March 7, 1944. W. F. OBERHUBER 2,343,572

FINELY DIVIDED FUEL BURNER

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Fig. 1.

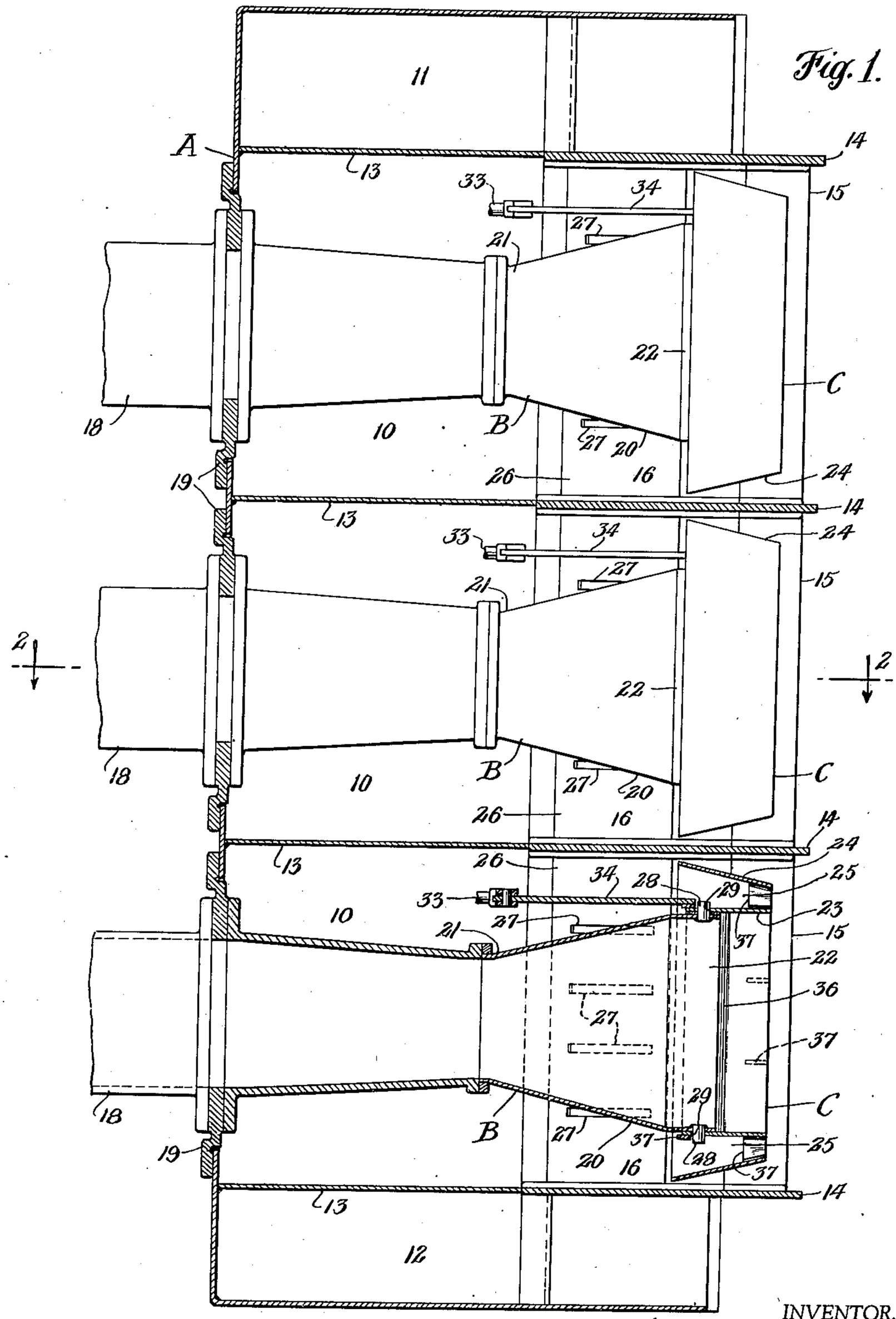

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Fig. 2.

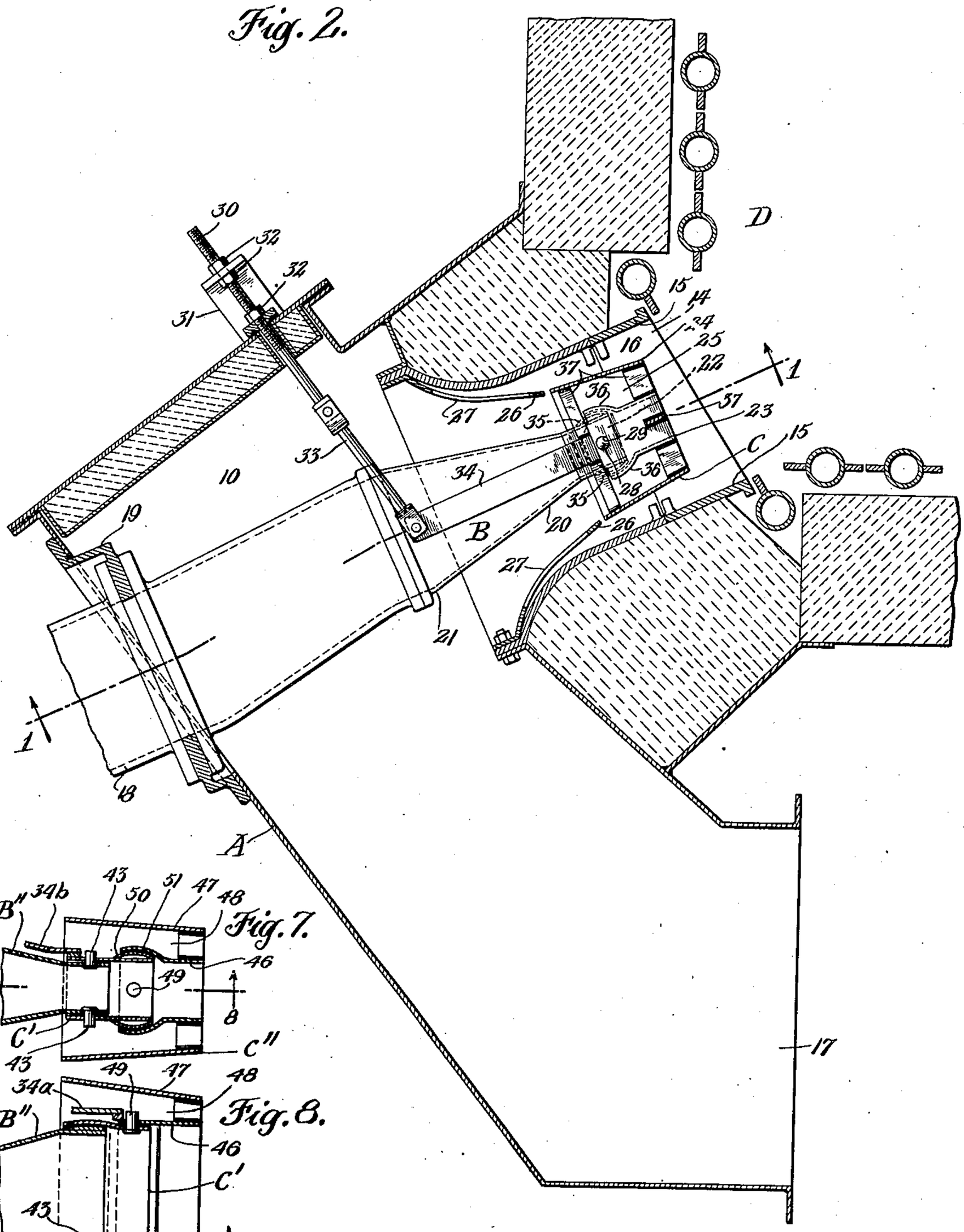

Fig. 7.

Fig. 8.

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Fig. 4.

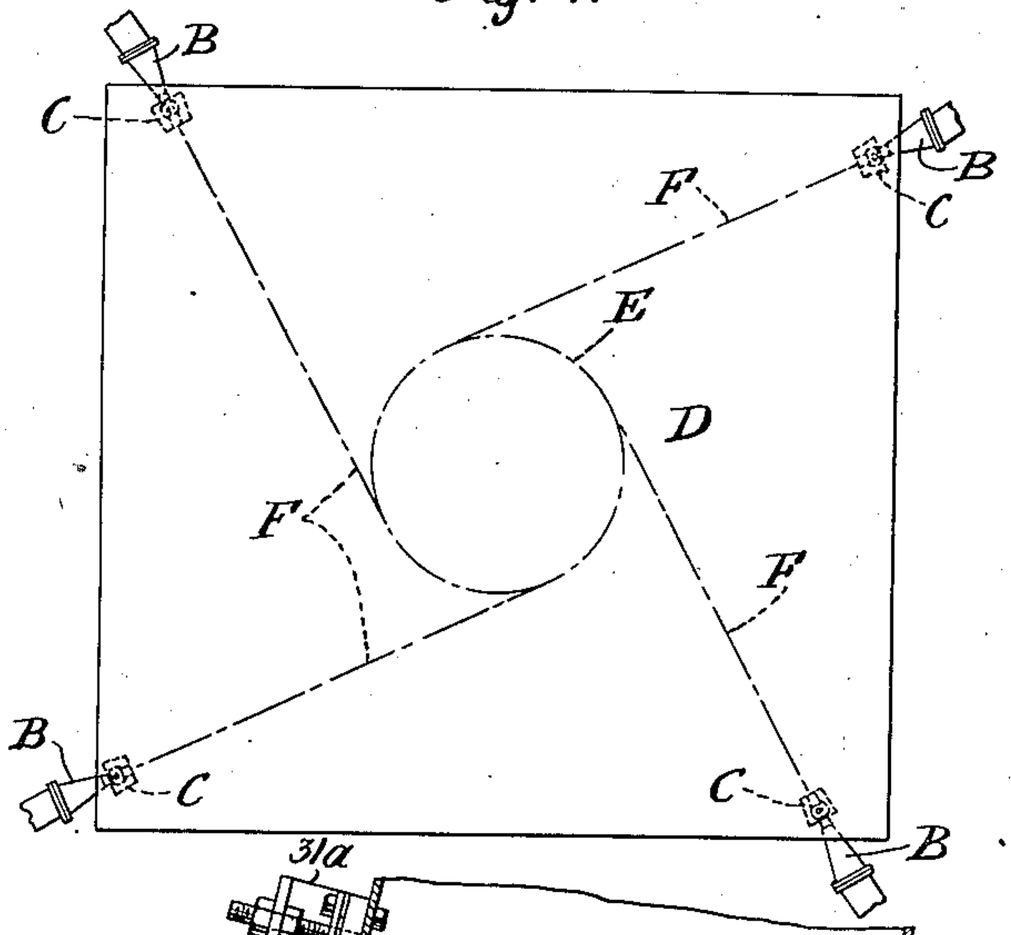
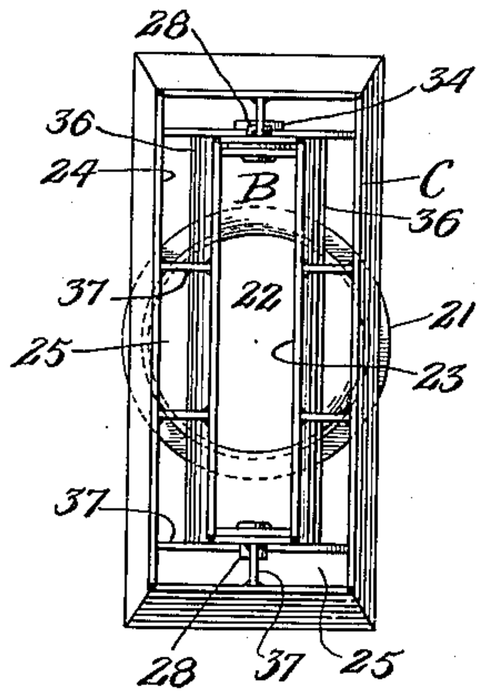


Fig. 3.



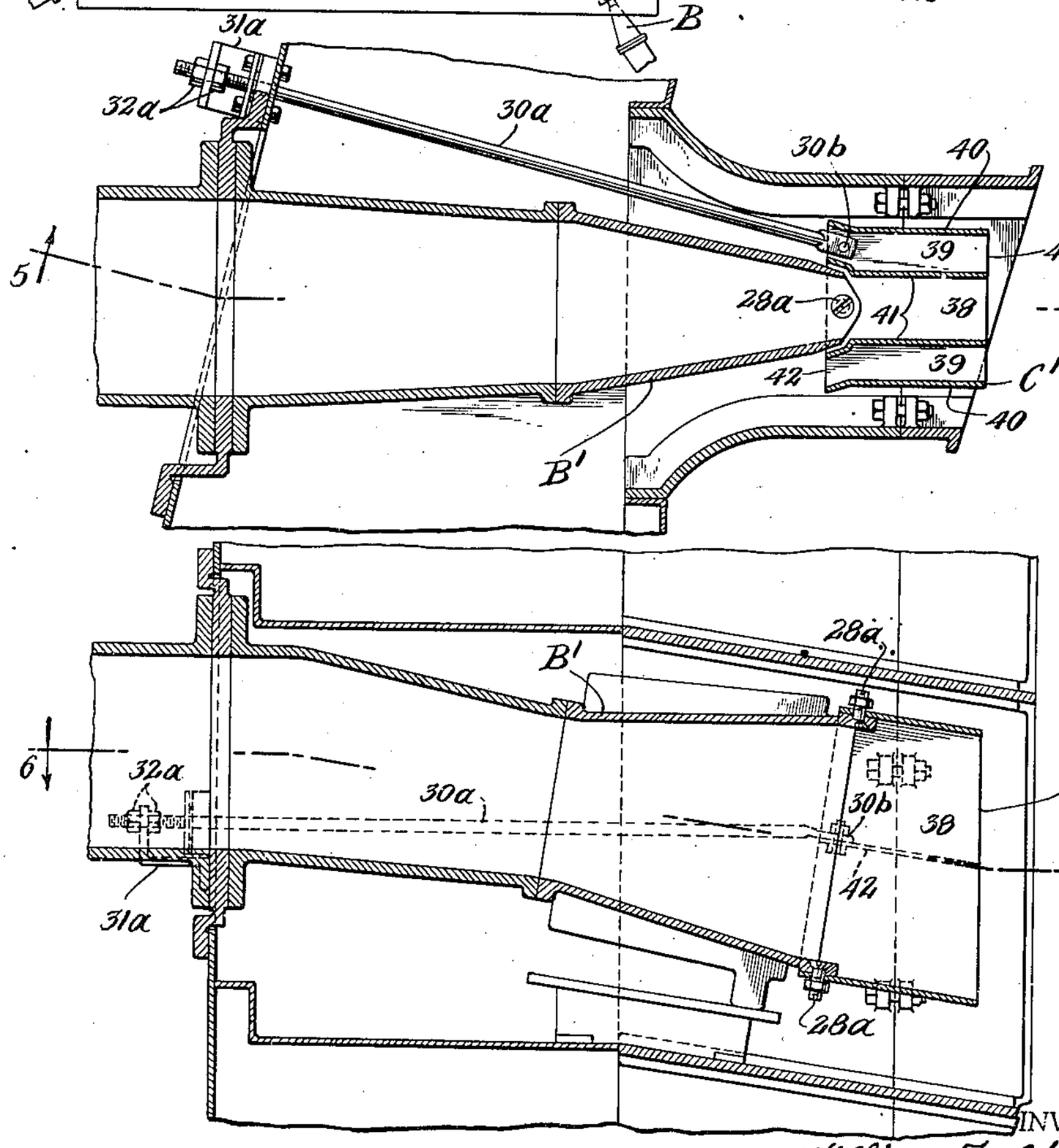


Fig. 6.

Fig. 5.

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2,343,572

UNITED STATES PATENT OFFICE

2,343,572

FINELY DIVIDED FUEL BURNER

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Application July 1, 1940, Serial No. 343,328

8 Claims. (Cl. 110—104)

This invention relates to fuel burners for use in pulverized coal burning furnaces and is particularly useful in furnaces in which the fuel is introduced by what is known as the tangential method of firing.

The primary object of my invention is the provision of burner means adapted to be adjusted in a simple and effective manner to vary the angle of discharge of the fuel and air streams into the furnace.

A more specific object of my invention is the provision of adjustable tip means for burners of the above character whereby the angle of discharging fuel and air streams may be varied while still maintaining effective admixture and, therefore, an even flame.

How the foregoing, together with such other objects and advantages as may hereinafter appear or are incident to my invention, are realized is illustrated in preferred form in the accompanying drawings wherein—

Figure 1 is a sectional elevational view of a burner constructed in accordance with my invention with the casing and the lower fuel nozzle and adjustable tip means shown in section as taken substantially on the line 1—1 of Figure 2;

Figure 2 is a plan section taken on the line 2—2 of Figure 1, but with the fuel nozzle and certain associated parts appearing in full plan view;

Figure 3 is an end view of one of the burner nozzles looking toward the left in Figure 1;

Figure 4 is a diagrammatic plan view of a furnace showing the burners of my invention mounted for tangential firing;

Figure 5 is a longitudinal section through a modified form of burner, the section being taken on the line 5—5 of Figure 6;

Figure 6 is a plan section taken on the line 6—6 of Figure 5;

Figure 7 is a fragmentary section taken on the line 7—7 of Figure 8, illustrating a modification of my invention; and

Figure 8 is a fragmentary vertical section taken on the line 8—8 of Figure 7.

Referring to Figures 1, 2 and 3, the burner comprises, in general, an air casing A, in this instance divided into three superimposed air chambers 10, in each of which a fuel nozzle B and associated adjustable tip means C is located. A top air chamber 11 and a bottom air chamber 12 may also be provided. In order to form the chambers 10 the rear portion of the casing is provided with a plurality of horizontal partitions 13 and the front portion with a plurality of horizontal partitions 14. Vertical side members 15 extend between the partitions 14 so as to form rectangular passages 16 which open at the rear into the air chambers 10 and at the front into the furnace chamber D. Air inlets 17 for the admission of air, preferably preheated, to the chambers 10 are provided. Suitable air dampers (not shown) are provided to control the admission of the air.

The fuel nozzles B, to which pulverized coal is led as by means of pipes 18, are supported in the casing by means of supporting members 19 and are so positioned that their nozzle portions 20 are located in the passages 16, it being noted that the nozzle portions merge from a round cross-section 21 at the rear to a rectangular cross-section 22 at the front, as clearly shown in Figure 3.

The adjustable tip means C for each nozzle comprises an inner rectangular shell 23 corresponding to the rectangular discharge end of the nozzle through which the fuel discharging from the fuel nozzle passes, and an outer rectangular shell 24 of larger size which provides an air passage 25 in surrounding relation to the inner shell. The outer shell 24 flares outwardly toward the back, and air from the air casing enters the enlarged end of the passage 25 and discharges through the smaller end into the furnace chamber. At the sides of the passages 16 flaring plates 26 are preferably employed to direct the air into the passage 25. A plurality of openings 27 are provided in the plates 26 to permit some air to pass therethrough and thus prevent any tendency for the creation of a vacuum in front of the plates.

In order to provide for adjustment of the tip means C it is pivotally mounted on the end portion of the nozzle B by means of vertically disposed pivot pins 28 which fit the holes 29 in the top and bottom walls of the inner shell 23. A threaded adjusting rod 30 is adjustably secured adjacent one end to the casing A by means of a bracket 31 and adjusting and locking nuts 32 located exteriorly of the air casing. This rod is connected at its other end to a link 33 which, in turn, is connected to an arm 34 rigidly secured to the inner shell 23.

Vertically extending curved members 35 are secured to the flattened sides of the nozzle at its discharge end to cooperate with the curved upright portions 36 of the inner shell 23 of the tip C so as to maintain a joint between the nozzle and the tip in any adjusted position of the tip, it being noted that the curve of these cooperating

portions is struck from the center of the pivot pins 28.

The outer shell 24 of the tip is secured in fixed spaced relation to the inner shell 23 by suitable braces 37, and it will thus be seen that the relation of the surrounding air passage 25 to the inner fuel passage is not altered in any position of adjustment of the tip. Thus, the tip C may be moved into any desired angular position of adjustment without altering the angle of the air stream issuing from the passage 25 relative to the angle of the fuel stream issuing from the nozzle B. This is of importance in order to obtain proper firing conditions because, if these relative angles were changed, improper admixture of fuel and air would result, certain portions of the flame being provided with inadequate air for complete combustion, and other portions having too much air. This would result in ineffective combustion and an uneven flame. For example, if the angle of the fuel stream were altered with respect to the air stream so as to be directed at an angle to the air stream, the resulting flame at the side where the larger amount of air is delivered would be bright, while on the other side where the smaller amount of air is delivered would be smoky. To avoid this condition I have provided an adjustable tip having fixed fuel and air passages providing proper admixture, which is bodily adjusted to vary the angle of discharge of the burner.

Referring now to Figure 4, I have therein diagrammatically illustrated an application of my invention to a pulverized coal burning furnace whereby tangential firing is obtained. The burners B are located at the corners of the furnace and positioned so as to deliver their streams in a direction tangent to an imaginary cylinder, indicated at E, having its axis extending vertically. As has been pointed out above, the angle of the streams discharging from the burners, indicated by the dot-and-dash lines F, may be altered by adjusting the angle of the tips C and this without altering the quality of the flame.

In Figures 5 and 6 I have illustrated adjustable tip means C′ of modified form provided with a central fuel passage 38, and side air passages 39, 39. The outer walls 40 of the passages 39 are braced from the inner walls 41 as by means of plates 42 so that the air and fuel streams are maintained in fixed relation in all positions of adjustment of the tip. The tip C′ is pivotally mounted on the nozzle B′ by means of the pivot pins 28*a* and adjustment is afforded by means of the adjusting rod 30*a* connected to the tip at 30*b* at one end and adjustably supported adjacent its other end by means of a bracket 31*a* and lock nuts 32*a*. In this modification I have shown the nozzle B′ directed downwardly as viewed in Figure 5.

While I have shown the tip means in Figures 1, 2, 3, 5 and 6 as being angularly adjustable on a substantially vertical axis only, I also contemplate having them universally adjustable, for example, as illustrated in Figures 7 and 8. In these figures the nozzle tip means comprises the tip members C′ and C″. The member C′ is of rectangular form corresponding to the rectangular discharge end of the nozzle B″ and is pivotally mounted on the horizontally disposed pivot pins 43 carried by the end portion of the nozzle, it being pointed out that curved surfaces 44 are provided on the nozzle which cooperate with the curved surfaces 45 on the member C′.

The member C″ comprises an inner rectangular shell 46 corresponding to the rectangular discharge end of the member C′ through which the fuel passes, and an outer rectangular shell 47 of larger size which provides an air passage 48 in surrounding relation to the inner shell 46 and the member C′.

The member C″ is pivotally mounted on the vertically disposed pivot means 49 carried by the member C′. Vertically extending curved members 50 are secured to the sides of the member C′ to cooperate with the curved surfaces 51 of the inner shell 46.

The nozzle tip means may be adjusted into various positions of adjustment by suitable adjusting means such, for example, as the arms 34*a* and 34*b* corresponding to the arm 34 of Figures 1 and 2, and operable by adjusting rods similar to the rod 30 of those figures. Adjustment of the arm 34*a* adjusts the tip means on the upright pivot pins 49, and adjustment of the arm 34*b* adjusts the tip means on the horizontal pivot pins 43 so that by manipulating the two adjusting rods substantially universal angular adjustment may be obtained.

The advantage of adjustment of the tip means vertically is that the level of the flame may be altered to suit coals having ash of different characteristics. For example, with a coal having low melting point ash it is desirable to keep the body of the flame as low as possible in the furnace in order to minimize slagging difficulties in the boiler tubes. With coal having high melting point ash the flame may be carried higher in the furnace.

I claim:

1. A finely divided fuel burner for furnaces comprising an air casing, means mounted in a wall of the furnace providing an air discharge outlet in said casing, a fuel nozzle mounted in said casing in fixed relation thereto to discharge fuel through said air discharge outlet, tip means associated with said fuel nozzle and said air discharge outlet, said tip means having a central fuel passage and a surrounding substantially parallel air passage in fixed relation to each other and constructed and arranged to separately discharge the air from said passage and the fuel from said passage directly into the furnace with the air in substantially uniform surrounding relation to the discharge from the fuel passage, and means for bodily adjusting said tip means to vary the angle of discharge of the fuel and air.

2. A finely divided fuel burner for furnaces comprising an air casing, means mounted in a wall of the furnace providing an air discharge outlet in said casing, a fuel nozzle mounted in said casing in fixed relation thereto to discharge fuel through said air discharge outlet, tip means associated with said fuel nozzle and said air discharge outlet, said tip means having a central fuel passage and a surrounding substantially parallel air passage in fixed relation to each other and constructed and arranged to separately discharge the air from said passage and the fuel from said passage directly into the furnace with the air in substantially uniform surrounding relation to the discharge from the fuel passage, and means for bodily adjusting said tip means to vary the angle of discharge of the fuel and air, comprising a pivotal mounting for the tip means, and an adjusting member connected to the tip means and extending through said air casing.

3. A finely divided fuel burner for furnaces comprising an air casing, means mounted in a

wall of the furnace providing an air discharge outlet in said casing, a fuel nozzle mounted in said casing in fixed relation thereto to discharge fuel through said air discharge outlet, tip means associated with said fuel nozzle and said air discharge outlet, said tip means having a central fuel passage and a surrounding substantially parallel air passage in fixed relation to each other and constructed and arranged to separately discharge the air from said passage and the fuel from said passage directly into the furnace with the air in substantially uniform surrounding relation to the discharge from the fuel passage, and means for bodily adjusting said tip means to vary the angle of discharge of the fuel and air, comprising universal connection means between the tip means and the nozzle, and adjusting means for said tip extending outside of the casing.

4. A finely divided fuel burner for furnaces comprising an air casing, means mounted in a wall of the furnace providing an air discharge outlet in said casing, a fuel nozzle mounted in said casing in fixed relation thereto to discharge fuel through said air discharge outlet, tip means associated with said fuel nozzle and said air discharge outlet, the walls of the tip being spaced from the walls of the air discharge outlet to provide a passage therebetween, said tip means having a central fuel passage and a surrounding substantially parallel air passage in fixed relation to each other and constructed and arranged to separately discharge the air from said passage and the fuel from said passage directly into the furnace with the air in substantially uniform surrounding relation to the discharge from the fuel passage, means for bodily adjusting said tip means to vary the angle of discharge of the fuel and air, and means for directing the air into the air passages of the tip.

5. A finely divided fuel burner for furnaces comprising an air casing, means mounted in a wall of the furnace providing an air discharge outlet in said casing, a fuel nozzle mounted in said casing in fixed relation thereto to discharge fuel through said air discharge outlet, tip means associated with said fuel nozzle and said air discharge outlet, the walls of the tip being spaced from the walls of the air discharge outlet to provide a passage therebetween, said tip means having fuel and air passages in fixed relation to each other through which fuel and air are discharged, means for bodily adjusting said tip means to vary the angle of discharge of the fuel and air, and plate means directing the air into air passages of the tip, said plate means having openings therein leading to the passage between the walls of the tip and the walls of the discharge outlet.

6. A finely divided fuel burner for furnaces comprising an air casing, means mounted in a wall of the furnace providing an air discharge outlet in said casing, a fuel nozzle mounted in said casing in fixed relation thereto to discharge fuel through said air discharge outlet, tip means associated with said fuel nozzle and said air discharge outlet, the walls of the tip being spaced from the walls of the air discharge outlet to provide a passage therebetween, said tip means having fuel and air passages in fixed relation to each other through which fuel and air are discharged, plate means directing the air into air passages of the tip, said plate means having openings therein leading to the passage between the walls of the tip and the walls of the discharge outlet, means for bodily adjusting said tip means to vary the angle of discharge of the fuel and air comprising universal connection means between the tip means and the nozzle, adjuster means for said tip means, and means for locking said tip means in adjusted position.

7. A finely divided fuel burner for furnaces comprising an air casing, means mounted in a wall of the furnace providing an air discharge outlet in said casing, a fuel nozzle mounted in said casing in fixed relation thereto to discharge fuel through said discharge outlet, tip means associated with said fuel nozzle and said air discharge outlet, the walls of the tip being spaced from the walls of the air discharge outlet to provide a passage therebetween, said tip means having fuel and air passages in fixed relation to each other through which fuel and air are discharged, plate means directing the air into the air passages of the tip, said plate means having openings therein leading to the passage between the walls of the tip and the walls of the discharge outlet, means for pivotally mounting said tip means for movement on a substantially horizontal axis, means for pivotally mounting said tip means for movement on a substantially vertical axis, and means for adjusting said tip means to angular positions on said axes.

8. A finely divided fuel burner for furnaces comprising an air casing, means mounted in a wall of the furnace providing an air discharge outlet in said casing, a fuel nozzle mounted in said casing in fixed relation thereto to discharge fuel through said discharge outlet, tip means associated with said fuel nozzle and said air discharge outlet, comprising a central fuel passage and a surrounding substantially parallel air passage in fixed relation to each other and constructed and arranged to separately discharge the air from said air passage and the fuel from said fuel passage directly into the furnace with the air in substantially uniform surrounding relation to the discharge from the fuel passage, means for pivotally mounting said tip means for movement on a substantially horizontal axis, means for pivotally mounting said tip means for movement on a substantially vertical axis, and means extending outside of the casing for adjusting said tip means to angular positions on said axes.

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