(No Model.)

J. BURNS.

APPARATUS FOR BURNING HYDROCARBONS MIXED WITH AIR AND SUPERHEATED STEAM.

No. 490,470. Patented Jan. 24, 1893.

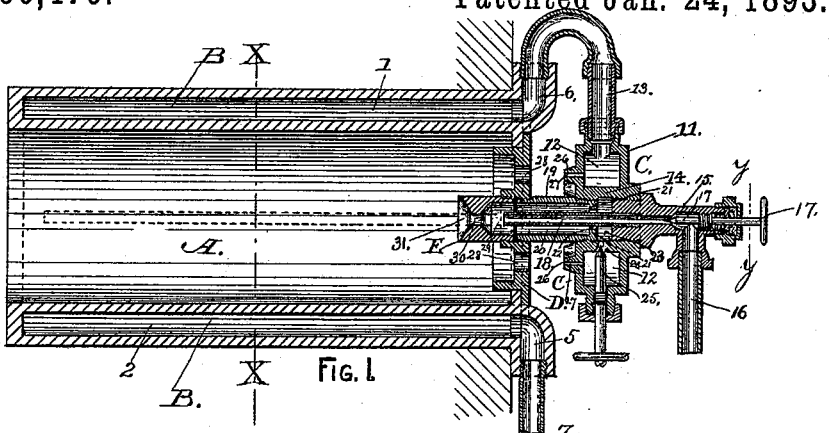

Fig. 1.

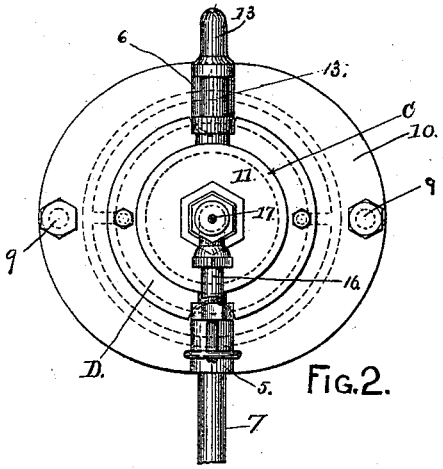

Fig. 2.

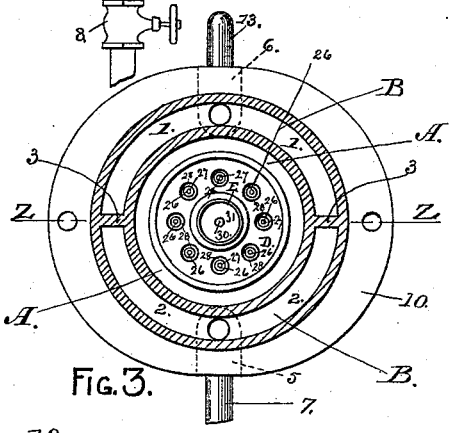

Fig. 3.

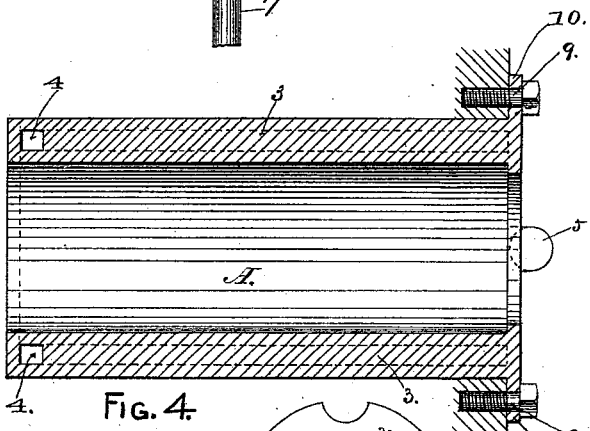

Fig. 4.

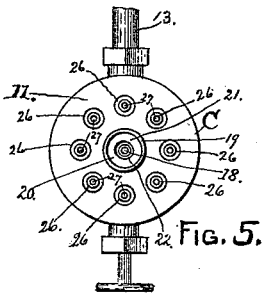

Fig. 5.

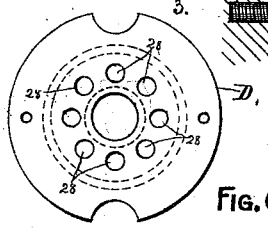

Fig. 6.

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APPARATUS FOR BURNING HYDROCARBONS MIXED WITH AIR AND SUPERHEATED STEAM.

SPECIFICATION forming part of Letters Patent No. 490,470, dated January 24, 1893.

Application filed June 17, 1892. Serial No. 437,068. (No model.)

To all whom it may concern:

Be it known that I, JOHN BURNS, of Rochester, in the county of Monroe and State of New York, have invented new and useful Improvements in Apparatus for Burning Hydrocarbons Mixed with Air and Superheated Steam, of which the following is a specification.

My invention relates to improvements in apparatus for burning hydrocarbons when mixed with air and superheated steam and for effecting a thorough commingling of those elements into the form of vapor; and the object of my invention is to provide facilities for superheating a current of steam and commixing it with air and hydrocarbon before the mixture is injected into the combustion-chamber within the superheater. This object I attain by the mechanism illustrated in the accompanying drawings which—being herein referred to—form part of this specification.

In said drawings, Figure 1 is a central vertical section of my apparatus; Fig. 2 is a front elevation of the same, with the stem of the valve for governing the admission of oil into the injector shown in vertical section at the line Y Y on Fig. 1; Fig. 3 is a vertical section of the combustion-chamber and superheater, at line X X on Fig. 1; Fig. 4 is a horizontal section of the combustion-chamber and superheater at the line Z Z on Fig. 3; Fig. 5 is a rear elevation of the injector detached from the combustion-chamber and superheater; and Fig. 6 is a front elevation of the front plate detached from the combustion-chamber.

As represented in the drawings, A designates the vaporizing or primary combustion chamber of my apparatus, which is made in the form of a hollow cylinder which is open at its inner end to allow for the emission of the flame from that end; said chamber is surrounded by an annular passage, B, which forms a superheater for a current of steam which passes through said passage. The annular passage B is divided into an upper section, 1, and a lower section, 2, by longitudinal partitions, 3, which join the outer head of the superheater and extend rearwardly nearly to the inner head of the latter, openings, 4, being left between the ends of said partitions and the inner head of the superheater so as to allow the steam to flow from the lower section 2 into the upper section 1, the steam thereby being forced to travel circuitously through the passage B so as to become thoroughly superheated in its travel through the annular passage B. The outer end of the superheater is provided with an inlet steam nozzle, 5, which leads into the lower section 2, and with an outlet steam nozzle, 6, which leads from the upper section 1. A steam supply-pipe, 7, which leads from a steam-generator and furnishes the saturated steam to the superheater, is connected to the nozzle 5 and is provided with a stop-valve, 8, for regulating the supply of steam to the apparatus. The vaporizing-chamber A is secured to the outer end of a furnace (not shown in the drawings) by means of bolts, 9, or other suitable appliances, and the outer end of said chamber is provided with a flange, 10, for receiving the fastening devices.

C designates the injector of my apparatus, and said injector is used for forcing oil commingled with superheated steam into the vaporizing-chamber A in the form of vapor; said injector consists of a casing, 11, containing an annular passage, 12, which is connected by means of a suitable pipe, 13, with the outlet of the annular passage B of the superheater for the purpose of conveying the superheated steam into the annular passage of said injector; a central sleeve, 14, forms the interior wall of the annular passage 12 and is provided with internal screw-threads at each end. Into the outer end of the opening in the sleeve 14, a tubular neck, 15, is secured for the purpose of conveying the hydrocarbon into the injector; said neck has an oil-supply pipe, 16, leading into its central bore, and a needle-pointed screw-valve, 17, is fitted into said bore for the purpose of regulating the inflow of oil to the injector; said neck is provided with an inwardly-extending pipe, 18, which forms a continuation of the bore of the neck; a pipe, 19, is secured in the inner end of the sleeve 14 and forms an annular passage, 20, around the inner portion of the pipe 18. The inner end of the pipe 19 is provided with an inturned circumferential flange, 21, to form an annular opening, 22, which leads from a chamber, 23, formed by the bore of the sleeve 14, into the bore of the pipe 19. An opening, 24, leads

from the annular passage 12 into the chamber 23 for the purpose of conveying the superheated steam into the latter, and a screw-valve, 25, is provided for the purpose of regulating the passage through said opening so as to vary the volume of superheated steam passing into the chamber 23. The inner end of the pipe 19 is secured in a central opening of a front-plate, D, which forms a closure for the outer end of the vaporizing-chamber A, and by said pipe the injector C is retained at a prescribed distance from the front-plate D, but parallel thereto. The inner face of the injector C is provided with a series of nipples, 26, each having a single perforation, 27, leading from the annular passage 12 in lines parallel with the central axis of the pipe 19. The front-plate D is provided with a series of openings, 28, arranged to correspond—both in number and positions—to the nipples 26 of the injector C, so that the minute currents of superheated steam, issuing from the perforations 27 of said nipples, will pass directly into the openings 28, and said currents will carry atmospheric air—from the space between the injector C and front-plate D—into said openings and the vaporizing-chamber A, for the purpose of supplying the required quantity of oxygen for maintaining combustion in said chamber. Into the central opening of the front-plate D, at the inner side of the latter, an extension-piece, E, is preferably secured; said extension-piece has a chamber, 29, into which the pipe 18 leads, and, corresponding to the center line of the bore of said pipe, a contracted passage, 30, leads from said chamber into an expanded-discharge opening, 31, whereby the oily-vapor will be thoroughly diffused through the vaporizing-chamber A for the process of combustion.

My apparatus operates in the following manner: Saturated steam from any suitable steam-generator is admitted into the annular-passage B of the superheater; simultaneously therewith the hydrocarbon, from any conveniently arranged oil-tank, is allowed to flow, through the pipe 16, into the neck 15. The superheated steam which issues in jets from the nipples 26 will forcibly inject volumes of atmospheric-air, mixed with the steam, through the openings 28, into the vaporizing-chamber A. The superheated steam will fill the annular passage 12 of the injector C so that, when the valve 25 is opened, the steam will pass, through the opening 24, from the passage 12 into the chamber 23, and thence through the annular passage 20, and extension-piece E—when the latter is used—into the vaporizing-chamber A. As soon as the valve 17 is opened to allow the oil, which enters through the pipe 16, to flow into the injector C, the steam-current passing through the annular passage 20 will cause, by reason of a partial vacuum thereby produced, a rapid flow of the oil through the pipe 18, and, as fast as the oil escapes from the open end of said pipe, the current of superheated steam will force said oil—now reduced to the condition of an oily-vapor—from the injector C into the vaporizing-chamber A, wherein it will commingle with the currents of air entering through the openings 28 so as to produce an intense combustion in said vaporizing-chamber. The combustion of the vapor in the vaporizing-chamber A effects the superheating of the steam which passes through the passage B, so that the moisture of the steam, entering through the pipe 7, will be entirely dissipated, so as to leave the steam emitted from the injector C in a condition to aid, rather than retard, the combustion taking place within the chamber A.

What I claim as my invention and desire to secure by Letters Patent is—

1. In a hydrocarbon-burner, the combination, with a vaporizing-chamber surrounded by an annular passage which forms a superheater for the steam circulating through said passage, and inlet and outlet steam-pipes connecting with said passage; said vaporizing-chamber being provided with a cap-plate provided with series of inlet air-openings which are arranged around a central opening fitted to receive the discharge-pipe of an injector, an injector consisting of an annular passage which is connected with the outlet pipe of said superheater, a valved-opening leading from said annular-passage into an inner chamber, an annular opening leading from said inner chamber into a pipe which connects the injector with the cap-plate of the vaporizing-chamber, a valved inlet-pipe for conveying the oil through said annular opening into the discharge end of said injector, and a series of perforations—corresponding in number and position to the air-openings of said cap-plate—leading from the annular passage of said injector; said injector being arranged to leave an open space between its inner face and said cap-plate, as and for the purpose herein specified.

2. The combination, of a vaporizing-chamber surrounded by an annular passage which forms a superheater for the steam circulating through said passage; said superheater being integral with the walls of said chamber, an inlet- and an outlet-steam-pipe leading into and out from said annular passage, a cap-plate which forms a closure for the outer end of said chamber; said cap-plate having a series of constantly-open apertures for the admission of mixed steam and air into the outer end of said vaporizing-chamber, an injector connected to the said outlet-steam-pipe, and—by a central discharge-pipe—to said cap-plate so as to leave a clear air-space between the adjacent faces of said cap-plate and injector; the latter being provided with a series of perforations corresponding in number and position to the apertures of said cap-plate, and an oil-supply-pipe which communicates with said central discharge-pipe; whereby a simultaneous forcible injectment of mixed steam and air into the outer end of said vaporizing-

chamber and of mixed steam and oil into the interior of said chamber may be effected, substantially as herein specified.

3. In a hydrocarbon-burner, the combination with a vaporizing-chamber, A, provided with a front-plate, D, having a series of air-inlet openings, 28, formed therein, of an injector, C, having a discharge-pipe, 19, connected to said front-plate; said injector having a steam-chamber, 12, into which a steam supply-pipe, 13, leads to supply steam to said injector, a series of steam-outlets, 27, corresponding to the air-inlet openings of said front-plate, a steam-chamber, 23, formed in the body of said injector, a valved opening, 24, forming a communication between the steam-chambers 12 and 23, an oil supply-pipe, 16, communicating with an inwardly-extending oil-delivery pipe, 18, and an oil-regulating valve, 17, for governing the inflow of oil into the apparatus, as and for the purpose herein specified.

4. An apparatus, substantially as described, for effecting a forcible injectment of mixed steam and air from the exterior into the interior of a vaporizing-chamber of a hydrocarbon-burner, and a simultaneous forcible injectment of mixed steam and oil into said chamber; the point of delivery of said steam and oil being farther from the outer end of said chamber than the point of delivery of the mixed steam and air, as and for the purpose herein specified.

5. The combination with a vaporizing-chamber having a series of constantly-open apertures in its outer head, of an injector adapted to forcibly inject currents of external air into said apertures by means of steam or other fluid under pressure; said injector also constituting an oil-atomizer whereby mixed steam and oil are forcibly injected into said vaporizing-chamber, as and for the purpose herein specified.

JOHN BURNS.

Witnesses:
CARL F. GEYER,
ALICE G. CONNELLY.