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APPARATUS FOR PRODUCING MOTIVE POWER.

APPLICATION FILED APR. 11, 1896.

974,166. Patented Nov. 1, 1910.

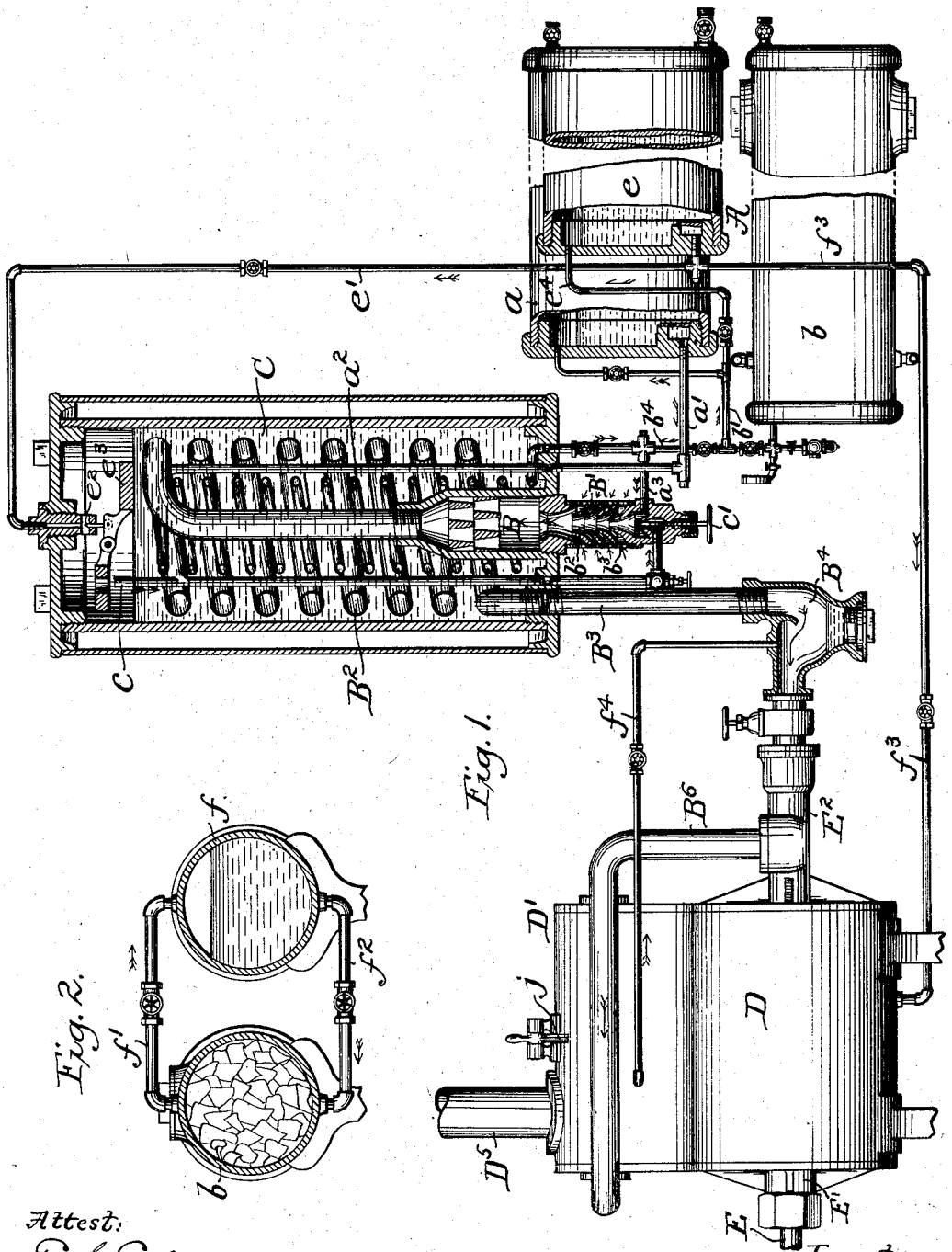

Fig. 1.

Fig. 2.

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APPARATUS FOR PRODUCING MOTIVE POWER.

974,166. Specification of Letters Patent. Patented Nov. 1, 1910.

Application filed April 11, 1896. Serial No. 587,100.

To all whom it may concern:

Be it known that I, HUDSON MAXIM, a citizen of the United States of America, and residing in the city, county, and State of New York, have invented certain new and useful Improvements in Apparatus for Producing Motive Power, of which the following is a specification.

The present invention relates to a novel apparatus for producing motive power and to a motor for utilizing such power although not necessarily limited thereto.

The invention more particularly relates to apparatus for burning a fuel under pressure and utilizing the products of combustion as a motive fluid to drive the motor or engine.

These improvements, briefly stated, consist in injecting atmospheric air with the vapor of a fuel, burning the same under pressure, cooling the gaseous products of combustion and then utilizing the more or less cooled products as a motive fluid. The heat of the gaseous products of combustion may be utilized to generate steam which may be then used to inject the air together with the fuel into the place of combustion and in addition serve to lower the temperature of the combustion.

The improvements further consist in utilizing the heat of combustion or of the gaseous products of combustion to evaporate a liquid fuel and to superheat the vapor thereof so that it shall be so increased in volume as to automatically feed or inject itself and air into the combustion chamber against the pressure therein; the fuel and air being thus supplied to the combustion chamber under a greater pressure than that in the combustion chamber.

The improvements furthermore consist in generating acetylene directly from the carbid; in controlling the formation of the acetylene so that it shall be formed only as fast and in such quantities as may be needed for immediate use; and in utilizing the acetylene by its combustion for preliminarily heating the necessary parts of the apparatus and for starting the motor, so that if desired another form of fuel may be subsequently utilized in its place. They also consist in utilizing the charge of carbid and the water for forming acetylene when the apparatus and motor are employed in a boat or vessel as a ballast therefor.

The improvements still further consist in the various novel constructions, combinations of parts and details of construction all as hereinafter set forth and illustrated in the accompanying drawings.

In carrying out the invention, a water and a fuel supply is provided and contained by a suitable tank or tanks, the necessary pressure in which to cause the proper feed of the fuel and if necessary of the water is had by utilizing the expansive force under ordinary atmospheric temperatures of some liquid or vapor preferably acetylene which may be also contained by a suitable tank or formed when and as desired. Instead of acetylene, carbonic acid, or even compressed hydrocarbon gas may be used. In using acetylene, it is preferred to generate it directly from the carbid, and for this purpose a tank, cylinder or receiver of carbid is provided with means for subjecting it to the action of water. In addition to using the expansive force of the acetylene for exerting pressure on the fuel to cause its feed, the acetylene thus formed or otherwise provided may be utilized for starting the apparatus and preparing it to utilize another form of fuel. Thus the acetylene may be admitted with a proper supply of air into a combustion chamber and there burned, the heated products of combustion passing thence through a tube or tubes arranged in a water chamber and thence onward for use or allowed to waste. The water in the chamber is thus raised in temperature and may be finally converted more or less into steam for subsequent use. As soon as this occurs the supply of acetylene may be stopped and the other fuel be admitted to the combustion chamber, this fuel being fed under pressure through a tube or tubes in the water chamber so that the fuel will become vaporized and superheated and thus sufficiently increased in volume that it will pass into the combustion chamber at a pressure greater than that in said chamber, in which case the high pressure vapor may be utilized to inject the proper quantity of air with the fuel vapor into the combustion chamber to support combustion therein. The steam gen-

erated in the water chamber by the heat of the combustion or of the products of combustion may also be used as a means of injecting the fuel vapor or air into the combustion chamber against the pressure therein or for simply augmenting the gaseous products formed therein and for lowering temperature of combustion. Water may be supplied to the water chamber against the pressure therein by the expansive force of acetylene or other vapor fluid admitted to a water supply tank or receiver; and this admission may be automatically controlled by the height of water in the water chamber. The products of combustion after passing through the tube or tubes of the water chamber are conducted thence for use in a motor or engine preferably of the rotary type.

With this general understanding of the improvements a detailed description of an apparatus adapted to carry them out will now be given, reference being had to the accompanying drawings, in which:—

Figure 1 is a sectional elevation of the improved apparatus, parts being broken away for lack of room and other parts closely assembled and shown in the same plane for the same reason. Fig. 2 is a cross section of the carbid and water cylinder and showing their connecting pipes.

Referring particularly to Fig. 1, the apparatus consists of a fuel supply A, a combustion chamber B for the fuel, a water chamber or boiler C heated by the products of combustion and a motor D to which said products are conducted to act as a motive fluid. The oil for the fuel is contained by a cylinder or tank a which by a pipe a' leading from its bottom connects with a coil a^2 arranged within the water space of the chamber C and thence by a pipe a^3 to an injector B′ communicating with the combustion chamber B. To provide and maintain sufficient pressure in the oil tank a to cause the feed of the oil through the coil to the injector and against the pressure in the combustion chamber, there is provided an acetylene tank b which by a pipe b' communicates with the upper portion of the oil tank, the expansion, under ordinary temperature of the acetylene admitted to the oil tank, exerting as high a pressure as may be needed, say, as high as 1,000 pounds to the square inch, while the pressure in the combustion chamber or of the products of combustion supplied to the motor need not exceed, say 50 to 100 pounds to the square inch.

Assuming that the water in the chamber C has been heated, the fuel passing through the coil a^2 will first be evaporated and then as the coil nears the hottest part of the chamber immediately adjacent the combustion chamber will become highly heated or superheated so that the volume of fuel vapor will be increased in which condition it enters the injector and by reason of its pressure and the force with which it passes into the combustion chamber may serve to draw in with it sufficient atmospheric air as will support its combustion in said chamber. The injector B′ for this purpose is provided with one or more funnel shaped nozzles b^2, the outer portions of which communicate with air orifices b^3 in the shell of the injector, so that many streams of air may be drawn in to mix with the fuel vapor on its way to combustion chamber.

The combustion chamber B with which the injector communicates is preferably arranged within the water space of the boiler C projecting vertically therein and communicating with a conduit B^2 in the form of a coil within the boiler so that the heated products of combustion may be caused to impart their heat or a portion of their heat to the water in the boiler to lower their temperature and if desired form steam. From the coil conduit B^2 the products of combustion pass to the motor D.

When steam is generated in the boiler C it may be led off by a pipe c to the injector B′ to serve as a means for injecting or to aid in injecting fuel and the necessary air, and further as a means of augmenting the products of combustion passing through the conduit B^2 and as a means of lowering the temperature of the combustion in the chamber B; the supply of steam being regulated, if desired, by a needle valve c'. As the water evaporates and the steam passes off from the boiler C, a water feed is provided in the form of a water supply tank e having a pipe e' leading to the top of the boiler C, the discharge end of said pipe in the boiler being controlled by a valve e^2 moved by a float e^3 regulated by the height of the water in the boiler. To obtain this feed of the water from its tank to the boiler and against the pressure therein, the pressure of the acetylene from the tank b may be utilized and for this purpose the pipe b' has a branch e^4 leading to the top of the water tank e. The acetylene from the single tank thus serving to feed the fuel and the water.

In order to place the apparatus in the first instance in condition for working with the oil from the tank a the water in the boiler C should be first sufficiently raised in temperature as that the liquid fuel may be vaporized before entering the injector or combustion chamber. This preliminary heating may conveniently be had by burning a proper quantity of acetylene in the combustion chamber B, and for this purpose the acetylene pipe b' is provided with a connection b^4 controlled by a valve communicating with the pipe a^3 leading to the injector B′. The heated products of the combustion of

the acetylene with air in the combustion chamber B will be conducted off by the conduit B^2 to pass into the motor D preferably of the rotary type. In the form shown the products pass to the valve chamber D′ past the drip B^4, through the bearing E^2 and pipe B^5, finally leaving the engine through the exhaust pipe D^5. Pipes f^3 and f^4 serve for conducting cooling fluid to and from the engine jacket. *j* designates a reversing lever, E a driving shaft and E′ a bearing. As this engine forms no part of the invention herein claimed, further description is deemed unnecessary. The water in the boiler C will thus be raised to the desired temperature, whereupon the supply of acetylene to the injector will be cut off and the oil from the oil tank *a* allowed to pass through its heating coil a^2 to vaporize and superheat it on its way to the injector.

It will be understood that all the various pipes referred to may have suitable valves and check valves to control or shut off the supply of vapor, oil, steam and water to the different points mentioned and as indicated in the drawings. So, too, the various tanks and boiler will have suitable supply passages and openings and also if need blow off valves and pressure and height gages all of any usual construction and not necessary to particularize.

Instead of storing a quantity of acetylene for use in the apparatus, it is preferable to generate it directly from the carbid in such quantities as may be needed. Thus the tank *b*, see Fig. 2, may be filled with or have a charge of carbid, and with this tank employ a water tank *f* connected top and bottom by pipes *f′*, f^2 with the top and bottom of the carbid containing tank *b*. The water led to the tank *b* will cause the generation of acetylene gas therein which may be allowed to pass to the tank *f* to equalize the pressure in both tanks and allow the water to feed by gravity; the acetylene thus formed in the tank *b* being conducted off for use as before described. I do not consider it essential that two separate tanks *b* and *f* need be used to form the acetylene, such tanks being simply illustrative of a mode of forming acetylene gas.

When desired, it is evident that the apparatus may employ acetylene as its combustible vapor in which case the oil tank *a* need not be used.

What is claimed is:—

1. The combination with a boiler and its furnace, of a water-tank communicating with the boiler, an oil tank communicating with the furnace and a gas generator delivering gas under pressure to both tanks, for the purpose set forth.

2. The combination with a boiler and its furnace, of an oil tank, an evaporating coil within the boiler, and communicating with said tank and with the furnace and a gas generator delivering gas under pressure to said tank, for the purpose set forth.

3. The combination with a boiler and its furnace, of an oil tank, an evaporating coil within the boiler and communicating with said tank and with the furnace, a coil leading from the furnace through the boiler and onward, and a gas generator delivering gas under pressure to said tank, for the purpose set forth.

4. The combination with a boiler and its furnace, of an oil tank, an evaporating coil within the boiler and communicating with said tank and with the furnace, an acetylene pressure supply leading to said tank and a connection between said supply and the furnace, as set forth.

5. The combination of a water boiler, a combustion chamber projecting within said boiler, an oil tank connected with the combustion chamber, and a water tank connected with the boiler, a source of gaseous fuel under pressure and connections between the source of gaseous fuel and the water tank, the oil tank and the combustion chamber.

6. The combination of a boiler, a source of liquid fuel, a source of gaseous fuel under pressure, a combustion chamber, and connections between the source of gaseous fuel and the combustion chamber, the liquid fuel and the combustion chamber, and between the sources of liquid and gaseous fuel.

7. The combination of a boiler, a motor, a combustion chamber, an imperforate conduit leading through the boiler from said chamber to the motor, a source of liquid fuel, and a conduit leading through said boiler from the fuel source to the combustion chamber.

8. The combination of a boiler, a motor, a combustion chamber delivering products of combustion under pressure to said motor, a source of liquid fuel, connections leading through the boiler from the combustion chamber to the motor, connections leading through the boiler from the fuel source to the combustion chamber, connections leading from the boiler to the combustion chamber, and fluid-pressure means independent of steam-pressure for forcing said fuel to said combustion chamber.

9. A combustion chamber, a source of liquid and a source of gaseous fuel supply, and connections from each to the combustion chamber and from one to the other.

10. The combination of a boiler or liquid receptacle, a combustion chamber within said boiler, a motor, a conduit leading from the combustion chamber to the motor and having its surface exposed to the liquid in the boiler, a source of fuel supply, a conduit leading from the source of fuel supply to

the combustion chamber and having an extended surface exposed to the liquid in the boiler, and a conduit leading from the upper portion of the boiler through the liquid in the boiler and to the combustion chamber, whereby the products of combustion and steam from the boiler are united to form a motive fluid, and the fuel in passing from the source of fuel supply to the combustion chamber is subjected to the heating influence of the liquid in the boiler.

11. The combination of a boiler, a combustion chamber in said boiler provided with a tortuous conduit in heat interchanging relation with the water in said boiler supplying fluid pressure to a motor, a vapor burner delivering its products of combustion under superatmospheric pressure to said chamber, an oil supply tank delivering oil to said burner, and an acetylene gas generator delivering acetylene under pressure to said oil tank.

12. In combination, a boiler, an injector burner, a water tank communicating with said boiler, an oil tank communicating with said burner, and an acetylene gas generator leading gas under pressure to each of said tanks and to said burner.

In witness whereof I have hereunto signed my name in the presence of two witnesses.

HUDSON MAXIM.

Witnesses:
GEO. H. GRAHAM,
E. L. TODD.