Oct. 13, 1931. C. O. GUNTHER 1,826,776

LIQUID FUEL BURNER AND METHOD OF ATOMIZING LIQUIDS

Filed July 20, 1928

Fig. 1

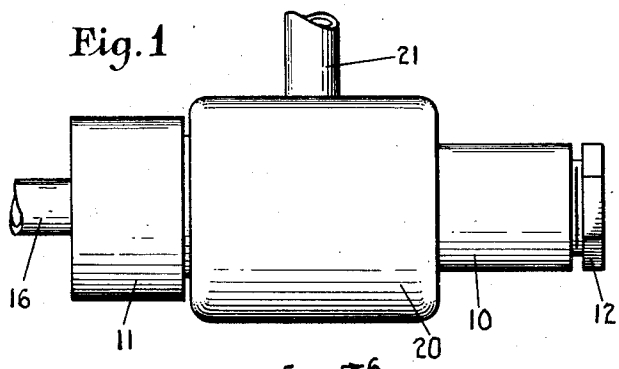



Fig. 2

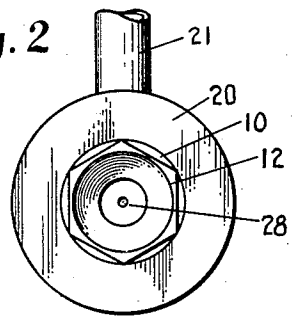



Fig. 3

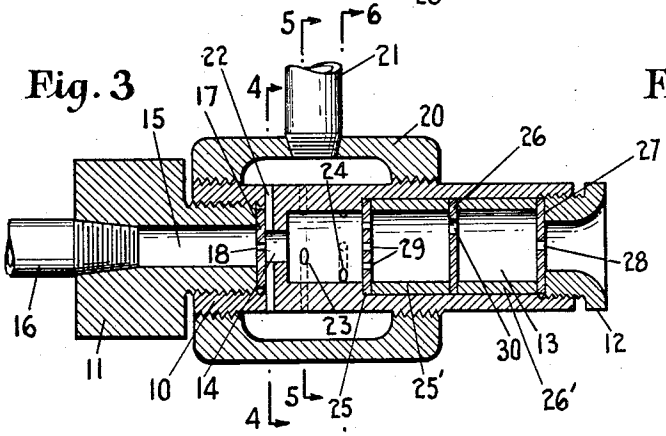



Fig. 4

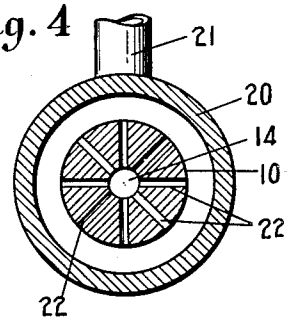



Fig. 5

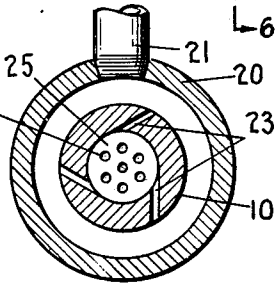



Fig. 6

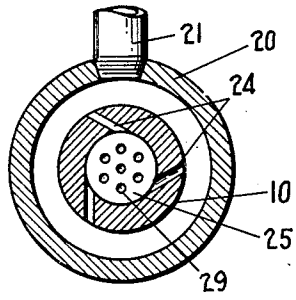



Fig. 7

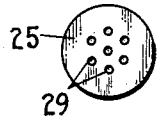
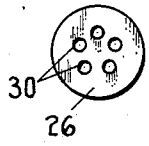



Fig. 8




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# UNITED STATES PATENT OFFICE

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## LIQUID FUEL BURNER AND METHOD OF ATOMIZING LIQUIDS

Application filed July 20, 1928. Serial No. 294,091.

The invention relates to a method of atomizing liquids and to liquid fuel burning apparatus for carrying out the novel method, more particularly to a burner member adapted for the burning of heavy fuel oils.

It has for its object to most effectively atomize a liquid, as fuel oil, and to construct a burner suitable for this purpose such that the same shall have no moving parts and, also one which will operate to burn heavy fuel oils economically and at relatively low pressures as well as without the necessity of preheating.

The nature of the invention, however, will best be understood when described in connection with the accompanying drawings, in which:

Fig. 1 illustrates the novel burner in side elevation, and Fig. 2 is an end elevation thereof.

Fig. 3 is a longitudinal section through the burner.

Figs. 4, 5 and 6 are vertical sections taken respectively on the lines 4—4, 5—5 and 6—6, Fig. 3 of the drawings.

Figs. 7 and 8 are elevations of the atomizing disks utilized in the novel burner.

Referring to the drawings, a simple embodiment of the invention is illustrated, the burner being constructed for example, of a cylindrical tubular body 10 having the oil-supplying base or plug 11 which may be removably fitted thereto at one end, as by being threaded therein, and at the opposite end having removably threaded therein the nozzle or cap member 12 and preferably flaring. The body 10 is axially bored through to provide a passageway 13, preferably of substantially uniform diameter throughout, except that in the larger capacity burners it terminates at the oil end in a portion 14 of reduced cross-sectional area.

The oil base 11 is also provided with an inlet duct 15 shown in the present embodiment coaxial with the passageway 13 and its reduced portion 14, the fuel being adapted to be delivered from a suitable source (not shown) through a pipe or the like 16 threaded into the oil base 11 and communicating with its inlet duct 15.

Communication of the oil or fuel, however, is not had directly with the passageway 13 for there is interposed between the duct 15 and the reduced area portion 14 a disk 17 which is provided with one or more orifices in size depending upon the specific gravity and the viscosity of the oil to be burned. For two oils of the same specific gravity but different viscosities, the one with the lower viscosity will require the smaller orifice; and if a greater consumption of oil is required than can be supplied by one orifice for a given pressure on the oil, two or more of such orifices may be utilized. However, in the present instance, but a single orifice 18 is indicated. The disk 17, furthermore, is rigidly held in position by the oil base 11 and discharges directly into the reduced area portion 14 of the passageway through cylinder 10.

About the latter, also, is provided an air-supplying jacket or chamber 20 surrounding the inner portion of the passageway 13 and terminal portion 14 thereof; and air or a mixture of air and gas, or solely gas, under the required pressure is supplied thereto from a suitable source (not shown) as through the pipe 21. By the term "air" as hereinafter used throughout the specification and claims, it is, therefore, to be understood that in the use of this term I do not limit myself to air as the gaseous medium.

Chamber 20, moreover, is designed to communicate both with the passageway portion 14 and the passageway 13, in the former instance by means of one or more series of radially directed ports 22 passing through cylinder 10 and located immediately adjacent the disk 17, causing jets of air under pressure to concentrate centrally and impinge upon the oil issuing through the orifice 18 to break up the same, the mixture then being carried axially along the passageway 13. The reduction in area of passageway as at 14 is provided for the purpose of preventing premature expansion of these air jets to obtain a positive impact of the same on the jet of fuel; but for smaller capacity burners may be of the same diameter as the remaining portion 13.

In its travel axially along this passageway

the mixture of liquid and air meets with further air jets delivered through sets of ports 23 and 24, respectively, which in this instance are directed from the air chamber 20 tangentially into the passageway 13 and the air from one set being delivered in a direction opposite to that delivered by the other set so that whirls in opposite directions will take place, the turbulence created thereby effecting a thorough mixing of the oil and air.

The free passage of this mixture to the nozzle member, however, is not permitted; but a series of disk members is interposed in the passageway 13 to provide further expansion chambers along the same, the number of such disks and corresponding expansion chambers depending upon the character of the oil utilized. As indicated, three disks 25, 26 and 27 are provided, the last being located immediately ahead of the nozzle member 12 and is provided with a single outlet orifice 28 discharging through said nozzle or cap member. The character of the flame desired will, of course, be determined by the outlet orifice 28; and it will be understood that the same may assume various shapes and sizes, and the disk as well may be constructed of a number of orifices.

The disks may conveniently be assembled in the cylinder 10 by shouldering the innermost one against said cylinder and utilizing intermediate sleeve members 25′ and 26′ held in position by the final disk 27 and the nozzle or cap member 12. The other disks may have one or more orifices, as the orifices 29 and 30 respectively, which should be small enough to insure proper atomization and with the aggregate area of the preceding set of orifices in the direction of flow always less to secure a pressure drop along the passageway. The term "disk" as used in the specification and claims is to be understood as referring to a plate as thin as consistent with the required strength; and the term "orifice" to a perforation in a thin disk, the diameter of the perforation being relatively small in comparison with the diameter of the disk. When there is more than one orifice in a disk, then the diameter of the orifice is relatively small as compared to the diameter of the area of the surface of the disk immediately surrounding said orifice.

The passageway 13 is thus subdivided by these disks into a succession of pressure chambers and the same serve to successively atomize the mixture of air and oil which expands into said chambers as it proceeds along the burner toward the nozzle, whereby a very effective atomization is obtained; and when the finely subdivided oil issues from the said nozzle the spray may readily be ignited in any well-known manner, as by means of a gas pilot flame, electric ignition means or merely by an ignited mass of oil-soaked waste. After the combustion chamber is sufficiently heated, the flame will support its own combustion from the reflected heat. The final velocity of the emerging spray, it will be understood, is dependent upon the pressure immediately behind the disk 27 which can be governed, for example, by the size of the orifice 28 of said disk.

In using heavy oils having a low viscosity, the disk 26 may be omitted; and for a low rate of oil consumption, a single orifice in each of the disks will suffice.

I claim:

1. A liquid fuel burner, comprising a body member having a longitudinal passageway therethrough, with fuel orifice constructed and located at one end thereof to supply fuel to the burners, a casing about said body portion affording an air chamber adapted to receive air under pressure and the said body portion being provided with ports spaced around the circumference of the air chamber and extending therefrom to the fuel supply end of the passageway located to concentrate a plurality of jets of air upon the fuel issuing from said orifice and with further sets of circumferentially disposed ports affording additional communication between the air chamber and the passageway, and a succession of disk members having orifices and subdividing the passageway beyond said ports into pressure chambers of successively lesser pressure values.

2. A liquid fuel burner, comprising a body member having a longitudinal passageway therethrough, with fuel orifice constructed and located at one end thereof to supply fuel to the burner and with a portion of reduced area immediately beyond said orifice, a casing about said body portion affording an air chamber adapted to receive air under pressure and the said body portion being provided with ports from said air chamber to the passageway portion of reduced area located to concentrate a plurality of jets of air upon the fuel issuing from said orifice and with further sets of ports affording additional communication between the air chamber and the passageway, and a succession of disk members having orifices and subdividing the passageway beyond said ports into pressure chambers of successively lesser pressure values.

3. A liquid fuel burner, comprising a body member having a longitudinal passageway therethrough, with fuel orifice constructed and located at one end thereof to supply fuel to the burners, a casing about said body portion affording an air chamber adapted to receive air under pressure and the said body portion being provided with radially directed ports from said air chamber to the fuel supply end of the passageway located to concentrate a plurality of jets of air upon the fuel issuing from said orifice and with further sets of ports affording additional com-

munication between the air chamber and the passageway, and a succession of disk members having orifices and subdividing the passageway beyond said ports into pressure chambers of successively lesser pressure values.

4. A liquid fuel burner, comprising a body member having a longitudinal passageway therethrough, with fuel orifice constructed and located at one end thereof to supply fuel to the burners, a casing about said body portion affording an air chamber adapted to receive air under pressure and the said body portion being provided with radially directed ports from said air chamber to the fuel supply end of the passageway located to concentrate a plurality of jets of air upon the fuel issuing from said orifice and with further sets of ports affording additional communication between the air chamber and the passageway located to deliver series of tangentially directed jets of air in opposite directions thereinto, and a succession of disk members having orifices and subdividing the passageway beyond said ports into pressure chambers of successively lesser pressure values.

5. A liquid fuel burner, comprising a body member having a longitudinal passageway therethrough, with fuel orifice constructed and located at one end thereof to supply fuel to the burners, a nozzle member located at the opposite end of the passageway, a casing about said body portion affording an air chamber adapted to receive air under pressure and the said body portion being provided with ports from said air chamber to the fuel supply end of the passageway located to concentrate a plurality of jets of air upon the fuel issuing from said orifice and with further sets of ports affording additional communication between the air chamber and the passageway, a succession of disk members having orifices and subdividing the passageway beyond said ports into pressure chambers of successively lesser pressure values, and a disk immediately ahead of said nozzle member and provided with an orifice discharging from the last pressure chamber through the nozzle.

6. A liquid fuel burner, comprising a body member having a longitudinal passageway therethrough, with fuel orifice constructed and located at one end thereof to supply fuel to the burners, a removable nozzle member with flaring outlet and located at the opposite end of the passageway, a casing about said body portion affording an air chamber adapted to receive air under pressure and the said body portion being provided with ports from said air chamber to the fuel supply end of the passageway located to concentrate a plurality of jets of air upon the fuel issuing from said orifice and with further sets of ports affording additional communication between the air chamber and the passageway, a succession of disk members having orifices and subdividing the passageway beyond said ports into pressure chambers of successively lesser pressure values, and a disk immediately ahead of said nozzle member and provided with an orifice discharging from the last pressure chamber through the nozzle.

7. A liquid fuel burner, comprising a body member having a longitudinal passageway therethrough, with fuel orifice constructed and located at one end thereof to supply fuel to the burners, a removable nozzle member located at the opposite end of the passageway, a casing about said body portion affording an air chamber adapted to receive air under pressure and the said body portion being provided with ports from said air chamber to the fuel supply end of the passageway located to concentrate a plurality of jets of air upon the fuel issuing from said orifice and with further sets of ports affording additional communication between the air chamber and the passageway, a succession of disk members having orifices and subdividing the passageway beyond said ports into pressure chambers of successively lesser pressure values, the innermost disk being shouldered against the body portion, and intermediate sleeve members spacing said disks, the final one of which is to be engaged by the nozzle member located to hold the assembly of disks and sleeve members in position.

8. A liquid fuel burner, comprising a body member having a longitudinal passageway therethrough, a disk at one end of said passageway having an orifice through which fuel may be supplied to the passageway, a casing about said body portion affording an air chamber adapted to receive air under pressure and the said body portion being provided with ports from said air chamber to the fuel supply end of the passageway located to concentrate a plurality of jets of air upon the fuel issuing from said orifice and with further sets of ports affording additional communication between the air chamber and the passageway, and a succession of disk members having orifices and subdividing the passageway beyond said ports into pressure chambers of successively lesser pressure values.

9. The method of atomization of liquids, which comprises directing air jets to a stream of fluid substantially at its point of issue, whirling the mixture by a series of further jets of air, and then successively expanding the said mixture.

10. The method of atomization of liquids, which comprises directing air jets perpendicularly to a stream of fluid substantially at its point of issue, whirling the mixture by a series of further jets of air, and then successively expanding the said mixture.

11. The method of atomization of liquids, which comprises directing air jets perpendicularly to a stream of fluid substantially at its point of issue, whirling the mixture by a series of tangentially directed jets of air, and then successively expanding the said mixture.

In testimony whereof I affix my signature.

CHARLES O. GUNTHER.