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LOW PRESSURE LIQUID FUEL BURNER

Filed July 12, 1928

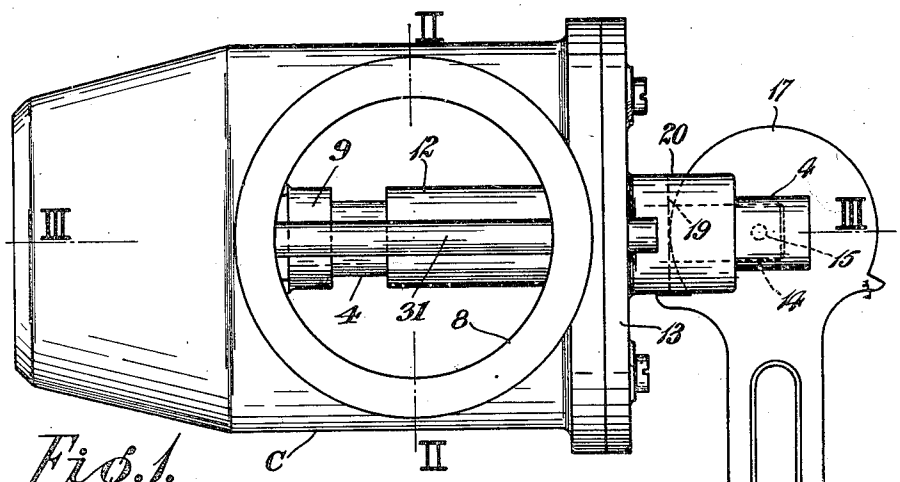



Fig. 1.

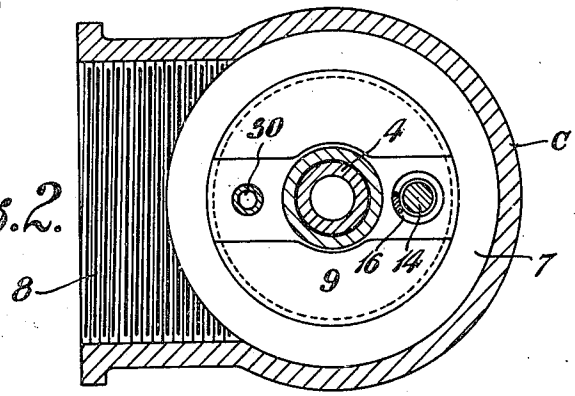
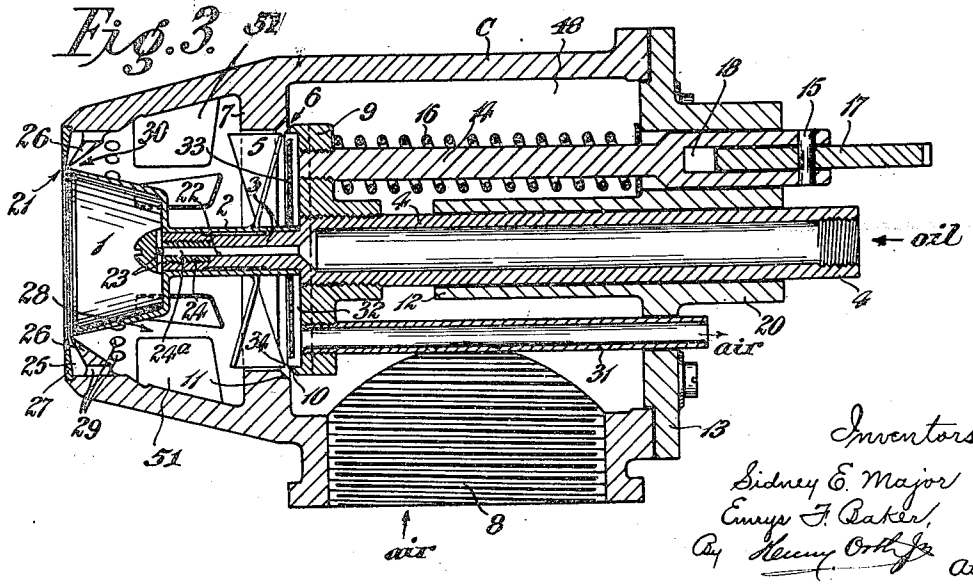



Fig. 2.




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# UNITED STATES PATENT OFFICE

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## LOW-PRESSURE LIQUID-FUEL BURNER

Application filed July 12, 1928, Serial No. 292,178, and in Australia July 26, 1927.

This invention refers to low pressure liquid fuel burners of the type having a rotary fuel atomizing cup driven by a propeller rotated by the low pressure air.

If air is supplied to a valved air inlet from a source of constant pressure, as a fan, the pressure at the discharge nozzle will be constant with varying openings, if the ratio between the area of the valve opening and the area of the nozzle opening is kept constant.

There is always a pressure reduction when there is a constriction in a fluid conduit, but it is also true that if two variable constrictions are placed in series on the conduit and so linked together that the area of one varies in correct proportion with the other, the pressure in that portion of the conduit between the constrictions can be kept at constant value despite varying openings of the constrictions, provided that the fluid is supplied to the conduit at constant pressure.

The amount of energy deliverable to the propeller will vary with the velocity of the air and the volume passing.

When a rotor is free to rotate and there is no friction or propeller loss no energy will be absorbed and the speed of the rotor will be dependent only on the velocity of the air and the pitch of the propeller blades. Variations in volume will not cause variations in the propeller speed unless there is a corresponding variation in velocity.

If, however, there is any material resistance to turning, the propeller speed will be reduced to a point where sufficient torque is exerted on the propeller blades to overcome the resistance, and there will consequently be a certain amount of "slip" between the air speed and the propeller speed. In this case increasing the volume of air will reduce the "slip" and the rotor speed will increase.

In the oil burner constructed according to the present invention the resistance to turning is very small in relation to the available turning effort, and consists mainly of the retarding effect of the oil being accelerated as it flows into a rotating cup. This small resistance varies directly as the rate of oil feed. For good combustion, it is necessary to regulate the amount of air proportionately to the oil; therefore if the oil flow is increased with the consequent increase in braking effect, the increased volume of air required for combustion also exerts a correspondingly greater torque on the propeller, thus maintaining an approximately even rotor speed.

In other words, the simultaneous adjustment of the air valve opening and the nozzle outlet maintains an approximately constant pressure in the chamber between the valve and the nozzle.

This pressure is necessarily less than the pressure applied at inlet port. The velocity of air issuing through the air valve opening is dependent on the difference in pressure on either side of the valve. Since this pressure difference remains the same with various valve openings, the velocity of annular air jet issuing from the valve opening remains constant, although the volume varies as the valve position is varied.

According to this invention therefore, manually adjustable means are employed for simultaneously and correspondingly adjusting the air inlet valve and the air jet or outlet and by preference the latter is controlled by sliding the atomizing cup to reduce or increase the area of the air outlet thus dispensing with the necessity of a slidable air jet or outlet valve with resultant economy in manufacture.

The invention also incorporates novel details of construction hereinafter fully explained and claimed.

A practical form of the invention is illustrated by the accompanying drawings whereof:—

Figure 1 is a side elevation of the burner.

Figure 2 a section on line II—II of Figure 1, and

Figure 3 a section on line III—III of Fig. ure 1.

Referring to these drawings the flared atomizing cup 1 is fitted to a sleeve 2 rotatably mounted on the reduced end 3 of an oil supply tube 4 said sleeve being fitted with an air propeller 5.

The air inlet 6 is formed in a partition 7 cast integral with the casing C and dividing

the latter into an outer compartment 28 and an inner compartment 48 which latter is provided with air at a low pressure through port 8.

The air inlet valve 9 is fitted on the oil supply tube 4 and is formed with a bevel face 10 parallel with a corresponding face 11 on the edge of the air inlet. The air propeller is located partly within the air inlet in front of the valve 9.

The oil supply tube 4 is slidably mounted in a bearing 12 and in a boss 20 on the end closure cap 13 of the casing and the inlet valve is provided with a longitudinal rod 14 slidably fitted in the boss 20 projecting outwardly and is fitted with a spring 16 that operates to urge the inlet valve into closed position.

Associated with the rod 14 is a manually operated cam 17 partially seated in an end recess 18 in said rod and a corresponding recess 19 in the boss 20 of the cap, said cam being mounted on a pivot 15 on said rod.

The cam bears against the end of the recess 19 in the boss and so in conjunction with the spring 16 adjusts the air inlet valve 6 and as the latter is fixed on the tube 4 the atomizing cup 1 is correspondingly adjusted in relation to the air jet or outlet 21 at the nozzle of the burner.

The atomizing cup 1 is fitted centrally with a hollow screw 24 that is screwed into the bore 22 of the reduced neck 3 of axial tube 4 on which the cup is rotatably mounted and the back of the head of said screw is scored or formed with radial grooves 23 in communication with the central hollow $24^a$ of the stem of said screw so that the oil fed in through said axial tube 4 and hollow stem $24^a$ will pass through said grooves 23 under the head and be delivered into the cup.

At the nozzle of the burner is an annular recess 25 formed between an annular tapering projection 26 on the casing and a centrally perforated washer or plate 27 fitted in the outer end of said casing. The space in said recess is tapered centrally towards the outlet 21 and the air is admitted from the outer compartment 28 of the casing through a series of ports 29 formed through the projection 26.

The terminal washer or plate 27 is tapered towards the outlet 21 so that the air is directed to same and the taper of the projection 26 together with the flare of the cup directs air to the narrow annular adjustable passage 30 formed between the lip of the cup and the inner pointed edge of the projection 26.

Air thus passes directly through passage 30 as well as through ports 29 recess 25 to the air jet or outlet 21 by means of which construction any oil dripping from the cup upon projection 26 will be blown free by the main air supply assisted by that coming from said recess 25.

The inlet valve 9 is provided with a tube 31 diametrically opposite the rod 14 and extending at one end through the cap 13 and communicating at the other end with a recess 32 formed in the front end of said inlet valve 9.

The front wall of said recess 32 consists of a circular plate 33 fitted in the mouth of said recess and fixed for convenience on the rotary sleeve 2 of the atomizing cup and the diameter of such plate is slightly less than that of said recess so that there is an annular opening 34 into said recess.

The object of this recess is to provide relief of end thrust on the propeller due to the excess air pressure in the outer compartment which may escape through the tube 31.

In the front or outer compartment 28 the casing is preferably fitted with a series of radial baffle plates 51 that deflect the whirling air leaving the propeller and lead same in a lineal direction to the air jet or outlet 30.

It will be apparent by the above description that when the air inlet valve is moved to restrict the inlet of air the atomizing cup simultaneously and correspondingly moves in the same direction to limit the exit area of the air jet or outlet.

The oil from tube 4 passes directly through ports 23 into cup 1 and the blast of air, passing between the outlet projection 26 and lip of the cup picks up any oil that may drip from the lip and thoroughly atomizes same, so that a highly combustible mixture is blown from the nozzle into the furnace. When the valve is moved backward to admit more air, the lip of the cup moves backward the same distance and correspondingly increases the area of the outlet. The reverse takes place when the valve and cup are moved in the opposite direction.

We claim:

1. In low pressure liquid fuel burners, a casing having an inner and an outer compartment, an air port formed in said inner compartment, an air inlet between said compartments, an outlet at the front end of said outer compartment, an atomizing cup into which the oil is fed located adjacent and controlling said outlet, an adjustable air inlet valve controlling the said air inlet, means for simultaneously and correspondingly adjusting said valve and cup and a propeller between the cup and valve to rotate the cup.

2. In low pressure liquid fuel burners, a casing having an inner and an outer compartment, an air port formed in said inner compartment, an air inlet between said compartments, an outlet at the front end of said outer compartment, an adjustable atomizing cup supplied with oil and located within and controlling said outlet, an adjustable air inlet valve controlling said air inlet, a manu-

ally controlled slidable element on which said cup and valve are mounted and a propeller between the cup and valve to rotate the cup.

3. In low pressure liquid fuel burners, a casing having an inner and an outer compartment, an air port formed in said inner compartment, an air inlet between said compartments, an outlet at the front end of said outer compartment, an oil supply tube, an adjustable atomizing cup rotatable on the oil supply tube and located adjacent and controlling said outlet, an adjustable air inlet valve on said tube controlling said air inlet, manually operated means for simultaneously and correspondingly sliding said valve and cup and a propeller between the cup and valve to rotate the cup.

4. In low pressure liquid fuel burners, a casing having an inner and an outer compartment, an air intake port formed in said inner compartment, an air inlet between said compartments, an outlet at the front end of said outer compartment, an oil supply tube, an adjustable atomizing cup connected with and rotatable on said oil supply tube and located adjacent and controlling said outlet, an adjustable air inlet valve on said tube controlling said air inlet, a rod fixed to the valve and slidable in the casing, a spring on said rod, a cam pivoted to the outer end of said rod and bearing against said casing and a propeller between the cup and valve to rotate the cup.

5. In low pressure liquid fuel burners, a casing having an interior annular projection dividing said casing into inner and outer compartments and forming an air inlet to the latter, an air port communicating with said inner compartment, a circular air inlet valve controlling said air inlet with the adjacent edges of said inlet and valve correspondingly bevelled, an air outlet at the front end of said outer compartment, an atomizing oil cup located adjacent and controlling said outlet, and means for simultaneously correspondingly adjusting said air inlet valve and cup and a propeller between the cup and valve to rotate the cup.

6. In low pressure liquid fuel burners, a casing having an interior annular projection dividing said casing into inner and outer compartments and forming an air inlet to the latter, an air intake port communicating with said inner compartment, a circular valve controlling said air inlet and formed in its forward end with a recess, a tube forming an air outlet from said recess, a rotatable circular plate in the mouth of said recess and less in diameter than said mouth, an air outlet at the front end of said outer compartment, a rotary atomizing oil cup located adjacent and controlling said outlet, a sleeve on said cup on which said circular plate is fixed, and means for simultaneously correspondingly adjusting said air inlet valve and cup and a propeller between the cup and valve to rotate the cup.

7. In low pressure liquid fuel burners, a casing provided with an inner and an outer compartment with an air inlet between said compartments, an air intake port formed in said inner compartment, an outlet formed by a projection from the casing at the front end of said outer compartment, a series of air ports in said projection, an annular terminal plate on the nozzle of the casing in advance of said projection, an annular recess between said plate and projection, an oil atomizing cup located adjacent and controlling said outlet, an air inlet valve controlling the aforesaid air inlet, means for simultaneously adjusting said air inlet valve and cup and a propeller between the valve and cup to rotate the cup.

8. In low pressure liquid fuel burners, a casing provided with an inner and an outer compartment with an air inlet between said compartments, an air intake port formed in said inner compartment, an outlet formed by a projection from the casing at the front end of said outer compartment, said projection being tapered towards the outlet, an annular terminal plate tapered towards the outlet and located on the nozzle of the casing in advance of said projection, an annular recess between said plate and projection to produce auxiliary air to blow free the drip, an oil atomizing cup located adjacent and controlling said outlet, an air inlet valve controlling the aforesaid air inlet, means for simultaneously adjusting said air inlet valve and cup and a propeller between the cup and valve to rotate the cup.

9. In low pressure liquid fuel burners, a casing provided with an inner and an outer compartment, an air intake port formed in said inner compartment, an air inlet between said compartments, an outlet at the front end of said outer compartment, an oil atomizing cup located adjacent and controlling said outlet, an oil supply tube, a sleeve on said cup rotatably mounted on said tube, a screw in the inner end of said cup formed with a hollow stem and screwed into the bore of said tube, a head on said screw formed with radial grooves in communication with the bore in the stem of said screw, an adjustable air inlet valve on said tube controlling said air inlet, manually operated means for simultaneously and correspondingly sliding said air inlet valve and cup and a propeller between the cup and valve to rotate the cup.

10. In low pressure liquid burners, a casing divided into an inner and an outer compartment, an air delivery port in communication with said outer compartment, an inlet valve at the division of said compartments, an oil delivery tube on which said valve is fitted, an outlet at the outer end of the outer compartment, an atomizing cup controlling

said outlet and provided with a sleeve rotatably mounted on said tube, an air propeller on said sleeve in front of said air inlet valve, and a series of baffles projecting from the interior wall of the outer compartment between said propeller and said outlet.

11. In a low pressure liquid fuel burner, a casing having an inner and an outer compartment, supply means for pressure air to the inner compartment, an air port between the compartments, a valve controlling the port, a propeller at said port, an atomizing cup connected to the propeller situated in the opening at the outer end of the casing, and means to simultaneously and axially shift the valve, the cup and the propeller.

In witness whereof we have signed this specification.

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EMRYS FRANCIS BAKER.