July 8, 1952 E. J. LEARY 2,602,443

SNOW DISSOLVER

Filed Oct. 14, 1949 2 SHEETS—SHEET 1

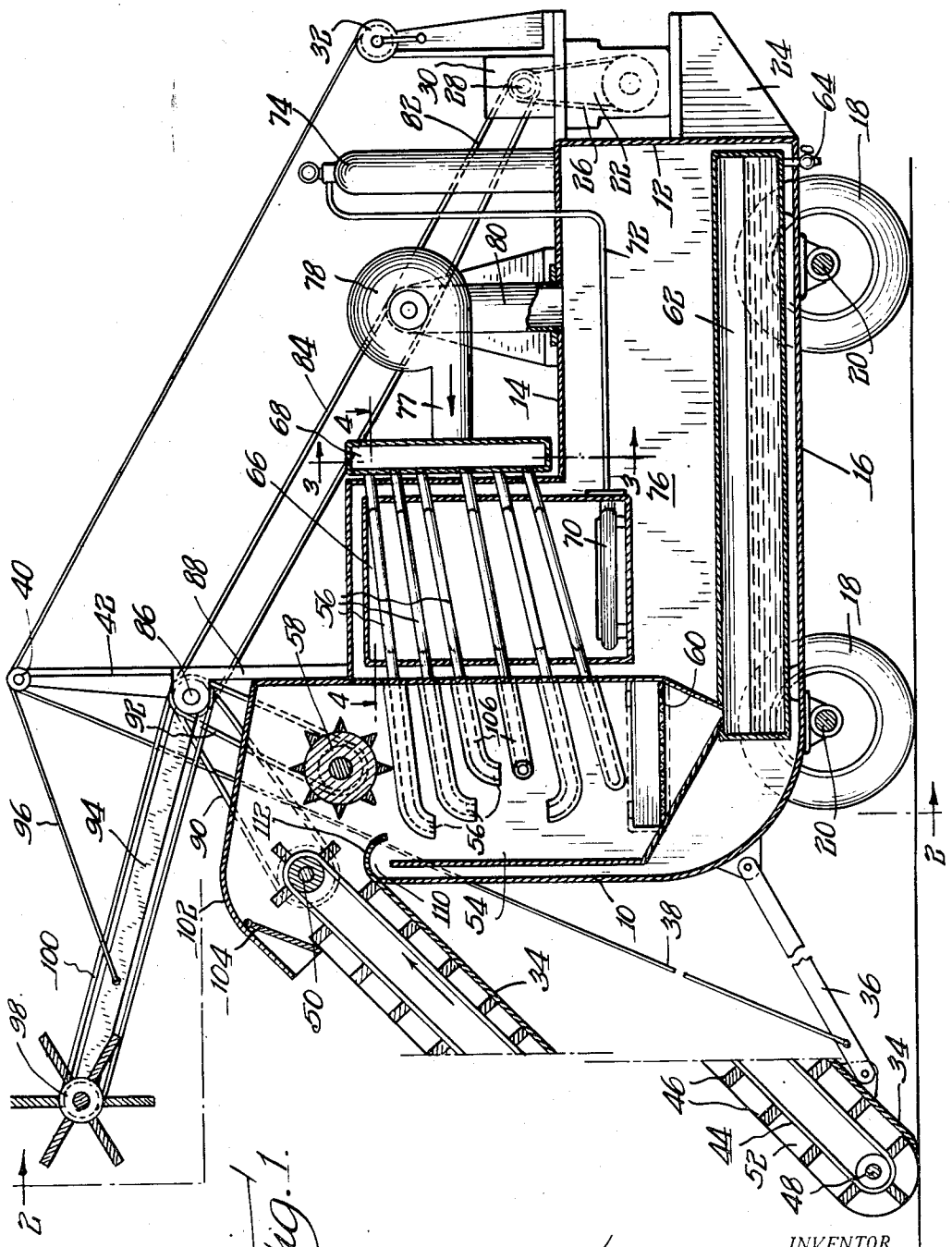

Fig. 1.

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Fig. 2.

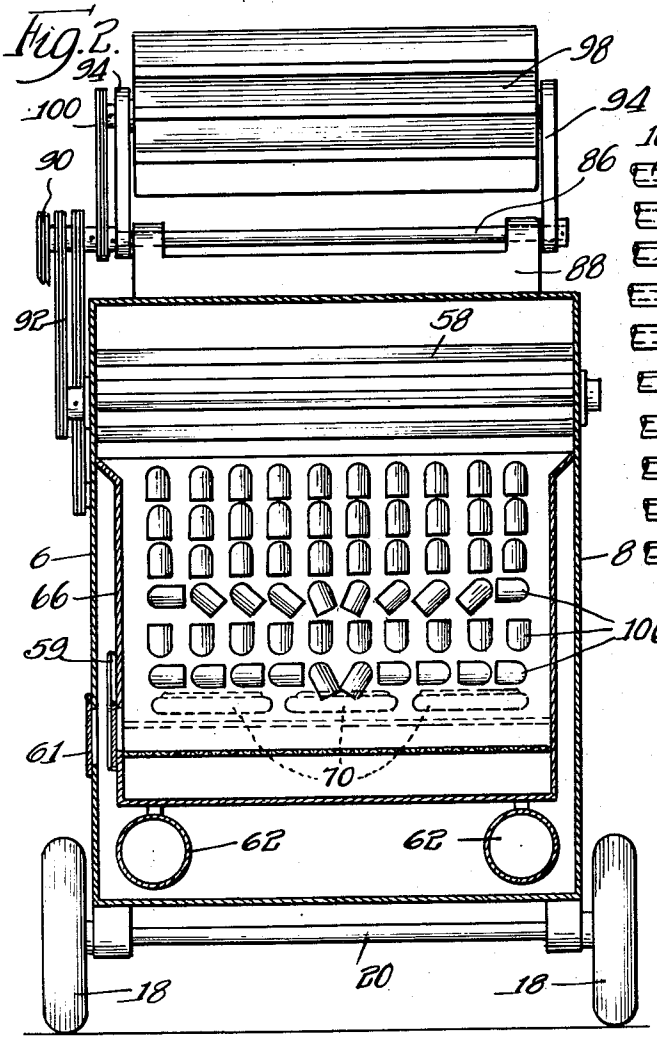
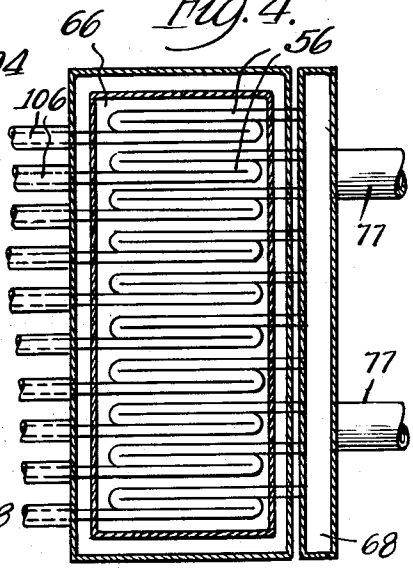


Fig. 4.



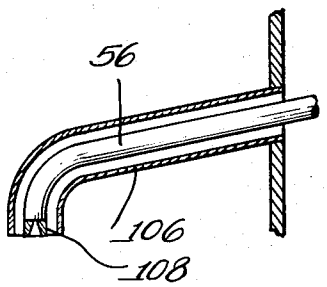


Fig. 5.

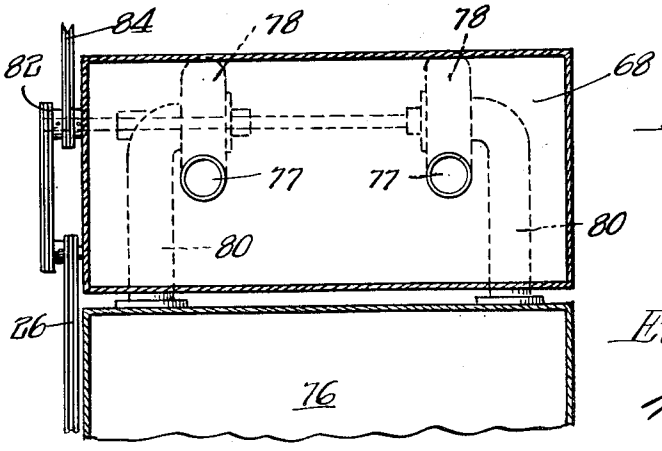


Fig. 3.

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Patented July 8, 1952 2,602,443

UNITED STATES PATENT OFFICE

2,602,443

SNOW DISSOLVER

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Application October 14, 1949, Serial No. 121,403

14 Claims. (Cl. 126—343.5)

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This invention relates generally to means for removing snow and more particularly relates to apparatus for lifting snow from roadways and the like and melting the snow so that it can be efficaciously disposed of.

The common snow plough which may constitute a single blade or may be wedge-shaped may prove generally satisfactory for pushing snow aside when snowfall has been light, but if the snowfall has been heavy or if the snow is wet or frozen, this type of plough quickly becomes stalled. The so-called rotary plough in which snow is lifted from a roadway or the like and is blown off to one side by a blower mechanism represents an improvement over the common blade plough in that it will operate satisfactorily in snow of much greater depth. It shares the disadvantage with the common blade plough that the snow must be displaced somewhere. In open country on a comparatively calm day, the snow may be readily blown to one side of the roadway, but in hilly country the hills immediately adjacent the roadway prevent the snow from being blown to one side. The same is true in industrial and residential areas where buildings may make the blowing of snow to one side of the roadway impossible and will always make it undesirable. Additionally, windy weather may cause the snow blown to one side to blow right back onto the roadway to negate the operation of the rotary plough.

It is well known that when snow is melted the water thus formed occupies only a small fraction of the volume of the snow. Accordingly, it has been proposed that snow should be removed from roadways or the like and melted to reduce its volume and simplify disposal. Prior snow removal and melting or dissolving devices with which I am familiar have attempted to melt snow by pushing it across a plate heated by burners beneath it or by blowing steam or exhaust gases from a truck or the like through the snow. Each of these devices has been plagued with one or more disadvantages which has kept it from being generally accepted.

Primary among the difficulties heretofore encountered has been that of providing sufficient capacity. The type of snow melting device which has been used in an attempt to melt snow by moving it across a heated plate is analogous to a common stove wherein snow may be melted by placing it in a bucket above a burner and may operate satisfactorily with light loading. If a fairly large quantity of snow is moved across a heated plate, the temperature of the plate is

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lowered by contact with the cold snow to such an extent that the plate will melt the snow only partially. For the plate to remain hot enough to melt the snow effectively, the snow must be advanced very slowly, and it may thus be seen that this type of melter has an inherently small capacity.

Substantially the same fault is found in melters blowing steam or exhaust gases from a prime mover through snow to melt it. The tubes through which the steam or gases are discharged are generally allowed to come into contact with the snow, which cools the pipes and prevents the steam or gases from exiting therefrom into the snow at a desirably high temperature. Additional faults are found in the steam blowing mechanism in that the water formed by the condensing steam adds to that which must be stored within the mechanism. In open country the water formed by melting snow and condensing steam may be disposed of readily by dumping it off the side of a highway, but in residential and industrial areas the water can be drained out of the mechanism only periodically and the additional water formed by the condensing steam is apt to present a serious storage problem. Snow dissolvers utilizing the exhaust from a truck or other prime mover are obviously not self-contained, and additionally deliver so little heat that very little snow can be melted.

All snow dissolvers with which I am familiar which utilize a fluid heat transfer medium require rather cold fluid to be heated. This wastes a considerable amount of fuel and often fails to raise the temperature of the fluid to a desirably high degree. Exhaust gases, air or uncondensed steam are generally exhausted directly to the atmosphere after acting upon the collected snow, and as these gases are considerably warmer than the outside air even after melting a quantity of snow, a considerable amount of heat is lost.

Other common defects which snow removers and melters suffer from include an inability to remove snow stuck at the top of banks or drifts and insufficient or no provision for keeping snow-water from freezing prior to disposal. Some attempt has been made to correct this latter difficulty by adding salt to the snow, which aids in the melting of the snow and in maintaining the water in a liquid state, but the resultant salt solution is very corrosive and materially shortens the life of the apparatus.

It is an object of this invention to provide a self-contained unit for lifting snow from a roadway or the like and melting the snow so lifted.

A more specific object is the provision of such a snow removal unit in which the snow is melted by blasts of hot air.

Another object of this invention is the provision of a snow disposal unit in which snow is melted by blasts of hot air and shields are provided for the blow pipes through which the hot air is discharged to prevent snow from coming into contact with them and lowering their temperature.

A further object of this invention is the provision of a snow lifting and dissolving unit in which the air used to melt the snow is pre-heated before being heated to its final temperature in a firebox.

A further object of this invention is the provision of a snow lifting and dissolving unit in which exhaust air from a melting chamber is used to pre-heat entering air to provide an insulating cushion and to maintain snow-water in storage tanks in a liquid state.

Yet another object of this invention is the provision of a snow lifter and dissolver having means for removing snow from the top of a high bank or drift.

Generally these objects are accomplished by a self-contained, mobile unit which may or may not be self-propelled as desired. The unit may be constructed in large sizes for highway clearance and may be propelled by a truck or self-powered, and may be made in small sizes for use on a sidewalk and may be hand operated. The snow is melted by means of jets of hot air in a substantially closed cycle, i. e., the same air is reused to prevent wastage of heat. A firebox, a melting chamber and a suitable number of storage tanks are contained within an insulated air chamber or casing. Air is blown from this chamber through blow pipes extending through the firebox and into the melting chamber, and exhaust ports are provided from the melting chamber to allow the warm exhaust air to pass from the melting chamber through double walls or bulkheads surrounding the chamber into the vicinity of the storage tanks. Concentric pipes encircle the tubes or pipes through which the air is blown into the melting chamber, and exhaust air is removed through the space between the inner and outer pipes to prevent cooling of the inner pipes and consequently of the air passing therethrough. An inclined ramp and conveyor are utilized to lift snow from the roadway or other surface into the melting chamber, and a rotatable paddle wheel is provided which may be raised to any desired height to knock snow down from an elevated position, such as the top of a bank or drift, onto the conveyor.

The details of one form of my invention will be understood from a perusal of the following description when taken in conjunction with the accompanying drawings in which:

Figure 1 is a longitudinal sectional view of my apparatus;

Figure 2 is a sectional view taken substantially along the line 2—2 in Figure 1;

Figure 3 is a sectional view taken substantially along the line 3—3 in Figure 1;

Figure 4 is a sectional view taken substantially along the line 4—4 in Figure 1; and

Figure 5 is a longitudinal sectional view showing one of the blow pipes in detail.

My snow lifting and dissolving unit includes an outer casing which may include side walls 6 and 8, front and rear walls 10 and 12, as well as top and bottom walls 14 and 16. all of which

may be constructed of sheet material and suitably insulated. Wheels 18 may be mounted on axles 20 suitably secured beneath the bottom wall 16 so that the entire unit may be moved at will. An internal combustion engine 22 is mounted on an engine bracket 24 suitably secured to the rear of the unit, and supplies power through suitable belting 26 to a pulley structure 28 suitably mounted on a bracket 30 above the engine. A hand operated winch 32, which may be in two sections, is also suitably secured to the bracket 30.

A ramp 34 slidably rests at its upper end on the top edge of the wall 10, and is secured in position by a brace 36 pivoted at one end to the ramp adjacent its lower end and at the other end to a point adjacent the bottom of the front wall 10. A cable 38 may run from the brace 36 adjacent the lower end thereof over a pulley structure 40 rotatably mounted on a bracket 42 extending above the main portion of the snow removal unit, and from there to the winch 32 so that the ramp 34 may be raised from contact with the ground. It is to be understood that a suitable connection is provided to prevent the upper end of the ramp from sliding off the edge of the front wall 10 and that if desired the ramp 34 could be hinged at the top end and the brace 36 could be telescoping or otherwise extendable to elevate the lower end of the ramp. An endless belt 44 carrying spaced cleats 46 passes over pulleys 48 and 50 located at the lower and upper ends of the ramp respectively to push snow up the ramp. Side walls 52 are provided on the ramp to prevent snow from falling off the sides thereof.

Snow passes from the ramp 34 into a melting or dissolving chamber 54 where it is dissolved by jets of hot air from a plurality of blow pipes 56, the construction of which will be described in detail later. A cleated, cylindrical agitator 58 is provided at the top of the melting chamber 54 to prevent packing and jamming of snow delivered thereto from the ramp 34. The bottom of the melting chamber 54 is substantially funnel-shaped in cross section so that water passing through a screen 60 to remove foreign objects will drain readily into storage tanks 62, which in the present illustration are two in number. One or more valves 64 are provided at the bottoms of the tanks so that water may be discharged therethrough into a drain, or in open country through a pipe or hose off the roadside. As stones and other foreign objects will collect on the screen 60 and must be removed therefrom, a sliding door 59 is provided in one side wall of the melting chamber directly opposite a door 61 in the side wall 6.

A heat member or firebox 66 is located adjacent the melting chamber 54, and the blow pipes 56 extend through the heat chamber or firebox from a manifold 68. The heat chamber or firebox may be of any well known type, and has burners 70 provided with gas or other fuel through a supply line 72 from a tank 74 carried at the rear of the snow disposal unit and which may conveniently consist of one or more steel bottles containing gas such as propane or butane. The engine 22 may be run on this fuel if desired. Air is supplied to the firebox 66 through suitable intakes which may be from the outside air or preferably from the air chamber 76 comprising substantially all of the interior of the unit heretofore unaccounted for, and products of combustion may be exhausted from the firebox in any suitable manner, although it is preferable that the heat from the exhaust should be trans-

ferred to the air chamber 76 insofar as possible. Air may be supplied to the manifold 68 through ducts 77 from a plurality of blowers 78 which may be of the centrifugal type and which receive air through ducts 80 from the air chamber 76.

Power is supplied from the pulley structure 26 through a belt 82 to a pulley mounted on the shaft of the blower 78, and from there through a belt 84 to a power shaft 86 carried by a bracket 88 atop the snow disposal unit. Power is transmitted from the power shaft 86 through a belt 90 to the conveyor belt 44 and through a belt 92 to the snow agitator 58.

Support arms 94 are suitably pivoted at one end of the bracket 88 and are supported and adjusted by means of a cable 96 passing over the pulley structure 40 atop the bracket 42 to one section of the hand operated winch 32. A paddle wheel 98 is rotatably carried at the free ends of the arms 94 and is driven by a belt 100 from the power shaft 86 to knock snow down onto the ramp 34 from an elevated position such as a bank or drift.

A hood 102 is carried above the melting chamber 54, and a flat 104 is carried by the hood directly above the ramp 34 to inhibit the passage of warm air from the snow melting chamber into the atmosphere. The melting chamber 54 and firebox 66 are both spaced somewhat from the outside walls of the snow disposal unit so that they are actually contained within the air chamber 76. Alternatively, the melting chamber and firebox may be thought of as having hollow walls opening to the air chamber 76. The purpose of this will be fully understood following a further description of the blow pipes and the movement of air through the snow disposal unit.

Several banks of blow pipes 56 are provided and are offset longitudinally from one another, as may be seen best in Figure 1, in order to discharge hot air over as large an area as possible. Each of the blow pipes 56 is curved at substantially right angles adjacent its discharge end, and each blow pipe has a protective pipe 106 concentrically mounted about it within the melting chamber 54 and opening into the air chamber 76. The discharge from the various banks of blow pipes 56 is directed in different directions, as in the present illustration wherein the top three banks are directed downward, the middle and lower banks are directed horizontally, and the remaining bank is directed upwardly, to strike the snow from as many angles as possible to melt it very quickly. As may be seen in Figure 5, each blow pipe 56 may be provided with a nozzle 108 to direct the air in a jet so that it will cut into the snow in a particularly effective manner. The blow pipes extend through the firebox 66 substantially horizontally and are curled back upon themselves substantially horizontally, as may be seen best in Figure 4, in order that the air passing therethrough may be heated to a very high degree.

When the snow disposal unit is operated, air is removed from the air chamber 76 through the ducts 80 and blown by the blowers 78 through the ducts 77 into the manifold 68. A plurality of blowers is used rather than a single large fan in order to give a wide range of air capacity without sacrificing efficiency to too great an extent. All of the blow pipes 56 are supplied with air from the same manifold 68, as it is necessary that air should be passing through all of the pipes when the unit is in operation to prevent any of the pipes from being burned out in the intense heat within the firebox 66. Air from the blow pipes 56 is discharged from the ends thereof in an obvious manner to melt the snow falling from the ramp 34. Even after melting the snow, the air is at a considerably higher temperature than the outside air and it is prevented from being dissipated into the atmosphere by the aforementioned hood 102 and flap 104. Exhaust ports 110 are provided adjacent the top of the melting chamber so that warm exhaust air may pass through them and through the hollow walls surrounding the melting chamber into the air chamber 76. The ports are protected from snow falling from the ramp by means such as caps 112. Additional exhaust means is provided from the dissolving or melting chamber 54 through the space between the concentric blow pipes 56 and their shields 106 into the air chamber 76. The warm air passing through this space prevents the blow pipes from being cooled by snow in the melting chamber, which would lower the temperature of the air discharged from the blow pipes and greatly reduce the efficiency of my apparatus. Thus, it may be seen that the air in the air chamber is supplied with the warm exhaust air from the melting chamber and is additionally heated by conduction through the walls of the firebox 66 contained within the air chamber 76. As the air supplied from the air chamber 76 is at a considerable degree above the outside air, it may be said to be pre-heated, and as the air passes through the blow pipes through the firebox 66, it is both heated and superheated so that the pipes within the firebox and even within the melting chamber may be maintained at a red heat to deliver extremely hot air to melt the snow. As the storage tanks 62 are located within the air chamber 76, it may be seen that no problems of freezing within the storage tanks are encountered prior to discharge of the water therefrom.

Those skilled in the art will now realize that I have provided a snow lifting and dissolving apparatus which has a much larger capacity than prior similar devices, due largely to the preventing of cooling of the heat delivering means by contact with snow, and which has a much higher efficiency than similar apparatus heretofore disclosed, due largely to the closed, continuous air cycle which prevents discharge of heat to the atmosphere and which allows the air directed upon the snow to be heated to a much higher and consequently more efficient temperature. Additionally, all problems of water freezing within the storage tanks are positively precluded by the carrying of the tanks within a heated chamber.

Although I have shown and described a particular embodiment of my invention, it is to be understood that this is for illustrative purposes only and that my invention is to be limited only by the spirit and scope of the following claims.

I claim:

1. Snow disposal apparatus comprising a dissolving chamber, means for introducing snow into said dissolving chamber, hot air supplying means, a blow pipe extending into and opening within said dissolving chamber and communicating with said hot air supplying means, and a shield surrounding said blow pipe and opening exteriorly of said dissolving chamber to allow warm air to pass out of said dissolving chamber through the space between said blow pipe and said shield to prevent cooling of said blow pipe by snow in said dissolving chamber.

2. Snow disposal apparatus comprising a dis-

solving chamber, means for introducing snow into said dissolving chamber, hot air supplying means, a plurality of blow pipes extending into and opening within said dissolving chamber and communicating with said hot air supplying means, and a plurality of shields surrounding said blow pipes and opening exteriorly of said dissolving chamber to allow warm air to pass out of said dissolving chamber through the space between said blow pipes and said shields to prevent cooling of said blow pipes by snow in said dissolving chamber.

3. Snow disposal apparatus including a substantially air-tight casing, a snow dissolving chamber within said casing, a heating chamber within said casing, means for introducing snow from outside said casing into said dissolving chamber with a minimum of air flow to and from said casing, means for forcing air from said casing into said heating chamber, means for directing hot air from said heating chamber into said dissolving chamber and against snow therein in a plurality of non-parallel paths, and means for exhausting warm air from said dissolving chamber into said casing past and around said heating chamber for pre-heating of the air.

4. Snow disposal apparatus including a substantially air-tight casing, a snow dissolving chamber within said casing, a heating chamber within said casing, water storage means within said casing, means for introducing snow from outside said casing into said dissolving chamber with a minimum of air flow to and from said casing, means for forcing air from said casing into said heating chamber, means for directing hot air from said heating chamber into said dissolving chamber and against snow therein, means for conducting dissolved snow from said dissolving chamber into said water storage means, and means for exhausting warm air from said dissolving chamber into said casing past said heating chamber for pre-heating and past said water storage means to prevent freezing of water therein.

5. Snow disposal apparatus as set forth in claim 4 wherein the means for directing hot air against snow in the dissolving chamber includes a plurality of blow pipes.

6. Snow disposal apparatus as set forth in claim 4 wherein the means for forcing air from the casing into the heating chamber comprises a plurality of air impellers.

7. Snow disposal apparatus as set forth in claim 4 wherein the means for directing hot air against snow in said heating chamber includes means for directing the air in a plurality of substantially parallel streams.

8. Snow disposal apparatus including a substantially air-tight casing, a snow dissolving chamber within said casing, a heating chamber within said casing, means for introducing snow from outside said casing into said dissolving chamber with a minimum of air flow to and from said casing, a plurality of blow pipes extending through said heating chamber and terminating in said dissolving chamber with their ends offset from one another and directed in a plurality of directions, means for forcing air from said casing through said blow pipes, and means for exhausting warm air from said dissolving chamber into said casing past said heating chamber for pre-heating of the air.

9. Snow disposal apparatus including a substantially air-tight casing, a snow dissolving chamber within said casing, a heating chamber within said casing, means for introducing snow from outside said casing into said dissolving chamber with a minimum of air flow to and from said casing, a plurality of blow pipes passing through said heating chamber and terminating in said dissolving chamber, shield means preventing contact of snow in said dissolving chamber against said blow pipes to preclude cooling of said blow pipes, means for forcing air from said casing through said blow pipes to direct hot air against snow in said dissolving chamber, and means for exhausting warm air from said dissolving chamber into said casing past said heating chamber for pre-heating.

10. Snow disposal means as claimed in claim 9 in which the shield means comprises a plurality of casings about said blow pipes in said dissolving chamber and opening exteriorly of said dissolving chamber to exhaust warm air through the space between said casings and said blow pipes into the substantially air-tight casing to prevent cooling of said blow pipes.

11. Snow disposal apparatus including a substantially air-tight casing, a snow dissolving chamber within said casing, a heating chamber within said casing, means for introducing snow from outside said casing into said dissolving chamber with a minimum of air flow to and from said casing, means for forcing air from said casing into said heating chamber, means for directing hot air from said heating chamber into said dissolving chamber and against snow therein in a plurality of non-parallel paths, means for warming the walls of said dissolving chamber to prevent sticking and non-melting of snow thereon, and means for exhausting warm air from said dissolving chamber into said casing past and around said heating chamber for pre-heating of the air.

12. Snow disposal apparatus as claimed in claim 11 in which the means for warming the walls of the dissolving chamber includes an air space between the dissolving chamber and the substantially air-tight casing through which warm exhaust air from the dissolving chamber is directed.

13. Snow disposal apparatus comprising a dissolving chamber, means for introducing snow into said dissolving chamber, a heating chamber, blow pipe extending through said heating chamber and extending into and opening within said dissolving chamber, an air impeller for forcing air through said blow pipe for heating of the air and discharge of the heated air into said dissolving chamber, and a shield surrounding said blow pipe and opening into said dissolving chamber, said shield and said blow pipe defining a space in communication with said air impeller whereby warm air is withdrawn from said dissolving chamber to prevent cooling of the blow pipe by snow and for recirculation of the air.

14. Snow disposal apparatus comprising a dissolving chamber, means for introducing snow into said dissolving chamber, a heating chamber, a plurality of blow pipes extending through said heating chamber and extending into and opening within said dissolving chamber, air impelling means for forcing air through said blow pipes for the heating of air and discharge of warm air into said dissolving chamber, and a plurality of shields each surrounding a blow pipe and opening into said dissolving chamber, said blow pipes and said shields defining spaces between them communicating with said air impelling means whereby warm air is withdrawn through said

spaces to prevent cooling of said blow pipes by snow and for recirculation of the air.

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