No. 710,130. Patented Sept. 30, 1902.

C. W. WEISS.

REGENERATOR BURNER.

(Application filed May 9, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

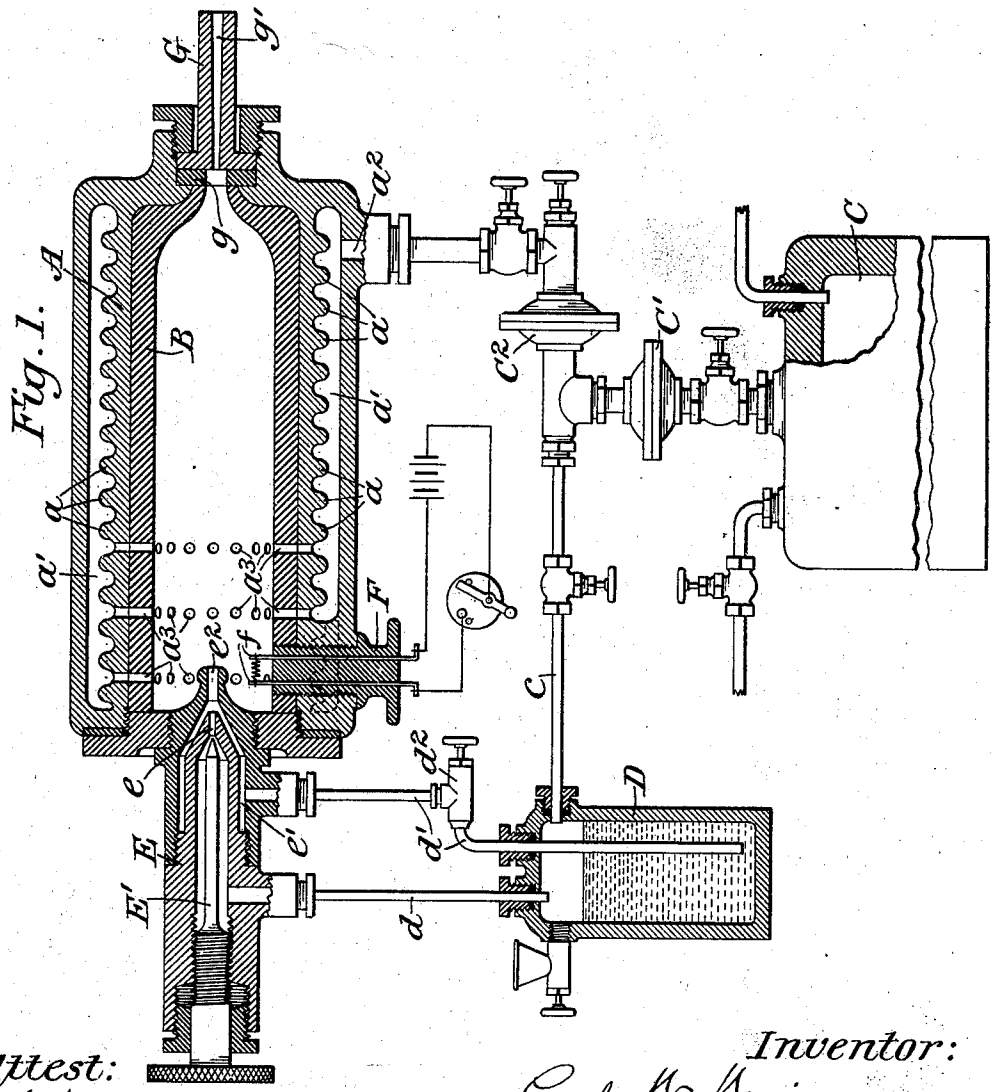


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Fig. 2.

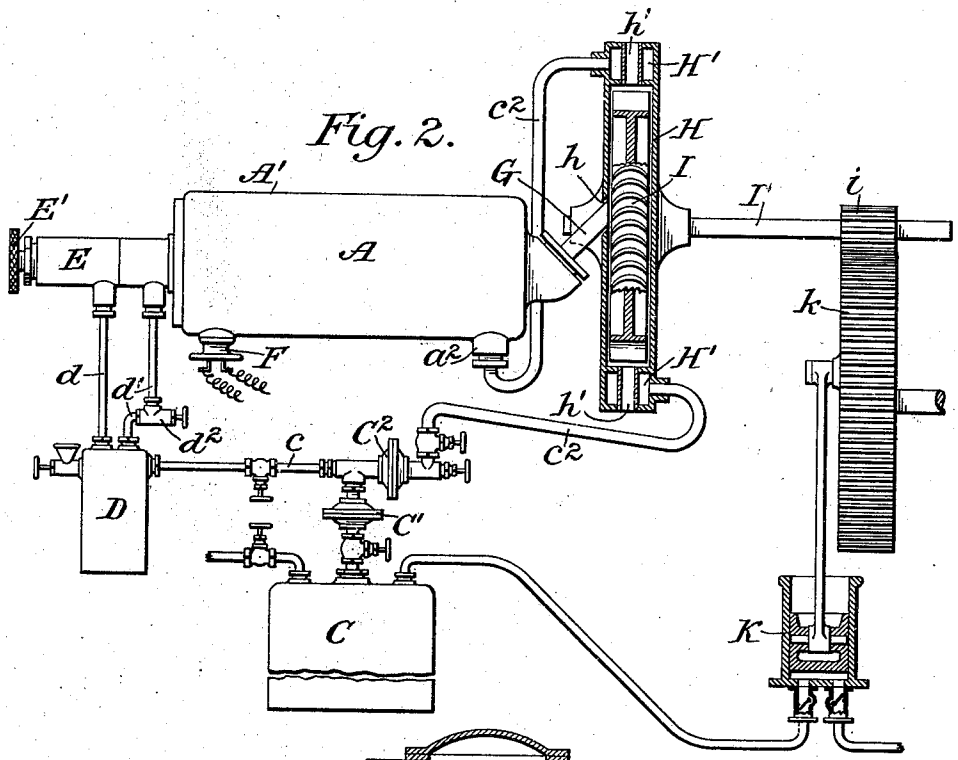
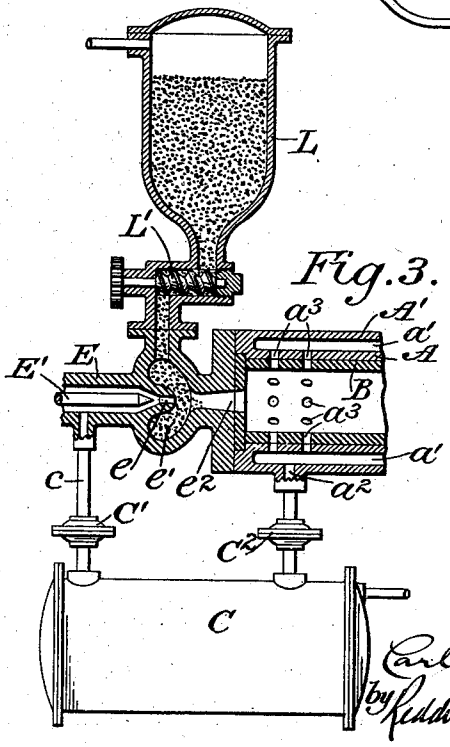



Fig. 3.

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# UNITED STATES PATENT OFFICE.

CARL W. WEISS, OF NEW YORK, N. Y.

## REGENERATOR-BURNER.

SPECIFICATION forming part of Letters Patent No. 710,130, dated September 30, 1902.

Application filed May 9, 1899. Serial No. 716,099. (No model.)

*To all whom it may concern:*

Be it known that I, CARL W. WEISS, a citizen of the United States, residing in the borough of Manhattan, city of New York, State of New York, have invented certain new and useful Improvements in Regenerator-Burners, of which the following is a specification, reference being had to the accompanying drawings, forming a part hereof.

This invention relates to that form of prime mover or source of energy in which the pressure depends upon the development of high temperature usually produced by continuous combustion, the energy being utilized by direct impingement of the hot blast upon a moving body, such as the blades or buckets of a turbine or other wheel.

The object of the invention is to produce an improved device of the character referred to which shall have the highest possible efficiency without complication of construction, as more fully described hereinafter. The combustible is preferably formed by the admixture of a suitable fuel in the form of oil or otherwise and air or other suitable gas under conditions which permit of perfect control, both as to the quality of the combustible and the pressure under which it is delivered, and air or other supporter of combustion is supplied under a less pressure to the closed burner-chamber, from which the products of combustion are directed to the motor. The air or other supporter of combustion is made to pass before its admission to the burner-chamber in contact with the outer wall of said chamber, but in a general direction opposite to the movement of the products of combustion, so that the temperature of the air or other supporter of combustion is raised materially before its admission to the burner-chamber and so also that the waste of heat by radiation from the burner-chamber and otherwise is reduced to a minimum.

The invention will be fully explained hereinafter with reference to the accompanying drawings, in which—

Figure 1 is a view, partly in section and partly in elevation, of a burner which embodies the invention and of the adjuncts of such burner. Fig. 2 is a similar view, but on a smaller scale, illustrating the application of the invention to a turbine or other wheel. Fig. 3 is a partial view illustrating a modification of the burner for using coal-dust as fuel.

In the construction shown in Figs. 1 and 2 of the drawings the burner-chamber is formed by a wall A, preferably of metal, which has preferably a lining B, of some refractory material, for contact with the flame. The outer surface of the wall A may be corrugated, as at $a$, for a purpose presently to be referred to, and a jacket A′ surrounds the whole, leaving a space $a'$, through which the incoming air or other supporter of combustion circulates in its passage from the inlet $a^2$, near the remote end of the jacketed space, to the holes $a^3$, by which it is admitted to the burner-chamber near the origin of combustion therein. The air or other supporter of combustion may be supplied from any suitable source, such as a compressed-air reservoir, (indicated at C,) which is connected with the inlet $a^2$ through a pressure-regulating device, (represented at C′,) by which the escape of air from the reservoir is determined, and a second pressure-regulating device at $C^2$, by which the pressure at which the air or other supporter of combustion is supplied to the burner-chamber can be regulated. In this instance the combustible is formed by an admixture of hydrocarbon and air, the latter being supplied, it may be, from the reservoir C. An oil receptacle or carbureter D is interposed between the source of air and the point of combustion, the air-delivery pipe $c$ being here shown as connected to the top of such vessel. One pipe $d$ extends from the top of such vessel to the air-nozzle $e$ of the burner E, and a second pipe $d'$, having a regulating stop-cock $d^2$, extends from a point near the bottom of such vessel to the chamber $e'$, surrounding the nozzle $e$ and communicating with the burner-nozzle $e^2$. The aspirating action of the current of air which issues from the nozzle $e$ draws the oil from the chamber $e'$ and vaporizes it, thereby forming a combustible mixture which is ignited at the burner-nozzle $e^2$. An adjustable needle-valve E′ regulates the passage of air through the nozzle $e$.

It will be observed that by the action of the pressure-regulator C′, above referred to, the pressure on the air, and consequently on the combustible mixture, as it is delivered at the

burner-nozzle $e^2$ can be regulated and determined and that through the action of the regulator $C^2$ the pressure on the air or other supporter of combustion as it is delivered to the burner-chamber can be further regulated so that it shall be less than the pressure on the combustible. It will be further observed that the air or other supporter of combustion passes from the inlet $a^2$ to the distributing-inlets $a^3$ in a general direction opposite to the movement of the products of combustion within the burner and is itself heated to a high temperature by contact with the corrugated wall of the burner-chamber and carries with it the heat which would be lost by radiation from the wall of the burner-chamber or otherwise.

In commencing the use of the device it is obviously necessary to employ a primary igniter of some sort, and for that purpose the wall of the burner-chamber is represented as having a removable plug F, which can be withdrawn to permit the introduction of a primary igniter, or it may itself carry the electrodes $f$ of an ordinary electric igniter.

It will be understood that through the supply of air or other supporter of combustion the combustion within the burner-chamber is complete. The products of this combustion can escape from the closed burner-chamber only through the nozzle which is provided for the purpose, from which they pass to the motor. In the practical operation of hot-air turbines it is found that in the passage of the products of combustion through the necessarily small nozzles the loss of heat is considerable because of the relatively large surface for contact with the products of combustion in proportion to the area of opening. In order to prevent this loss in the present case, the nozzle G, of lava or nickel alloy or other suitable material, is insulated from the wall of the burner or combustion chamber by asbestos insulation, as at $g$, or in any other suitable manner, so that the reduction of the temperature of the nozzle by conduction shall be as little as possible. Furthermore, the bore $g'$ of the nozzle is enlarged outwardly, so that the products of combustion are expanded and delivered to the motor at the highest possible velocity. It will be observed that the nozzle E is also insulated from the body of the burner-chamber so as to prevent loss of heat and also to prevent overheating and consequent decomposition of the oil in its passage to the point of ignition. It will also be understood that the delivery-nozzle G is a blast-nozzle and delivers the products of combustion directly from the burner-chamber to the motor, so that the jet or blast acts directly by impact upon the blades or paddles of the motor. The proximity of the motor and the burner-chamber is important for the reason that it secures the delivery to the motor of the products of combustion at a maximum temperature, the efficiency of the motor being determined by the difference between the temperature where the blast strikes the motor and that of the exhaust. The motor, it is to be observed, is driven by the impact of the products of combustion, not by using such products expansively.

In Fig. 2 the nozzle G is shown as connected directly with a port $h$ in the casing H of a motor-wheel I, the blast from the nozzle being directed against the paddles or buckets of such wheel. In this arrangement the air on its way from the reservoir C to the burner-chamber to support combustion therein is conducted by means of pipes $c^2$ to a chamber H', surrounding the wheel I and formed in the casing H, where it is heated by the exhaust from the ports $h'$. The air may be compressed into a reservoir C by means of a pump K, operated from the shaft I' of the motor I through the gears $i$ and $k$.

In Fig. 3 is illustrated a construction adapted for the use of coal-dust as fuel. A suitable receptacle L is provided for the reception of the coal dust and communicates with the chamber $e'$ in rear of the burner-nozzle $e^2$ through a passage in which is placed a feeding device, such as the worm L'. The air under pressure from the reservoir C, controlled by the regulating device C', is delivered to the chamber $e'$ and nozzle $e^2$ through a nozzle $e$. The blast of air drives the fuel with it through the burner-nozzle, where it is ignited and burns, as already described.

It will be understood that the invention is not to be limited to the precise construction and arrangement of parts shown and described herein, as the same may be varied without departing from the spirit of the invention.

I claim as my invention—

1. A regenerator-burner, comprising a closed burner-chamber having an outlet-nozzle at one end, and air-inlets at its other end, means for supplying air to said inlets to support combustion, an injector also at said last-named end, an oil-reservoir, a pipe leading from below the oil-level up to one member of the injector, a second pipe leading from above the oil-level in said chamber to the other member of the injector, and a compressed-air pipe discharging air into the upper end of the oil-receptacle to force oil through one pipe and carbureted air through the other; substantially as described.

2. A regenerator-burner comprising a closed air-jacketed burner-chamber, having air-inlets at one end from said jacket and provided at its opposite end with a discharge-nozzle, an injector at the air-inlet end of the chamber, an oil-reservoir, a pipe leading from below the oil-level of said reservoir to one member of the injector, a second pipe leading from above the oil-level to the other member of said injector; a compressed-air reservoir, and pipe leading from said air-reservoir to the air-jacket and upper part of the oil-reservoir and provided with pressure-regulating valves to cause the pressure at the air-

inlets of the burner-chamber to be less than the pressure at the injector; substantially as described.

3. The combination with an air-jacketed burner-chamber, having air-inlets from its jacketed space, an injector for the chamber, means for supplying oil to the injector, a compressed-air reservoir, piping connecting the reservoir with the injector and oil-reservoir, and piping leading from the air-reservoir to the air-space around the burner-chamber, of an engine or motor having an air-jacket incorporated in the piping leading to said burner-chamber, and a nozzle or pipe connecting the outlet end of the burner-chamber with the motor or engine; substantially as described.

4. The combination with the air-jacketed burner-chamber having air-inlets from its jacketed space, and an injector for combustible material, of a compressed-air reservoir, piping connecting the reservoir with the injector and the said air-jackets respectively, and pressure-reducers in said piping to cause the air from said reservoir to be of greater force at the injector than at the air-inlets of the burner-chamber; substantially as described.

5. A regenerator-burner, comprising the jacketed chamber A having a contracted outlet end, a lining fitting the chamber and also having a contracted outlet registering with that of the chamber, inlet-apertures from the jacketed space to the interior of the combustion-chamber, an annular plug screwed into the open end of the chamber and engaging that end of the lining to hold it in place, a blast-nozzle at the opposite end of the chamber, an air-nozzle screwed into said annular plug, an oil-nozzle screwed into the air-nozzle, an air and oil supply for said nozzle, and an air-supply for the chamber-jacket; substantially as described.

This specification signed and witnessed this 8th day of May, A. D. 1899.

CARL W. WEISS.

In presence of—
W. B. GREELEY,
L. R. MOORE.