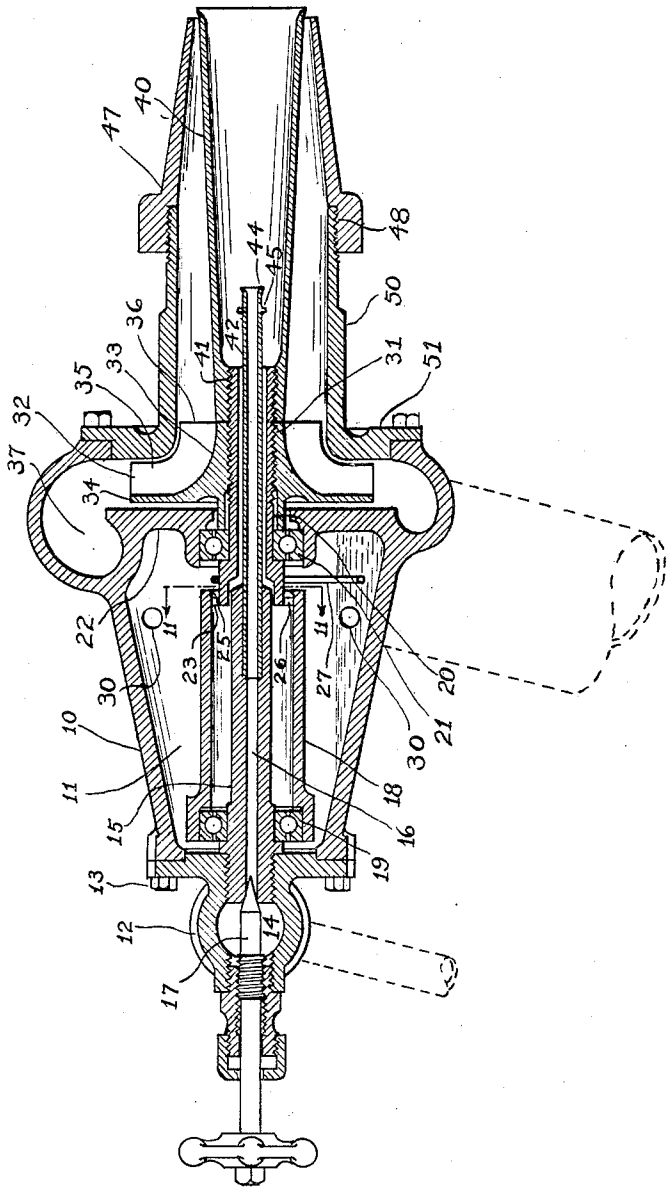
Nov. 15, 1927. **1,649,745**

C. A. SCHELLENS ET AL

OIL BURNER

Filed Nov. 23, 1923 4 Sheets-Sheet 1

Fig. 1.



INVENTORS

Christopher A. Schellens

and

BY Arthur T. Trowbridge

ATTORNEY.

Nov. 15, 1927. 1,649,745

C. A. SCHELLENS ET AL

OIL BURNER

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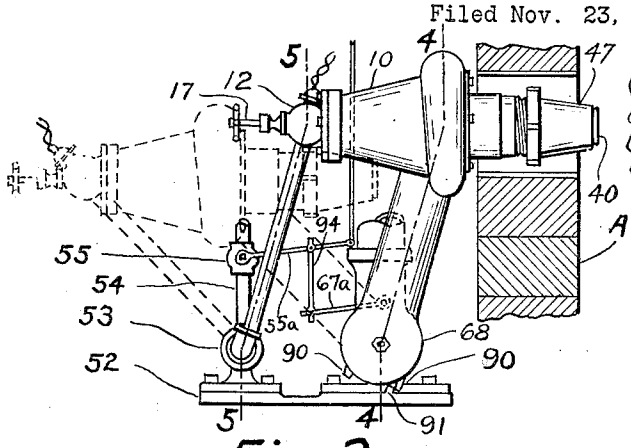


Fig. 2

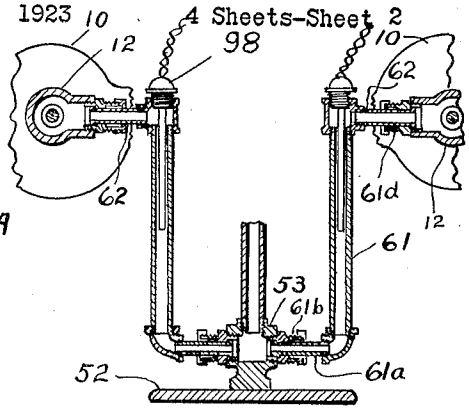


Fig. 5

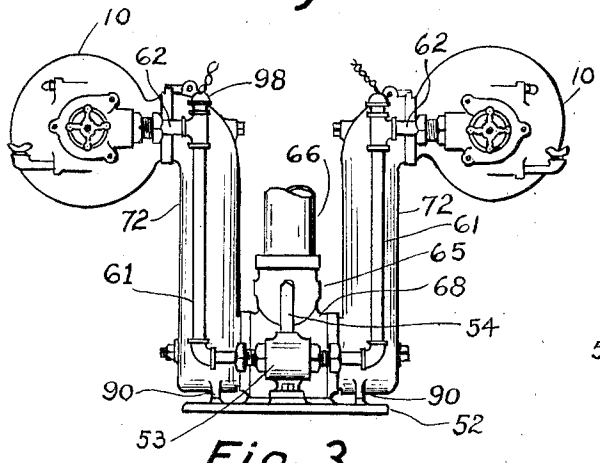


Fig. 3

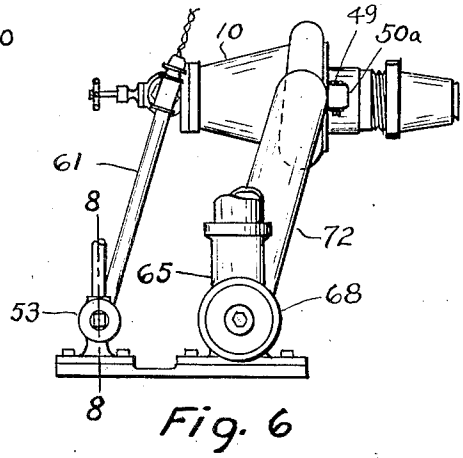


Fig. 6

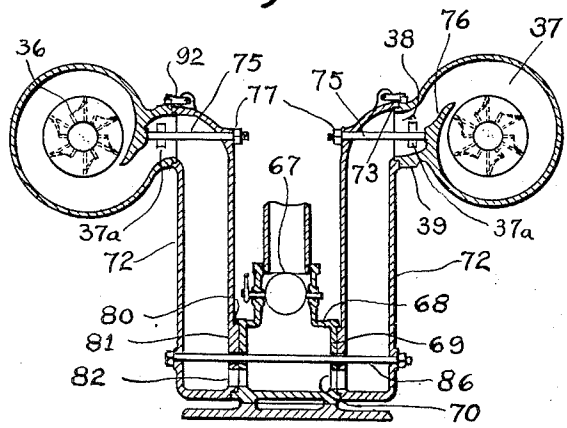


Fig. 4

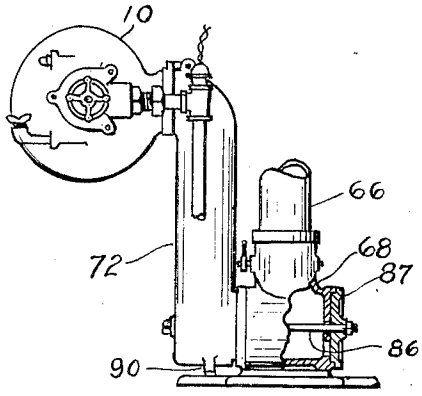


Fig. 7

INVENTORS
Christopher A. Schellens
and Arthur T. Trowbridge
BY T. T. Fraser
ATTORNEY.

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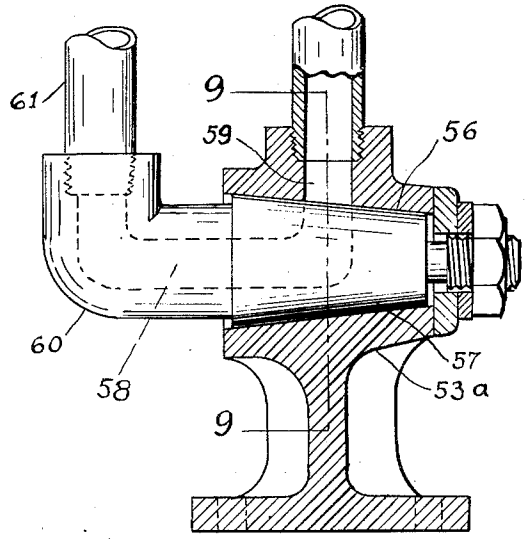


Fig. 8

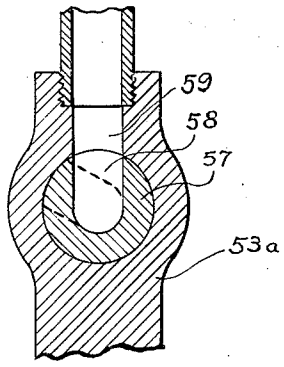


Fig. 9

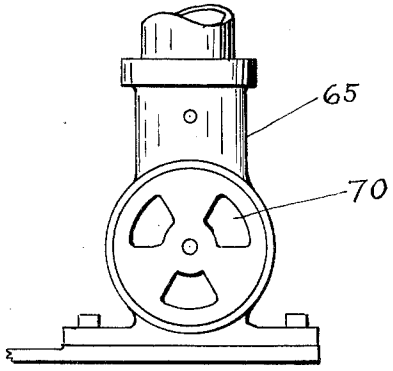


Fig. 10

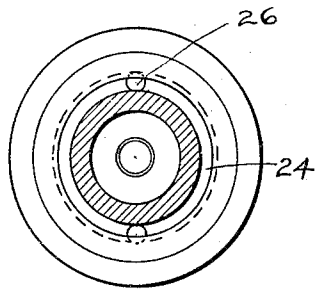


Fig. 11

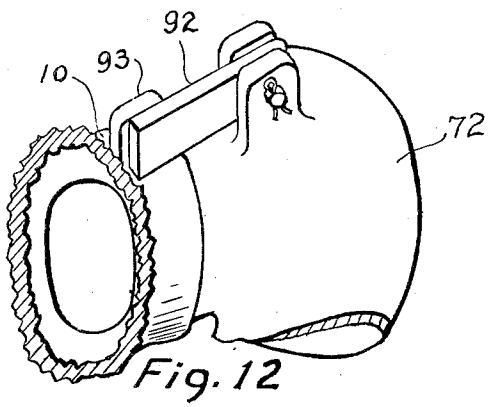


Fig. 12

INVENTORS
Christopher A. Schellens
and Arthur T. Trowbridge
BY
ATTORNEY.

Nov. 15, 1927. 1,649,745

C. A. SCHELLENS ET AL

OIL BURNER

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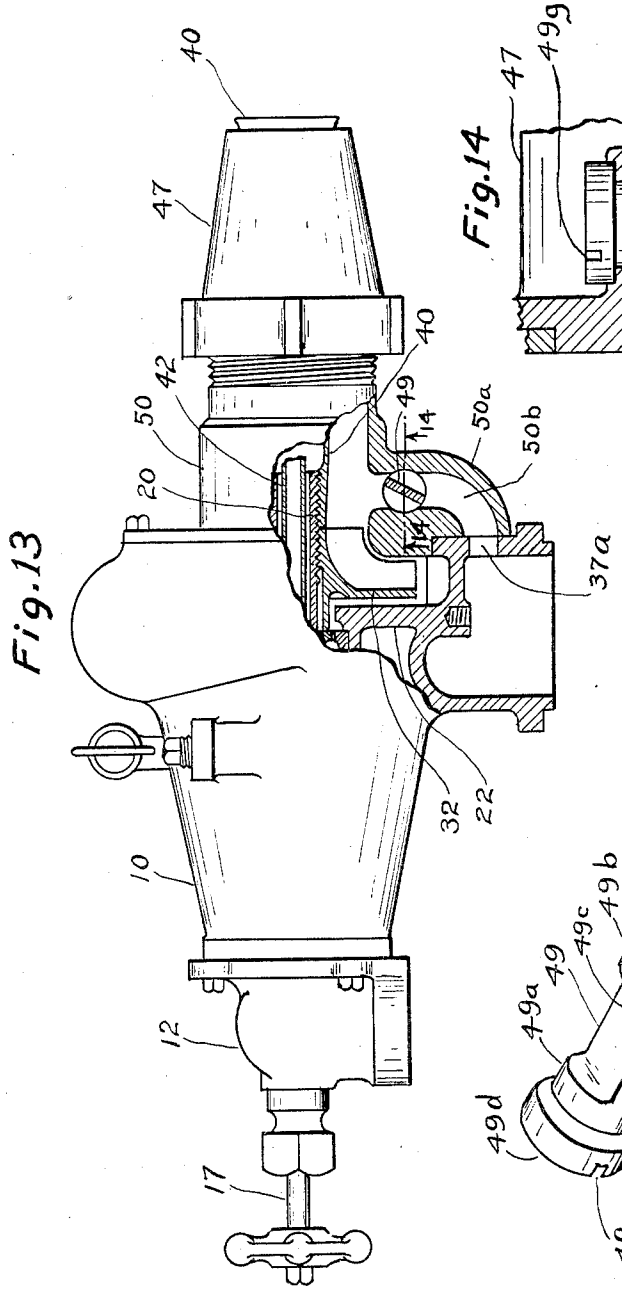


Fig.13

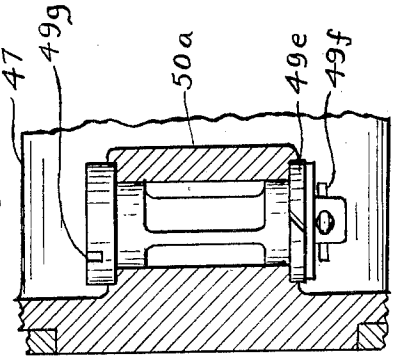


Fig.14

Fig.15

INVENTORS
Christopher A. Schellens
and Arthur T. Trowbridge
BY
ATTORNEY.

Patented Nov. 15, 1927. 1,649,745

UNITED STATES PATENT OFFICE.

CHRISTOPHER A. SCHELLENS, OF MARBLEHEAD, AND ARTHUR T. TROWBRIDGE, OF ARLINGTON, MASSACHUSETTS.

OIL BURNER.

Application filed November 23, 1923. Serial No. 676,641.

This invention relates to liquid fuel burners of the type characterized by having a rotatable cup by which the liquid fuel, usually oil, is atomized.

An object of this invention is to provide the burner head, which head may include an air nozzle and the aforesaid vaporizing cup rotatable within said nozzle, with improved means for mounting the vaporizing cup rotatably and driving it at a high velocity by air supplied to the air nozzle.

It is customary to provide the burner head with means to advance it into and withdraw it from the normal firing position and a further object is to provide improved means to accomplish this result.

A yet further object is to provide means automatically to cut off the supply of liquid fuel and air to the burner head when it is withdrawn from firing position.

The fire-boxes or combustion chambers of boiler-furnaces vary in dimensions as, for instance, one may be long and narrow, and another, short and wide. A flame suitable for one type of combustion chamber may not be suitable for another type. Consequently, a further object of this invention is the provision of means to vary the dimensions of the flame produced by the burner head, whereby a single type or size of burner head may be adjusted for use with various types of combustion chambers. We have found that the flame dimensions may be varied by varying the speed of rotation of the fuel atomizing member and a further object of the invention, therefore, is to provide means to vary the speed of rotation of the atomizing member, or cup, and, particularly, without varying or at least without unduly diminishing the supply of air to the nozzle of the burner head.

A further object is generally to improve the construction and operation of liquid fuel burners.

Fig. 1 is a longitudinal sectional elevation through a liquid fuel burner head embodying the invention.

Fig. 2 is a side elevation of the liquid fuel burner disposed in operative, or firing, position.

Fig. 3 is an end elevation of the apparatus of Fig. 2.

Fig. 4 is a sectional elevation taken along line 4—4 of Fig. 2.

Fig. 5 is a view similar to Fig. 4, taken along line 5—5 of Fig. 2.

Fig. 6 is a side elevation of the apparatus arranged with a single burner head.

Fig. 7 is an end elevation of the apparatus of Fig. 6, partly broken away to illustrate the cap over one of the air supply member outlet passages.

Fig. 8 is a sectional view along line 8—8 of Fig. 6.

Fig. 9 is a sectional detail along line 9—9 of Fig. 8.

Fig. 10 is a detail illustrating the valve ports or air register in the air supply member.

Fig. 11 is a sectional detail taken along line 11—11 of Fig. 1.

Fig. 12 is a perspective detail illustrating one of the locks for the burner head.

Fig. 13 is a plan view of the burner head of Fig. 1, partially in section to illustrate means for varying the speed of rotation of the vaporizing cup by by-passing air about the driving impeller.

Fig. 14 is a sectional detail of the by-pass valve taken along line 14—14 of Fig. 13.

Fig. 15 is a perspective detail of the by-pass valve of Figs. 13 and 14.

As here shown, the liquid fuel burning apparatus embodying the invention includes the burner head having the casing 10, which casing is adapted to support the rotary elements of the head. Said casing is or may be formed or provided with a rear compartment 11 which is adapted to contain the bearings for the vaporizing cup, and oil for the lubrication of the bearings. Said compartment is or may be closed at the rear end thereof by a fuel valve casing 12, which casing is or may be secured, preferably removably, to said burner head by suitable means as the bolts 13. Said valve member 12 is formed or provided with an internal passage 14 for the liquid fuel. A rod 15 is or may be screw-threaded in said valve member and extended forwardly into the compartment 11 of the burner head, and preferably arranged coaxially therewith. Said rod is or may be formed with a passage 16 therethrough by which liquid fuel may flow from the valve casing to the vaporizing cup, and said passage is or may be controlled by a valve stem 17, by which the supply of fuel to the cup may be regulated.

A cup-supporting hub 18 is or may be disposed in said burner-head compartment 11 about and co-axial with said rod 15, and supported rotatably thereon. For this purpose, the inner race of a ball bearing 19 may be received on said rod 15, adjacent the valve casing 12, and the outer race of said ball bearing may be received within said hub. The forward end of said hub is or may be formed or provided with an extension 20, preferably integral with the body of the hub. The inner race of a second ball-bearing 21 may be received on said extension and the outer race of said ball bearing may be received in a recess in the forward wall 22 of said burner head compartment 11. By this means, a rigid mounting is secured for the supporting hub 18 while the rear portion of the rod 15 may be made comparatively large, thereby securing freedom from vibration.

Said forward extension 20 of said hub 18 is or may be connected to the rear portion of the hub by the connecting wall 23. The outer face of said wall is preferably formed with a circular recess or groove 24 therein, Fig. 11, and the outer wall 25 of said groove is preferably inclined outwardly toward the rear. Said wall is also formed with one, or more, oil passages 26 therethrough by which communication with the interior of the hub may be established. An oil ring 27 may ride upon said hub-extension 20 between said wall 25 and the forward bearing 21 and dip into the oil in said compartment 11, whereby to supply lubricant to said forward bearing. Oil may also flow into the interior of the hub 18, by reason of the inclined wall 25 of said groove 23 and the passages 26, and thereby lubricate the rear bearing 19. Lubricating oil may be introduced into said compartment 11 through one or the other of the oil passages 30, which passages are or may be located on the same side of the casing 10 on opposite sides of the axis thereof so that either one or the other may be utilized, depending upon the arrangement of the burner head as right or left hand, which arrangement is hereinafter set forth.

Said hub-extension 20 is or may be extended through said forward wall 22 and its forward end is provided with the external screw-threads 31.

Means are provided to rotate said hub 18 rapidly by means of the air supplied to the burner head for combustion with the fuel. Said means may include the impeller 32 which is or may be formed with the hub 33, and said hub may be screw-threaded removably upon the hub-extension 20 forward of the wall 22 of said burner head. Said impeller is or may be formed with the radial rear wall 34 and the radial vanes 35. Said vanes 35 are or may be formed or provided with forward-extended inner edges, or discharge vanes 36, which preferably are inclined with respect to the axis of the impeller, and away from the direction of rotation thereof, as illustrated in Fig. 4. The burner head is or may be formed or provided with a spiral passage 37 therein which surrounds said impeller and is in communication with an inlet passage 38 arranged within the laterally-disposed neck 39. Said spiral passage 37 and discharge vanes 36 are so arranged as to cause the air flowing through said passages and impeller to impart a high rate of rotation to said impeller and consequently to said hub 18.

A vaporizing cup 40 is secured to the end of said hub-extension 20 and for this purpose, the bottom wall 41 of said cup may be internally screw-threaded and threaded removably on said hub-extension. Said cup is arranged to bear against the hub of the impeller 32 whereby to lock said impeller in position on said hub-extension. Said cup 40 may be relatively long as compared to its diameter and the side wall thereof may be inclined gradually outward as is or may be more or less common practice.

Liquid fuel may be supplied to the interior of said cup by means of the stationary tube 42, which tube is fixed in the stationary rod 15 and in communication with the fuel passage 16 therein. Said tube 42 is extended forwardly of said rod through and free from said hub extension 20 and terminates within the lower portion of said vaporizing cup 40. The forward end of said tube, within said cup, may be flared outwardly, as indicated at 44, whereby to permit the liquid fuel to flow the more readily onto the wall of the cup. Preferably said tube 42 is formed or provided with a peripherally-outstanding flange 45 which is disposed within the cup rearwardly of the open end thereof the purpose of which is to prevent liquid fuel from creeping back on the exterior surface of said tube into the compartment 11 of the burner head.

A tapered air nozzle 47 is or may be disposed about said vaporizing cup and said nozzle may terminate slightly to the rear of the end and in proximity to the wall of said cup and serve to direct the air for combustion across the film or sheet of atomized fuel as it is thrown outwardly off the lip of the cup. Said nozzle may be formed with the internally screw-threaded shoulder 48, which shoulder may be screw-threaded removably on the forward end of the tubular member 50. Said tubular member 50 may be formed or provided with an outstanding circular flange 51 at the rear end thereof which is secured removably to the burner head in front of the impeller 32.

It is obvious that as air is forced at suitable pressure through the burner head and the impeller and out of the nozzle, the impeller and cup will be rapidly rotated and

oil fed into the interior of the cup through the tube 42 will be thrown off the lip of the cup in a finely divided state and will mix with the air discharged through said nozzle.

The construction above described is or may be such that nozzles and vaporizing cups of varying dimensions may be utilized, whereby to vary the capacity of the burner head as may be desired.

Means are or may be provided to vary the speed of rotation of the atomizing cup 40 whereby to regulate the degree of atomization and the characteristics of the resulting flame. While the speed of rotation of the cup might be varied by varying the supply of air to the burner head, this method, usually, is undesirable as it also varies the velocity and volume of the air discharged about the lip of the atomizing cup. The means we prefer to employ includes means to by-pass air about the driving impeller 32 whereby to govern the speed thereof, and without varying the amount of air supplied to the nozzle 47. For this purpose the tubular member 50 of the burner head may be formed or provided with a lateral extension 50^a having an air passage 50^b therein; and said air passage is adapted to register with a port 37^a formed in the side wall of the burner head and in communication with the impeller compartment thereof and preferably in the immediate vicinity of air entrance thereto, as illustrated in Fig. 13. As thus arranged some of the air supplied to the burner head may flow directly into said tubular member and thence to the nozzle 47, without passing through the impeller. Means are or may be provided to regulate the amount of air by-passed about the impeller and said means may include the valve-member 49. Said valve member is preferably journalled in said lateral extension 50^a and disposed transversely across said by-pass passage 50^b in a position to control the flow of air therethrough. Said valve member may be formed or provided with the cylindrical end-portions 49^a and 49^b which portions may be journalled in the opposite side walls of said lateral extension, and may also be formed or provided with the intermediate and opposed slots or reduced portions 49^c, which provide for the passage of air through the valve member. The amount of air by-passed about the impeller may be regulated by properly adjusting the position of said valve member in said passage 50^b. Said valve member is or may be formed or provided with an enlarged head 49^d; and suitable means, as the spring washer 49^e and the cotter pin 49^f may serve to retain the valve-member yieldingly in adjusted position. The position of said valve-members may be adjusted in any suitable manner as by applying a suitable tool in the slot 49^g in the said head.

As thus arranged, it is apparent that the greater is the quantity of air by-passed about the impeller 32 through said by-pass passage 50^b, the slower is the speed of the impeller, although the quantity and velocity of air discharged from the nozzle 47, may remain substantially constant. In practice, we have found that the quantity and velocity of the air discharged from the nozzle is increased somewhat where the by-pass is opened.

The burner head is adapted, in an operative or firing position, to extend into an aperture in a wall A, as illustrated in Fig. 2, which wall may be a furnace wall, and be withdrawn free from said wall for purposes of inspection, or otherwise.

The burner head is adapted to be supported movably by and above the base 52 and supplied with fuel and air from stationary members carried by said base. For this purpose, said base may be provided with a liquid fuel supply member 53 which member is or may be fixed to said base and provided with a fuel supply pipe 54 by which fuel under suitable pressure may be supplied to said member. Said fuel supply pipe 54 may be provided with a regulating valve 55 of any desirable construction by which the supply of fuel to the burner head may be positively regulated.

A flexible connecting and supporting member is extended between said fuel supply member and the burner head. Said member may include the more or less vertically-extended fuel pipe 61. Said fuel pipe may be provided with a lower lateral extension 61^a which is adapted to be received in a lateral opening in said fuel supply member 53 and have a swivel connection 61^b therewith, whereby to permit said pipe 61 to pivot in a vertical plane about said supply member 53 while maintaining fluid communication therewith. Said swivel connection 61^b may also be provided with suitable means to prevent leakage of liquid fuel between the extension 61^a of said pipe and the stationary supply member 53. The upper end of said pipe 61 may be formed or provided with a second lateral extension 62, which extension is opposed to said lower extension 61^a. Said upper extension is received in and has a swivel connection with the valve casing 12 of the burner head, and is in fluid communication with the interior of said valve casing. Suitable packing means 61^d may be provided to seal the swivel connection against escape of liquid fuel thereat. This arrangement provides means whereby the burner head may be moved into and withdrawn from firing position while maintaining fluid communication with the source of liquid fuel and providing support for the rear portion of the burner head.

When two burner heads are used, as illustrated in Fig. 3, for instance, the second head may be provided with a similar pipe 61 and connected with the stationary fuel supply member through an opening in the other side of said stationary member, as illustrated more particularly in Fig. 5.

For some purposes, means may be provided whereby the fuel may be automatically turned off when the burner head is withdrawn from firing position. For this purpose, the stationary fuel supply member 53ª, which is the equivalent of said member 53, may also constitute a valve member, as illustrated more clearly in Fig. 8 and may have a conical passage 56 therein in which a plug-valve member 57 is received. Said plug valve member 57 may be formed with a passage 58 therein which is adapted to be in communication with the fuel passage 59 of the fixed fuel valve member 53 in a position corresponding with the firing position of the burner head, whereby to admit fuel through said valve passage, and be out of alignment and therefor out of communication therewith in a position corresponding to the retracted position of the burner head, as indicated by the dotted lines, Fig. 9, whereby to cut-off the supply of fuel to the burner head as the burner head is withdrawn from firing position; and automatically turn on the fuel as the burner head is moved toward firing position. Said plug member 57 is or may be provided with a lateral extension 60 in which the fuel pipe 61 is received, and the passage 58 in said plug member is arranged to communicate with the interior of said pipe. Said pipe is extended upwardly toward said burner head and may be connected thereto as above set forth.

Said supporting base 52 is or may be provided also with an air supply member 65 which is fixedly attached thereto. Said member is hollow and is provided with an air pipe 66 which is adapted to extend to a suitable air supply under pressure, as a blower, not shown. Said member is or may be provided with a valve, as the butterfly valve 67, Fig. 4, by which the supply of air to the burner head or heads may be controlled.

Said air supply member 65 preferably is formed or provided with a lateral extension 68 on opposite sides thereof, and end walls 69 in said extensions, which walls are or may be formed with ports or apertures 70 therein. Air is conducted to the burner head by means of a conduit 72, the upper end of which is extended laterally outward and is or may be formed with an annular groove 73 therein in which the neck 39 of the burner head is adapted to be swivelly received and supported. A tie rod 75 may be fixed in a wall 76 of the burner head and extended co-axially in the opening 38 of said neck 39 and loosely through the wall of said conduit 72, whereby to secure said burner head in swivel connection with said conduit. Said burner head may be detached from said conduit by removing the nut 77 with which said tie rod is provided.

The lower end of said conduit 72 is or may be provided with a lateral extension 80 which is adapted to be received and journalled within a lateral extension 68 of the air supply member. Said extension 80 may be provided with a wall 81, which wall is adapted to bear against and ride upon the wall 69 of said air supply member 68. Said wall 81 may be formed or provided with ports or apertures 82, one of which is illustrated in Fig. 4, which ports are adapted to register with the ports 70 of said air supply member in certain positions, and be out of register therewith in other positions, whereby to control the supply of air to the burner head. The arrangement is or may be such that, when the burner head is in firing position, the ports are in register and air may flow freely to the burner head and, when the burner head is in a retracted position, the ports are out of register, thereby cutting off the supply of air to the burner head.

When two burner heads are used, as illustrated in Fig. 4, a tie rod 86 may extend through both conduits 72 and the stationary air supply member 65 whereby to secure said conduits in swivel connection with said air supply member. When but one burner head is attached to the air supply member, one of the conduits 72 may be replaced by a cap 87, as illustrated in Fig. 7, and the rod may pass through the remaining conduit and said cap, whereby to secure both to the air supply member.

Preferably the swivel connections between said fuel conduit 61 and air conduit 72 with their cooperating fixed members and burner head are in parallel planes, whereby the burner head may be moved horizontally between firing and retracted positions. One of said conduits 72 may be provided with spaced projections 90 at the lower end thereof, which projections are or may be arranged to engage a fixed projection 91 of said base 52, whereby to define the retracted and firing positions of the burner head.

The conduit 72 may also be provided with a pivoted latch 92 which is adapted to extend over the neck 39 of the burner head and engage with a projection 93 thereof whereby to restrain said burner head in firing position.

As shown in Fig. 2, the fuel supply pipe may be provided with a valve 55 adjacent the supporting base, and said valve and the air supply valve 67 may be interconnected by the valve levers 55ª and 67ª and the connecting link 94 whereby both valves may be actuated conjointly.

Preferably means for heating the fuel are provided and said means may comprise an electric heating unit 98, which unit may be inserted in a fuel supply pipe 61 adjacent a burner head as illustrated in detail in Fig. 5.

The invention may be otherwise modified without departing from the spirit thereof.

We claim:

1. A liquid fuel burner comprising a casing having fuel-vaporizing means, means to supply fuel to said means, and means to move said casing into and away from firing position in approximately parallel lines including an approximately vertically extended air conduit disposed mainly beneath and at one side of said casing and having a pivotal support at its lower end and having a horizontal extension at its upper end which has a lateral pivotal connection with said casing, which connection is in approximately air tight communication with said casing in any position thereof.

2. A liquid fuel burner comprising a supporting base, a casing disposed above said base and having fuel-vaporizing means, and means to support said casing above said base for movement toward and away from a firing position while maintaining an approximately horizontal position of said casing, said means including an approximately vertically-extended air conduit which is disposed mainly beneath and at one side of said casing, said air conduit having a pivotal connection at its lower end and having a lateral and horizontal extension at its upper end, which extension is directed toward said casing and has a swivel connection therewith and is in free communication with the interior of said casing, and a guide-member disposed in parallel relation with said air conduit and having pivotal connection both with said casing and said base.

3. A liquid fuel burner having a vaporizing casing movable into and out of firing position, a stationary supporting base including an air-supply box disposed beneath and on one side of the vertical plane including said casing, and supporting means connecting said casing and base including an air conduit having at its lower end and on one side thereof a horizontal pivotal connection with said box and having at its upper end and on the other side thereof a horizontal pivotal connection with said casing, and a guide member cooperating with said air conduit to guide said vaporizing casing for movement in approximately parallel lines into and out of firing position, said guide member being approximately parallel and in line with said air conduit, whereby the space immediately below said casing is free and unobstructed.

4. A liquid fuel burner including a stationary air supply member having an air inlet opening and two opposed air outlet openings, two air conduits each independently pivoted to said supply member in alignment with an outlet opening therein, said conduits extended upwardly above said supply member, a casing pivoted to and supported by each conduit, said casings each having fuel vaporizing means, and means including said air conduits arranged to guide said casings for independent movement toward and away from firing position.

5. A liquid fuel burner including a stationary air supply member having an air inlet opening and two opposed air outlet openings, two air conduits each independently pivoted to said supply member in alignment with an outlet opening therein, said conduits extended upwardly above said supply member, a casing pivoted to and supported by each conduit, said casings each having fuel vaporizing means, and means including said air conduits arranged to guide said casings for independent movement toward and away from firing position, and means arranged to shut-off the supply of air to each casing when withdrawn from firing position.

6. A liquid fuel burner including a stationary air supply member having an air inlet opening and two opposed air outlet openings, two vertically-extended air conduits each independently pivoted to said supply member in alignment with an outlet opening therein, said conduits and air supply member having cooperating components providing air registers each of which is arranged to shut off and admit air to its conduit, a casing pivoted to and supported by the upper end of each conduit, fuel vaporizing means contained in said casings, and means including said air conduits arranged to guide said casings for independent movement in parallel lines.

7. A liquid fuel burner including a casing having a liquid fuel vaporizer, and an air nozzle disposed in proximity to said vaporizer, a supporting base, means to support said casing for approximately horizontal movement above said base into and out of firing position, said means including two parallel supporting members pivotally connected with said base and said casing, means to restrict the movement of said casing in both directions about said base and means releasingly to lock said casing in firing position, including a latch pivoted to one of said supporting members and arranged to engage an abutment of said casing.

8. In a liquid fuel burner, the combination with an enclosing casing and a rotatable atomizing cup, of a hollow hub which carries the cup at one end, and supporting means for the hub comprising spaced ball bearings, one of which is disposed on the

outside of the hub and near the cup, and the other of which is disposed within the hub and remote from the cup.

9. A liquid fuel burner including a casing having an approximately closed rear compartment adapted to contain a supply of lubricant, an intermediate air compartment and an air nozzle arranged at the forward end of the casing and a communication with said air compartment, a tubular hub extended through said rear compartment and into said air compartment and journalled in said casing within said rear compartment, an oil ring riding on said hub within said rear compartment and dipping into the lubricant therein, an impeller disposed within said air compartment and fixed to said hub and arranged to be rotated by air passed through said air compartment to said nozzle, a vaporizing cup disposed within said nozzle and fixed to said hub, whereby to be driven by said air impeller, said cup having an open bottom and a fuel conduit fixed to said casing and extended through said hub into said cup and arranged in communication with said cup.

10. A liquid fuel burner including a casing having a rear compartment formed with rear and forward walls, said forward wall formed with an aperture therethrough, an intermediate air compartment and an air nozzle arranged at the forward end of the casing and in communication with said air compartment, a stud-shaft fixed to the rear wall of said rear compartment and extended through the aperture in the forward wall of said compartment into said air compartment, a hub arranged on said stud-shaft within said rear and air compartments and having an internally disposed bearing rotatable on said stud-shaft adjacent the rear wall of said rear compartment and a second and externally disposed bearing rotatable on the forward wall of said rear compartment, an air impeller disposed within said air compartment and fixed to said hub, and a vaporizing cup disposed within said nozzle and fixed to said hub, said stud-shaft having a fuel passage therethrough arranged in communication with the interior of said cup.

11. A liquid fuel burner having a rotatable atomizer, means to admit liquid fuel to said rotatable atomizer and means to rotate said atomizer including a casing and an air impeller disposed within said casing and arranged in driving relation with said atomizer, said impeller having a plurality of vanes extended inwardly from the periphery thereof, and said casing and impeller constructed and arranged to pass air from the periphery inwardly through said impeller, whereby to cause said impeller to rotate.

12. A liquid fuel burner having a rotatable vaporizer, means to introduce fuel to said vaporizer, and means to rotate said vaporizer including a casing, and an air impeller disposed within said casing and arranged in driving relation with said atomizer, said impeller having means to guide air approximately radially through it from said casing, whereby to be rotated by the air.

13. A liquid fuel burner having a rotatable vaporizer, means to introduce fuel to said vaporizer, and means to rotate said vaporizer including a casing, and an air impeller disposed within said casing and arranged in driving relation with said atomizer, said impeller having a peripheral inlet and an outlet disposed within its periphery, and said casing and impeller constructed and arranged to pass air from said casing into the inlet and out of the outlet of said impeller in a direction to rotate said impeller.

14. A liquid fuel burner having a rotatable vaporizer, means to introduce fuel to said vaporizer, and means to rotate said vaporizer including a casing, and an air impeller disposed within said casing and arranged in driving relation with said atomizer, said impeller having approximately radial blades formed with inner discharge lips inclined away from the direction of rotation of the impeller and said casing and impeller constructed and arranged to pass air from said casing inwardly from the periphery of said impeller and discharge it between the inclined lips of said blades, whereby to cause the impeller to rotate.

15. A liquid fuel burner comprising a casing, an atomizing cup rotatably mounted therein, an air nozzle carried by said casing and surrounding said atomizing cup, means for conducting fuel to the interior of said atomizing cup, an air-actuated rotor discharging into said air nozzle and arranged to drive said atomizing cup, said rotor having approximately radial vanes, means for conducting air to flow to said rotor spirally inwards along said vanes substantially in a plane perpendicular to the axis of rotation of said rotor.

16. In a liquid fuel burner, the combination with an enclosing casing, and a rotatable atomizing cup, of a hollow hub carrying said cup at one end, and supporting means for said hub comprising spaced ball bearings carried by said casing, one of which surrounds said hub adjacent said cup and the other of which is disposed within said hub remote from said cup.

17. A liquid fuel burner having a rotatable fuel-atomizing member, an air motor driving said atomizing member, a casing enclosing said air motor and having a restricted outlet arranged to direct air from said air motor into the atomized fuel, means to supply air to said casing and air motor, and means to by-pass air about said air mo-

tor and to introduce the by-passed air into said casing between the outlet of said air motor and said fuel-atomizing member.

18. A liquid fuel burner having a rotatable fuel-atomizing member, an air motor driving said atomizing member, a casing enclosing said air motor and having a restricted outlet arranged to direct air from said air motor into the atomized fuel, means to supply air to said casing and air motor, and means to by-pass air about said air motor and to introduce the by-passed air into said casing between the outlet of said air motor and said fuel-atomizing member and means to vary the volume of by-passed air.

19. A liquid fuel burner including a rotatable vaporizing cup, an air nozzle closely surrounding said cup and having a restricted air outlet, a turbine for driving said cup having radially-disposed vanes and exhausting into said nozzle, air directing means arranged to direct pressure air against said vanes, and means to admit pressure air directly into the exhaust air from said turbine and between said turbine and the restricted nozzle-outlet.

20. A liquid fuel burner including a casing having an air inlet and a nozzle having a restricted air outlet, a fuel-atomizing cup rotatable in said nozzle, a cup-driving air motor disposed within said casing between said air inlet and nozzle and arranged to drive said cup having an unvariable air connection with said air inlet, said casing having an air by-pass passage extended directly from the air inlet to and opening into said nozzle and excluding said air motor and a valve in said by-pass passage, said by-pass passage and valve comprising means to vary the back-pressure in said nozzle, whereby to vary the speed of said air motor.

21. A liquid fuel burner comprising a casing, a fuel-atomizing cup disposed within and supported rotatably by said casing, means for conducting liquid fuel to the interior of said atomizing cup, regulating means for said fuel, an air actuated rotor having vanes and arranged to discharge into said air nozzle and drive said atomizing cup, means for directing air against the vanes of said rotor at a relatively high velocity, thereby to cause it to rotate, an air conduit for supplying air to said air directing means at a relatively low velocity, the communication between said air motor and air conduit having fixed dimensions, a bypass conduit extended from said air conduit directly to said nozzle behind the rotor exhaust whereby air is conducted into said nozzle without passing through said air directing means and said rotor, air regulating means in said conduit whereby the amount of air admitted to said rotor and said by-pass is controlled, and air regulating means in said by-pass conduit whereby the air passing therethrough may be independently controlled.

22. A liquid fuel burner including a casing containing a vaporizing cup and an air motor for driving said cup, said casing also having a bearing-compartment which is isolated from said cup and air-motor, a tubular shaft fixed to said air motor and extended rotatably into said bearing-compartment, and spaced ball bearings for said tubular shaft contained in said bearing-compartment including an external ball bearing disposed on said shaft adjacent said air motor and a ball bearing disposed within said shaft at the end thereof.

In testimony whereof, we have signed our names to this specification.

CHRISTOPHER A. SCHELLENS.
ARTHUR T. TROWBRIDGE.