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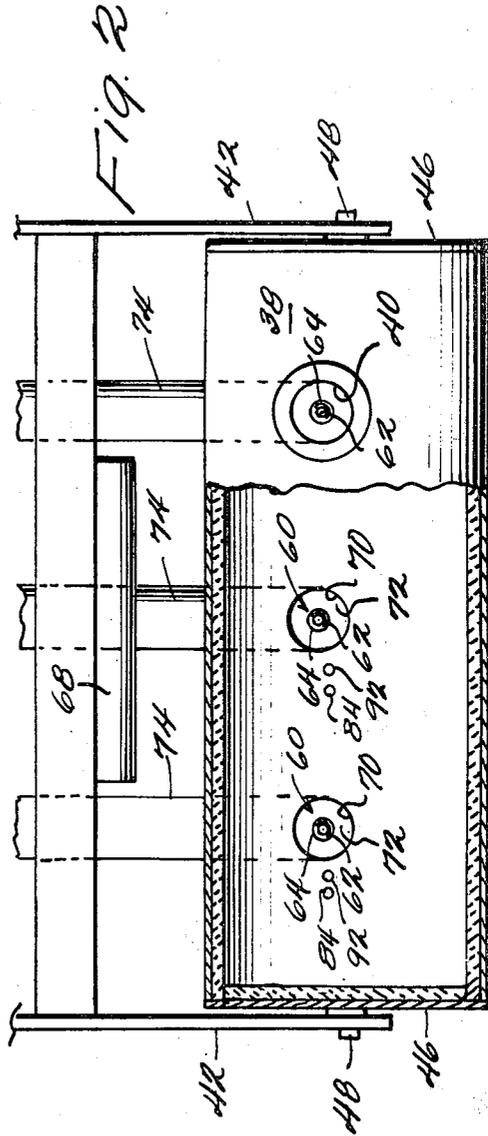
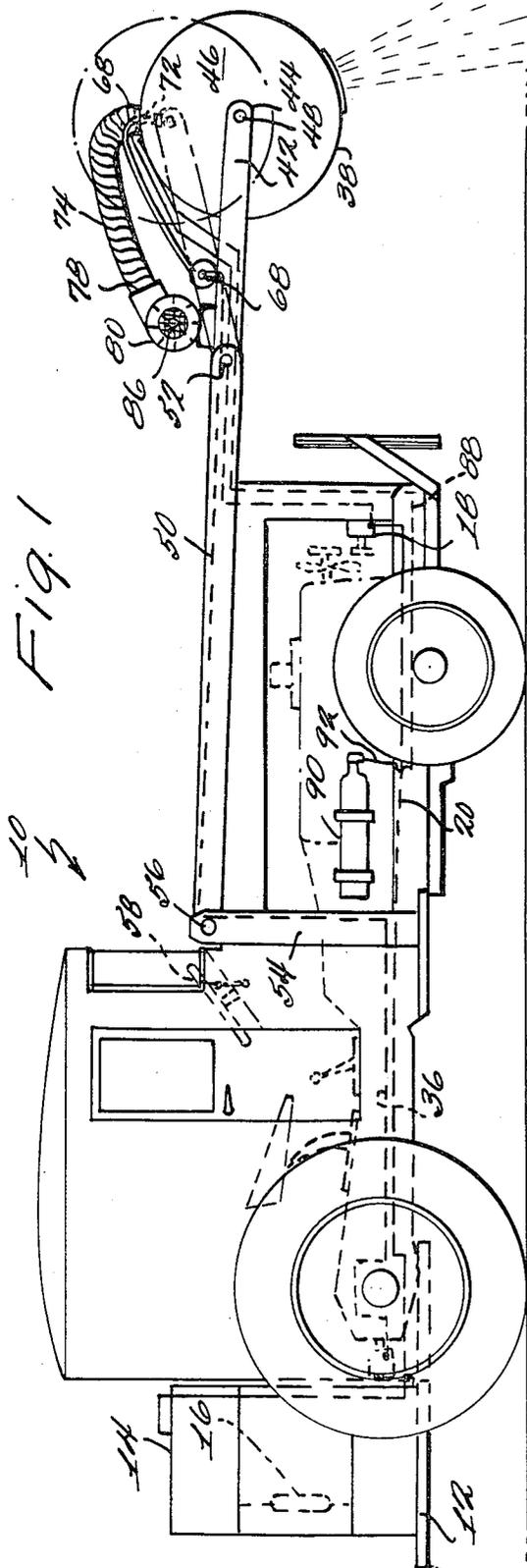
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SNOW MELTING DEVICE

Filed April 7, 1967

2 Sheets-Sheet 1



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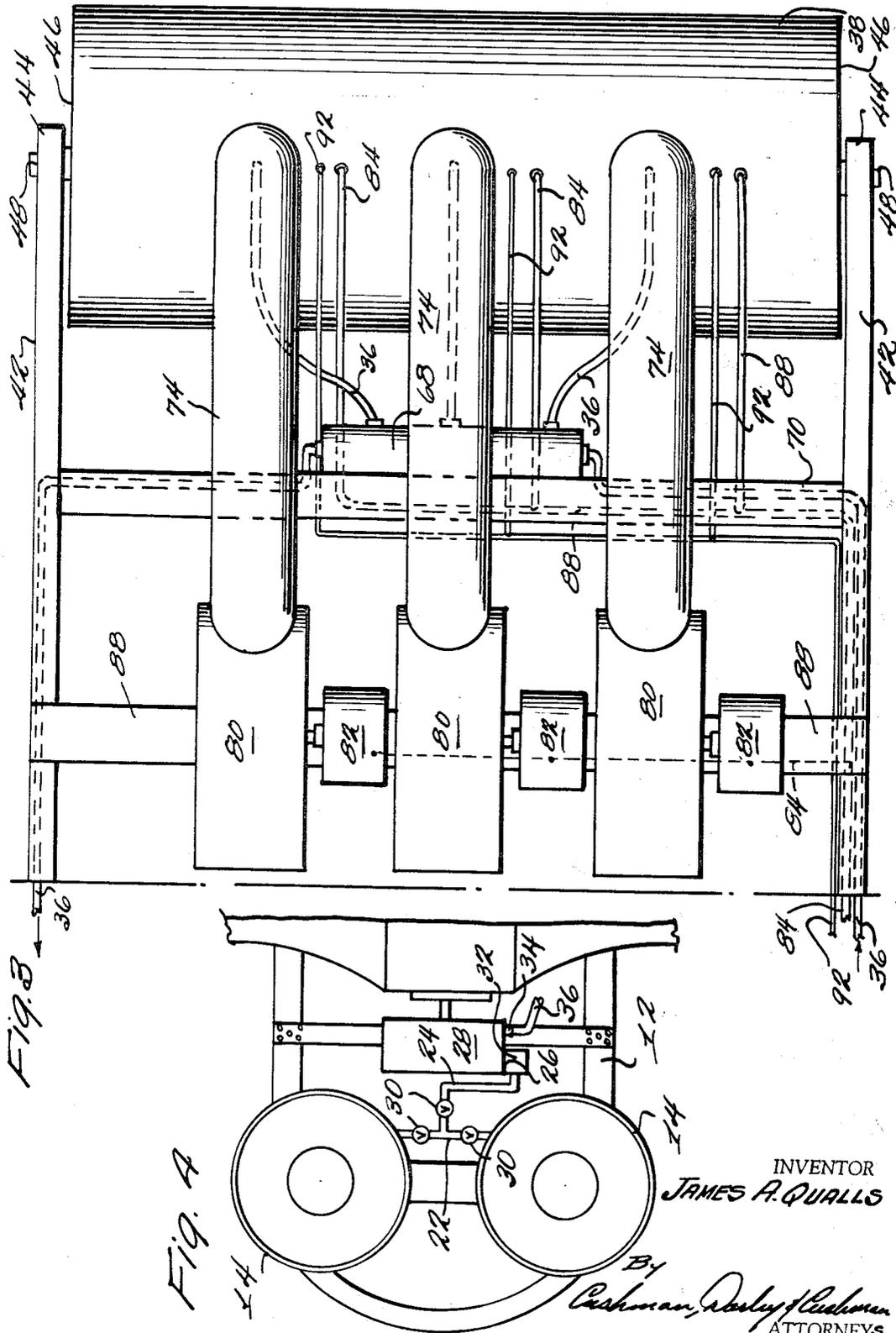
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SNOW MELTING DEVICE
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ABSTRACT OF THE DISCLOSURE

Ice, snow and slush removal apparatus having a combustion chamber pivotably mounted on a vehicle and movable to several operative positions. The combination chamber is provided with at least one aperture through which flame and combustion gas are discharged for direct contact with the ice, snow or slush to melt the same. A fuel supply also mounted on the truck is connected to the combustion chamber. An electric heater is used to preheat the fuel. The power for operating the fuel pump, the electric preheater, the ignition system in the combustion chamber and the blower means for delivering air to the combustion chamber and for discharging the combustion gases and flame are taken from the engine of the vehicle.

This invention relates to apparatus for melting snow and ice from roadways and the like and more particularly to apparatus which readily and rapidly removes snow or the like by direct contact of a combustion gas and flame with said snow, ice or slush.

Heretofore, various devices and means have been proposed for the removal of snow from roadways, parking areas, airport runways and the like. Often these devices are characterized by high costs and slowness in operation such as those employing scrapers and brushes. Others, employing jet engines for a source of heated gas are often prohibitively expensive and thus their widespread commercial acceptance is seriously minimized. Still other devices employ the principle of indirect heat exchange with a body of the ice or snow. These latter devices are generally considered to be inefficient from a standpoint of heat utilization.

It is therefore an object of the present invention to provide apparatus for rapidly removing snow from roadways or other areas which overcomes the disadvantages of prior art devices. Another object of the invention is the provision of apparatus for removing snow comprising a vehicle adapted to travel over the ground; a combustion chamber adapted to be mounted on said vehicle and provided with at least one aperture through which combustion gases and flame are discharged for direct contact with snow or the like; blower means operatively connected to said combustion chamber to deliver air to said combustion chamber, to provide efficient mixture of air with combustible fuel therein and to impart sufficient discharge velocity to the resulting combustion gases and flame issuing from the aperture in said chamber for direct contact with said snow or the like; fuel supply means adapted to be mounted on said vehicle, preferably remote from said combustion chamber, said fuel supply means including pump means to deliver said fuel to said combustion chamber and preheating means for maintaining said fuel at a predetermined temperature, thereby increasing the combustion efficiency thereof regardless of the ambient temperature. Another object of the present invention is the provision of means for operatively connecting said combustion chamber to said vehicle whereby said combustion chamber can be moved in a substantially vertical plane to provide more than one operative position thereof and thereby permitting the use of the device to effectively remove snow drifts or snow piles.

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For a better understanding of these and other objects of the invention, reference may be had to the following detailed description taken in conjunction with the accompanying drawings in which:

5 FIGURE 1 is a side elevation of a vehicle which is provided with the snow removal apparatus in accordance with the invention;

FIGURE 2 is a bottom plan view of the combustion chamber mounted on the vehicle shown in FIGURE 1;

10 FIGURE 3 is a top plan view of the forward end of the vehicle of FIGURE 1 showing the combustion chamber and blowers mounted thereon; and

15 FIGURE 4 is a top plan view of the rearward end of the vehicle of FIGURE 1 showing the fuel supply means including the fuel delivery means and fuel preheating means associated therewith.

20 Referring now particularly to the drawings, 10 is a vehicle such as a motor truck or the like upon which the snow removal assembly of this invention is mounted. At the rear of the vehicle 10, there is fixedly mounted by any suitable means, such as by welding or the like, a platform 12, on which is carried fuel supply means 14. Conveniently, the fuel supply means can comprise one or more fuel tanks containing, for instance, No. 4 grade fuel oil. The capacity of the tanks can, of course, be varied, but it has been found convenient to mount at least two 150 gallon tanks thereon. 75 gallon tanks or any other convenient size can also be employed.

25 Each of said fuel supply tanks is equipped with an electric fuel preheating mechanism 16. The electric power for operating the fuel preheater can be provided from the vehicle's generator 18 through suitable conductor means 20. Conveniently a D.C. generator with a transformer, rated at 110 volts with 4 to 1 ratio from the vehicle engine to the generator pulley is employed. The preheater 16 can include conventional thermostat controls so that the temperature of the fuel supply can be preselected depending, for instance, on the ambient temperature and the grade of fuel oil employed. Obviously, the preheat temperature chosen will be such that the fuel has desirable flow characteristics at the ambient temperature as well as efficient combustion characteristics when delivered to the combustion zone at the forward end of the vehicle 10. It has been found that when using a No. 4 grade fuel oil, the temperature thereof is maintained at about 180° F. Addition of a vapor indicator can also be used in conjunction with the thermostat as an additional safety feature.

30 The fuel supply tanks 14 are connected to a fuel supply delivery means comprising conduit means 22 leading from each tank to a common fuel line 24 which in turn is in operative engagement with the inlet side 26 of supply pump 28. The fuel conduits 22 and 24 are controlled by valves 30, which can be, for instance, 3 inch gate valves, although any other conventionally employed valve mechanisms can be used. Conveniently, the conduits 22 and 24 are quarter-inch in diameter. Prior to delivery of the fuel from the tanks 14 to the pump 28, the fuel can, advantageously, be passed through a filter or straining mechanism 32 to remove any deleterious residue therein which would interfere with efficient combustion. Leading from the discharge side 34 of the fuel pump 28 is one end of flexible conduit means 36 which can be, for instance, one-quarter inch flexible tubing. The other end of flexible conduit means 36 is in fluid communication with the combustion zone located at the forward end of the vehicle 10. Any conventional type fuel pump can be employed and preferably, it has been found advantageous to employ a pump capable of delivering about 0.3 to 0.6 gallon of fuel per minute. However, it will be recognized that the rate of fuel delivery to the combustion zone can be varied over a wide range. The pump 28 is operatively

connected to the engine of the vehicle so as to be driven thereby.

The combustion zone at the forward end of the vehicle **10** is defined by a combustion chamber **38**, which is conveniently an elongated closed-end tubular member, provided with at least one discharge aperture **40** through which the combustion gas and flame produced therein are discharged for direct contact with the snow and ice. Typically, the combustion chamber can be a 72 inch long chamber, 24 inches in diameter and provided on the interior surface thereof with a one-half inch refractory lining. Preferably, a plurality of circular discharge apertures, for instance, three, each of which can be about six inches in diameter as shown in FIGURE 2 are provided. The combustion chamber **38** is mounted on the forward end of the truck by means of a pair of spaced arms **42**, the free end, **44**, of each being rigidly secured to corresponding end **46** of the combustion chamber by bearing member **48**. The other end of each spaced arm **42** is pivotally connected to a corresponding one of a pair of spaced support arms **50** at one end thereof by, for instance, pin means **52**. The other end of each of the spaced support arms **50** is rigidly attached to a post member **54** fixed, for instance, to the vehicle **10** by connecting means **56**. Suitable hydraulic means, not shown, driven by the vehicle engine and controlled by levers **58** in the cab of the vehicle are operatively connected to the pivot arms **42** by suitable and conventional attachment to cause pivot arms **42** to move in a vertical plane. This advantageous feature permits the raising and lowering of the combustion chamber to a plurality of operative positions thereby enabling the use of the apparatus for the removal of snow in the form of drifts or piles.

Arranged for communication with the interior of the combustion chamber **38** at a point remote from the discharge aperture **40** and adjacent the upper peripheral surface thereof is fuel burner mechanism **60** which can include, for instance, a burner pipe fitted with low pressure fuel atomizing nozzle **62**, having for instance, a 1.59 inch nozzle opening, and having associated therewith ignition means **64**. The pipe is connected to the flexible conduit **36** for delivery of fuel oil to the combustion chamber. Preferably, a plurality of burner mechanisms **60** are employed. Thus, as is shown, when three such burner mechanisms are employed they have a combined output capacity of 25 g.p.h. and a BTU rating of 62,500 B.t.u.'s/hr. Usually, one burner mechanism **60** is provided for each aperture **40** employed. The burner mechanism **60** can be connected to the flexible conduit **36** through a manifold **68** fixedly attached to a brace **70**, each end of which is secured to one of the pivot arms **42**. The brace **70** can be an inverted U-shaped member to house the flexible conduits leading to the combustion chamber in the channel portion thereof.

Ignition means **64**, which can be in the form of an electrical igniter such as a spark plug, is also provided adjacent each burner nozzle **62** in the combustion chamber **38**. When the ignition means is in the form of an electrical igniter, electrical power can be taken from the D.C. generator **18** of the vehicle through suitable flexible electrical conductor means **66**.

Also arranged for communication with the interior of the combustion chamber **38** is the outlet end **72** of flexible air duct **74** through aperture **76** about which the duct is sealingly secured. The aperture **76** can provide an opening about 1.04 square inches. Preferably, the burner mechanism **60** is axially aligned within aperture **76**. The inlet end **78** of air duct **74** is in fluid communication with the discharge end of a forced draft blower **80** driven by a variable speed motor **82**. Electrical power for operating the draft blower motor can be taken from the D.C. generator **18** of the vehicle by means of suitable electrical conductors **84**. Conveniently, a plurality of draft blowers can be utilized. Generally one blower for each burner mechanism **60** is employed. It has been found advanta-

geous to employ a six inch diameter, three inch wide blower provided with a thirty-two curve blade fan. The blower motor, for instance, can be a 110 volt, 3600 r.p.m. rated motor. The forced draft blower housing is also provided at the top thereof with screened air inlet **86**. Additionally, the forced draft blower and the motor to drive the same are conveniently mounted on support means **88** extending between and fixedly attached to the pivot arms **42**.

Also mounted on the vehicle **10** is a supply of acetylene gas **90** which can be, for instance, a pressure cylinder provided at its discharge end with a flexible conduit **92**. The outlet end of conduit **92** is arranged to deliver acetylene gas in the combustion chamber **38** closely adjacent the atomizing nozzle **62**.

Apparatus of the above described type is extremely effective in snow and ice removal. For example, each burner mechanism can be operated to melt 24 square inches of ice, 1 foot thick, when the ambient temperature is 32° F. and when the vehicle is travelling at a rate of 5 m.p.h.

It is thus apparent that an efficient and effective snow melting apparatus has been provided which utilizes directly combustion products, including gas and flame produced in the vertically movable combustion chamber, to remove snow and ice of varying heights from a surface covered thereby.

While various changes may be made in the structure as disclosed, it shall be understood that such changes shall be within the spirit and scope of the present invention as defined by the appended claims.

What is claimed is:

1. Apparatus for melting snow and ice comprising a vehicle adapted to travel over the ground, a combustion chamber, mounting means for pivotally securing said combustion chamber to said vehicle whereby said combustion chamber can be moved in a substantially vertical plane from a first operative position to another operative position, said combustion chamber comprising a closed-end elongated substantially tubular housing provided with at least one aperture for discharge of combustion gas and flame therethrough for direct contact with said snow and ice, at least one ignition means provided within said combustion chamber, said ignition means being spacedly removed and disposed substantially opposite said discharge aperture, said combustion chamber provided with at least one other aperture which is substantially aligned opposite said discharge aperture, a fuel nozzle substantially axially aligned within said second aperture, blower means to deliver air to said combustion chamber to provide efficient mixture of air with combustible fuel delivered thereto through said fuel nozzle and to impart sufficient discharge velocity to the combustion gas and flame produced in said combustion chamber and issuing therefrom through said discharge aperture for direct contact with said snow and ice, fuel supply means mounted on said vehicle, said supply means including pump means to deliver fuel to said fuel nozzle in said combustion chamber and preheating means for maintaining said fuel at a predetermined temperature.

2. The apparatus of claim 1 including a plurality of discharge apertures which are spacedly removed from each other, a plurality of other apertures, each of which is in substantial alignment opposite a corresponding one of said discharge apertures, a plurality of ignition means each of which is disposed substantially opposite a corresponding one of said discharge apertures and a plurality of fuel nozzles, each of which is axially aligned within a corresponding one of said other apertures.

3. The apparatus of claim 1 wherein said combustion chamber is mounted at one end of said vehicle and the fuel supply means are mounted at the other end of said vehicle.

4. The apparatus of claim 1 wherein said fuel pump is operatively connected to the engine of said vehicle.

5. The apparatus of claim 1 wherein the ignition means

is an electrical igniter connected to the generator of said vehicle.

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