G. W. GARVEY.

STOVE AND FURNACE.

APPLICATION FILED JULY 19, 1920.

1,410,909.

Patented Mar. 28, 1922.

2 SHEETS—SHEET 1.

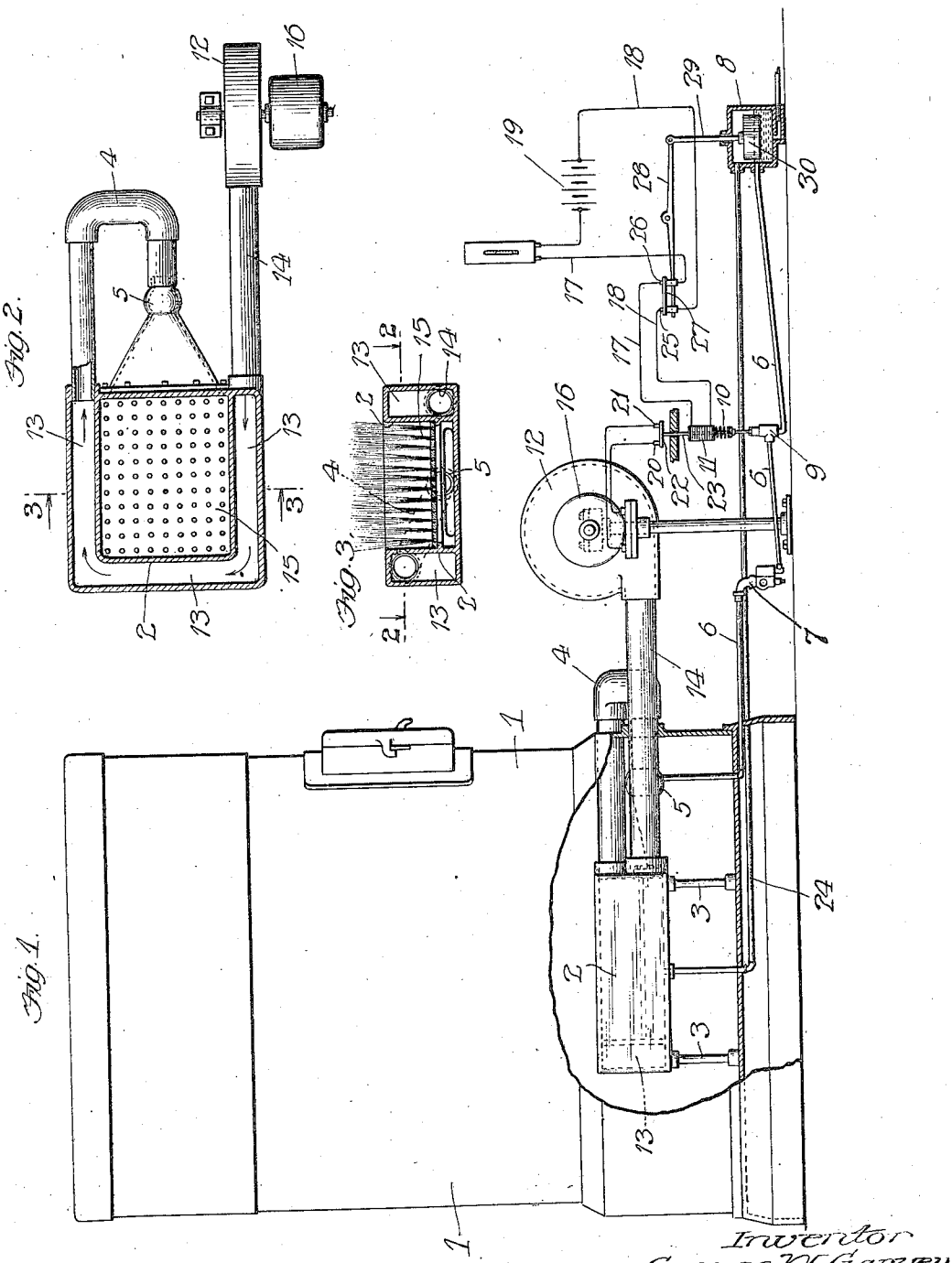

Fig. 1.

Fig. 2.

Fig. 3.

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2 SHEETS—SHEET 2.

Fig. 4.

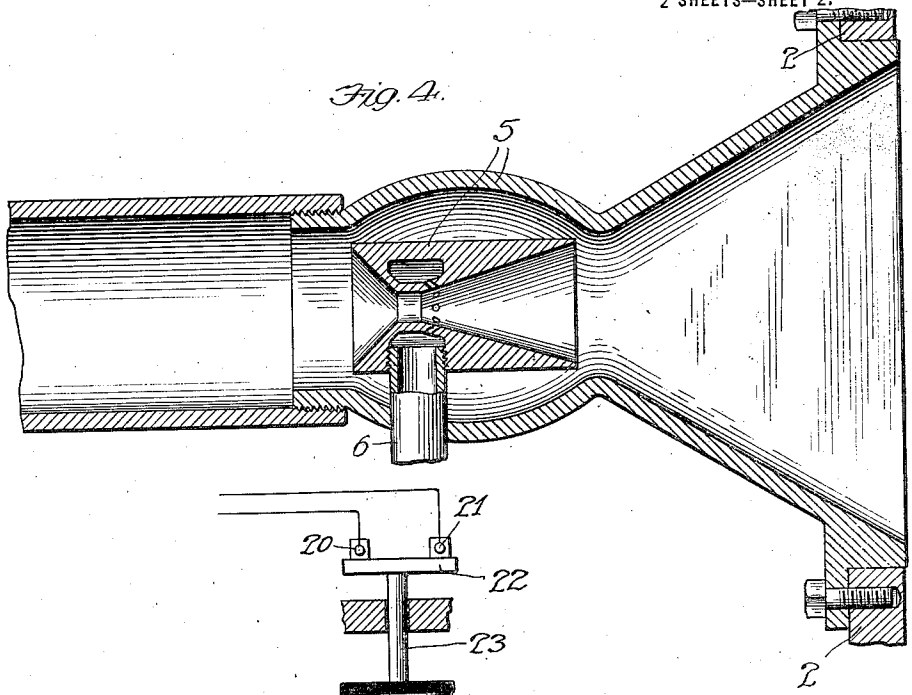
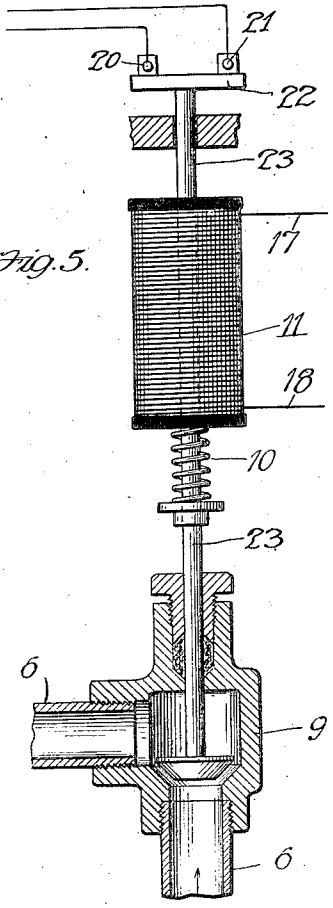


Fig. 5.



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UNITED STATES PATENT OFFICE.

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STOVE AND FURNACE.

1,410,909. Specification of Letters Patent. Patented Mar. 28, 1922.

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To all whom it may concern:

Be it known that I, GEORGE W. GARVEY, a citizen of the United States, and resident of Escanaba, in the county of Delta and State of Michigan, have invented a new and useful Stove and Furnace, of which the following is a specification.

This invention relates to stoves and furnaces and relates particularly to oil burning furnaces of the general type comprising a fire pot positioned in the combustion chamber of the stove or furnace, into which the fuel oil in atomized or vaporized form and mixed with air to form a combustible mixture, is delivered.

A primary object of the invention is to provide means for increasing the practicability and economy in operation of stoves and furnaces of the type specified, by effecting more thorough and intense combustion of the liquid hydrocarbon or other fuel oil and, at the same time, reducing the quantity of fuel consumed as compared with present furnaces of this type, of which I have any knowledge.

Specifically, the object of the invention is to provide means for effecting more complete and thorough vaporization of the hydrocarbon, and, at the same time, heating the combustible mixture of vaporized oil and air, whereby complete combustion of all of the fuel oil will be effected under conditions which will produce a heat of maximum intensity in the furnace.

In accordance with my invention, I attain the objects of the invention by providing means in association with the furnace, for heating the air which is to be mixed with the vaporized hydrocarbon to form a combustible mixture, said heated air operating both to volatilize the hydrocarbon and also to provide a combustible mixture which will generate a heat of relatively great intensity as compared with present methods.

The invention also comprises the various other features, combinations of features and details of construction hereinafter described and claimed, relating to the construction, operation and control of the furnace.

In the accompanying drawings, in which my invention is fully illustrated,

Figure 1 is a side view of a heating furnace embodying combustion means of my invention.

Figure 2 is a separate sectional view of a preferred form of fire pot embodying my invention, taken on the line 2—2 of Fig. 1.

Figure 3 is a sectional view thereof on the line 3—3 of Fig. 2.

Figure 4 is an enlarged central sectional view of an injector nozzle for vaporizing the fuel oil delivered to the furnace; and

Figure 5 is an enlarged sectional view of thermostatically controlled means for shutting off the supply of fuel oil to the heater and for cutting out the motor which supplies air to the furnace, whenever the temperature reaches a predetermined point.

Referring now to the drawings, 1 designates the body portion or casing of the furnace; 2 the fire pot positioned in the combustion chamber thereof, being shown as supported on legs 3; 4 the pipe for supplying air under pressure to said fire pot; 5 an injector positioned in the pipe 4 and which discharges directly into said fire pot; 6 the fuel supply pipe which communicates with the nozzle 5; 7 a carbureter in the fuel supply pipe 6; 8 the float chamber of said carbureter; 9 an emergency valve which controls the fuel supply pipe 6; 10 a spring applied to said valve for maintaining the same normally closed; 11 a solenoid applied to said valve for opening the same against the force of said spring and which is adapted to be controlled by a thermostatically operated switch positioned in the space to be heated, said solenoid also controlling the supply of air to the pipe 4 and thus to the furnace, and the relation being such that when said solenoid is in circuit, air under pressure will be supplied to the furnace and the valve 9 will be open and vice versa.

As shown, air under pressure is adapted to be supplied to the fire pot 2 through the pipe 4 by means of a fan 12 with which the pipe 4 is connected in the manner presently described.

Most of the foregoing elements are old and well known in the art, and as regards their usual features of construction and operation, and excepting as hereinafter particularly described, they may be of any usual or approved construction and will be readily understood by persons skilled in the art without a description thereof in detail.

In accordance with my invention, I attain the object of the invention as it relates to heating the air supplied to the furnace

in the following manner:—Formed in the walls of the fire pot 2 is a chamber 13, which, in the preferable construction shown, surrounds said fire pot on three sides. Communicating with one end of said chamber is a pipe 14 which connects said chamber with a source of supply of air under pressure, as shown with the fan 12. The opposite end of said chamber communicates directly with the interior of the fire pot by means of the air supply pipe 4. My invention, however, contemplates the employment of any other desired or approved means for supplying air under pressure to the fire pot of the furnace and I do not, therefore, desire to limit myself to the particular means shown.

With the described construction, it is obvious that when the fan 4 is running, it will cause a circulation of air from said fan through the pipe 14, the chamber 13, and the pipe 4, which will be discharged through the injector 5 into the fire pot 2, and that, when the furnace is in full operation, the air passing through the chamber 13 will be heated to a high temperature.

The current of air passing through the injector nozzle will operate by suction to draw atomized fuel oil from the carbureter 7 into said nozzle, where it will be thoroughly mixed with the hot air passing through the pipe 4 and injector 5. The hot air will operate to thoroughly volatilize the fuel oil, said highly heated air and volatilized fuel oil forming a highly combustible mixture, which will burn with a very intense heat and, when the quantities of air and fuel oil are properly proportioned, will produce perfect and complete combustion of the fuel oil, whereby more heat is produced from a given quantity of fuel oil or less fuel oil is required to produce the same amount of heat.

In the preferable construction shown also, a perforated plate 15 is supported within the fire pot 2 at a distance above the bottom of said fire pot and substantially parallel therewith, said plate being of substantially the same size as the cross-section of the interior of said fire pot, and the injector 5 discharging into said fire pot beneath said plate 15. With this construction, it is obvious that the combustible mixture under pressure entering the fire pot will be discharged upwards through the perforations in the plate 15 into the upper compartment of said fire pot where combustion will take place.

While I consider the use of the perforated plate desirable and preferable, for the reason that it will discharge the combustible mixture uniformly over the entire area of the upper compartment of said fire pot, I do not desire to limit myself thereto, as even without said plate, highly advantageous results will be obtained by the use of a fire pot and associate features, as herein described.

In accordance with my invention, the fan 12 is driven by an electric motor indicated at 16, which is connected by electrical conductors 17 and 18 with an electrical generator indicated at 19, the electric circuit being controlled by a switch comprising pole pieces 20 and 21 and a contact piece 22 which, as shown, is mounted on the stem 23 of the emergency valve 9.

As herein previously stated, the solenoid 11 is in electric circuit with a thermostatic switch, located in the space to be heated indicated at 11', the relation being such that when the temperature at said thermostatic valve is below a predetermined normal, said switch will be open and when above such normal temperature, said switch will be closed. Thermostatic switches suitable for the purpose may be purchased commercially and it is therefore unnecessary to show or describe the same in detail.

With the described construction, it is obvious that when the emergency valve 9 is closed, thus shutting off the supply of fuel to the furnace, the fan motor 16 will be "cut out", and vice versa, when said emergency valve is open so as to admit fuel to the furnace, the fan motor 16 will be in circuit and will supply combustible mixture to the fire pot 2.

In order to prevent flooding of the fire pot 2, in case of defective operation of the furnace or from any other cause, said fire pot is provided with a drain pipe 24 which connects it with the float chamber 8 above the normal liquid level therein.

Also, in addition to said drain connection, means are provided for closing the emergency valve 9 and for cutting out the fan motor 16, controlled by the level of liquid fuel in the fuel supply pipe 6 and float chamber 8.

In accordance with my invention, this can be effected in a simple manner by means of a switch in the electric circuit of the solenoid 11 controlled by means constructed and arranged to open said switch whenever the liquid level in the float chamber 8 exceeds a predetermined level, which will "cut out" the solenoid 11—thereby permitting the emergency valve 9 to close, and stopping the fan 12—said switch operating means being also constructed and arranged to close said switch whenever the liquid level in said float chamber falls below said predetermined level—thereby opening said emergency valve and starting the fan.

As shown, said switch consists of pole pieces 25 and 26 and a contact piece 27, said pole pieces being mounted on one arm of a lever 28 the opposite end of which is connected by a link 29 with the flat 30 in the float chamber 8.

I claim:

1. In a furnace of the type specified, the

combination of a fire pot positioned in the combustion chamber of the furnace, the walls of said fire pot being chambered to form an air heating passageway, air admission and discharge pipes which communicate with opposite ends of said chamber, the discharge pipe connecting said chamber with the interior of the fire pot, and circulating means applied to one of said pipes, substantially as described.

2. In a furnace of the type specified, the combination of a fire pot positioned in the combustion chamber of the furnace, means for supplying fuel thereto, and a perforated plate supported within said fire pot above the bottom thereof beneath which the fuel is discharged into said firepot, substantially as described.

3. In a furnace of the type specified, the combination of a fire pot positioned in the combustion chamber of the furnace a perforated plate supported within said fire pot above the bottom thereof, the walls of said fire pot being chambered to form an air heating passageway, air admission and discharge pipes which comunicate with opposite ends of said chamber, the discharge pipe connecting said chamber with the fire pot beneath the perforated plate supported therein, substantially as described.

4. In a furnace of the type specified, the combination of a fire pot positioned in the combustion chamber of the furnace, the walls of said fire pot being chambered to form an air heating passageway, air admission and discharge pipes which communicate with opposite ends of said chamber, the discharge pipe connecting said chamber with the interior of the fire pot, circulating means applied to one of said pipes, said chamber being of such large size in cross section as will provide a sufficiently low velocity of the gaseous product passing through same in the operation of the furnace to insure heating of said gaseous product to a relatively high initial temperature prior to being discharged into the fire pot of the furnace, substantially as described.

5. In a furnace of the type specified the combination of a fire pot positioned in the combustion chamber of the furnace, the walls of said fire pot being chambered to form an air heating passageway, air admission and discharge pipes which communicate with opposite ends of said chamber, the discharge pipe therefrom communicating with the fire pot, and circulating means applied to one of said pipes, the area in cross section of said chamber being relatively much larger than the cross sectional area of either pipe connection thereto, substantially as described.

6. In a furnace of the type specified, the combination of a fire pot positioned in the combustion chamber of the furnace, the walls of said fire pot being chambered to form an air heating passageway, air admission and discharge pipes which communicate with opposite ends of said chamber, said discharge pipe communicating with said fire pot, circulating means applied to one of said pipes, a fuel supply pipe and fuel vaporizing means in said fuel supply pipe, substantially as described.

7. In a furnace of the type specified, the combination of a fire pot positioned in the combustion chamber of the furnace, a fuel supply pipe, a valve which controls said pipe, means for maintaining said valve normally closed, means for opening said valve against the force of said closing means, and means controlled by a defined level of liquid fuel in said fuel supply pipe for rendering said valve opening means inoperative, substantially as described.

8. In a furnace of the type specified, the combination of a fuel supply pipe, a valve which controls said pipe, means for maintaining said valve normally closed, a solenoid applied to said valve for opening the same against the force of said closing means, a switch which controls the electric circuit of said solenoid, and means for opening said switch when the liquid fuel in said fuel supply pipe attains a predetermined level, substantially as described.

9. In a furnace of the type specified, the combination of a fuel supply pipe, a valve which controls said pipe, means for maintaining said valve normally closed, a solenoid applied to said valve for opening the same against the force of said closing means, a switch which controls the electric circuit of said solenoid, and means for opening said switch when the liquid fuel attains a predetermined level, said means comprising a chamber with which the fuel supply pipe communicates, a float therein, a pivoted lever on which the contact piece of the switch which controls the solenoid circuit is mounted, and connection between said float and lever, substantially as described.

10. In a furnace of the type specified, the combination of a fire pot, a motor driven fan for supplying air under pressure thereto, a fuel supply pipe, a valve which controls said pipe, means for maintaining said valve normally closed, a solenoid applied to said valve for opening the same against the force of said closing means, and thermostatic means for "cutting out" said solenoid and the fan motor substantially as described.

11. In a furnace of the type specified, the combination of a fire pot, a motor driven fan for supplying air under pressure thereto, a fuel supply pipe, a valve which controls said pipe, means for maintaining said valve normally closed, a solenoid applied to said valve for opening the same against the force of said closing means, a thermostatic switch

which controls said solenoid, a switch which controls the electric circuit of the fan motor comprising a contact mounted on the stem of said valve and the relation being such that movement of the valve stem to open said valve will close the fan motor switch and movement thereof to close said valve will open said fan motor switch, substantially as described.

In testimony that I claim the foregoing as my invention, I affix my signature this 1st day of July, 1920.

GEORGE W. GARVEY.