Sept. 3, 1946. W. S. SUTTON 2,407,188

BURNER

Filed Sept. 27, 1943

Fig. 1

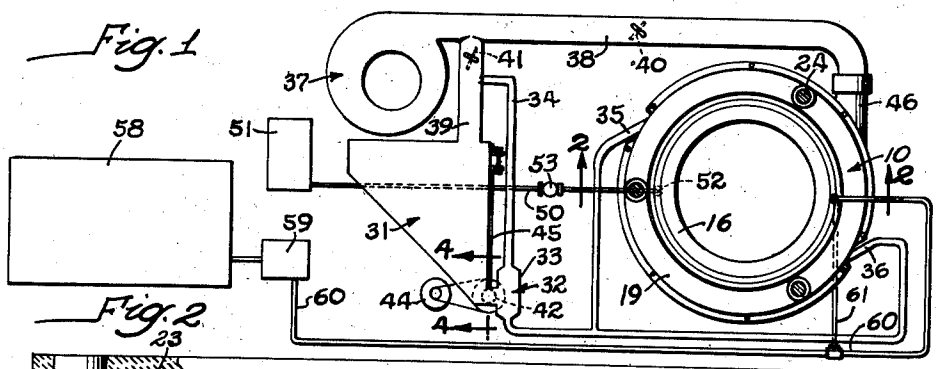
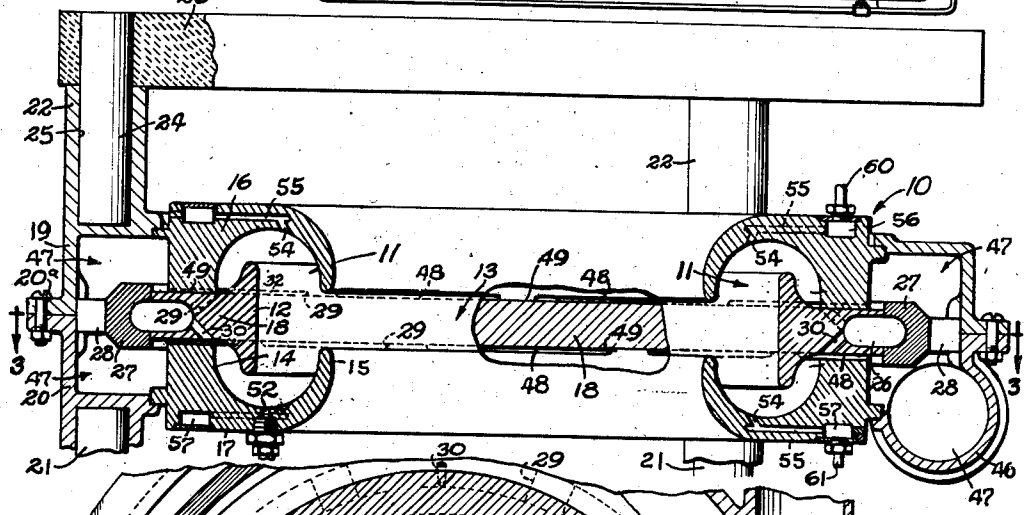


Fig. 2



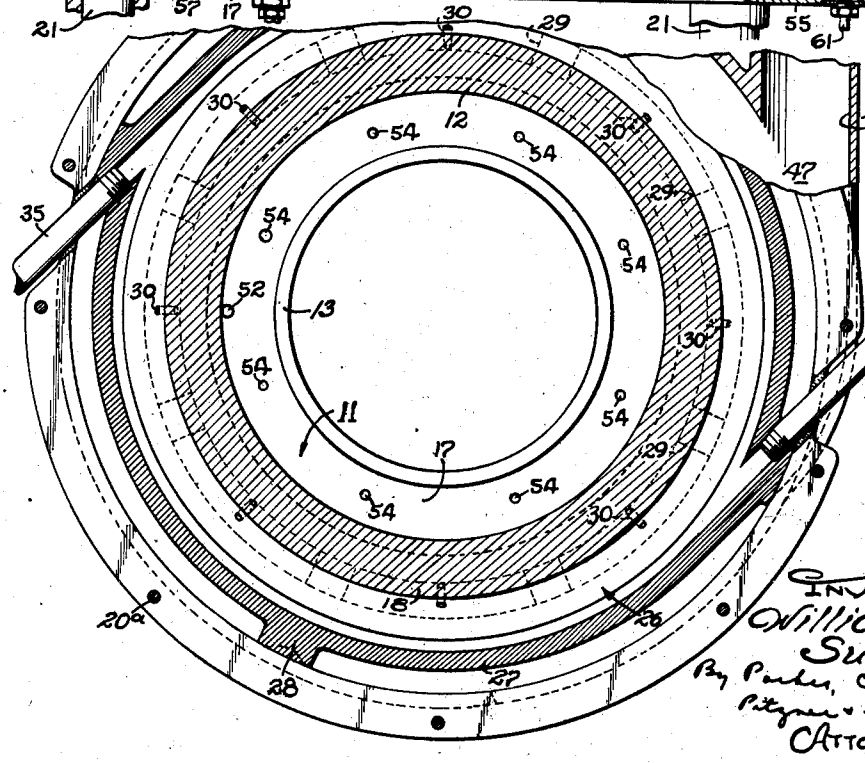


Fig. 3

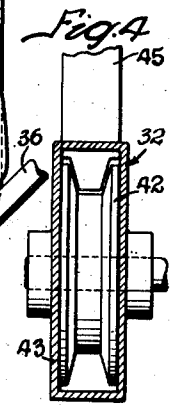


Fig. 4

INVENTOR
William S. Sutton
By Parker, Coykendall, Pilgrim & Hubbard
ATTORNEYS

Patented Sept. 3, 1946

2,407,188

UNITED STATES PATENT OFFICE

2,407,188

BURNER

William S. Sutton, Rockford, Ill.

Application September 27, 1943, Serial No. 503,951

10 Claims. (Cl. 110—28)

1

The invention pertains to burners for installation in the fire box of a furnace or boiler, and it has particular reference to a burner designed for the use of powdered fuel such as pulverized coal.

The primary object of the invention is to provide a burner in which fuel and air are introduced and intermixed in a novel and advantageous manner so as to promote efficient combustion.

A further object is to provide a burner structure for use in the combustion chamber of a furnace or boiler and having an annular burner head providing a combined mixing and combustion chamber of advantageous character to which the powdered coal and air are supplied for intimate mixture.

Still another object is to provide a burner head of the character set forth in which the air and fuel is supplied under pressure to an annular chamber and discharged through an annular discharge nozzle opening inwardly or centrally of the head.

A further object is to provide a burner for powdered fuel adapted to receive an initial supply of oil or other liquid fuel capable of being ignited easily.

Another object is to provide an auxiliary oil supply to the burner when desirable for the purpose of enriching the combustible mixture.

The objects of the invention, thus generally stated, together with other and ancillary advantages are attained by the construction and arrangement shown by way of illustration in the accompanying drawing forming a part hereof, in which:

Figure 1 is a schematic view of the improved burner and an associated fuel supply system.

Fig. 2 is a fragmentary vertical sectional view through the burner taken approximately in the line 2—2 of Fig. 1, but on a larger scale.

Fig. 3 is a fragmentary horizontal sectional view taken approximately in the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary sectional view taken approximately in the plane 4—4 of Fig. 1 and also on an enlarged scale.

The improved burner is adapted to be positioned centrally within the combustion chamber or fire box of a furnace, boiler or other heating plant (not shown). It comprises, in general, a burner head 10 providing a combined mixing and combustion chamber 11 to which fuel in the form of powdered coal is delivered with air under pressure. The chamber 11 is preferably annular in form and the incoming fuel and air is admitted through one wall so as to impinge upon a baffle 12 so as to insure intimate mixture in the chamber. Ignition takes place in the chamber and burning gases are discharged through an annular slot 13 opposite the inlet and directed horizontally across a rising column of secondary air admitted to the fire box in the usual way.

2

In the present illustrative embodiment of the invention, the annular chamber 11 formed by the burner head is of oval cross section while the structure of the burner head is substantially C-shaped in cross section so as to form a closed outer wall 14 and an inner wall 15 apertured to form the outlet slot 13.

As shown, the burner structure is composed of two head members 16 and 17 separated by a spacer ring 18 and each shaped to form a semicircular channel, with the two channels in opposed relation. Due to the interposition of the spacer ring 18, the chamber assumes a vertically elongated or oval form and the inner sides of the two members occupy a spaced relation to form the slot 13.

The burner head may be supported in any suitable or preferred manner in the combustion chamber or fire box in which it is to be used. As herein shown, it is clamped between upper and lower supporting members 19 and 20 detachably secured together by means of bolts 20^a. The lower one of the two supporting members is shown equipped with supporting legs 21 and in the present instance the upper one of the two members carries a plurality of posts 22 for supporting a baffle plate 23 adapted to deflect the flames laterally outward against the sides of the fire box. The baffle plate is equipped with studs 24 for engagement with sockets 25 in the posts.

In the preferred embodiment of my invention, powdered coal is supplied to the annular chamber 11 through the medium of an annular feed channel 26 which is conveniently formed in part by the spacing ring 18 and in part by an encircling ring 27 having radial lugs 28 clamped between the two main supporting members. From the inner side of the feed channel 26 two series of discharge ports 29 and 30 lead respectively upwardly and downwardly as well as inwardly for discharge into the annular chamber 11. As shown in Fig. 3, the ports 29, 30 are spaced apart circumferentially and the ports of one series are preferably staggered with respect to the ports of the other.

The baffle ring 12 may conveniently be cast integral with the spacing ring 18. It is shaped to provide two circular wings respectively, project-

ing toward the top and bottom of the annular chamber 11, thereby forming an approximately vertical web disposed adjacent to the outer peripheral wall of the chamber so as to be impinged upon by the incoming mixture of fuel and air in the manner which will presently appear.

The means for delivering the powdered fuel to the burner head is of the type in which primary air supplied under pressure is utilized for entraining the fuel as it is fed from its source of supply. As shown in Fig. 1, 31 designates a fuel hopper having at its outlet a motor driven feed device 32 acting to deliver a measured flow of fuel into a chamber 33 interposed in a feed line 34, the latter having branch lines 35 and 36 respectively discharging at diametrically opposed points into the annular feed channel 26 tangentially thereof (Fig. 3).

To supply air under pressure to the feed line 34, to provide an additional supply of primary air, and to supply air to the upper portion of the hopper so as to promote proper feeding of fuel from the hopper, I provide a blower 37 having a main discharge line 38 leading to the burner head for the purpose of supplying air under pressure to the burner, and a branch line 39 connected with the upper portion of the hopper, the feed pipe 34 being connected to the branch line 39. To regulate the volume of air supplied to the burner, a suitable valve 40 is interposed in the main air line 38. Similarly, a valve 41 is provided in the branch line 39 so as to control the volume of air supplied to the hopper and to the fuel feed line 34.

The fuel feeding device 32 associated with the hopper may be of any suitable or preferred character. As shown, it comprises a disk 42 (Fig. 4) having an annular groove in its periphery and mounted in a housing 43 communicating with the chamber 33 in the feed line. The disk 42 is driven by a motor 44 and the amount of fuel delivered thereby to the chamber 33 is determined by the position of a slide 45 adjustably mounted on one side of the hopper and projecting into the housing 43 for coaction with the disk.

The main air supply line 38 is connected with the burner head through the medium of an inlet pipe 46 discharging tangentially at the bottom of an annular air chamber 47 surrounding the burner head and formed by the two supporting castings 19 and 20. As shown in Fig. 2, the inlet pipe 46 is formed as a part of the lower supporting member 20 and communicates freely with said annular air chamber. It will be understood that free communication is also permitted between the upper and lower portions of the air chamber due to the fact that the ring 27 is supported by radial lugs 28.

From the air chamber 47 air is admitted to the annular chamber 11 of the burner head through narrow horizontal slots 48 formed between the respective head members and the central spacing ring 18, the head members being formed with spacing bosses 49 at circumferentially spaced points. Preferably, the fuel outlet ports 29 and 30 communicate with the annular mixing chamber through the medium of these slots. Thus the inner ends of the ports open into the slots at the point of discharge of the latter into the mixing chamber, as shown clearly in Fig. 2.

The construction and arrangement thus set forth insures a complete and thorough mixing of the main air supply with that utilized for feeding purposes, the mixture impinging in separate

streams upon the wings of the baffle ring 12. Moreover, the division of the mixture into upper and lower portions by the use of two series of ports, while guiding and directing such portions oppositely, causes them to impinge upon each other forwardly of the baffle ring, thereby additionally promoting intermixture and efficient combustion.

To facilitate ignition in starting the burner in operation, provision is made for the use of an easy starting fuel such as oil. To this end, the trough or bowl-like character of the bottom of the mixing chamber is utilized to advantage. Thus, I provide an oil supply pipe 50 leading from a supply tank 51 to an inlet port 52 opening into the bottom of the chamber. The pipe is equipped with a valve 53 to permit of the flow of a small quantity of fuel into the bottom of the chamber where it may be ignited.

The improved burner structure also lends itself readily to the supply when desired of an auxiliary fuel such as oil for the purpose of enriching the mixture, thereby permitting the use of a low grade of powdered coal. For this purpose, each of the burner head members is provided with a series of inlet ports 54 connected by radial passages 55 with annular supply channels 56 and 57 respectively in the two burner head members. Fuel oil is supplied from a tank 58 under the control of a suitable regulating device 59 to a supply line 60, the latter having two branches 60 and 61 leading respectively to the supply channels 56 and 57.

In operation, a small quantity of oil or other starting fuel is first admitted to the bottom of the mixing chamber by suitably operating the shut off valve 53 in the pipe line 50. The blower 37 is then set in operation and the motor of the feed device similarly started. Air thus supplied to the fuel feed line 34 acts to entrain fuel delivered by the feeding device 32 into the chamber 33, and the mixture of fuel and air is thus delivered to the feed channel 26 in the burner head for discharge through the two series of ports 29 and 30 into the annular chamber 11 of the burner head.

Simultaneously, air is supplied through the main air supply line 38 to the annular air chamber 47 encircling the burner, from which it passes through the slots 48 into the inner ends of which the fuel ports 29, 30 discharge. Thus a mixture of air and powdered coal is delivered to the chamber 11 through the outer wall thereof and this mixture is divided into two portions deflected by the baffle 12 so as to follow respectively the upper and lower curved surfaces of the chamber 11. Finally the two portions of the mixture impinge one upon the other inwardly of the baffle ring, thereby insuring an intimate and thorough mixture of the fuel and air for ignition in the chamber.

The burning gases are discharged centrally of the burner so as to intersect a rising column of secondary air admitted to the fire box from below, and at a point spaced upwardly from the burner the flames impinge upon the baffle plate 23 so as to be deflected outwardly against the sides of the fire box. It will of course be understood that if desired, the baffle plate 23 may be omitted when desired.

When burning a low grade of fuel, or under other conditions when enrichment of the mixture is rendered desirable, fuel oil may be supplied to the burner head from the tank 58. In this connection, it will be observed that the intro-

duction of such additional source of fuel to the mixing chamber through the top and bottom walls thereof is advantageous in that it is over these walls that the primary mixture of air and powdered fuel is caused to sweep in the operation of the burner.

The construction thus provided has been found to operate with a high degree of efficiency. Moreover, the structure is relatively simple, with no moving parts with the exception of the blower and feed device, and is accordingly relatively trouble free.

I claim as my invention:

1. A burner of the character set forth comprising, in combination, a burner head comprising upper and lower members each having a semicircular channel, a spacer ring interposed between said members with said channels in opposed relation to form a mixing and combustion chamber, said members defining an annular outlet opening at the inner side of said chamber, and means for supplying fuel to said chamber including an annular channel in said spacer ring and ports connecting said channel with said chamber.

2. A burner of the character set forth comprising, in combination, a burner head comprising upper and lower members each having a semicircular channel, a spacer ring interposed between said members with said channels in opposed relation to form a mixing chamber, said members defining an annular outlet opening at the inner side of said chamber, means for supporting said members comprising upper and lower sections clamping said two members together with said spacing ring interposed between them, and inlet slots formed between opposite sides of said spacer ring and said burner members.

3. A burner of the character set forth comprising, in combination, a burner head comprising upper and lower members each having a semicircular channel, a spacer ring interposed between said members with said channels in opposed relation to form a mixing chamber, said members defining an annular outlet opening at the inner side of said chamber, means for supporting said members comprising upper and lower sections clamping said two members together with said spacing ring interposed between them, and fuel and air inlet means including air slots formed at opposite sides of the spacer ring and fuel supply ports opening into said chamber at the inner ends of said slots.

4. A powdered fuel burner comprising, in combination, a burner head having an annular horizontally disposed chamber defined by outer, inner, top, and bottom walls, said inner wall having an annular outlet slot narrower in vertical height than the spacing of said top and bottom walls, means forming an annular fuel supply channel surrounding said outer wall, means for supplying a mixture of powdered fuel and air under pressure to said channel, and means providing a plurality of passages extending from said channel through said outer wall to connect the channel and said chamber, certain of said passages being inclined upwardly from said channel to direct streams of air and fuel mixture into said chamber upwardly toward said top wall and certain of the passages being inclined downwardly from said channel to direct the air and fuel mixture downwardly toward said bottom wall.

5. A powdered fuel burner comprising, in combination, a burner head having an annular horizontally disposed chamber defined by outer, inner, top, and bottom walls, said inner wall having an annular outlet slot narrower in vertical height than the spacing of said top and bottom walls, and said top and bottom walls being of concave contour, means providing passages extending through said outer wall into said chamber, and means for supplying a mixture of powdered fuel and air under pressure to said passages, certain of said passages extending upwardly to project the air and fuel mixture into said chamber toward said top wall, and the other passages extending downwardly into said chamber to project the fuel and air mixture toward said bottom wall.

6. A powdered fuel burner comprising, in combination, a burner head having an annular horizontally disposed chamber defined by outer, inner, top, and bottom walls, said inner wall having an annular outlet slot narrower in vertical height than the spacing of said top and bottom walls, means providing passages extending upwardly and downwardly through said outer wall into said chamber and diverging away from each other toward said top and bottom walls respectively so as to direct streams of air and fuel mixture respectively toward said top and bottom walls, means for supplying a mixture of powdered fuel and air under pressure to said passages, and means for supplying additional air under pressure through said outer wall and into said chamber adjacent the points of entry of said fuel and air mixture.

7. A powdered fuel burner comprising, in combination, a burner head providing an annular horizontally disposed chamber having inner, outer, top, and bottom walls, said inner wall having an annular opening therein narrower than the spacing of said top and bottom walls, baffle means projecting into said chamber from said outer wall and defining adjacent the outer wall upwardly and downwardly inclined surfaces which diverge away from each other toward said top and bottom walls and terminate short of said opening, and means for delivering a mixture of powdered fuel and air under pressure through said outer wall and in separate streams respectively directed toward and against said upwardly and downwardly inclined baffle surfaces.

8. A powdered fuel burner comprising, in combination, a burner head providing an annular horizontally disposed chamber having inner, outer, top, and bottom walls, said inner wall having an annular opening therein narrower than the spacing of said top and bottom walls and said top and bottom walls being of concave contour, baffle means in said chamber defining adjacent the outer wall upwardly and downwardly inclined surfaces which diverge away from each other toward said concave top and bottom walls, and means for delivering a mixture of powdered fuel and air under pressure through said outer wall and in separate streams respectively directed toward and against said upwardly and downwardly inclined baffle surfaces.

9. A powdered fuel burner comprising, in combination, a burner head providing an annular chamber having inner and outer walls and a connecting wall, said inner wall having an annular opening therein narrower than the axial height of said chamber, baffle means in said chamber having a surface disposed opposite said outer wall and inclined toward said connecting wall and terminating short of the latter and said annular opening, and means for delivering a mixture of powdered fuel and air under pressure through said outer wall and into said chamber and against said baffle surface.

10. A powdered fuel burner comprising, in combination, a burner head providing an annular chamber having inner, outer, top, and bottom walls, said inner wall having an annular opening therein narrower than the spacing of said top and bottom walls, a baffle ring supported within said chamber and dividing the latter into upper and lower portions, and means for delivering a mixture of powdered fuel and air under pressure through said outer wall and in separate streams directed into said upper and lower portions and against the opposite side surfaces of said baffle ring.

WILLIAM S. SUTTON.