

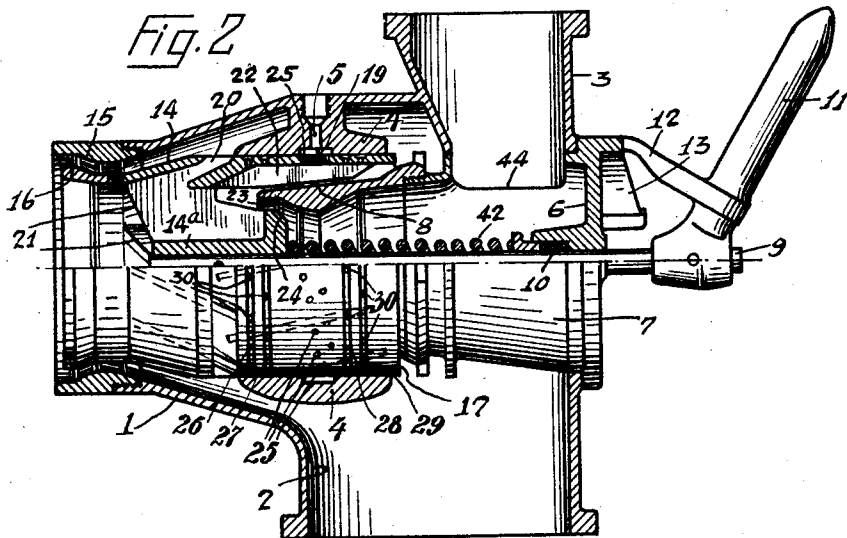
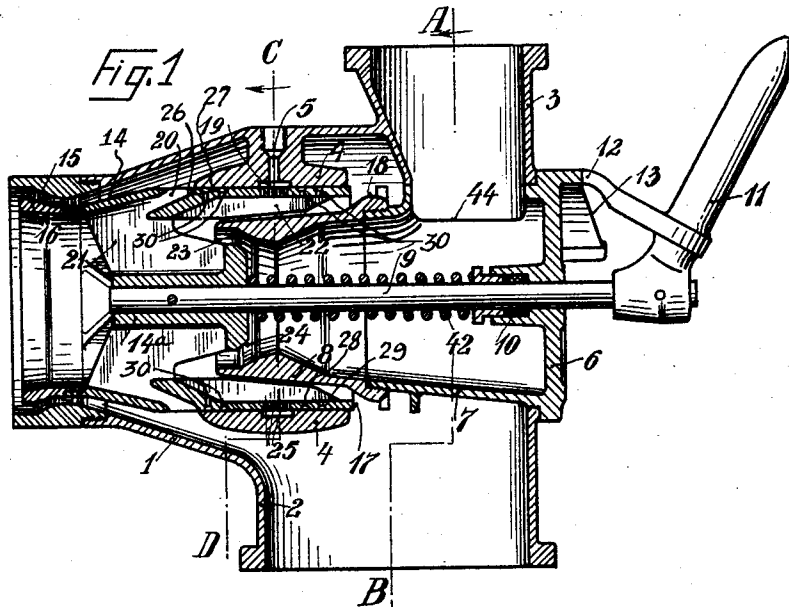
Feb. 19, 1929.

1,702,298

F. K. HETSCH
BURNER FOR FURNACES

Filed Dec. 2, 1926

4 Sheets-Sheet 1



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Feb. 19, 1929.

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4 Sheets-Sheet 2

Fig. 3

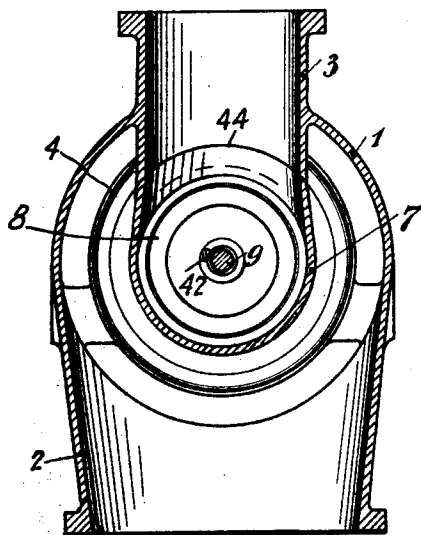


Fig. 4

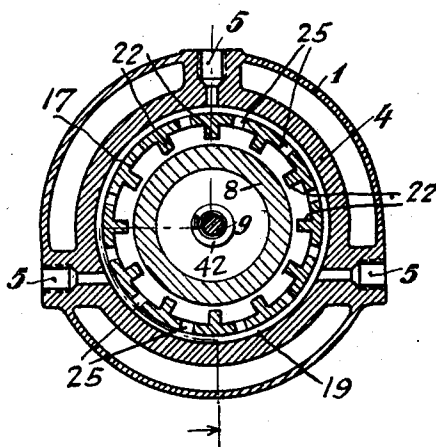
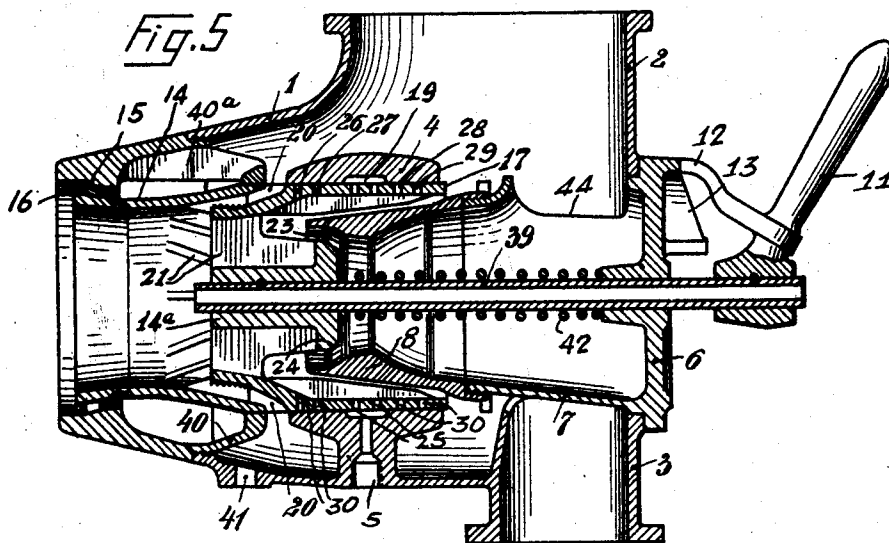


Fig. 5



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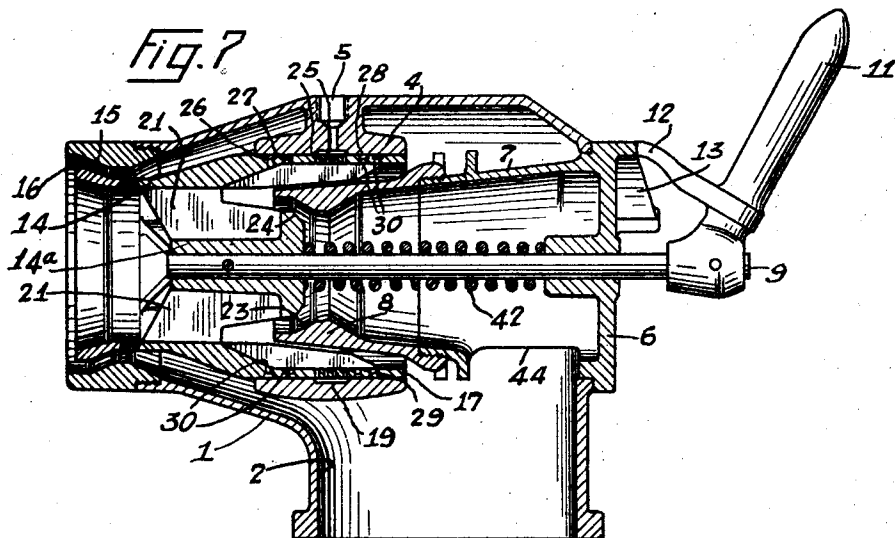
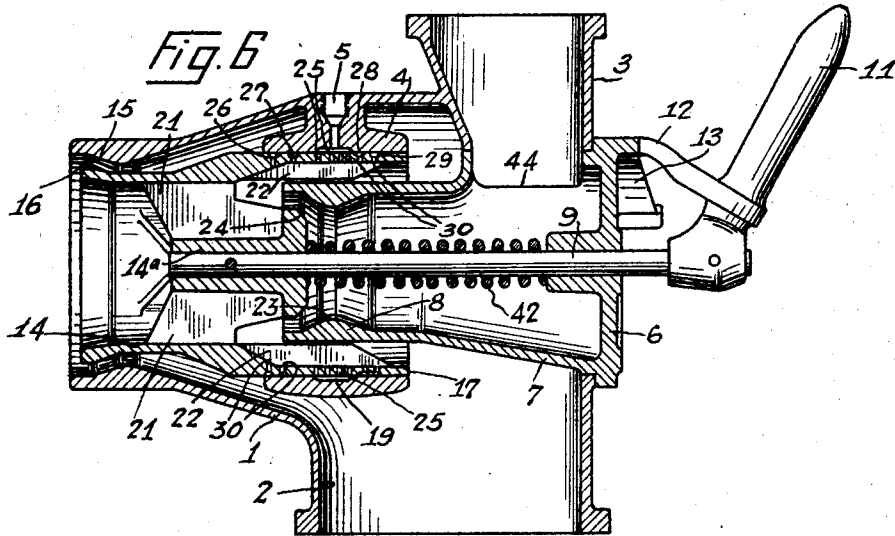
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4 Sheets-Sheet 3



Inventor
 Franz Karl Hetsch
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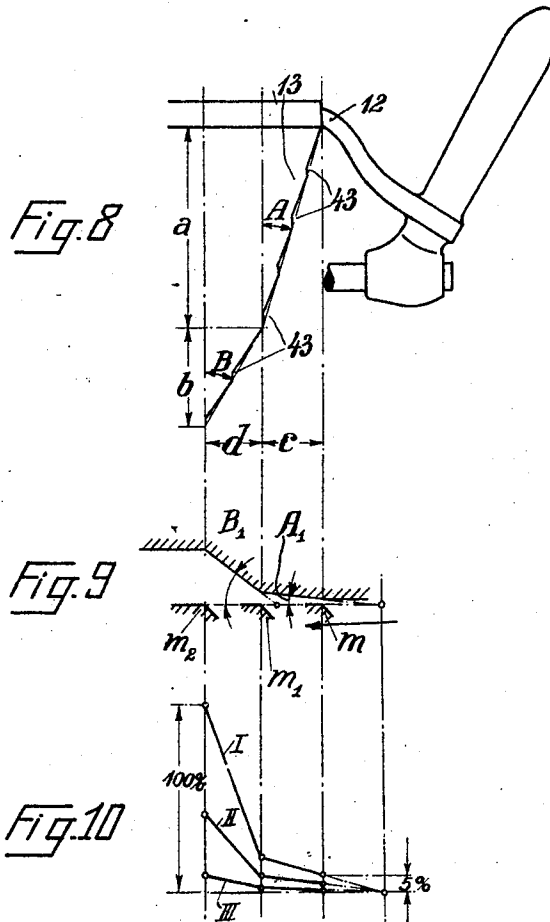
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BURNER FOR FURNACES

Filed Dec. 2, 1926

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE.

FRANZ KARL HETSCH, OF MANNHEIM, GERMANY.

BURNER FOR FURNACES.

Application filed December 2, 1926, Serial No. 152,190, and in Germany November 4, 1925.

My invention relates to a burner for furnaces.

In many furnaces it is desirable to change the fuel used according to whether coal, oil or gas is the most economical fuel for the time being.

My invention consists of a burner which permits the supply of fuel gases or liquid or pulverized fuel to the furnace either alternately or simultaneously. In this way the first cost of the furnace plant and the space requirement is considerably reduced and the plant itself becomes simpler in operation as well as in layout.

Some embodiments of my invention are illustrated in the drawings affixed hereto.

In these drawings:

Fig. 1, represents a longitudinal section through the improved burner,

Fig. 2, a sectional elevation through the burner casing with the regulating member partly in full view,

Fig. 3, a cross-section along line A—B of Fig. 1,

Fig. 4, a cross-section along line C—D of Fig. 1,

Figs. 5, 6 and 7 cross-sections through modified constructions of a burner,

Fig. 8, a development of the cam faces for the regulator,

Fig. 9, a diagrammatic representation of the cooperation of the distributing edges, and

Fig. 10, a diagram showing the variations in the controlled cross-sections.

Referring to Fig. 1 of the drawings, the burner consists of a tubular casing 1 provided with an admission branch 2 for the air and an admission branch 3 for the combustible gas. Within the casing 1 is located a concentric ring 4 cast integral with the casing and provided with three bores 5, see also Fig. 4, through which oil can be supplied. The end of the casing facing the furnace is open while its rear end is closed by a cover 6 having a tubular inward projection 7. To this projection is attached, for instance by threading an extension 8. The tubular projection 7 is provided at the top with an opening 44 into which opens the gas admission branch 3, see also Fig. 3. In the cover 6 is journaled a spindle 9 which is sealed by a stuffing box 10. Upon the outer end of the spindle is mounted

the control lever 11. It is equipped with a nose 12 which runs over a cam surface 13 cast upon the cover.

By turning the lever 11 the spindle 9 is not only turned but also axially displaced, due to the cam, against the compression spring 42 mounted on spindle 9. To the inner end of the spindle 9 is pinned the hub 14^a of a tubular sliding piston 14. This slide is connected with the hub 14^a by helical ribs 21. Between the frusto-conical walls of the piston slide and the casing 1 on the one hand and the frusto-conical tubular extension 8 on the other hand are formed the passages for the air of combustion and the fuel. The illustrations show that position of the control lever 11 in which the respective walls forming these passages are farthest apart and thus the passage cross-sections are the largest. By rotating the regulating lever 11 the piston slide is gradually drawn farther into the casing and thus all passage cross-sections are reduced. The outer current of air supplied through inlet 2 issues between the walls 15 and 16. A second current of air enters the furnace through an annular channel or port 20 provided in the distributing slide 14 and extending in the direction of flow. One edge of this port registers in the wide open position shown in Figs. 1 and 2 with the edge of fixed ring 4. The width of this port is varied during the above-mentioned longitudinal motion of slide 14 when the front edge of the ring gradually closes this port. The main air current is controlled by the position of edges 17 and 18 and when entering the mouth it forms an annular inner jet. The helical spring 42 abuts against the stuffing box 10 and presses against the hub 14^a so that the nose 12 of the control lever 11 is permanently kept in contact with the control cam 13.

The fuel gas entering through the inlet 3 flows through the interior of the inner tubular casing 7, 8 and is controlled by the annular edges 23 and 24. The oil inlets 5 in the casing open into an annular groove 19 opposite which are located the radial bores 25 in the control slide. As Fig. 2 shows these bores are staggered in relation to one another so that they are closed or opened in succession by the longitudinal regulating motion of the slide piston 14. At both sides of these bores

packing or sealing grooves 26, 27, 28, 29 with radial drain openings 30 are provided through which leakage oil is conducted into the main air current. In this way dripping of the burner is effectively avoided. The sealing grooves 26, 27, 28 and 29 remain in any regulating position covered by the cylindrical wall surface of the ring 4 within the burner body. They neither issue at the two ends of this ring nor do they come in direct communication with the oil supply groove 19, when the slide is operated.

Instead of fuel gas a combustible powder whirled up by air may be blown into the gas admission branch 3, for instance pulverized coal or sawdust. Oil and gas or oil and pulverized coal may even be employed simultaneously.

The distributing or control edges are so shaped that at the end they merge into the cylindrical shape as closely as possible such as the edges 15, 16 and 23 as well as 24 show particularly clearly. In this way the air and the fuel attain an axial direction of flow for the purpose of bringing about a uniform mixture. The helically shaped ribs 21 and 22, impart a rotary motion to the central and the main air current as well as to the entering gas current. Between the individual gyrating air currents passing between these vanes evacuated spaces are formed so that in the case of operation with gas the gaseous fuel and in the case of operation with oil the central current of air is sucked into the spaces. This results in a particularly uniform mixture and whirling through of the fuel and the combustion air.

In the burner according to my invention the control cam surface 13 and the distribution edges 15, 18 and 23 are so shaped that at small outputs a very fine adjustment is possible, for larger outputs on the other hand a wide regulation range with coarse adjustments is attainable.

In Fig. 8 of the drawings the controlling cam surface is shown developed with reference to the modification Figs. 1 to 4 for example. For small outputs the gradient of the curve face is less, as angle A shows, and for larger outputs the gradient is steeper, as angle B shows. Both angles of inclination A and B are preferably located within the angle of friction for the particular material used so that the parts remain automatically in adjusted position. Small notches 43 may be provided for intermediate positions. While the nose 12 slides along the cam portion of the lesser gradient the spindle is axially displaced by the distance c . A similar distance is consequently also traversed in the same direction by the distributing edges of the slide. The distributing edge m in Fig. 9, which might represent for instance edge 17 in Fig. 1, thus reaches the position m^1 , when the lesser grade cam portion a has been trav-

ersed. The stationary edge 18 is inclined by the angle A_1 . In the second steeper part b of the cam control the controlling edges traverse an approximately equally long axial path d . The controlling edge thus reaches the position m^2 . The cross-section then opens considerably more inasmuch as the stationary edge is here inclined at the larger angle B^1 . In Fig. 10 of the drawings the size of the discharge cross-section is graphically illustrated, the broken line I indicating the sum of the regulated air discharge cross-sections, the line II the sum of the gas discharge cross-sections and III the sum of the oil discharge cross-sections. The graphic representation shows that the control elements adjusts all fuel and air outlet cross-sections simultaneously for each unit of length traversed in axial direction and effects the supply of fuel and combustion air mixed in the correct proportion, so that a regulating range of 5% to 100% is possible and a particularly fine adjustment is obtained for small outputs. By this fine adjustment of the combustion the operation of the furnace is improved, the consumption of fuel reduced and the economy of the service increased.

The burner operates satisfactorily with air pressure corresponding to a 100 mm. water column or with a steam pressure of 0.2 atmospheres. The gas pressure required amounts to 30 mm. water column and may be higher. The internal stuffing box 10 shown in Figs. 1 and 2 prevents the escape of the gas to the outside. Preferably the gas and the air pressure should be adjusted at different values. In the case of inferior gases the gas may be introduced through the intake of larger diameter 2 and the air through the intake of smaller diameter 3 in order to avoid higher gas pressures otherwise necessary. When standard fuel oil is employed a useful oil pressure of 500 mm. water column is quite sufficient. These low working pressures for the atomizing agent and the fuel facilitate the sealing of the pipe-lines and reduce the auxiliary power requirement necessary for operating the furnace. The rapid wear and tear forming an objectionable feature of high-pressure atomizing nozzles is also effectively avoided.

The mouthpieces of the nozzles with their controlling or distributing edges are demountable involving, as Fig. 1 shows the controlling edges 15, 16, 18 and 23 by way of example, so that the nozzle areas may be easily and quickly adapted for different pressures or heating values of the gases or for different pressures of the atomizing medium at low air pressure or low steam pressure.

If oil only is employed the central part of the burner enclosed by the tubular extension 7, 8 may also be utilized for the supply of the combustion air. This may be effected in a simple manner by turning the

casing 2 through an angle of 180° in relation to the cover 6 and its inward extension. This is illustrated in Fig. 5 of the drawings. The inner discharge end of intake 3 which in Figs. 1, 2 and 3 is shown to register with intake port 44 of the inner tubular member 7 is then located on the side opposite from port 44, whereas the latter port now receives combustion air entering through the intake 2 which now registers with port 44 so that this air now passes through the interior of the tubular extensions 7 and 8. The gas intake 3 then remains closed towards the outside and may be omitted altogether, as illustrated in Fig. 7 of the drawings, in which casing 1 is shown again turned in the same position as shown in Figs. 1 and 2.

In the embodiment of my invention illustrated in Fig. 5 further provisions are made to prevent the burner from dripping. For this purpose a ring 40 is provided within the casing or shell of the burner which on the air supply side of the casing, in the illustrated relative position of the parts in Fig. 5 the upper side, is provided with a port 40^a, the ring being otherwise closed. The air supplied through intake 2 reaches the outer nozzle 15—16 through this port. The leakage oil which otherwise could seep through between the ring 4 of the casing and the tubular distribution slide, is then trapped by the ring 40 and thus cannot reach the outer air jet which should remain dry. It is discharged into the inner air jet, however, through a port 20 and part of it, or at times all of it, may be drained off through oil discharge opening 41. Through this opening 41 are also discharged the quantities of oil which accumulates in the interior of the burner in case the air blower should accidentally stop, for instance due to the breaking of the driving belt or failure of the electric power supply, which oil would otherwise flow into the hot combustion chamber where it might lead to an explosion. If the oil issuing from the outlet 41 is discharged through a syphon not shown here the risk of an explosion is entirely eliminated.

In Fig. 5 the hand regulator is shown with a hollow spindle 39. Such a spindle may be employed in all modifications and serves for the introduction of a gas ignition flame or an electric igniter which ignites the combustible mixture directly in front of the mouth of the burner. In this way not only the starting of the furnace is facilitated, but also an increased operation reliability is obtained.

In some instances it is not necessary, as shown in Figs. 1 and 2, to make the extension 8 of the inner fixed tubular member 7 as a separate element, threaded onto member 7. It may also be made integral therewith as is shown in Fig. 6.

Various modifications and changes may be made without departing from the spirit and

the scope of the invention, and I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art.

I claim as my invention:—

1. A burner comprising in combination a tubular casing open at one end and having a cover at the other end, a gaseous fuel inlet and an air inlet on said casing, a guide ring fixed concentrically within said casing and bores through said ring and casing for liquid fuel admission to the interior thereof, an inner tubular element extending coaxially with said casing from the casing cover and having an intake opening adjustable in line with said gaseous fuel inlet, a spindle in said extension journaled slidably and rotatably in the casing cover in axial alinement therewith, a rotary piston slide fixed upon the free end of said spindle and disposed between said ring and said tubular extension, the outer end of said slide forming an annular nozzle with the mouth of the casing and permitting the issue of a portion of the combustion air therethrough, a port in said slide controlled by said ring at the axial slide motion for supplying another portion of the combustion air to the inside of the slide to issue at its mouth, the rear slide end forming an annular port with an outside portion of said tubular extension for controlling the passage of the remainder of the combustion air between said extension and the slide to the interior of the slide by the axial slide motion, said slide having perforations on its circumference registerable with said liquid fuel bores in said ring when the slide is axially shifted to supply liquid fuel to the remainder of the combustion air to be atomized by it, a hub on said slide forming an annular port with the free end of said tubular extension for controlling by the axial slide motion the gaseous fuel delivery from said tubular extension to the slide mouth, and means on the outer end of said spindle for rotating and axially displacing said slide.

2. A burner comprising in combination a tubular casing open at one end and having a cover at the other end, a gaseous fuel inlet and an air inlet on said casing, a guide ring fixed concentrically within said casing and bores through said ring and casing for liquid fuel admission to the interior thereof, an inner tubular element extending coaxially with said casing from the casing cover and having an intake opening adjustable in line with said gaseous fuel inlet, a spindle in said extension journaled slidably and rotatably in the casing cover in axial alinement therewith, a rotary piston slide fixed upon the free end of said spindle and disposed between said ring and said tubular extension, the outer end of said slide forming an annular nozzle with the mouth of the casing and permitting the issue of a portion of the com-

bustion air therethrough, a port in said slide controlled by said ring at the axial slide motion for supplying another portion of the combustion air to the inside of the slide to
 5 issue at its mouth, the rear slide end forming an annular port with an outside portion of said fixed tubular extension for controlling the passage of the remainder of the combustion air between said extension and the slide
 10 to the interior of the slide by the axial slide motion, said slide having perforations on its circumference registerable with said liquid fuel bores in said ring when the slide is axially shifted to supply liquid fuel to the
 15 remainder of the combustion air to be atomized by it, a hub on said slide forming an annular port with the free end of said tubular extension for controlling by the axial slide motion the gaseous fuel delivery from said
 20 tubular extension to the slide mouth, a lever on the outer end of said spindle for rotating it, and a suitably stepped cam on the outside of the casing cover cooperating with said lever to axially displace said spindle when
 25 the lever is rotated, to control said slide ports, and liquid fuel supply for obtaining the desired air and fuel proportions for different burner outputs.

3. A burner comprising in combination a
 30 tubular casing open at one end and having a cover at the other end, a gaseous fuel inlet and an air inlet on said casing, a guide ring fixed concentrically within said casing and bores through said ring and casing for liquid
 35 fuel admission to the interior thereof, an inner tubular element extending coaxially with said casing from the casing cover and having an intake opening adjustable in line with said gaseous fuel inlet, a spindle in
 40 said extension journaled slidably and rotatably in the casing cover in axial alinement therewith, a rotary piston slide fixed upon the free end of said spindle and disposed between said ring and said tubular extension,
 45 the outer end of said slide forming an annular nozzle with the mouth of the casing and permitting the issue of a portion of the combustion air therethrough, a port in said slide controlled by said ring at the axial slide
 50 motion for supplying another portion of the combustion air to the inside of the slide to issue at its mouth, the rear slide end forming an annular port with an outside portion of said fixed tubular extension for controlling
 55 the passage of the remainder of the combustion air between said extension and the slide to the interior of the slide by the axial slide motion, said slide having perforations on its circumference registerable with said liquid
 60 fuel bores in said ring when the slide is axially shifted to supply liquid fuel to the remainder of the combustion air to be atomized by it, a hub on said slide forming an annular port with the free end of said tubular
 65 extension for controlling by the axial slide

motion the gaseous fuel delivery from said tubular extension to the slide mouth, a compression spring on said spindle bearing at one end against said slide hub and at the
 70 other end against the casing cover, tending to move the slide forward, a lever at the outer end of said spindle for rotating it and a suitably stepped cam on the outside of the casing cover cooperating with said lever to axially
 75 displace said spindle against the force of said spring when said lever is rotated.

4. A burner comprising in combination a tubular casing open at one end and having a cover at the other end, a gaseous fuel inlet and an air inlet on said casing, a guide ring
 80 fixed concentrically within said casing and bores through said ring and casing for liquid fuel admission to the interior thereof, an inner tubular element extending coaxially with said casing from the casing cover and
 85 having an intake opening adjustable in line with said gaseous fuel inlet, a spindle in said extension journaled slidably and rotatably in the casing cover in axial alinement therewith, a rotary piston slide fixed upon the free
 90 end of said spindle and disposed between said ring and said tubular extension, the outer end of said slide forming an annular nozzle with the mouth of the casing and permitting the issue of a portion of the combustion air
 95 therethrough, a port in said slide controlled by said ring at the axial slide motion for supplying another portion of the combustion air to the inside of the slide to issue at its mouth, the rear slide end forming an annular port
 100 with an outside portion of said fixed tubular extension for controlling the passage of the remainder of the combustion air between said extension and the slide to the interior of the slide by the axial slide motion, said slide having
 105 perforations on its circumference staggered in a plurality of transverse planes through the slide, said perforations being registerable with said liquid fuel bores in said ring when the slide is axially shifted to supply
 110 liquid fuel to the remainder of the combustion air to be atomized by it, a hub on said slide forming an annular port with the free end of said tubular extension for controlling by the axial slide motion the gaseous
 115 fuel delivery from said tubular extension to the slide mouth, and means on the outer end of said spindle for rotating and axially displacing said slide.

5. A burner comprising in combination a
 120 tubular casing open at one end and having a cover at the other end, a gaseous fuel inlet and an air inlet on said casing, a guide ring fixed concentrically within said casing and bores through said ring and casing for liquid
 125 fuel admission to the interior thereof, an inner tubular element extending coaxially with said casing from the casing cover and having an intake opening adjustable in line with said gaseous fuel inlet, a spindle in said
 130

extension journaled slidably and rotatably in the casing cover in axial alinement therewith, a rotary piston slide fixed upon the free end of said spindle and disposed between said ring and said tubular extension, the outer end of said slide forming an annular nozzle with the mouth of the casing and permitting the issue of a portion of the combustion air there-through, a port in said slide controlled by said ring at the axial slide motion for supplying another portion of the combustion air to the inside of the slide to issue at its mouth, the rear slide end forming an annular port with an outside portion of said fixed tubular extension for controlling the passage of the remainder of the combustion air between said extension and the slide to the interior of the slide by the axial slide motion, said fixed casing ring having an annular recess at its inner periphery in which the aforementioned liquid fuel supply bores terminate, said slide having radial perforations on its circumference staggered in a plurality of transverse planes through the slide, so that they can be gradually brought into and out of register with said annular recess when the slide is axially shifted for variably supplying liquid fuel to said remainder of the combustion air to be atomized by it, circumferential grooves on said slide on either side of the zone in which said staggered perforations are located, for receiving liquid fuel leaking between the slide and the fixed ring and radial perforations extending from said grooves into the slide interior for atomizing the leakage fuel, a hub for said slide forming an annular port with the end of said tubular extension for controlling by the axial slide motion the gaseous fuel delivery from said tubular extension to the slide mouth, a lever on the outer end of said spindle for rotating it, and a suitably stepped cam on the outside of the casing cover cooperating with said lever to axially displace said spindle when the lever is rotated, to control said slide ports and liquid fuel supply for obtaining the desired air and fuel proportions for different burner outputs.

6. A burner comprising in combination a tubular casing open at one end and having a cover at the other end, a gaseous fuel inlet and an air inlet on said casing, a guide ring fixed concentrically within said casing and bores through said ring and casing for liquid fuel admission to the interior thereof, an inner tubular element extending coaxially with said casing from the casing cover and having an intake opening adjustable in line with said gaseous fuel inlet, a spindle in said extension journaled slidably and rotatably in the casing cover in axial alinement therewith, a rotary piston slide fixed upon the free end of said spindle and disposed between said ring and said tubular extension, the outer end of said slide forming an annular nozzle with the

mouth of the casing and permitting the issue of a portion of the combustion air there-through, a port in said slide controlled by said ring at the axial slide motion for supplying another portion of the combustion air to the inside of the slide to issue at its mouth, the rear slide end forming an annular port with an outside portion of said fixed tubular extension for controlling the passage of the remainder of the combustion air between said extension and the slide to the interior of the slide by the axial slide motion, said slide having perforations on its circumference registerable with said liquid fuel bores in said ring when the slide is axially shifted to supply liquid fuel to the remainder of the combustion air to be atomized by it, a hub on said slide forming an annular port with the free end of said tubular extension for controlling by the axial slide motion the gaseous fuel delivery from said tubular extension to the slide mouth, and means on the outer end of said spindle for rotating and axially displacing said slide, the mouth portion of said casing, said slide and said inner tubular extension being detachable.

7. A burner comprising in combination a tubular casing open at one end and having a cover at the other end, an air inlet on said casing, a ring fixed concentrically within said casing and bores through said ring and casing for liquid fuel admission to the interior thereof, an inner tubular extension element extending coaxially with said casing from said cover, a spindle in said extension disposed slidably rotatably in the cover in axial alinement therewith, a rotary piston slide fixed upon the inner end of said spindle and disposed between said ring and said tubular extension, the outer end of said slide forming an annular nozzle with the casing mouth and permitting the issue of a portion of the combustion air there-through, a port in said slide controlled by said ring at the axial slide motion for supplying another portion of the combustion air to the inside of the slide to issue at its mouth, the rear slide end forming an annular port with an outside portion of said fixed tubular extension for controlling the supply of a third portion of combustion air from said inlet between said extension and the slide to the slide interior, said slide having perforations on its circumference registerable with said liquid fuel bores in said fixed ring when said slide is axially shifted to supply liquid fuel to said third portion of combustion air to be atomized by it, a chamber in said casing open to the slide interior and to the combustion air inlet, for receiving leakage fuel escaping between the slide and the fixed ring and means for draining said fuel, and means for shifting said slide axially in to desired positions to control the air and fuel supply in the desired proportion for different outputs.

8. A burner comprising in combination a

tubular casing open at one end and having a cover at the other end, a gaseous fuel inlet and an air inlet on said casing, a guide ring fixed concentrically within said casing and bores through said ring and casing for liquid fuel admission to the interior thereof, an inner tubular element extending coaxially with said casing from the casing cover and having an intake opening adjustable in line with said gaseous fuel inlet, a spindle in said extension journaled slidably and rotatably in the casing cover in axial alinement therewith, said spindle being hollow for introducing ignition devices into the burner, a rotary piston slide fixed upon the free end of said spindle and disposed between said ring and said tubular extension, the outer end of said slide forming an annular nozzle with the mouth of the casing and permitting the issue of a portion of the combustion air therethrough, a port in said slide controlled by said ring at the axial slide motion for supplying another portion of the combustion air to the inside of the slide to issue at its mouth, the rear slide end forming an annular port with an outside portion of said fixed tubular extension for controlling the passage of the remainder of the combustion air between said extension and the slide to the interior of the slide by the axial slide motion, said slide having perforations on its circumference registerable with said liquid fuel bores in said ring when the slide is axially shifted to supply liquid fuel to the remainder of the combustion air to be atomized by it, a hub on said slide forming an annular port with the free end of said tubular extension for controlling by the axial slide motion the gaseous fuel delivery from said tubular extension to the slide mouth, and means on the outer end of said spindle for rotating and axially displacing said slide.

9. A burner comprising in combination a tubular casing open at one end and having a cover at the other end, a gaseous fuel inlet and an air inlet on said casing, a guide ring fixed concentrically within said casing and bores through said ring and casing for liquid fuel admission to the interior thereof, an inner tubular element extending coaxially with said casing from the casing cover and having an intake opening adjustable in line with said gaseous fuel inlet, a spindle in said extension journaled slidably and rotatably in the casing cover in axial alinement therewith, a rotary piston slide fixed upon the free end of said spindle and disposed between said ring and said tubular extension, the outer end of said slide forming an annular nozzle with the mouth of the casing and permitting the issue of a portion of the combustion air therethrough, a port in said slide controlled by said ring at the axial slide motion for supplying another portion of the combustion air to the inside of the slide to issue at its mouth, the rear slide end forming an annular port

with an outside portion of said fixed tubular extension for controlling the passage of the remainder of the combustion air between said extension and the slide to the interior of the slide by the axial slide motion, said slide having perforations on its circumference registerable with said liquid fuel bores in said ring when the slide is axially shifted to supply liquid fuel to the remainder of the combustion air to be atomized by it, a hub on said slide forming an annular port with the free end of said tubular extension for controlling by the axial slide motion the gaseous fuel delivery from said tubular extension to the slide mouth, and means on the outer end of said spindle for rotating and axially displacing said slide, said casing cover with said tubular extension being rotatable through a suitable angle to register the intake opening of said extension with either the combustion air or the gaseous fuel intake of the casing.

10. A burner comprising in combination a tubular casing open at one end and having a cover at the other end, a gaseous fuel inlet and an air inlet on said casing, a guide ring fixed concentrically within said casing and bores through said ring and casing for liquid fuel admission to the interior thereof, an inner tubular element extending coaxially with said casing from the casing cover and having an intake opening adjustable in line with said gaseous fuel inlet, a spindle in said extension journaled slidably and rotatably in the casing cover in axial alinement therewith, a rotary piston slide fixed upon the free end of said spindle and disposed between said ring and said tubular extension, the outer end of said slide forming an annular nozzle with the mouth of the casing and permitting the issue of a portion of the combustion air therethrough, a port in said slide controlled by said ring at the axial slide motion for supplying another portion of the combustion air to the inside of the slide to issue at its mouth, the rear slide end forming an annular port with an outside portion of said fixed tubular extension for controlling the passage of the remainder of the combustion air between said extension and the slide to the interior of the slide by the axial slide motion, said slide having perforations on its circumference registerable with said liquid fuel bores in said ring when the slide is axially shifted to supply liquid fuel to the remainder of the combustion air to be atomized by it, a hub on said slide forming an annular port with the free end of said tubular extension for controlling by the axial slide motion the gaseous fuel delivery from said tubular extension to the slide mouth, and means on the outer end of said spindle for rotating and axially displacing said slide and helical ribs connecting the slide with its hub and helical ribs extending from the inner slide periphery towards said tubular extension within the zone of the liquid

fuel bores, said two sets of ribs imparting a whirling motion to the fuel air mixture passing through the burner.

5 11. A burner having a casing provided with an air intake, a fuel intake and a liquid fuel intake, a tubular element extending from the rear casing end into the interior thereof, and a slide between the casing and said element

having ports for controlling the air-fuel mixture for the burner, said element having 10 an intake port leading to its interior, and being rotatably disposed to permit the connection of said port with said air intake or said gas intake at will.

In testimony whereof I affix my signature.

FRANZ KARL HETSCH.