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Vosper et al.

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[45] **Aug. 14, 1973**

[54] **VARIABLE FLAME SHAPE OIL BURNER**

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[22] Filed: **Nov. 27, 1968**

[21] Appl. No.: **779,333**

[52] **U.S. Cl.** **239/413**, 239/422

[51] **Int. Cl.** **B05b 7/00**

[58] **Field of Search** 239/422, 398, 418, 239/413, 412; 431/175

[56] **References Cited**

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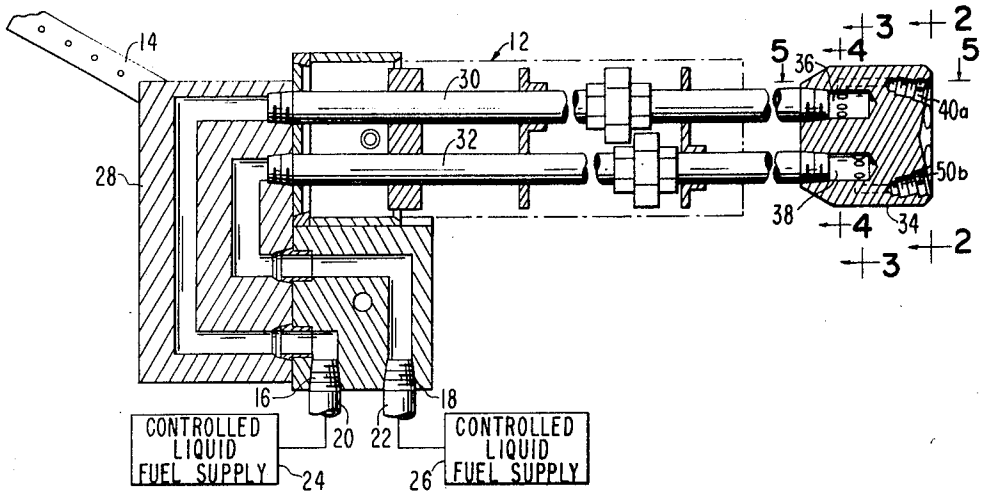
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[57] **ABSTRACT**

An oil burner having two separate, individually fed oil injection systems, one of which injects one or more narrow, axially directed oil streams, and the other of which injects one or more short, wide-angle oil streams. The apparatus is so arranged that the streams injected by the two systems intersect one another to form a composite stream which combusts to form a composite flame.

3 Claims, 9 Drawing Figures



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2 Sheets-Sheet 1

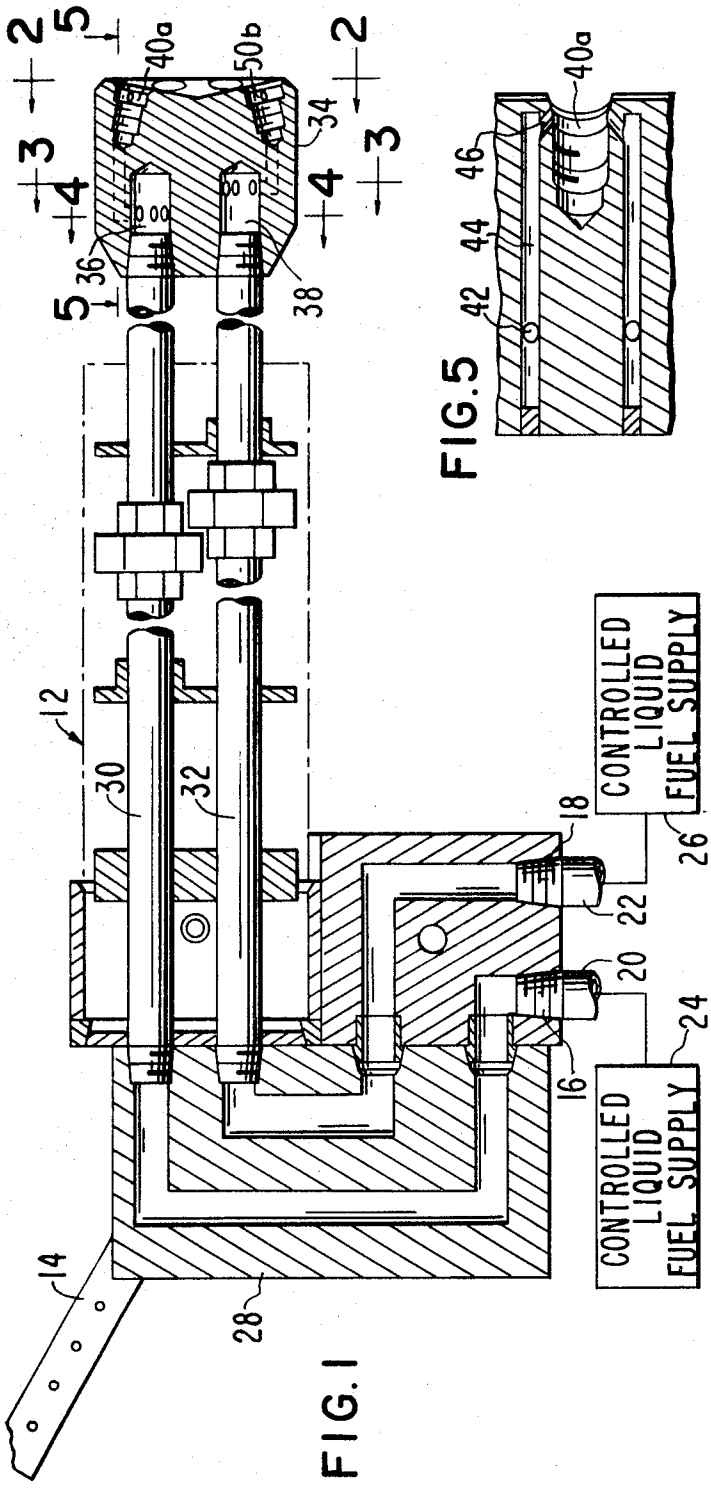


FIG. 1

FIG. 5

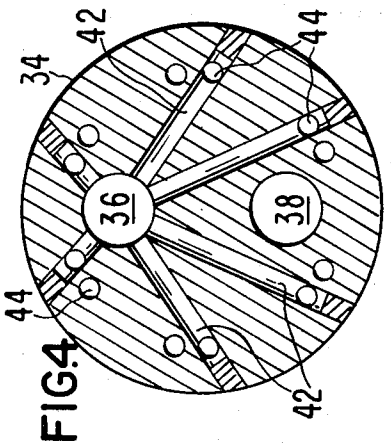


FIG. 4

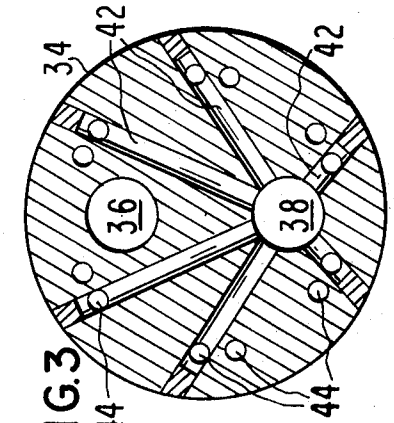


FIG. 3

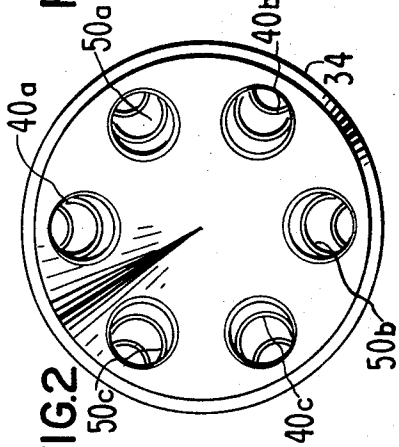


FIG. 2

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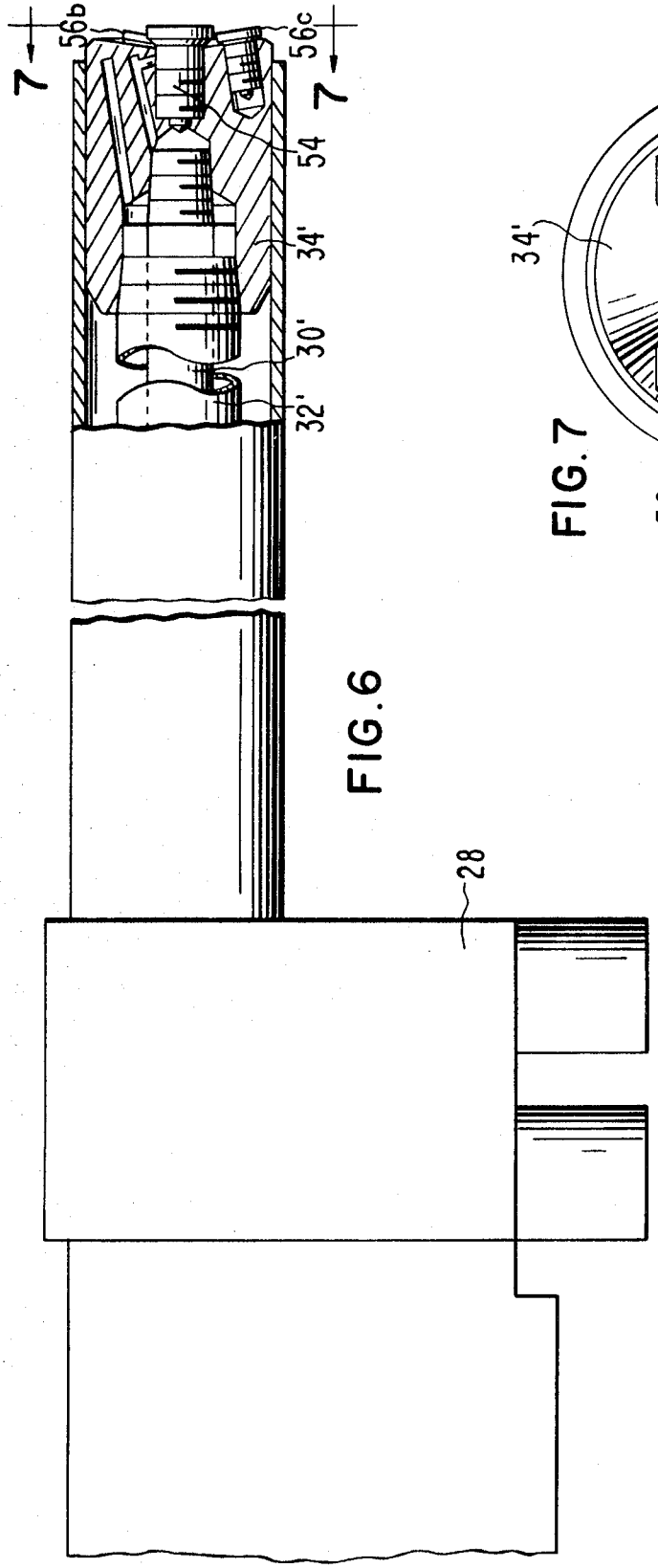


FIG. 6

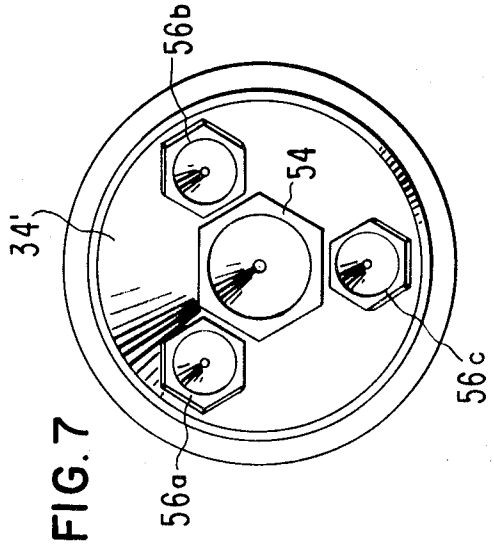


FIG. 7

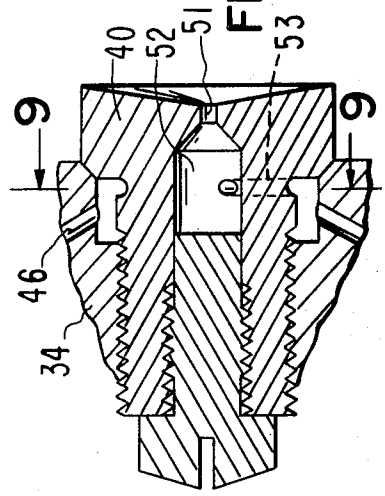


FIG. 8

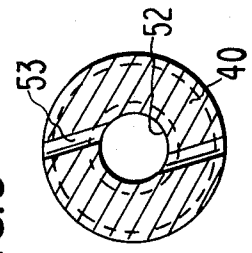


FIG. 9

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VARIABLE FLAME SHAPE OIL BURNER

This invention relates to an oil burner that affords adjustment of the shape of the flame produced thereby.

In many burner applications, for example, in firing a rotary kiln, it is desirable to vary the flame pattern from time to time. In the exemplary environment, a rotary kiln, variations in the constitution and feed rate of the raw materials fed into the kiln require variations in flame shape in order to achieve optimum operation. An adjustable gas fired burner is disclosed in U.S. Pat. No. 3,218,049; the present invention provides a comparable burner that is fired by oil or like liquid fuel.

According to the present invention, two individually fed fuel injection tips are provided; one tip produces a relatively narrow flame pattern longitudinally of the chamber that the burner fires, and the other tip produces a wider angle flame. The burner tips are mounted closely adjacent one another so that the flames produced by the individual tips combine to produce a composite oil spray and flame shape. Thus when more fuel is supplied to the first tip than is supplied to the second, the composite flame has a long narrow shape; when the rate at which fuel is supplied to the second burner tip exceeds that to the first, the composite flame has a short wide angle shape. In accordance with the present invention, it is possible to maintain constant the total amount of fuel supplied to both burners, as a consequence of which the total heat input to the combustion chamber can be maintained independently of the composite flame shape.

The principal object of this invention is to provide a burner that is capable of producing any desired flame shape between a long narrow flame at one extreme and a short, wide bushy flame at the other extreme. This object is achieved by providing in close spaced relation a pair of individually fed nozzle tips, and means for varying the amount of fuel supplied to each of the nozzle tips.

A feature and advantage of the present invention is that either the rate or the pressure at which fuel is supplied to one or both of the nozzle tips can be varied in order to extend still further the range over which the flame shape can be varied.

Other objects, features and advantages of the present invention will be more apparent after referring to the following specification and accompanying drawings in which:

FIG. 1 is a side view of a burner gun assembly employing the structure of the invention;

FIG. 2 is a view taken along line 2—2 of FIG. 1;

FIG. 3 is a cross-sectional view taken along line 3—3 of FIG. 1;

FIG. 4 is a cross-sectional view taken along line 4—4 of FIG. 1;

FIG. 5 is a cross-sectional view at enlarged scale taken along line 5—5 of FIG. 1;

FIG. 6 is a side elevation view of an alternate embodiment of the present invention;

FIG. 7 is a view taken along line 7—7 of FIG. 6;

FIG. 8 is a side cross-sectional view at enlarged scale of an oil burner tip suitable for use in practicing the invention; and

FIG. 9 is a view taken along line 9—9 of FIG. 8.

Referring more particularly to the drawings, reference numeral 12 indicates a burner gun assembly that has a bracket 14 for attaching the assembly adjacent a combustion chamber such as a cement kiln or the like.

The gun assembly includes two independent fuel inlet openings 16 and 18 to which are connected, through fuel lines 20 and 22, controlled liquid supply means 24 and 26, respectively. Fuel supply means 24 and 26 are conventional devices and typically include fuel pumping and filtering apparatus as well as devices for controlling the pressure at which fuel is supplied through lines 20 and 22 or the rate at which the fuel is supplied.

Fuel openings 16 and 18 communicate with a manifold chamber 28 from which extends a pair of burner tubes 30 and 32. Connected to the ends of burner tubes 30 and 32 remote from manifold chamber 28 is a burner tip head 34. The head 34 has a pair of axially extending chambers 36 and 38 with which the burner tubes respectively communicate. Chamber 36 communicates with fuel tips 40*a*, 40*b*, and 40*c*. One satisfactory form of passageway for communicating fuel from chamber 36 to the tips is indicated by bored transverse passages 42 which communicate with longitudinally extending passages 44 and which latter passages communicate with a tip socket, such as the socket indicated in connection with tip 40*a*, through obliquely extending openings 46. Thus fuel entering the tip sockets has a component of force that is tangential of the axis of the socket.

Fuel chamber 38 communicates with fuel injection tips 50*a*, 50*b*, and 50*c*. The passages for effecting such communication are shown in FIG. 3 and need no further explanation since they are formed in the same fashion as are passages 42, 44, and 46 hereinabove described in detail.

Tips 40*a*, 40*b*, and 40*c* are configured to form a long, narrow stream of fuel. Streams of fuel issuing from tips 40*a*, 40*b*, and 40*c* converge out in front of the tip head because the end of the tip head is concave. The individual streams cooperate to form a long narrow fuel stream into the combustion chamber. Tips 50*a*, 50*b*, and 50*c* are configured to form wide angle streams of fuel which intersect the streams from tips 40*a*, 40*b*, and 40*c*, and direct fuel outwardly of burner gun assembly 12. The construction of tips 40 and 50 is shown in FIG. 8 and 9. Each tip has an axially directed outlet passage 51 that communicates with a chamber 52 disposed therebehind. The chamber is supplied with fuel from one or more tangentially directed passages 53. Tips 40 are adapted to form a long narrow fuel stream by enlarging tangential passages 53 relative the size of axial passages 51. Tips 50 are adapted to form a short wide fuel stream by reducing the diameter of tangential passages 53 relative the size of axial passages 51. Thus the arrangement of tips 40 and 50 in burner tip head 34 enables achievement of composite flame shape adjustment.

Adjustment of fuel supply means 24 so that it supplies fuel to chamber 36 at a rate about 3 to 4 times the rate at which fuel is supplied to chamber 38 by fuel supply means 26 produces a composite flame that is comparatively long and narrow. A long and narrow flame is produced because more fuel is supplied through tips 40 than through tips 50. Contrariwise, adjustment of fuel supply means 26 so that it supplies 3 to 4 times more fuel than is supplied by fuel supply means 24 will produce a composite flame pattern that is wide and short, because the amount of fuel ejected from tips 50 exceeds the amount of fuel ejected from tips 40. Intermediate settings between the two extremes

will produce flame shapes intermediate the two extreme flame configurations described above.

It will be obvious that other numbers and/or arrangements of tips can be employed without departing from the present inention. Moreover, the number of tips producing long narrow flame patterns can exceed the number of tips producing short wide flange patterns, or vice versa, depending on the flame shape and range of flame shape variation desired.

An alternate configuration is shown in FIGS. **6** and **7** wherein coaxial burner tubes **30'** and **32'** are provided between manifold block **28** and tip head **34'**. A single tip **54** is installed centrally of tip head **34** and is configured to form a long narrow oil stream. The tip head is supplied with fuel through burner tube **30'**. A plurality of tips **56***a*, **56***b*, and **56***c* are disposed radially outwardly of tip **54**. Tips **56** are configured to form a wide short fuel stream so that the mode of variable operation described hereinabove in connection with FIGS. **1–5** can be effected with the embodiment of FIGS. **6** and **7**. For example, if a long narrow stream is desired, the rate at which fuel is supplied to tip **54** is adjusted to exceed the rate at which fuel is supplied to tips **56**. The opposite setting provides a short wide flame in that the preponderance of fuel is supplied through tips **56**. Because fuel issuing from tips **56** diverges from the central axis of each of the tips, such fuel intersects the fuel issuing from tips **54** so that a composite single flame is produced by a structure made according to the present invention.

Although the forward surface of tip head **34** shown in the drawings is concave, it should be understood that a flat or a convex face can be employed to achieve a slightly different relative alignment between the various tips. More specifically, a flat face on tip head **34** will produce a wider, shorter flame than will be produced by the tip head depicted in the drawings, and a convex face will produce a still wider and shorter flame. The shape of the combustion chamber fired by the burner gun assembly dictates which surface configuration on tip head **34** is most advantageous.

Thus it will be seen that the present invention provides an oil burner in which the shape of the flame produced is widely variable to suit operating conditions. Such variation is achieved very simply by altering one or more independent controlled fuel supply systems that feed various groups of fuel injection tips in the system.

Although two embodiments of the invention have been shown and described, it will be apparent that other adaptations and modifications can be made without departing from the true spirit and scope of the invention.

What is claimed is:

1. A variable oil fired burner assembly comprising first liquid fuel injection tip means for forming a long narrow liquid fuel jet along a first axis and second liquid fuel injection tip means for forming a short wide liquid fuel stream that intersects said first axis so as to form a composite liquid fuel jet, a tip head for mounting said tip means in relative fixed spaced apart relation, first fuel supply means for controllably supplying liquid fuel to said first tip means, second fuel supply means for controllably supplying liquid fuel to said second tip means, and means for independently controlling the relative rate at which said first and second fuel supply means supply liquid fuel to respective said tip means so that the shape of the composite liquid fuel jet can be controllably continuously varied between a long narrow fuel jet and a wide short fuel jet.

2. The invention of claim **1** in combination with third liquid fuel injection tip means for forming a short wide liquid fuel stream, said third tip means being in communication with said second fuel supply means, said third tip means being spaced from said first and second tip means, said third tip means being oriented so that the short wide liquid fuel stream produced thereby intersects with the liquid fuel stream that is formed by said first tip means.

3. The invention of claim **1** in combination with third and fourth fuel tips in communication with said first fuel supply means, said first, third and fourth fuel tips being adapted to form long narrow convergent fuel streams, fifth and sixth fuel tips in communication with said second fuel supply means, said second, fifth and sixth fuel tips being adapted to form short wide fuel streams, all said fuel tips being arranged in a circular pattern, members of a group consisting of said first, third and fourth tips alternating with members of a group consisting of said second, fifth and sixth tips around said circular pattern.

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