April 13, 1965 R. H. PARDEE 3,177,922

BURNER FOR FLAME CULTIVATORS

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FIG. 1

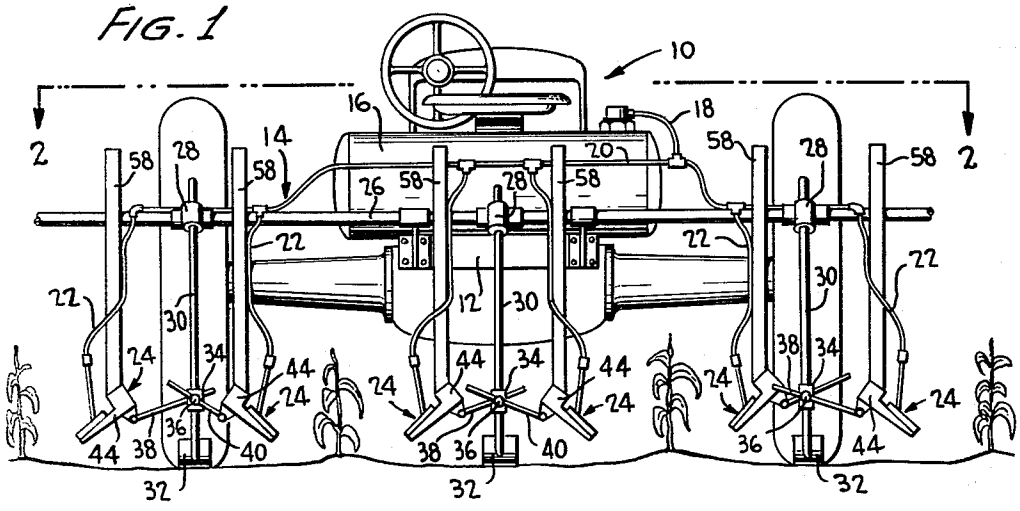
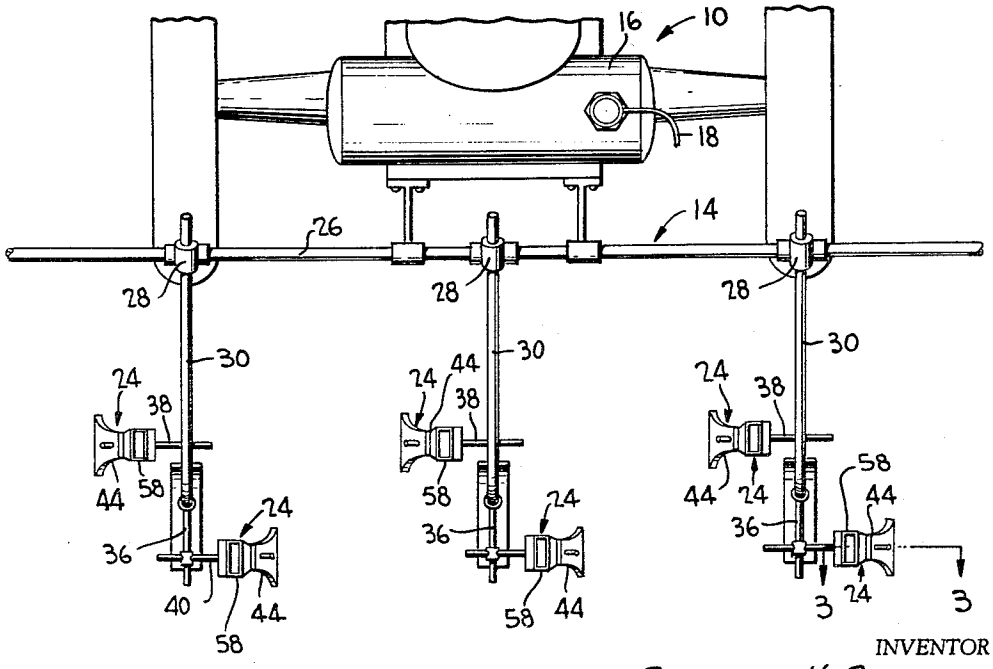


FIG. 2



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FIG. 4

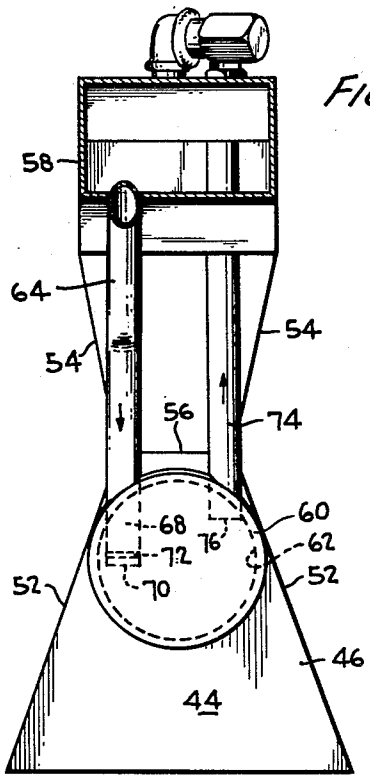


FIG. 3

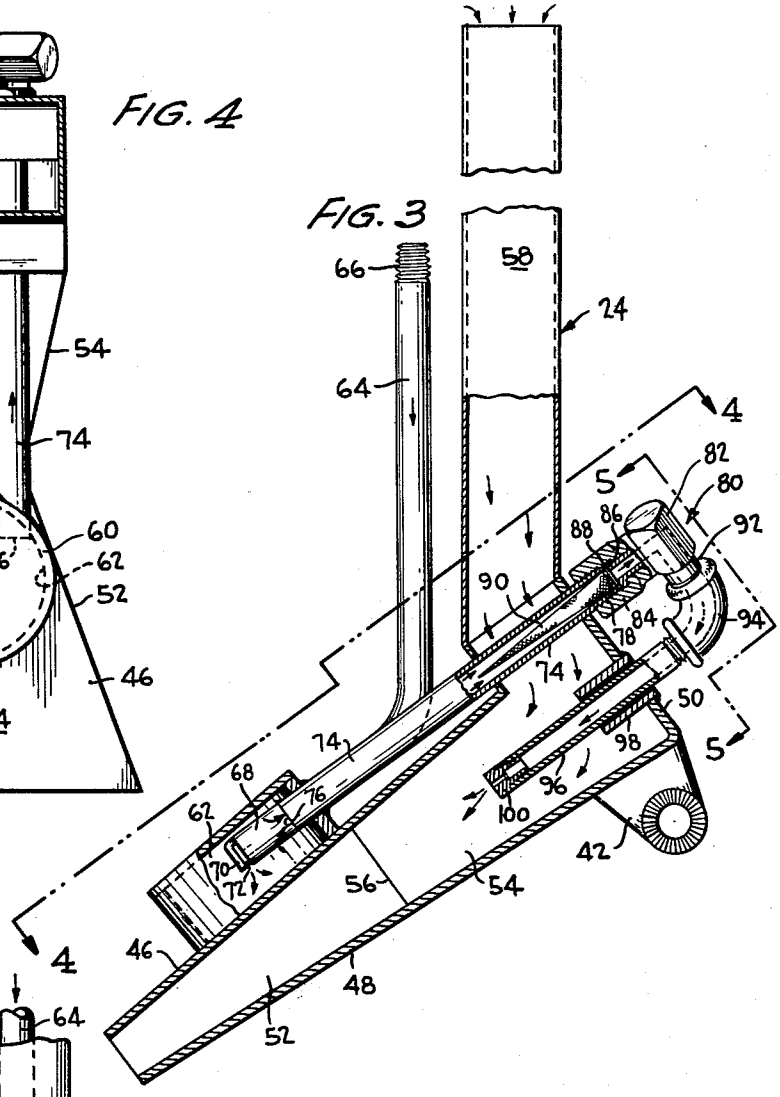
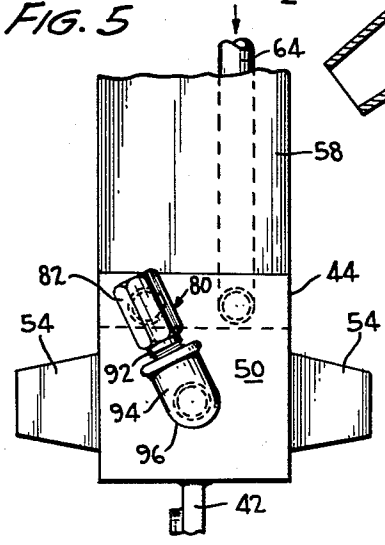


FIG. 5



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FIG. 7

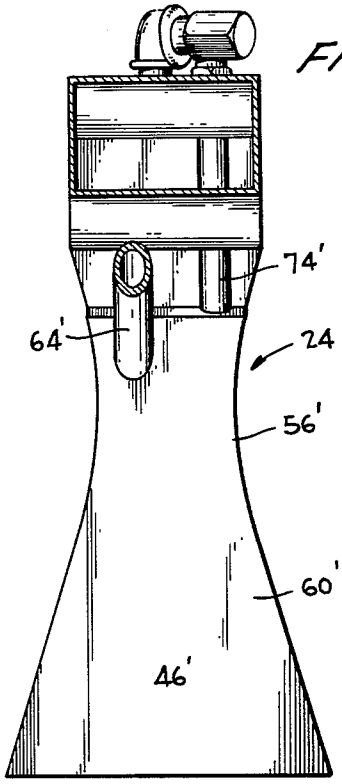


FIG. 6

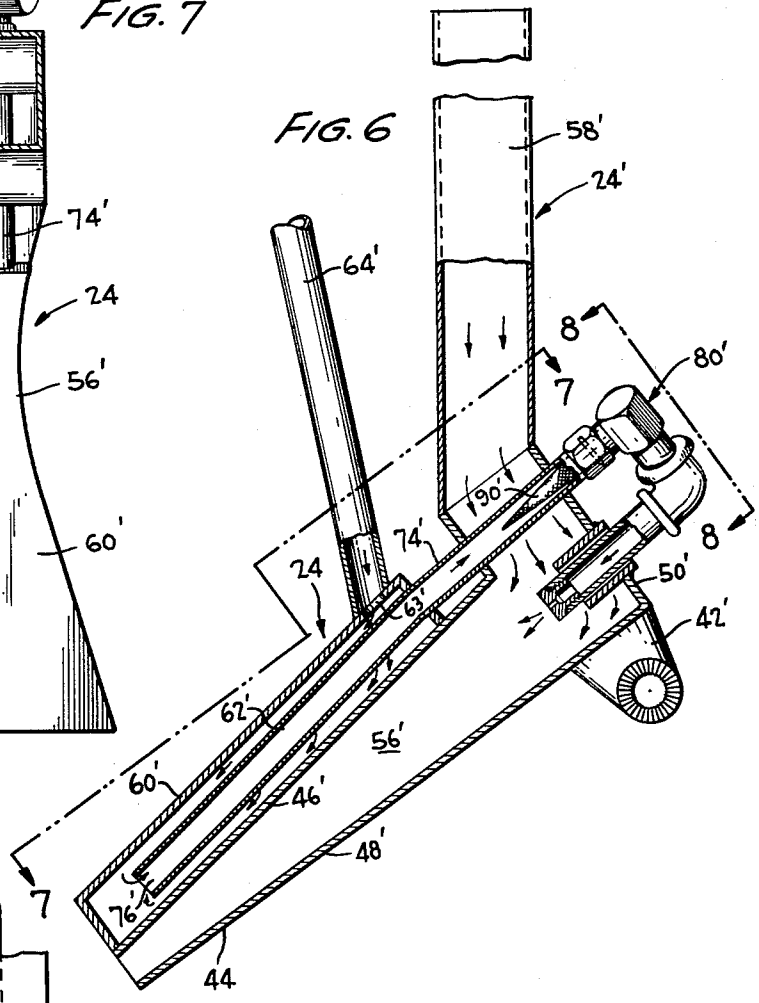
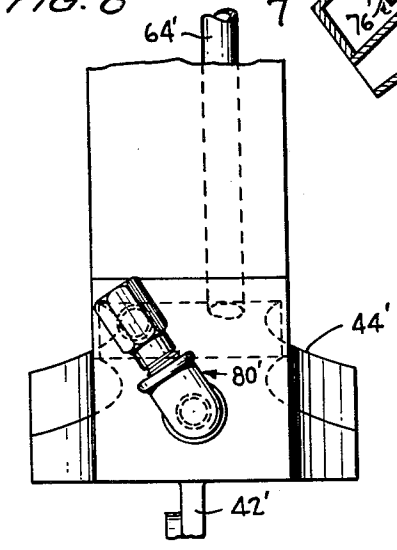


FIG. 8



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United States Patent Office 3,177,922 Patented Apr. 13, 1965

3,177,922

BURNER FOR FLAME CULTIVATORS

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Filed May 7, 1963, Ser. No. 278,677
8 Claims. (Cl. 158—63)

This invention relates generally to apparatus for the cultivation of crops of the general character disclosed in United States Letters Patent to McLemore, 2,408,328 issued September 24, 1946. The general theory of flame cultivation is set forth in detail in Patent 2,408,328, and further description is apparently unnecessary.

In theory flame cultivation is practical and highly desirable. However, it is not only important, but imperative that the burners of the apparatus are operating at substantially peak efficiency at all times. The ability of the burner to remain ignited at all times during operation, i.e., a minimum of "blow outs," reduces shut-down periods and loss of time.

Additionally, since a predetermined amount of heat must be directed toward the plants, weeds, etc., in relation to the speed of a tractor vehicle moving along a row of crops, an inefficiently operating burner, i.e., insufficient B.t.u. output, will result in (1) improper weeding, i.e., poor crops, and (2) excessive consumption of fuel.

One principal factor deterring universal and more extensive use of flame cultivators in farming is the inability of a previously known burner to operate consistently over long periods of time whereby a minimum of maintenance and "shut-down" periods is encountered during flame cultivation.

Many times during operation of known flame cultivators, due to wind conditions (i.e., a following wind) or atmospheric conditions (i.e., heavy atmosphere due to high humidity, etc.) the products of combustion (i.e., carbon monoxide, carbon dioxide, nitrogen, etc.) which do not support combustion, are drawn into the air intake of known conventional burners and cause the burner flame to be extinguished or inefficient and excessive fuel combustion. When this happens, inefficient cultivation occurs, possibly requiring more frequent cultivation periods or inconsistent and inefficient cultivation.

In order to obviate some of the problems with respect to inefficient combustion and the accompanying inconsistent cultivation, independent blowers, compressors or substantially closed fuel systems have been used in the past.

A primary object of the present invention is to provide an improved burner for use on flame cultivators.

A further object of the present invention is to provide an improved flame cultivator burner which draws air to supoprt combustion from an area removed from the burner to eliminate the hazards of poor atmospheric or wind conditions.

Another object of the present invention is to provide a novel flame cultivator burner which utilizes the heat of combustion for efficient vaporization of the fuel such as liquid propane or the like being used.

A still further object of the present invention is to provide a flame cultivator burner which includes a venturi portion for inspiring a mixture of air and fuel to be efficiently and thoroughly combusted therein.

And yet another object of the present invention is to provide a novel flame cultivator burner which includes a detachable fuel outlet and fuel jet orifice coupling to facilitate maintenance and repair.

A still further object of the present invention is to provide a novel flame cultivator burner including a fuel vaporization chamber in which liquid fuel is substantially impinged onto a wall common to both the vaporization chamber and a combustion chamber at a point sufficiently removed from a vaporized-fuel inlet whereby substantially only fuel vapor is directed to the combustion chamber.

These together with other and more specific objects will become apparent from a consideration of the following description taken in conjunction with the accompanying drawings forming a part thereof, wherein:

In the drawings:

FIGURE 1 is a rear elevation of a tractor vehicle having a flame cultivation assembly mounted thereon;

FIGURE 2 is a fragmentary top plan view taken substantially on the plane of line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged vertical section taken substantially on the plane of line 3—3 of FIGURE 2 and showing details on one embodiment of the flame cultivator burner of the invention, portions being broken away for the purpose of showing details;

FIGURE 4 is a sectional view taken substantially on the plane of line 4—4 of FIGURE 3 looking down on top of the burner;

FIGURE 5 is a rear elevation of the flame cultivator burner looking substantially from the plane of line 5—5 of FIGURE 3;

FIGURE 6 is a view similar to FIGURE 3 showing another embodiment of the flame cultivator burner;

FIGURE 7 is a view taken substantially on the plane of line 7—7 of FIGURE 6, and similar to FIGURE 4; and

FIGURE 8 is a rear elevational view of FIGURE 6, taken on the plane of line 8—8 of FIGURE 6, and similar to FIGURE 5.

Referring to the drawings in detail, and first considering FIGURES 1 and 2, a suitable tractor vehicle is indicated generally at 10 and will be of the character which will have an adjustable speed control to permit it to move between a row of crops at a uniform rate of travel.

Suitably mounted on the rear of the tractor 10 at 12 is a flame cultivator assembly indicated generally at 14. The tractor and mounting for the flame cultivator, as mentioned above, are of any suitable character, and it will be recognized by those skilled in the art that the flame cultivator assembly could be mounted on the side or front of the tractor vehicle in the manner shown for example in the U.S. Letters Patent to McLemore, 2,408,328. Additionally, the basic principles of flame cultivation are set forth in the patent to McLemore, mentioned above, and thus a detailed explanation thereof is apparently unnecessary.

The flame cultivator assembly 14 includes a pressurized fuel supply tank 16 suitably mounted on the tractor vehicle 10. The tank 16 will generally contain liquid propane (LP) or the like and will supply fuel through a conduit 18 to a manifold type conduit 20 which has connected thereto a plurality of branch lines 22 for furnishing fuel to the different burner assemblies indicated generally at 24.

The tractor vehicle includes a transverse support or tool bar 26 upon which is mounted suitably spaced fittings 28 from which depend vertically adjustable support rods 30 having lower skids or support shoes 32. The rods 30 have extending from a fitting 34 opposed substantially horizontal rods 36 (only one shown) which have extending therefrom lateral support rods 38 and 40 which are suitably mounted thereon a burner 24; the mounting being adjacent the rear lower surface of the burners.

The burners are disposed in staggered pairs; see FIGURE 2, however, this is not part of the present invention. It will be clearly apparent from FIGURES 3 and 6, note serrated mounting brackets 42 and 42' on burners 24 and 24', respectively, that the optimum "angle

of attack" of the burners can be readily adjusted, as well as the desired height of the burners.

If the tractor vehicle moves at a uniform rate of speed, and various adjustments have been made as to the burner angle, height, etc., it might be assumed that efficient flame cultivation will be accomplished. However, problems of improper combustion due to excessive products of combustion adjacent the burner air inlet, adverse wind conditions, improper fuel vaporization, contaminated burners, etc., are factors which must be substantially eliminated or reduced in order to obtain uniform and consistent cultivation.

The present invention involves the improved burner assemblies indicated generally at **24** and **24'**, and similar primed reference numerals will be used to describe the later mentioned embodiment to facilitate the identification of similarly functioning portions thereof.

The burner of the present invention lends itself to being constructed from a suitable sheet metal or the like.

Referring to FIGURES 3–5, the burner assembly **24** comprises an elongated hollow body **44** including forwardly tapered upper and lower walls **46** and **48**; the serrated mounting bracket **42** being suitably secured beneath and adjacent a transverse rear wall **50**. The body **44** includes pairs of front and rear side wall portions **52** and **54**, the pairs of side wall portions converging intermediately of the body **44** and forming an intermediate venturi throat portion **56** for drawing a mixture of fresh air into the burner in order to sustain efficient combustion therein.

The portion of the body **44** bounded by portions **52**, and forwardly of the venturi portion **56**, may be generally described as the combustion chamber area, and as will be observed in FIGURE 4 flares outwardly from the venturi throat portion **56**. The portion bounded by portion **54**, rearwardly of the venturi portion, may be generally described as the fuel and air mixing chamber.

Communicating with the fuel and air mixing chamber within the body **40** and adjacent the rear wall **50** is a vertically extending air intake tube **58** which is of a substantial cross-section. The upper end of tube **59** terminates well above the burner **24** and thus during conditions where smoke accumulates adjacent the ground being cultivated or during adverse wind conditions, essentially fresh, combustion supporting air will be drawn into the fuel and air mixing chamber.

Fixed to the upper surface of the wall **46** of the burner is a housing **60**, cylindrical, if preferred, and forming above the combustion chamber a fuel vaporizing chamber **62**. The burner will be ignited in any suitable manner, for example, by an electrical igniter (not shown) and the heat of combustion will vaporize liquid fuel delivered into chamber **62**.

Fixed to one side of the housing **60**, by welding, for example, is one end of an L-shaped fuel inlet conduit **64** which is connected at **66** by a suitable coupling to one of the branch lines **22**. The conduit **66** includes a portion **68** within the housing **60** which terminates in a downwardly bent terminal baffle plate portion **70** overlying the portion **68** and forming a downwardly opening slot **72**. The slot directs liquid fuel intermediately of he upper surface of wall **46** subject to the extreme heat n the underlying combustion chamber. In this manner, iquid fuel is substantially vaporized.

Fixed to the wall of the housing **60** is a vaporized uel outlet tube **74** which includes an inlet **76** substanially spaced from slot **72** to essentially insure that liquid uel does not pass therethrough. In the event liquid uel should accumulate in the bottom of housing **60**, he inlet **76** is spaced thereabove to aid to prevent liquid uel from moving therein.

The outlet tube **74** extends through the air inlet tube 58 and causes a turbulence to the incoming fresh air to id in good fuel and air mixing rearwardly of the venturi ortion **56**. The rear end of tube **74** projects beyond

wall **50** and is threaded at **78** to removably accommodate thereon a combined fuel-strainer and burner jet assembly indicated generally at **80**.

The assembly **80** comprises an L-shaped coupling **82** including an internally threaded, captive sleeve **84** on one end. The sleeve **84** includes an internal screen seat **86** which receives thereon the flanged end **88** of an elongated, conical vaporized fuel straining screen **90**. The coupling **82** includes a threaded nipple portion **92** to which is secured an elbow **94** receiving therein an elongated jet mounting tube **96**.

The wall **50** of body **46** includes a transverse support sleeve **98** in substantial alignment with the longitudinal axis of body **46** and removably receiving sleeve **96** therein. The terminal end of sleeve **96** threadedly supports thereon a jet or orifice element **100** which can be readily removed, replaced or cleaned by a piece of wire or the like.

The entire assembly **80** can be removed as a unit by loosening the captive sleeve **84**, and it will be apparent that the screen **90** can be readily removed and replaced, and access will be had to the orifice element **100**. The assembly **80** can be removed and replaced as a unit, and thus a minimum loss of time is involved for this maintenance.

Once the burner has ignited, liquid fuel is readily vaporized in chamber **62**, fresh, uncontaminated air is drawn into the fuel and air mixing chamber, and the air drawn into the body **46** will impinge on tubes **74** and **96** to cause turbulence and mixing of fuel vapor emitted from the orifice element.

Referring to FIGURES 6–8, another slightly modified burner assembly is indicated generally at **24'**. The burner assembly **24'** includes a body portion **44'** including an upper wall **46'** and lower wall **48'**. A rear wall **50'** has mounted thereon a fuel strainer and burner jet assembly **80'** essentially the same as assembly **80** previously described in detail.

The body **44'** is formed with an intermediate venturi portion **56'** of a slightly different configuration from the comparable portion **56** of FIGURES 3–5, but functioning in the same manner. The body **44'** communicates with an air intake tube **58'** which permits uncontaminated air to be drawn therein.

The body **44'** has formed thereon a housing **60'** which corresponds to and covers essentially the entire combustion chamber of the burner and has a bottom wall common therewith to form a fuel vaporization chamber **62'**. A fuel inlet conduit **64'** communicates liquid fuel to the chamber **62'** by means of an aperture **63'** in the upper wall of housing **60'**. Liquid fuel impinges on the bottom of the chamber **62'** substantially at the rear thereof, and a vaporized fuel outlet tube **74'** extends into the vaporization chamber. The rear end of tube **74'** receives a screen **90'** of the assembly **80'**, and the forward or inlet end **76'** terminates adjacent the forward end of chamber **62'**. Thus liquid fuel impinging and entering into the rear of chamber **62'** will be substantially, if not completely, vaporized as it leaves tube inlet **76'**.

All of the advantages and benefits afforded by the assembly **24** are present in assembly **24'**. The essential difference between these embodiments resides in the differently conformed liquid fuel vaporization chambers which function in a generally similar manner.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification with respect to the exemplary embodiments, but only as indicated in the appended claims.

What is claimed is:

1. A burner assembly for use in a flame cultivator comprising a hollow body member open at a forward end, closed at the opposite rear end and including in order

from said open forward end a combustion chamber area, intermediate venturi portion and fuel-and-air mixing chamber, an air intake tube extending vertically from said body member at the immediate rear of said body member and communicating directly with the interior of said fuel-and-air mixing chamber rearwardly of said venturi portion, said air intake tube terminating at the upper end substantially above the body member to provide a relatively uncontaminated supply of combustion air which will be directly inspired into the rear portion of said fuel-and-air chamber by said venturi portion, a vaporization chamber overlying the upper surface of said combustion chamber area at the upper surface of said body member and subject to the heat generated therein, a fuel inlet tube directly extending to and communicating with said vaporization chamber for directing liquid fuel thereto, a vaporized-fuel outlet tube communicating with the rear of said vaporization chamber and extending transversely through the lower end of said air intake tube and terminating exteriorly at the rear of said body member, and a coupling assembly including a fuel orifice connected to said vaporized-fuel outlet tube, said fuel orifice extending directly into said fuel-and-air mixing chamber at the rear of said body member rearwardly of said venturi portion and in intersecting relation to the lower end of said air intake tube, whereby air directed onto said transverse vaporized-fuel outlet tube and fuel orifice causes turbulence and complete mixing of said vaporized fuel and air.

2. The structure of claim 1 in which said coupling assembly includes an integral screen extending into the rear end of said fuel outlet tube for protecting said fuel orifice from contamination.

3. The structure of claim 1 in which said body member includes a support sleeve on the closed end of said body member in alignment with the center of said venturi portion, said fuel orifice comprising an elongated tube removably supported in said sleeve and including a terminal jet element removably supported at the end of said elongated tube.

4. The structure of claim 1 in which said vaporization chamber includes a bottom wall common with the upper wall of said body member forwardly of said venturi portion.

5. The structure of claim 4 in which said fuel inlet tube includes an outlet directed toward the upper surface of said bottom wall, said fuel outlet tube having an inlet disposed in spaced relation from said inlet tube outlet.

6. The structure of claim 5 in which said fuel inlet tube comprises a baffle portion disposed in spaced overlying relationship with respect to the open end of said fuel inlet tube and forming a downwardly directed slot therewith.

7. The structure of claim 5 in which said fuel inlet tube terminates in an open end directed toward the forward end of said vaporization chamber.

8. The structure of claim 7 in which said vaporization chamber overlies and extends on opposite sides of said venturi portion and terminates substantially at the open end of said body member.

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