Dec. 16, 1924. 1,519,249

S. FRIEDMAN

SNOW GATHERING AND LOADING MACHINE

Filed Sept. 2, 1920 4 Sheets-Sheet 1

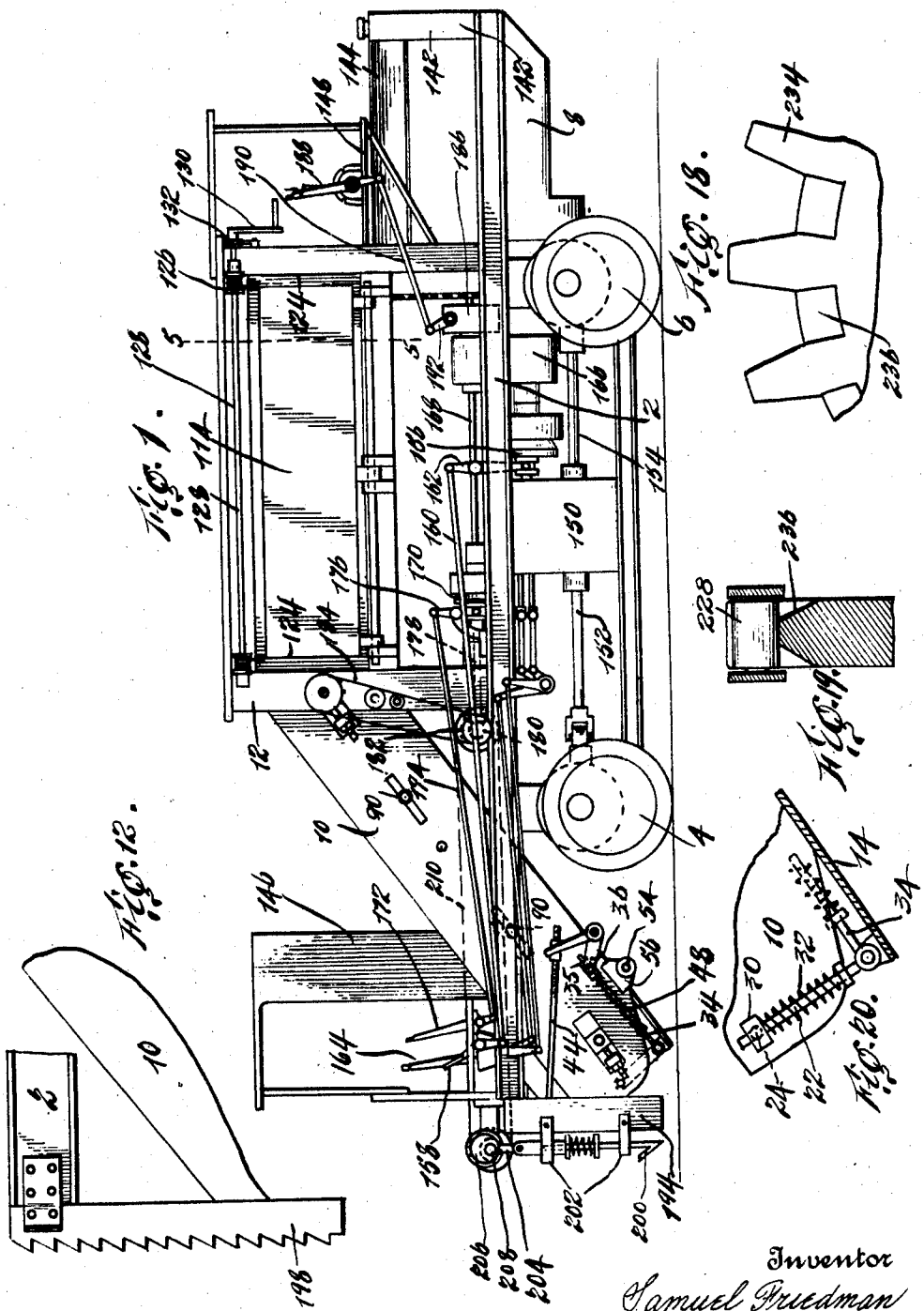


Fig. 1.

Fig. 18.

Fig. 19.

Fig. 12.

Fig. 20.

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Dec. 16, 1924. 1,519,249

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SNOW GATHERING AND LOADING MACHINE

Filed Sept. 2, 1920 4 Sheets-Sheet 3

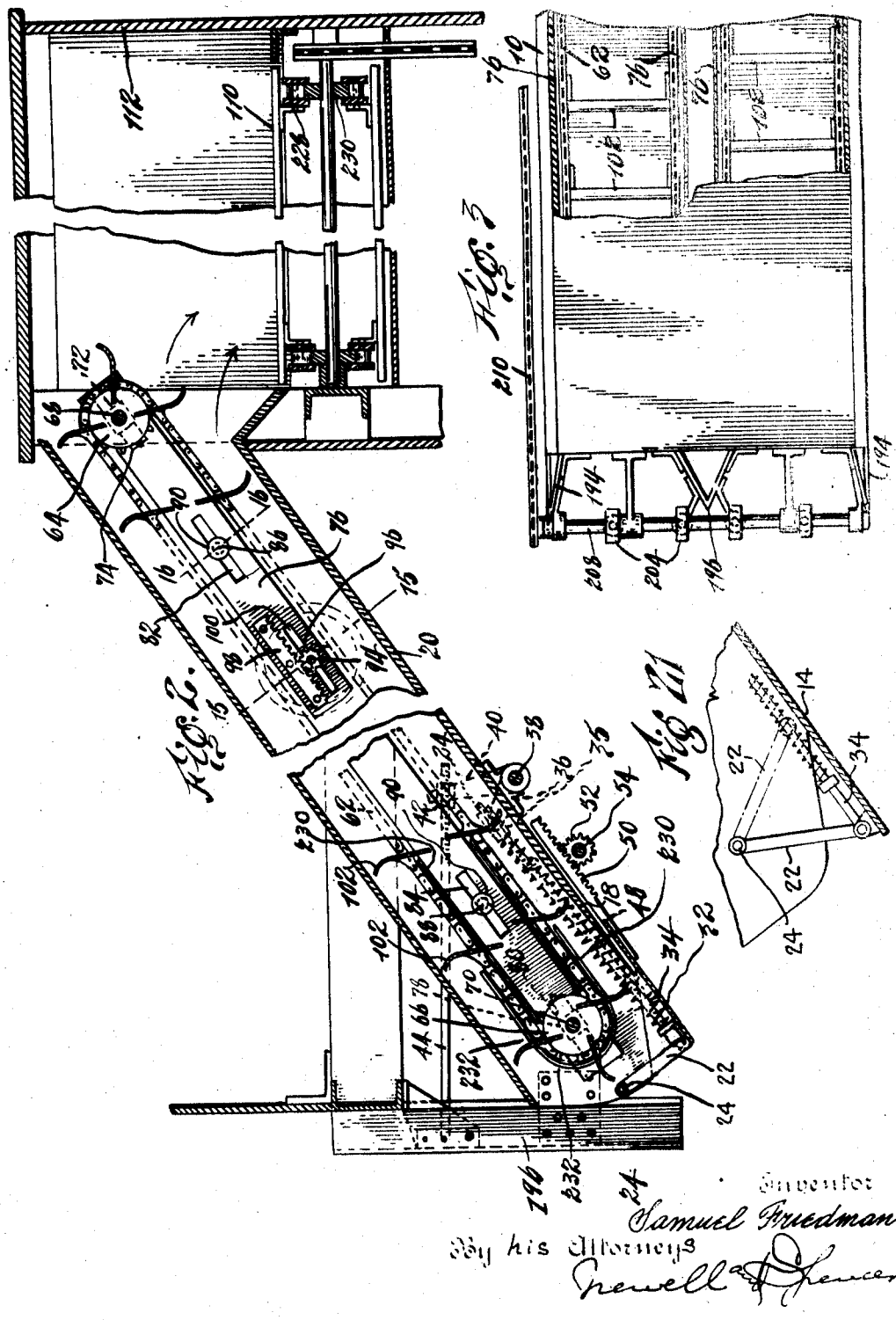


Fig. 2.

Fig. 3.

Fig. 4.

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SNOW GATHERING AND LOADING MACHINE

Filed Sept. 2, 1920 4 Sheets-Sheet 3

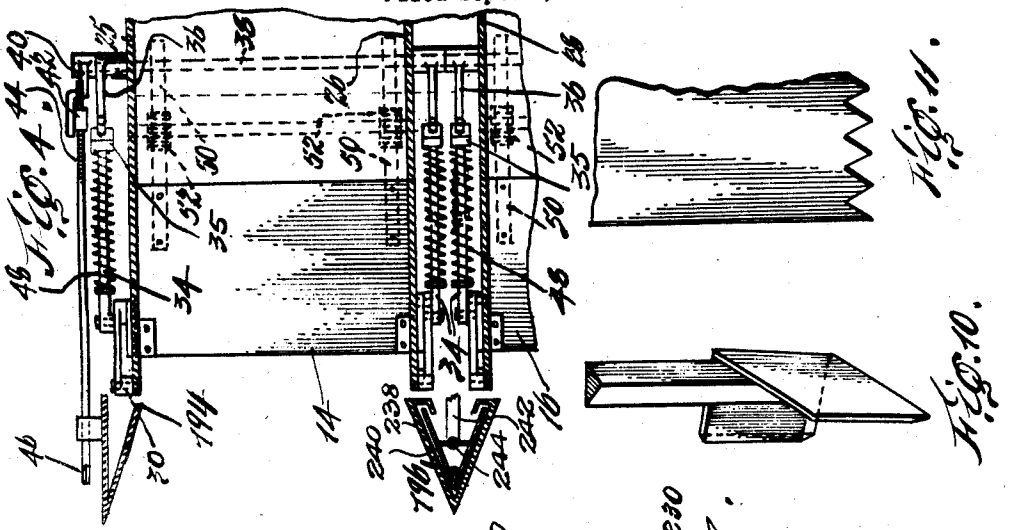


Fig. 11.

Fig. 10.

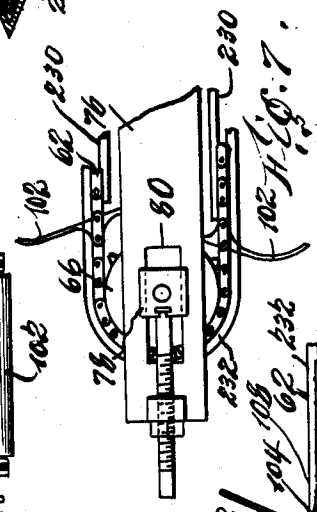


Fig. 7.

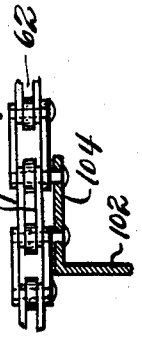


Fig. 9.

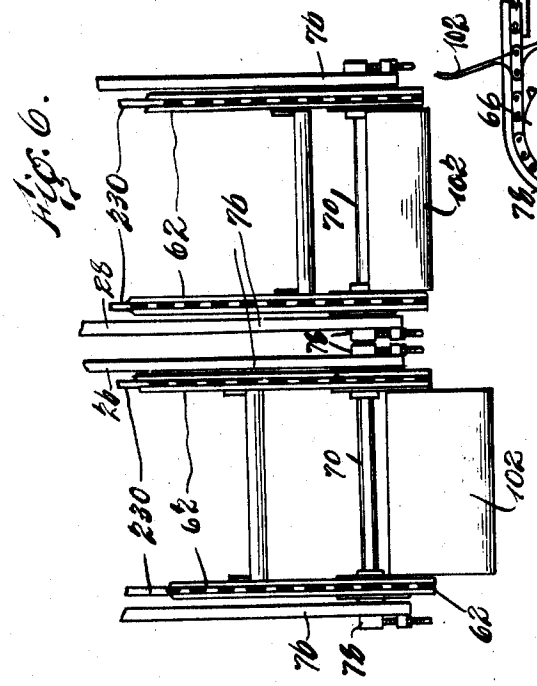


Fig. 6.

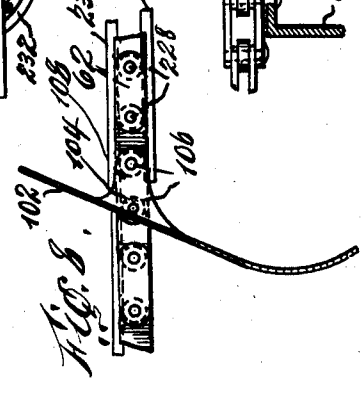


Fig. 8.

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Dec. 16, 1924. 1,519,249

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SNOW GATHERING AND LOADING MACHINE

Filed Sept. 2, 1920 4 Sheets-Sheet 4

FIG. 5

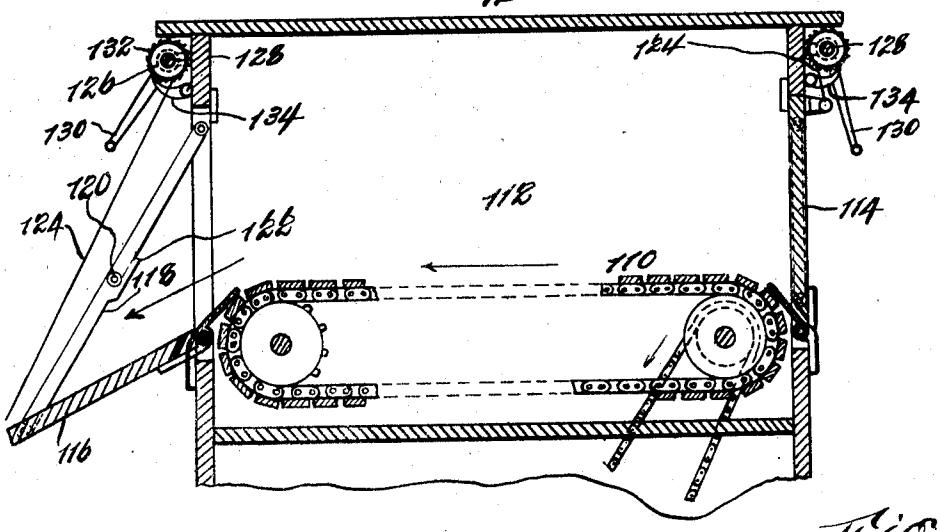


FIG. 17.

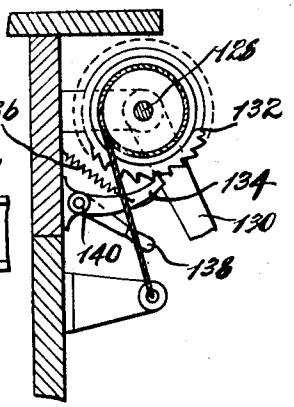


FIG. 15.

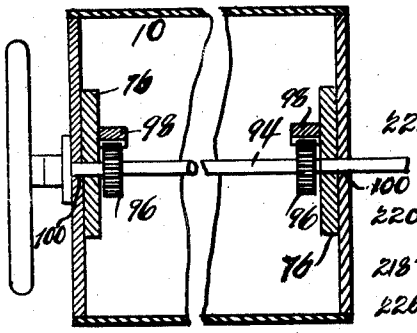


FIG. 13.

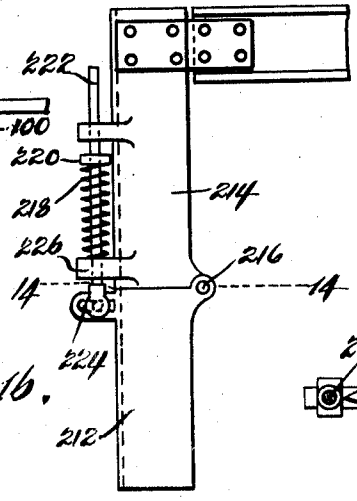


FIG. 14.

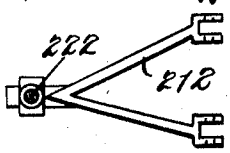
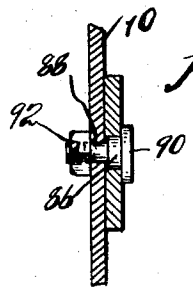


FIG. 16.



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Patented Dec. 16, 1924. 1,519,249

UNITED STATES PATENT OFFICE.

SAMUEL FRIEDMAN, OF NEW YORK, N. Y.

SNOW GATHERING AND LOADING MACHINE.

Application filed September 2, 1920. Serial No. 407,645.

To all whom it may concern:

Be it known that I, SAMUEL FRIEDMAN, a citizen of the United States, residing at 67 East 93rd Street, New York city, New York, have invented certain new and useful Improvements in Snow Gathering and Loading Machines, of which the following is a clear, full, and exact description.

This invention relates to a machine for gathering up material in the path of movement of the machine and particularly to a machine for gathering up snow in the various forms in which it is found upon city streets, the invention being herein shown as embodied in a machine for collecting snow, elevating it and discharging it at one side of the machine, either into another vehicle located at the side of the machine or upon the ground at one side of the path of travel of the machine. It will be understood, however, that the invention is not restricted to the embodiment and uses herein illustrated and described, and that many features of the invention are of general applicability in the art to which the invention relates.

The present invention, which is the result of years of practical study of the problem of handling snow, has for its general object the substantial elimination of manual labor in the cleaning of snow from city streets and the provision of a machine which will handle snow in almost any form in which it is found upon the streets of a city—as, for example, freshly fallen snow, snow which has been trodden by traffic and even those forms in which there is a considerable admixture of ice, due to a mixed storm of rain or sleet and snow, or due to thawing. More particularly, the invention aims to improve snow removing machines of the general type shown in my prior Letters Patent 1,242,433 granted October 9, 1917, for improvements in snow removing apparatus.

Important features of the present invention are the improvement in the means for gathering up the snow from the street, improvement in the construction, mounting and control of the conveyor elements, and, in general, improvement in the means for operating, adjusting and controlling the machine.

Other important features and objects of the invention will appear from the following description and claims when considered in connection with the accompanying drawings, in which,—

Fig. 1 is a side elevation of a machine embodying the present invention;

Fig. 2 is a vertical section through the inclined conveyors and through that part of the machine in which the horizontal conveyor is located;

Fig. 3 is a plan detail of the front part of the machine, with parts broken away to show the inclined conveyors;

Fig. 4 is a sectional detail showing in plan one of the plows and the associated guards;

Fig. 5 is a transverse section through the machine on the line 5—5 of Fig. 1;

Fig. 6 is a detail view illustrating the out-of-step operation of the conveyors;

Fig. 7 is a detail view of the means for tightening the conveyor chains;

Fig. 8 is a vertical section through one of the conveyor blades or shovels;

Fig. 9 is a sectional detail showing the manner of connecting the conveyor blades or shovels with the conveyor chain;

Figs. 10 and 11 are details illustrating different forms of ice cutters;

Fig. 12 shows one form of plow guard;

Fig. 13 shows a modified form of plow guard;

Fig. 14 is a section on the line 14—14 of Fig. 13;

Fig. 15 is a section on the line 15—15 of Fig. 2;

Fig. 16 is a section on the line 16—16 of Fig. 2;

Fig. 17 is a sectional detail showing the mechanism for operating the doors of the transverse conveyor compartment;

Figs. 18 and 19 are a side elevation and a sectional detail of the self-cleaning conveyor chain sprocket wheels.

Fig. 20 is an enlarged detail showing the preferred construction and arrangement of the radius link connection between the plow and the supporting frame.

Fig. 21 shows the preferred mounting of the radius link when the yielding construction shown in Fig. 20 is not employed.

The illustrated machine comprises a main horizontal frame 2 mounted upon front and rear pairs of driving wheels, 4 and 6, respectively, the front pair of wheels being arranged also for steering. The frame 2

extends a considerable distance both to the front and to the rear of its supporting wheels and at its front end carries the snow gathering and elevating mechanism and at its rear end carries the power plant. The power plant of the vehicle comprises an internal combustion engine 8, from which power is transmitted to the driving wheels 4 and 6, and from which also the elevating and transverse conveyors are driven.

The snow gathering means is mounted in or carried by an inclined casing 10, which is supported both by the horizontal frame 2 and by an upright frame structure 12, upon which the transverse conveyor is mounted, and in which there is also a compartment for receiving snow to be discharged by the transverse conveyor.

In order to cover the whole path of travel of the machine and to distribute the strain of the snow gathering operation more evenly over the machine, there are provided two snow gathering plows and two inclined conveyors cooperating with said plows and discharging the elevated snow to the common cross conveyor. As shown herein the plows 14 and 16 are mounted adjustably upon the lower end of the casing 10 and are also held in adjusted position upon the lower end of said casing by means now to be described.

Each of the plows 14 and 16 is projected beyond the reduced lower end 18 of the associated inclined chute 20, and each plow is supported at its sides by swinging links or radius rods 22 pivoted at 24 upon the outer sides of the casing 10 and upon the inner walls 26 and 28 which bound the two compartments in the casing 10. The links 22 are preferably formed as rods, each extending through a block 30 carried upon the pivot 24 and surrounded by a spring 32 between the block and the lower connection of the rod with the plow, as shown in Fig. 20 of the drawings whereby an upward yielding of the plow is permitted when an obstruction is encountered. The plow is normally projected beyond the lower end of the chute 20 by means of a second link 34, which is connected at one end to the lower end of the plow and at its other end is provided with a nut or head beyond a block 35, through which it passes, said block 35 being pivotally carried by an arm 36 attached to a rockshaft 38, to the outer end of which is connected an operating arm 40, having thereon a nut 42, through which is threaded a bolt or shaft 44, having a squared end 46 to receive a crank or wrench by which the plow may be adjusted from the front of the machine.

A spring 48, surrounding the rod or link 34 and confined between a block 35 carried by the arm 36 and a shoulder on said link near its connection with the lower end of the plow, provides for yielding movement of the plow up the chute when an obstruction is encountered, the rod or link 34 being slidable through said block. Through this spring 48 the plow projecting movement of the plow adjusting mechanism is transmitted to the plow.

The upper end of the plow is supported by racks 50, which ride upon pinions 52 upon a transverse pinion shaft 54 carried by brackets 56 depending from the casing 10.

Each plow has two supporting racks and pinions as shown in dotted lines in Fig. 4.

One of the most important features of the present invention is the construction and mounting of the inclined conveyors which form a very important part of the snow gathering mechanism. As hereinabove pointed out, two of these inclined conveyors are provided, arranged side by side so as to cover the entire width of the path of travel of the machine, the plows and inclined conveyors being located in front of the steering wheels and operating to clear the path of the driving wheels of the machine.

Each of the conveyors comprises a pair of endless chains 62, passing over upper and lower sprockets 64 and 66, carried by upper and lower shafts 68 and 70, the upper shafts 68 having their bearings in adjustable blocks 72, slidably mounted in guideways 74 in the side supports 76 of the conveyor mechanism, and the lower shafts 70 having bearings in similar adjustable blocks 78 in guideways 80 in the side supports 76.

The side supports 76 are in turn carried by the side walls of the conveyor compartments in the casing 10, being adjustably supported upon these side walls in the manner clearly shown in Figs. 2 and 16 of the drawings. Each of the side supports 76 is provided with upper and lower slots 82 and 84, which are guided upon the shoulders 86 of bolts 88, having heads 90 overlapping the sides of the slots 82 and 84, the bolts being confined in the outer side walls of the casing 10, and in the walls 26 and 28 of the compartments in said casing, by nuts 92. Upon these shouldered bolts the side supports 76 of the conveyor may be adjusted up and down the inclined conveyor casing 10 by loosening the nuts on the bolts. Means are also preferably provided for effecting the adjusting movement, the illustrated means comprising a pinion shaft 94, having its bearings in the side walls of the conveyor compartment, and carrying pinions 96, which engage racks 98 attached to the respective side supports 76, a slot 100 being provided to permit the supports 76 to slide over the pinion shaft.

The inclined conveyors of the machine of

the present invention, like those disclosed in my Letters Patent hereinabove identified, and in my co-pending application, Ser. No. 236,561, filed May 25, 1918, have blades or shovels of a shape and construction peculiarly adapted for the handling of snow and ice, the design of these blades being the result of years of practical study of the snow and ice removing problem.

It will be noted from an inspection of Fig. 2 of the drawings that the conveyor chains 62 travel in such a path that the blades or shovels 102 carried by these chains engage the snow as it is gathered up from the street by the plow, each blade or shovel biting out from the mass of snow scraped up by the plow a substantial portion, and moving it up the inclined chute 20. To perform its operation effectively, it is therefore important that the transverse curvature of each of the blades or shovels 102—that is, its curvature back from its cutting edge—shall be so related to its path of travel at the time it engages the snow that it will cut through the snow and take its proportionate part thereof without undue strain upon the machine and without tendency to pack and clog the snow at the point where the snow collecting operation takes place. The blades or shovels illustrated in transverse section in Figs. 2 and 8 of the drawings and in elevation in Fig. 7 have been found peculiarly effective when employed with a conveyor having the general path of travel of those herein shown.

From an examination of Figs. 8 and 9 of the drawings, it will be seen that each of the blades or shovels 102 is preferably formed with side arms 104, which may be integral with the body portion of the blades or shovels, each of these arms being provided with two points of connection 106 with a single link 108 of the conveyor chain 62. The arms 104 are preferably located intermediate between the upper and lower edges of the blades or shovels whereby the resistance to the snow conveying movement of the blades or shovels will be more evenly balanced and will not tend so much to distort the chain.

It will be noted that the blades or shovels are so suspended from or supported by the conveyor chains that the blades as a whole are substantially vertical, whereby a ready discharge of the snow onto and over the whole surface of the cross conveyor 110, near the upper end of the path of travel of the inclined conveyors, is obtained without the necessity for changing the direction of travel of the conveyors to bring the blades or shovels into discharging position. Nevertheless, the transverse curvature is such that as the blades or shovels travel about the lower sprockets 66, the lower edge of each blade will cut through and bite out its portion of the snow without undue strain, as in the machines of my prior Letters Patent and co-pending application hereinabove identified. The construction and arrangement of the blades and the blade design have contributed very materially to the success of this machine in the handling of snow, which is a material presenting problems peculiar to itself in the matter of handling by automatic machinery.

It will be noted that the inclined chute 20 terminates at a point in close proximity to the end of the inclined path of travel of the conveyor blades, thus permitting the blades to discharge the snow over the edge of the chute before starting their travel upward about the upper sprockets 64. The conveyors as a whole may be adjusted lengthwise of their compartments to provide for more or less discharging travel beyond the upper end of the chute as required and also to bring the lower end of the conveyor mechanism closer to or farther away from the operations of the plow.

The snow gathered up by the plows and moved up the inclined chutes by the conveyors is discharged upon the cross conveyor 110, which is located in a compartment 112 extending across the machine and having doors 114 and 116 in its ends, which are closed while the inclined conveyors are discharging snow upon the cross conveyor. These doors, as shown particularly in Figs. 1 and 5, are hinged on their lower edges and swing outward to form discharging chutes down which the snow is discharged from the compartment, by the movement of the cross conveyor, into another vehicle stationed beside the machine or down which it may be continuously discharged while the machine is moving.

In the collection of snow to be carried away from city streets the doors 114 and 116 will ordinarily be kept in a closed condition, and then the door, upon that side of the machine upon which the truck or cart to receive the snow is located, will be lowered into its discharging position, and the cross conveyor will be actuated to move the snow in the compartment to that side of the machine, provision being made for driving the conveyor 110 in either direction. Each of the doors 114 and 116 is supported in its open position by a link 118 having a hinge 120. One of the parts of the link is provided with a stop 122 overlapping the other part to stop the link in such a position that when the door is lifted to its closed position the link will fold back against the side of the machine. Mechanism for lifting and lowering the doors comprises cables 124 connected to each corner of the door and each wound upon a drum 126 on a drum shaft 128

mounted on the side of the machine above each door and provided with a handle or crank 130 and a ratchet wheel 132 engaged by a pawl 134 upon the machine crank, the pawl 134 being yieldingly held in engagement with the ratchet wheel by a spring 136. A handle 138 connected with pawl 136 through its rockshaft 140 is arranged to be moved by the operator to disengage the pawl 134 from the ratchet wheel 132 when it is desired to lower one or the other of the doors 114 and 116 to snow discharging position.

As hereinabove pointed out, power for propelling the machine and for driving the conveyors is preferably obtained from an internal combustion engine 8 located at the rear of the machine and provided with a radiator 142 and a hood cover 144. The machine is preferably arranged to require the services of two operators, one of whom is located in a driver's compartment 146 at the front of the machine and controls the propulsion of the machine over the ground, the operation of the inclined conveyors, the adjustment of the plows and the operation of the ice cutting mechanism and other parts of the machine connected with the snow gathering operation proper, the other operator being located upon a platform 148 near the rear end of the machine, the latter operator having control of the discharging functions of the machine, that is, the opening of the compartment doors and the actuation and control of the direction of the cross conveyor.

As hereinabove pointed out, the machine is preferably driven by all four of its supporting wheels, the front wheels 4 being arranged also for steering. The transmission gearing is contained in a casing 150 from which driving shafts 152 and 154 extend respectively to the driving mechanism for the front wheels 4 and the driving mechanism for the rear wheels 6. The clutch for connecting the motor to the transmission gearing is shown at 156, and is controlled by connections to a pedal 158 comprising a link 160 and a lever 162. The transmission gearing is controlled to effect the change of speeds and reversal, etc., through a lever 164, connected with the transmission gearing through any suitable gear changing connections, the particular mode of effecting the change of speed and the reversal of the driving connections not constituting a part of the present invention and therefore not being specifically shown and described.

Reduction gearing is provided in the casing 166 from which a shaft 168 extends to a clutch 170 controlled by a lever 172 connected to said clutch through a link 174 and a lever 176. The clutch 170 is arranged to connect the shaft 168 to a second shaft 178 connected by beveled gearing, not specifically shown, to a cross shaft 180, having thereon sprockets 182 connected by sprocket chains 184 to the driving sprockets 64 by which the inclined conveyor chains 62 are driven.

The transverse conveyor is driven from the reduction gearing in casing 166 by suitable connections comprising a clutch 186 located upon the side of said casing 166 opposite to that upon which the clutch 170 is located, said clutch being controlled from a lever 188, arranged to be operated by the operator who stands upon the platform 148, and being connected to the clutch 186 by a link 190 and a lever 192. The clutch mechanism 170, and also the clutch mechanism 186, preferably comprises suitable means for reversing the direction of movement of the conveyors or conveyor controlled thereby.

In order to cut the snow to be gathered from that which lies outside the field of the gathering operation of the machine, side guards or cutters 194 are preferably arranged at the front of the machine, these guards extending down from the frame 2 in front of the side walls of the casing 10 and being connected to and helping to support casing 10 against the strains of the snow gathering operation, the casing 10 also affording support for these guards, in addition to the support which they obtain from the frame, against the shock of the snow and ice cutting operations of the guards. It will be noted from inspection of Fig. 3 of the drawings that these guards or cutters are wedge-shaped in cross section, the outer sides of the side guards being preferably substantially parallel to the side walls of the compartment or casing 10, whereby they do not offer substantial resistance to the movement of the machine. The inner walls preferably slope somewhat toward the center of the machine to aid in directing the snow toward the shovels and the conveyors. A third guard or cutter 196 is also preferably provided which extends down over the central compartment partitions and over the space between the two compartments, this guard being V-shaped and so arranged that it directs the snow away from this part of the machine to the two plows and the inclined conveyors. These guards are of relatively short dimensions in transverse section, so that only a small movement of the snow is effected by them and thus they do not offer substantial resistance to the progress of the machine.

It sometimes happens that the machine is called upon to gather ice which has frozen to the ground, and in such case it is preferable to effect a breaking up of the ice in advance of the operation of the plows and the inclined conveyors. This, of course, may be done by hand, or by a separate machine, or it may be done by an attachment on the present machine. If snow is merely provided with a surface encrustation, the con-

veyor blades will handle this or it may be broken by the guards shown in Fig. 3 of the drawings, or its breaking may be facilitated by employing a serrated guard 198 such as shown in Fig. 12. But when the machine is called upon to gather ice which has frozen solid and also frozen to the ground so the plow cannot get under it, the ice may be operated upon by ice cutting mechanism such as shown in Fig. 1 of the drawings, this mechanism comprising ice cutters 200, vertically movable in guides 202 attached to the guards 194 and 196 and connected by eccentric straps 204 to eccentrics 206 on a cross shaft 208 driven from a sprocket and chain connection 210 with the shaft 180. Modified designs of the cutting tools are shown in Figs. 10 and 11.

To prevent bending or breaking of the guards 194 and 196, these may each be constructed as shown in Figs. 13 and 14 with a hinged lower section 212 yieldingly held in vertical alinement with the upper sections 214 and against movement about the hinge 216 by means of a spring 218 compressed between a collar 220 on a rod 222, having a pin and slot connection 224 at its lower end with the part 212, and one of the guides 226 for said rod.

As shown in Figs. 9 and 19 of the drawings and also in Fig. 2, the conveyor chains are provided with rollers 228 between the side members of the links, these rollers being of somewhat less diameter than the vertical dimensions of the links whereby the link side members serve to confine the chains upon tracks 230 upon which the rollers 228 run, these tracks being preferably located upon the inner side of the chains—that is, within the loop. In the case of the inclined conveyors, the tracks or guides have an added function in that they compel the conveyor blades to travel in a predetermined path in spite of possible slackness in the chain, thus insuring a positive snow cutting and snow conveying operation. It will be noted that the tracks or guides 230 for the inclined conveyors extend approximately to the sprockets 66 upon the inside of the path of travel of the chain, and in order further to support the chain and direct it in a definite path, other guides or tracks 232 are provided along the outer path of travel of the chain about the sprockets 66, thus insuring confining the blades to a predetermined curved path of travel in the region of their snow engaging operation.

To prevent clogging of the chain by the snow, the machine is provided with novel self-cleaning sprockets, these sprockets being shown particularly in Figs. 18 and 19 of the drawings. From an inspection of these figures, it will be seen that each of the sprockets is provided between its teeth 234 with beveled discharging surfaces 236, sloping to either side of the sprocket wheel so that any snow that may tend to get between the chain and the spaces between the sprocket teeth will be forced down these inclined surfaces 236 to the sides of the sprocket wheel and out of the way.

In order to distribute the strain of the snow gathering operation more uniformly over the working parts of the machine, the two inclined conveyors are so timed with respect to each other that the conveyor blades of the one conveyor move in out-of-step relation to the blades of the other conveyor, as shown particularly in Fig. 6 of the drawings. It will thus be seen that when one of the conveyor blades engages the snow gathered up by the associated plow to bite out a portion of this snow one of the blades of the other conveyor will have substantially completed its cutting out operation.

In Fig. 21 is shown a modification of the arrangement of the radius rods which support the plows for longitudinal adjustment, to prevent too great a rocking of the plows out of the plane of the chutes as they are adjusted from one extreme limit to the other. The radius rods as shown in this figure are each preferably pivoted at a point in that radius of the arc of swing of the rod which is normal to the cord of said arc drawn from one extreme position of the plow to the other.

To permit a vertical adjustment of the intermediate guard or cutter to suit it to different conditions which may be encountered in the operation of the machine, this guard or cutter may be made in two sections, one of which telescopes within the other as shown in Fig. 4. Suitable mechanism may be provided for effecting the vertical adjustment of the lower telescopic section 238 of this guard or cutter, this mechanism comprising a rod 240 connected to said telescopic section. To provide proper support for this telescopic section, it may have connected therewith a radius link 242 pivoted to a pivot pin 244 in said section, the radius link or rod 242 being preferably of sufficient length so that its arc of swing in the vertical movement of the section 238 will be comparatively flat.

In order to hold the machine at operative distance from the street curb the outside radius rods may be provided, if desired, with curb engaging wheels turning about vertical axes.

In the present machine the speed of the elevating and cross conveyors is preferably constant, but the speed of travel of the machine can, of course, be varied by the speed changing mechanism, thus the relative speeds of the machine and conveyors can also be varied.

Although the term "snow" has usually been used throughout the specification and claims to designate the material which the

machine is designed to handle, it will be understood that the utility of the machine is not restricted to the handling of snow proper but also to the handling of both snow and ice as it appears upon streets, highways, railroads, etc.

What I claim as new is:

1. In a machine of the class described, endless inclined conveyors having blades arranged to cut down through and sever from the mass portions of snow coming into the field of operation of said conveyors and to elevate said snow, and means for simultaneously operating said conveyors in out-of-step relation to each other.

2. In a traveling machine for gathering up snow from city streets, snow collecting means comprising an inclined chute, endless conveyors arranged side by side for moving snow up the chute and having blades shaped and arranged to positively cut down through and sever individual portions from the mass of snow that comes into the field of operation of said conveyors and means for operating said conveyors in out-of-step relation to each other.

3. In a traveling machine for gathering up snow from city streets, snow collecting means comprising an inclined chute, endless conveyors arranged side by side for moving snow up said chute and having blades shaped and arranged to positively cut down through and sever individual portions from the mass of snow that comes into the field of operation of said conveyors, means for bringing into the field of operation of said conveyors the snow which is in the path of travel of the said machine, and means for operating said conveyors in out-of-step relation to each other.

4. In a traveling machine for gathering up snow from city streets, snow collecting means comprising endless inclined conveyors arranged side by side and constructed and arranged to positively cut down through and sever from the mass portions of the snow coming into the field of operation of said conveyors, an inclined chute up which said conveyors move the snow thus gathered and divided and means for operating said conveyors in out-of-step relation to each other.

5. In a machine of the class described, snow collecting means comprising endless inclined conveyors arranged side by side, means for directing into the field of operation of said conveyors the snow which is in the path of travel of said machine, a transverse conveyor upon which said endless conveyors discharge the collected snow, a compartment in which said transverse conveyor is located and which, when closed, serves to confine the collected snow upon said conveyor, said compartment being adapted to open to either side of said machine, means for operating said inclined conveyors in out-of-step relation to each other, means for operating said cross conveyor to discharge the collected snow to either side of the machine and chutes cooperating with the respective ends of said cross conveyor in discharging the snow, either of said chutes when not so used being adapted to serve as a door to close an end of said compartment.

6. In a snow gathering machine, means for collecting the snow, comprising an endless inclined conveyor having blades for elevating successive portions of the snow coming into the field of operation of said conveyor, and reciprocating ice cutting or breaking means arranged in front of said conveyor and movable transversely to the surface of the ice.

7. In a traveling machine for gathering up snow from city streets, snow collecting means comprising endless inclined conveyors arranged side by side and each having blades constructed and arranged to positively cut down through and sever from the mass portions of the snow coming into the field of operation of said conveyors, and reciprocating ice-breaking means operating in advance of said collecting means and movable transversely to the surface of the ice.

8. A traveling machine for gathering up snow from city streets, comprising two pairs of driving wheels, one pair at least of which is arranged for steering, a frame carried by said wheels and extending both to the front and to the rear of said wheels, snow collecting means carried upon said frame at the front end thereof and comprising an inclined conveyor, a motor for driving said wheels and operating said conveyor carried upon said frame at the rear end thereof, a transverse collecting and discharging conveyor carried upon said frame intermediate between the ends thereof, and suitable operating connections between said motor, said driving wheels and said conveyors.

9. In a machine of the class described, snow collecting means comprising an endless inclined conveyor having blades constructed and arranged to positively cut out portions of the snow coming into the field of operation of said conveyor and means for positively confining said conveyor to a predetermined path of movement throughout the snow collecting operation thereof.

10. In a machine of the class described, snow collecting means comprising an endless inclined conveyor having blades shaped to cut down through and sever from the mass portions of the snow coming into the field of operation of said conveyor, lateral supporting chains to which said blades are connected and means for confining said chains and therewith said blades to a definite path of travel throughout the snow collecting operation.

11. In a machine of the class described,

an endless inclined conveyor comprising a pair of sprocket chains, blades supported by said chains and each constructed and arranged to positively cut down through and sever from the mass a portion of the snow coming into the field of operation of said conveyor, an inclined chute up which snow is carried by said conveyor, upper and lower supporting sprockets for said chains, inner rails upon which said conveyor chains run between the said sprockets confining said conveyor to a predetermined path of movement with relation to the chute during the snow collecting operation.

12. In a machine of the class described, an endless inclined conveyor having blades shaped to engage and positively cut out portions of snow coming into the field of operation of said conveyor, a chute up which the conveyor moves the snow thus gathered, supporting wheels about which said conveyor travels in its snow cutting operation, and tracks extending about said wheels and confining said conveyor to a predetermined curved path of movement during the snow cutting operation.

13. In a snow collecting machine, snow collecting means comprising an endless inclined conveyor having blades constructed and arranged to positively cut down through and sever from the mass portions of the snow coming into the field of operation of said conveyor, and an inclined chute up which said conveyor moves the snow collected thereby and over the upper edge of which it discharges said snow, said conveyor being bodily adjustable lengthwise of said chute.

14. In a snow collecting machine, snow collecting means comprising an endless inclined conveyor having blades constructed and arranged to positively cut down through and sever from the mass portions of the snow coming into the field of operation of said conveyor, an inclined chute up which said conveyor moves the snow collected thereby and over the upper edge of which it discharges said snow, said conveyor being bodily adjustable lengthwise of said chute, and means for effecting such adjustment and for securing the conveyor in adjusted position.

15. In a machine of the class described, snow gathering means comprising an endless inclined conveyor having blades shaped to cut down through and sever from the mass portions of the snow coming into the field of operation of said conveyor and elevating the snow thus gathered, supports for said conveyor bodily adjustable with said conveyor up and down said incline and means on said supports for adjusting the slack in said conveyor.

16. A machine of the class described, comprising an endless inclined conveyor having blades arranged to engage and elevate successive portions of the snow coming into the field of operation of said conveyor, a plow for directing the snow into the field of operation of said conveyor, said plow being yieldingly projected beyond said conveyor in the general direction of the inclination thereof and also being yieldingly supported against transverse movement relative to said conveyor.

17. In a machine of the class described, the combination with means for elevating snow, of means for bringing the snow into the field of operation of said elevating means comprising a plow inclined to the surface over which the machine passes, radius links supporting the forward end of said plow, a rear support for said plow over which it is adjustable in the general direction of its inclination, and means for adjusting said plow comprising means for yieldingly maintaining said plow projected to the limit of its adjusted position.

18. In a machine of the class described, snow collecting means comprising endless inclined conveyors arranged side by side and each adapted to cut down through and sever from the mass portions of snow coming into the field of operation thereof and elevate said snow, plows projecting in front of said conveyors arranged to bring the snow into the field of operation of said conveyors, and a guard covering the space between said plows and between said conveyors and yieldingly supported against excessive strain.

19. In a machine of the class described, an endless conveyor for collecting and elevating snow, said conveyor comprising cross blades and lateral supporting chains, and chain supporting sprockets having between the successive teeth laterally inclined snow discharging surfaces.

20. In a snow gathering machine, means for collecting the snow comprising an endless inclined conveyor having blades shaped and arranged to positively cut out portions of the snow coming into the field of operation of said conveyor, each of said blades being provided with a toothed cutting edge.

21. In a snow gathering machine, means for collecting the snow comprising an endless inclined conveyor for engaging and elevating the snow, a cross conveyor adapted to be operated in either direction and upon which said inclined conveyor discharges its snow, a compartment for said cross conveyor comprising doors hinged at their bottoms and arranged respectively to be swung down to constitute discharging chutes for said cross conveyor.

22. In a snow gathering machine, means for collecting the snow comprising an endless inclined conveyor for engaging and elevating the snow, a cross conveyor adapted

to be operated in either direction and upon which said inclined conveyor discharges its snow, a compartment for said cross conveyor comprising doors hinged at their bottoms and arranged respectively to be swung down to constitute discharging chutes for said cross conveyor and a folding stop for each door arranged to hold it in chute position when the door is open and to fold beside said door when it is closed.

Signed at New York city, New York, this 20th day of August, 1920.

SAMUEL FRIEDMAN.