

Nov. 21, 1967

A. A. MARKS

3,353,286

SNOW DISPOSAL UNITS

Filed July 30, 1964

6 Sheets-Sheet 1

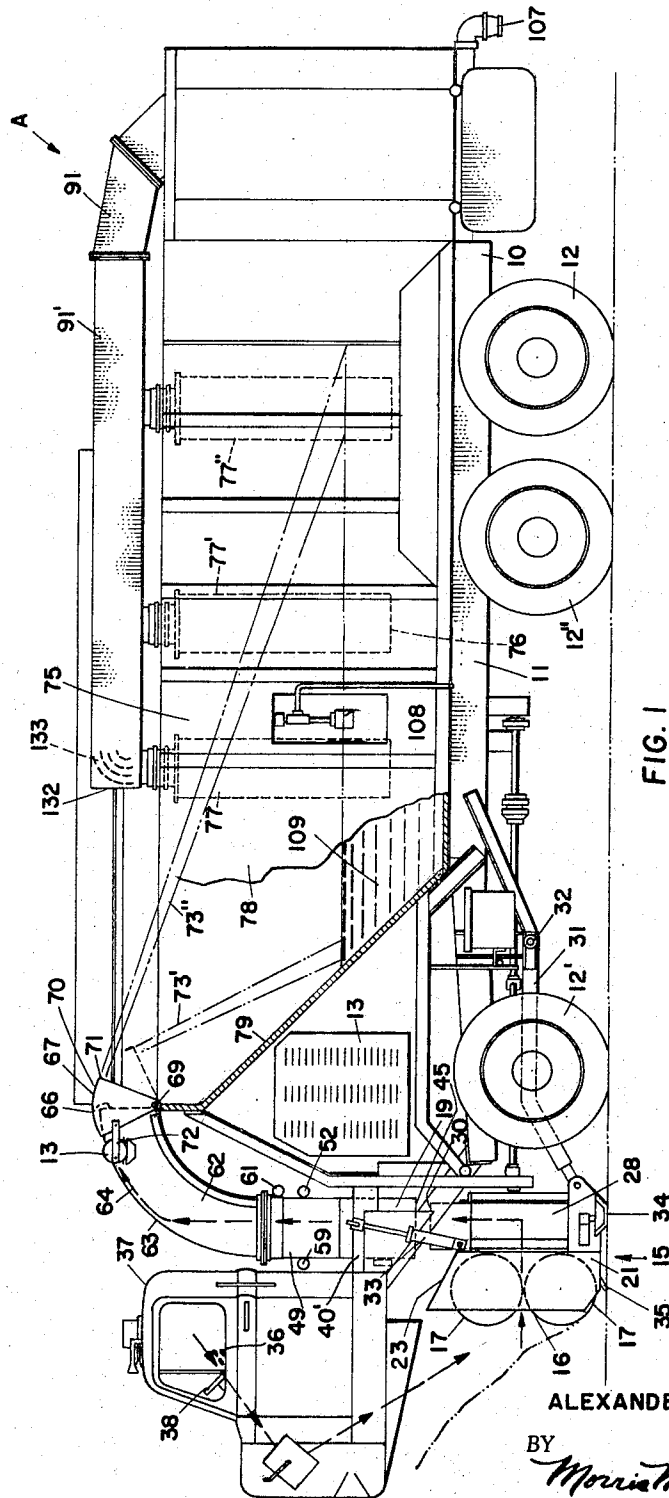


FIG. 1

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6 Sheets-Sheet 2

FIG. 2

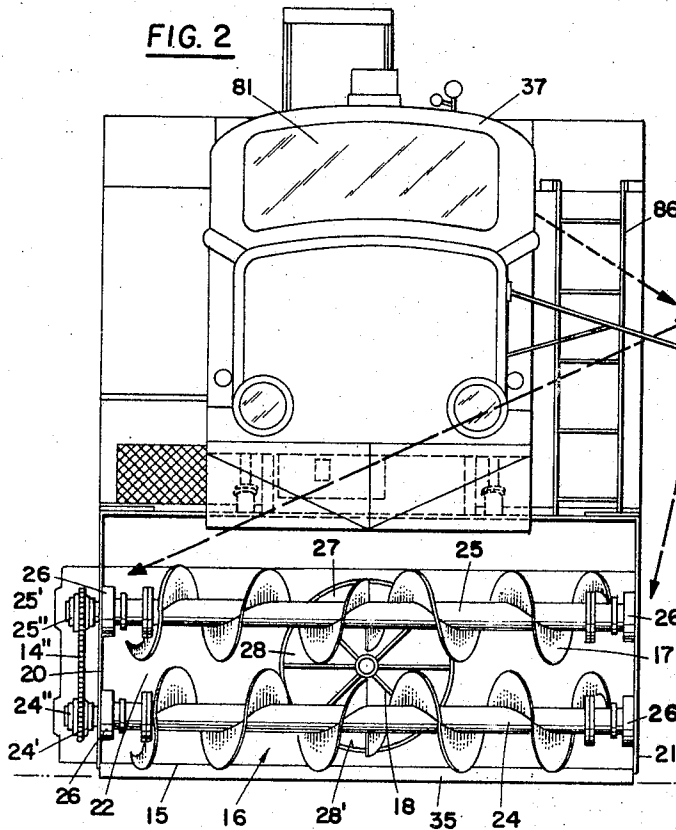


FIG. 4

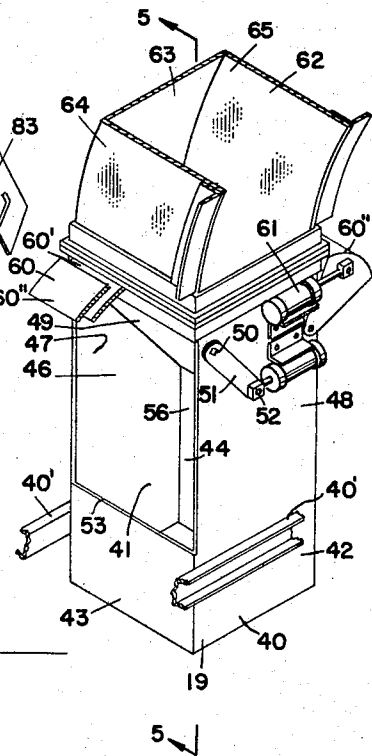


FIG. 5

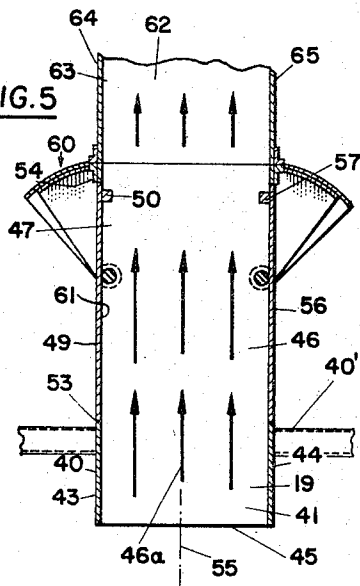
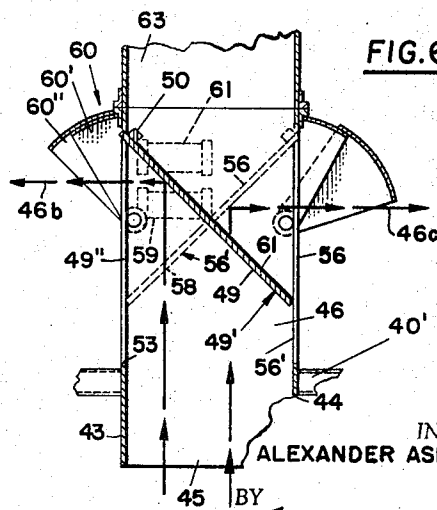


FIG. 6



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6 Sheets-Sheet 3

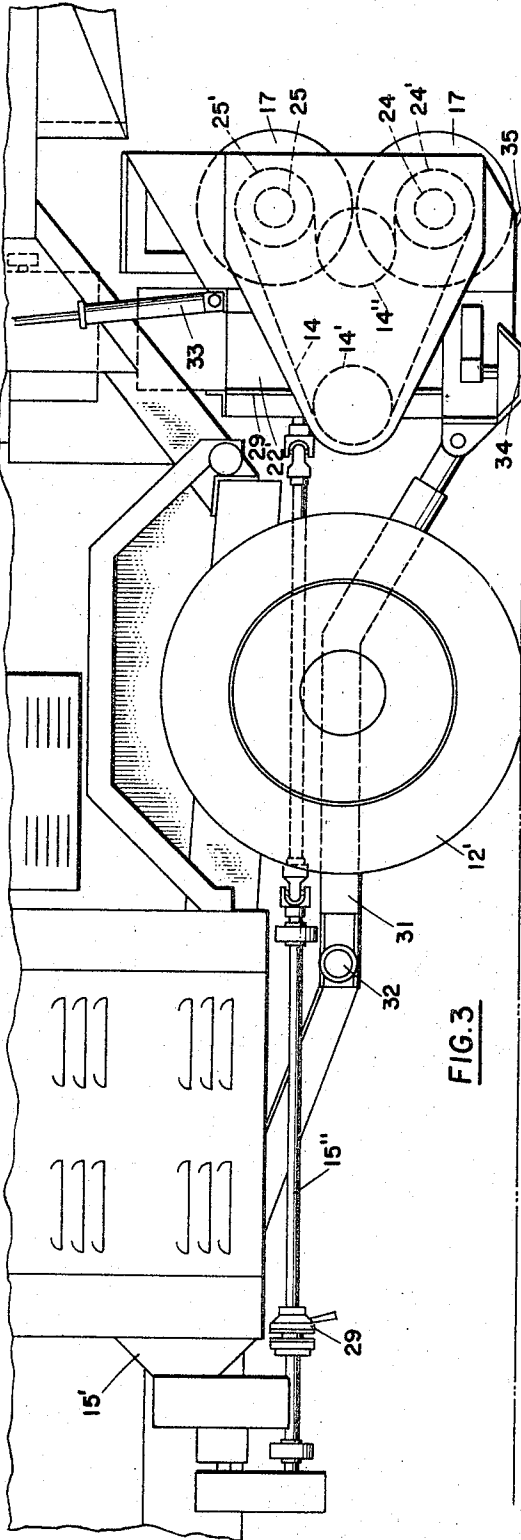


FIG. 3

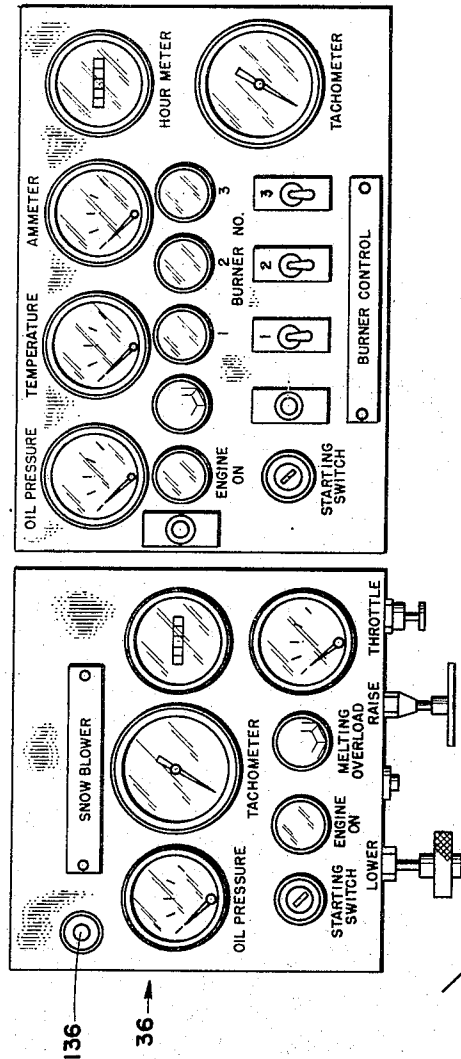


FIG. 17

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SNOW DISPOSAL UNITS

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6 Sheets-Sheet 5

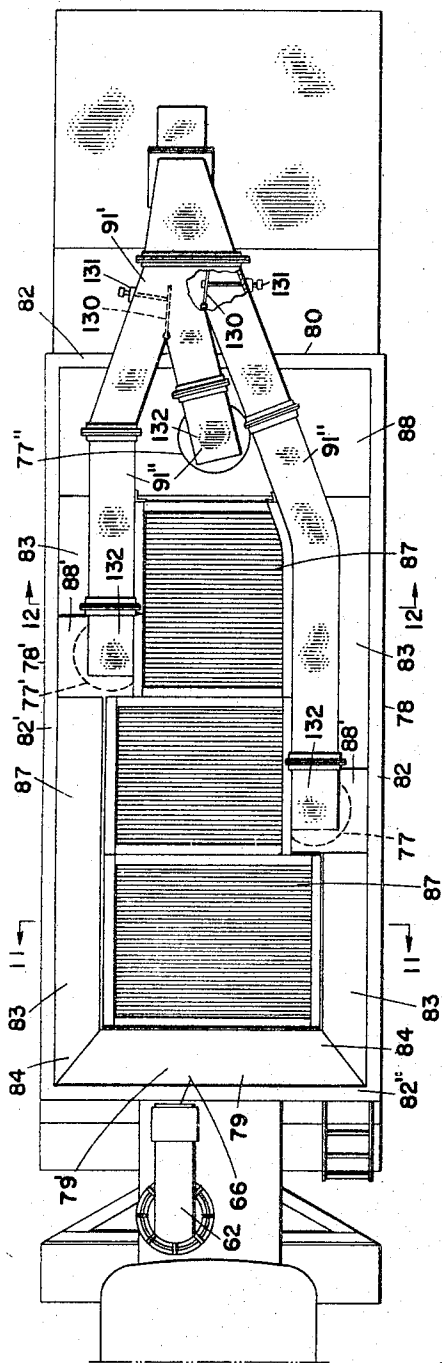


FIG. 9

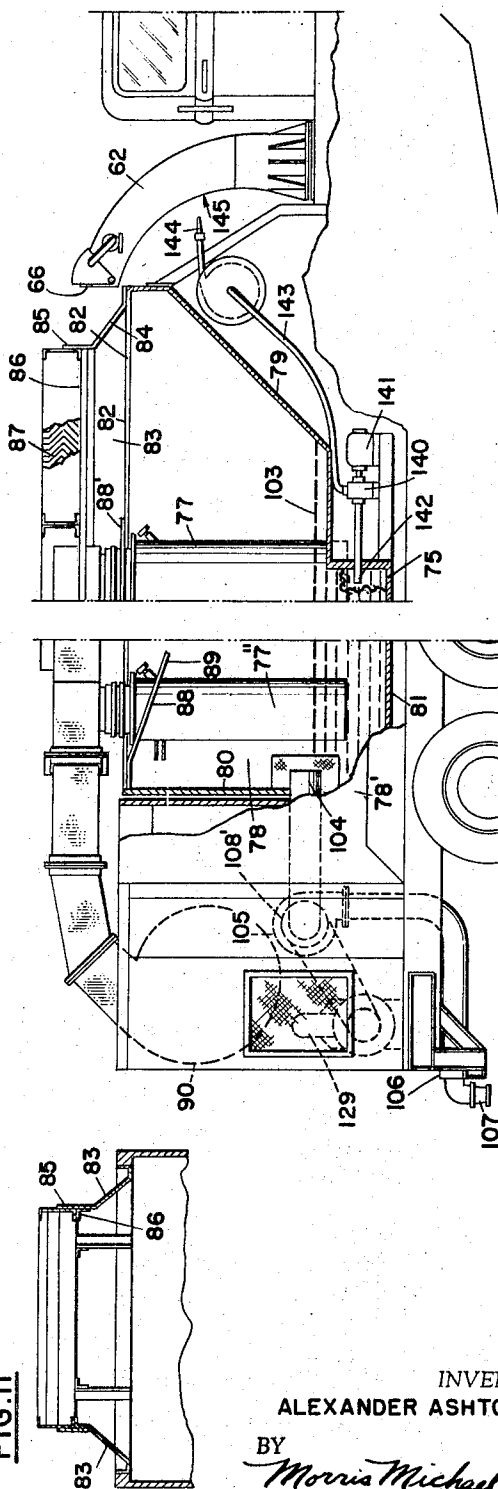


FIG. 10

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1

3,353,286
SNOW DISPOSAL UNITS
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Filed July 30, 1964, Ser. No. 386,327
10 Claims. (Cl. 37—12)

My invention relates to snow disposal means, and it relates more particularly to means for gathering snow and melting it for efficient disposal.

The removing of snow and efficient disposal thereof poses substantial problems. The wintry weather and often adverse conditions make rigorous demands on both men and machinery. Yet the need for rapid removal of accumulated snow is manifest.

It is known that snow in the mass occupies much larger space than the water into which form it may melt. Attempts have heretofore been made to provide means for melting snow in order to reduce the volume thereof and more readily dispose the resultant water. However, such attempts have often failed of success because they did not properly coordinate with the snow removal means, failed properly to provide for the efficient transfer of heat to the snow, were not composed of such basic elements as to lend themselves readily to the heavy duty, rugged performance which is required for dependable operation in the out-of-doors in wintry weather, or otherwise were not based upon proper concepts of snow removal, melting and disposal. Breakdowns in operation were frequent and costly. The encountering of obstacles such as foreign matter hidden in the snow resulted either in damage to the conveying means or cutting of shear pins requiring time-consuming replacement often in severe cold weather. Inadvertent encountering of curbs beneath the snow similarly resulted in cutting of shear pins, so that even though the vehicle would back away, the shear pins had to be manually replaced in the adverse weather environment.

Moreover, should it be desired not to use the snow melting means but instead to throw the snow to one side or another of the vehicle, as for instance when traveling along an open road between two areas requiring snow melting operation, or when opening an area in which the snow melter may be used, it was necessary manually to redirect the snow blowing means, and when it was desired to resume snow melting operation, it again became necessary manually to direct the snow conveying means toward the snow melter. Furthermore, indiscriminate selection of conveying means could clog the melter with chunks of snow, or with foreign matter inadvertently gathered with the snow.

A gang of workers was thus often required not only to operate the machine but also to service it in operation and to keep it in repair. Not only so, but the stormy, wintry weather under which such workers often must operate in the snow removal procedure, made their work difficult and expensive, and slowed the snow removal operation.

One object of my invention therefore is to provide a snow disposal means which is so constructed as to reduce manual labor and servicing to a minimum, and in which various operations which previously required manual maneuvering in the wintry out-of-doors, can now be achieved substantially by one man in the warmth and comfort of the cab.

Another object of my invention is to provide an automotive snow disposal unit, adapted in a single automotive device, to provide a path for the entrance of the snow disposal unit into an area which requires the removal of snow, to melt the snow and provide for disposition of the resultant water in a preselected location exterior of the disposal unit, and to provide a path for the snow disposal unit as it moves from one snow melting area to another.

2

A further object of my invention is to provide snow disposal means adapted readily and efficiently to change the direction of snow throw, whether to a selected side of the vehicle or into a snow melter, by control means operable within the cab.

Another object of my invention is to provide an automotive snow disposal unit in which the snow gathering means become disengaged when there is encountered an obstruction of such nature as to impose undue strain on the snow gathering and conveying means, and which becomes automatically reengaged when said gathering means is freed of such obstructions.

A further object of my invention is to provide an automotive snow disposal unit in which the snow gathering and conveying means are automatically freed from engagement with their power drive when the snow conveying means is clogged for any reason as by foreign matter or otherwise, and can be reengaged only after manual removal of the obstruction, whereupon reengagement is accomplished either manually or by a switch operation in the cab.

Another object of my invention is to provide a snow disposal unit which is adapted to achieve a rate of snow disposal substantially greater than any commercially available heretofore, of comparable size.

A further object of my invention is to provide a snow disposal unit wherein snow is conveyed in the form of small particles and substantially spread in a snow melting tank maintained at a temperature sufficient to melt the snow.

Another object of my invention is to provide a snow melter of such construction that a rapid and complete heat transfer is achieved whereby the snow is quickly and efficiently melted in a manner to maintain a high rate of snow melting production.

A further object of my invention is to provide a snow disposal unit whereby particles of snow are introduced into highly agitated water whose agitation is achieved by means of a blast of heated air and hot products of combustion introduced beneath the water level thereof.

Another object of my invention is to provide a snow melter wherein pressurized heated air and hot products of combustion are directed beneath the water level of a snow melting liquid, having means to assure the operating water level being located above the location of discharge of said pressurized heated air and hot products of combustion regardless of the tilt of the vehicle in operation carrying the snow melter.

A further object of my invention is to provide a snow melter wherein a hot gaseous blast is introduced beneath the operating water level of a snow melting liquid, and having means to protect said blast against back pressure resulting from the operation of the snow melting unit.

Another object of my invention is to provide a snow disposal unit comprising a snow conveyor and a snow melter, and having means for protecting said snow melter from undue accumulation of water, said means including a provision for the prevention of introduction of further snow until the excess water has been removed.

A further object of my invention is to provide a snow disposal unit having means whereby a snow conveyor can be cleared of obstructions, and cleaned by the use of snow-melting liquid facilities provided in a snow melter.

Another object of my invention is to provide a snow melter operated by a gaseous blast emitted beneath the operating water level of snow-melting water, resulting in heating and agitating said water, and having means whereby said gas is separated from said water and allowed to escape while said water is recovered for re-use in melting snow.

A further object of my invention is to provide a snow disposal unit which is dependable and inexpensive in op-

3

eration, rugged in use, of high efficiency and of relative simplicity in construction and performance.

Other objects may be found in the more detailed description which follows.

For the purpose of illustrating my invention, I have shown in the accompanying drawings forms thereof which are at present preferred by me, since the same have been found to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized, and that my invention is not limited to the precise arrangements and organizations of the instrumentalities as herein shown and described.

Referring now to the drawings in which like reference characters indicate like parts:

FIGURE 1 represents a side elevational view of a snow disposal unit embodying my invention.

FIGURE 2 represents a front elevational view of a snow disposal unit embodying my invention.

FIGURE 3 represents an enlarged, fragmentary elevational view of the lower, forward end region of the snow disposal unit illustrated in FIGURE 1, taken from the opposite side thereof, and embodying my invention.

FIGURE 4 represents a perspective fragmentary view of one form of chute forming part of a snow disposal unit embodying my invention.

FIGURE 5 represents a vertical sectional view taken generally along the lines 5—5 of FIGURE 4, with the distribution chamber in position for transfer of snow to the melting tank, in accordance with my invention.

FIGURE 6 represents a view similar to FIGURE 5, but with the distribution chamber in position for transfer of snow to one side of the vehicle, in accordance with my invention.

FIGURE 7 represents an enlarged elevational fragmentary view, partly in section, of a chute of modified construction forming part of a snow disposal unit embodying my invention.

FIGURE 8 represents a sectional view taken generally along the lines 8—8 of FIGURE 7.

FIGURE 9 represents a plan view of a snow disposal unit embodying my invention.

FIGURE 10 represents a fragmentary side elevational view of the snow disposal unit illustrated in FIGURE 9, taken with the unit facing in the opposite direction.

FIGURE 11 represents a sectional view taken generally along the lines 11—11 of FIGURE 9 and illustrating a portion of the baffle and air eliminator region of a snow disposal unit embodying my invention.

FIGURE 12 represents a vertical sectional view of a snow melting tank, illustrating the agitated action of the water during the operation thereof, in accordance with my invention.

FIGURE 13 represents an enlarged vertical sectional view of a portion of the snow melting means comprising a burner in a tank covered by an air eliminator, and embodying my invention.

FIGURE 14 represents a vertical sectional view of a snow melting tank, illustrating more particularly the trough and float switch portions thereof, and embodying my invention.

FIGURE 15 represents a vertical sectional view taken generally along the lines 15—15 of FIGURE 14, with the baffles, eliminators and burners removed.

FIGURE 16 represents a plan view of that portion of the snow melting tank illustrated in FIGURE 15.

FIGURE 17 represents a plan view of the controls in the cab of a snow disposal unit embodying my invention.

According to my invention, I provide a snow removal unit such for instance as the unit designated as A, and which may include a chassis 10 comprising a frame 11, mounted on wheels 12 which may comprise steer-type wheels 12', and drive wheels 12'' operated by an automotive engine 13. A suitable snow gathering and conveying means, such for instance as the snow blower mechanism 15 may be mounted on the forward end region of the chassis 10, and may be of any desired construction.

4

Thus it may comprise an intake region such as the intake 16 in which is disposed rotary cutters such for instance as the spiral conveyor blades 17 adapted to cut the snow and convey it to a suitable impeller 18 disposed behind the cutter and conveyor blades 17, and immediately beneath the inlet portion 45 of a suitable chute 19. In a preferred form, the intake 16 may comprise side walls 20 and 21, a rear wall 22 and a top 23. The spiral conveyor blades 17 may be carried by suitable shafts 24 and 25 to which they are fixedly secured, said shafts extending transversely of the intake 16 and mounted on suitable bearings 26 inwardly projecting from the side walls 20 and 21, the shaft 25 being disposed parallel to the shaft 24 and vertically spaced therefrom.

The impeller 18 may comprise rotary blades 27 disposed in a suitable impeller chamber 28 having an inlet 28' and an outlet 30 disposed beneath the chute 19.

The intake 16 and the impeller chamber 28, together with the mechanism carried thereby, may be mounted on suitable forwardly projecting struts 31 pivoted as at 32 to the frame 11; and may also be carried by suitable raising and lowering mechanism such as the hydraulic device 33 supported by superstructure 40' mounted on the frame 11. Suitable skids 34 may be positioned below the impeller chamber 28, and a scraper 35 may be disposed beneath the lower conveyor blades 17 in a manner to guide snow upwardly from the roadbed toward said blades 17.

The raising and lowering device 33 may be operated by a suitable control device included among master controls 36 which are disposed in the cab 37 in addition to the customary automotive controls 38 normally disposed therein.

The snow blower mechanism 15 may be powered by a suitable engine 15' carried by the chassis 10. In a preferred form this is achieved by means of a transmission 22' connected to the engine 15' by a suitable power transmitting means such as the drive shaft 15''. The transmission 22' preferably is adapted to transmit torque at a high rate of speed to the impeller 18 operably to discharge snow vertically through the outlet 30, and also at a reduced speed to the shafts 24 and 25.

In a preferred form, means are provided for rotating the shafts 24 and 25 in the same directions, operably to cause the blades 17 to cut and convey the snow to the impeller inlet 28' as the vehicle chassis 10 moves forwardly. Thus, a chain 14 may be serially mounted on a sprocket wheel 14' deriving power at reduced speed from said transmission 22', a sprocket wheel 24' fixed to the shaft 24, an idler or take-up wheel 14'', a sprocket wheel 25' fixed to the shaft 25, and back to the power-driven wheel 14'.

If desired, the sprocket wheels 24' and 25' may include self-releasing clutches 24'' and 25'' respectively, adapted to transmit power to the conveyor blades 17 as long as the torque does not exceed a predetermined limit. When the torque exceeds said limit said clutches are released, and when the torque is reduced below said limit the clutches 24'', 25'', are automatically reactivated. This not only eliminates the labor and time-consuming operation of replacement of shear pins, but also makes it unnecessary for the operator to leave the cab to reactivate the shafts 24, 25 at such times as he is able to remove the cause of the excessive torque by means available to him within the cab 37.

Also if desired, a self-releasing clutch 29 may be disposed in a readily available portion of the power transmitting means between the engine 15' and the transmission 22'. In a preferred form this clutch 29 is adapted to transmit power to the transmission 22' as long as the torque of the impeller 18 does not exceed a predetermined limit, and to release transmission of power thereto whenever said limit is exceeded. Moreover, in one preferred form, the clutch 29 is not self-reactivating but requires

5

manual manipulation to be reactivated; thus requiring the operator physically to determine the cause of the excessive load or torque and to eliminate the cause thereof before the clutch 29 is reset. Self-releasing clutch devices suitable for use as described hereinbefore are available from the Dalton Gear Company of Minneapolis, Minn., and are shown and described in U.S. Patents 3,092,983 and 2,659,220.

These clutches automatically reengage when the over-torque condition is removed. Self-releasing clutches which require a manual reset in order to cause reengagement of the clutch are exemplified by U.S. Patent No. 2,966,247.

Control devices, other than the manual reset, for operating the snow blower mechanism, are included among the master controls 36 in the cab 37.

The chute 19 may comprise a base portion 40 mounted on suitable superstructure 40' carried by the frame 11. In a preferred form the base portion 40 has a front wall 41, rear wall 42 and side walls 43 and 44 extending therebetween, defining an inlet portion 45 coaxial with, spaced from, and preferably of larger cross-sectional area than the outlet 30 of the impeller 18.

A distribution chamber 46 may be disposed directly above the base portion 40 and preferably of substantially the same cross-sectional area. The chamber 46 may comprise a front wall 47 and a rear wall 48, which may respectively be integral with, and upwardly project from, the front and rear walls 41 and 42 of the base portion 40.

A deflector wall 49 may be fixedly mounted on a suitable shaft 50 rotatably extending between the front wall 47 and rear wall 48 of the distribution chamber 46. The shaft 50 extends outwardly beyond the distribution chamber 46, and may have keyed thereto a suitable lever 51 connected to, and operated by, any suitable operating mechanism which may be either manual or mechanical, such for instance as a hydraulic air or electric actuator 52 governed by one of the master controls 36 in the cab 37.

The lever 51 is adapted selectively to be moved to, and be maintained in, one of two positions. In one position, the deflector wall 49 is disposed vertically, and when so disposed it preferably extends between the front and rear walls 47 and 48, and from the upper edge 53 of the side wall 43 to the upper end region 54 of the distribution chamber 46. When the lever 51 is in its second position the deflector wall 49, as illustrated in FIGURES 4 and 6 is disposed across the distribution chamber 46, and preferably at an inclined angle to the vertical axis 55 thereof, with the lower end of the deflector wall 49 abutting the inner face 56' of the opposed vertically disposed deflector wall 56.

The deflector wall 56 is preferably similar to the deflector wall 49 and may be mounted on a shaft 57 keyed to a lever (not shown) operated by suitable mechanism 59 in substantially the same manner as the deflector wall 49 is operated by the mechanism 52, and is preferably similarly governed by one of the controls 36 in the cab 37. Thus, the deflector wall 56 is adapted to be disposed either in the vertical position illustrated in solid lines in FIGURES 4, 5 and 6 wherein it is substantially flush with the side wall 44, or in the inclined position indicated in dotted lines at 58 wherein it is transverse to the interior of the distribution chamber 46 and abuts the rearward face 61 of the vertically disposed deflector member 49.

The distribution chamber 46 may thus be adjusted to provide a choice of three conditions:

(a) An open channel for snow to pass from the base portion 40 to the upper end region 54, as illustrated at 46a in FIGURE 5;

(b) A snow diversion channel wherein snow blown upwardly from the impeller 18 strikes the inclined outer face 49' of the deflector wall 49 and is thus directed outwardly through the open region 49'' which is normally occupied by the deflector wall 49 when it is in its vertical

6

position. The snow is thus "blown" outwardly to one side as illustrated at 46b in FIGURE 6;

(c) A snow diversion channel wherein snow blown upwardly from the impeller 18 strikes the inclined outer face 56' of the deflector wall 56 and is thus directed outwardly through the open region which is normally occupied by the deflector wall 56 when it is in its vertical position. The snow is thus "blown" outwardly to the other side as illustrated at 46c in FIGURE 6.

If desired, an auxiliary deflector means 60 may be used, and may comprise a fixed deflector member 60' mounted on the upper end region 54 in a manner to project outwardly from the distribution chamber 46 above each of the deflector walls 49 and 56; and an adjustable deflector 60'' mounted on a suitable level operated by mechanism 61 governed by one of the controls 36 in the cab 37. The adjustable deflector 60'' is adapted when in its retracted position, to telescope over the fixed deflector member 60'; and when in an extended position, to project outwardly and downwardly over and beyond the outer edge of the fixed deflector member 60' thereby to extend into the path of snow which is diverted from the deflector wall 49, 56 with which it is associated. Thus, by varying the position of the adjustable deflector 60'' the operator is enabled to divert the throw of snow downwardly at any desired degree according to the range of movement of the adjustable deflector 60''.

The upper end region 54 of the distribution chamber 46 may lead into a duct 62 and in substantially flush relation thereto. The duct 62 may comprise a forward wall 63 and side walls 64 and 65, with the forward wall 63 curving upwardly and rearwardly toward the horizontal, terminating in a discharge outlet 66.

A guide member or capper 67 may be disposed in the vicinity of the discharge outlet 66 and adapted to direct the flow of snow emanating therefrom. Thus, the guide member 67 may comprise an inverted, substantially U-shaped hood having V-shaped side walls 68 pivoted at their lower apexes as at 69 on the side walls 64 and 65 of the duct 62 at the discharge outlet 66 thereof. A cap 70 extends between the side walls 68 at the upper ends thereof, thereby completing the inverted U of the U-shaped member 67. The cap 70 is adapted to penetrate the path of flow of snow emanating from the duct 62 as the hood 67 is moved rearwardly about the pivot 69 and to guide said flow in varying angles downwardly into a snow melting tank 75 carried by the chassis 10.

Suitable means may be used for establishing the direction of the thus diverted flow. In a preferred form, such means may consist of a link 72 pivoted at one end to one of the V-shaped walls 68, and at the other end to a rotary crank 73 mounted on an outer side wall 64 of the duct 62. The crank 73 may be operated by any suitable means such for instance as a motor (not shown) controlled by one of the master controls 36 in the cab 37. Thus as the crank 73 rotates about its horizontal axis, the link 72 is continuously oscillated rearwardly and forwardly in a manner to oscillate the capper 67 about the pivots 69 thereby producing a substantially uniform distribution of snow into the snow melting tank 75. In this manner, the throw is caused to sweep continuously, forwardly and rearwardly in a downwardly inclined direction between the limits 73' and 73''. On the other hand, should it be desired to maintain a constant direction of flow, it is merely necessary to manipulate the control for this device in the cab 37, to cause the oscillation to stop at the desired location.

In FIGURES 7 and 8 are illustrated a modified construction 310 of chute or discharge portion adapted to receive snow from the impeller 18. This modified construction may comprise a vertical tubular portion 311 having a lower, intake portion 312. A flange 313 may be disposed a suitable distance above the intake portion 312, and have a lower face 314 adapted to ride on a suitable bearing such as a ball race 315 disposed on an annulus 316 mounted on the superstructure 11'. A suit-

able gear, such for instance as the sprocket wheel 318 may be mounted on the tubular portion 311 beneath the horizontal structure 317, and may be connected by means of a suitable chain 319 to a sprocket wheel 320 mounted on a vertical shaft 321 extending through the floor 322 of the cab 37 alongside the operator's seat 323. A crank 324 may be mounted on the upper end of the shaft 321, and a vertically retractable handle 325 may be mounted on the outer end region of the crank 324, and may be suitably biased downwardly by a spring means (not shown) in a manner to project the lower end 326 of the handle 325 downwardly beneath the crank 324 and into any of suitable selected recesses (not shown) on a stationary dial 327.

The upper portion 328 of the chute 310 may be formed substantially similar to the duct 62, and may include the cap 67 and operating means such as the crank 73.

In operation, when it is desired to discharge snow into the tank 75, the operator lifts the handle 325 and turns the crank 324 thereby activating the sprocket 319 in a manner to rotate the vertical tubular portion 311 of the chute 310 until the discharge outlet 66 is directed toward the rear. The operator then releases the handle 325 thereby disposing its pin 326 within the adjacent recess (not shown) of the dial 327, thus locking the chute 310 in place. When it is desired to discharge snow to one side or the other, of the chassis 10, the operator need merely lift the handle 325 and rotate the crank 324 thereby activating the sprocket 319 in a manner to rotate the vertical tubular portion 311 until the discharge outlet 66 has been moved to the desired direction and angle with respect to the chassis 10. Release of the handle 325 permits the pin 326 to engage the then adjacent recess (not shown) of the dial 327, thereby locking the chute in its newly directed position.

It will thus be seen that with either construction the operator has the choice of discharging the snow out of one side or the other of the vehicle or discharging it rearwardly into a suitable container or vessel such as the tank 75.

In a preferred form, the container 75 is associated with snow melting means 76 which may include downwardly projecting burners 77, 77' and 77"; and may consist of a tank having a side wall 78, an opposed side wall 78', a generally downwardly and rearwardly inclined front wall 79, a rear wall 80 and a bottom 81. Baffles 83 may extend from the upper edge regions 82, 82' respectively of the walls 78, 78', and may if desired be inwardly and upwardly inclined a suitable distance from said walls. Rearwardly and upwardly inclined baffles 84 may be similarly mounted on the upper region 82" of the front wall 79, and preferably disposed on either side of the discharge outlet 66 when said outlet is disposed rearwardly. The inner edge regions of the baffles 83, 84 may be disposed upwardly to form a vertical wall 85, and a suitable seat such as an inwardly projecting angle iron 86 may be mounted on the inner face of each of said walls 85. Air eliminators 87 may be mounted on said seats 86 and substantially abutting the inner faces of the walls 85. In a preferred form a downwardly and inwardly inclined baffle 88 may be mounted on the upper edge region of the rearward wall 80 and extends forwardly to an edge 89 disposed beneath the rearwardmost of the eliminators 87. The baffle 88 may be disposed about the burner 77" in a manner to hold it in place. The burners 77 and 77' may also be supported by suitable burner supports 88' adapted to serve as baffles.

Thus there may be formed a tank 75 having an inlet region 79' disposed immediately behind and below the discharge outlet 66 of the duct 62, said tank having a vertical rear wall 80 leading upwardly to a downwardly and forwardly inclined baffle 88 supporting a downwardly projecting burner 77", burner supports 88' holding downwardly projecting burners 77, 77' and serving as baffles, and vertical side walls 78, 78' leading upwardly to inwardly and upwardly inclined baffles 83, which combine

with inwardly and upwardly inclined baffles 84 extending from the front wall 79, to support removable eliminators 87 which substantially cover the tank 75.

The snow melting means 76 preferably comprises an engine-operated air blower 90 having a discharge duct system 91 leading to the air intake 92 of each of the burners 77, 77' and 77". The duct system 91 preferably comprises a header 91' connected to individual ducts 91" leading to the individual burners 77, 77' and 77". Means are preferably provided in the header 91' for adjusting the flow of air from the blower 90 to each of the burners 77, 77' and 77". Thus, suitable variable control splitter dampers 130 may be pivotally mounted at the entrance to the passages leading to the ducts 91", and may be adjusted in position by means of suitable devices such as the adjustable lock type levers 131.

The outlets 132 of the ducts 91" are preferably provided with guided turning vanes 133 adapted to distribute uniformly pressurized air from the header 91' into the burners 77, 77' and 77". Each burner 77, 77', 77" is preferably equipped with one or more fuel nozzles 93, a pilot nozzle 94 and a suitable ignition system comprising an electrode 95. The fuel nozzles 93 and pilot nozzle 94 of each burner 77, 77', 77" are disposed in a suitable combustion chamber 100. Passages 134 are preferably provided for conveying a flow of air from the air intake 92, and about the combustion chamber 100, in a manner to absorb heat therefrom. In a preferred form, each of the burners 77, 77' and 77" is provided with a flame monitor 102 adapted to react electrically whenever a flame is present or ceases within the combustion chamber 100.

Each burner 77, 77' and 77" comprises a discharge vent 101 through which heated air under pressure, and hot products of combustion, are emitted.

In a preferred mode of operation, water is initially introduced into the tank 75 until the water level 103 has attained sufficient elevation to assure the submergence of the burner discharge vents 101. Snow thereafter emitted through the chute discharge outlet 66 will, particularly by means of the oscillating cap 67, be distributed throughout the length of the body of water 109 in the tank 75.

When the air blower 90 is in operation, and combustion of fuel is taking place in the burners 77, 77' and 77", a steady stream of pressurized air heated by the burners together with hot products of combustion, is emitted downwardly through the discharge vents 101 of the burners 77, 77' and 77", into the body of water 109. There is thus established a high turbulence, and a rapid heat transfer from the hot gaseous discharge emanating from the submerged outlet of the burners to the surrounding water resulting in the agitated heated water forcefully intermingling with the snow particles and thereby effecting a rapid melting of the snow, as illustrated for instance in FIGURE 12.

Particles of the highly agitated heated water in the tank 75 are lifted beyond the upper edge regions 82, 82' of said tank whereupon they either strike the baffles 83, 84, 88, or burner supports 88', and are thereby deflected back to the body of water 109, or they strike the air eliminators 87, which permits the upward flow through of pressured air and other gases emanating from the discharge vent 101 while diverting back to the body of water 109 the particles of water carried thereby. The agitated water in the melting tank, and the water which is deflected back from the baffles, burner supports and air eliminators tend to intermingle with the snow particles introduced into the tank 75, causing rapid melting of the snow particles.

In a preferred form, means are provided for establishing the water level 103 at a height best suited for optimum performance. Thus, a suction outlet 104 may be disposed within the tank 75 in a manner to establish a predetermined water elevation 103 above the bottom 81 of

the tank 75. In a preferred form this outlet is disposed at said water level in order to permit floating particles of snow to flow freely therethrough, and thus to reduce the quantity of heat required to melt the snow in the tank 75. A suitable water pump 105 may be connected to the suction outlet 104, operable to pump water from said outlet 104 to a discharge outlet 106 which may comprise a swivel nozzle 107 adapted to discharge melted snow to an adjacent free area, or by means of a coupled hose (not shown) to a nearby sewer inlet. The water pump 105 may be actuated automatically by means of a float switch 108 actuating a magnetic clutch 108' deriving motion from the engine 129 which operates the blower 90.

In one preferred form, a trough 110 is mounted along the side walls 78, 78' and rear wall 80. The upper edge 111 of the trough 110 is disposed at the preferred water level 103. The bottom 112 of the trough 110 on each of the portions 110' and 110'' thereof along the respective side walls 78, 78', may be rearwardly and downwardly inclined as illustrated in FIGURE 15, and the bottom 114 of the rear portion 113 of the trough 110 along the rear wall 80 may be substantially disposed at the bottom 81 of the tank 75. A suitable outlet 115 may be disposed through the rear wall 80 and into the interior of the rear portion 113 of the trough 110 in the vicinity of the bottom 114 thereof, said outlet 115 leading to the water pump 105 for disposal of overflow water which has accumulated in the trough 110.

A downwardly inclined baffle such as the runoff diverter 116 may be mounted on the side walls 78, 78' and rear wall 80 above the trough 110, and having an innermost edge portion 117 disposed inwardly from the wall on which it is mounted a distance preferably somewhat greater than the distance from said wall to the interior face 118 of the inner wall 119 of the trough 110 adjacent said wall. A suitable screen 120 may be pivotally mounted on the diverter 116 as at 121, and may be releasably secured to the inner wall 119 of the trough 110, as at 122.

The float switch 108 may be mounted in a suitable container 123 having a base 124 on which the float switch 108 is mounted, a top 125, a bottom 126, and an inward wall 127 as well as side walls 128. The base 124, side walls 128, top 125, bottom 126 and inward wall 127 define a chamber 123' in which the float 108'' of the float switch 108 is adapted to operate. The bottom 126 of the chamber 123' contains a port 126', and the top 125 contains a vent 125'.

A similar float switch 135 may be similarly mounted on the base 124 with its float 135' disposed in the chamber 123' at an upper water level of safe operation of the snow melting unit. The upper float switch 135 may be connected to a suitable alarm such as a flashing light 136, bell (not shown) or the like disposed among the master controls 36 in the cab 37 to warn the operator to bring the vehicle to a halt and thereby prevent further conveying of snow to the interior of the tank 75. Alternatively, the upper float switch 135 may be connected to suitable means for stopping the rotation of the conveyor blades 17, or otherwise automatically preventing further introduction of snow into the tank 75. The container 123 may be mounted in any suitable location in the interior of the tank 75, such for instance as on the wall 78 or 78' as shown, and may be disposed within the trough 110 as illustrated in FIGURE 14.

In operation, the tank 75 is initially supplied with water to the starting level 103. When the snow melter is in operation, the blast of hot products of combustion and heated air directed downwardly through the discharge vents 101 of each of the burners 77, 77', 77'', is deflected outwardly and upwardly by the bottom 81 of the tank 75, and in so doing disturbs the surrounding water in a manner to create great agitation thereof.

The water is thus hurled upwardly and along the sides and some of the thus displaced water may flow over the

upper edge 111 into the interior of the trough 110. The downwardly and rearwardly inclined bottom 112 of the trough carries such water toward the rear 113 until the trough 110 is full. Thus, even the trough 110 is filled with water that has been dislodged by the operation of the blast emanating from the discharge vents 101, the float switch 108 will not become energized, for it is set to be inoperative until a water level above the upper edge 111 has been reached.

As the snow melts however water is thus added to the water initially placed in the tank 75, and its nominal level will have increased beyond the starting water level 103. It will be noted that whereas the water in the interior of the tank 75 outside of the trough 110 is in great agitation, there is much less agitation in the trough 110. Such water enters the ports 126' of the float switch container 123 and rises in the chamber 123' according to hydrostatic pressure. Thus very little agitation is imparted to the water within the chamber 123'. Nevertheless, as water continues to accumulate in the tank 75, the very accumulation thereof tends to overflow the upper edge 111 of the trough 110, and the hydrostatic pressure within the chamber 123' is thereby increased. The float 108'' is accordingly made to rise and to actuate the switch 108 and thus to actuate the pump 105. Should the increase in volume of water within the tank exceed the capacity of the pump to expel the excess water therefrom, or should the pump be manually disconnected as for instance when it is desired not to discharge water from the tank 75, the upper limit 103' of safe operation may be reached. The hydrostatic pressure having thus impelled the water in the chamber 123' to reach and to lift the valve float 135', the float and switch 135 is actuated to initiate the stopping of further introduction of snow into the tank 75.

Should the vehicle be disposed on an incline, as for instance when it is on a road which is either ascending or descending a hill, or when it is on a banked curve causing one side to be higher than the other, the nominal water level 103'' within the tank will be substantially similar inclined. Thus, water may be overflowing in at least one of the trough portions 110, 110', 113, while leaving another of such portions exposed above the nominal water level 103''. Nevertheless, because of the inclined bottom 112 of the trough sides, and the accumulation of the water in the rear portion 113, water is collected which may still form a substantially reliable basis for measuring its elevation; and the float switches 108, 135 may be disposed at that portion of the trough 110 where the median water level 103'' is most likely to occur.

It should be noted that whereas water is initially placed in the tank to a starting level which is disposed above the discharge outlets 101 of the burners 77, 77', 77'', this water becomes greatly agitated during the normal operation of the snow melting means, and in fact particles may be hurled upwardly against the sides, baffles and eliminators. Nonetheless, water is disposed above the burner outlets 101, whether in the body of water 109 or in a free capacity above said body 109. In said free capacity it seeks its lower level and ultimately descends to the body 109. Thus, regardless of the continuous issuance of a gaseous blast from the discharge outlets 101 creating agitation and displacement of water in the tank 75, there is an operating head of water above said discharge outlets, and the nominal location of the level of this head may be referred to as the operating level.

During the operation of the snow disposal unit, the chute 62 may on occasion become clogged as with snow or ice. Hitherto such a condition usually required manual scooping, shovelling or chopping, to remedy the clogged condition.

According to my invention, I provide means whereby water, above freezing temperatures may be forcefully directed into the interior of the chute, thereby melting the clogging ice or snow, and freeing the chute for further snow disposal operation.

Thus, I provide a pump 140 operated by a suitable motor 141, and leading from a pipe 142 in the interior of the tank 75 below the water level 103 thereof, to a suitable hose 143 having a nozzle 144. The chute 62 being open at its rearward side 145 through most of its length, it is possible to aim the water forcefully issuing from the nozzle 144 directly at the clogging snow or ice in nearly every possible location thereof. This water is itself heated by the hot gaseous discharge from the burners 77, 77', 77'', and the above-freezing temperature of this water is thus assured regardless of the sub-freezing temperature of the outside atmosphere.

It will thus be seen that by the snow disposal unit of my invention there is provided a unitary device whereby snow may be gathered and selectively conveyed either to one side or another of the vehicle, or into a snow melting tank, and when thus conveyed into such tank said snow is uniformly distributed into a mixture of highly agitated, heated water and gaseous discharge from heaters, with means being provided for separating said gaseous discharge and allowing it to escape while recovering said water for re-use, together with means whereby accumulation of water and melted snow is confined within a range of optimum performance, regardless of the operating angle of the vehicle, and means are further provided whereby the snow blower mechanism may be brought to a stop when either excess water has accumulated in the tank or an obstruction has been encountered preventing proper performance of the blower mechanism, and when either condition has been remedied the snow blower mechanism can resume operation—all being governed by control mechanism within the cab; and means are also provided whereby the snow blower mechanism can be freed of clogging snow by means of water heated within the snow melting tank. The simplicity of construction and principles of operation aid in enabling my snow disposal unit to be built of rugged construction capable of withstanding severe weather conditions; and the nature of the combination of elements is such as to make it possible for my snow disposal unit to be operated and serviced by a minimum of labor. Indeed, a very substantial portion of the operation is performed under the control of the driver of the vehicle, who governs the operation while protected from the elements, in the warmth and comfort of the cab. Moreover, by means of my invention it is possible to maintain a very high rate of snow melting production and disposal at a minimum of expense and at a maximum of efficiency and dependability.

I am aware that the invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and I therefore desire the present embodiment to be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A snow disposal unit comprising in combination,
A tank adapted to hold water and to receive snow;
A heater;
Means to convey air under pressure to said heater in a manner to be heated thereby;
A discharge vent adapted to discharge said air under pressure from said heater downwardly beneath the operating water level of said tank;
Means to convey combined melted snow and said water from said tank;
A snow chute having a discharge outlet adapted to introduce snow into said tank; and
Means adapted to distribute said snow substantially evenly upon said water in said tank;
Said last-mentioned means comprising a capper, and means to automatically oscillate said capper between

preset limits across the path of snow being emitted from said chute.

2. A snow disposal unit comprising in combination,
A tank adapted to hold water and to receive snow;
A heater;
Means to convey air under pressure to said heater in a manner to be heated thereby;
A discharge vent adapted to discharge said air under pressure from said heater downwardly beneath the operating water level of said tank;
Means to convey combined melted snow and said water from said tank;
A snow chute having an inlet at its lower end and a discharge outlet at its upper end adapted to introduce snow into said tank and having a partially open underside;
Said chute and said tank being mounted on the chassis of a vehicle comprising snow blower mechanism having an impeller operative to discharge snow into said chute inlet and drive the snow upward for discharge out of said outlet; and
A higher pressure water nozzle mounted to forcefully discharge heated water from said tank into the said open underside of said chute and downward into said impeller in a manner to disengage clogging snow therefrom.
3. A snow disposal unit comprising in combination,
A tank adapted to hold water and to receive snow;
A heater;
Means to convey air under pressure to said heater in a manner to be heated thereby;
A discharge vent adapted to discharge said air under pressure from said heater downwardly beneath the operating water level of said tank;
Means to convey combined melted snow and said water from said tank;
A snow chute having a discharge outlet adapted to introduce snow into said tank;
Said chute and said tank being fixedly mounted on the chassis of a vehicle having a cab and comprising snow blower mechanism having an impeller;
A three-way distribution chamber having a lower inlet end and an upper outlet end disposed intermediate said impeller and said chute;
Said distribution chamber comprising a pair of facing deflector walls each of which is pivoted at its upper end region along an axis substantially parallel to a side of said vehicle;
Control means coupled to said deflector walls selectively operable in a first way to dispose both of said deflector walls in the positions of opposite facing walls of a channel between said impeller and said chute and thereby cause snow to pass upward therebetween entirely through said distribution chamber into said chute and out of the chute discharge outlet, and said control means being operable in a second way to selectively dispose either of said pair of deflector walls transversely to said channel to thereby divert snow thrown by said impeller outwardly through a selected side of said distribution chamber below the upper outlet of the distribution chamber and toward and laterally outward beyond the corresponding side of said vehicle.
4. A snow disposal unit comprising in combination,
A tank adapted to hold water and to receive snow;
A heater;
Means to convey air under pressure to said heater in a manner to be heated thereby;
A discharge vent adapted to discharge said air under pressure from said heater downwardly beneath the operating water level of said tank;
Means to convey combined melted snow and said water from said tank;
A snow chute having a discharge outlet adapted to introduce snow into said tank;

Said chute and said tank being fixedly mounted on the chassis of a vehicle having a cab and comprising snow blower mechanism having an impeller;

A distribution chamber having a lower inlet end and an upper outlet end disposed intermediate said impeller and said chute;

Said distribution chamber comprising a deflector wall pivoted at its upper end region along an axis substantially parallel to a side of said vehicle;

Means selectively to dispose said deflector wall in the position of a wall of a channel between said impeller and said chute and thereby cause snow to pass upward entirely through said distribution chamber into said chute and out of the chute discharge outlet, or transverse to said channel operably to divert snow thrown by said impeller outwardly through a side of said distribution chamber below the upper outlet of the distribution chamber and toward and laterally outward beyond the side of said vehicle;

An auxiliary deflector disposed exterior of said distribution chamber and above said deflector wall;

Said auxiliary deflector being extendable to selectively different degrees of penetration into the path of snow thrown toward a side when said reflector wall is disposed transverse to said channel to thereby control the angle of snow discharge relative to the horizontal; and

Means coupled to said auxiliary deflector and operable from within said cab to vary the degree that said auxiliary deflector penetrates into said path of thrown snow.

5. Snow melting apparatus comprising:

A tank adapted to hold water and to receive snow, and having a bottom;

A heater;

Means to convey air under pressure to said heater in a manner to be heated thereby;

A discharge vent adapted to discharge hot products of combustion and said air under pressure from said heater downwardly beneath the operating water level of said tank;

Means to convey combined melted snow and said water from said tank;

Means to confine the operating water level of said water in said tank, to an elevation below such water level as would impose a deleterious back pressure on said discharge from said discharge vent;

A snow chute having a discharge outlet adapted to introduce snow into said tank;

Said chute and said tank being mounted on a chassis of a vehicle comprising snow blower mechanism having an intake, an impeller, and a conveyor adapted to convey said snow from said intake to said impeller; and

A cab;

An alarm device;

Means mounted on said tank and adapted to actuate said alarm device when the water level in said tank has reached a height which would impose deleterious back pressure on the discharge emanating from said discharge vent.

6. A snow disposal unit comprising in combination,

A tank adapted to hold water and to receive snow;

A heater;

Means to convey air under pressure to said heater in a manner to be heated thereby;

A discharge vent adapted to discharge said air under pressure from said heater downwardly beneath the operating water level of said tank;

Means to convey combined melted snow and said water from said tank;

Said heater being mounted on a base member disposed on said tank above said operating water level;

Said base member being adapted to deflect downward-

ly toward said bottom, water carried upwardly by said air under pressure emitted through said discharge vent;

Baffles disposed above said operating water level, and adapted to deflect downwardly toward said bottom, water carried upwardly by said air under pressure emitted through said discharge vent;

Eliminators disposed above said operating water level, and adapted to permit passage therethrough of gases emitted through said discharge vent, while deflecting downwardly toward said bottom, water carried above said operating water level by said gases;

A snow chute having a discharge outlet adapted to introduce snow into said tank;

Means adapted to distribute said snow substantially uniformly into said tank;

Said last-mentioned means comprising a capper, and means to oscillate said capper across the path of snow being emitted from said chute;

Said chute and said tank being mounted on a chassis of a vehicle comprising snow blower mechanism having an intake, an impeller, and a conveyor adapted to convey said snow from said intake to said impeller;

An engine adapted to operate said impeller;

Said engine being connected to said impeller and said conveyor by means of a transmission;

A self-releasing clutch disposed intermediate said transmission and said conveyor, and adapted to become disposed in release condition whenever the torque is beyond a safe limit of operation, and to resume engagement when the torque is below said safe limit;

A self-releasing clutch disposed intermediate said engine and said transmission, and adapted to become disposed in release condition whenever the torque is beyond a safe limit of operation, and to require a manual reset in order to resume engagement;

Means adapted to discharge heated water from said tank into said chute and said impeller in a manner to disengage clogging snow therefrom;

Said chute having means adapted selectively to discharge snow at various angles;

A cab;

Means disposed within said cab, for controlling the angle of discharge;

Said tank having a wall;

A trough projecting inwardly from said wall, and adapted to receive overflow water and melted snow from said tank;

Means to convey combined melted snow and said water from said trough;

A float switch disposed in said trough, and adapted to actuate said means for conveying melted snow and water from said trough;

Said trough having connecting sections disposed substantially along a plurality of non-linear portions of the perimeter of said tank;

Means mounted on said tank and adapted to effectuate a suspension of delivery of snow into said tank when the operating water level in said tank has reached a height which would impose deleterious back pressure on the discharge emanating from said discharge vent.

7. A snow disposal unit comprising in combination,

A tank adapted to hold water and to receive snow;

A heater;

Means to convey air under pressure to said heater in a manner to be heated thereby;

A discharge vent adapted to discharge said air under pressure from said heater downwardly beneath the operating water level of said tank;

Means to convey combined melted snow and said water from said tank;

Said heater being mounted on a base member disposed on said tank above said operating water level;

15

Said base member being adapted to deflect downwardly toward said bottom, water carried upwardly by said air under pressure emitted through said discharge vent;

Baffles disposed above said operating water level, and adapted to deflect downwardly toward said bottom, water carried upwardly by said air under pressure emitted through said discharge vent;

Eliminators disposed above said operating water level, and adapted to permit passage therethrough of gases emitted through said discharge vent, while deflecting downwardly toward said bottom, water carried above said operating water level by said gases;

A snow chute having a discharge outlet adapted to introduce snow into said tank;

Means adapted to distribute said snow substantially uniformly into said tank;

Said last-mentioned means comprising a capper, and means to oscillate said capper across the path of snow being emitted from said chute;

Said chute and said tank being mounted on a chassis of a vehicle comprising snow blower mechanism having an intake, an impeller, and a conveyor adapted to convey said snow from said intake to said impeller;

An engine adapted to operate said impeller;

Said engine being connected to said impeller and said conveyor by means of a transmission;

A self-releasing clutch disposed intermediate said transmission and said conveyor, and adapted to become disposed in release condition whenever the torque is beyond a safe limit of operation, and to resume engagement when the torque is below said safe limit;

A self-releasing clutch disposed intermediate said engine and said transmission, and adapted to become disposed in release condition whenever the torque is beyond a safe limit of operation, and to require a manual reset in order to resume engagement;

Means adapted to discharge heated water from said tank into said chute and said impeller in a manner to disengage clogging snow therefrom;

A distribution chamber disposed intermediate said impeller and said chute;

Said distribution chamber comprising a deflector wall pivoted at its upper end region along an axis substantially parallel to a side of said vehicle;

Means selectively to dispose said deflector wall in the position of a wall of a channel between said impeller and said chute,

or transverse to said channel operably to divert outwardly toward the side of said vehicle, snow thrown by said impeller;

An auxiliary deflector disposed exterior of said distribution chamber and above said deflector wall;

Said auxiliary deflector extending into the path of snow thrown toward said side when said deflector wall is disposed transverse to said channel;

Means to vary the extent said auxiliary deflector extends into said path;

Said tank having a wall;

A trough projecting inwardly from said wall, and adapted to receive overflow water and melted snow from said tank;

Means to convey combined melted snow and said water from said trough;

A float switch disposed in said trough, and adapted to actuate said means for conveying melted snow and water from said trough;

Said trough having connecting sections disposed substantially along a plurality of non-linear portions of the perimeter of said tank.

8. Snow melting apparatus comprising:

(a) a vehicle,

(b) a tank mounted on said vehicle, said tank being adapted to hold water and to receive snow, and having a wall,

16

(c) a trough projecting inwardly from said wall and adapted to receive overflow water and melted snow from said tank,

(d) means to convey combined melted snow and said water from said trough, and

(e) a float switch disposed in said trough, and adapted to actuate said last named means.

9. Snow melting apparatus as defined in claim 8 wherein said trough includes connecting sections disposed substantially along a plurality of non-linear portions of the perimeter of said tank.

10. Snow melting apparatus comprising in combination

(a) a tank for holding water and receiving snow, said tank having a top of substantially the same area as the free water surface of the water in said tank,

(b) heater means,

(c) a source of gas under pressure and means for conveying said gas to said heater means for heating by the latter,

(d) gas discharge means from said heater means having outlet means opening beneath the operating water level of said tank to thereby cause the pressurized heated gas to discharge directly into the water in said tank,

(e) water discharge means operative to prevent the water level in said tank from exceeding a predetermined operating level,

(f) means for discharging pulverized snow and ice into the atmosphere of said tank, and

(g) water eliminators forming the major portion of said tank top disposed directly above said operating water level adapted to permit passage therethrough of gases emitted through said discharge outlet means while deflecting downwardly toward said operating water level, water particles carried above said operating water level by said gases,

said source of gas under pressure supplying a volumetric flow of heated gas out of said gas discharge outlet means and into the water in said tank sufficient to create substantial water turbulence and generate a heated turbulent mist atmosphere of heated water particles and gas in said tank above the water operating level, whereby, ice and snow discharged into the heated turbulent mist atmosphere of the tank is substantially melted while descending to the operating water level in the tank to thereby provide a very high melt rate.

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