Nov. 11, 1930. F. LILGE 1,781,236

WHIRL BURNER

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Fig. 1.

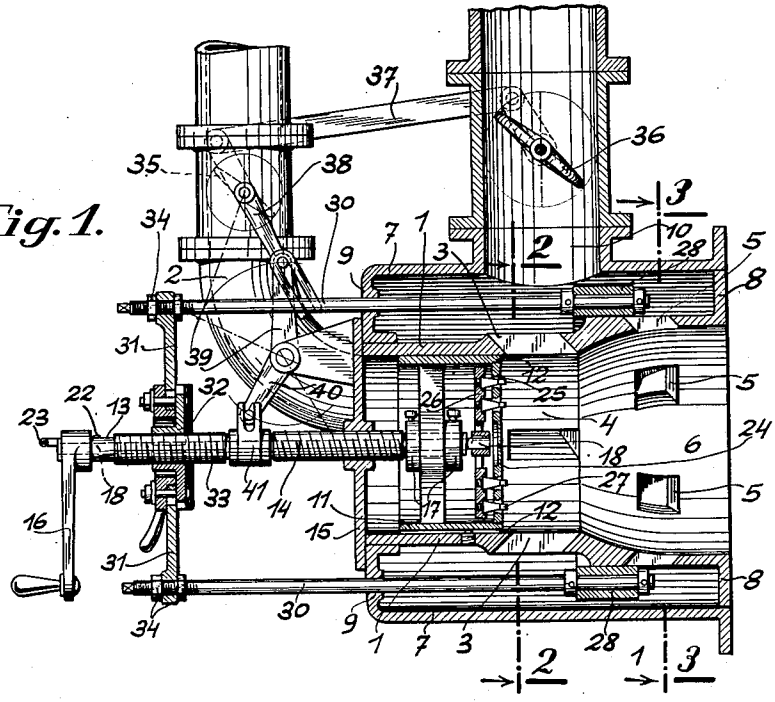

Fig2.

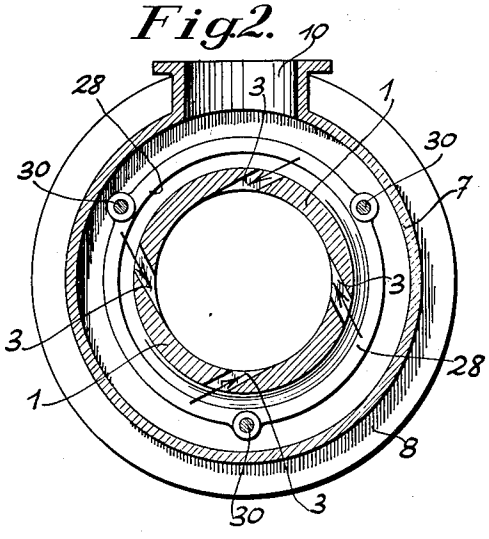

Fig.3.

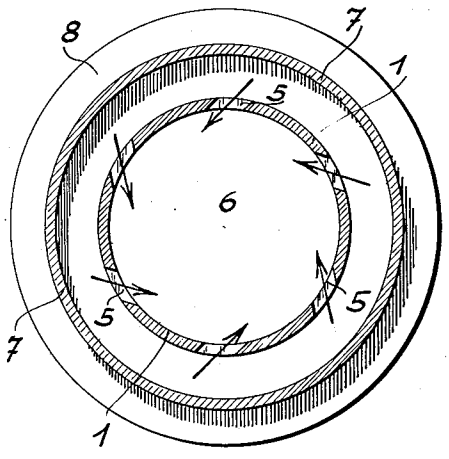

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Fig. 4.

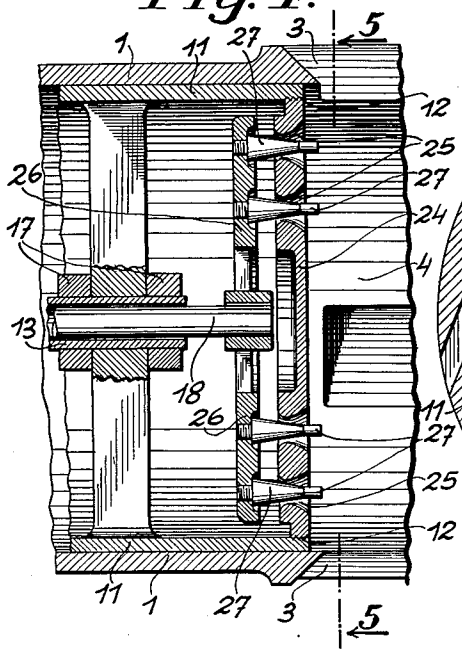


Fig. 5.

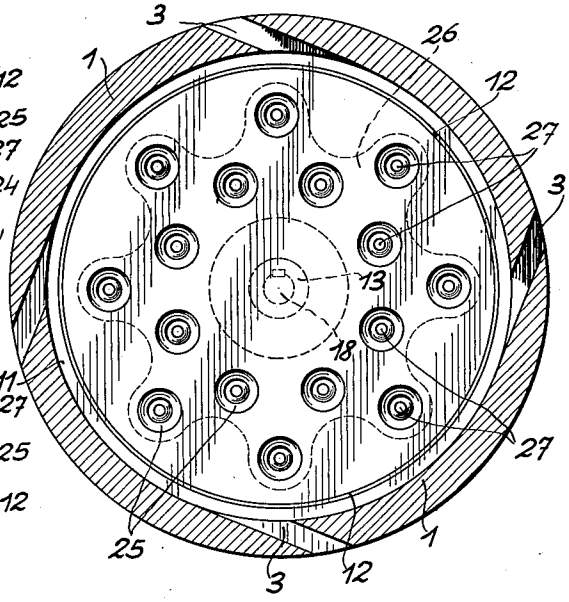
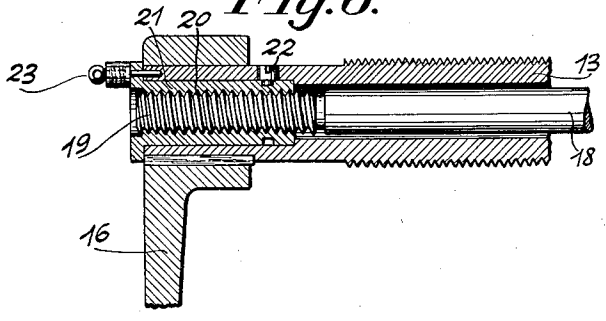


Fig. 6.



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UNITED STATES PATENT OFFICE

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WHIRL BURNER

Application filed July 25, 1928, Serial No. 295,237, and in Czechoslovakia April 23, 1928.

This invention has reference to burners for the combustion of gaseous fuel by means of air in which both of these agents are admitted to the device under pressure and it is particularly intended to provide means of more accurately adjusting the relative amounts of these two agents and the rate of admission thereof and to generally facilitate the manipulation and the construction of devices of the kind referred to. In burning and heating means of this general description and as disclosed by the previous art, various regulating and controlling means have been suggested for the regulation of the relative amounts of gaseous fuel and air, so as to adapt them to the output and the efficiency of the burner, but with all these regulating and controlling devices there was the difficulty that the rates of flow at which the gaseous fuel and the air or oxygen were caused to meet each other, where incorrectly acted upon by the regulating and controlling means themselves, and in particular in such a manner that the rates of flow of the two agents were reduced in proportion with the reduction of the amounts of gaseous fuel and air. This was due to the fact that in the gas burners or the like heretofore known the regulating and controlling means for the flowing passages of the two agents were situated at such a distance from the meeting point of the two agents that the rates of flow produced by the regulating means in the controlled cross sections of the passages were again obliterated upon a reduction of the consumption, as became noticeable in the ports or passages leading off from such regulating and controlling members, inasmuch as these passages were of course dimensioned for the largest amounts of these agents to be employed and were of constant unchanging cross-section. In view thereof the gaseous fuel and air in spite of the controlling means were caused to meet each other only at such velocities or rates of speed as corresponded to the cross-sectional areas of the admission passages directly in front of the meeting point of the agents and to the then prevailing quantities of gas and air, always assuming the pressure in the admission passages to remain uniform. Thus, the rates of flow or the velocities at the meeting point became smaller with the reduction of the amounts of air and gas.

For the purpose of producing a complete combustion an intimate mixing of gaseous fuel and air is however necessary and this object can only be accomplished, in case both parts are caused to impinge upon each other with certain minimum velocities, so that upon the reduction of the amounts of gas and air their velocities or rates of flow immediately before their union should not be diminished. This object is accomplished in accordance with this invention by so arranging the means for effecting the regulation of the sizes of the cross-sectional passages for gaseous fuel and air in accordance with the output of the burner at the particular time in such a manner that they will terminate directly in front of the meeting point of the current of air and current of fuel. The regulating and controlling means being positioned directly in front of the mixing point may be adjusted in common and in such a manner that the most favorable rates of flow for gas and air may be obtained. By this invention a further improvement is produced in view of the fact that the pressure may also be varied in front of the regulating and controlling means referred to and in such a manner that a still more effective regulation of the mixing rates may be obtained by suitable means, particularly in the case of smaller consumption at the burner. Obviously the controlling means for the regulation of the size of the cross-sectional passages may be arranged and constructed in different ways and may comprise dampers, slides, rotating slides, piston slides, valves and the like.

On the accompanying drawing a form of preferred construction of the novel burner or heating device is shown by way of exemplification in Fig. 1 in axial longitudinal section. Figures 2 and 3 are cross-sections on the lines 2—2 and 3—3 respectively of Fig. 1, while Figures 4 and 5 illustrate a part of the device on an enlarged scale and respectively in longitudinal and transverse section. Fig.

6 is a sectional view of a detail to be referred to.

In accordance with Fig. 1 the gas burner or heater according to this invention, which is connected to the gas admission pipe 2 comprises the casing 1 communicating with the pipe 2 and axially connected to the mixing chamber 4 which is provided with the air admission slots 3. In the case of burners with secondary air admission the mixing chamber 4 has a conically flaring section which constitutes another mixing and combustion chamber 6 provided with the air admission slots 5. The cylindrical chamber 1 is surrounded by a likewise cylindrical sleeve or casing 7 which is connected at one of its ends to the flange 8 of the casing 1 and at its other end is connected to the front portion of the casing 1 by means of the front wall 9. The said sleeve or casing 7 is provided with the pipe 10 for the admission of air. The main piston 11 is displaceably and axially mounted in the cylindrical body 1 and is suitably secured against rotation, and it is so arranged that upon its displacement it will cover more or less the tangentially directed slots 3 in accordance with the consumption of fuel and up to a complete closing of the said slots. The annular edge 12 of the piston 11 operates as a regulating and controlling means for the closing up of the slots. The displacement of the piston 11 is effected by means of a hollow spindle or shaft 13 which is threaded at 14 and with its threaded part projects through the bottom wall 15 of the casing. By the operation of the crank-handle 16 the spindle 13 is rotated and the piston 11 is reciprocated by means of the setting rings 17 and the spindle is likewise reciprocated thereby. In the interior of the hollow spindle 13 a shaft 18 is rotatably disposed which with its threaded portion 19 is screw-threadedly secured in the master threads 20 of a collar 21 inserted into the end of the shaft or spindle 13. The collar 21 is kept from longitudinal movement with relation to the spindle 13 by means of the screw 22. The collar may be connected to the spindle 13 by the detachable latch pin 23 and be prevented from rotation thereby. The end wall 24 of the piston 11 is provided with openings 25. To the end of the shaft 18 a disk 26 is secured in which conical studs 27 are arranged which in the axial movement of the parts are adapted to close and to respectively uncover the openings 25 in the end wall of the piston 11. The current of gas is distributed by the several openings 25 over the front wall of the piston and it is thereby divided into several ring shaped hollow cylinders, and in this state the gas current will pass through the air chamber and the mixing chamber. The displacement of the plate or disk 26 with these studs 27 is effected upon turning the collar 21 which is coupled with the spindle 13, and by this means the piston 11 and a ring 28 for the regulation of the slots 5 for the secondary air are likewise displaced. The ring 28 is connected by means of the rods 30 to the transverse bar 31 which by means of a master nut 32 is in engagement with a threaded part 33 of the spindle 13. If this spindle or shaft 13 is rotated for the purpose of effecting the common displacement of the piston 11 and of the ring 28 and for the purpose of adjusting the size of the slots 3 and 5 respectively intended for the primary and secondary air, the threaded part 14 becomes screwed into the head wall 15 of the casing 1, and in view of the fact that the threads 14 are of lower pitch than the threads 33, the movement of the piston 11 will be correspondingly advanced with relation to the movement of the ring 28 which is adapted to the length of the slots 3 and 5. When it is desired to only effect the simultaneous adjustment of the piston 11 and of the disk 26 with the studs 27, the master nut 32 is opened, so that upon the rotation of the shaft or spindle 13 the piston 11 is displaced and the studs 27 are simultaneously displaced in the openings 25. In case however, that both the pin 23 as well as the master nut 32 are disengaged, each of the parts 11, 28 and 27 may be adjusted independently.

The ring 28 is capable of an additional adjustment with relation to the piston 11 by adjusting the rods 30 within the cross head 31 by means of the nuts 34. By this means it becomes possible to impart to the ring 28 an advancing or retarding, or respectively a leading or lagging motion with relation to the piston 11, so that either the main air admitting slots 3 are still open, when the secondary air slots 5 are already closed or inversely. On the other hand, the shaft 18 with the studs 27 may be given a corresponding adjustment in the axial direction with relation to the piston 11 by the rotation of the disengaged sleeve 21. The burner is moreover provided with special closing devices 35 and 36 which are connected to each other by a link 37 and are coupled to a sleeve or collar 41 by means of a system of levers or links 38, 39, 40, so that upon the displacement of the spindle or shaft 13 the collar 41 is reciprocated, and the shutters or closures 35 and 36 are actuated by means of the levers or links 38, 39, 40. Upon moving the spindle or shaft 13 to the right from the position shown in Figure 1 the gas and air escape openings are reduced, while at the same time the shutters 35, 36 or dampers are opened, so that the pressure in front of the escape slot, the so-called preliminary pressure, is increased. As a result thereof the speeds of discharge into the mixing chamber are increased, and the load is reduced, while the mixing speeds are increased.

Upon screwing the spindle 13 to the left

from the position shown in Figure 1 of the drawing, the gas- and air-escape slots remain open, while at the same time the dampers or closures 35, 36 are closed, so that the pressure in front of the discharge slots, the preliminary pressure, is decreased. The speeds of escape into the mixing chamber are therefore additionally decreased.

By operating in this manner and by thus varying the preliminary pressure of gas and air from their lowest up to their highest value within the corresponding extent of highest down to the lowest load or consumption, mixing speeds of corresponding values may be obtained. Burners as described in this specification may also be employed for the burning of coal dust, tar oil, petroleum residues and the like and for similar purposes.

The invention is however not restricted to the particular embodiments herein shown and described merely by way of exemplification, but it is susceptible of other modifications and changes to suit existing conditions and the convenience of the user and without thereby deviating from the spirit and scope of the invention, as particularly set forth in the appended claims.

I claim:—

1. In a burner in combination, fuel-admitting means and air admitting means, separate from but intersecting each other for supplying both fuel and air substantially in proper proportions for combustion, regulating means for each of said admitting means, each disposed substantially in front of the point of intersection and conjointly controlling the supply of fuel and air to form the combustible mixture, and throttling means for both fuel and air different from the regulating means and spaced therefrom in the course of the admitting means.

2. In a burner in combination, fuel-admitting means and air admitting means, separate from and meeting each other at a mixing point, regulating means for each of the said admitting means, each disposed substantially directly in front of the meeting point in the direction of flow, and throttling means different and spaced from said regulating means, and link connection between the throttling means.

3. In a burner in combination, fuel-admitting means and air admitting means, communicating means between the two kinds of admitting means, throttling means for the fuel admitting and for the air admitting means, regulating means at the point of connection of the communicating means with the admitting means, and operating means for the regulating means and for the throttling means and adapted to actuate the throttling and regulating means inversely with relation to each other.

4. In a burner in combination, an interior slotted chamber, an exterior chamber spacedly and substantially concentrically surrounding the interior chamber, admission conduits for said chambers, axially displaceable annular outer regulating means for the interior slotted chamber, interior axially displaceable regulating means for the slotted chamber, and operating means for the regulating means.

5. In a burner in combination, an interior, cylindrical chamber, a substantially tangentially slotted annular portion on said chamber, a slotted cylindrical extension on said chamber and of somewhat larger diameter than the same, an outer surrounding jacket, spacedly and concentrically surrounding the chamber and its extension, admission conduits for the chamber and respectively for the jacket, annular regulating means surrounding the extension and in contact therewith and axially displaceable, an apertured partition transversely disposed in the chamber, regulating means for said partition, engaging the openings thereof, and operating means, adapted to actuate said regulating means.

6. In a burner in combination, an interior, cylindrical chamber, a slotted annular portion on said chamber, a slotted cylindrical extension, coaxially disposed on said chamber and of somewhat larger diameter than the same, an exterior, surrounding jacket, spacedly and concentrically disposed around the chamber, annular regulating means axially movable within the jacket and engageable with the openings of the extension, a transverse partition in the chamber adjacent the annular slotted portion thereof, a perforated section on said partition, axially movable, substantially stud-shaped regulating means within the chamber, and engageable with the perforated section, an operating shaft, substantially centrally disposed in the chamber, and means connecting the shaft with the regulating means and adapted to operate the regulating means simultaneously as well as independently.

7. In a burner in combination, a substantially cylindrical interior chamber, an apertured annular portion thereof, a somewhat larger axial extension on said chamber adjacent its apertured portion, an additional annular apertured portion on the extension, axially movable interior regulating means within the chamber and engageable with its apertured portion, and axially movable exterior regulating means engageable with the apertured portion of the extension, a jacket annularly surrounding the chamber and the exterior regulating means, and admission conduits for the chamber and for the jacket.

8. In a burner in combination, a substantially cylindrical interior chamber, an apertured annular portion thereof, and a cylindrical, axial extension on said chamber, ad-

jacent its apertured portion, an additional annular apertured portion on the extension, a jacket spacedly surrounding the chamber and its extension, substantially annular regulating means respectively disposed in the chamber and in the jacket and engageable with the apertured portions of the chamber and of the extension, and admission conduits for the chamber and for the jacket.

9. In a burner in combination, a substantially cylindrical interior chamber, an apertured annular portion thereof, an axial extension on said chamber, an additional annular apertured portion on said extension, a cylindrical jacket, spacedly surrounding the chamber and the extension, substantially annular interior and substantially annular exterior regulating means, respectively disposed in the chamber and in the jacket and respectively engageable with the apertured portions of the chamber and of the extension, a transverse partition on the interior regulating means, an apertured section on said partition, axially displaceable, substantially stud-shaped regulating means for said last-mentioned apertured section, admission conduits for the chamber and for the jacket, and engageable operating means for the three kinds of regulating means.

10. In a burner in combination, a cylindrical interior chamber, an apertured portion thereof, an axial cylindrical extension on said chamber, an additional apertured portion on said extension substantially ring shaped interior and exterior regulating and adjusting means, respectively engageable with the apertured portions of the chamber and of the extension, a jacket, spacedly surrounding the chamber, admission conduits for the jacket and for the chamber, regulating means in said conduits, adjustable and regulatable disc-shaped admission means in the chamber, adjacent the apertured portion thereof, and means to engageably and detachably connect the said regulating and adjusting means and the disc-shaped admission means.

11. In a burner in combination, a cylindrical interior chamber, a spacedly disposed jacket around the chamber, communicating means between the jacket and the chamber, admission conduits for the jacket and the chamber, outer and inner regulating means for the communicating means, and additional regulating means for the conduits, and axially movable regulatable admission means within the chamber, a support outside of the chamber and of the jacket, telescopingly arranged and relatively displaceable operating shafts journalled in the support, and respectively connected to the regulatable admission means, and to the inner regulating means and to the conduit-regulating means, and operating shafts for the outer regulating means, journalled in the support, and means to detachably connect said operating shafts with the support and respectively with each other.

12. In a burner in combination, an interior chamber, a spacedly disposed jacket around the chamber, communicating means between the jacket and the chamber, admission conduits for the jacket and the chamber, outer and inner regulating means for said communicating means, and additional regulating means for the conduits, and axially movable regulatable admission means within the chamber, a support outside of the chamber and of the jacket, a hollow operating shaft in the support connected to the inner regulating means, an interiorly threaded sleeve within said hollow shaft and secured against longitudinal displacement, means to detachably connect the sleeve to the shaft, an interior shaft within the hollow shaft and screw-threadedly engageable with the sleeve and connected to the regulatable admission means, means to detachably connect the hollow shaft to the support, operating shafts for the outer regulating means, journalled in the support, and means to detachably connect said last mentioned operating shafts to the support, and operating means for the conduit regulating means, axially displaceable upon the hollow shaft.

13. In a burner in combination, a cylindrical interior chamber, a spacedly disposed jacket around the chamber, communicating means between the jacket and the chamber, admission conduits for the chamber and for the jacket, outer and inner regulating means for the communicating means, additional regulating means for the conduits and regulatable admission means within the chamber, operating means for the admission means, and operating means for the regulating means, and means to impart different speeds of movement to said operating means, and to cause the admission means and the different regulating means to move in advance of each other.

14. In a burner in combination, an interior chamber, a spacedly disposed jacket around the chamber, communicating means between the jacket and the chamber, outer and inner regulating means for the communicating means, substantially transversely disposed and axially movable admission means within the chamber, screw-threadedly and telescopingly engaging operating shafts, respectively connected to the admission means and to one of the regulating means, an outer screw-threaded portion on the outermost shaft, and extensions on the other regulating means engaging said last mentioned screw threaded portion.

15. In a burner in combination, an interior chamber, a spacedly disposed jacket around the chamber, communicating means between the jacket and the chamber, outer and inner

regulating means for the communicating means, substantially transversely disposed and axially movable admission means within the chamber, screw threadedly and telescopingly engaging operating shafts, respectively connected to the admission means and to one of the regulating means, exterior screw-threaded sections of different pitch on the outer operating shaft, extensions on the other regulating means engaging one of said exterior sections, admission conduits for the chamber and for the jacket, regulating means in said conduits, an interiorly threaded sleeve movable along the other exterior screw threaded section of the shaft and operatively connected to the conduit-regulating means.

16. In a burner in combination, an interior chamber, a jacket spacedly surrounding said chamber, communicating means between the jacket and the chamber, outer and inner regulating means on the chamber, engaging the regulating means, a hollow operating shaft, connected to one of said regulating means, an adjustable interiorly screw-threaded sleeve in the interior of said shaft, a screw-threaded interior shaft engaging said sleeve, and connected to another regulating means, an exterior screw-threaded part on the hollow shaft, connected to still another regulating means and means to detachably connect the sleeve and the shafts to each other.

17. In a burner in combination, an interior chamber, an outer jacket spacedly surrounding said chamber, tangentially and outwardly slotted annular portions in said chamber, fuel admitting and air admitting means respectively connected to the chamber and to the jacket, regulating means on the inside and on the outside of the chamber, and engageable with the slotted portions, and operating means for said regulating means.

In testimony whereof I affix my signature.

FRIEDRICH LILGE.