No. 684,051. Patented Oct. 8, 1901.

F. W. & H. S. FARQUHAR.

APPARATUS FOR TREATING AND REMOVING SNOW.

(Application filed Mar. 28, 1899.)

(No Model.) 3 Sheets—Sheet 1.

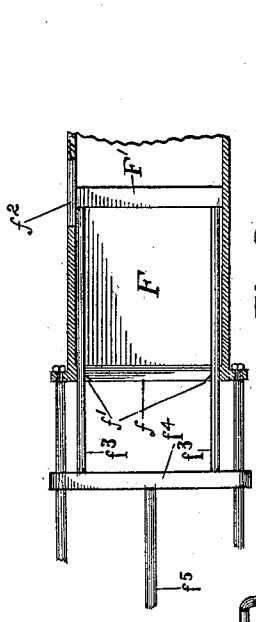


Fig. 2.

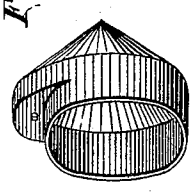


Fig. 3.

Fig. 1.

Fig. 4.

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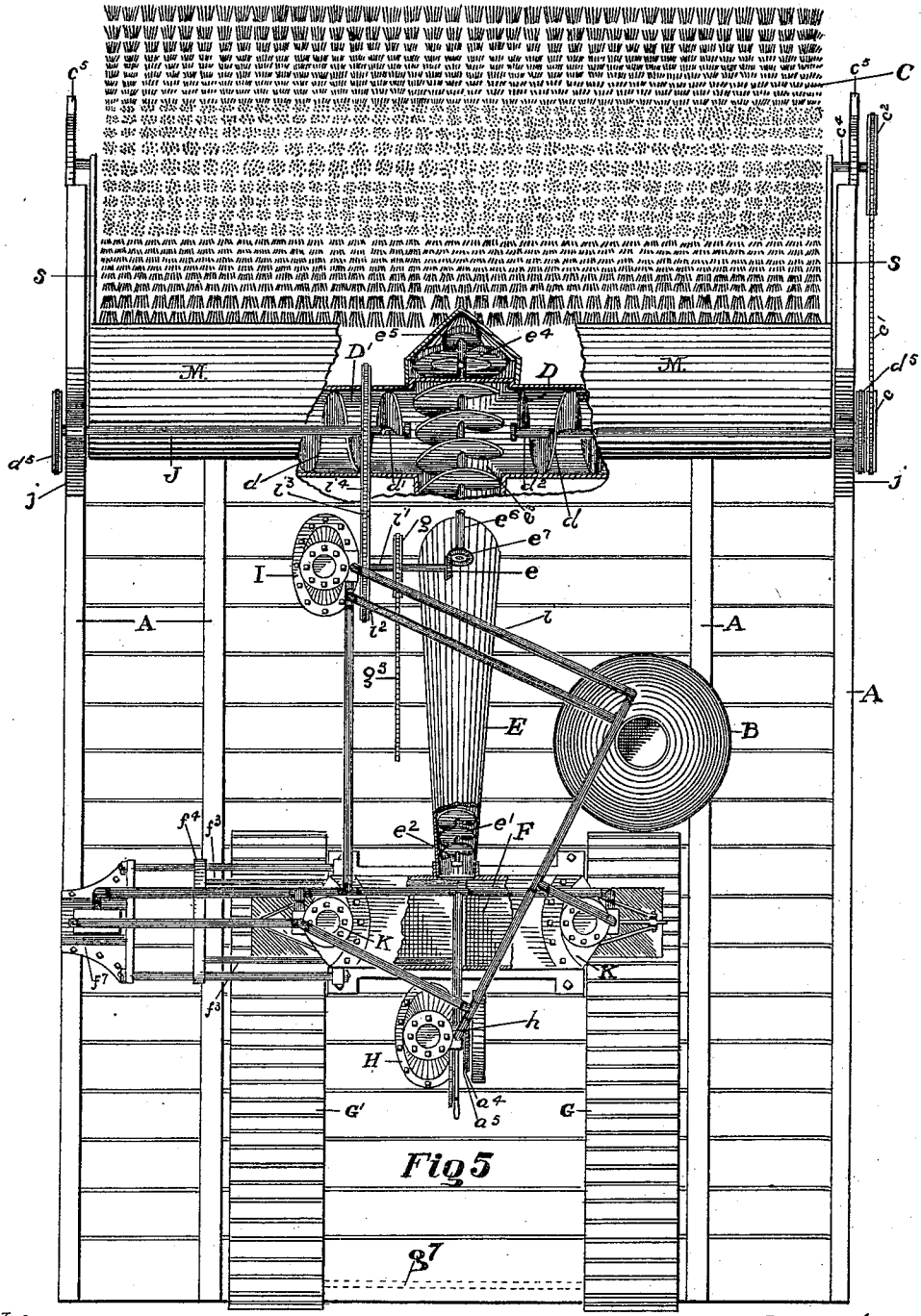


Fig 5

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(No Model.) 3 Sheets—Sheet 3.

Fig. 6.

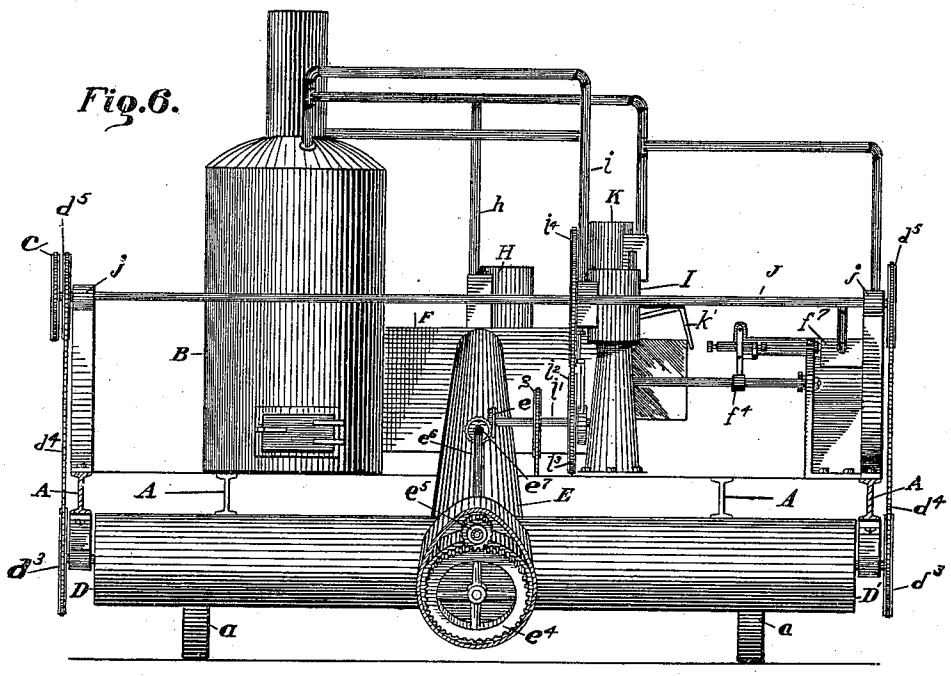
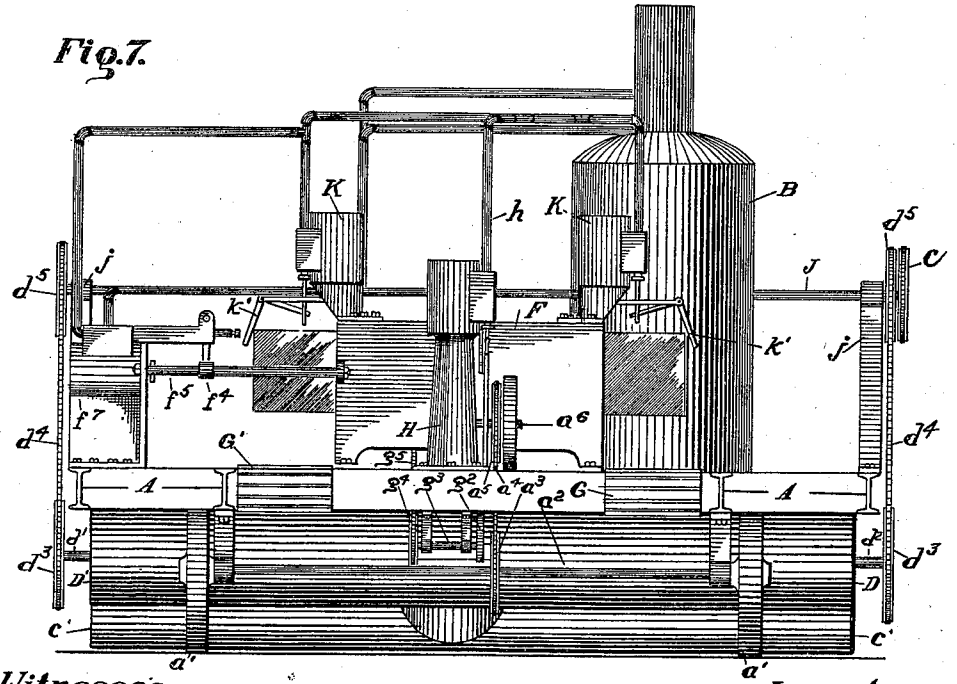


Fig. 7.



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APPARATUS FOR TREATING AND REMOVING SNOW.

SPECIFICATION forming part of Letters Patent No. 684,051, dated October 8, 1901.

Application filed March 28, 1899. Serial No. 710,807. (No model.)

To all whom it may concern:

Be it known that we, FREDERICK WILLIAM FARQUHAR and HENRY STILSON FARQUHAR, citizens of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Methods and Apparatus for Treating and Removing Snow; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to certain new and useful improvements in the method of and apparatus for removing snow from streets and other localities.

It is a matter of common knowledge that the difficulty of disposing of snow in populated cities and towns becomes greater in proportion to the increase of population and business traffic, and up to the present time, so far as we are aware, the only practical method of disposing of snow is to gather the same into carts or other vehicles and transport the same to suitable localities, where it is dumped or deposited.

Under ordinary conditions snow occupies space enormously disproportionate to the amount of water involved in its formation, and consequently its bulk renders its removal slow and expensive.

Our invention has for its object the collection of the snow, subjecting the same to compression, with or without the application of heat, to eject the water therefrom, and delivering the residuum in block or brick form in small compass and reduced weight ready for subsequent transportation to the dump or other place of deposit; and with these ends in view our invention consists in the method and apparatus hereinafter more fully described.

In order that others may fully understand our invention, we will proceed to describe the method of treatment and the apparatus devised by us, referring by letters to the accompanying drawings, in which—

Figure 1 shows a side elevation, partly in section; Fig. 2, a detail section of the compressing-chamber; Fig. 3, a view of housing at front end of conical conveyer; Fig. 4, a section on line 4 4, Fig. 1; Fig. 5, a plan, partly in section, of the machine; Fig. 6, a section on line 6 6 of Fig. 1. Fig. 7 shows a rear elevation of the machine.

In the drawings the letter A designates the frame of the machine, mounted on suitable wheels a a'.

B designates a steam-boiler mounted on the frame; C, a rotary broom extending crosswise of the front end of the frame A and supported thereby; D D', rotary conveyers, also extending crosswise of the frame back of the rotary broom; E, an inclined conveyer extending lengthwise of the machine and in the center thereof from the cross-conveyer D, referred to, to a compressing-chamber F, preferably square in cross-section, extending crosswise of the machine and parallel with the conveyer D first mentioned; G G', two endless conveyers, one at each side, running lengthwise of the machine and at right angles to the compression-chamber F and outside thereof and from it to the rear end of the frame A.

Mounted on the frame A and toward the rear end thereof is a suitable driving-engine H for propelling the machine, connected by a pipe h with the steam-boiler B. This engine is suitably connected with the axle a^2 of the rear wheels a', on which the rear end of frame A is supported. These wheels a' are for driving or propelling the machine and are rigidly fixed on the axle a^2. On this axle a^2 is also fixed a sprocket-wheel a^3, connected by an endless chain a^4 with a similar sprocket-wheel a^5, mounted on the shaft a^6 of the driving-engine H, referred to. A second engine I, also connected with the boiler B by a pipe i, is mounted on the frame A. This engine I is connected with and rotates the collecting-broom C, the rotary conveyer D D', the inclined conveyer E, and the two endless side conveyers G G'. On the driving-shaft i' of this engine are fixed two sprocket-wheels i^2 g and a bevel-gear e. One of these sprocket-wheels i^2 is connected by an endless chain i^3 with a similar wheel i^4, mounted on a main shaft J, extending entirely across the

frame A and journaled in supports j, mounted thereon. This shaft J extends beyond the supports j and at one end carries a fixed sprocket-wheel c, connected by an endless chain c' with a sprocket-wheel c^2 on the end of the shaft c^4, on which the rotary broom C is fixed. The shaft c^4 just referred to passes loosely through upwardly-extending slotted supports c^5. The said slots c^6 are approximately vertical and form circular arcs from the cross-shaft J. A latch c^7 is fixed near the top end of each bracket and extends across the slot c^6 therein and forms a support for the broom should it be desirable at any time to carry the broom C elevated or out of action.

To stop the rotation of broom C when elevated, suitable clutches (not shown) may be provided. The rotation of broom C is toward the rear or as indicated by the arrow. (See Fig. 1.) The rapid rotation of the broom in the direction indicated sweeps the snow back and up an inclined chute C', leading to the cross-conveyers D D', which are of the screw type. The sides s of the chute C' at its rear end serve also, respectively, as a head for the conveyers D D'. The blades d of each cross-conveyer D D' are fixed on a shaft d' d^2, and extend beyond the sides or heads s of the respective conveyer-chambers.

The shafts d' d^2 just referred to are each provided at their exterior ends with a sprocket-wheel d^3, connected by an endless chain d^4, respectively, with one of two sprocket-wheels d^5, also mounted on the main shaft J, one at one end and the other near the opposite end of the shaft. It will thus be seen that the conveyer-blades d rotate in the same direction; but the blades of one conveyer are placed so that they thrust in a direction opposite to those of the other conveyer, and the direction of their rotation is such that they force their respective contents toward each other or toward the longitudinal center of the machine.

Between the inner ends of the cross-conveyers D D' is a longitudinally-inclined conveyer E, into which they thrust their contents. This latter conveyer E extends lengthwise of the machine from in front of the cross-conveyers back to the compressing-chamber F, into which it empties. This conveyer is conical in shape, being larger in diameter at its forward or receiving end e^3 than at its rear or discharging end. The screw e' in like manner decreases in size from end to end and is mounted on a shaft which extends through the front end e^3 of the conveyer-casing and is provided with a gear e^4, meshing with a pinion e^5, mounted on one end of a rearwardly-inclined shaft e^6 above the conveyer-casing. This shaft e^6 at its opposite end is provided with a bevel-gear e', which meshes with the bevel-gear e, heretofore referred to, on the engine-shaft i'. The engine thus through this train of gears just described rotates the conical screw.

The conical conveyer empties its contents, as heretofore stated, through its small end into the compressing-chamber F, which is square in cross-section and extends transversely across the frame A of the machine and is open at each end. These end openings f, however, are somewhat contracted by internally-inclined flanges f' (see Fig. 2) and are the discharge-openings for the compression-chamber. A reciprocating piston F' is arranged in this compression-chamber F and alternately passes across the receiving-opening f^2 at the center of the chamber or at the point of discharge from conical conveyer and somewhat beyond—enough at least to entirely clear the receiving-opening f^2 in the chamber. This reciprocating piston is connected by two rods f^3 with a cross-head f^4, mounted on the end of a piston-rod f^5 of a reciprocating engine f^7, which imparts motion to the piston F', referred to. At each end and above the compressing-chamber F is mounted a steam-cylinder K for operating a vertically-movable cutter-blade k connected therewith. This cutter-blade is normally raised above and just outside the end opening of the compressing-chamber F.

The up-and-down movement of each cutter-blade k is controlled by a suitable valve actuated by a bell-crank lever k'. One arm of the latter extends down and in front of its respective end opening of the compressing-chamber F, but is some distance from it. The operation of the bell-crank k' will be hereinafter described.

At each side of the machine from the end openings of the compressing-chamber F, but on a lower plane than the bottom thereof and extending toward the rear end of the machine, is an endless platform conveyer G G', the upper surface of which moves from the front to the rear of the machine past its respective end opening of the compressing-chamber F. The two endless conveyers just referred to are mounted on suitable drums fixed on suitable shafts g^6 g^7. The front or driving one, g^6, of these shafts is common to both conveyers and operates the two conveyers simultaneously. This shaft is suitably journaled on the frame of the machine and on it is a fixed gear-wheel g', which meshes with another gear g^2 on a counter-shaft g^3, provided with a sprocket-wheel g^4, connected by an endless chain g^5 with a sprocket-wheel g on the main shaft i' of the broom and rotary conveyer-engine I.

In the drawings, and with special reference to Fig. 1, M' is the exhaust-pipe leading from the engines to the smoke-stack of the boiler, and N is a suitable valve for controlling the exhaust when desired. O and P are pipes leading from the exhaust-pipe M' to the compressor and conveyers, respectively, and each of the pipes O P is provided with a valve Q, so that when the valve N is closed and the valves Q are opened the exhaust-steam is fed to the compressor-boxes and conveyer-trunks and

the heat utilized to melt the snow and aid in its compression. It is obvious that we may employ the exhaust-steam at either or both of the localities named or dispense with its use entirely.

Having described the construction of the machine or apparatus which we have devised for carrying out successfully our improved method, we will now explain said method by explaining the operation of the machine.

When it is desired to clean a thoroughfare of snow holding in suspension fluids of any nature which can be freed or ejected by compression, the machine is propelled along said thoroughfare and against the matter to be collected. The rapid revolution of the broom C sweeps such matter up the chute C′ and into the cross-conveyers D D′, which in turn force it toward the longitudinal center of the machine and into the casing of the inclined conical screw conveyer E. This conveyer then acting on the matter forces it toward the rear through its small end and into the central opening of the square compression-chamber F, where it is acted upon by the piston of said chamber F. The matter while being forced through the conical inclined screw conveyer is partly compressed, due to its being forced rearward at a uniform speed, but at the same time gradually forced, due to conical section of the conveyer-casing, into a smaller space or to a smaller bulk, during which action a portion of the fluids held in suspension are expelled, which fluids would drain off through holes in the casing to the ground and then flow off. The matter when acted upon by the reciprocating piston of the compression-chamber F is forced outward or toward one of the contracted end openings of the chamber, which opening tends first to block or bank up the matter, tending to form an arch inside the opening. The continued movement of the piston then continues to press out a further quantity of the remaining fluids held in suspension and reduces the matter in bulk until the pressure of the piston overcomes the arch and forces the matter in a comparatively compact hard mass, the particles of which hold together by cohesion, through the respective end opening. The mass in passing out engages one of the bell-crank levers which controls its respective vertically-movable cutter *k*. The hard mass in moving the bell-crank operates the valve of the steam-cylinder of the respective cutter-blade and causes the latter to descend and strike the mass and break off the extended end in the form of a block L, which drops upon the respective rearwardly-moving platform conveyer G G′, from which the block is taken and loaded into carts to be conveyed away to some suitable point. The compressing-chamber, like the conical inclined conveyer-casing, is provided with holes to drain off the fluids ejected from the mass.

It will be readily understood that, if desired, the broom may be elevated and thrown out of action and the chute come in direct contact with the crude mass. It will also be seen that it might be preferable at times to dispense with the broom and the chute and shovel the crude matter by hand directly into the conveyers, to be then acted upon as before. It might further be possible to use the inclined conical screw conveyer alone and dispense with the compressing-chamber F and eject the compressed matter directly out of the rear end of the conveyer, and in like manner, as in the case of the compressing-chamber, cut it into blocks by suitable cutters arranged in front of the discharge-opening. On the other hand, the conical inclined screw conveyer might be dispensed with and the compression-chamber used directly with its cutters, suitably arranged, as shown, in front of its respective discharge-openings.

While we have shown and described an apparatus or machine especially devised and adapted to carry out our improved method of disposing of snow, we do not wish to be confined in the scope of our invention to the details of construction and arrangement of said machine, as other machines may be readily devised to accomplish the results aimed at; but

What we claim as new, and desire to secure by Letters Patent, is—

1. In a portable machine for reducing snow in bulk from a crude to a solid or compressed state, the combination of a frame, a screw compressing-conveyer mounted on said frame and means for rotating said screw.

2. In a portable machine for reducing snow in bulk from a crude to a solid or compressed state, the combination of a frame, a compressing-chamber, a reciprocating piston arranged in said chamber, and means to operate said piston.

3. In a portable machine for reducing snow in bulk from a crude to a solid or compressed state, the combination of a frame, a suitable compressor on the frame, having a discharge-opening; means to operate said compressor; and a cutter to operate on the mass after it leaves the said compressor.

4. In a portable machine for reducing snow in bulk from a crude to a solid or compressed state, the combination of a frame, a suitable compressor on the frame; means to operate said compressor; a cutter to operate on the mass after it leaves the compressor; and a conveyer to deliver the crude matter to the compressor.

5. In a portable machine for reducing snow in bulk from a crude to a solid or compressed state, the combination of a frame, a suitable compressor on the frame; means to operate said compressor; a cutter to operate on the mass after it leaves the compressor; a conveyer to deliver the crude matter to the compressor; and a broom to sweep the crude matter to the conveyer.

6. In a portable machine for reducing snow in bulk from a crude to a solid or com-

pressed state, the combination of a frame, a suitable compressor on the frame; means to operate said compressor; a cutter to operate on the mass after it leaves the compressor; and a conveyer to carry off the compressed mass after it has been acted upon by the cutters heretofore referred to.

7. In a portable machine for reducing snow in bulk from a crude to a solid or compressed state, the combination of a frame, a collecting-broom; two cross-conveyers mounted on same plane and having a common center line, operating in opposition and toward each other; a central conveyer between said cross-conveyers and into which they discharge; a compressing-chamber having two end or discharge openings and a central receiving-opening into which the longitudinal conveyer empties; and a reciprocating piston in the compression-chamber which alternately passes the said central receiving-opening.

8. In a portable machine for reducing snow in bulk from a crude to a solid or compressed state, the combination of a frame, a collecting-broom; two cross-conveyers mounted on same plane and having a common center line, operating in opposition and toward each other; a central compressor-conveyer between said cross-conveyers and into which they discharge; a compressing-chamber having two end or discharge openings and a central receiving-opening into which the longitudinal conveyer empties; and a reciprocating piston in the compression-chamber which alternately passes the said central receiving-opening.

9. In a portable machine for reducing snow in bulk from a crude to a solid or compressed state, the combination of a frame, a collecting-broom adapted to be raised and held out of operative position; an inclined chute arranged behind said broom; two cross-conveyers on a fixed shaft and revolving in the same direction but one a right-hand and the other a left-hand screw to force their respective contents to a common point; a conical screw compressing-conveyer arranged at right angles to those first mentioned and into which they discharge; a compression-chamber having a contracted discharge-opening at each end and a receiving-opening in the center into which the said conical screw compressing-conveyer empties; a reciprocating piston in compressing-chamber which alternately passes said central receiving-opening; two cutters mounted respectively outside the end openings of the compression-chamber; a detent at each end of the compression-chamber, acted upon by the mass as it leaves the respective end opening to control the movement of the respective cutter; and two rearwardly-movable endless platform conveyers, one passing by the one end opening of the compression-chamber but on a lower plane, and the other by the other end opening in the compression-chamber, but on a lower plane.

10. In a portable machine for reducing snow in bulk from a crude to a solid or compressed state, the combination of a frame, a collecting-broom adapted to be raised and held out of operative position; an inclined chute arranged behind said broom; two cross-conveyers on a fixed shaft and revolving in the same direction but one a right-hand and the other a left-hand screw to force their respective contents to a common point; a conical screw compressing-conveyer arranged at right angles to those first mentioned and into which they discharge; a compression-chamber having a contracted discharge-opening at each end and a receiving-opening in the center into which the said conical screw compressing-conveyer empties; a reciprocating piston in compressing-chamber which alternately passes said central receiving-opening; two cutters mounted respectively outside the end openings of the compression-chamber; a detent at each end of the compression-chamber, acted upon by the mass as it leaves the respective end opening to control the movement of the respective cutter; and an engine to operate the broom, cross-conveyers and longitudinal conical screw compressing-conveyer.

11. In a portable machine for reducing snow in bulk from a crude to a solid or compressed state, the combination of a frame, a collecting-broom adapted to be raised and held out of operative position; an inclined chute arranged behind said broom; two cross-conveyers on a fixed shaft and revolving in the same direction but one a right-hand and the other a left-hand screw to force their respective contents to a common point; a conical screw compressing-conveyer arranged at right angles to those first mentioned and into which they discharge; a compression-chamber having a contracted discharge-opening at each end and a receiving-opening in the center into which the said conical screw compressing-conveyer empties; a reciprocating piston in compressing-chamber which alternately passes said central receiving-opening; two cutters mounted respectively outside the end openings of the compression-chamber; a detent at each end of the compression-chamber, acted upon by the mass as it leaves the respective end opening to control the movement of the respective cutter; two steam-cylinders one for each cutter; and a steam-cylinder for reciprocating the piston of the compression-chamber.

12. A portable machine for reducing snow in bulk from a crude to a solid or compressed state, embodying in its organization a frame, driving or propelling wheels on which said frame is mounted; a collecting-broom adapted to be raised and held out of operative position; an inclined chute arranged behind said broom; two cross-conveyers on a fixed shaft and revolving in the same direction but one a right-hand and the other a left-hand screw to force their respective contents to a common point; a conical screw compressing-

conveyer arranged at right angles to those first mentioned and into which they discharge; a compression-chamber having a contracted discharge-opening at each end and a receiving-opening in the center into which the said conical screw compressing-conveyer empties; a reciprocating piston in compressing-chamber which alternately passes said central receiving-opening; two cutters mounted respectively outside the end openings of the compression-chamber; a detent at each end of the compression-chamber; acted upon by the mass as it leaves the respective end opening to control the movement of the respective cutter; an engine to operate the broom, cross-conveyers and longitudinal conical screw compressing-conveyers; two steam-cylinders one for each cutter; and a boiler to supply steam to the respective engines.

13. In a machine for gathering and treating snow, the combination with means for gathering the snow, and means for compressing the same, means for heating the snow during its movement through the machine, substantially as and for the purpose described.

14. In combination with the snow gathering and compressing devices, means for conducting the water eliminated from the snow, away from the machine, substantially as described.

15. In combination with the cone-shaped conduit and means for feeding the snow thereto, means for forcing the snow through and out of the contracted conduit, substantially as and for the purpose set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

FREDERICK WILLIAM FARQUHAR.
HENRY STILSON FARQUHAR.

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Witnesses as to Henry S. Farquhar:
RUFUS W. WHARTON, Jr.,
ZEBBIE G. ROGERS.