

March 20, 1956

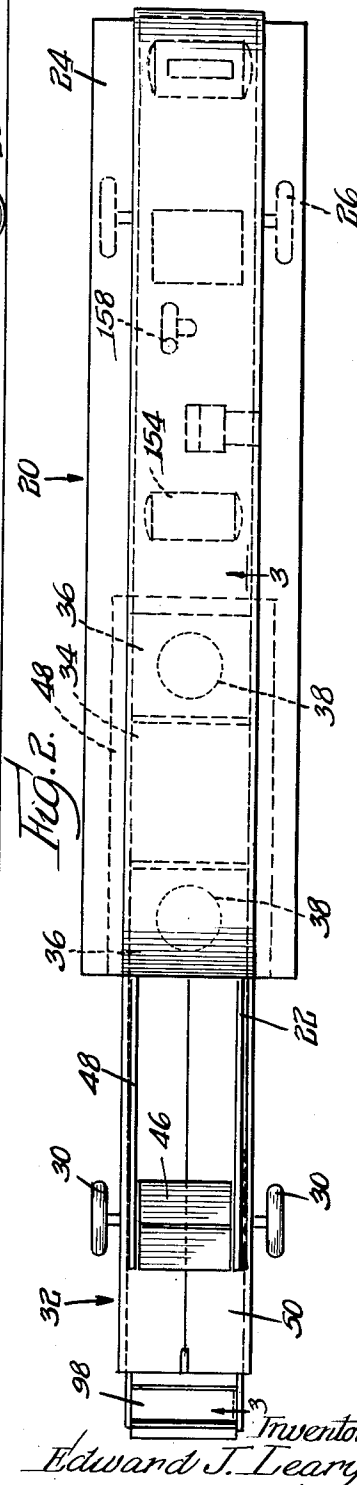
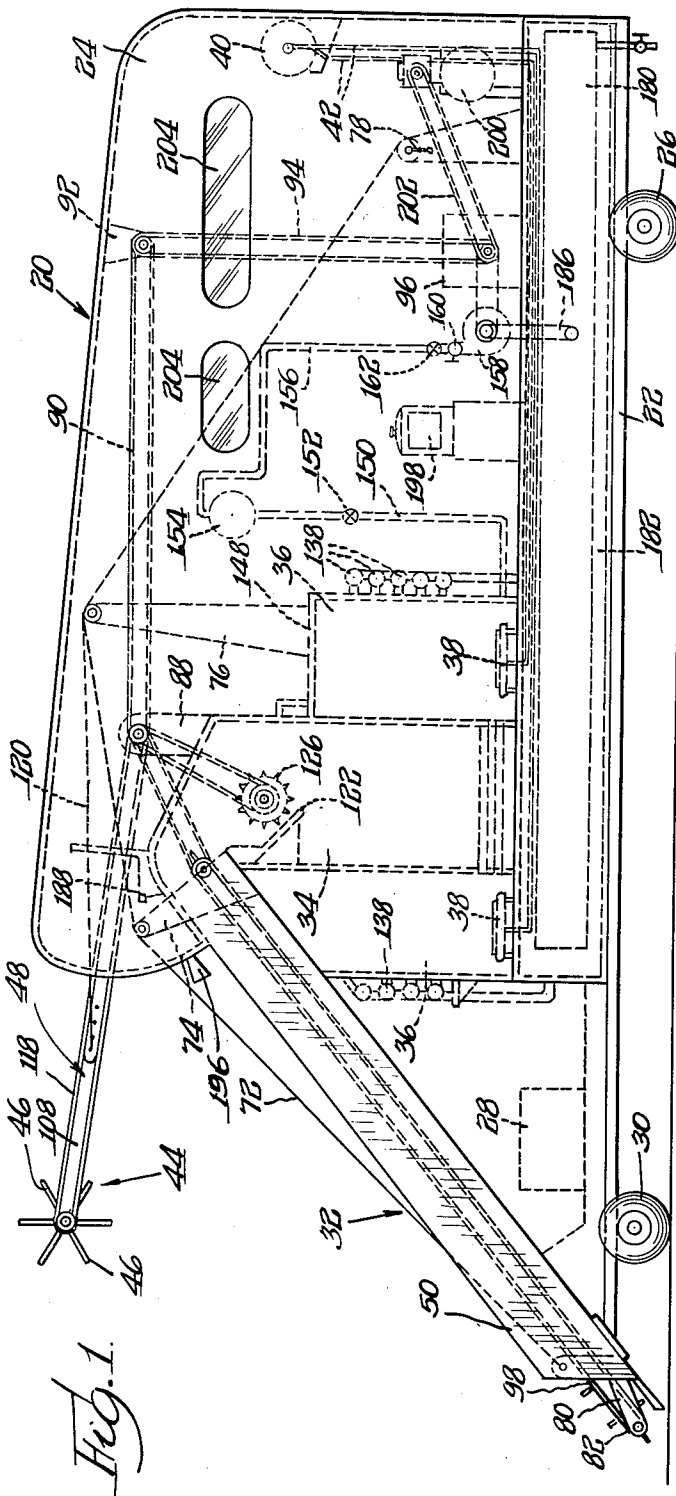
E. J. LEARY

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SNOW DESTROYER

Filed March 15, 1952

3 Sheets-Sheet 1



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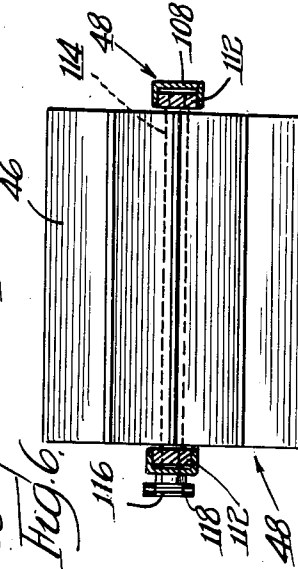
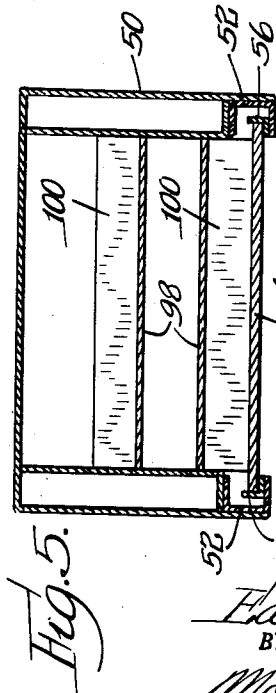
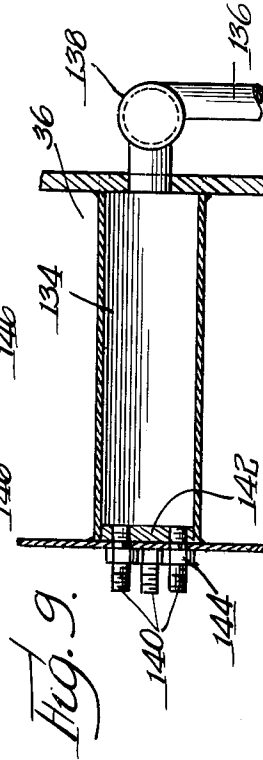
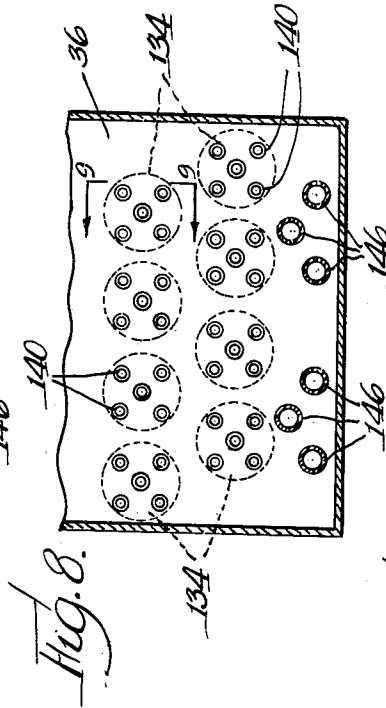
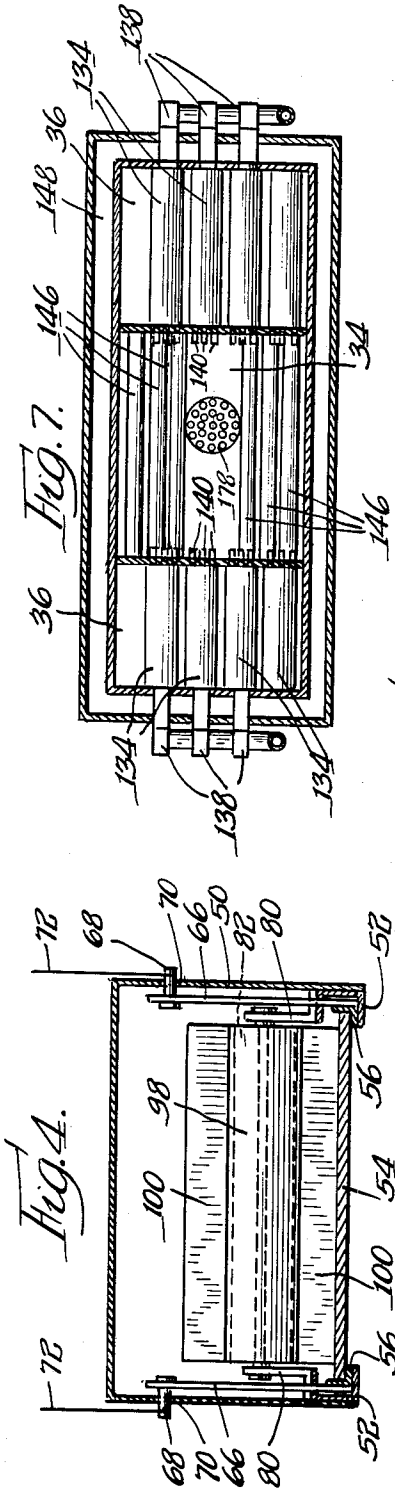
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SNOW DESTROYER

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14 Claims. (Cl. 126—343.5)

This invention is concerned with snow removal, and particularly with a snow destroyer for removing snow from streets and railroads and totally destroying the same.

It is the general practice to remove snow from both streets and railroads by pushing it aside with a blade, or by picking up and blowing the snow to one side by means of a rotary plow. Piled up snow takes a long time to melt, particularly when compacted by a blade, and snow blown to one side by a rotary plow is loose and may be blown back onto the street or railroad by a strong wind. Efforts heretofore have been made to improve on the foregoing by collecting and melting snow. The resulting snow water is of only about one-tenth the volume of the snow and is readily poured off into drains, ditches, et cetera. Such snow removal apparatus has not come into general use principally due to inadequate snow melting capacity.

Heat transfer, and hence melting, depends on the effective area heated. I have found that the best possible melting of snow is attained when hot air blasts are directed into a snow mass from different directions. The air blasts agitate and break up the snow masses physically, thereby exposing greater areas for heat transfer.

Accordingly, it is an object of this invention to destroy snow by directing blasts of very hot air into a collected mass of snow from opposite sides of the machine.

A more specific object of this invention is to direct a great many hot air blasts of relatively small size into a mass of snow from opposite sides thereof for most effective penetration of the snow mass.

A further object of this invention is to melt collected snow by spraying boiling water on the snow and also directing hot air blasts into the snow.

Another object of this invention is to provide apparatus for melting collected snow by directing hot air blasts into the snow in a melting chamber and reusing the air from the melting chamber for further heating and melting to obtain a high efficiency.

Another object of this invention is to provide a snow collecting and melting apparatus having a snow water storage tank entirely surrounded by hot air to prevent freezing of the snow water in subfreezing weather.

A further object of this invention is to provide snow collecting and melting apparatus having fire boxes on opposite sides of a melting chamber for great heat.

Another object of this invention is to conduct the exhaust of snow melting apparatus through the snow being melted for utmost utilization of the heat and to arrest smoke.

Another object of this invention is to provide a snow collecting and melting apparatus wherein air for melting the snow is heated in a plurality of tanks to avoid convection effects within the heating enclosure.

Yet another object of this invention is to provide a snow collecting and melting apparatus having a plurality of air heating tanks and a blower for each tank to preclude interaction and to preclude total disability in case of failure of one blower.

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A further object of this invention is to provide, in snow collecting and melting apparatus, a snow loading ramp adjustable for different types of roadways and automatically adjustable to compensate for rough pavement.

A still further object of this invention is to provide an automotive snow collecting and destroying apparatus having an operator's seat in clear view above the upper end of a snow loading ramp.

Other objects and advantages of the present invention will be apparent from the following description, wherein similar numbers are utilized to identify similar parts throughout and in which:

Fig. 1 is a side view of a snow destroying machine embodying the principles of my invention;

Fig. 2 is a top view of the machine;

Fig. 3 is a vertical sectional view taken substantially along the line 3—3 in Fig. 2;

Fig. 4 is a cross sectional view of the ramp taken along the line 4—4 of Fig. 3;

Fig. 5 is a cross sectional view of the ramp taken along the line 5—5 of Fig. 3;

Fig. 6 is a cross sectional view of the snow knocker along the line 6—6 of Fig. 3;

Fig. 7 is a horizontal sectional view through the melting chamber and heating chambers, and is taken along the line 7—7 of Fig. 3;

Fig. 8 is a vertical sectional view substantially along the line 8—8 of Fig. 3;

Fig. 9 is a sectional view through one of the air heaters as taken substantially along the line 9—9 in Fig. 8; and

Fig. 10 is a fragmentary view showing the snow destroyer as adapted for railway use.

Referring first to Figs. 1 and 2 for a general understanding of my invention, there may be seen a snow destroyer 20 in the form of a truck having a frame 22 carrying a body 24. Driving wheels 26 are carried in conventional manner at the rear of the frame 22 and are driven by suitable drive connections (not shown) from a motor indicated diagrammatically at 28. The frame 22 also is provided with a pair of front wheels 30 which are steered through suitable connections from an operator's seat shortly to be disclosed.

A snow loading ramp 32 is secured at the front of the snow destroyer 20 and extends upwardly within the upper front part of the body 24 to dump snow into a snow melting chamber 34. Heating chambers 36 are located forwardly and rearwardly of the melting chamber 34 and are provided with burners 38. The burners shown are for burning gas such as butane or propane, although it will be understood that substantially any type of heaters may be used. Fuel for the burners 38 is stored in a tank 40 located on the rear wall of the body 24. Pipes 42 extend from the fuel tank 40 to the burners 38 for conducting fuel to the burners.

In order to knock down high snow banks I have provided a snow knocker 44 located at the upper front portion of the body 24. The snow knocker comprises a rotatable paddle wheel 46 carried at the end of an adjustable boom 48.

The snow loading ramp 32, as shown in Figs. 1-6, includes a sheet metal tunnel or box 50 open at both ends and along the bottom. The sheet metal tunnel 50 is provided with longitudinal channel-shaped beams or braces 52 suitably secured along the lower longitudinal edges of the tunnel by means such as rivets or welding. A plate 54 which conveniently is made of plywood, but may be made of metal if desired, is provided with longitudinal angle members 56 suitably secured along its long edges. The angle members 56 rest within the channel members 54 and are slidable therein to allow the plate 54 to be slid up and down. The normal height of the ramp plate 54 is determined by spacer plates 58 placed between

a wall 60 upstanding from the melting chamber 34 and a flange 62 extending downwardly from the upper end of the plate. The ramp plate 54 will slide upwardly automatically to pass over rough pavement without damage to the ramp plate. The plate 54 further is protected against damage by a steel tip 64 at the lower end.

A pair of brace members 66 (Figs. 3 and 4) extend upwardly from the lower ends of the angle members 56 and are provided with pins 68 extending laterally through slots 70 in the opposite sides of the tunnel 50. Cables or wires 72 are secured to the outer ends of the pins 70 and extend upwardly over pulleys carried by supports 74 and 76 (Figs. 1 and 3) within the body of the snow destroyer and back to a double winch 78 (Fig. 1) within the body 24 near the rear thereof. Operation of one section of the winch 78 pulls on the wire or cable 72 to retract the ramp plate 54 for traveling or for removing additional spacer plates 58.

Brace members 80 (Figs. 1, 3 and 4) extend forwardly from the lower end of the ramp channel members 52 and rotatably support an idler roller 82. This roller is fixed in position by virtue of its support from the channel members and does not shift longitudinally with the ramp plate 54. A drive roller 84 is fixed at the upper end of the ramp by suitable support means connected to the channel members and is rotatable by means of an endless chain 86 passed over a sprocket wheel fixed on the roller shaft and over a sprocket wheel carried by a support 88 within the body 24. A drive chain 90 extends rearwardly from another sprocket carried by the support 88 to a sprocket carried by a support 92 (Fig. 1). Another sprocket is fixed to the sprocket carried by the support 92 and a drive chain 94 extends downwardly therefrom to an output sprocket on a small engine 96.

A belt 98 (Figs. 1-5) is passed over the drive roller 84 and idler roller 82. Pusher members or plates 100 are fixed on the belt and extend outwardly therefrom into contact with the ramp plate 54 for pushing snow up the plate 54 and into the melting chamber 34.

Clearance is provided between the downwardly returning pushers 100 and the top of the tunnel 50, and warm air is prevented from escaping through this clearance space by a plate 102 pivotally connected to a roof section 104 over the melting chamber 34. The plate 102 is pulled into a position perpendicular to the reaches of the belt 100 by a spring 106.

The boom 48 of the snow knocker 44 comprises a pair of parallel channel members 108 (Figs. 1, 3 and 6). Each channel member 108 is constructed in two sections so as to be telescopically adjustable. The sections are held together by bolts 110 passed through suitable apertures in the channel sections. The channel members 108 carry bearing members 112 (Fig. 6) at their outer ends and a cross shaft 114 carrying the paddle wheel 46 is journaled in these bearing members. A sprocket 116 is fixed on an outer end of the cross shaft 114 and a chain 118 is passed over this sprocket and over a sprocket on the support 88 ganged with the sprocket driven by the chain 90 in order to rotate the paddle wheel 46.

The rear ends of the channel members 108 of the boom 48 are pivotally carried by the support 88. Wires or cables 120 are connected to the boom 48 approximately at the middle thereof and are passed over the pulleys carried by the support 76 to the other half of the double winch 78. Operation of this half of the winch allows the snow knocker 44 to be raised and lowered as desired to knock down snow banks.

A plate 122 (Figs. 1 and 3) juts diagonally into the upper end of the melting chamber 34 and is braced by a brace member 124 extending outwardly from the wall 60. A cylinder 126 is suitably supported a short distance from the plate 122 and is provided with a plurality of radially extending spikes 128 substantially contacting the plate 122. A sprocket 130 is fixed on the end of the shaft carrying the cylinder 126 and a sprocket chain

132 drives this sprocket and hence the cylinder from the gang of sprockets carried by the support 88. Rotation of the cylinder 126 causes the spikes 128 to break up snow crusts so that they can be melted more readily.

Each of the heating chambers 36 includes a plurality of cylindrical tanks 134 (Figs. 3 and 8) arranged horizontally and supplied with air through ducts 136 and blowers 138 (Figs. 3 and 9). Each tank 134 is provided with an individual blower 138 which preferably includes its own small electric motor (not shown), although the blowers are arranged in horizontal rows and each horizontal row could be powered as a group. The tanks 134 are arranged in horizontal rows, and the tanks of adjacent rows are offset from one another for efficient air circulations. A plurality of jets 140, illustrated as five in number, project from the front end of each tank through the wall of the melting chamber 34. The jets are threaded into end blocks 142 in the tanks 134 which are clamped against the melting chamber wall by nuts 144 threaded on the outer ends of the jets. The burning gases in the heating chambers 36 heat all of the tanks as they pass upwardly through the heating chambers. The lower tanks are heated to a high degree because of the high initial temperature of the burning gases, while the upper tanks are heated to substantially the same degree due to the natural tendency of heat to rise. The upper tanks are not heated appreciably more than the lower tanks because of the extraction of heat from the burning gases by the lower tanks.

Due to the small cross sectional area of the jets as opposed to that of the tanks, the air moves relatively slowly through the tanks and is heated to a much higher degree than would be possible if the air were moving at the same very rapid rate as it leaves the jets. The high velocity of the air blasts from the jets aids the very hot air in penetrating to the very heart of the snow mass falling into the melting chamber. The striking of the snow mass by the oppositely opposed jets, and the offsetting of the jets due to the offsetting of adjacent horizontal rows of tanks causes considerable physical agitation of the snow. This aids in breaking up the snow to present large surface areas for rapid heat transfer and hence for rapid melting of the snow.

Some snow may not be completely melted, but remains in a slushy condition in the bottom of the melting chamber 34. In order to melt this slush I have provided fire tubes 146 (Figs. 3, 7 and 8) passing between the heating chambers 36 near the bottom thereof. Hot gases passing through these fire tubes quickly melt any slush in the bottom of the heating chamber 34.

In order to prevent burning or buckling of the walls of the heating chambers 36, I have provided a water jacket 148 (Figs. 1, 2, 3 and 7) surrounding the heating chambers on three sides and on the tops. The fourth side of each heating chamber faces the melting chamber 34 and is cooled by snow, slush, and snow water in the melting chamber. The heating of the melting chamber walls by the heating chambers aids in melting the snow and prevents the snow from sticking to the walls as it might if the walls were cool.

The water jacket 148 preferably is passed along the outside walls of the melting chamber 34 as shown in Figs. 2 and 7 to maintain the outside walls warm so that snow will not stick to them.

The water in the water jacket 148 is supplied through a pipe 150 (Figs. 1 and 3) having a valve 152 (Fig. 1). Water enters the pipe 150 from a storage tank 154 (Figs. 1 and 2) which in turn is supplied through a pipe 156 from a pump 158 having a valve 160. The pipe 156 preferably is provided with a check valve 162.

The water near the top of the water jackets 148 is heated substantially to boiling and pipe connections 164 extend from the tops of the water jackets into the melting chamber and are provided with spray heads 166. The pipe connections 164 are not provided with valves and there-

fore serve as safety releases if the water in the water jackets is overheated. The continuous circulation of the water by the pump 158 insures a continuous spray on the snow from the spray heads 166.

Further heating of the snow is provided by pipes 168 leading from the tops of the heating chambers 36 to tanks or manifolds 170. Air connections also are made to the manifolds 170 through blowers 172 so that hot exhaust gases passing into the manifolds are carried out through conduits 174 extending downwardly into the melting chamber 34. The hot exhaust gases thus help in melting the snow and the snow effectively smothers any smoke in the exhaust gases.

A water outlet 176 extends upwardly into the melting chamber 34 and is provided with a perforated, dome-shaped head 178 through which water passes into the interior of the outlet and from there into a water storage tank 180. The water storage tank 180 is completely surrounded by an air space 182 and conduits 184 are provided leading from the melting chamber near the top thereof to the air space 182 so that used, but still warm, air passes from the melting chamber into the air space 182. The tank 180 thereby is surrounded by hot air and the melted snow water cannot freeze regardless of the outside temperature. The pipes 136 supply air to the blowers 138, leading from the air space 182 and constant recycling of the air thus is insured. By this means all of the heat is utilized and none is exhausted into the atmosphere.

The pump 158 is connected to the tank 180 by a conduit 186 (Fig. 1) for supplying water to the tank 154 and water jacket 148 so that much of the heat in the water tank 180 is utilized. The tank 180 further is provided with a drain connection at the rear end thereof and connections (not shown) preferably are made from the pump 158 to spray nozzles (not shown) outside the body 24 for spraying snow banks adjacent the road to form crusts on the snow banks and thereby to prevent the snow banks from collapsing or being blown into the cleared roadway.

The snow destroyer 20 is provided with an operator's seat 188 (Figs. 1 and 3) positioned above the top, rear end of the ramp where everything ahead of the ramp readily can be seen through a windshield 190. A steering wheel 192 and operating pedals 194 are positioned directly in front of the operator's seat and are suitably connected by any conventional means to steer and control the snow destroyer 20. A headlight 196 is secured to the front of the body 24 directly beneath the windshield 190 for night operation.

The snow destroyer is completed by a combination engine-dynamo 198 (Fig. 1) within the body 24 for supplying electric power for the blowers, headlight, et cetera, and by an air compressor 200 driven by the motor 96 through the intermediary of a belt or chain 202. The air compressor is useful for force feeding the liquid fuel from the tank 40 when liquid fuel is used, and may be used for other purposes as well. Windows 204 preferably are provided in the side of the body 24 to provide light to the interior of the body and so that persons within the body can see out.

A modification of the invention for use on railroads is shown in Fig. 10. The majority of the parts are identical with those heretofore shown and described and are identified by similar numerals with the addition of the suffix "a," further description therefore being unnecessary. The only differences lie in the provision of railroad trucks 206 carrying railroad wheels 208 resting on tracks 210, and in the omission of the mechanism for adjusting the height of the ramp plate 54a which is fixed in position due to the constancy of construction of railroad roadbeds.

It now will be obvious that the snow destroyer shown and described meets the objects of my invention and that snow, as such, is totally destroyed, being reduced to water, which readily can be discharged down drains or into ditches. The large number of small jets and their op-

posed disposition leads to extremely effective melting of the snow collected.

It is to be understood that the specific examples shown and described are for illustrative purposes only and that my invention includes all that which falls fairly within the spirit and scope of the appended claims.

I claim:

1. Snow disposal apparatus including a snow melting chamber, heating chambers on opposite sides of said melting chamber, means for forcing substantially opposed streams of hot air from said heating chambers into said melting chamber from opposite sides of said melting chamber to agitate and break up snow therein to effect rapid melting, and means for conducting melted snow water from said melting chamber.

2. Snow disposal apparatus including a snow melting chamber, heating chambers on opposite sides of said melting chamber, means for forcing substantially opposed streams of hot air from said heating chambers into said melting chamber from opposite sides of said melting chamber to agitate and break up snow therein to effect rapid melting, means for exhausting air from said melting chamber to said air forcing means for recycling the air, and means for conducting melted snow water from said melting chamber.

3. Snow disposal apparatus including a snow melting chamber, heating chambers on opposite sides of said melting chamber, means for forcing substantially opposed streams of hot air from said heating chambers into said melting chamber from opposite sides of said melting chamber to agitate and break up snow therein to effect rapid melting, a water storage tank, means for conducting melted snow water from said melting chamber into said water storage tank, and means for exhausting air from said melting chamber past said water storage tank to said heating chamber for recycling said air and maintaining snow water in a liquid state in said tank.

4. Snow disposal apparatus including a snow melting chamber, heating chambers on opposite sides of said melting chamber, a plurality of jets extending from said heating chambers into said melting chamber from opposite sides thereof, substantially all of said jets being parallel, means for forcing hot air through said jets from said heating chambers into said melting chamber to agitate and break up snow therein to effect rapid melting, and means for removing melted snow water from said melting chamber.

5. Snow disposal apparatus including a snow melting chamber, heating chambers on opposite sides of said melting chamber, a plurality of air heating tanks in each of said chambers, means for forcing substantially opposed streams of hot air from said air heating tanks into said melting chamber from opposite sides of said melting chamber to agitate and break up snow therein to effect rapid melting, and means for removing melted snow water from said melting chamber.

6. Snow disposal apparatus including a snow melting chamber, heating chambers on opposite sides of said melting chamber, a plurality of relatively large air heating tanks in each of said heating chambers, a plurality of relatively small jets extending from each of said air heating tanks into said melting chamber, and means for forcing hot air relatively slowly through said tanks for efficient heat transfer and relatively rapidly through said jets into said melting chamber to agitate and break up snow therein to effect rapid melting.

7. Snow disposal apparatus including a snow melting chamber, heating chambers on opposite sides of said melting chamber, a plurality of horizontally disposed air heating tanks extending across each of said heating chambers, the tanks being arranged in horizontal rows and the tanks of adjacent rows being offset from one another, and means for forcing streams of hot air from said air heating tanks into said melting chamber to melt snow therein.

8. Snow disposal apparatus including a snow melting chamber, a heating chamber adjacent said snow melting chamber, a plurality of relatively large air heating tanks in said heating chamber, a plurality of relatively small jets from each of said tanks opening into said heating chamber, means for forcing streams of hot air from said jets into said melting chamber to agitate and break up snow therein to effect rapid melting, and means for removing melted snow water from said melting chamber.

9. Snow disposal apparatus including a snow melting chamber, heating chambers on opposite sides of said melting chamber, means for forcing streams of hot air from said heating chambers into said melting chamber from opposite sides of said melting chamber to agitate and melt snow therein, a water storage tank, means for conducting melted snow water from said melting chamber into said tank, water jacket means around said heating chambers, means for circulating water from said tank into said water jacket means, and means for spraying hot water from said water jacket means onto snow in said melting chamber.

10. Snow disposal apparatus including a snow melting chamber, a heating chamber adjacent said melting chamber, a plurality of air heating tanks in said heating chamber, a plurality of jets extending from each of said tanks into said melting chamber, means for forcing hot air through said jets from said tanks into said melting chamber to agitate and melt snow therein, a water jacket around said heating chamber, means for circulating melted snow water from said melting chamber into said water jacket, and means for spraying hot water from said water jacket onto snow in said melting chamber.

11. Snow disposal apparatus including a snow melting chamber, heating chambers on opposite sides of said melting chamber, means for forcing a plurality of substantially opposed streams of hot air from said heating chambers into said melting chamber from opposite sides of said melting chamber to agitate and break up snow therein to effect rapid melting, means for heating all of the side walls of said melting chamber to prevent snow from sticking thereto, and means for removing melted snow water from said melting chamber.

12. Snow disposal apparatus including a snow melting chamber, a heating chamber adjacent said melting cham-

ber, means for burning a fuel in said heating chamber, means for forcing streams of hot air from said heating chamber into said melting chamber to agitate and melt snow therein, means for conducting exhaust gases of the burning fuel from said heating chamber into snow in said melting chamber to melt said snow and to arrest smoke from said fuel, a water jacket surrounding said heating chamber, means for circulating melted snow water from said melting chamber into said water jacket, and means for spraying hot water from said water jacket onto snow in said melting chamber.

13. Snow disposal apparatus including a snow melting chamber, heating chambers on opposite sides of said melting chamber, a plurality of horizontally disposed air heating tanks extending across each of said heating chambers, some of said tanks being vertically offset from others of said tanks, vertically adjacent tanks being horizontally displaced from one another, and means for forcing streams of hot air from said air heating tanks into said melting chamber to melt snow therein.

14. Snow disposal apparatus including a snow melting chamber, a heating chamber on one side of said melting chamber, a plurality of horizontally disposed air heating tanks extending across said heating chamber, the tanks being arranged in horizontal rows and the tanks of adjacent rows being offset from one another, and means for forcing streams of hot air from said air heating tanks into said melting chamber to melt snow therein.

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