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abandoned, which is a division of Ser. No.
524,672, Feb. 3, 1966, Pat. No. 3,373,941
[45] Patented **May 11, 1971**
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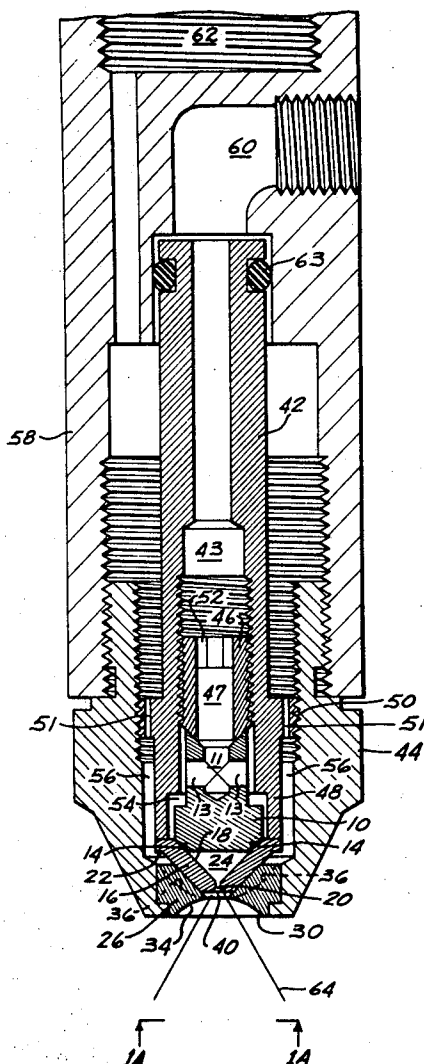
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[54] **SPRAYING PROCESS**
6 Claims, 8 Drawing Figs.
[52] U.S. Cl. **239/8,**
239/403, 239/424.5, 239/296, 239/545
[51] Int. Cl. **B05b 7/06**
[50] Field of Search 239/8, 291,
296, 543, 544, 545, 403, 424.5

ABSTRACT: A spray having a generally circular cross section is modified into one having an oblong cross section. A pair of pressurized fluid streams are charged in a collision course directly into each other on one side of said spray while a second pair of pressurized fluid streams are charged in a collision course directly into each other on the diametrically opposite side of said spray. Said pairs of fluid streams compress the circular cross section of said spray into an oblong cross-sectional configuration.



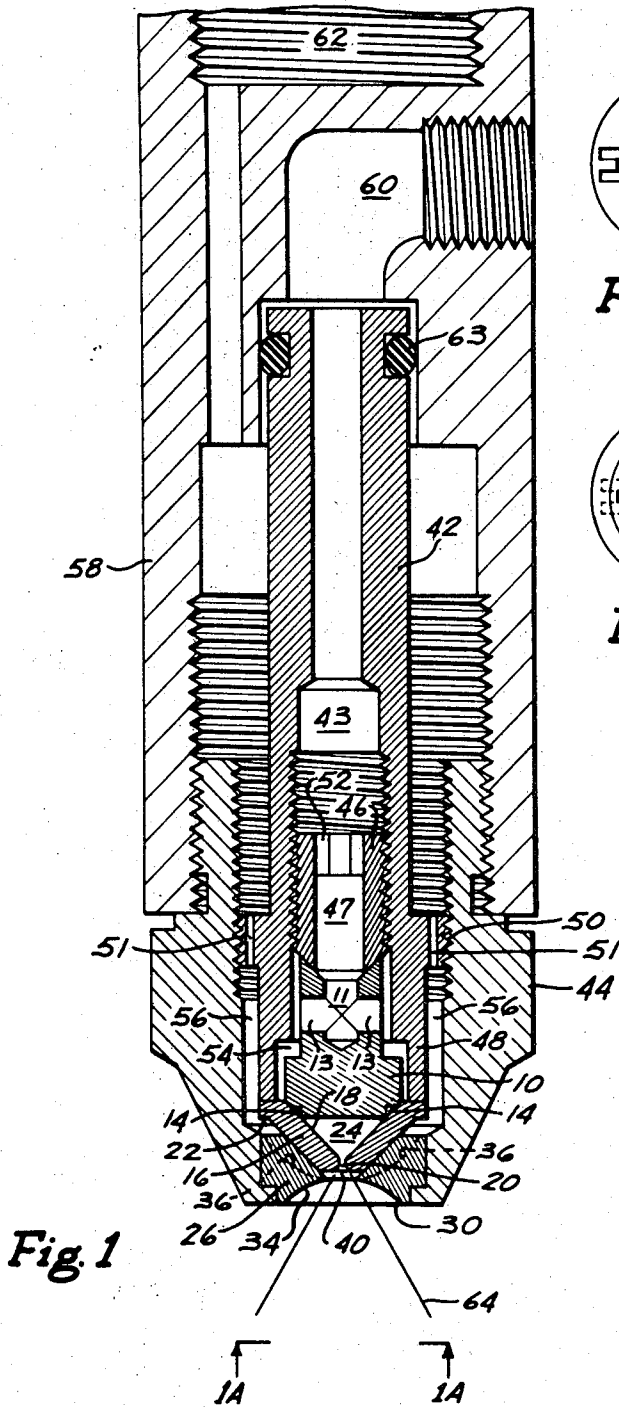


Fig. 1

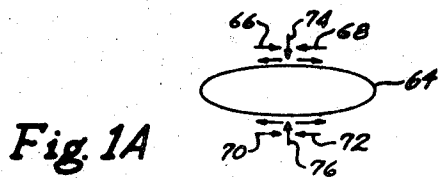


Fig. 1A

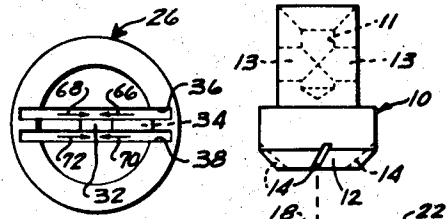


Fig. 2

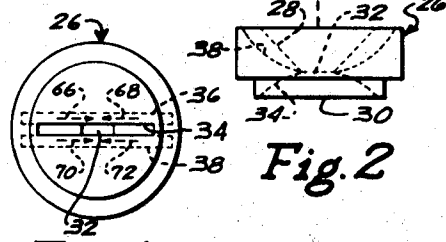


Fig. 3

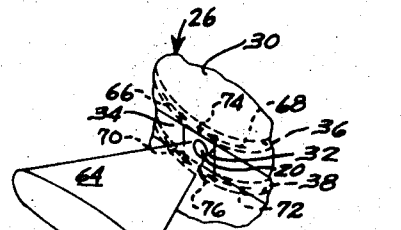


Fig. 4

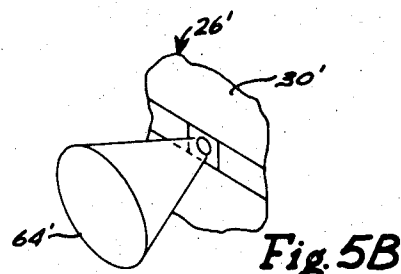


Fig. 5A

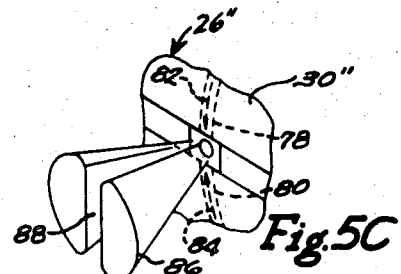


Fig. 5B

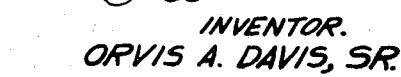


Fig. 5C

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SPRAYING PROCESS

This application is a division of Ser. No. 687,236, filed Dec. 1, 1967 now abandoned which in turn was a division of Ser. No. 524,672, filed Feb. 3, 1966, now U.S. Pat. No. 3,373,941.

This invention relates to a process involving spray nozzles such as oil burner nozzles. More particularly, it relates to a process involving nozzles for producing a spray of a primary fluid, such as fuel oil, having means for introducing a jet or a plurality of disjunct jets of a secondary fluid, such as air, to the periphery of said spray or the flame produced upon combustion thereof without permitting said jet or jets to divide or split the spray of primary fluid or the flame produced upon combustion thereof upon impingement thereon.

Conventional oil burner nozzles have a swirl chamber wherein liquid oil is swirled as a thin film at high velocity. Upon discharge from the discharge orifice of the swirl chamber, the swirling film is suddenly released from the confines of the swirl chamber wall surface whereupon it disintegrates into a spray of highly atomized oil droplets. The spray is substantially circular in cross section and, ignition, the resulting flame is also circular in transverse section.

In conventional nozzles wherein one or more separate jets of pressurized gas, such as air, are charged from within the spray nozzle to the periphery of an atomized spray or the flame produced upon combustion thereof, the pressurized jets travel at a high velocity and penetrate the spray, or the flame produced upon combustion thereof, and split or divide it at the point of impingement. In accordance with the present invention, a single relatively narrow jet or a plurality of disjunct narrow jets of pressurized air are charged directly to the periphery of the flame produced by the nozzle oil spray substantially without said air jets splitting the body of said flame. In the practice of this invention each jet of pressurized air reaching the flame is the resultant of two substantially equal streams of pressurized air which are charged at high velocity and pressure in a collision course directly into each other and the impact of the two high velocity streams occurs close to a lateral nozzle opening or passageway which is in close proximity to and facing the periphery of the flame. Following the high velocity impact of the two colliding air streams, a resultant stream is formed having a substantial pressure but having a very low velocity as a result of the impact. Since the lateral resultant stream travels toward the periphery of the flame at a low velocity, impingement thereof upon the flame does not split the flame. The two colliding air streams prior to impact travel in channels directed substantially transverse with respect to but offset from the longitudinal axis of the nozzle. The stream formed as a result of impact is charged in a direction which is substantially radial but which can also be somewhat forwardly with respect to the nozzle axis.

The nozzle for carrying out the process of this invention has particular utility for use as an oil burner nozzle for flame welding. When utilizing a flame to destroy weeds growing along the ground near desired crops, it is customary to attach a series of burners to the rear of a tractor. The burners are arranged in a row laterally along the rear of the tractor and spaced apart from each other by a distance corresponding to the spacing between the rows of crops. The flame weeder burners are inclined downwardly at an angle toward the ground at the side of a row of growing crops so that as the tractor travels in the direction of the row the flame can scorch any ground weeds growing in the vicinity of the crops. In order to confine the flame to the ground with a minimum of impingement upon the upper regions of the desired plant which are particularly heat sensitive because they contain the foliage and flower of the plant, the flame is advantageously oblong, being flattened or elongated in the direction of movement of the tractor. By utilizing a nozzle of this invention, a flattened or oblong flame is produced without splitting the flame or otherwise destroying the uniform texture thereof by compressing the flame between a pair of low velocity pressurized air streams, each of said pair of air streams being the resultant of a pair of colliding air streams as described above. Two air stream collide in the nozzle

on one side of the burner flame to produce a resulting low velocity jet thereat while two other air streams collide in the nozzle on the diametric opposite side of the flame to produce a second low velocity jet thereat. These two low velocity jets are directed axially outwardly toward the periphery of the flame, sandwiching the flame therebetween, and compressing said flame to produce an oblong flame configuration without fracturing said flame. The oblong flame thus produced is highly suitable for purposes of flame weeding.

This invention is further explained by reference to the accompanying drawings in which:

FIG. 1 is a longitudinal sectional view of an assembled burner nozzle for carrying out the process of this invention,

FIG. 1A is a view of the flame produced by tee nozzle of FIG. 1 as seen from the position 1A-1A of FIG. 1,

FIG. 2 is an exploded view of certain elements of the nozzle of FIG. 1,

FIG. 3 is a plan view of the interior of nozzle element 26,

FIG. 4 is a plan view of the exterior of nozzle element 26, and

FIG. 5A is an isometric view of a segment of the front face of element 26 showing the flame configuration produced during combustion therewith. FIGS. 5B and 5C are isometric views of the corresponding region of two nozzles not of the present invention showing their respective flame configurations to illustrate the advantageous effect upon flame configuration accomplished with the nozzle of this invention.

Referring to both FIGS. 1 and 2, inner conical member 10 has a conical surface 12 having a plurality of slanted surface slots 14. Inner member 10 also has a central bore 11 and lateral passageways 13 radiating therefrom. Intermediate conical member 16 has an interior conical surface 18, an exterior conical surface 19, a forward axial orifice 20 having a curved and tapered surface, and an upper ledge 22. Conical surface 12 of inner conical member 10 abuts in fluidtight engagement against interior conical surface 18 of intermediate conical member 16 to define swirl chamber 24 therebetween.

Outer conical member 26 is shown in side view in FIGS. 1 and 2 and is shown in interior plan view in FIG. 3 and exterior plan view in FIG. 4. The inner surface 28 of outer member 26 is conical while the outside surface 30 is flat. Axial opening 32 defines an elongated discharge orifice. The exterior of orifice 32 is at the center of groove 34 which is cut into the flat surface 30. The interior of orifice 32 is sandwiched between a pair of parallel arcuate grooves or slots 36 and 38 and is disposed at the center of said parallel grooves. As indicated in FIGS. 3 and 4, exterior groove 34 becomes substantially contiguous with interior grooves 36 and 38 at the elongated sides of orifice 32. Interior conical surface 28 of outer member 26 abuts in fluidtight engagement against outer conical surface 19 of intermediate member 16 to define enclosed channels of slots 36 and 38 and to define a small chamber 40.

The conical surfaces of inner conical element 10, intermediate conical element 16 and outer conical element 26 are in fluidtight abutting engagement in the assembled nozzle, as shown in FIG. 1. In assembling the nozzle, hollow interior plug 42 is screwed into outer nozzle body 44. Interior plug 42 has a central bore 43 into which a set screw 46 is screwed. Set screw 46 has a central bore 47. When the nozzle is assembled cylindrical prong 48 is pressed tightly against ledge 22 of element 16 by screwing threaded shoulder 50 into nozzle body 44. Threaded shoulder 50 has a plurality of longitudinal passageways 51 extending therethrough. Set screw 46 is then urged tightly against member 10 by utilizing an elongated wrench in hex 52.

In the assembled nozzle a passageway 54 is defined between member 10 and prong 48 of plug 42. Another passageway 56 is defined between prong 48 of plug 42 and nozzle body 44. The assembled nozzle is screwed into an adapter 58 having a lateral fuel oil inlet passageway 60 and an axial pressurized air inlet passageway 62. The oil and air passageways are sealed off from each other by means of O-ring 63.

In the operation of the nozzle, fuel oil under a pressure of about 80 to 100 pounds per square inch is charged through passageways 60, 43, 47, 11, 13 and 54 to tangential slots 14. Tangential slots 14 cause the oil to swirl as a thin film within swirl chamber 24. When the swirling film is discharged through orifice 20 and thereby released from the confines of conical surface 18, it disintegrates and becomes atomized into small droplets of oil in a conical diverging spray. Upon ignition, the resulting flame has a configuration as indicated at 64.

Pressurized air at a pressure of between about 30 and 50 pounds per square inch is charged through passageways 62, 51 and 56. In annular passageway 56 the pressurized air is admitted to opposite ends of each arcuate channel or groove 36 and 38 so that the air destined to travel through each groove is divided into substantially equal portions, the first of which enters its groove from one end thereof and the second of which enters the same groove from the opposite end thereof. The two portions of air flow toward each other in a collision course from opposite ends of the same groove as indicated in FIGS. 1A, 3, 4 and 5A by arrows 66 and 68 in groove 36 and arrows 70 and 72 in groove 38. The momentum of impact of streams 66 and 68 in groove 36 and streams 70 and 72 in groove 38 is great because it is established by the impact of two moving streams and results in stopping the forward movement of the colliding streams. Thereupon, air streams 66 and 68 combine to form a new stream 74 which travels in a direction which is 90° lateral with respect to streams 66 and 68. Similarly, air streams 70 and 72 combine to form a new stream 76 which travels in a direction which is 90° lateral with respect to streams 70 and 72. Because streams 74 and 76 are each the resultant of two streams colliding head-on at high velocity, streams 74 and 76 at the moment of formation have a relatively low velocity and therefore are capable of flattening the opposite ends of flame 64 without otherwise violently disrupting flame 64, as shown in FIG. 1A.

The comparative flame configurations represented in FIGS. 5A, 5B and 5C illustrate the advantageous effect of parallel grooves 36 and 38. FIG. 5A is an isometric view of a segment of the front face 30 of element 26 showing the flame configuration produced during combustion. FIGS. 5B and 5C are isometric views of the corresponding region of two nozzles not of the present invention showing their respective flame configurations. Referring first to FIG. 5B, front face 30' of an element 26' is shown which differs from element 26 of the nozzle of this invention in that it possesses no grooves corresponding to grooves 36 and 38. Element 26' therefore does not admit pressurized air and a flame 64' is produced which has a conventional round cross-sectional configuration.

Referring next to FIG. 5C, front face 30'' of element 26'' is shown which differs from element 26 of the nozzle of the invention by employing a pair of grooves 78 and 80 which approach the axial discharge orifice radially. Approach of high velocity air streams 82 and 84 from a radial direction permits streams 82 and 84 to impinge upon opposite sides of flame 86 at a very high velocity and impart a fissure 88 in the flame, thereby splitting flame 86 into two segments. This is contrasted to the operation of the nozzle of the invention, as shown in FIG. 5A, wherein the air streams impart a flattened configuration to the flame without creating a fissure therein. As shown in FIG. 5A, air streams 66 and 68 collide with each other to form a lateral air stream 74 having a very low velocity. Streams 70 and 72 collide with each other to form a resulting lateral air stream 76 whose velocity is also very low. Air streams 74 and 76, each having a low velocity, are directed toward the opposite sides of flame 64 to convert the flame from a round configuration as shown in FIG. 5B to the oblong configuration shown in FIG. 5A, without dividing the flame into two segments as shown in FIG. 5C.

Various changes and modifications can be made without departing from the spirit of this invention and the scope thereof as defined in the following claims.

I claim:

1. A process comprising producing an axial spray, charging separate pressurized fluid streams from opposite ends of the same path which path is substantially transverse to and offset from the axis of said spray so that they collide head-on in the region of said spray with the forward motion of the colliding streams substantially stopped to produce a resultant fluid stream traveling in a lateral direction with respect to said separate streams, and discharging said resultant stream laterally with respect to said separate streams and in the direction of said spray.

2. The process of claim 1 wherein said lateral direction is about 90° lateral with respect to the separate streams.

3. A process comprising producing an axial spray which is generally circular in cross section, charging a first pair of pressurized fluid streams from opposite ends of the same path which path is substantially transverse to and offset from the axis of said spray so that they collide head-on in the region of said spray with the forward motion of the colliding streams substantially stopped to produce a first resultant fluid stream traveling in a lateral direction with respect to said first pair of streams, discharging said first resultant stream laterally with respect to said first pair of streams and in the direction of said spray, charging a second pair of pressurized fluid streams from opposite ends of the same path which path is substantially transverse to and offset from the axis of said spray so that they collide head-on in the region of said spray with the forward motion of the colliding streams substantially stopped to produce a second resultant stream travelling in a lateral direction with respect to said second pair of streams, discharging said second resultant stream laterally with respect to said second pair of streams and in the direction of said spray, said first and said second resultant streams approaching said spray on diametrically opposite sides thereof and compressing said spray to produce an oblong cross-sectional configuration therein substantially without imparting a fissure into said spray.

4. The process of claim 3 wherein said first resultant stream travels in a direction about 90° lateral with respect to said first pair of streams and said second resultant stream travels in a direction about 90° lateral with respect to said second pair of streams.

5. A process comprising producing an axial spray of atomized oil droplets which upon combustion produces a flame which is generally circular in cross section, charging a first pair of pressurized high velocity air streams from opposite ends of the same path which path is substantially transverse to and offset from the axis of said spray so that they collide head-on in the region of said flame with the forward motion of the colliding streams substantially stopped to produce a first resultant air stream of low velocity travelling in a lateral direction with respect to said first pair of streams, discharging said first resultant air stream laterally with respect to said first pair of air streams and in the direction of said flame, charging a second pair of pressurized high velocity air streams from opposite ends of the same path which path is substantially transverse to and offset from the axis of said spray so that they collide head-on in the region of said flame with the forward motion of the colliding streams substantially stopped to produce a second resultant air stream of low velocity traveling in a lateral direction with respect to said second pair of streams, discharging said second resultant air stream laterally with respect to said second pair of air streams and in the direction of said flame, said first and said second resultant air streams approaching said flame on diametrically opposite sides thereof and compressing said flame to produce an oblong cross-sectional configuration therein substantially without imparting a fissure thereto.

6. The process of claim 5 wherein said first resultant stream travels in a direction about 90° lateral with respect to said first pair of streams and said second resultant stream travels in a direction about 90° lateral with respect to said second pair of streams.