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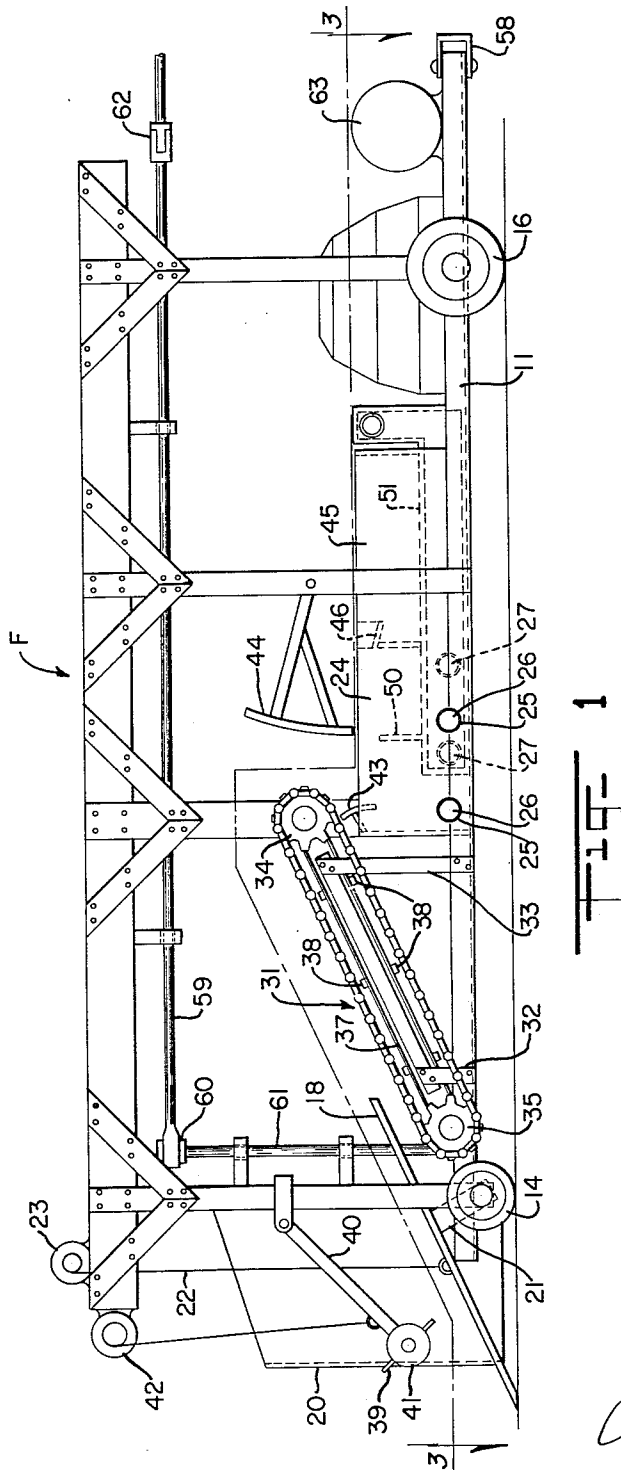
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2,995,841

ICE AND SNOW REMOVING MACHINE

Filed Oct. 20, 1958

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

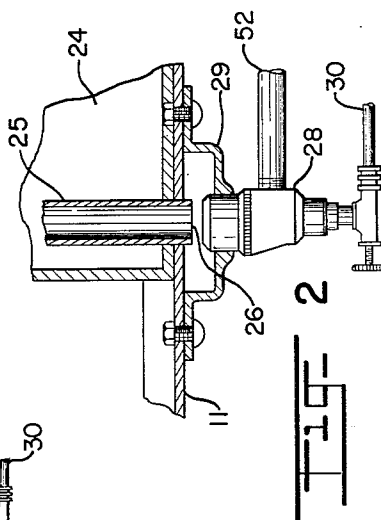
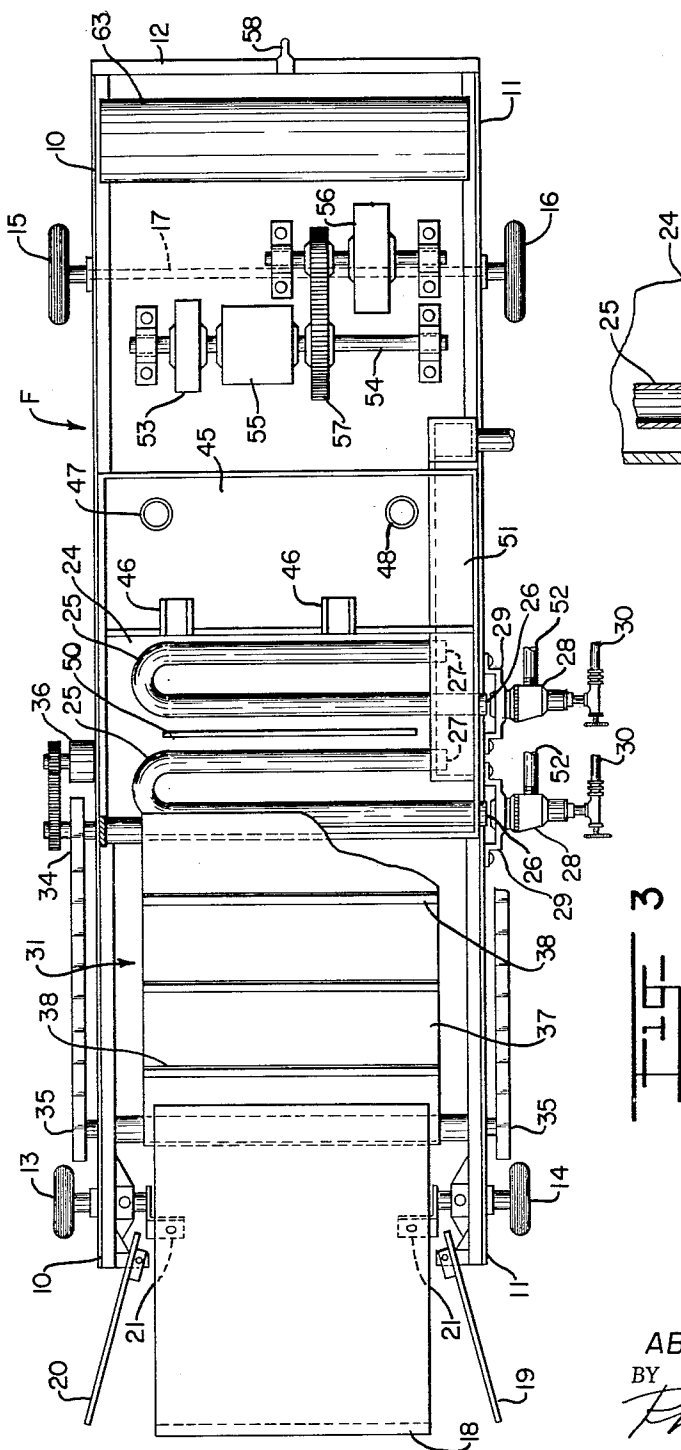


Fig. 3

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This invention is directed to an ice and snow removing machine and more particularly to such a machine constructed and designed for cleaning streets and highways.

A principal object of the invention is to provide an improved ice and snow removing machine which can be moved on a street or highway and remove ice and snow therefrom and then subsequently cause such to be melted and discharged as water for disposal.

Another object of the invention is to provide an improved ice and snow removing machine having a high capacity for melting and which will accomplish the melting without the necessity of pulverizing.

Still another object of the invention is to provide a novel ice and snow removing machine wherein a heated water bath is employed to melt ice and snow so removed.

Another object of the invention resides in the provision of a novel ice and snow removing machine employing a plurality of high heat exchange fire tubes within a tank adapted to retain water which when heated provides rapid melting of ice and snow removed, together with means for disposal of excess water produced by such melting.

Other and further objects of the invention will become more apparent as the description proceeds taken in connection with the accompanying drawings in which:

FIGURE 1 is a side view of an ice and snow removing machine according to the invention and being particularly constructed for use on streets and highways;

FIGURE 2 is a view to an enlarged scale of one of the fire tubes showing the arrangement of the burner therewith; and

FIGURE 3 is a top view of the base frame structure taken along line 3-3 of FIGURE 1.

Referring to the drawings, and to FIGURES 1 and 3 in particular, the improved ice and snow removing machine comprises a frame generally designated by the letter F which is made up of two spaced apart structures 10 and 11 connected together at their rear by a cross frame structure 12. The front end of this frame, to the left in the drawing, is unobstructed so that snow can readily pass into the space between the two side frame structures as the machine is moved forwardly on a street, highway or other surface desired to be cleaned of snow. At the forward end of the side frame 10 is a wheel 13 and a like wheel 14 is carried at the forward end of the other side frame structure 11. Both of these wheels have a short axle structure so there will not be any cross axle to interfere with the movement of snow into the machine. At the rear of the frame are mounted two other wheels 15 and 16 carried on the ends of an axle 17 which extends completely across the rear end of the frame and is suitably supported by the rear ends of the two side frame structures 10 and 11. With these four wheels, the machine can be readily moved down a highway or any other surface from which it is desired to remove snow and ice. The forward end of the two side frame members 10 and 11 also carry a snow scoop 18 in the form of an adjustable inclined plane. Suitable wings 19 and 20 may be provided to either side of scoop 18 as means to assist in guiding the snow and ice to be removed into the machine between the two side frame structures. Scoop 18 is pivotally mounted on the side frames by means of depending members 21 by suitable means and is adapted to be raised and lowered into contact with a street or highway by means of a cable 22 and winch 23 mounted on one side frame and positioned above scoop 18. Scoop

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18 may be raised when moving the machine from one location to another.

An important feature of the invention resides in the use of a melting tank 24 which is mounted between the two side frame structures 10 and 11 of the machine. A plurality of generally U-shaped fire tubes 25 of the immersion type are positioned within tank 24 in heat exchange relation with the interior thereof and are each provided with an inlet 26 and exhaust 27. Referring to FIGURE 2, an oil burner 28 is mounted to jet into the inlet means of bracket 29. Burner 28 is connected to a source of fuel oil (not shown) by means of a conduit 30 which may conveniently be fed from a manifold in a manner as well understood in the art.

A conveyor generally designated as 31 is positioned to receive the ice and snow from scoop 18 and deliver same to tank 24 for melting. Conveyor 31 is mounted between frame structures 10 and 11 and supported by means of upright members 32 and 33. Pairs of sprocket wheels 34 and 35 are suitably mounted for rotation on frame structures 10 and 11 with pair 34 being driven by a suitable motor 36. A conveyor belt 37 is positioned on sprocket wheels 34 and 35 and is provided with cleats 38 to assist in the moving of the ice and snow. As seen in FIGURE 1, sprocket wheels 35 are positioned below the rear edge of scoop 18 and the sprocket wheels 34 are positioned over the forward edge of tank 24, such that conveyor belt 37 picks up ice and snow discharging from scoop 18 and delivers same to the tank 24. A fan 39 is pivotally mounted on the front of the side frame structures 10 and 11 by means of arms 40. Fan 39 is powered by means of a motor 41 and is adapted to be raised or lowered by means of winch and cable 42. The height of fan 39 may be adjusted to cut into snow drifts.

Guide means 43 and 44 are mounted on side frame structures 10 and 11 and positioned to guide ice and snow from conveyor 31 into the warmest part of tank 24. A baffle 50 is positioned within tank 24 to divide same into front and rear compartments. The top of baffle 50 extends to a point below the normal water level of the tank. An overflow tank 45 is mounted between side frame structures 10 and 11 to the rear of melting tank 24 and one or more weirs 46 are provided between tanks 24 and 45 through which excess water from the melting of the ice and snow may flow to outlets 47 and 48 to disposal. Exhaust chamber 51 connected to exhausts 27 of immersion fire tubes 25 is seen to be in heat exchange relation with an end of tank 45 and supplies heat thereto to melt any ice or snow passing over weirs 46, which establish the normal water level within tank 24. Chamber 51 is vented to the atmosphere through a suitable stack.

The burners 28 supplying heat to tubes 25 and the contents of tank 24 may be of any suitable type, but are preferably of a forced draft type whereby heat from the burners will be caused to flow rapidly through the walls of the tubes to the contents of tank 24. Fuel is supplied to the burners through conduits 30 and forced air will be delivered to the burners through the conduits 52, these conduits being suitably connected to a blower indicated at 53 as shown in FIGURE 3.

The blower is shown as being driven by a cross drive shaft 54 journaled on the frame and driven by a suitable engine 55. This driving shaft 54 is also arranged to drive an electric generator 56, through gear train 57, to supply electricity to the machine to perform certain of the operations.

The snow removing machine just described is arranged to be pushed by a tractor, not shown, of any suitable construction. This tractor will have wheels and be provided with an engine for moving the tractor. The front

end of the tractor will be arranged to be coupled to the rear end of frame F of the snow removing machine by any suitable coupling 58. The operator's cab of the tractor and snow machine will be positioned at a high point thereon so the operator can look forwardly of the machine and see the road ahead. In the cab will be all the necessary controls for the snow removing machine, that is, the controls for motors 41 and 36. Also in the tractor will be provided a steering control which will extend forwardly by means of column 59 to a steering gear 60 at the front of the snow removing machine and mounted on its upper structure. From this gear, there will be a shaft 61 by means of which the two front wheels 13 and 14 can be steered. The steering column will be made so it can be divided whenever it is desired as at 62 to disconnect the tractor from the snow removing machine. All connecting structure such as electrical cables, conduits, etc., between the tractor and snow machine, will be provided with suitable connecting joints so that uncoupling of the tractor and machine can be accomplished if desired.

The snow removing machine will also carry a large storage tank 63 for furnishing fuel to the burners for supplying heat to the interior of the melting tank.

The operation of the improved snow removing machine is believed to be obvious from the foregoing detailed description of structure embodying the invention. Briefly described, however, this operation consists of driving the machine forward at a predetermined rate of speed, dependent on the amount of snow to be removed. The burners will be set in operation before the machine moves and the melting tank filled to the normal water level with water. When the water within the melting tank is properly heated, the machine can be caused to move forwardly at the desired speed. By proper adjustment of scoop 18, snow will be fed to conveyor 31 to be deposited in melting tank 24. The snow and ice deposited in tank 24 will be immediately melted on coming into contact with the heated water therein. Guides 43 and 44 direct the snow into the warmest part of the water in tank 24 and baffle 50, while of a height to permit chunks of ice to pass thereover, confines and localizes the melting action. When the water level in tank 24 exceeds that determined by weirs 26, the water overflows into auxiliary tank 45 and is pumped to disposal through outlets 47 and 48 by means of a pump energized from generator 56.

With reference to the efficiency of using heated water to effect the melting of snow over the more conventional methods, it will be noted that it takes 143.6 B.t.u. to melt one pound of ice at 32 degrees F. Snow having a 15% moisture content contains 9.37 pounds of ice crystals per cubic foot. Each cubic foot of the above snow will require 1345.5 B.t.u. of heat to melt the ice crystals to water at the freezing point. Thus a strip of this snow one-half mile long, six feet wide and one foot in depth amounts to 15,840 cubic feet and will require 15,840 times 1345.5 or 21,312,720 B.t.u. to melt this much snow in one hour's time. Due to the high specific heat of water, a rapid transfer of heat is effected resulting in a rapid conversion of the ice and snow into water. The rate that snow will be removed from a street or highway will depend on the depth of the snow to be removed

and other factors. However, it is estimated that on an average depth of snow on the highway, the snow-removing machine can be caused to move and clear snow therefrom at a rate of several miles per hour. Where the snow is light, a greater rate can be achieved.

While there has been described what at present is considered to be the preferred embodiment of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention. It is aimed, therefore, in the appended claims to cover all such changes and modifications which fall within the true spirit and scope of the invention.

What is claimed is:

1. In an ice and snow removing machine, wherein there is provided a wheeled frame structure for movement over a surface, an inclined scoop for picking up snow as the machine is moved over the surface, and conveyor means including guides for delivering ice and snow rearwardly from the scoop, the combination of a melting tank containing water being positioned within the frame structure with its front end disposed to receive ice and snow delivered by the conveyor means, a transverse baffle extending from the bottom of said tank to just below the normal water level to divide said tank into front and rear compartments, an overflow tank communicating with said rear compartment for removing excess water from said melting tank and including outlets for disposal of any excess water, a plurality of immersion type heating tubes positioned in at least said front compartment below the normal water level and with means for delivering a high temperature fuel through said tubes from the inlet to the exhaust ends thereof, and an exhaust chamber communicating with the exhaust ends of said tubes and extending throughout said melting tank and overflow tank in direct heat exchange relation therewith for heating the water in said melting tank and said overflow tank.

2. In an ice and snow removing machine according to claim 1 wherein at least one weir is positioned between said melting tank and said overflow tank to control the passage of water from said melting tank into said overflow tank and thereby to establish the normal water level within said melting tank.

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