May 19, 1931. R. L. LLOYD 1,806,069

APPARATUS FOR MELTING SNOW

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Fig. 1.

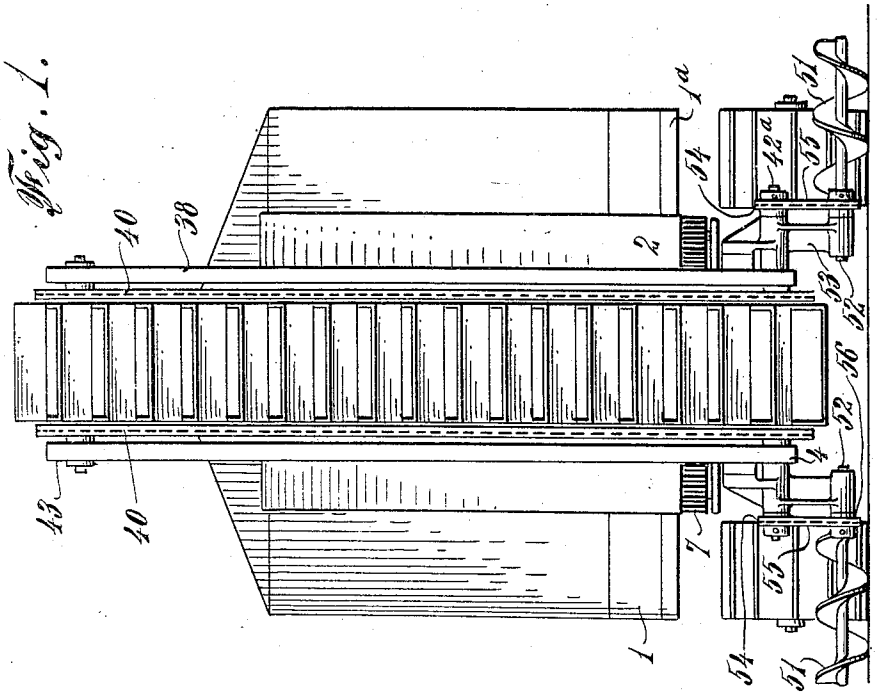
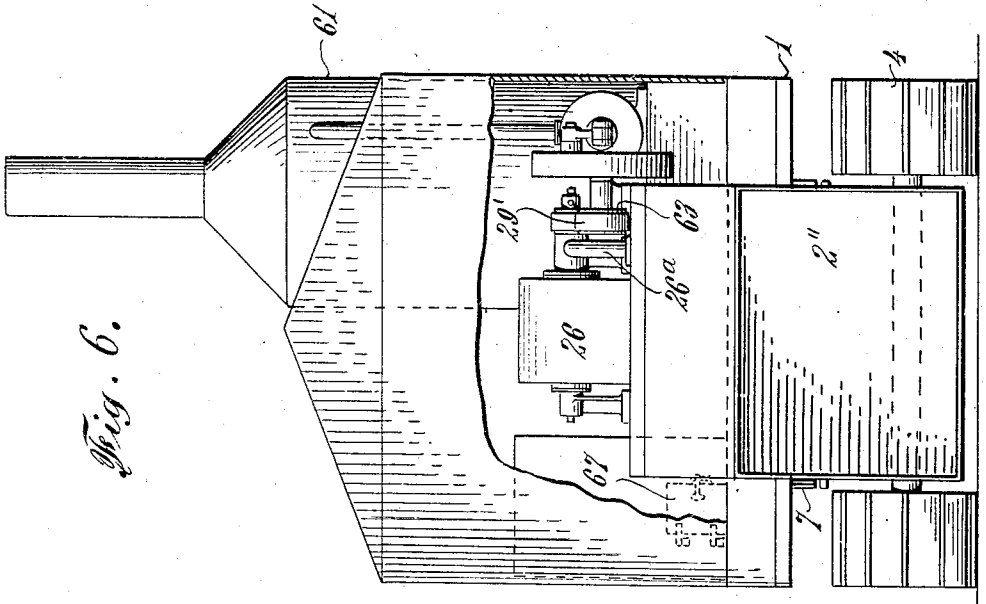


Fig. 6.



INVENTOR.
R. L. Lloyd
BY
T. F. Bowne
ATTORNEY

May 19, 1931. R. L. LLOYD 1,806,069

APPARATUS FOR MELTING SNOW

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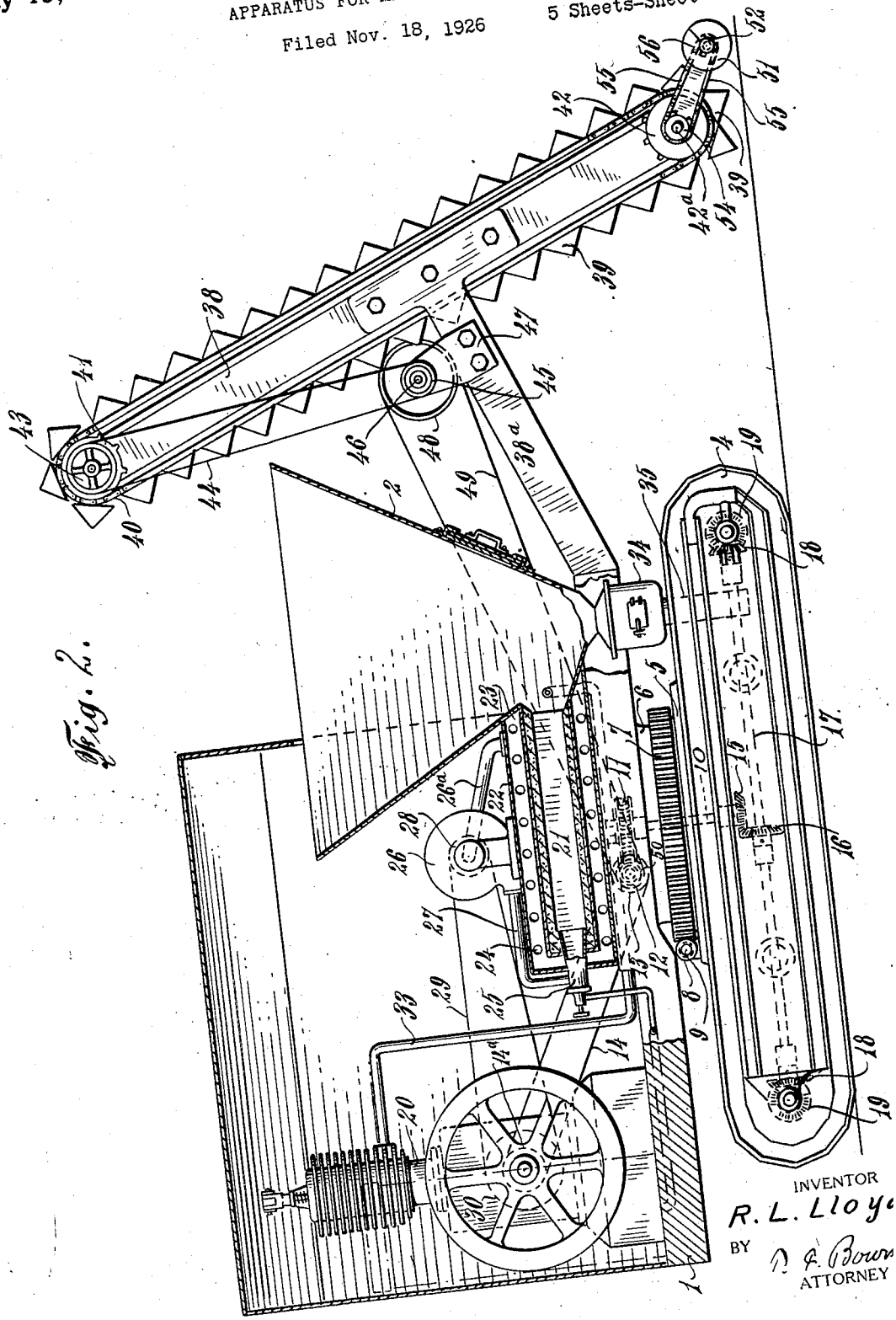


Fig. 2.

INVENTOR
R. L. Lloyd
BY D. F. Bowers
ATTORNEY

May 19, 1931. R. L. LLOYD 1,806,069

APPARATUS FOR MELTING SNOW

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Fig. 3.

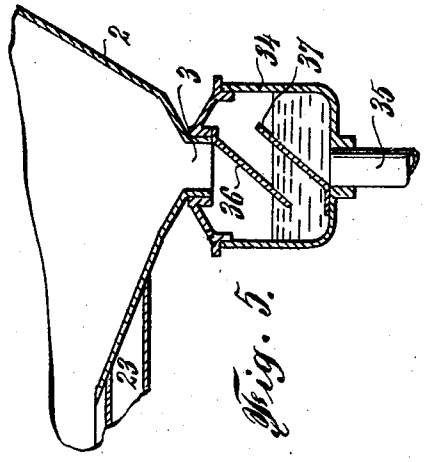
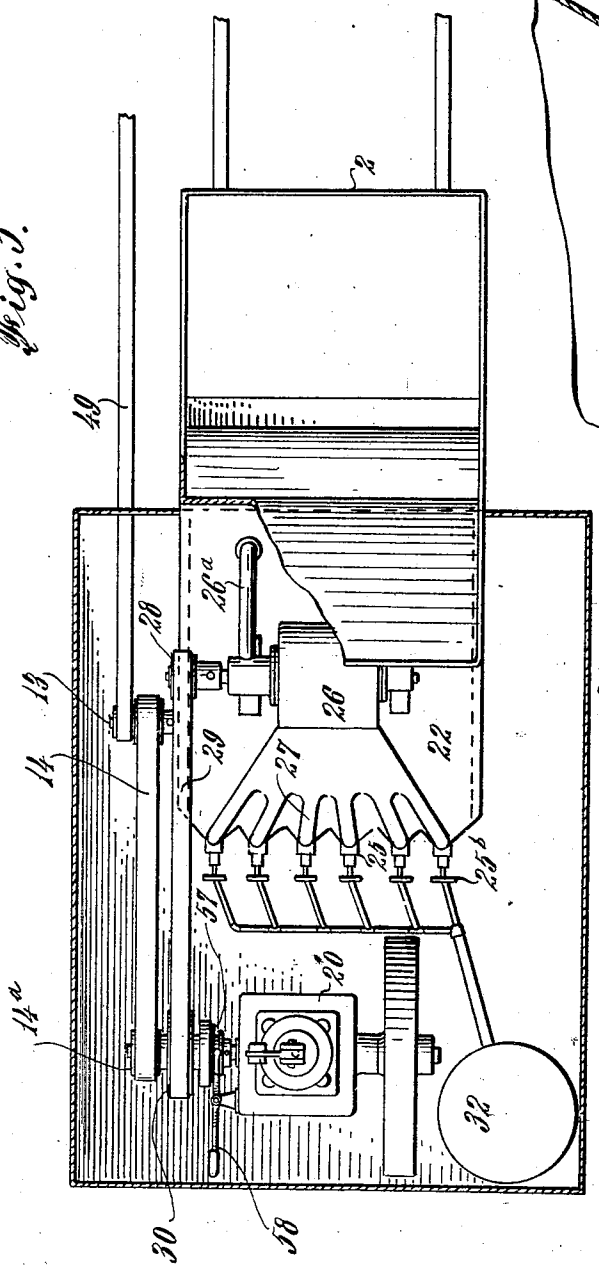


Fig. 5.



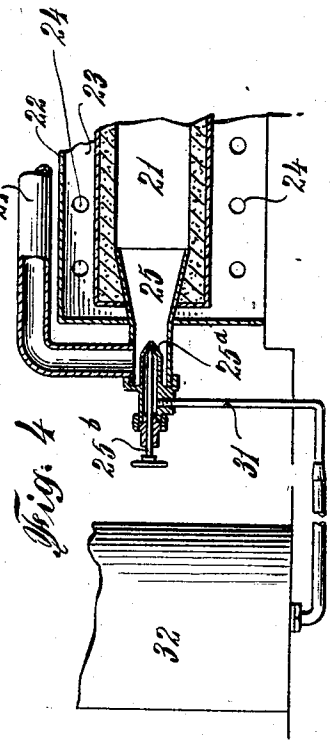


Fig. 4

INVENTOR
R. L. Lloyd
BY R. F. Bourne
ATTORNEY

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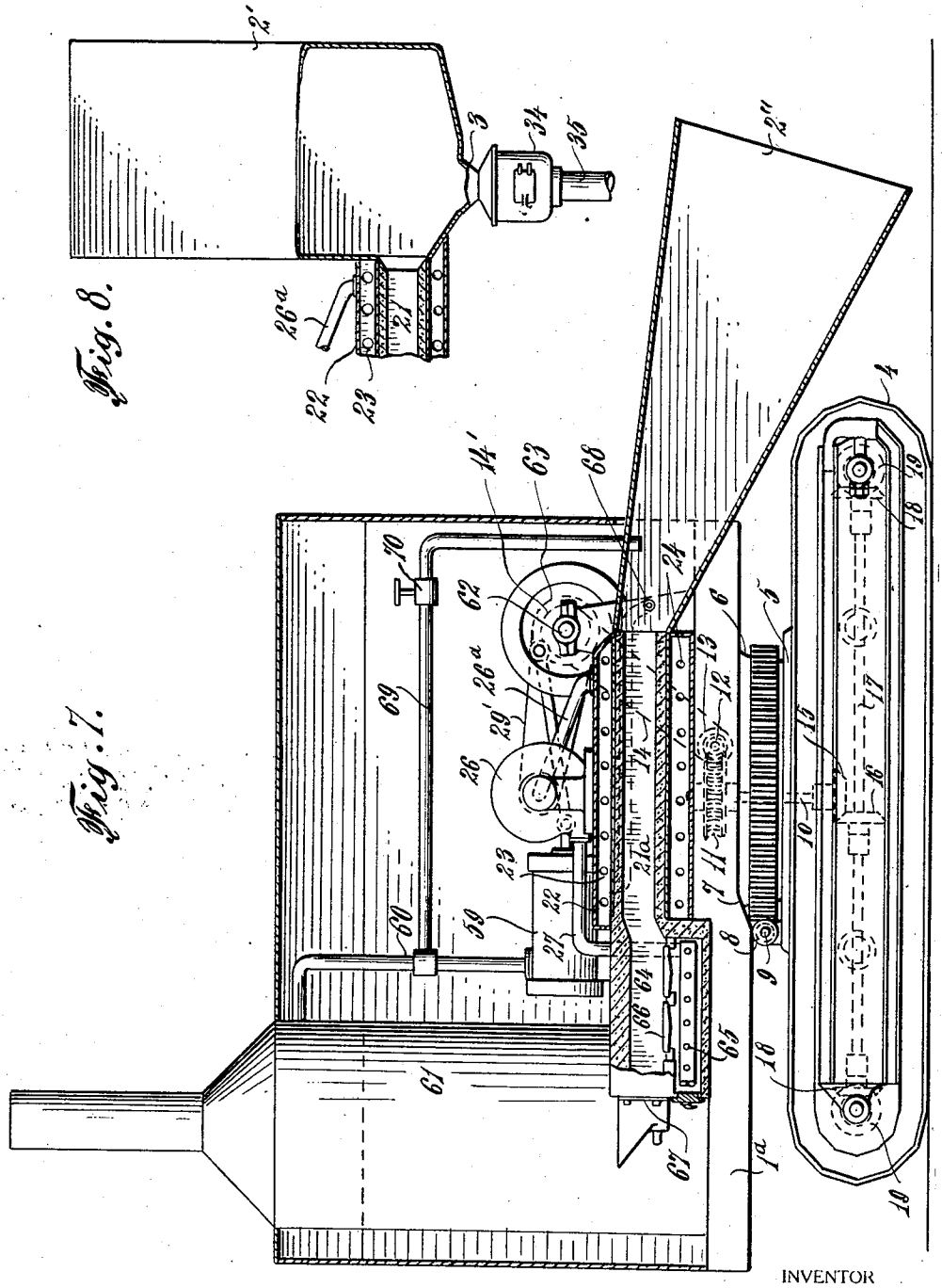


Fig. 8.

Fig. 7.

INVENTOR
R. L. Lloyd
BY
T. F. Bourne
ATTORNEY

May 19, 1931. R. L. LLOYD 1,806,069

APPARATUS FOR MELTING SNOW

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Fig. 10.

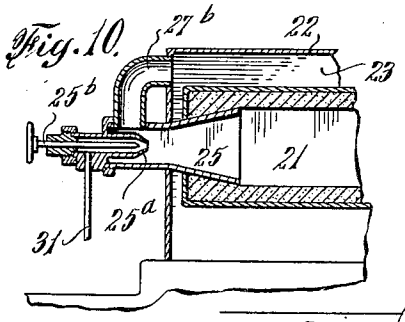
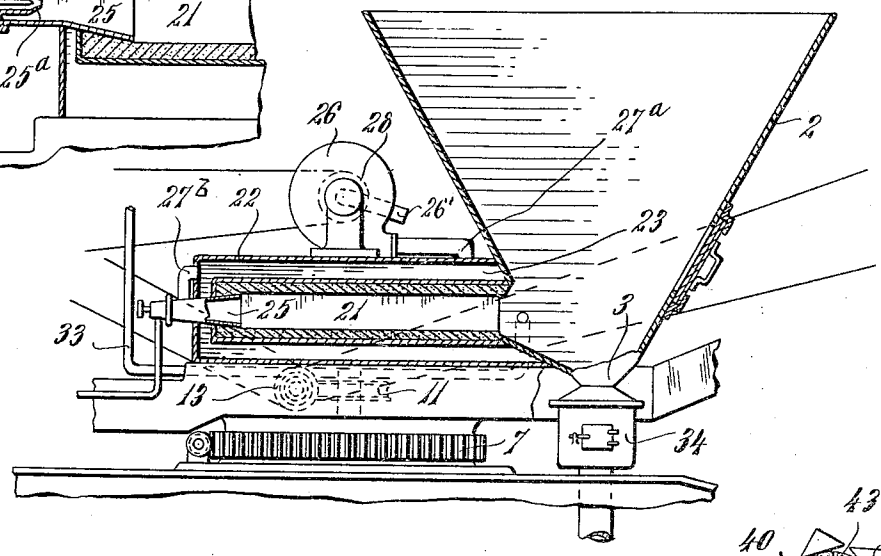


Fig. 9.



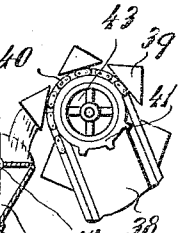


Fig. 12.

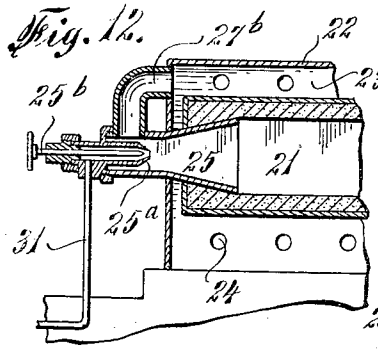


Fig. 11

INVENTOR
R. L. Lloyd

BY

R. F. Bourne
ATTORNEY

Patented May 19, 1931 1,806,069

UNITED STATES PATENT OFFICE

RICHARD LEWIS LLOYD, OF NEW YORK, N. Y.

APPARATUS FOR MELTING SNOW

Application filed November 18, 1926. Serial No. 149,067.

The object of my invention is to melt snow to cause its ready removal from desired places, or to melt snow or ice from frozen material to loosen or separate the latter, such as coal, by forcing heated air, gases, vapor, or steam through the mass to reduce the snow or ice to water which will flow away to any desired place.

A particular object of my invention is to provide means for melting snow on roadways and other places in such a way that the water from the melted snow will be discharged on to the roadway, or may be conducted away through a suitable conduit, whereby snow removal may be carried out expeditiously and economically.

In the accompanying illustrations of my invention I provide a vehicle with means for propelling it, said vehicle being provided with a receiver for snow and with means to heat air and force it through the snow in the receiver for melting the snow, and means to cause discharge of water resulting from the melted snow, whereby the snow may be charged into the receiver and melted as the apparatus proceeds along a roadway or other place.

In addition to forcing heated air through the snow the discharged heated gases or vapors from the heating apparatus are also preferably directed into the snow in the receiver, whereby the heat in such exhaust gas or vapor is utilized to assist in melting the snow, or steam with heated air may be forced through the snow for melting it.

My invention also comprises novel details of improvement that will be more fully hereinafter set forth and then pointed out in the claim.

Reference is to be had to the accompanying drawings forming a part hereof, wherein

Fig. 1 is a front elevation of a snow melting apparatus embodying my invention illustrating a receiver at the forward part of the apparatus adapted to receive the snow for melting as the apparatus advances;

Fig. 2 is a side elevation, partly in section, of part of the apparatus;

Fig. 3 is a partly broken plan view, the elevator being omitted;

Fig. 4 is a partly sectional detail of air heating means for melting the snow;

Fig. 5 is a sectional detail of the receiver;

Fig. 6 is a partly broken front view of a modified form of apparatus;

Fig. 7 is a side elevation, partly in section, of said modified form of apparatus;

Fig. 8 is a sectional detail of a modified form of snow receiver;

Fig. 9 is a sectional view through the heater and snow receiver illustrating a modification;

Fig. 10 is an enlarged detail of part of Fig. 9;

Fig. 11 is a sectional view illustrating another modification, and

Fig. 12 is an enlarged detail of Fig. 11.

Similar numerals of reference indicate corresponding parts in the several views.

A vehicle is indicated generally at 1, which may be of any desired or suitable construction adapted to travel along a roadway or the like.

Said vehicle is provided with a snow receiver 2, which may be in the form of a hopper, as indicated in Figs. 1, 2, 3, 5 and 8, open at the top to receive the snow and provided with a discharge outlet at 3. The vehicle body or frame may be provided with any suitable means for supporting it for travel along the ground. I have illustrated a support in the nature of a caterpiliar, indicated generally at 4, upon which the frame 1*a* of the vehicle is mounted to swivel on a vertical axis by means of a bearing 6 depending from the vehicle body and journaled on the vehicle, in the nature of a turn-table. A gear 7 secured to said bearing 6 is in mesh with a pinion 8 on a shaft 9 that is journaled in a transverse direction upon the vehicle, (Figs. 2 and 7). A crank handle may be applied to said shaft for rotating the vehicle body upon the vehicle or angularly respecting the snow in front. A shaft 10 journaled on a vertical axis at the center of the vehicle is provided with a worm wheel 11 in mesh with a worm 12 journaled upon the vehicle body and rotated by sprocket wheel or pulley 13 secured to the worm 12 and driven by a chain or belt 14. At the lower end the shaft 10 is shown provided with a bevel gear 15 in mesh with a cor-

responding gear 16 on a longitudinal shaft 17 journaled upon the vehicle, the shaft 17 being shown provided with gears 18 at its ends in mesh with gears 19 that operate the chains of the vehicle for propelling the latter.

A motive power apparatus for operating my improvement may comprise an internal combustion engine or a steam engine. An internal combustion engine is indicated at 20, adapted to operate the chain or belt 14 by means of sprocket wheel or pulley 14*a* on the motor drive shaft, whereby the vehicle may be propelled as required. At 21 is a heating chamber carried by the vehicle body, shown enclosed within an annular casing 22 providing a chamber 23 for air to be heated by radiation from chamber 21. Chamber 23 may be supplied with atmospheric air by means of openings at 24. The chamber 21 communicates with the lower part of receiver or funnel 2 to supply heated air to the snow in the receiver. At 25 are indicated oil burners which may be of any suitable construction, shown projecting into chamber 21, adapted to deliver blasts of flame thereinto. Air under pressure for the burners may be supplied by means of any suitable air blower carried by the vehicle, indicated at 26. Pipe 26*a* provides communication between chamber 23 and the blower for delivering heated air to the latter from said chamber. The blower is shown provided with air delivery tubes 27 communicating with the corresponding burners 25. The blower 26 is shown provided with pulley 28 receiving belt 29 from pulley 30 operated by the motor 20, (Fig. 3). The oil jets 25*a* of the burners are shown connected by tubes 31 with a fuel oil tank 32 carried by the vehicle, (Figs. 3 and 4), the delivery of the oil being controlled by valves 25*b* in a well known way. The exhaust pipe 33 from the internal combustion motor 20 terminates in the lower part of receiver 2, (Fig. 2), for delivering hot exhaust gases into the snow in the receiver. The burners 25 may receive any appropriate fuel.

When snow is placed in the receiver and the heated air and the hot gases of combustion both from the fuel burners 25 and from the exhaust pipe 33 are blown into the snow they will percolate upwardly through the snow, being first applied to the snow in the lower part of the receiver, so that as the heated air and gases encounter and travel through the snow they will melt the latter, which will flow through the lower outlet 3 of the receiver. In order to prevent the heated air and gases from blowing away through receiver outlet 3 I provide a water trap communicating with said outlet and indicated at 34, the lower part of the trap being provided with a discharge outlet at 35 to deliver the melted snow or water to the roadway or ground. Within trap 34 are baffle plates 36, 37, spaced apart, the baffle plate 36 extending downwardly into the trap casing, and the baffle plate 37 extending upwardly from the bottom within the trap casing with its upper edge above the lower edge of plate 36, providing a water seal within the trap to resist the outflow of the air and gases so that they will be compelled to flow through the snow in the receiver. The water from the trap flowing over the upper edge of plate 37 is discharged through the outlet 35.

Instead of drawing heated air from chamber 23 through the blower 26 for discharge through the burners 25 into chamber 21 air may be blown through chamber 23 to the burners, as illustrated in Figs. 9 and 10. In this form the blower 26 will take in outside air through its inlet 26′ and blow said air through the outlet 27*a* into chamber 23, in which chamber the air will be heated and will be discharged through pipes 27*b* into the burners for passage through chamber 21 into the snow.

In the form of receiver having its open receiving end projecting upwardly, as illustrated in Figs. 1 to 3, 5 and 8, the snow may be charged into the receiver manually or in any other desired way. In Fig. 8 is illustrated a tubular form of receiver 2′ as distinguished from the cone-like form illustrated in Fig. 2. For expedition in snow removal I provide an elevator, indicated generally at 38, which may be of any well known construction, provided with buckets or scoops 39 on endless chains 40 so inclined over the top of the receiver 2 as to dump snow thereinto, (Fig. 2). The frame of the elevator is shown provided with upper and lower sprocket wheels 41 and 42, over which the chains 40 travel for operating the buckets or scoops. A pulley 43 on the shaft of sprocket wheel 41 receives a belt 44 from a pulley 45 on a shaft 46, shown journaled upon bracket 47 carried by the arm 38*a* of the elevator, which shaft is provided with a pulley 48 receiving belt 49 from a pulley 50 on shaft 13, (Fig. 2), whereby the chains 40 are driven for operating the elevator. In order to gather snow at the sides of the elevator and advance it to a position to be scooped up by the buckets of the elevator I provide right and left hand worms 51 carried by shafts 52 journaled in arms 53 that project downwardly and forwardly from the lower part of the elevator. The shaft 42*a* of the elevator is provided with sprocket wheels 54 receiving chains 55 that pass over sprocket wheels 56 on the shaft 52. When the elevator is being operated to discharge snow from a roadway into receiver 2 the worms 51 will be operated to push snow at the sides of the elevator to a position in front of the same to be scooped up for delivery into the receiver.

In order to control the operation of the mechanism described from the motor 20 a clutch of any well known character may be

provided at 57, operable by hand lever 58, whereby the clutch may be thrown into and out of action as desired for controlling the pulleys 14*a* and 30 that are loose on the motor drive shaft to be driven by the latter through the clutch.

Instead of forcing heated air through the snow in the receiver by blowing said air the heated air may be exhausted or sucked through said snow, in the form shown in Figs. 11 and 12 wherein the receiver 2*b* is provided with a cover 2*a* to which is attached a pipe 26*c* leading to the air intake of the exhaust apparatus or blower 26, from which the air flows through outlet 27*d*. Air enters chamber 23 through openings 24 to be heated therein and flows to the burners 25 through pipes or connections 27*b*. The apparatus 26 will induce or force flow of the air from the burners through chamber 21 into and through the snow in the receiver 2*b*, thence through pipe 26*c* to apparatus 26, maintaining a flow of heated air through the snow for melting it. The cover 2*a* is shown provided with an inlet chute or passage 71 for the snow delivered thereto by the elevator 38, and said chute or passage is provided with a rotary gate 72, shown comprising radially disposed vanes or wings 73, horizontally pivoted at 74, the outer edges of which are adapted to engage the walls of the chute, during rotation, to resist the entrance of air, in conjunction with the charges of snow delivered by the elevator buckets 39. The weight of the snow on the gate will cause its rotation for delivering the snow through the chute into receiver 2.

Instead of operating the apparatus by means of an internal combustion engine the appartus may be provided with a steam boiler and steam engine, indicated in Figs. 6 and 7. A steam engine is shown at 59 carried by the vehicle and supplied with steam through pipe 60 from boiler 61. Pulley or sprocket wheel 14′ is carried by the engine shaft 62 and the air blower 26 is driven by belt 29′ operated by pulley 63 on the engine shaft, (Fig. 7). Heated air for the blower is supplied from chamber 23 through pipe 26*a*, and the blower delivers air through pipes 27 to a combustion chamber 64 through outlet nozzles 65 shown in the lower part of the chamber below grate bars 66 therein. The combustion chamber communicates with heating chamber 21*a* and the combustion chamber is provided with a door 67 for supplying coal on the grate bars, in an ordinary way for feeding coal to furnaces. When air is blown through pipe 27 into the combustion chamber 64 said air will pass through the bed fire on the grate bars and such heated air and products of combustion from the coal fire will pass through chamber 21. Radiation from the chamber heats air in chamber 23 to conserve heat. The heated air and products of combustion will flow under pressure into the funnel-like receiver 2″, (Fig. 7), and thence into and through the snow therein for melting the latter, the melted snow or water flowing out through the lower end of the receiver, which extends downwardly so that the melted snow will be delivered upon the roadway or ground. The receiver 2″ is adapted to scoop up the snow as the vehicle travels. Exhaust steam from the steam engine may be delivered into the inner end of the receiver 2″ by means of pipe 68 leading from the engine exhaust port to aid in melting the snow in the receiver. Live steam may be supplied from the boiler through pipe 69, controlled by valve 70, to the receiver 2″ for melting the snow therein.

In accordance with my invention the removal of snow from streets, roadways and other places may be more expeditiously and economically performed than is customary where it has been necessary to shovel the snow into trucks and transport the snow to some dumping place. By the use of my improvement a limited number of operatives are required, men merely being necessary to operate the apparatus and keep the receiver supplied with snow, thereby dispensing with the use of trucks for hauling, because the cost of the fuel required for blowing hot air and gases through the snow in a receiver or funnel will be considerably less than the cost of the trucks and men required as compared to the practise of shoveling, hauling and dumping the snow. Furthermore, the operation of my improved apparatus may be substantially continuous and the vehicle may travel forwardly or be turned in any desired directions to scoop up the snow in advance of the traveling vehicle.

While I have illustrated my improved snow removing vehicle or apparatus as mounted upon a caterpillar form of supporting and propelling mechanism it will be understood that the apparatus may be provided upon wheels and driven in the ordinary form of a motor vehicle or truck. But the caterpillar form lends itself particularly for snow removal use since it can travel through deep snow with greater facility than an ordinary motor truck.

While I have illustrated a receiver in which snow may be placed for melting, it will be understood that any other desired frozen material may be placed in the receiver through which the air, steam or other gases may be forced. It also will be understood that, in accordance with my invention, the heated air, steam or other gases may be forced through snow or snow mixed with other material, or through frozen or partially frozen material, such as frozen coal, by directing the same into such material at the lower portion and causing the heated air, steam or other gases to flow upwardly through such material in means other than that illustrated and described for the purpose of melting the snow or ice that is mixed

with or binds the material together, the water flowing from the material being allowed to pass away in any desired manner to any desired place of reception. My invention, therefore, is not limited to the details of construction and arrangement of parts set forth, which may be varied, within the scope of the appended claim, without departing from the spirit of my invention.

The term "heated" as used in the specification and claim is to be understood as relative with respect to the temperature of the snow or ice, and its melting point. I use the term "gases" as including air, steam, vapor and other gases useful for the purposes of my invention when heated.

I use the term "frozen" or "frozen material" as including snow, as such, or snow mixed with other material, or any material the parts of which have been frozen together by snow or ice combined therewith.

Having now described my invention what I claim is:—

A melting apparatus of the character set forth comprising a vehicle provided with means for propelling it, a receiver for frozen material, and means upon the vehicle for heating air and blowing it through the material in the receiver, the receiver having a water outlet, and a trap for water communicating with said outlet to retain water to resist flow of air from the receiver through the trap.

RICHARD L. LLOYD.