July 22, 1969 L. G. JACQUES 3,456,368

SNOW REMOVING AND MELTING MACHINE

Filed May 5, 1967 4 Sheets-Sheet 1

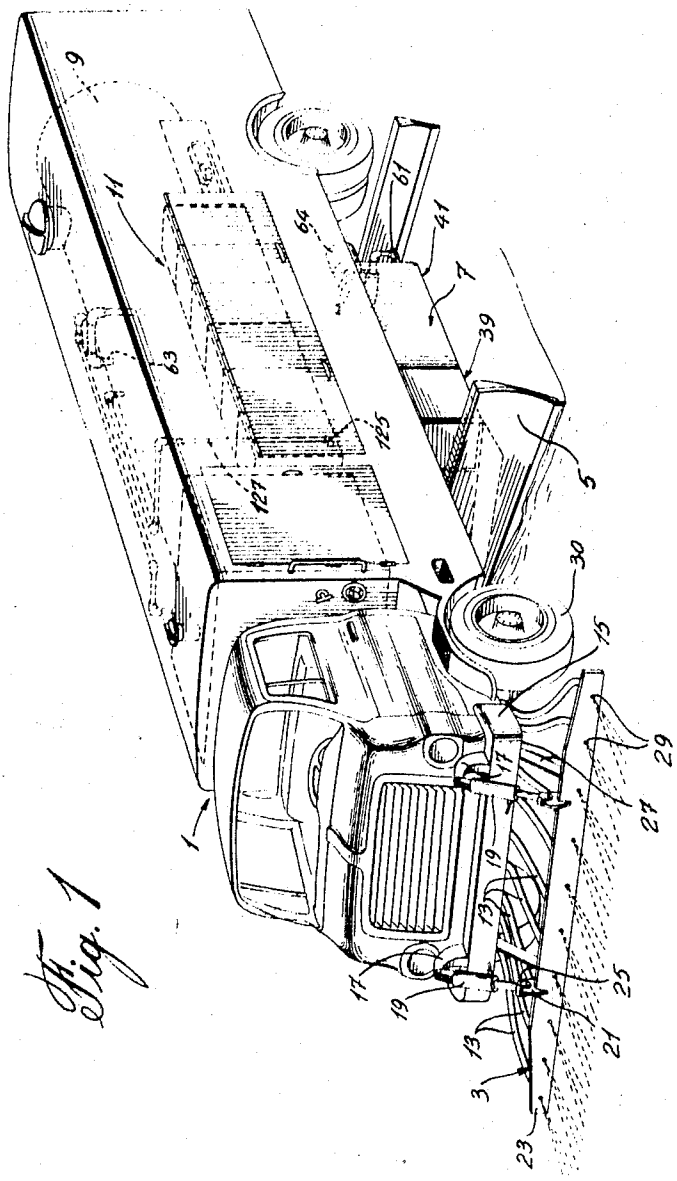

Fig. 1

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Fig. 2

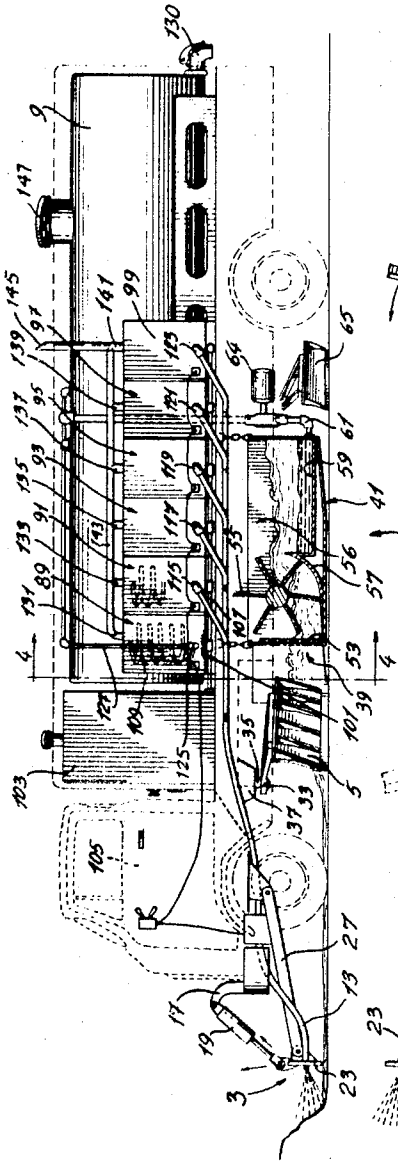
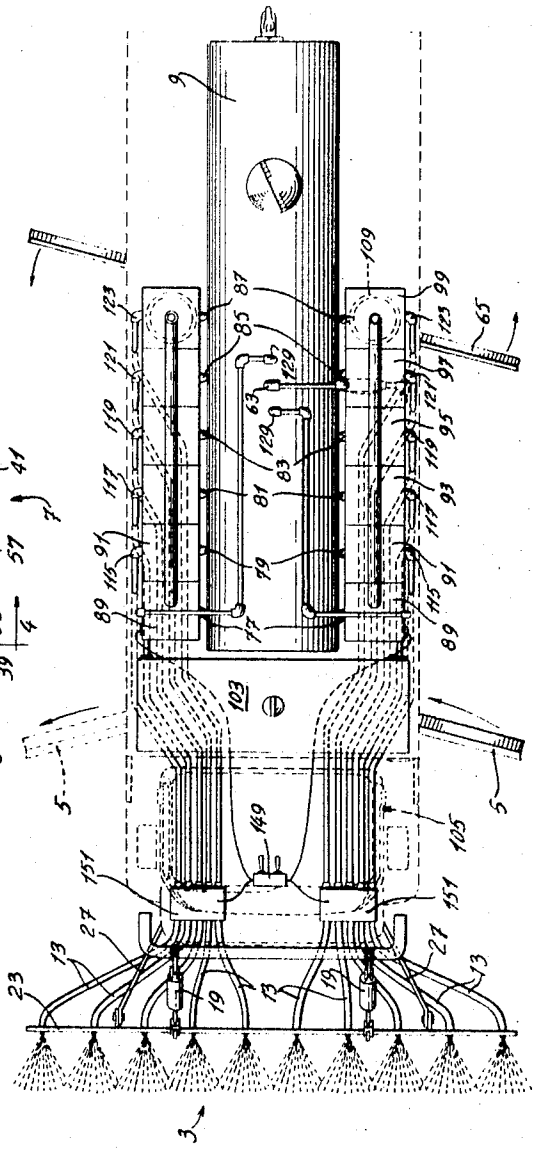


Fig. 3



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SNOW REMOVING AND MELTING MACHINE

Filed May 5, 1967 4 Sheets-Sheet 3

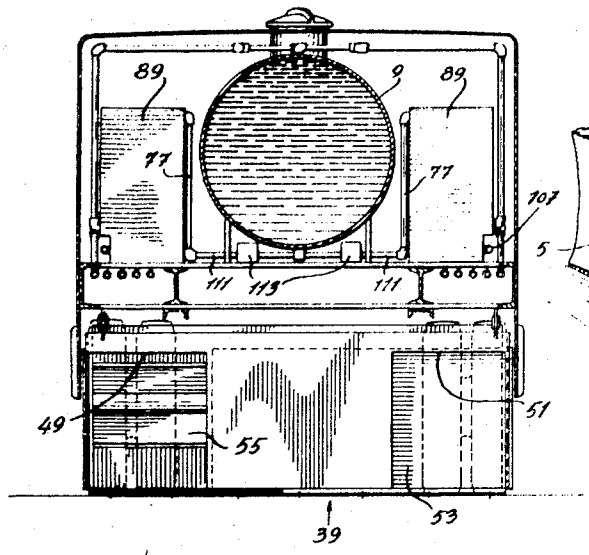

Fig. 4

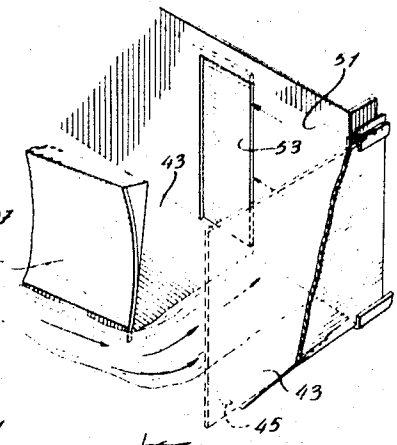

Fig. 5

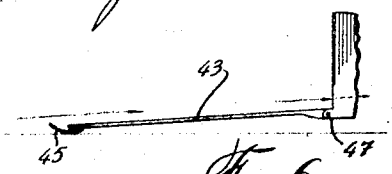

Fig. 6

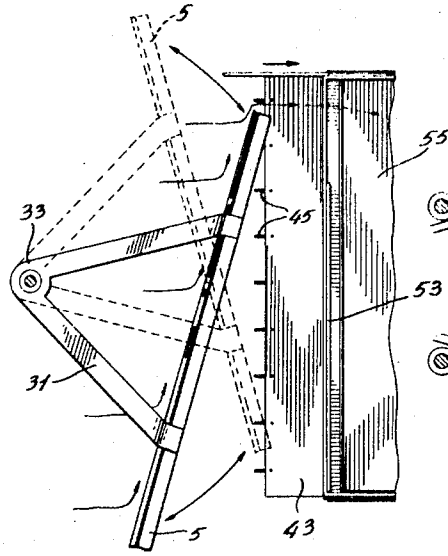

Fig. 7

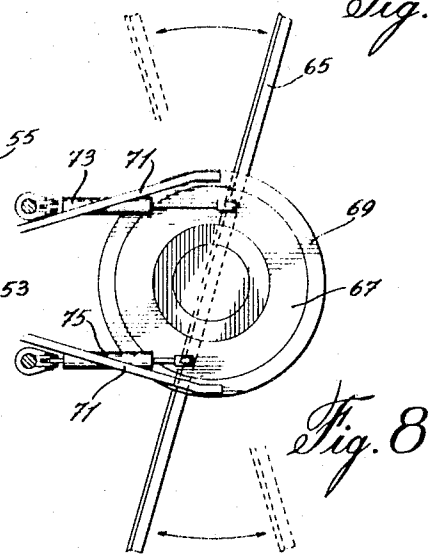

Fig. 8

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SNOW REMOVING AND MELTING MACHINE

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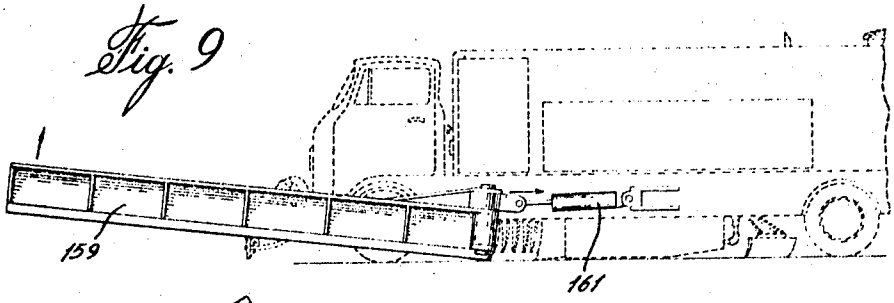
Fig. 9



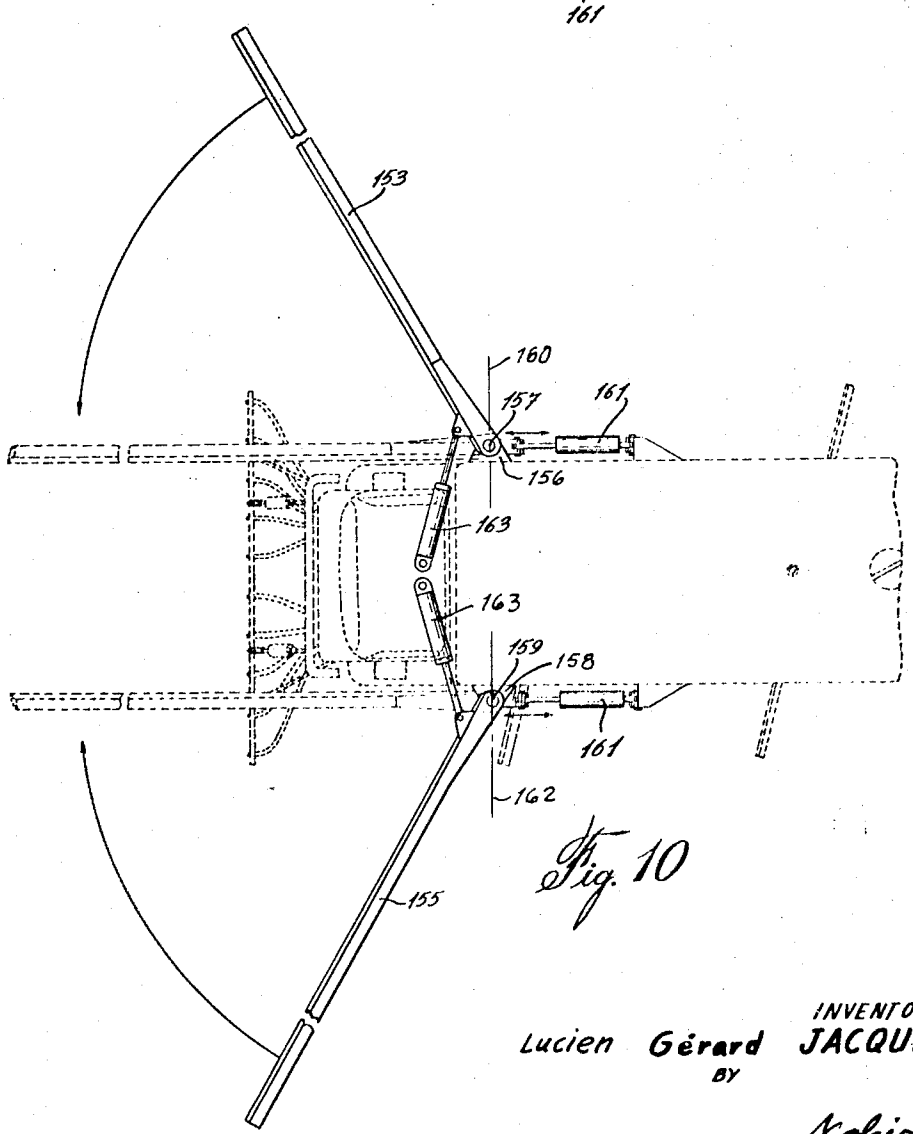


Fig. 10

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3,456,368

SNOW REMOVING AND MELTING MACHINE

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U.S. Cl. 37—12 12 Claims

ABSTRACT OF THE DISCLOSURE

A snow removing and melting machine mounted on a motor vehicle, preferably a heavy truck. In front of the motor vehicle and attached to the front bumper, there are provided hot water spraying means. Underneath the truck there is a water and slush pick-up unit. This unit is situated between the front and the rear wheels and is capable of receiving water and slush resulting from the treatment of the snow by means of the above hot water spraying means. This unit may comprise a scraper, an impeller and a suitable pumping device to carry the mixture of water and slush to a reservoir wherein the remaining snow is melted and water is heated, preferably by means of oil fired heaters, to be therafter delivered to the hot water spraying means.

This invention relates to a snow removing and melting machine. More particularly, the invention is concerned with a snow removal device mounted on a motor vehicle and making use of a hot water spray to melt and remove snow from a snow covered surface. Part of the water produced from melting the snow is recycled and heated for melting additional snow.

In the past, the snow removal problems have been partly resolved by utilizing a great variety of devices involving a number of operations but always at the cost of large expenditures. The usual method consists in using snow plows to accumulate snow banks on the sides of a street or of a highway and loading the accumulated snow in suitable carriers such as trucks or the like by means of snow blowers. This involves a large display of machines and manpower. When the snow removal is in progress, the streets are practically completely occupied by the snow removal equipment, thereby contributing to increase traffic jams in a city of substantial size and population.

Furthermore, as the size of a city increases, the distance to which snow has to be carried away becomes more and more substantial, thus again raising the operational costs of snow removal.

In order to cut down the expenses required in the usual snow removal methods, it has been suggested to melt the snow instead of carrying it away usually at far reaching distances. However, the devices which have been designed up to date are often quite expensive and are not completely satisfactory. For example, it has been suggested to pick-up snow by means of a suction blower and convey it to a melting chamber mounted at the rear of a motor vehicle. Such a device requires a complex operational system for both the suction blower and the melting chamber, and has proven to be unsatisfactory since the capacity of the melting chamber as compared with the snow input in the suction blower cannot be always equitated. Other machines make use of a heating device mounted in front of the motor vehicle to melt the snow and are provided with various devices to get rid of the water or water and slush thus produced. Such a heating device is usually a complex mechanical structure and has not appeared to be practical.

It has been found that the above disadvantages may be overcome by providing a snow removing and melting machine mounted on a motor vehicle and comprising hot water spraying means mounted in front of the motor vehicle and adapted to convert snow into water and slush. A water and slush pick-up unit is mounted underneath the motor vehicle rearwardly of the hot water spraying means to receive a mixture of water and slush produced by the hot water spraying means. The device also comprises means for conveying the water and slush from the pick-up unit into a reservoir mounted on the motor vehicle, and means for conveying water and slush from the reservoir to the spraying means, including heating means to raise the temeprature of the mixture of water and slush.

Preferably, the melting machine comprises means in the receptacle to change the mixture of water and slush into water so that only water is conveyed from the reservoir to the heating means and from there to the spraying means.

In the drawings which illustrate an embodiment according to the invention,

FIGURE 1 is a perspective view of the snow removing and melting machine according to the invention;

FIGURE 2 is a longitudinal view illustrating the operation of the device according to the invention;

FIGURE 3 is a top plan view of the device according to the invention;

FIGURE 4 is a section taken along line 4—4 of FIGURE 2;

FIGURE 5 is a perspective view illustrating the water and slush input funnel;

FIGURE 6 is a cross-section view of the scoop and apron plate of the input funnel shown in FIGURE 5;

FIGURE 7 is a top plan view of the first scraper and of its control device;

FIGURE 8 is a top plan view of the second scraper and of its control device;

FIGURE 9 is a longitudinal view of the snow removing machine according to the invention, provided with a pair of pivoting scrapers; and

FIGURE 10 is a top plan view of the machine illustrated in FIGURE 9.

Referring to the drawings, it will be realized that the snow removing and melting machine according to the present invention generally comprises a motor vehicle **1** provided with a hot water spraying unit **3** mounted in front of the vehicle, a scraper underneath the motor vehicle **1** for directing the water and slush produced by the hot spraying unit **3** into a suction funnel unit **7** and from there into a reservoir **9**. The machine comprises heating means **11** for heating the water from the reservoir **9** and a plurality of ducts **13** for conveying the hot water into the spraying unit **3**.

With particular reference to FIGURES 1, 2 and 3, the motor vehicle **1** is provided with a reinforced bumper **15** mounted at the front thereof. The bumper **15** is provided with a pair of bracket supports **17** mounted on the upper face of the bumper **15**. On each of the brackets **17** there is connected a hydraulic lifter **19** provided at the other end thereof with a clamp **21** engaging the carrier **23**. Since the clamp **21** is in pivotal engagement with the bracket **25** at the end of the hydraulic lifter **19**, it is obvious that the carrier **23** will always be in a vertical position with respect to the snow covered surface.

For a better rigidity of the carrier when it is in operation over a snow covered surface, there is provided a pair of braces **27** adapted to pivot at both ends thereof at the rear of said carrier **23** and underneath the bumper **15**. The carrier **23** is provided with a number of nozzles **29** which are adapted to spray hot water on the snow covered surface, the hot water being lead from the reservoir **9** through the ducts **13** into the nozzle **29**.

Underneath the motor vehicle **1** and rearwardly of the front wheels **30** thereof, there is provided a scraper **5** as

mentioned above, which may be rotated to carry the mixture of water and slush produced by the spraying unit 3 into either side of the suction funnel 7. Reference is made to FIGURE 7 for the operation of the scraper 5 leading the mixture of water and slush into either side of the suction funnel 7. A V-shaped support 31 is fixedly secured at the ends thereof to the upper portion of the scraper 5. The apex 33 of the said V-shaped support 31 is mounted at the end of a shaft 35 (FIGURE 2) to pivot about the axis of the said shaft. The shaft 35 may be rotated through any suitable pivoting means 37 mounted underneath the motor vehicle 1. The control for the pivoting means 37 which is of standard construction should be inside the vehicle 1, although not shown in the drawings. The pivoting means is illustrated schematically in FIGURE 2.

Referring again to FIGURE 7, it will be realized that by pivoting clockwise the shaft 35 and the V-shaped support 31, the mixture of water and slush will be directed towards the right hand side of the suction funnel 7. Reversely, when pivoting the shaft 35 counterclockwise, the scraper 5 will adopt the position illustrated in dotted lines in FIGURE 7 and the mixture of water and slush will enter the suction funnel 7 on the left hand side thereof.

For a description of the suction funnel 7, reference is made to FIGURES 2, 5, 6 and 7. The suction funnel 7 may be subdivided into two portions 39 and 41. 39 is the water and slush mixture entrance and 41 is the suction portion of the suction funnel 7. The entrance side 39 of the suction funnel 7 is better illustrated in FIGURE 5. It is in the general shape of a rectangular enclosure having the upper face and one longer side thereof removed therefrom. The bottom portion of the entrance portion 39 comprises an apron plate 43 (FIGURE 6) provided at one end thereof with a scoop 45 and pivoting at the other end thereof 47 at the junction between the two portions 39 and 41 of the suction funnel 7. It will be realized that as the motor vehicle proceeds on the highway, the apron plate 43 will pick up the water and slush mixture produced by the spraying unit 3, by having the scoop 45 thereof riding on the surface of the highway. There are two inlets 49 and 51 for the mixture of water and slush to pass from the entrance of the suction funnel to the suction portion 41 thereof. When it is intended to have the water and slush mixture enter through the left side through the inlet 51, the scraper 7 is pivoted counterclockwise so that the water and slush mixture enter in the lefthand side through inlet 51 of the suction portion 41 of the suction funnel 7. If the right side through inlet 49 is preferred, the scraper 7 is pivoted clockwise and the operation will proceed as illustrated in FIGURE 2.

There is a sliding door 53 provided in the partition dividing the entrance 39 and the suction portion 41 to open one of the inlets 49 or 51 while closing the other. For example, as shown in FIGURE 5, inlet 51 is opened while inlet 49 is closed.

Suction portion 41, near the inlets 49 and 51 has an impeller 55 adapted to rotate counterclockwise about a horizontal shaft not shown. The impeller 55 is mounted within an enclosure defined by vertical walls 56 and an arcuate bottom portion 57. The mixture of water and slush is picked up by the blades of the impeller 55 and is thrown rearwardly into a rectangular container 59 where it will be pumped into the reservoir 9.

Referring to FIGURES 1 and 2 it will be seen that the mixture of water and slush will be discharged laterally from the bottom of the rectangular container 59 through a conduit 61. The conduit 61, as aforesaid, is connected laterally at one end thereof to the bottom of container 59 and at the other end thereof at 63 on top of the reservoir 9. In order to suck the mixture of water and slush from the container 59 and convey it into the reservoir 9 there is a high capacity pump 64 mounted on conduit 61, so that as long as there is a mixture of water and slush in the container 59 it will be immediately discharged from the bottom of the container 59, through the conduit 61, into the reservoir 9.

In order to free the street or highway surface of any surplus water and slush mixture there is provided, rearwardly of the suction funnel 7, an additional scraper 65 (FIGURE 2). The scraper 65 is fixedly mounted on an inner disc 67 rotatable within an outer ring 69 (FIGURE 8). The outer ring 69 is fixedly connected such as by welding to a V-shaped support 71 fixedly mounted at its apex (not shown) somewhere underneath the body of the motor vehicle. The inner rotatable disc 67 may be rotated by operating a pair of hydraulic lifters 73 and 75 in opposite directions. For example, by extending the hydraulic lifter 73 and by retracting the hydraulic lifter 75 the scraper 65 will be rotated clockwise. Vice versa, by extending the hydraulic lifter 75 and by retracting the hydraulic lifter 73 the scraper 65 will be rotated counterclockwise. In general, it may be stated that the two scrapers 5 and 65 should be rotated in the same direction so that if the first scraper 5 is adjusted to direct the mixture of water and slush toward the right-hand side of the suction funnel unit 7, the scraper 65 will be adjusted to move a mixture of water and slush which has not been picked up by the suction funnel 7 on the right-hand shoulder of the highway or on the right-hand side of the street. On the other hand, the first scraper 9 may be adjusted to direct water and slush towards the lefthand side of the suction funnel unit while the second scraper moves remnant portions of water and slush to the center of the street or highway.

As aforesaid the mixture of water and slush is lead from the container 59 by means of the conduit 61 and pump 64 into the reservior 9. From the bottom of the reservoir 9, there are six water ducts 77, 79, 81, 83, 85 and 87 to transfer water from the bottom of said reservoir 9 into six different heating units 89, 91, 93, 95, 97 and 99 provided on said motor vehicle 1 alongside of said reservoir 9. In each of the heating units, there is provided an oil burner. Since all these oil burners are identical, only one has been illustrated at 101 in heating unit 89. For supplying these oil burners, oil is fed from the oil tank 103 mounted on the motor vehicle at the back of the cab 105 by means of an oil duct 107. Since the motor of the above motor vehicle 1 is preferably of the diesel type, the oil tank 103 could at the same time supply oil to the diesel motor and to the oil burners 101. This oil burner 101 will be used to heat water coming from the reservoir 9 and passing into the heating unit 81 through a coil 109. In all the heating units 89 to 99 inclusive the water flows laterally from the outlets 77 to 87 inclusive at the bottom of reservoir 9 to the upper portion of the heating unit by means of suitable ducts. Reference is made to FIGURE 4 for the illustration of the water circulation from the resorvoir 9 into the first heating unit. It will be seen that ducts 111 provided with as uitable pump 113 will convey water from the reservoir 9 to the upper portion of heating unit 89 into heating coil 109 down to the lower portion of the heating unit 89. Turning now to heating unit 91 to 99, the water entering the upper portion of these units in the respective heating coils is heated therein and is taken out at the bottom of these heating units by means of the respective water outlets 115 to 123 inclusive (FIGURES 2 and 3). These outlets 115 to 123 inclusive are connected to respective hot water ducts 13 to convey the hot water produced in the heating coils into the spraying means 3 to be projected on the snow covered surface by means of the nozzles 29. It is desirable to have a pre-heating step in the reservoir in order to melt the snow in the water and slush mixture. For that purpose, there is provided at the bottom of heating unit 89 a water outlet 125 connected to a duct 127 to convey hot water heated in the heating coil 109 into the upper portion of the reservoir 9 at water inlet 129. If any snow remains in the mixture

of water and slush pumped into the reservoir **9**, it will be immediately transformed into water through this preheating step. The circulation of water is assured by means of the pump **64** which is adapted to pump the mixture of water and slush from the container **59** into the reservoir **9** and by means of further pumps **113** mounted on each of the ducts **111** conveying water from the bottom of the reservoir **9** to the top of the heating coils in the heating units **89** to **99** inclusive.

There is of course provided an outlet valve **130** to remove the surplus water from the reservoir **9**. Furthermore, each of the heating units **89** to **99** inclusive is provided with a gas outlet **131** to **141** respectively, all of said gas outlets being connected to a suitable duct **143** to exhaust the gases from the gas burners into a gas flue **145**.

Finally, on top of the reservoir **9** there is provided a water inlet **147** to at least partly fill said reservoir before initiating the snow removing process.

The hot water flow in ducts **13** is assured through control **149** which at the same time regulates the heating capacity of the oil burners **101**. For that purpose, the control **149** is connected to water valves **151** and also to the oil burners. Since the same control operates both the oil burners and the water valves, the temperature of the hot water coming out of the spraying means is always the same, the only variation being in the amount of hot water used.

In a further embodiment illustrated in FIGURES 9 and 10, the snow removing and melting machine according to the invention is provided with a pair of lateral scrapers **153** and **155** mounted for swinging movement on each side of the motor vehicle **1** through vertical pivot connections **157** and **159**, respectively mounted on brackets **156, 158.** The scrapers are constructed for operation between an open position illustrated in FIGURE 10 and a retracted non-operating position shown in dotted lines in FIGURE 10. For this purpose, scrapers **153, 155** are connected to two hydraulic cylinders **163.** These scrapers serve to pick up snow or a mixture of snow and slush which would not be picked up by the scraper **5.** The improved assembly is obviously capable of cleaning a street over the entire width thereof.

As stated above, the scraper **153** may be adjusted to any intermediate position comprised between those illustrated in FIGURE 10. This operation is carried out by operating the hydraulic cylinders **163** which are mounted underneath the cab of the motor vehicle. On the other hand, it may be desirable to vertically adjust the scraper by slightly raising its lower edge above the surface of the road, as illustrated by the arrow *a* in FIGURE 9. This may be obtained by operating the hydraulic cylinder **161** and by mounting brackets **156, 158** on the cab to be pivoted above horizontal axes **160, 162.**

I claim:

1. A snow removing and melting machine mounted on a motor vehicle, said machine comprising:

(a) hot water spraying means mounted in front of said motor vehicle and adapted to convert snow into water and slush;

(b) a water and slush pick-up unit mounted underneath said motor vehicle rearwardly of said hot water spraying means to receive a mixture of water and slush produced by the said hot water spraying means;

(c) means for conveying the water and slush from said pick-up unit into a reservoir mounted on the motor vehicle; and

(d) means for conveying said water and slush mixture from said reservoir to said spraying means, including heating means in said reservoir to raise the temperature of the mixture of water and slush.

2. A snow removing and melting machine according to claim **1,** said hot water spraying means comprising an elongated carrier adjustably mounted in front of said motor vehicle and a plurality of hot water ducts adapted to convey hot water from said heating means into a plurality of nozzles provided in said carrier.

3. A snow removing and melting machine according to claim **1,** said water and slush pick-up unit comprising a scraper rotatably mounted underneath said motor vehicle.

4. A snow removing and melting machine according to claim **3,** said pick-up unit further comprising, rearwardly of said rotatable scraper, a funnel device provided with an impeller adapted to receive said mixture of water and slush and to propel the same into a container mounted rearwardly of the said impeller.

5. A snow removing and melting machine according to claim **4,** said means for conveying said water and slush from said pick-up unit including a duct having mounted thereon a suction pump and adapted to convey the said mixture of water and slush from the bottom of said container into the upper portion of the said reservoir.

6. A snow removing and melting machine according to claim **1,** wherein said reservoir is provided at the bottom portion thereof with water outlets leading into a plurality of heating units mounted on said motor vehicle along said reservoir to raise the temperature of said water and slush.

7. A snow removing and melting machine according to claim **6,** wherein each of said heating units comprises a heating coil through which water circulates from the top to the bottom of said heating units and wherein said heating coil is heated by means of an oil burner mounted inside said heating unit.

8. A snow removing and melting machine according to claim **7,** wherein one of the heating units is provided with means to recirculate heated water back into the water reservoir.

9. A snow removing and melting machine according to claim **8,** wherein the remaining heating units are provided with water outlets adapted to convey hot water by means of hot water ducts to said hot water spraying means.

10. A snow removing and melting machine according to claim **1,** wherein there is provided an additional scraper rearwardly of said pick-up unit to remove remains of water and slush which have not been picked up by the pick-up unit.

11. A snow removing and melting machine mounted on a motor vehicle, said machine comprising:

(a) an elongated carrier adjustably mounted in front of said motor vehicle, said carrier being provided with a plurality of nozzles capable of spraying hot water on a snow covered surface to produce a mixture of water and slush;

(b) a scraper rotatably mounted underneath said motor vehicle rearwardly of said elongated carrier to pick up said mixture of water and slush;

(c) a funnel device provided with an impeller mounted underneath said motor vehicle rearwardly of said scraper and adapted to receive said mixture of water and slush from said scraper and to propel the same into a container mounted rearwardly of the said impeller;

(d) a duct and pump unit connected at one end thereof laterally to the bottom of said container and at the other end thereof to the upper portion of a water and slush reservoir mounted on said motor vehicle, to convey said mixture of water and slush from said container to said reservoir;

(e) water outlets provided at the bottom portion of said reservoir and leading into a plurality of heating units mounted on said motor vehicle along said reservoir, to convey water from said reservoir to said heating units;

(f) pump means between said reservoir and said heating units to force circulation of water in said machine;

(g) heating coils in said heating units through which water circulates downwardly;

(h) oil burners inside said heating units to heat the water circulating in said heating coils;

(i) means on at least one of said heating units to recirculate hot water back into said reservoir; and

(j) means on the remaining heating units to convey hot water into the nozzles provided in said carrier.

12. A snow removing and melting machine according to claim **11**, further comprising a pair of lateral scrapers mounted for swinging movement on each side of the motor vehicle through pivot connections provided on both sides of said motor vehicles, said lateral scrapers connected to first hydraulic cylinders mounted underneath said motor vehicle to operate said lateral scrapers between an open position and a retracted non-operating position, said lateral scrapers further connected to second hydraulic cylinders mounted on each side of said motor vehicle, said second hydraulic cylinders operating to vertically adjust said lateral scrapers by slightly raising the lower edges thereof above the surface of the road, said lateral scrapers serving

to pick up snow or a mixture of snow and slush which is not picked up by said rotatably mounted scraper.

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U.S. Cl. X.R.

126—343.5; 134—107, 108