July 15, 1941. E. J. PEARSON 2,249,434

FUEL BURNER

Filed Dec. 26, 1939 2 Sheets-Sheet 1

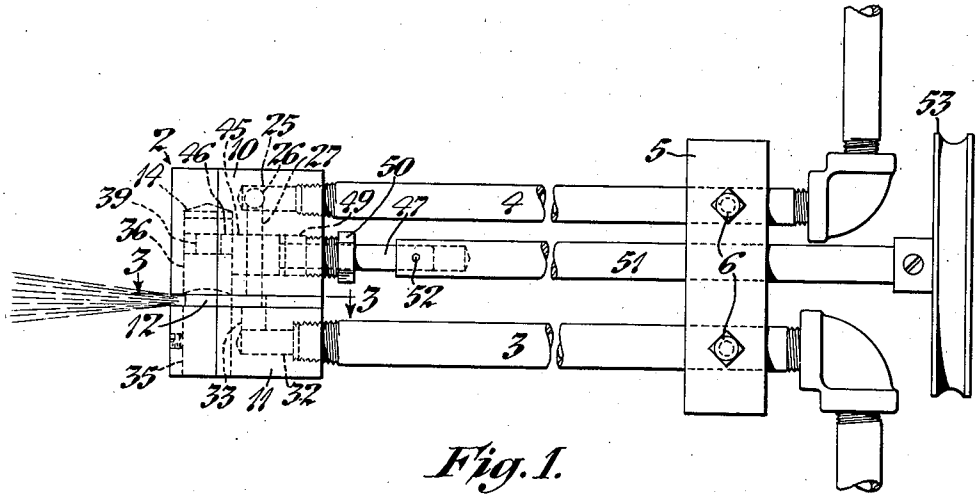


Fig. 1.

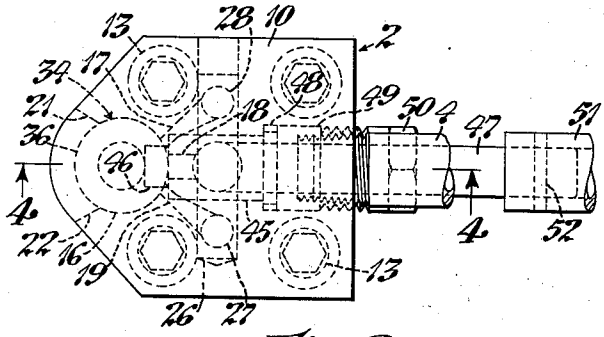


Fig. 2.

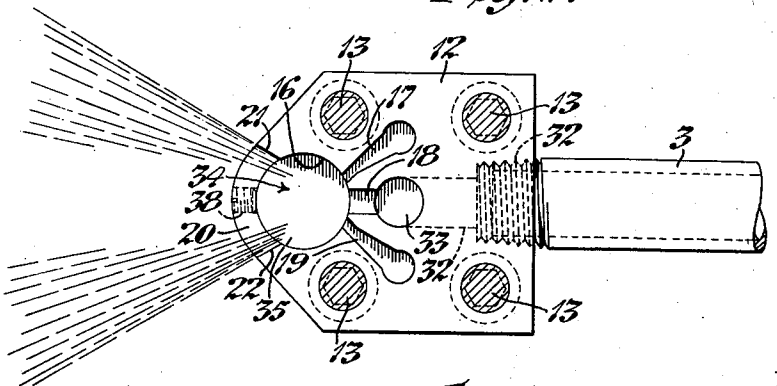


Fig. 3.

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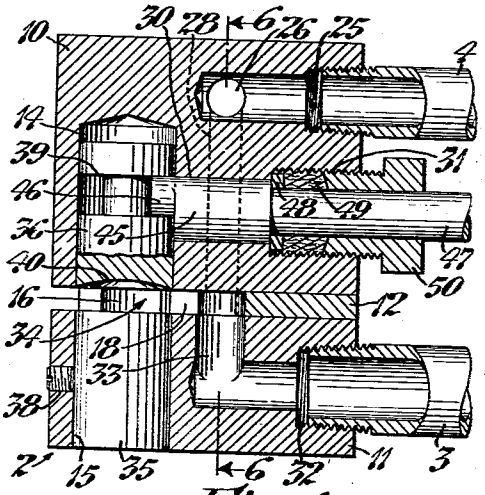


Fig. 4.

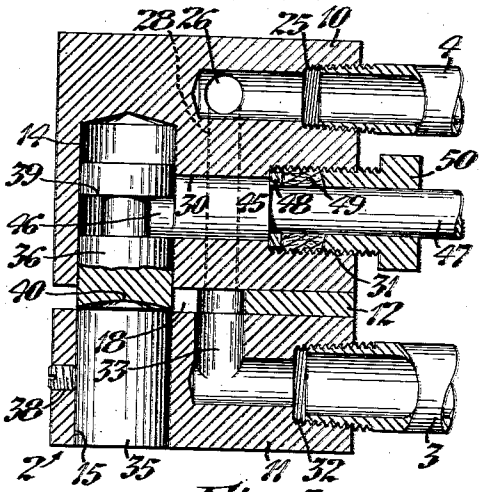


Fig. 5.

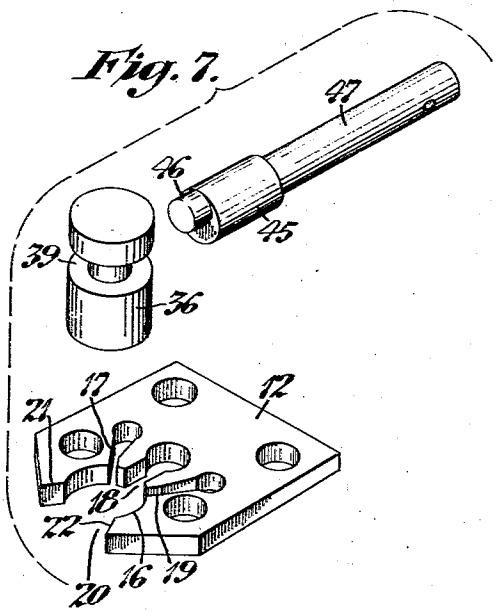


Fig. 7.

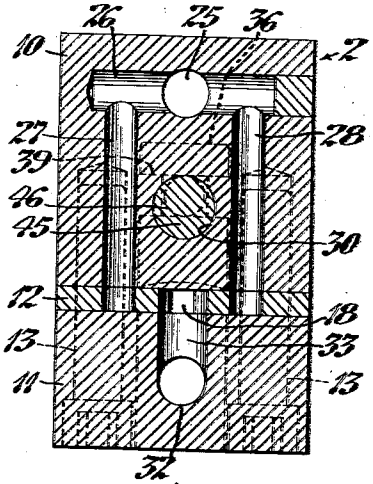


Fig. 6.

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UNITED STATES PATENT OFFICE

2,249,434

FUEL BURNER

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Application December 26, 1939, Serial No. 310,871

11 Claims. (Cl. 299—140)

The present invention relates to improvements in fuel burners and more particularly to burners in which a jet of atomized fuel is injected into the furnace of a boiler, heating apparatus or the like.

One of the objects of the present invention is to provide a burner-tip of novel construction having superimposed casing sections providing a mixing chamber within the casing, inlet ports for the fuel and atomizing medium and an outlet port or jet orifice for the mixed fuel charge.

Another object of the present invention is to provide a device of the type indicated adapted to be manually controlled to vary the volume of the fuel charge while maintaining the same relative mixture of fuel and atomizing medium.

Another object of the invention is to provide a device of the type indicated in which the inlet ports for the fuel and atomizing medium are opened and closed simultaneously with the opening and closing of the outlet port or jet orifice for the mixed fuel charge.

Another object of the invention is to provide a device of the type indicated having inlet and outlet ports at the sides of the mixing chamber and a manually operable valve adjustable in the chamber to simultaneously vary the area of the inlet and outlet ports in direct proportion.

Still another object of the invention is to provide a device of the type indicated which is efficient in its operation to control the volume of the fuel charge while of simple and compact construction to adapt it for economical manufacture.

Further objects of the improvement are set forth in the following specification which describes a preferred form of construction of the device, by way of example, as illustrated by the accompanying drawings.

In the drawings:

Fig. 1 is an elevational view of a burner incorporating the novel features of the present invention and showing the sectional construction of the burner-tip;

Fig. 2 is a plan view of the burner-tip;

Fig. 3 is a transverse sectional view taken on line 3—3 of Fig. 1 showing the apertured construction of the intermediate plate of the tip-casing to provide a mixing chamber with inlet and outlet ports therefor;

Fig. 4 is a longitudinal sectional view taken on line 4—4 of Fig. 2 showing the piston-valve for controlling the fuel charge in its uppermost position;

Fig. 5 is a view similar to Fig. 4 showing the piston-valve moved to its lowermost position to simultaneously close the inlet ports for the fuel and atomizing medium and the outlet port for the mixed fuel charge;

Fig. 6 is a transverse sectional view taken on line 6—6 of Fig. 4 showing the cored construction of the burner-tip casing providing channels or ducts for directing the fuel and atomizing medium to the inlet ports in the intermediate plate of the casing; and

Fig. 7 is a detailed perspective view of the intermediate plate, piston-valve and eccentric actuator for the piston-valve shown in disassembled relationship.

Referring to the accompanying drawings the present burner comprises a tip 2 mounted at the ends of pipes 3 and 4 for supplying fuel and an atomizing medium from suitable sources. The burner is particularly adapted for use with fuel oils but may be used with hydrocarbons of gaseous or powdered solid forms. The atomizing medium may be either compressed air or steam. The pipes 3 and 4 are supported by a bracket 5 to which they are clamped by means of set screws 6 and the bracket is in turn supported on the frame of a furnace or the like, not herein shown.

The casing of the tip 2 is of sectional construction, having an upper part 10, a lower part 11 and an intermediate plate 12 clamped in superimposed relationship by means of bolts 13. The sections 10 and 11 have alined vertical bores 14 and 15 and the plate 12 has a cylindrically-shaped opening 16 of the same diameter as the bores disposed in alinement therewith to provide a cylindrical chamber in the casing. As illustrated in Figs. 3 and 7 the plate 12 has a series of slots 17, 18 and 19 extending rearwardly from the periphery of the cylindrical opening 16 and closed at their top and bottom by the flat faces of the adjacent top and bottom sections 10 and 11 of the casing to provide a central inlet port for the fuel and a pair of inlet ports for the atomizing medium at opposite sides of the fuel port. The inlet ports 17 and 19 for the atomizing medium have restricted necks adjacent the cylindrical opening 16 and gradually widen toward their rearward terminals which are of circular contour. The inlet port 18 for the fuel is of uniform width with a rearward terminal of circular contour. The plate 12 also has a relatively wide slot 20 with angular sides 21 and 22 communicating with the forward side of the cylindrical opening 16 to provide a fan-shape outlet port or jet orifice.

The upper section 10 of the tip-casing 2 has a tapped bore 25 into which the threaded end of the pipe 4 is screwed. Extending transversely of the bore 25 is a conduit 26 and extending vertically from the conduit are two branch conduits 27 and 28, see Fig. 6, which communicate with the circular terminals at the rearward ends of the ports 17 and 19 in the plate 12. A second bore 30 having a tapped counterbore 31, see Fig. 4, is provided in the upper section 10 of the tip-casing 2.

The lower section 11 of the tip-casing 2 has a tapped bore 32 in which the threaded end of the pipe 3 is screwed and a vertical conduit 33 connecting the bore with the circular terminal at the rearward end of the central port 18 in the plate 12. Thus, oil or other fuel may be supplied through the pipe 3 to the central inlet port 18 while an atomizing medium, such as steam or air, is supplied through the pipe 4 to the inlet ports 17 and 19 at opposite sides of the port 18.

In accordance with the present invention a mixing chamber 34 for the fuel and atomizing medium is formed by the circular wall of the plate 12 surrounding the cylindrical opening 20 and the end of a piston-valve 36 in the bore 14 of the upper casing section 10 cooperating with the end of a cylindrical plug 35 in the bore 15 of the lower casing section 11. The piston-valve 36 is of a diameter to fit closely within the bore 14 in the upper casing section 10 and is formed with an annular groove 39 intermediate its ends. The lower end of the piston-valve 36 forming the upper wall of the mixing chamber 34 is preferably concaved as indicated by the reference character 40, see Fig. 4. The inlet and outlet ports 17, 18, 19 and 20 are thus located at the sides of the mixing chamber 34 extending through the intermediate plate 12. The plug 35 is of a diameter to fit closely within the bore 15 in the lower section 11 of the casing 2 and may be fixedly held in adjusted position in the bore by means of a set-screw 38.

The piston-valve 36 is movable axially in the mixing chamber 34 toward and away from the upper end of the plug 35 to either partially or completely close the inlet and outlet ports 17, 18, 19 and 20. The piston-valve 36 is adapted to be manually operated by means of an eccentric member 45. As illustrated most clearly in Figs. 4 and 5 the eccentric member 45 is in the form of a cylindrical plug which fits closely within the transverse bore 30 in the upper casing-section 10 and is provided at its end with an eccentric extension or crank-pin 46 projecting into the annular groove 39 in the piston-valve 36.

Formed integral with the eccentric member 45, or rigidly attached thereto, is an operating stem 47. The stem 47 projects through a packing-gland in the upper casing section 10, the gland having a washer 48 and a packing 49 compressed in the counterbore 31 around the stem by a gland-nut 50 screwed into the tapped counterbore 31. An operating rod or spindle 51 rotatably supported in the bracket 5 has its inner bored end telescoped over the end of the stem 47 of the eccentric member 45 and connected thereto by means of a pin 52 or the like, with an operating handle 53 at its outer end. One embodiment of the invention having now been described in detail the mode of operation of the burner is explained as follows:

It will be understood that the burner-tip 2 is assembled by clamping the upper section 10, intermediate plate 12 and lower section 11 in superimposed relationship by means of the bolts 13 having their heads received in sockets on the underside of the lower section 11. The piston-valve 36 is inserted into the bore 14 in the upper section 10 through the bore 15 in the lower section 11 and the cylindrical opening 16 in the plate 12. The plug 15 is thereafter inserted into the bore 15 and fixed in adjusted position by tightening the set-screw 38. The eccentric member 45 is inserted into the bore 30 to engage its crank-pin 46 in the groove 39 in the piston-valve 36 whereafter the packing gland is applied to the counter-bore 31 to prevent leakage around the operating stem 47. The spindle or operating rod 51 is connected to the end of the stem 47 and the threaded ends of the pipes 3 and 4 are screwed into the tapped bores 32 and 25 in the lower and upper sections of the casing.

Fuel and atomizing medium from suitable sources are introduced under pressure into the tip 2 through the pipes 3 and 4. The fuel enters the lower casing-section 11 and feeds through the bore 32 and conduit 33 to the circular terminal at the rearward end of the slot or port 18 in the plate 12. The atomizing medium enters the upper casing section 10 through the bore 25 and feeds through the conduit 26 and branch conduits 27 and 28 to the circular terminals at the rearward ends of the slots or ports 17 and 19 in the plate 12. The fuel and atomizing medium being under pressure are forced through the inlet ports 17, 18 and 19 and into the mixing chamber 34 formed by the sides of the plate 12 around the circular opening 20 and the ends of the plug 35 and piston-valve 36. The mixed fuel charge then discharges in a fan-shaped jet emitted through the outlet port or jet-orifice 20 formed by the angular faces 21 and 22 at the forward end of the burner-tip. Due to the mixture of fuel and atomizing medium and the pressure under which the mixture discharges the fuel immediately breaks up into a fine spray effecting substantially complete combustion when ignited.

To vary the volume of the fuel-charge the operating rod 51 may be turned by means of the handle 53 to cause the stem 47 to rotate the eccentric member 45 in the bore 30. Rotation of the eccentric member 45 serves to actuate the crank-pin 46 projecting into the annular groove 39 in the piston-valve 36 to slide the latter axially in the mixing chamber 34 to any position between the opposite extremes indicated in Figs. 4 and 5. With the piston-valve 36 in the position illustrated in Fig. 4 the inlet and outlet ports formed by the slots 17, 18, 19 and 20 in the plate 12 are opened to the full extent permitting a relatively large fuel charge to be ejected from the burner. With the piston-valve 36 moved to the position shown in Fig. 5 its lower end seats against the upper end of the plug 35 and closes the several ports to cut off the admission of fuel or atomizing medium through the inlet ports 17, 18 and 19 and the discharge of fuel through the outlet port 20. When the piston-valve 36 is moved to any position between the extremes illustrated in Figs. 4 and 5 the inlet port 18 for the fuel and the inlet ports 17 and 19 for the atomizing medium are opened a measured area in ratio or directly proportional to each other to maintain a constant predetermined mixture of fuel and atomizing medium as required for maximum combustion. Simultaneously, the outlet port is opened proportionately with respect to the inlet ports to discharge a measured amount of the mixed fuel. Thus, for any particular setting of the piston-valve 36 the areas of the inlet ports 17, 18, 19 and outlet port 20 are proportional to maintain a predetermined mixture for any size of the jet of mixed fuel. In other words, the fuel charge introduced into the mixing chamber 34 is increased or decreased directly in proportion to the increase or decrease in the area of the outlet port 20 to constantly maintain the same relative mixture. Simultaneously, with the opening and closing of the inlet ports 17, 18, 19 and outlet port 20 the

volume of the mixing chamber **34** is varied in direct proportion to maintain a constant pressure of the mixed fuel charge therein and therefore the same velocity to the jet issuing from the outlet port for all positions of the piston-valve **36**.

It will be observed from the foregoing specification that the present invention provides a novel construction and arrangement of elements in a burner-tip for controlling the volume of a mixed fuel charge without altering the proportions of the atomizing medium and fuel in the mixture.

While a preferred embodiment of the invention is herein described and illustrated it will be understood that modifications may be made in the structure and arrangement of the parts of the device without departing from the spirit or scope of the invention. Therefore, without limiting myself in this respect, I claim:

1. A burner of the type indicated comprising a casing forming a mixing chamber having separate inlet ports at the side thereof for supplying fuel and an atomizing medium, said inlet ports being spaced from each other and positioned both in the same plane, and a valve movable in the chamber transversely of the plane of the ports to simultaneously vary the areas of the separate inlet ports in direct proportion.

2. A burner of the type indicated comprising a casing forming a mixing chamber having inlet ports for supplying fuel and an atomizing medium and an outlet port through which the atomized fuel is discharged, said inlet and outlet ports being positioned both in the same plane, and a valve movable in the chamber transversely of the plane of the ports to simultaneously vary the areas of the inlet and outlet ports to control the volume of the atomized fuel charge while maintaining the same relative mixture of the fuel and atomizing medium.

3. A burner of the type indicated comprising a casing forming a cylindrical mixing chamber having peripheral inlet ports at one side for supplying fuel and an atomizing medium and a peripheral outlet port at its opposite side, said inlet and outlet ports being positioned in the same plane, and a piston-valve movable axially of the mixing chamber for simultaneously varying the area of the inlet ports and outlet port to control the volume of the fuel charge while maintaining the same relative mixture of fuel and atomizing medium.

4. A burner of the type indicated comprising a casing forming a mixing chamber having inlet ports at one side for supplying fuel and an atomizing medium and an outlet port at its opposite side, a valve forming one end of the mixing chamber and movable to control the area of the inlet and outlet ports, said valve having a transverse groove intermediate its end, and a manually rotatable actuating member having an eccentric pin engageable with the groove in the valve to adjust the latter in the mixing chamber.

5. A burner of the type indicated comprising a casing having cylindrical bores extending at right-angles to each other, one of said bores having inlet ports for supplying fuel and an atomizing medium and an outlet port for discharging the atomized fuel, a piston-valve movable in said bore for varying the area of the inlet and outlet ports and having a peripheral groove intermediate its end, a rotary member in the other bore having a crank-pin extending into the groove in the piston-valve, and manually-operable means for actuating said rotary member to slide the piston-valve axially in its bore to vary the area of the inlet and outlet ports.

6. A burner of the type indicated comprising a casing having cylindrical bores extending at right-angles to each other, one of said bores having inlet ports for supplying fuel and an atomizing medium and an outlet port for discharging the atomized fuel, a piston-valve movable in one of said bores and having an annular groove intermediate its ends, a plug adjustable in said bore, the ends of the piston-valve and plug forming an atomizing chamber therebetween, a rotary member in the other bore having a crank-pin engaging the groove in the piston-valve, and manually-operable means for actuating the rotary member to slide the piston-valve axially of the bore to vary the area of the inlet and outlet ports.

7. A burner of the type indicated comprising a casing having upper and lower sections, a plate held between said sections, said plate having an opening therein and slots at the sides of the opening forming inlet and outlet ports, means for supplying fuel and an atomizing medium to the opening through the inlet ports to cause the mixed fuel to be discharged through the outlet port, and means movable in the opening in the plate for simultaneously opening or closing the inlet and outlet ports.

8. A burner of the type indicated comprising a casing having upper and lower sections, a plate held between said sections, said plate having a circular opening therein forming a mixing chamber and slots at the sides of the opening forming inlet and outlet ports, and a piston-valve movable transversely of the plate in said circular opening for simultaneously opening or closing the inlet and outlet ports.

9. A burner of the type indicated comprising a two-part casing having a bore therein, a plate held between the casing parts and having a circular opening therein with a series of slots at the periphery of the opening, said circular opening in the plate being alined with the bore in one of the casing parts, means in the casing for supplying fuel and an atomizing medium to the circular opening in the plate through the slots, and a piston-valve slidable in the alined bore and circular opening to control the amount of fuel and atomizing medium supplied to and discharged from the burner.

10. A burner of the type indicated comprising a casing forming a mixing chamber having inlet ports for supplying fuel and an atomizing medium and an outlet port for the mixed fuel charge, said inlet and outlet ports being positioned in the same plane, and a control member movable in the chamber in a direction transverse to the plane of the ports for simultaneously varying the area of the inlet and outlet ports of the mixing chamber in direct proportion.

11. A burner of the type indicated comprising a casing forming a cylindrical mixing chamber having inlet ports in its periphery for supplying fuel and an atomizing medium and an outlet port in its periphery for the mixed fuel charge, said inlet and outlet ports being positioned in a common plane transverse to the axis of the cylindrical mixing chamber, and a piston-valve movable axially of the mixing chamber for varying the area of the outlet port to control the volume of the mixed fuel charge.

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