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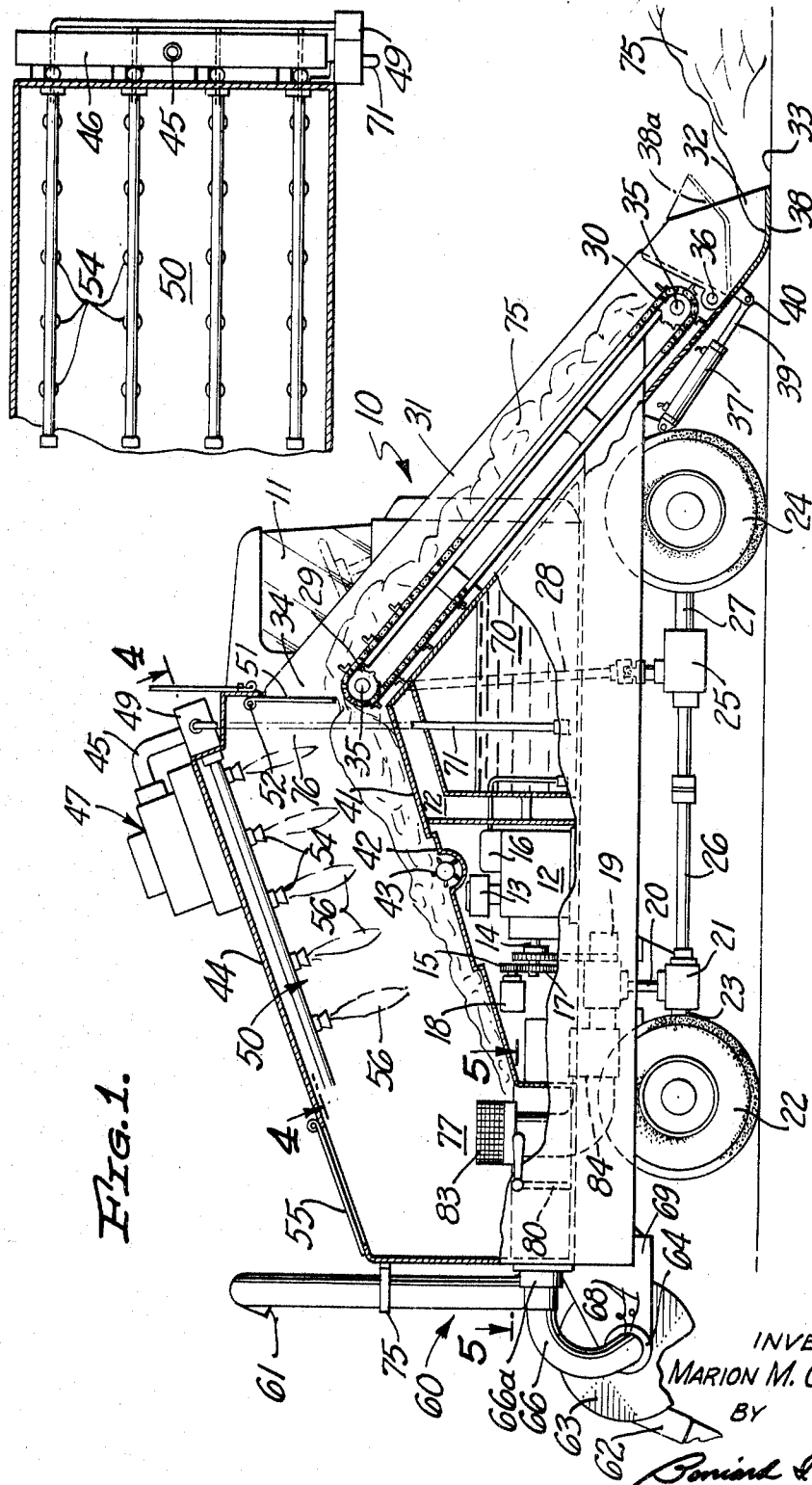
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3,484,961

AUTOMATIC SNOW MELTER

Filed Nov. 28, 1966

3 Sheets-Sheet 1



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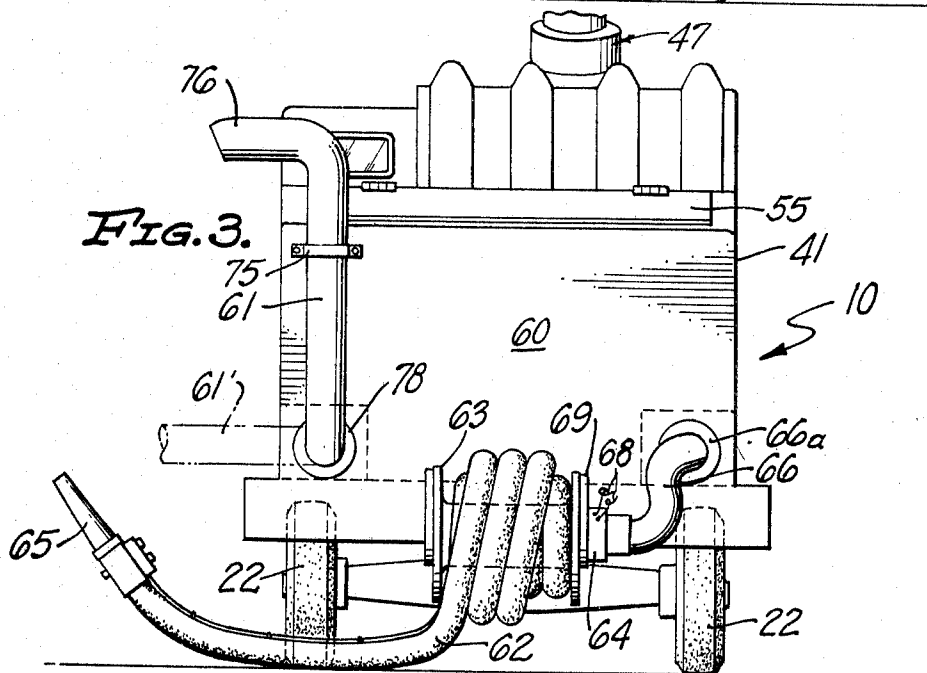
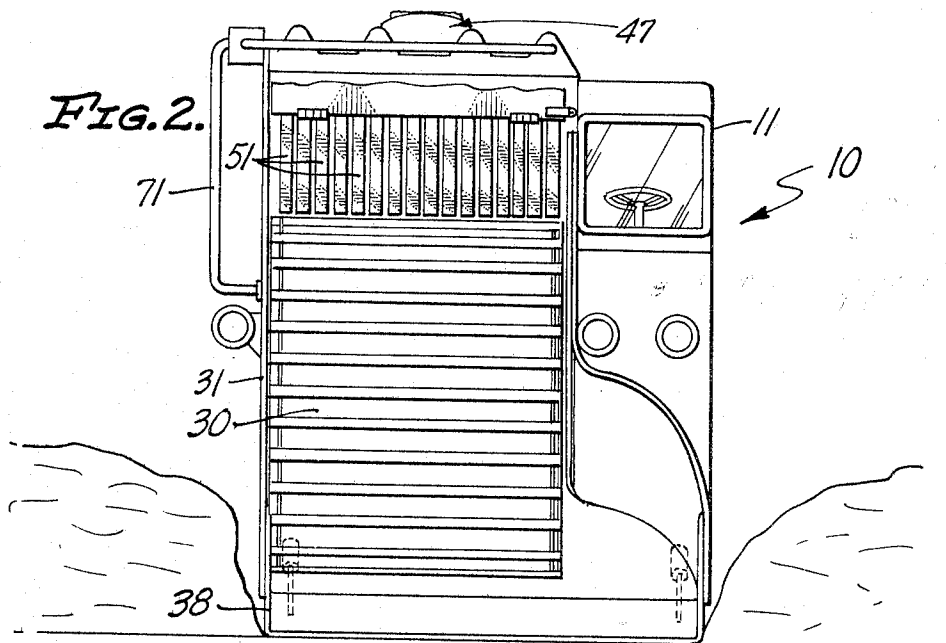
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3 Sheets-Sheet 2



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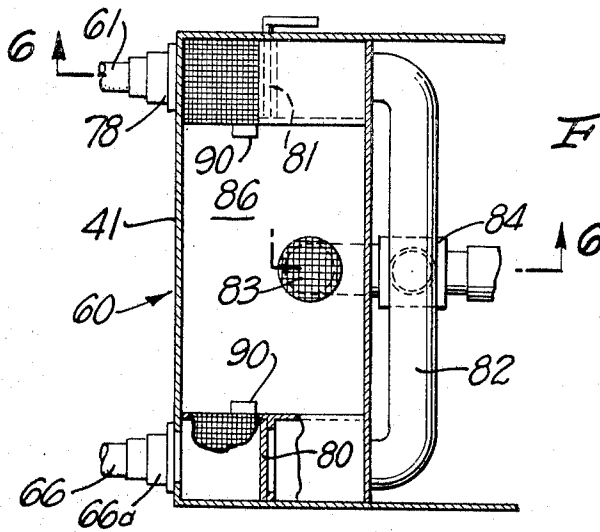


FIG. 5.

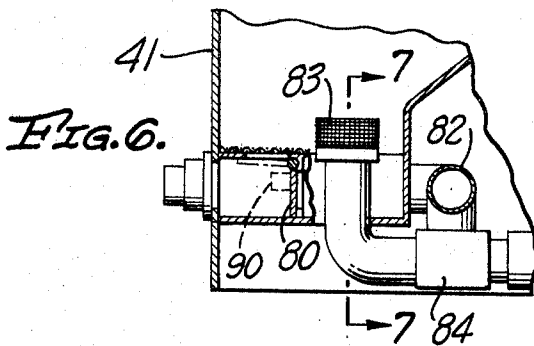


FIG. 6.

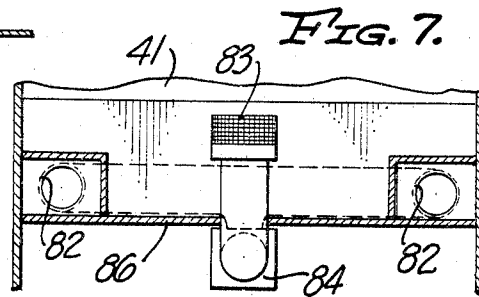


FIG. 7.

FIG. 9.

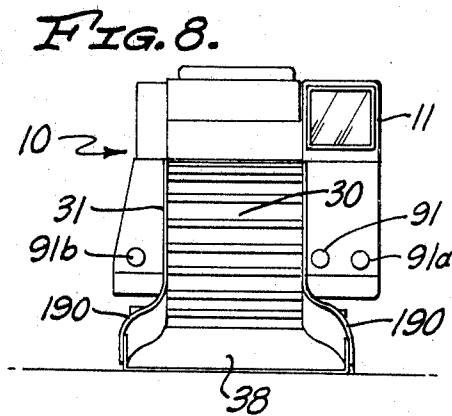
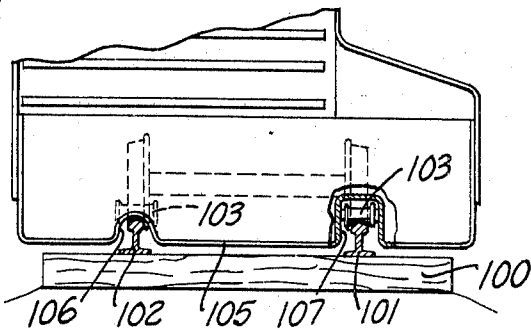


FIG. 8.



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4 Claims

ABSTRACT OF THE DISCLOSURE

A snow removal machine including a vehicle mounting an infeed conveyor which picks up snow from the area to be cleared as the vehicle travels over the area and transports the snow upwardly to the elevated infeed end of an inclined melting ramp enclosed within a heating chamber containing burners which are mounted over the ramp so as to melt the snow as the latter gravitates downwardly along the ramp. The water emerging from the lower end of the ramp enters a receiver or tank from which the water may be selectively discharged to a sewer or to the side of the cleared area through a hinged spout and a hose wound on a power driven reel.

This invention relates generally to snow removal machinery; more particularly, the present invention relates to a novel snow melting machine in an automotive vehicle in which means are provided for more efficient and rapid removal of snow from roadways both of the flat-surfaced type and railroad beds, even when the new snow melting vehicle travels at relatively high speed.

In prior art efforts to provide snow removal machinery for the clearing of roadways and railroad beds that have been covered with heavy snow, melting techniques have been employed, but these have been more complex and less efficient and have required greater road personnel. The prior art methods were thus both slow and costly. Even when incorporated in automotive vehicles the prior art snow removal equipment left much to be desired in the rates of removal, melting and discharge of the snow picked up by the removal vehicle.

This invention contemplates improved and more efficient means for removing snow from highways and railroad beds faster than prior art equipments. Consequently, the work is accomplished more economically than with the prior art or other means used heretofore.

The new equipment according to this invention is incorporated in a truck-like vehicle which may use highway traction means or railroad traction means. It incorporates a snow conveyor at the end of which is a scoop that in snow removal operation rides upon the roadbed or rails. While en route to a location for snow removal the scoop may be raised to clear the road surface and any relatively low lying obstacles that may be in the path. The positioning of the conveyor and scoop is accomplished with pneumatic drive components.

The conveyor is inclined so as to bring the snow being removed upwardly into a melting chamber in which the snow is passed under gas jets which quickly melt the snow to fill the chamber with water. The water is removed through a novel hose coil arrangement which may be readily unreeled as the vehicle approaches and passes a sewer inlet. The water may be discharged into the sewer even while the snow removal vehicle according to this invention continues to travel along the road removing snow as it goes.

Alternatively, relatively rigid side ejection spouts are provided to discharge the fluid residue of the melted snow to the side of the road as the snow removal vehicle travels along the road. These spouts are elevated so as to

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permit the discharge to be made onto high drifts or snow piles at the side of the highway or railroad bed.

The novel reel mechanism according to this invention is arranged to be operated by an electric or other type of motor driven to reel out the discharge hose and draw it back in again after the fluid has been discharged down a sewer.

An advantage of the present invention over prior art methods is that the new machine incorporates means for using the same fuel for igniting the jet flames for melting the snow in the melting chamber as is used in operation of the traction motors and in operating the conveyor drive mechanisms. The need for separate tanks for different fuels is eliminated. Conventional fuel compression means is provided to bring the fuel up to an appropriate pressure and temperature at which the burners will operate efficiently. Air is permitted to circulate freely through the air space between the melting chamber and the fuel tank for insulation so as to prevent accidental overheating or explosion. Vertical valve doors are provided at the inlet of the melting chamber in communication with the conveyor which are open during loading, that is during operation of the conveyor belt raising snow from the street or roadbed level to the melting chamber inlet. The open valve doors permit the discharge of the combustion products.

When the snow removal machine is at rest the valve doors remain closed to keep out rain, snow or sleet and reduce any icing tendencies likely when the machine is not in use. Access doors are also provided in the melting chamber through which solid debris not subject to the melting action of the flames may be removed.

Further objects and advantages of the invention include the provision of a high seated cab for the operator of the vehicle placed on the side of the conveyor which gives him a clear view even over very high snow drifts so that the vehicle can be driven along its path without loss of visibility to the operator.

When operated on rails the scoop end of the conveyor has track riding rollers which allow the scoop to move smoothly into the snow covering the tracks.

Operation of the snow removal machine according to this invention can be accomplished by one man when on a highway or railroad snow removal mission and the discharge of residue can be made to the side of the road through the outlet discharge pipes provided therefor. These discharge pipes are normally inclined to the side of the vehicle and can be raised overhead for high snow conditions and where there is no room to discharge water to the side. When operated in city-street snow-removal activities a second man is best used to operate and control the functioning of the reeled-up flexible hose so that the nozzle may be directed into sewers along the snow-removal path. The purpose of this operation is to avoid pouring out melted water on the street, where it will freeze again and create hazards. Instead it is poured into drains and sewers.

The snow removal truck or vehicle according to this invention need not be stopped while the hose is discharging the fluid from the melting chamber into a sewer since the hose reel will unwind as the vehicle moves on and when the fluid has been discharged it will automatically roll up again, the hose being stored back on the reel. During a transition period when the hose nozzle is being transferred from one sewer to the next, valves are provided for shutting off the outflow of fluid from the melting chamber.

In any case whether the reeled flexible hose or the outlet pipes are used, the fluid is discharged therethrough. Pumps are provided to accomplish the raising of the water level to discharge through the hard hoses. The pumps

are operated only when water has to be discharged through the hard hoses at the level higher than the outflow from the chamber. The flexible hose when used is reeled in and played out from the reel under electric motor driven power controlled by the operator in the cab or by the second man who may be afoot or on a special tricycle which has cabled electric connection with the snow removal truck or he may be provided with remote control switching apparatus for operation of the reeling motors by radio. With modern technology the man afoot can easily carry appropriate radio control gear by which to remotely control the reeling in or playing out of the hose.

The objects of the invention may be clearly discerned from the foregoing discussion and from the specification which follows taken together with the appended claims and the drawings which illustrate representative embodiments of the features of the invention and should not be construed as limiting the invention solely to the illustrated embodiment since those skilled in the art pertaining thereto may, in the light of this disclosure, conceive other embodiments within the ambit of the claims.

In the drawings:

FIGURE 1 is a partially sectional side elevational view of a snow melting vehicle according to the invention showing some of the details of the internal structures therein;

FIGURE 2 is a partially cut away front view of the vehicle shown in FIGURE 1;

FIGURE 3 is a partially cut away rear view of the vehicle illustrated in FIGURE 1;

FIGURE 4 is a fragmentary, partially sectional view of a detail of a burner mechanism used in the invention, shown through 4—4 of FIGURE 1;

FIGURE 5 is a fragmentary partially sectional view of details of the fluid discharge mechanism of the invention taken through 5—5 of FIGURE 1;

FIGURE 6 is a section through 6—6 of FIGURE 5;

FIGURE 7 is a section through 7—7 of FIGURE 6;

FIGURE 8 is a front view of a modified form of vehicle configuration according to the invention; and

FIGURE 9 is a detail of a scoop mechanism shown in partially cut away and partially sectional form such as may be used in a railroad adaptation of the invention.

Referring to FIGURE 1 and the other figures as may be applicable, it may be seen that the snow removal vehicle of the present invention consists of a truck body indicated generally at 10 having a driver's or operator's cab 11 on the driver's front side of the vehicle, a prime moving engine 12 having a carburetor 13 and a fuel pump 16 thereon. Engine 12 is coupled by a shaft 14 to a gear train 15, 17 to a generator 18 and a clutch mechanism 19. The clutch mechanism 19 is coupled through a shaft 20 to a gear box 21 which connects to rear wheels 22 through a shaft 23 and to front wheels 24 through gear box 25, a shaft 26 and a shaft 27. From gear box 25 a shaft 28 is operated perpendicularly to shafts 27 and 26. Shaft 28 is coupled to a sprocket gear train 29, and chain conveyor 30 which has side walls as indicated partially cut away at 31 to reveal the inner mechanisms. The walls 31 are securely mounted on the vehicle body 10 at a sloping angle such that the scoop end 32 is at ground level 33 and the discharge end 34 is near the top of the elevated cab 11 of the vehicle. Within housing 31 on axles 35 chain and sprocket drive means 29 is provided to move a conveyor belt 30 upon them. The axles 35 are coupled to the engine 12 through the transmissions 19, 21 and 25 operated by levers in the driver's compartment 11 so that the driver may cause the shaft 28 and axle 35 to rotate or stop as necessary in the use of the vehicle.

The scoop 38 of housing 31 is articulated on a pivot 36 so that it may be lifted from ground level 33 to the position thereof shown at 38a by operation of pneumatic cylinder and piston 37, 39 articulately coupled to a dog 40 on the underside of scoop 38.

The portions of the body 10 shown cut away at 41 constitute a tank or chamber in which are contained a fire jet assembly 50 further described below and a valve plate 51 articulating on a pivot 52. In the lower cascaded floor 42 of tank or chamber 41 a clod breaker 43 is provided to break up larger snow masses which may fall on the surface 42 and tumbled by the cascades so as not to become lodged thereon. On the top outer surface 44 of tank 41 a combustion mechanism 47 (an air blower and associated equipment) is mounted and coupled by piping 45, 46, to the jet assembly 50. Clod breaker 43 is operated by its own motor (not shown) which may be controlled from the cab. The clod breaker motor may be either a rotary device or an oscillatory device such as a vibrator. A hingedly mounted cover 55 is provided in top 44 of tank 41 to provide access for service and cleaning.

Fuel for jets 54 is derived from the motor fuel tank 70 through pipe 71 pumped to the combustion mechanism by pump 49 (FIGURE 4) to provide jet flames 56. Thermostatic mechanisms 90 are immersed in fluid 92 to sense the decrease in water temperature to actuate the burners.

As shown in FIGURE 1, an insulating air chamber 72 is defined between the fuel tank 70 and the combustion chamber to eliminate the hazard of fuel explosion.

In the rear 60 of tank 41 are provided an adjustable stiff discharge spout or conduit 61 and a flexible hose 62 coiled on a motorized reel 63. The motor 64 drives the reel axle directly. Hose 62 may be coupled to the tank by quick disconnect or threaded couplings for removal when not needed.

Hose 62 has a nozzle 65 on the end thereof and outlet 66 through reel center 63 from tank 41. The quick disconnect coupling is shown at 66a.

Wires 68 are connected to a power driven source for motor 64.

Reel 63 is supported on back 60 of tank 41 and frame 10 by a bracket 69.

The reel and hose assembly 62, 63, 65 and its motor drive 64 are shown more clearly in FIGURE 3.

Rigid hose 61 may be long as shown for use over high snow and is held in the upright position by a bracket 75 and spout 76 thereof points outward and downward. Hose 61 may be a smaller unit pointing out and downward. Hose 61 whether large or small may be rotated in its outlet 78 in the rear 60 of tank 41 to position shown at 61' in FIGURE 3.

As may be seen in FIGURE 5 valves 80, 81 are provided to regulate the outflow of water through the hoses 62 or 61.

In the bottom 86 of tank 41, a strainer outlet 83 is connected through pump 84 to a pipe 82 which communicates with valves 80 and 81, so that when pump 84 is operated melted snow (water) in tank 41 is pumped out through outlet 66 or 78 to hose 62 or 61, as determined by whichever valve (80 or 81) has been opened. Valves 80, 81 can be manually operated or solenoid operated by conventional means.

As viewed in the partial cross-section FIGURE 6 the positions of outlet strainer 83, T-pipe 82 and pump 84 are shown in relation to their location in tank 41. In the cross-sectional view of FIGURE 7, the relationships are shown in further detail, in particular thermostats 90 are shown to sense water temperature and thus secure automatic operation of the burners. The thermostats work in a manner well known to the art pertaining thereto. That is, when the thermostats 90 are immersed in the melted snow effluent they are responsive to the effluent water temperature to turn on the burners when the effluent temperature is low. This is when the snow is coming to the chamber 41. The burners are turned off when the snow is not conveyed to the chamber 41, and when the water temperature rises. These are further connected to

the switches controlling the burners, as previously described.

In FIGURE 8, a front view of a modified form of the invention shows the locations of scoop 38, cab 11, headlamps 91, 91a and 91b, etc. The flared side walls 190 part of side walls 31 previously described prevent the relatively light vehicle from skidding by equalizing the snow drag on both sides.

In FIGURE 9 on a railbed 100, rails 101 and 102 are shown with the scoop 105 riding thereon. Rollers 103 are disposed beneath scoop 105 which is notched as at 106, 107 to clear rails 101 and 102.

Referring to the figures generally the operation of the snow removal machine can be seen to be as follows:

Scoop 35 riding along surface 33 urges snow 75 onto conveyor assembly 30, 31 which is moving up along the sloping path thereof into the opening 76 in tank 41. The tank 41 is configured so as to slope oppositely to that of conveyor 30, 31. When curtain 51 is forced open by pressure of snow arising on the conveyor the snow falls through opening 76 into tank 41 under the flames 56 of jets 54 in jet assembly 50. The heat melts the snow and the water resulting therefrom falls into tank area 77. If any snow packs on the sloping area 42 of tank 41, a rotating mechanism 43 driven by an independent motor not shown breaks up the compacted snow dropping it into the water in compartment 77.

As water fills compartment 77 (tank 41) selected valves 80 or 81 can be opened to permit the water from 77 to flow out of either spout 61 or hose 62. The motor driven reel 63 can be operated by motor 64 through electric conductors 68 (connected to the cab and to a battery) to unreel hose 62 so that a helper on the snow removal vehicle can set it into a sewer while the vehicle continues to move into the snow being removed.

If used in the railroad configuration, if hose 61 is stiff and is in an upright form, it can be directed to deposit the water along the railroad right-of-way spraying the water out over head if the snow is too high—otherwise hose 61 can point downward and outward towards the road and may be short rather than long. A pump provides pressure to lift the water in stiff hose 61 to the height necessary and provide sufficient force for the water to be ejected onto the trackside area.

The conveyor 30-31 is coupled via drive shafts 35 and 28 to the main engine 12 through gear box and transmission chains 25, 26, 21 and 19. The pump 84, generator 18 and the motive wheels 22, 24 also are driven from main engine 12.

Scoop 35 is articulatable on pivot 36 so as to be lifted by pneumatic piston to clear obstacles.

The motor 64 on hose reel 63 may be operated by a long wire on the hose or built into the hose by the helper walking along with the snow removal vehicle. He may also have a radio control switching means for motor 64 to reel up or play out the hoses as desired.

Those versed in the art will appreciate that the present invention achieves the objects and realizes the advantages hereinbefore mentioned.

Although specific embodiments of the present invention have been illustrated and described herein, it will be understood that the same are merely exemplary of presently preferred embodiments capable of attaining the objects and advantages hereinbefore mentioned, and that the invention is not limited thereto; variations will be readily apparent to those versed in the art, and the invention is entitled to the broadest interpretation within the terms of the appended claims.

The inventor claims:

1. A snow removal machine comprising:

- a vehicle including an engine for propelling said vehicle over a snow covered area to be cleared and a tank for containing engine fuel,
- a snow infeed conveyor mounted on the front end of

said vehicle having a front lower infeed end and a rear upper discharge end,

a melting chamber on said vehicle behind said conveyor having an entrance opening at said conveyor discharge end,

said infeed end being situated close to ground level and being disposed to remove from said area snow encountered from said infeed end as said vehicle travels over said area, and said discharge end being situated at a level well above said infeed end, whereby snow entering said infeed end is transported upwardly to and discharged from said outfeed end into said melting chamber through said entrance opening,

a plurality of hanging laterally spaced valve flaps hinged at their upper ends to the upper edge of said opening for independent swinging movement to permit entrance of snow into and escape of excess combustion gas from said chamber while retaining heat in said chamber,

an inclined cascaded melting ramp mounted on said vehicle within said chamber having a front upper infeed end disposed to receive snow from the discharge end of said conveyor a rear lower discharge end located below the level of said ramp infeed end, whereby snow entering said ramp from said conveyor gravitates slowly along said ramp toward its discharge end, and a number of steps between said ramp infeed and discharge ends,

a powdered clod breaker rotatably mounted within a transverse trough in said ramp,

said chamber having a ceiling over and parallel to said conveyor,

burners mounted on the underside of said ceiling for heating and thereby melting the snow as the latter gravitates along said ramp to convert the snow to water which flows by gravity along said ramp to the discharge end thereof, and

a receiver communicating with the discharge end of said ramp for receiving said water and unmelted snow from said ramp.

2. A snow removal machine according to claim 1 wherein:

said conveyor extends generally longitudinally of said vehicle and slopes upwardly in the direction of its discharge end,

said ramp infeed end is located opposite said conveyor end and said ramp extends rearwardly and downwardly from said conveyor discharge end, said receiver comprises a tank on said vehicle at the rear lower discharge end of said ramp,

there being a compartment below said conveyor and ramp containing said engine and fuel tank, and means providing an insulating air space between said melting chamber and fuel tank.

3. A snow removal machine according to claim 1 wherein:

said vehicle includes flanged wheels for riding on railroad tracks, and

a hinged vertically swingable infeed scoop on the front end of said conveyor having rollers on its underside for riding on said railroad tracks.

4. The subject matter of claim 1, wherein:

said receiver comprises a water collection tank on said vehicle at the rear lower discharge end of said ramp, a rigid discharge spout having an inlet end rotatably mounted on the rear wall of collection tank to turn on a longitudinal axis of said vehicle and an opposite arcuate discharge end curving and opening laterally of said axis, whereby said spout may be positioned to direct water downwardly onto or laterally to one side of a road being cleared,

means including a valve communicating said spout inlet end to the interior of said collection tank,

a reel rotatably mounted on said rear tank wall,

a motor for driving said reel in rotation,

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a hose wound on said reel having a discharge nozzle
at one end,
means including a valve communicating the opposite
end of said hose to said tank interior,
means for controlling said motor to wind said hose on
and unwind said hose from said reel,
means for opening and closing said valves, and
a pump within said tank interior having an inlet com-
municating to said tank interior and an outlet com-
municating to said spout and hose through said
valves, whereby water may be pumped from said
tank interior to either or both said spout and hose.

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