March 2, 1965 W. J. MILLER 3,171,405

SNOW LIQUEFYING DEVICE

Filed Sept. 16, 1963 4 Sheets-Sheet 1

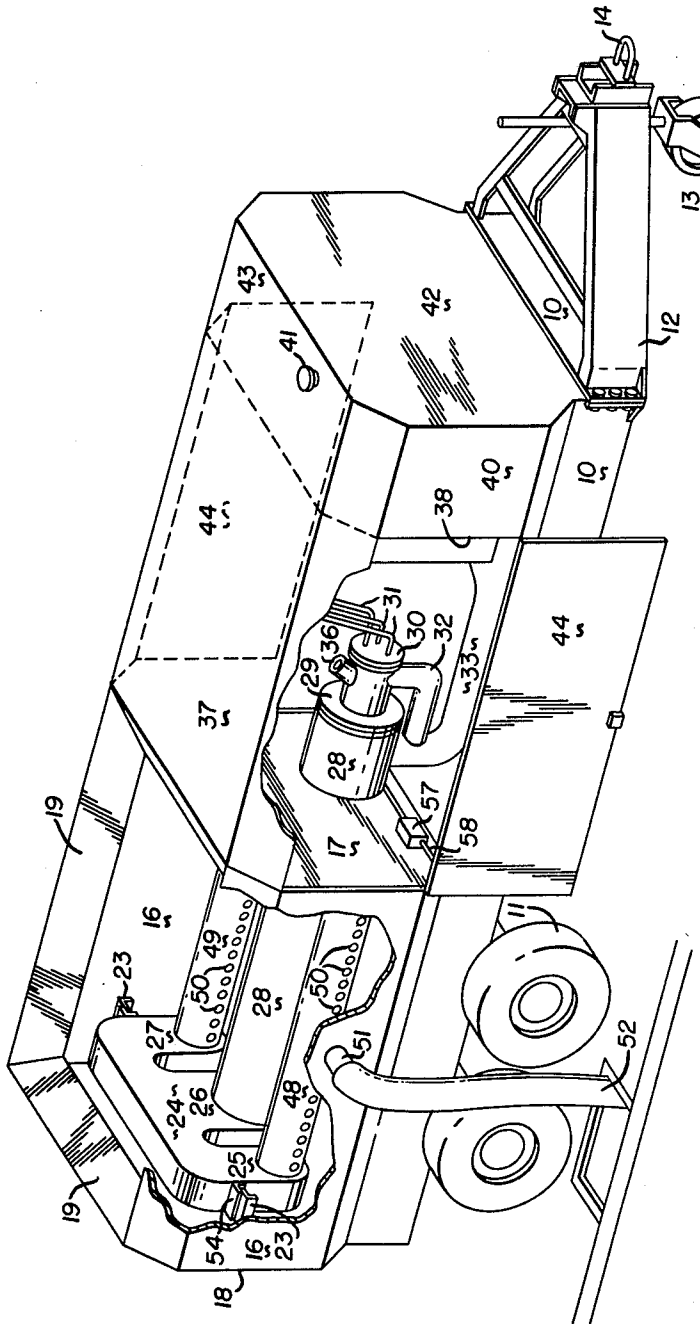


FIG. 1

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SNOW LIQUEFYING DEVICE

Filed Sept. 16, 1963 4 Sheets-Sheet 2

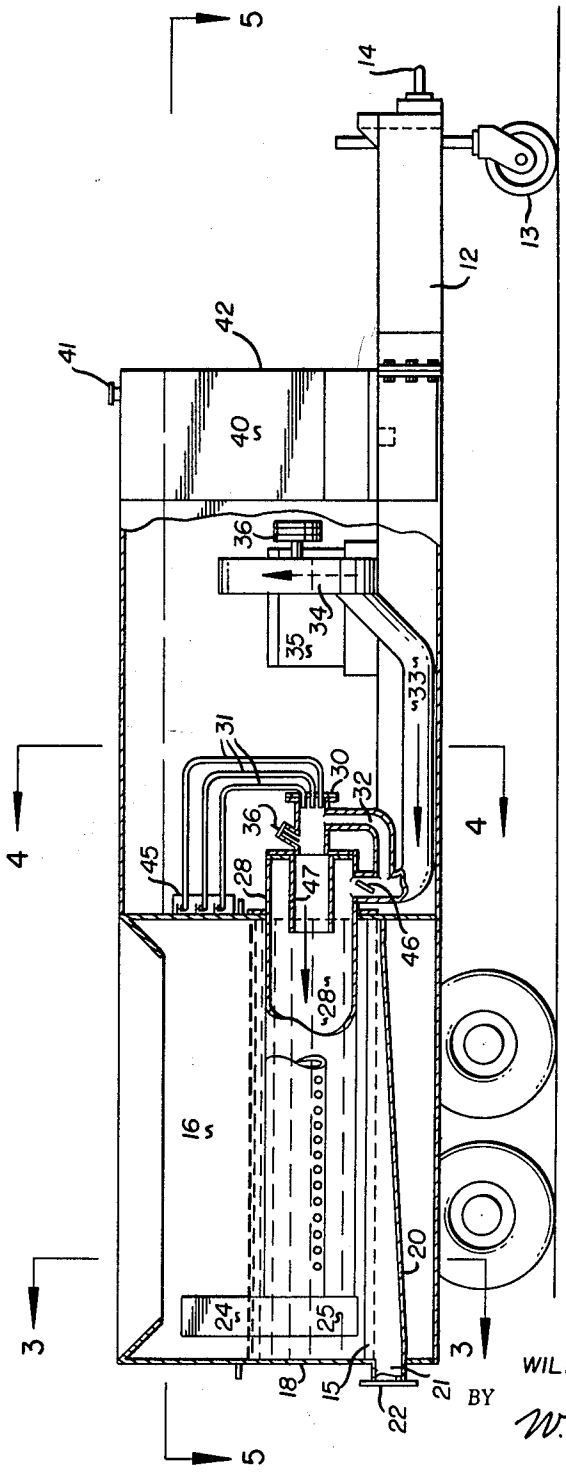


FIG. 2

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SNOW LIQUEFYING DEVICE

Filed Sept. 16, 1963 4 Sheets-Sheet 3

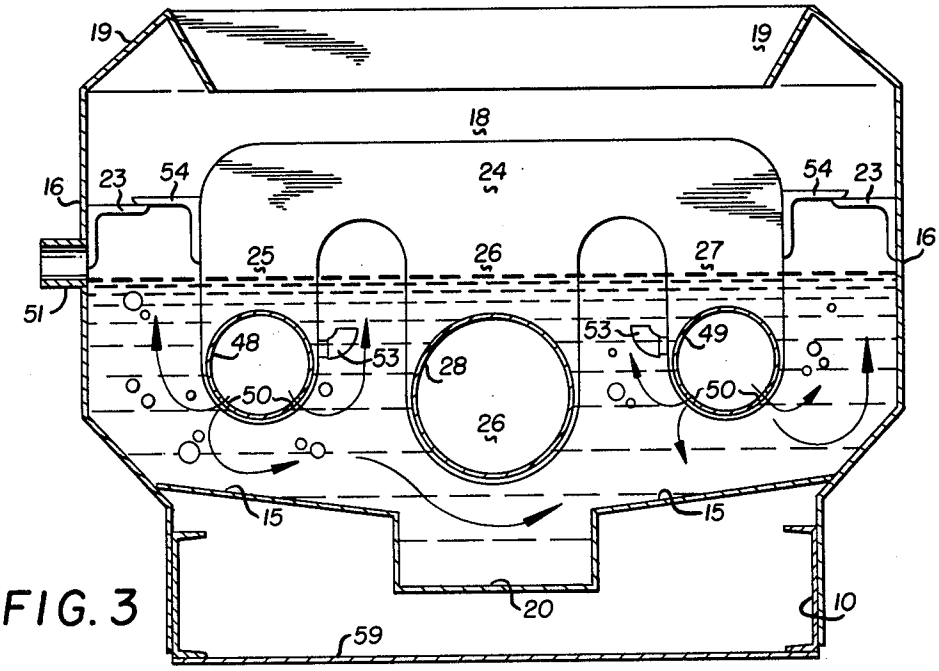


FIG. 3

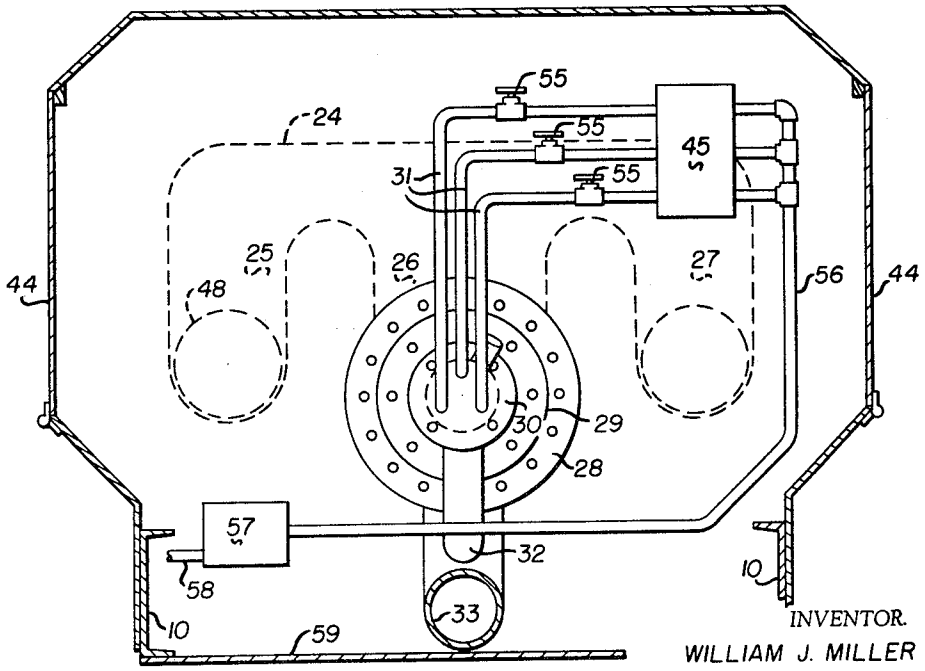


FIG. 4

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March 2, 1965 W. J. MILLER 3,171,405

SNOW LIQUEFYING DEVICE

Filed Sept. 16, 1963 4 Sheets-Sheet 4

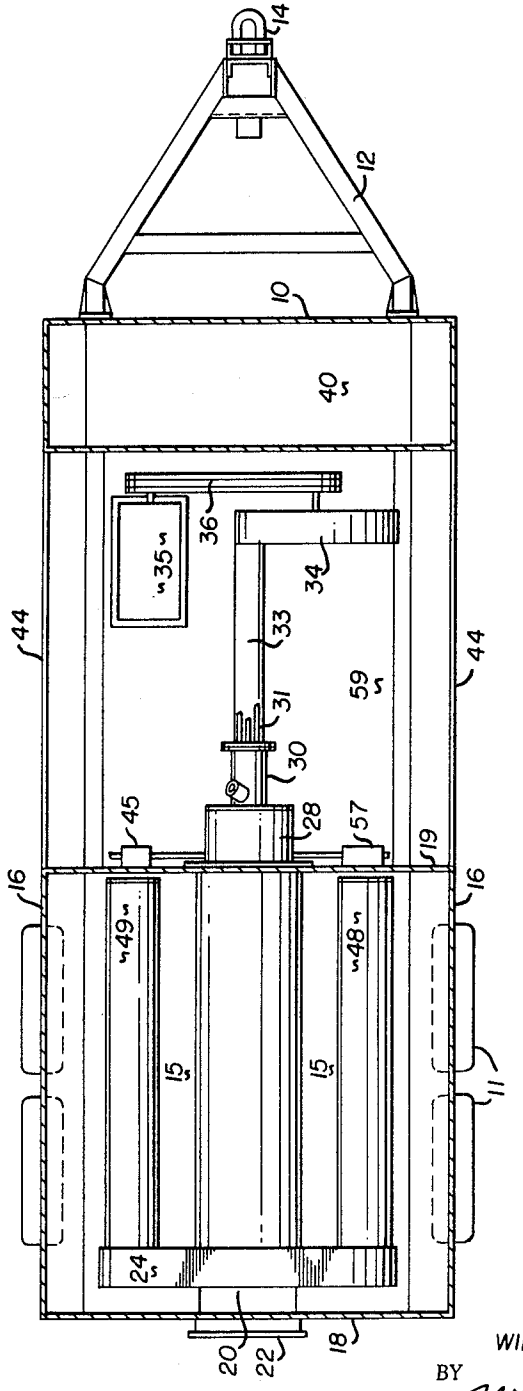


FIG. 5

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United States Patent Office 3,171,405
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3,171,405

SNOW LIQUEFYING DEVICE

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Filed Sept. 16, 1963, Ser. No. 309,034
4 Claims. (Cl. 126—343.5)

This invention relates to a device for disposing of snow by liquefying the same and more particularly to a device which is portable and capable of being moved from one location to another.

The principal object of the invention is the provision of a device for rapidly and efficiently liquefying snow.

A further object of the invention is the provision of a device for liquefying snow through a combination of heat and agitation in a liquid bath.

A still further object of the invention is the provision of a device for liquefying snow which is self-contained and which is provided with a drain so that the liquefied snow may be conveniently disposed of.

The device for liquefying snow disclosed herein comprises an improvement in the art relating to such devices and in particular in that it utilizes all of the heat generated in the device by applying it to a bath in which the snow being liquefied is placed. The snow liquefying device disclosed herein provides a tank-like construction in which the snow is positioned, the lower portion of the tank being normally filled with water which surrounds and covers a combination heat exchanger and agitator unit. Heat is supplied from an oil burner with the products of combustion directed into a portion of the heat exchanger along with a source of secondary air which mixes with the heated gases in the heat exchanger and emerges therewith through a plurality of orifices in the heat exchanger to cause a desirable agitation in the liquid bath. The resulting action has been found to be most efficient in rapidly liquefying snow placed in the tank.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being the intention to cover all changes and modifications of the example of the invention herein chosen for purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention.

The invention is illustrated in the accompanying drawings, wherein:

FIGURE 1 is a perspective view of the snow liquefying device.

FIGURE 2 is a side elevation with parts broken away and parts in cross section.

FIGURE 3 is a vertical section on line 3—3 of FIGURE 2 on an enlarged scale.

FIGURE 4 is a vertical section on line 4—4 of FIGURE 2 on an enlarged scale.

FIGURE 5 is a horizontal section on line 5—5 of FIGURE 2.

By referring to the drawings and FIGURE 1 in particular, it will be seen that a snow liquefying device has been disclosed which comprises a rectangular frame **10**, the rear portion of which is supported on wheel and axle assemblies **11** as customary in the trailer art and the front end of which is detachably secured to a triangular subframe **12** which is provided with a ground engaging wheel and a towing connection **14**. The rear portion of the rectangular frame **10** directly supports a rectangular tank having a shaped bottom **15** extending between vertically standing sides **16, 16** and vertically standing front and back walls **17, 17** and **18, 18**. The sides **16, 16** are preferably offset outwardly between their upper and

lower edges and a rectangular top portion **19** is positioned thereon which extends inwardly and downwardly a short distance and provides a modified chute-like structure around the large open center area defined thereby through which snow to be liquefied is placed in the tank of the device.

By referring to FIGURES 2, 3 and 4 of the drawings, it will be seen that the bottom **15** comprises two side portions which slope inwardly and downwardly toward the center thereof which center portion comprises a longitudinally tapered channel **20** having its shallowest portion adjacent the front wall **17** of the tank and its deepest portion adjacent the back wall **18** of the tank. The back wall **18** has a clean-cut opening **21** therein which is normally closed by a closure member **22** and which communicates directly with the rearmost portion of the channel **20** so that gravel, stones and other debris which are received in the snow liquefying device along with snow may be periodically removed therefrom. The side walls **16** of the tank have supporting brackets **23, 23** secured thereto in oppositely disposed relation and which supporting brackets engage and hold a transverse heat exchanger **24** in elevated relation to the bottom of the tank. The transverse heat exchanger **24** is a hollow member, as may best be seen in FIGURES 1 and 3 of the drawings, having three spaced depending portions **25, 26** and **27** respectively, each of which is rounded at its lowermost end and each of which communicates at its uppermost end with a common transverse chamber in the heat exchanger **24**. A first heat exchanger tube **28** extends from the front of the depending portion **26** of the heat exchanger where it communicates with the interior thereof forwardly through the tank and through the front wall **17** and in spaced relation to the bottom of the tank and in particular in spaced relation to the channel **20** therein. The forward end of the first heat exchanger tube **28** extends into a compartment forwardly on the frame **10** of the tank and has an end enclosure **29** which in turn receives an oil burner head **30** which is supplied by a plurality of oil lines **31** and a combustion air supply tube **32**. The combustion air supply tube communicates with a circulation air source tube **33** which in turn is supplied with air by a large blower **34** which is located in the compartment forward of the tank and is adapted to be driven by a suitable power source such as an internal combustion engine **35** which is connected to the blower by a typical V-belt drive **36**. Additionally, the internal combustion engine drives a generator (not shown) which provides electric current for operating the firing plug **36** of the oil burner, as will be understood by those skilled in the art, and the compartment in which the oil burner head **30**, the blower **34** and the internal combustion engine **35** are positioned is defined by a top portion **37** extending between the front wall **17** of the tank and the back wall **38** of a fuel tank **40** which is positioned on the front of the frame **10** and provided with a filler opening and cap **41**. The tank **40** has a front wall **42** and a top portion **43** and it will be seen that its side walls are offset outwardly in the same configuration as the tank on the rear portion of the frame **10** in which the heat exchanger is located. Hinged access doors **44** located on the opposite sides of the compartment in which the oil burner head **30** and blower **34** and internal combustion engine **35** are positioned provide convenient access to the interior thereof and at least one is normally opened when the snow liquefying device is in operation. The compartment also encloses oil lines and a pump by means of which fuel from the tank **40** is delivered to a control valve panel **45** from which the several oil lines **31** lead to the burner head **30**. A valve **46** is located in the tube **33** adjacent its point of communication with the first heat exchanger tube **28** and a tubular nozzle **47** is positioned within the outer end

of the first heat exchanger tube **28** adjacent the oil burner head and extends inwardly therefrom and into the portion of the first heat exchanger tube **28** within the tank and beyond the opening therein through which the air from the blower is introduced under control of the valve **46**.

A pair of secondary heat exchanger tubes **48** and **49** are attached to and communicate with the depending portions **25** and **27** respectively of the transverse heat exchanger **24** and each of these secondary heat exchanger tubes **48** and **49** has a series of apertures **50**, **50** spaced longitudinally thereof below the center line thereof as best seen in FIGURE 3 of the drawings. The forward ends of the secondary heat exchanger tubes **48** and **49** are closed and are positioned in spaced relation to the front wall **17** as may be seen in FIGURE 5 of the drawings.

It will thus be seen that air from the blower **34** is delivered through the primary air source tube **33** directly to the first exchanger tube **28** and by way of the combustion air supply tube **32** to the burner head **30** and that all of the air is therefore directed into the first heat exchanger tube **28** together with the products of combustion from the oil burner. The air and the products of combustion must flow rearwardly through the heat exchanger tube **28** into the depending portion **26** of the transverse heat exchanger **24**, it being observed, as by referring to FIGURE 3 of the drawings, that the tube **28** is totally immersed in water in the tank of the snow liquefying device. The air and products of combustion then flow sidewardly and downwardly through the portions **25** and **27** and into the secondary heat exchanger tubes **48** and **49** and heat the same.

The secondary heat exchanger tubes **48** and **49** are totally immersed in the water in the tank. The air and products of combustion emerge from the longitudinally spaced orifices **50**, **50** in the heat exchanger tubes **48** and **49** at a point well below the liquid level in the tank of the snow liquefier and move upwardly and therethrough causing severe agitation. Snow deposited in the snow liquefying tank is immediately subjected to the boiling, rolling action of the heated water in the tank and the combination of the heat and the water and the motion quickly liquefies the same and the liquid drains off through the side of the tank and specifically through an outlet orifice **51** to which a flexible disposal hose **52** may be attached and lead to a storm sewer or the like.

By referring now to FIGURE 5 of the drawings, it will be seen that the first heat exchanger tube **28** and the secondary heat exchanger tubes **48** and **49** are spaced with respect to the bottom, sides and end walls of the snow liquefier tank and that all of the surfaces thereof with the exception of the upper portions of the transverse heat exchanger **24** are therefore utilized in heating the water in the tank. The elevated portion of the transverse heat exchanger **24** provides a radiant heat effect and is necessary to prevent liquid in the tank from flowing upwardly into the same from whence it could flow into the first heat exchanger tube **28**. The portions of the transverse heat exchanger **24** which interconnect the depending portions **25**, **26** and **27** are utilized as heat exchanger surfaces by providing bubble pipes **53**, **53** which communicate with the depending portions **25** and **27** and extend upwardly and outwardly so that air and the products of combustion arising therefrom will lift the water in the tank upwardly against the lower surfaces of the horizontal heat exchanger **24** for the indicated purpose. Brackets **54**, **54** on the opposite sides of the horizontal heat exchanger rest on and are secured to the support brackets **23**, **23** heretofore referred to as best seen in FIGURE 3 of the drawings.

By referring now to FIGURE 4 of the drawings, the oppositely disposed access doors **44**, **44** may be seen in vertical section and a detail of the head end of the first combustion tube **28**, closure **29** and oil burner head **31** may be seen. The oil lines **31** are also illustrated and it will be noted that each is provided with a control valve. The oil lines **31** are also controlled by automatic valves positioned within a control panel **45** and provided with conventional control means such as customary in oil burner constructions. A main oil supply line **56** communicates therewith and extends to a fuel pump **57** which in turn has a supply line **58** which extends to the fuel tank **40** heretofore referred to. The bottom of the compartment defined by the liquefying tank and the fuel tank **40** is indicated by the numeral **59** and comprises a suitable metal panel directly supported by the frame **10** as best seen in FIGURES 3 and 4 of the drawings.

It will thus be seen that a snow liquefying device has been disclosed which comprises a self-contained trailer unit which may be moved from place to place as desired where it may be conveniently used to dispose of snow, collected, and loaded thereinto by means (not shown) and it will occur to those skilled in the art that if desired a snow elevator mechanism can be attached to the rear of the device and arranged so that snow is picked up directly from the ground and moved upwardly into the liquefying tank. Snow positioned in the liquefying tank of the device is subjected to a very rapid liquefying action as occasioned by the high rate of heat exchange obtained by the heat exchange tubes **28**, **48** and **49** and more specifically by the discharge from the tubes **48**, **49** of the products of combustion and the agitating air directly into the liquid in the tank which very effectively breaks up the snow and liquefies it as it sinks into the liquid in the tank.

It has been determined that the device will burn two gallons of No. 2 fuel oil per ton of snow liquefied with a suitable burner firing rate and that the device is capable of easily handling more than twenty-five tons of snow per hour and that larger quantities of snow may be handled by increasing the size of the tank and the length of the heat exchanger tubes and proportionately increasing the amount of fuel burned therein.

It will thus be seen that a snow liquefying device has been disclosed which meets the several objects of my invention, and having thus described my invention, what I claim is:

1. A snow liquefying device including a tank having bottom, side and end walls and an open top and a liquid outlet spaced with respect to the bottom thereof, a first heat exchanger tube positioned across said tank in spaced relation to the bottom thereof and having one end extending through one end wall of said tank, a pair of secondary heat exchanger tubes extending across said tank in spaced relation to said first heat exchanger tube and each having one of its ends closed, said secondary heat exchange tubes being apertured in their lower portions, a transverse hollow heat exchanger in communication with the other end of said first heat exchanger tube and with the other ends of said secondary heat exchanger tubes, said first and secondary heat exchanger tubes positioned below said liquid outlet and normally covered with water in said tank, a source of air under pressure and a fuel source, an oil burner mounted on the end of said first heat exchanger tube beyond the wall of the tank and means connecting said air pressure source to said first heat exchanger tube and to said oil burner, an oil line having a control valve therein establishing communication between said fuel source and said oil burner.

2. The snow liquefier set forth in claim 1 and wherein said first heat exchanger tube and said second heat exchanger tubes are positioned in said tank in spaced parallel relation on a common horizontal plane.

3. The snow liquefier set forth in claim 1 and wherein said transverse heat exchanger comprises a hollow body member having three spaced depending portions and wherein said first and second heat exchanger tubes communicate with said spaced depending portions.

4. The snow liquefier set forth in claim 1 and wherein said transverse heat exchanger comprises a hollow body member having three spaced depending portions and wherein said first and second heat exchanger tubes com-

municate with said spaced depending portions and wherein the upper portion of the transverse heat exchanger is positioned above said liquid outlet.

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