April 8, 1924. 1,490,008

F. K. HETSCH

BURNER FOR LIQUID FUEL

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Fig. 1.

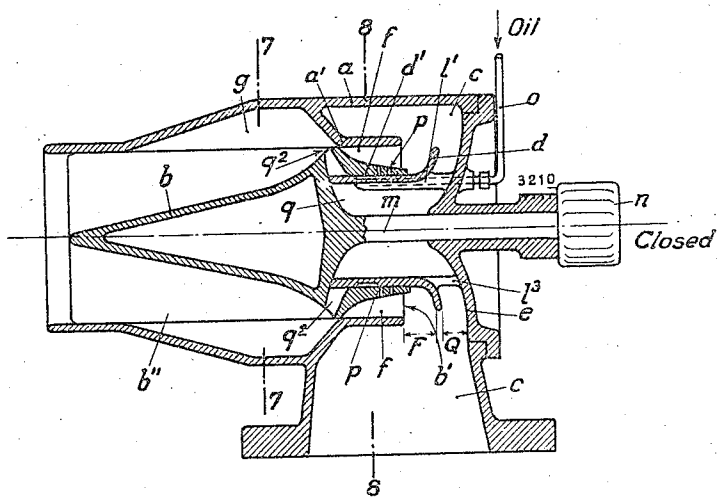
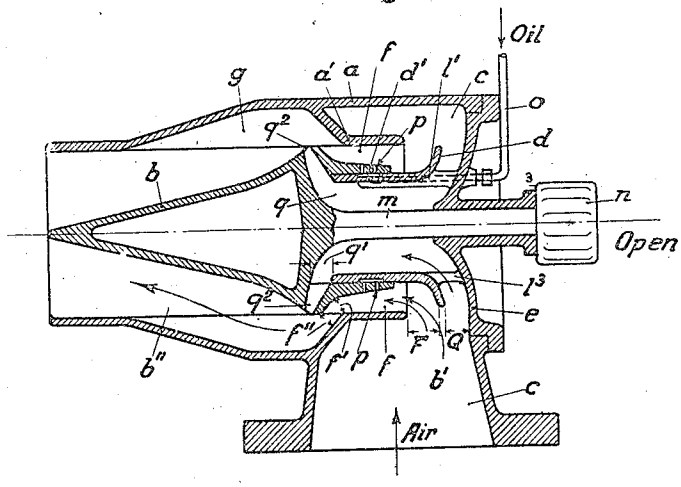


Fig. 1a.



Witnesses:

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By Fr. Hetsch

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April 8, 1924. 1,490,008

F. K. HETSCH

BURNER FOR LIQUID FUEL

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Fig.2.

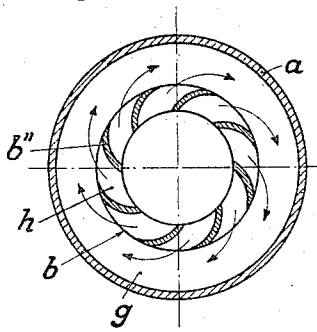


Fig.3.

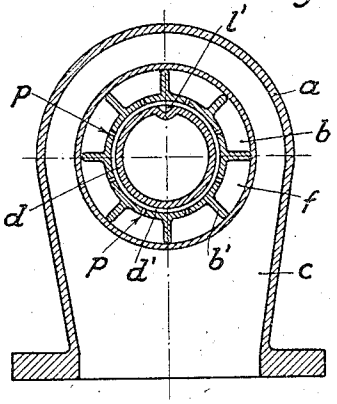
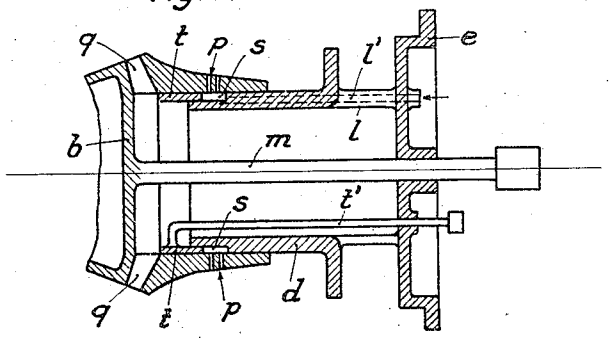


Fig.4.



Witnesses:

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BURNER FOR LIQUID FUEL

Filed Aug. 2, 1920 5 Sheets-Sheet 3

Fig. 5.

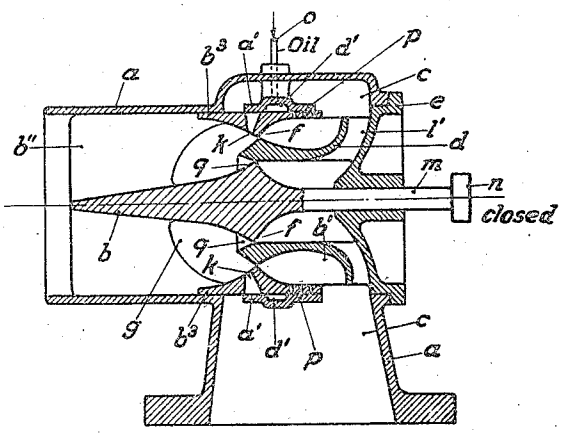
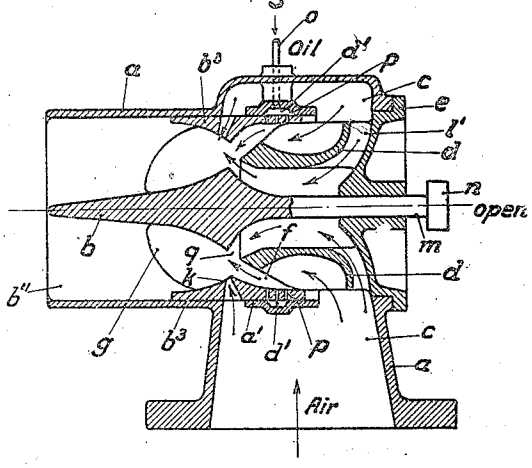


Fig. 5a.



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April 8, 1924. 1,490,008

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BURNER FOR LIQUID FUEL

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Fig. 6.

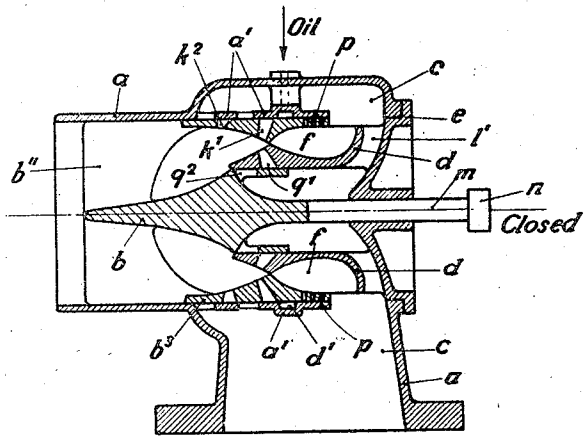
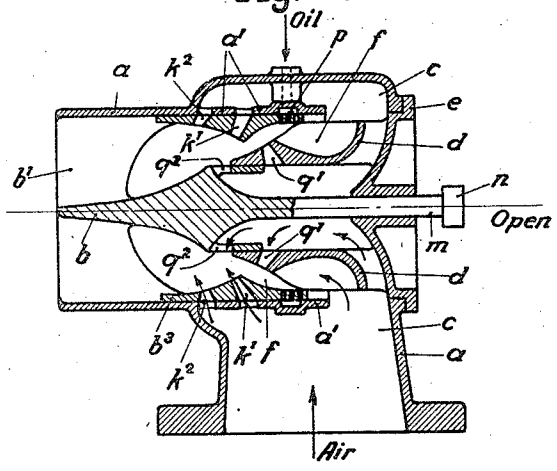


Fig. 6a.



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April 8, 1924. 1,490,008

F. K. HETSCH

BURNER FOR LIQUID FUEL

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Fig. 7.

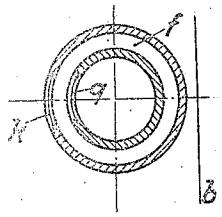


Fig. 8.

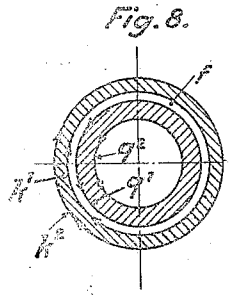
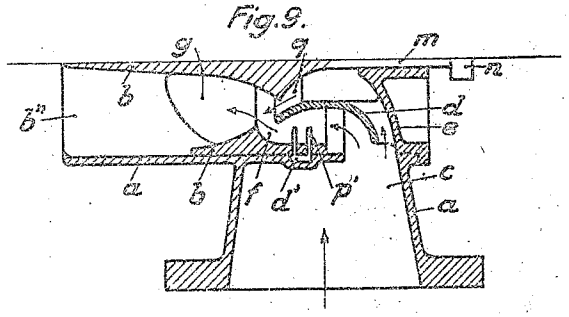


Fig. 9.



Witnesses:

Inventor:

Patented Apr. 8, 1924. 1,490,008

UNITED STATES PATENT OFFICE.

FRANZ KARL HETSCH, OF MANNHEIM, GERMANY.

BURNER FOR LIQUID FUEL.

Application filed August 2, 1920. Serial No. 400,884.

(GRANTED UNDER THE PROVISIONS OF THE ACT OF MARCH 3, 1921, 41 STAT. L., 1313.)

To all whom it may concern:

Be it known that I, FRANZ KARL HETSCH, a citizen of the Free State of Czechoslovakia, residing at Mannheim, Germany, have invented certain new and useful Improvements in Burners for Liquid Fuel (Germany, 9th April, 1919, Patent No. 343,716, Nov. 7, 1921; Czechoslovakia, 26th June, 1920; France, 28th June, 1920; Italy, 29th June, 1920; Sweden, 29th June, 1920; Belgium, 29th June, 1920; England, 2nd July, 1920; Poland, 2nd July, 1920; Spain, 14th July, 1920; Denmark, 29th July, 1920; Switzerland, 5th August, 1920; Rumania, 27th November, 1920; in the Netherlands, 19th March, 1921; Japan, 27th May, 1921), of which the following is a specification.

This invention relates to a burner for liquid fuel with annular mixing chamber arranged in the burner-casing. The invention consists therein that in such a burner a regulating piece is inserted centrally with regard to the casing and surrounded by the mixing chamber, said regulating piece being conical at both ends and having channels or passages upon its conical ends which are curved in opposite directions one set with regard to the other set, a sleeve being fixed in the casing at the rear end of the regulating piece so that said regulating piece in combination with said fixed sleeve can regulate the cross section of the passages for air and fuel through the displacement of said cone in axial direction. The special construction of the burner with adjustable regulating cone permits of an easy supply of fuel. The overflow channels or passages for the air can further be formed so that the cross sections gradually vary in the direction in which the air moves, said sections being large enough to reduce the loss from pressure within the burner as much as possible. There can further be arranged in the regulating cone respectively in the casing in which the same is located, passages for auxiliary air which can be suitably regulated and in which gyrating air currents are produced between which the jet of air and liquid fuel mixture proper is enclosed, whereby the adhering of oil particles upon the wall of the burner is prevented and a thorough spraying of the liquid fuel is effected. This is particularly important if heavy oils are used. The ratio of mixture of oil and air can be properly regulated so that complete combustion is ensured for any fuel, the regulation being effected through the proper construction of the fixed sleeve and of the passages which can be regulated.

The improved burner is particularly adapted for heavy oils, as the fuel is already admixed with air when it is admitted to the mixing chamber, eddies being formed in the mixture in said mixing chamber through oppositely directed air currents before the mixture finally flows through spiral-shaped channels to the orifice of the burner from which it escapes in a perfectly sprayed state.

In the accompanying drawings the invention is shown by way of example in several forms of construction.

Figs. 1 and 1ª show the first form of construction of the burner in longitudinal section, the regulating cone being shown in each figure in another position.

Fig. 2 is a section on line 7—7 of Fig. 1.

Fig. 3 is a section on line 8—8 of Fig. 1.

Fig. 4 shows another form of construction of the fixed sleeve.

Figs. 5, 5ª and 6, 6ª represent two modified forms of construction of the burner in longitudinal section similar to Figs. 1 and 1ª.

Figs. 7 and 8 illustrate diagrammatically the corresponding air currents.

Fig. 9 shows a fourth form of construction of the burner with adjustable air nozzles adapted to be displaced in axial direction and with separate oil supply.

In the form of construction shown in Figs. 1 to 3 the burner is composed of a mixing chamber formed by the casing *a* and by the regulating cone *b* and of a sleeve *d* for regulating the admission of air and liquid fuel. The sleeve *d* is fixed to the cover *c* by means of ribs *l*. The regulating cone *b* consists of a hollow body which is cone-shaped at the end turned towards the orifice of the burner and at its rear part. The largest diameter of the regulating cone *b* is situated at the part *a'* of the wall of the casing. The hollow body *b* has longitudinal ribs *b'* upon the rear part and *b''* upon the front part, in front of and behind the largest diameter,

the outer edges of said ribs being in contact with the inner surface of the wall of the casing *a*. Channels *f*, formed by the ribs *b'* serve for connecting the air chamber *c* with the mixing chamber *g*, said channels standing obliquely with regard to the axis of the burner, being almost spiral-shaped. The bottom of these channels *f* rises towards the mixing chamber *g'*. Channels *h* are formed by the ribs or partitions *b''* said channels *h* being curved in a direction contrary to the direction of curvature of channels *f*.

In the rear end of the casing *a* a sleeve *d* is fixed by means of ribs l^3. The regulating cone *b* is arranged in such a manner that it can be displaced upon the sleeve *d* and in the casing *a*, the displacement in axial direction being effected by means of the spindle *m* guided in the cover *e* and of the nut *n*. According to the position of the cone *b* more or less perforations *p* of said cone will communicate with the annular groove *d'* of the sleeve *d*, said groove being connected with the burner conduit *o* through a boring *l'*.

If the regulating cone *b* is in the position shown at the upper half of Fig. 1 the oil passages *p* and the air passages *f* and *q* communicating with the mixing chamber *g* are obturated. If the regulating cone *b* is brought into the position shown at the lower half of Fig. 1, all the oil passages are connected with the annular groove *d'*, and the air passages *f* and *q* are uncovered completely so that air for the mixture is admitted through the passages *f*, air for spraying the liquid fuel being blown in through the passages *q*. This position corresponds with the full working of the burner.

For intermediary positions the orifices of the oil and air-passages are released in such a proportion that, at all positions of the regulating cone *b*, distribution of the fuel and air mixture is regulated automatically through the position of the regulating cone *b* with regard to the fixed sleeve *d* so that only such a quantity is supplied to the burner which can be always burned completely.

In the burner of this form of construction the openings of the passages at *f'* and *q'* can always be exactly regulated according to the degree of loading of the burner, the passage from F to *f''* and from Q to *q''* being effected so uniformly that loss from pressure within the burner is absolutely avoided, great velocities of the air happening only at such parts where they are required for the obtention of a perfect spraying. A perfect spraying is thus ensured also with any degree of load upon the burner even with a lesser wind pressure than would be necessary otherwise.

Fig. 4 shows another form of construction of the burner according to which the annular groove *s* of the fixed sleeve which is open at one side, is closed by a ring *t* adapted to be adjusted by means of the spindle *t'*, the width of the free annular groove *s* and consequently the supply of fuel and further the position of the extreme edge of the ring *t* and consequently the admission of air being thereby regulated according to the properties of the fuel respectively to the air pressure.

As shown in Fig. 5 the regulating cone can further be composed of an inner conical body *b* and of an annular outer body b^3, connected the one with the other through ribs *b''*, said two bodies forming between them an annular gap which can be enlarged or reduced by means of the fixed sleeve *d*. There is further arranged, besides the air-fuel passage *f* and the passage *q* for the spraying air, an auxiliary spraying channel *k* so that in all three air currents are provided. The air current *f*, which is divided into several currents by means of the ribs *b'* (cfr. Fig. 3) draws the fuel along which is admitted through the perforations *p*, to arrive in the enlarged spraying chamber *g* as a mixture of oil and air after it has flown through the nozzle *f* where the highest air speed is attained. The passages for the air currents *q* and *k* are arranged tangentially so that the air currents are made to rotate to strike upon the mixture of fuel and air which is coming out of the channels *f*, with the greatest velocity from the inside as well as from the outside, after they have left the nozzle-shaped orifices. The mixture is thus completely enclosed by gyrating air currents whereby the adhering of oil particles upon the walls of the burner is prevented. The passages *q* and *k* are arranged in such a manner that the one air current rotates to the left the other air current rotating to the right (Fig. 6). The mixture located between the air currents which gyrate in opposite directions and carried by the same is therefore thoroughly sprayed.

If the current of oil and air is also made to gyrate, which can be obtained through making the ribs *b''* spiral-shaped instead of straight, the two currents of spraying air can be made either not to gyrate at all or in a direction opposite to the direction in which the mixture gyrates.

Fig. 7 shows a burner of similar construction, in which however the increased spraying effect is obtained through baffling repeatedly the oil and air mixture which comes out of the passage *f* through being struck from the inside and from the outside by spraying air which flows out of the adjustable passages q^1 and q^2 respectively k^1 and k^2. Fig. 8 illustrates diagrammatically how the air currents flow, the air from the passages q^1 *and* q^2 rotating in one direction and the air coming from passages k^1 and k^2 rotating in the opposite direction, the fuel and air mixture flowing between said air currents.

The burners of improved construction as hereinbefore described are particularly adapted for heavy oils as the most perfect spraying is ensured the oil and air mixture being carried within the spraying air so that it does not come in contact with the walls.

A similarly good spraying effect can be obtained without gyrating air currents if the adjustable nozzles are arranged so that they alternate in axial direction as shown for example in Fig. 9. In this case it is advisable to conduct the fuel by means of small tubes p' to about the middle of the air current f so that the oil drops which get out of the tubes are surrounded on all sides by air, the one air current having thus the effect of two air currents, the air coming not in contact with the walls.

A further increased spraying effect is obtained where the fuel flows out of nozzle f, the current q of spraying air flowing along the orifice of the nozzle at an acute angle so that the oil is thoroughly diffused within the burner in the various air currents which strike the one upon the other and which penetrate into one another, the fuel being hereafter conducted to the mouth of the nozzle at a combustible state. This arrangement has the advantage of the least inner resistance respectively of the least expense of energy for spraying.

In the apparatus constructed as shown in Figs. 5, 6 and 9 the nozzles q, f, k, as well as the oil passages p are also regulated through displacement of the regulating cone b. The regulating of the cross section of the nozzles f and q of the regulating cone being however effected through the cooperation with the distributor d fixed to the cover e, the regulation of the cross section of k and of the passages p for the fuel being effected through the cooperation with a valve face a' arranged in the casing a. The fuel supply is thus also simplified, as the oil conduit o can be made to communicate directly with the circular groove d' arranged in the valve face a'. The middle part of the burner is further free to be used for the air passages so that the passage from one cross section to the other can be made gradual in all the air passages, the highest velocities being used only at the points where they are necessary to ensure a good spraying effect. As further an almost rectilineal direction of the main current is obtained through making the nozzles f, k and q slightly conical, only a very small inner loss of pressure will occur with this burner.

I claim:—

1. An improved burner for liquid fuel comprising in combination with the burner casing an inwardly projecting rearwardly bent partition in said casing, having an air inlet in its rear part and forming an annular air chamber at the rear end of said casing separated from the mixing chamber formed in the front part of the casing, a bottom plate closing the rear end of the casing, a forwardly projecting hollow body fixed upon said bottom plate having air inlets at its rear end and an annular groove for fuel in the outer surface at its front end, a fuel supply pipe terminating in said annular groove, a regulating cone upon the front end of said hollow body, a shaft of said regulating cone guided in said bottom plate of the casing and axially arranged in said hollow body so that an inner annular air channel is formed between said shaft, the rear end of said regulating cone and the inner surface of said hollow body, a rearwardly projecting sleeve-like extension of said regulating cone tightly enclosing said hollow body having outlet openings for the fuel adapted to be brought in communication with said fuel groove of the hollow body and air outlets at the front end so that said inner annular air channel gets narrower towards said air outlets, an outer annular air channel getting narrower towards the front end being formed between the outer surface of said sleeve like extension of the regulating cone and said partition of the casing, ribs projecting from the outer surface of said regulating cone forming channels which connect said annular air channels with said inner chamber and means for adjusting the regulating cone in axial direction with regard to said hollow body and for regulating simultaneously the quantity of air and fuel supplied to the mixing chamber.

2. An improved burner for liquid fuel comprising in combination with the burner casing having an air inlet at its rear part and forming an annular air chamber in its rear and a mixing chamber in its front part, a ring in said annular chamber forming on its inner surface a fuel distributing groove, a fuel supply tube connected with said fuel distributing groove, a bottom plate closing the rear end of said casing, a forwardly projecting hollow body fixed upon said bottom plate, a regulating cone in said hollow body so that its pointed front end projects from said hollow body, a shaft of said regulating cone guided in said bottom plate of the casing and axially arranged in said hollow body so that an inner annular air channel is formed between said shaft, the rear end of said regulating cone and the inner surface of said hollow body, said air channel getting narrower towards the front end, an outer sleeve like part of said regulating cone having outlet openings for the fuel in its rear end adapted to be brought in communication with said fuel distributing groove of the casing, an inwardly projecting thickened part of said sleeve like part forming at its rear part an outer annu-

lar air channel together with the outer surface of said hollow body and having air holes in its front part situated in front of said hollow body, ribs connecting said sleeve like part with said regulating cone and forming channels which connect the annular air chambers with the mixing chamber and means for adjusting the regulating cone in axial direction with regard to the hollow body for opening the inner and outer annular air channels and for regulating simultaneously the quantity of air and fuel supplied to the mixing chamber.

3. An improved burner for liquid fuel comprising in combination with the burner casing having an air inlet at its rear part and forming an annular air chamber in its rear and a mixing chamber in its front part, a ring in said annular chamber forming on its inner surface a fuel distributing groove, a fuel supply to be connected with said fuel distributing groove, a bottom plate closing the rear end of said casing, a forwardly projecting hollow body fixed upon said bottom plate, a regulating cone in said hollow body so that its pointed front end projects from said hollow body, a shaft of said regulating cone guided in said bottom plate of the casing and axially arranged in said hollow body so that an inner annular air channel is formed between said shaft, the rear end of said regulating cone and the inner surface of said hollow body, said air channel getting narrower towards the front end, an outer sleeve like part of said regulating cone having outlet openings for the fuel in its rear end adapted to be brought in communication with said fuel distributing groove of the casing, an inwardly projecting thickened part of said sleeve like part forming at its rear part an outer annular air channel together with the outer surface of said hollow body and having air holes in its front part situated in front of said hollow body, ribs connecting said sleeve like part with said regulating cone and forming channels which connect the annular air chambers with the mixing chamber which conduct the air arriving from the annular air chamber of the casing through the air hole of the said sleeve-like part of the regulating cone upon the current of air and fuel coming from said outer annular air channel in a direction opposite to the direction of the air coming from the inner annular air chamber, and means for adjusting the regulating cone in axial direction with regard to the hollow body for opening the inner and outer annular air channels and for regulating simultaneously the quantity of air and fuel supplied to the mixing chamber.

4. An improved burner for liquid fuel comprising in combination with the burner casing having an air inlet at its rear part and forming an annular air chamber in its rear and a mixing chamber in its front part, a ring in said annular chamber forming on its inner surface a fuel distributing groove and having an air outlet in front of said groove, a fuel supply tube connected with said fuel distributing groove, a bottom plate closing the rear end of said casing, a forwardly projecting hollow body fixed upon said bottom plate having an air outlet near its front end and a thickened part upon the outer surface, a regulating cone upon the front end of said hollow body, a shaft of said regulating cone guided in said bottom plate of the casing and axially arranged in said hollow body so that an inner annular air channel is formed between said shaft, the rear end of said regulating cone and the inner surface of said hollow body, a rearwardly projecting cylindrical extension of said regulating cone having air holes at its front end adapted to register with said air outlet of said hollow body, an outer sleeve like part of said regulating cone having outlet openings for the fuel in its rear end adapted to be brought in communication with said fuel distributing groove of the casing, an inwardly projecting thickened part of said sleeve like part forming at its rear part an outer annular air channel together with the outer surface of said hollow body and having two ranges of air holes in its front part situated in front of said hollow body, ribs connecting said sleeve like part with said regulating cone and forming channels which connect the annular air chambers with the mixing chamber which conduct the air arriving from the annular air chamber of the casing through the air hole of the said sleeve like part of the regulating cone upon the current of air and fuel coming from said outer annular air channel in a direction opposite to the direction of the air coming from the inner annular air chamber, and means for adjusting the regulating cone in axial direction with regard to the hollow body for opening the inner and outer annular air channels and for regulating simultaneously the quantity of air and fuel supplied to the mixing chamber.

5. An improved burner for liquid fuel comprising in combination with the burner casing an inwardly projecting rearwardly bent partition in said casing, having an air inlet in its rear part and forming an annular air chamber at the rear end of said casing separated from the mixing chamber formed in the front part of the casing, a bottom plate closing the rear end of the casing, a forwardly projecting hollow body fixed upon said bottom plate having air inlets at its rear end, a regulating cone upon the front end of said hollow body, a shaft of said regulating cone guided on said bottom plate of the casing and axially arranged

in said hollow body so that an inner annular air channel is formed between said shaft, the rear end of said regulating cone and the inner surface of said hollow body, a rearwardly projecting sleeve like extension of said regulating cone tightly enclosing said hollow body having air outlets at the front end so that said inner annular air channel gets narrower towards said air outlets, an outer annular air channel getting narrower towards the front end being formed between the outer surface of said sleeve like extension of the regulating cone and said partition of the casing, tubes with narrow orifices coming from a fuel reservoir and terminating in the middle of said outer annular air channel so that the fuel is admixed with the air in a nongyrating hollow cylindrical air current and the air and fuel mixture when flowing out of said outer annular air channel into the mixing chamber is struck at an acute angle by a non-gyrating hollow cylindrical air current flowing out of said air holes at the front end of said sleeve-like extension of the regulating cone, ribs projecting from the outer surface of said regulating cone forming channels which connect said annular air channels with said inner chamber and means for adjusting the regulating cone in axial direction with regard to said hollow body and for regulating simultaneously the quantity of air and fuel supplied to the mixing chamber.

6. An improved burner for liquid fuel comprising in combination with the burner casing having an air inlet at its rear part and forming an annular air chamber in its rear and a mixing chamber in its front part, a ring in said annular chamber forming on its inner surface a fuel distributing groove and having an air outlet in front of said groove, a fuel supply tube connected with said fuel distributing groove, a bottom plate closing the rear end of said casing, a forwardly projecting hollow body fixed upon said bottom plate having an air outlet near its front end and a thickened part upon the outer surface, a regulating cone upon the front end of said hollow body, a shaft of said regulating cone guided in said bottom plate of the casing and axially arranged in said hollow body so that an inner annular air channel is formed between said shaft, the rear end of said regulating cone and the inner surface of said hollow body, a rearwardly projecting cylindrical extension of said regulating cone having air holes at its front end adapted to register with said air outlet of said hollow body, an outer sleeve like part of said regulating cone having outlet openings for the fuel in its rear end adapted to be brought in communication with said fuel distributing groove of the casing, an inwardly projecting thickened part of said sleeve like part forming at its rear part an outer annular air channel together with the outer surface of said hollow body and having two ranges of air holes in its front part situated in front of said hollow body, ribs connecting said sleeve like part with said regulating cone and forming channels which connect the annular air chambers with the mixing chamber which conduct the air arriving from the annular air chamber of the casing through the air hole of the said sleeve like part of the regulating cone upon the current of air and fuel coming from said outer annular air channel in a direction opposite to the direction of the air coming from the inner annular air chamber, and means for adjusting the regulating cone in axial direction with regard to the hollow body for opening the inner and outer annular air channels and for regulating simultaneously the quantity of air and fuel supplied to the mixing chamber, the controlled air outlets from the three annular air channels being situated at all positions of the regulating cone with regard to the direction of flow immediately behind the fuel outlets, the flows in the three controlled air outlets being directed slightly conical towards the axis of the burner.

In testimony whereof I affix my signature in presence of two witnesses.

FRANZ KARL HETSCH.

Witnesses:
HANS TH. MYER,
TUNI KAST.