F. C. STARR.

FUEL OIL BURNER.

APPLICATION FILED MAR. 27, 1920.

1,381,095.

Patented June 7, 1921.

3 SHEETS—SHEET 1.

Fig. 1.

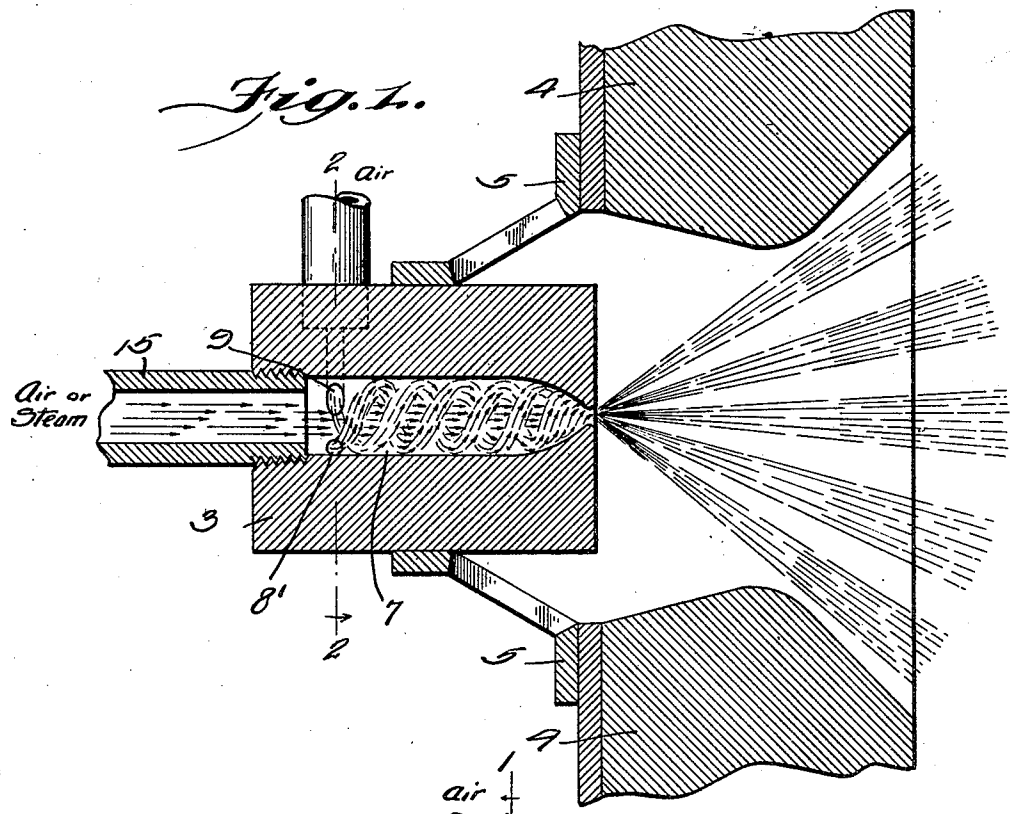
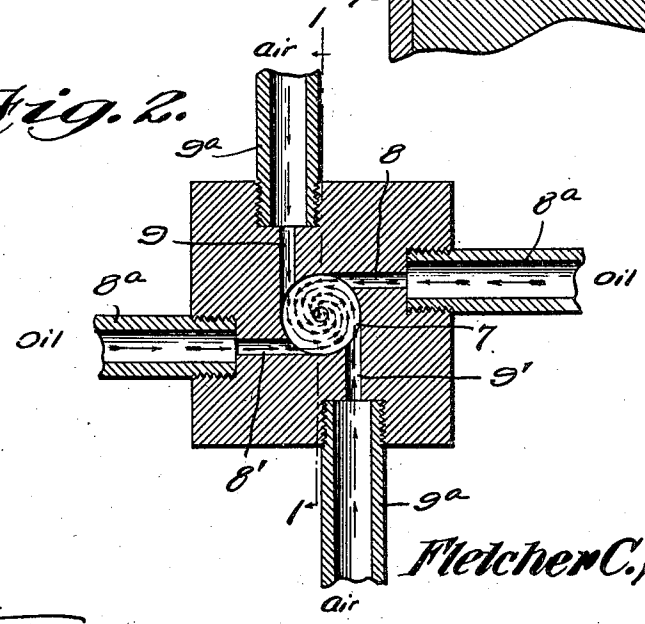


Fig. 2.



Witness

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3 SHEETS—SHEET 2.

Fig. 3.

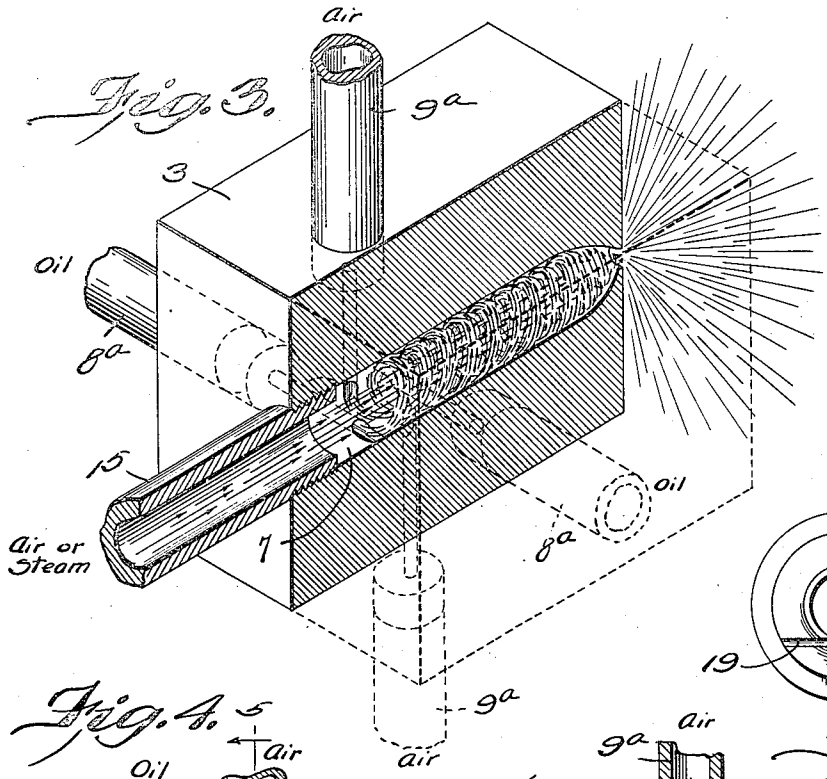


Fig. 4.

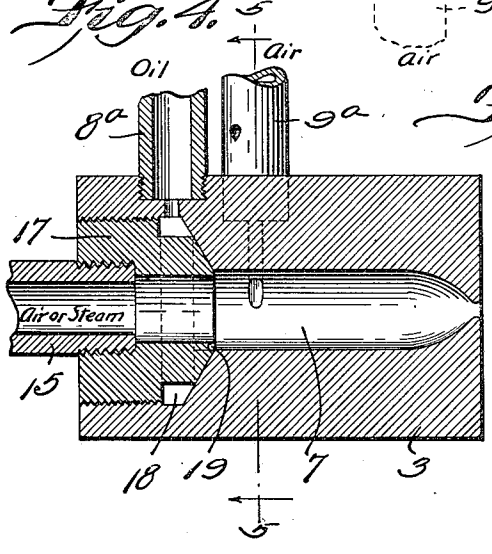


Fig. 5.

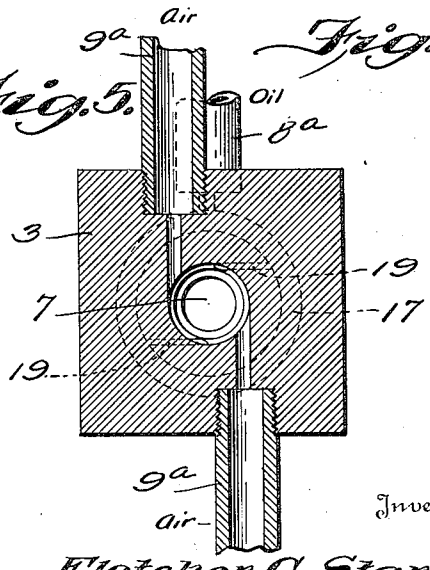
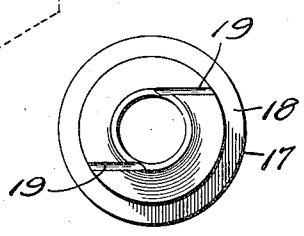


Fig. 6.



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3 SHEETS—SHEET 3.

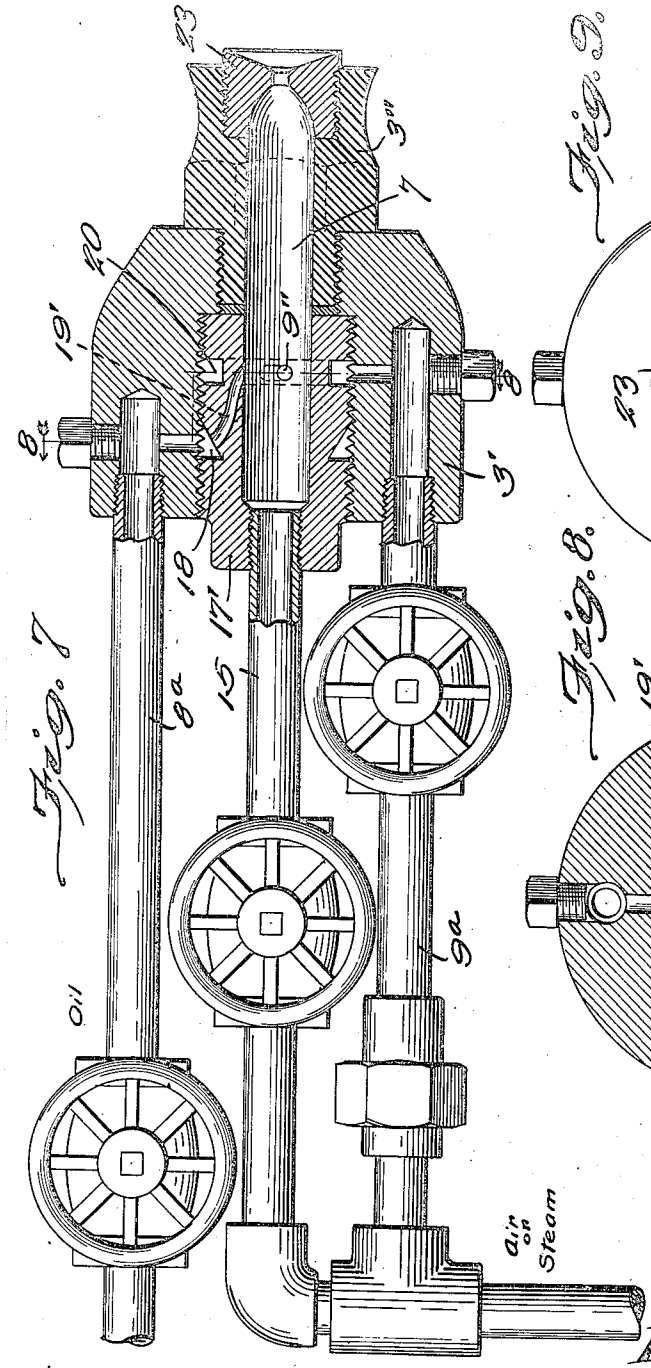


Fig. 7.

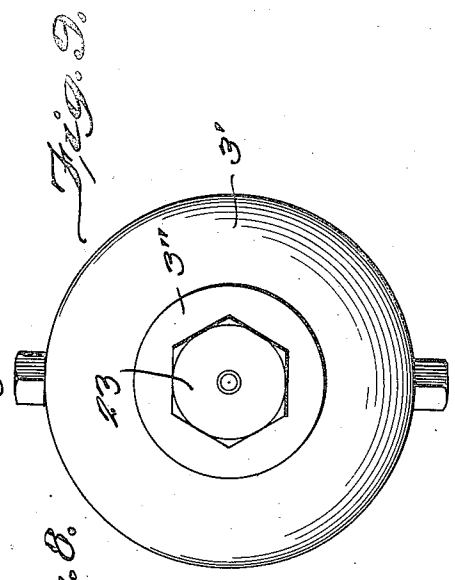


Fig. 9.

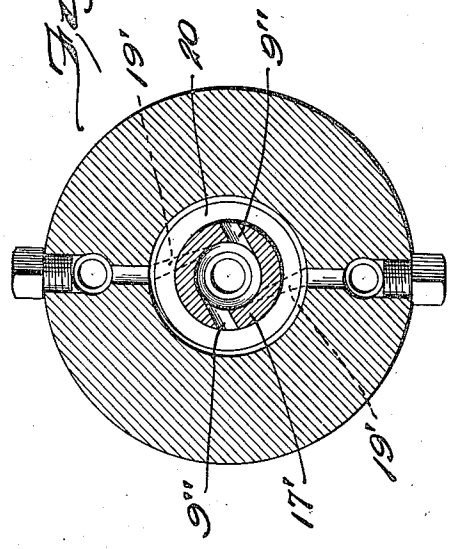


Fig. 8.

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UNITED STATES PATENT OFFICE.

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FUEL-OIL BURNER.

1,381,095. Specification of Letters Patent. Patented June 7, 1921.

Application filed March 27, 1920. Serial No. 369,321.

To all whom it may concern:

Be it known that I, FLETCHER C. STARR, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Fuel-Oil Burners, of which the following is a specification.

This invention relates to oil atomizing burners which eject the oil in the form of an extremely fine mist or spray, and particularly to the type in which the atomization is effected mechanically by introducing the jets or streams of oil tangentially into a nebulizing chamber, thereby setting up a rapid rotation or whirling motion which disrupts the oil and produces a more or less complete atomization.

Inasmuch as mechanical atomization depends directly upon the velocity of rotation, oil burners of this type have heretofore been operated under a high oil pressure. One of the objects of my invention is to obtain a high velocity of rotation in the nebulizing chamber with a low oil pressure. I obtain this result by causing streams of air, introduced tangentially into the mixing or nebulizing chamber, to impinge upon the oil and speed up its rotation. The air not only causes an increased velocity of rotation but mixes with the oil particles to form a vapor or gas.

A further object is to greatly augment the flexibility of operation of the burner and extend its range of control. Thus the burner may be operated at a very low oil pressure and by increasing the tangential air supply a good mixture may be obtained at the extreme low limit of capacity. Then by increasing the oil pressure or by opening the oil control valve wider, the capacity of the burner may be increased while maintaining the proper mixture by introducing a stream of air transverse to the rotating streams and in the rear thereof. I am thus enabled to obtain a wide range of operation and great flexibility and at the same time increasing the efficiency over prior burners.

In the following detailed description I shall refer to the accompanying drawings, in which—Figure 1 is a longitudinal sectional view of a burner embodying my invention, and showing also its relation to the burner opening in the furnace wall; Fig. 2 is a transverse sectional view on the line 2—2 of Fig. 1; Fig. 3 is a perspective view, partly in section of the burner; Fig. 4 is a longitudinal sectional view of another form of my invention; Fig. 5 is a transverse sectional view on the line 5—5 of Fig. 4; Fig. 6 is a front elevation of the plug member shown in Fig. 4; Fig. 7 is a top plan view showing one form of my burner connected to the air and oil supply pipes which are provided with regulating valves, the burner being in section; Fig. 8 is a sectional view on the line 8—8 of Fig. 7; and Fig. 9 is an enlarged front elevation of the tip or nozzle of the burner shown in Fig. 7.

The burner nozzle may be in the form of a metal block 3 which is supported at the mouth of the fuel inlet of the furnace 4 by a yoke frame 5. The nozzle is provided with an elongated mixing chamber 7, and adjacent its rear end are introduced alternate pairs of oil and air inlet ducts or channels 8, 8′ and 9, 9′ respectively, tangential with respect to the bore of the nozzle. Inlet oil and air supply pipes 8^a and 9^a are threaded into the block.

The oil entering the chamber 7 tangentially at opposite points sets up a whirling motion which is greatly augmented by the air streams which also enter the chamber tangentially at diametrically opposite points intermediate the oil inlets. By this arrangement the oil may be under a comparatively low pressure and by placing the air under a very much higher pressure the entering air streams impinge upon the oil and supply the energy necessary to cause the oil to whirl with a high velocity, thereby nebulizing the oil and forming an intimate mixture of air and minute oil particles.

It has heretofore been proposed to introduce an auxiliary fluid, such as air or steam, into the atomizing or whirling chamber but it was specified that the pressure of the auxiliary fluid should not exceed that of the oil and it was introduced at such points or in such manner that it could not impinge directly upon the entering oil jets. My method, on the contrary introduces the air under a much higher pressure than the oil and directly impinges upon the oil jets or film. By causing the jets or streams of air entering under high velocity to directly impinge upon the tangentially entering jets of oil, as indicated in Fig. 2, I secure a mechanical disrupting action of the high velocity air streams upon the oil jets, at the same time supplying the energy required to

produce the velocity of rotation upon which the atomization depends and furthermore secure a more intimate and thorough mixture of the air and oil.

By causing the air to initially impinge upon the oil jets as they enter the whirling chamber, and by its disrupting action causing an intimate mixture of oil and air particles, I am enabled to secure a more effective and persistent whirling or rotary motion of the mass because a column of mixed oil and air will maintain a rotary motion whereas a column of air alone will not do so.

As the whirling atomized mixture strikes the converging walls of the whirling or atomizing chamber adjacent the nozzle, the velocity is increased. To further increase the velocity, I introduce another force acting in a longitudinal direction along the axis of the burner by means of a pipe 15 entering the rear end of the atomizing chamber through which steam or air under pressure is introduced. This not only exerts a pressure to force the already mixed air and atomized oil through the nozzle but supplies additional air for combustion. Furthermore this additional air supply lends great flexibility and range to the burner. Thus the burner can be operated efficiently at the extreme low limit of capacity at a very low oil pressure while obtaining a good mixture by opening the supply of air to the tangential air inlet pipes. Then by increasing the oil pressure or by opening wider the oil control valve, the capacity of the burner may be increased and the proper amount of air supplied by opening the valve controlling the air supplied to the rear pipe 15 to the desired extent. It is evident, therefore, that a very wide range of flexibility of operation is afforded by the coöperative use of the axial and tangential streams of air and that under all conditions of operation, the efficiency of the burner is enhanced by such cooperative action.

In Figs. 4 to 6 I have shown a modification which differs from the construction previously described in having a plug 17 located in a recess in the rear end of the burner and having a central bore with which the rear axially disposed air pipe 15 is connected. The oil inlet ports enter an annular recess 18 in the plug from which channels 19, cut in the conical forward end of the plug, lead tangentially into the atomizing chamber 7.

A further modification is illustrated in Figs. 7 to 9. In this form the plug 17′ extends forwardly beyond the air inlet ducts and is provided with annular grooves 18 and 20, connected respectively with the oil and air supply pipes. The oil groove 18 communicates with the bore 7 of the burner by means of ducts 19′ which enter midway between the air ducts 9″. The operation will be understood from the previous description in connection with the other figures. As it is sometimes desirable to renew the burner tip or nozzle, this may be in the form of a separable plug 23, threaded into the end of the burner, and provided with a projecting hexagonal portion by which it may be screwed, or unscrewed. I prefer to make the barrel of the burner in two parts 3′ 3″ and which are threaded into an outer casing as shown in Fig. 7. Instead of making the tip 23 as a separate member, it may be made integral with the front barrel portion 3″.

I have described in detail the particular constructions illustrated in the accompanying drawings for the purpose of disclosing the manner in which my invention may be embodied but it will be evident to engineers that various changes and modifications can be made without departing from the principles of my invention.

I claim:—

1. The method of atomizing a hydrocarbon fuel, which consists in injecting streams of fuel and an atomizing medium tangentially into a confined space so that the atomizing medium will impinge upon the fuel streams to form a whirling mass, and injecting a stream of atomizing medium axially into said whirling mass to complete the atomization of the fuel and to force the resulting mixture outwardly from said confined space.

2. An oil atomizing burner, comprising a body or casing having an axially disposed atomizing and mixing chamber, alternately arranged tangential oil and air inlet ports entering said chamber and so disposed that the air jets will impinge directly upon the entering oil and an axially disposed inlet in the rear of said ports through which a stream of air or steam may be injected to exert an impelling pressure upon the rotating mixture of air and oil issuing from said ports.

3. An oil atomizing burner, comprising a body or casing having an axially disposed atomizing and mixing chamber converging at its forward end into a nozzle opening, means for injecting alternately arranged jets of oil and air tangential to the wall of the chamber, and means for injecting a stream of air or steam into the rear end of said chamber and in an axial direction.

4. An atomizing burner comprising a body or casing having a mixing chamber, tangential oil and air inlet ports entering said chamber and so disposed that an air jet will impinge directly upon the entering oil, and an inlet arranged in rear of said ports and through which an atomizing medium may be injected to exert an impelling pressure upon the rotating mixture of air and oil issuing from said ports.

5. An oil atomizing burner comprising

a body or casing having an axially disposed atomizing and mixing chamber having at its forward end a nozzle opening, means for injecting jets of oil and an atomizing medium tangential to the wall of the chamber, and means for injecting a stream of atomizing medium into the rear portion of said chamber and toward said nozzle opening.

6. The method of atomizing a hydrocarbon fuel, which consists in directing a stream of fuel and atomizing medium tangentially into a confined space to form a whirling mass, and directing a stream of atomizing medium axially into said whirling mass to force the mixture outwardly from said confined space.

In testimony whereof I affix my signature.

FLETCHER C. STARR.