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COMBUSTION APPARATUS.

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1,379,177. Patented May 24, 1921.

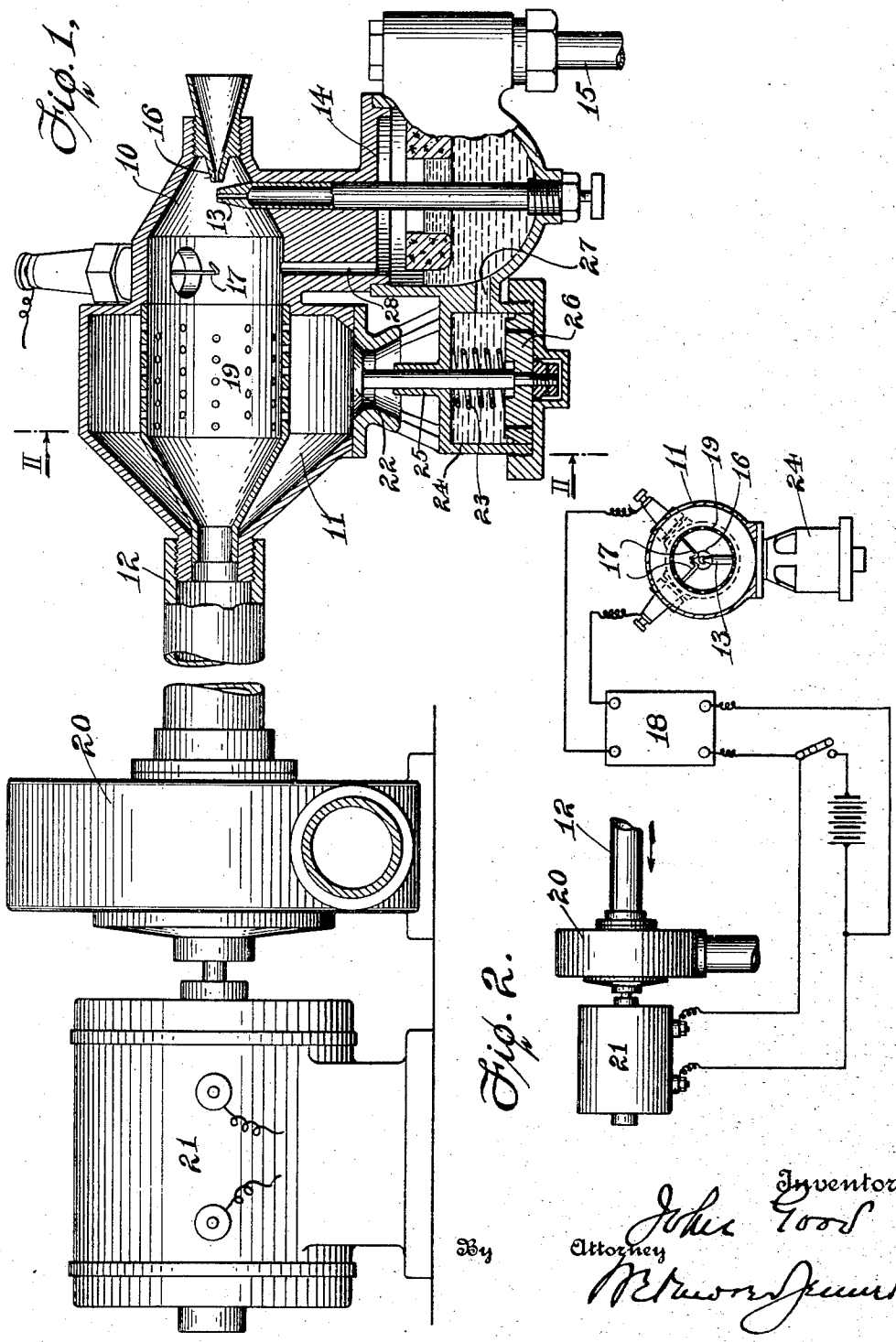


Fig. 2.

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COMBUSTION APPARATUS.

1,379,177. Specification of Letters Patent. Patented May 24, 1921.

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To all whom it may concern:

Be it known that I, JOHN GOOD, a United States citizen, and resident of Brooklyn, New York, have invented the following described new and useful Improvements in Combustion Apparatus.

The invention relates to inclosed liquid fuel burners wherein kerosene and similar fuels are electrically ignited and caused to burn non-explosively within confined flame passages, and especially those which are adapted to be set in action and operated by an air flow proceeding from a single source under a moderate pressure difference and such as may be produced by a suction fan applied to the burner outlet causing air to flow into the burner from atmosphere. The invention consists in an improved method and means of insuring reliable ignition of the fuel mixture in burners of this kind even though the apparatus be quite cold, as in zero weather, or the fuel be of low inflammability. In a copending application, now Patent No. 1,331,985, I have disclosed a method of insuring reliable ignition in liquid fuel burners of this general class which consists in causing the mixture in the burner to be initially richer in fuel than required for the subsequent combustion, and this is accomplished, in the specific structure of that patent, by initially intermitting the action of one of the two air-supplying devices comprehended in that structure, with the result that the action of the remaining device produces a rich spray mixture in the burner adapted for instant and certain ignition. In some of the various uses to which this class of apparatus may be put however, it is not always convenient or suitable to produce the initial richness in this manner, nor with fuels of better flammability, is it necessary to use the higher pressure differences which are preferred in said patent. The present invention provides an improved and simplified method and means for accomplishing the initially rich effect in burners operated by a single air-flow-producing means at very moderate pressure differences and particularly those burners which are of small compass and are operated by suction. According to this invention the burner functions, on the establishment of such an air flow, to produce an abnormally high rate of fuel delivery during the initial period of operation, so as to produce that degree of richness of the fuel spray mixture and that degree of fineness of atomization which will make ignition certain under otherwise difficult or impossible conditions. In its preferred form such temporary rich condition is obtained by choking or restricting the air flow and this is also done automatically and caused to persist for an appropriate period while the igniter is in action.

The mechanism diagrammed in the the accompanying drawings is merely one of many different embodiments taken for illustration of the principle of the invention.

In these drawings:

Figure 1 is a vertical, longitudinal section of such embodiment, the suction creating means being shown in side elevation, and

Fig. 2 is a diagram of the electrical connections, the flame-generating part being shown on smaller scale and in section on line 11—11 of Fig. 1.

The burner or flame-generating part of the heating device includes a nozzle part 10 and an admission chamber 11 for the combustion-supporting air. These parts are connected to an outlet passage 12 of any suitable length, through which the flame is maintained and its products exhausted. The burner is provided with a liquid fuel spraying device comprising a nozzle 13 adapted to draw liquid fuel from a receptacle 14, supplied by pipe 15, the liquid in the chamber being kept at a constant level by a float-controlled valve of usual type. An air nozzle 16 entering the burner in aspirating relation to the oil nozzle 13 is adapted to deliver an air jet co-acting with fuel orifice and produce a liquid fuel spray inside of the interior wall or shell 19 which forms the ignition and mixing space of the burner. This spray is intercepted by two opposing electrodes 17 of an electric igniter which may be of common type, but is here shown as two similar insulated plugs mounted adjacent to the nozzles in the casing part 10 and connected with a source of electrical energy, as, for instance, the secondary of a sparking induction coil 18. (Fig. 2.) The combustion-supporting air from the chamber joins the spray in the ignition and mixing space through a number of holes in the shell 19, these being distributed around about the spray as indicated. Such air enters the air-distributing space 11 from the valve 22 when it is open, as presently explained, and

joins the ignited spray uniformly on all sides and mixes with it, thereby serving to produce intense heat from the combustion, without explosion.

The mechanism above described is operated by the suction flow produced by a fan 20, here used in representation of any form of suction or pumping means, and which is connected to the burner outlet or tube 12. The said tube may itself constitute the part to be heated or may extend through or adjacent to such part or parts, and it may be associated with and used for vaporizing the fuel charge of an internal combustion engine. The suction producing means may be operated from any suitable source of power, such for example as an electric motor 21 which may be connected with the same source of electrical energy that operates the igniter, so that the closing of the circuit to operate the igniter will, at the same time, close the circuit of the electric motor, and thereby produce ignition and combustion by the operation of a single member.

When the suction-producing means is set in operation, the suction effect in the burner, besides drawing liquid fuel into the combustion space, as above described, also starts to draw in air through the valve 22 and chamber 11 but the air flow through this path is obstructed by the position of the valve 22 which is closed at the start and not opened, or allowed to open, promptly so that practically the full force of the suction is momentarily active on the fuel spraying means to cause a very vigorous air jet and a correspondingly copious delivery of fuel. This produces in the ignition and mixing space a mixture of atomized fuel and air the properties of which are abnormally rich and suited for spark ignition. In the case in hand the opening of the valve is retarded and timed automatically, by a dash-pot arrangement, comprising a dash-pot piston 26 connected to the valve stem and working in a chamber 24 which contains the valve spring 23 and is kept filled with liquid by a passage 21 connecting with the fuel receptacle. Holes in the piston allow the liquid to flow to its opposite sides and the size of the piston and its holes determines the period of restriction, as will be understood. As the valve 22 approaches its normal position, moving against the spring, the ignition will be effected and while the combustion proceeds the fuel and air proportions entering the burner become those suited for the normal combustion operation, and thereafter the action of the spring produces a correlation between the velocity of the air jet and the flow through chamber 11 which keeps the proportions constant. That is to say, the valve 22 admits more or less air according as variation in the suction condition in the burner causes more or less fuel to be delivered by the fuel spraying means, thus keeping the proportions constant though the suction and the rate of combustion may vary. Delivery of fuel, except by the aspirating action of the air jet, is prevented by the pressure-equalizing passage 28 through which the pressure condition in float chamber is equalized with that in the interior of the device, and this is arranged in the bottom of the burner to serve also as a drain back for liquid fuel, if any should collect therein. To prevent the collection of liquid fuel on the spark-plug electrodes which might short-circuit them, they are made hook shaped so that drops of liquid thereon will drain away from the gap.

From the foregoing description of the apparatus illustrated it will be apparent that invention consists in starting the combustion in this class of burners by initially producing an abnormally high rate of fuel delivery into the burner, igniting it, and while burning, reducing the rate of fuel delivery to that required for the normal supply of combustion-supporting air, and more particularly consists in producing this effect by coincidently restricting the entrance of the said air which has the effect of increasing the suction effect on the fuel spraying means with a corresponding intensification of the atomizing action.

Claims:

1. The method of starting combustion of liquid fuel in a confined combustion space which consists in momentarily supplying said space with liquid fuel at an abnormally high rate of delivery adapted to produce a rich and readily ignitible mixture flow of fuel and air therein igniting said mixture flow and while it is burning reducing said fuel rate and thereby establishing the proportions suited for normal combustion.

2. The method of starting combustion in liquid fuel burners which consists in coincidently supplying the same with liquid fuel at an abnormally high rate of delivery and with air at an abnormally low rate of delivery and thereby producing a rich and readily ignitible flow of fuel mixture therein igniting said flow and while it is burning, coincidently changing said delivery rates to establish normal mixture proportions in the supply to the burner.

3. The method of starting combustion in suction-operated liquid fuel burners which consists in momentarily restricting the suction air flow thereto and thereby causing the suction effect to draw in fuel at an abnormally high rate adapted to produce a flow of rich mixture, igniting said mixture and while it is burning removing said restriction and thereby establishing normal proportions in the burner.

4. The method of starting combustion in suction-operated liquid fuel burners, of the

kind having air-atomized fuel-spray means, which consists in momentarily increasing the velocity of the atomizing air jet to produce a readily ignitible mixture flow in the burner, igniting said flow and then diminishing said air jet velocity.

5. Inclosed liquid fuel burning apparatus comprising a combustion space, a single air-flow-producing means therefor, a fuel spraying means correlated with the latter to maintain combustible proportions in the mixture flowing in said space, an igniter in such space, and means for making said mixture relatively rich in fuel when said air-flow-producing means begins to function.

6. Inclosed liquid fuel burning apparatus comprising a combustion space, a single air-flow-producing means, a fuel-spraying means correlated therewith to produce combustible proportions in the mixture flowing in said space, an igniter in said space, a single means for setting all said means and the igniter in action and means for automatically making said mixture initially rich in fuel and later less rich.

7. Inclosed liquid fuel combustion apparatus comprising in combination, an ignition and mixing space, a suction means in communication with the outlet of said space, an electric igniter in said space, a liquid fuel passage adapted for supplying fuel to said space at a rate establishing combustible mixture proportions therein, and means for automatically and momentarily making said mixture relatively rich in fuel when the suction means is started.

8. Liquid fuel combustion apparatus comprising an ignition and mixing space, a suction means connected therewith, a liquid fuel passage for delivering fuel to said space adapted to supply such fuel thereto at a variable rate maintaining substantially constant mixture proportions in said space and means for automatically making said mixture proportions momentarily rich in fuel when the suction means begins to function.

9. Inclosed liquid fuel combustion apparatus comprising a motor, a suction producing means actuated thereby, a combustion space connected to said means and having an air entrance, a valve for said entrance which is closed when said motor is started, a liquid fuel passage adapted for supplying fuel to said space in proportion to the suction flow therein and an electric igniter in said space adapted to ignite said mixture while said valve is closed or during its movement to normal position.

10. The combination of a passage to be heated, having a liquid fuel atomizing means, an electric igniter, an inlet for combustion-supporting air, and a slow-moving valve member controlling said inlet and operating by virtue of the establishment of a predetermined pressure difference between the source of air supply and the interior of said passage.

11. The combination of an inclosed flame passage of small compass, containing means for delivering an atomized liquid fuel therein and an electric igniter, suction means for creating flow through said passage, and means for admitting combustion-supporting air to said passage upon a predetermined lowering of the pressure therein.

12. The combination of an inclosed flame chamber of small compass, having a liquid nozzle, an open air nozzle in aspirating relation thereto and in open communication with the atmosphere at its inlet end, an inlet for combustion supporting air, an inwardly opening, spring-pressed valve adapted for closing or obstructing said last mentioned inlet, and means for creating suction within said chamber to first atomize fuel and thereafter open said inlet valve.

13. The combination of an inclosed chamber of small compass, having a liquid fuel nozzle, an air nozzle in aspirating relation thereto, an igniter in the path of the atomized fuel, an inlet for combustion supporting air including a perforated wall, an inwardly opening, spring-pressed valve normally obstructing said last mentioned inlet, and means for creating a difference in pressure between the interior of said chamber and the source of air supply to effect first an atomizing of the liquid fuel and ignition of the spray and later, the opening of said inlet valve.

14. In combination, a substantially cylindrical, perforated wall, a burner head at one end thereof and having a means for spraying fuel thereinto, an igniter in the path of the liquid spray, an air admission chamber encircling said wall and having an inlet, a valve normally obstructing said inlet, a dash pot connected to said valve, and means for establishing a difference in air pressure between the interior of said admission chamber and the source of air supply to open said valve after the establishment and ignition of the liquid spray.

15. In combination, a substantially cylindrical, perforated wall, a burner head at one end thereof and having a liquid fuel nozzle and an air delivery nozzle in aspirating relation thereto, an igniter in the path of the liquid spray, an air admission chamber encircling said wall and having an inlet, a spring-pressed valve normally closing said inlet, a dash pot connected to said valve, and a suction device for opening said valve and drawing in combustion-supporting air after the ignition of the liquid spray.

In testimony whereof, I have signed this specification.

JOHN GOOD.