a discharge conduit communicating with the water space of the boiler.

In testimony whereof I affix my signature.
JOSEPH G. YONKESE.

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