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Maisonneuve et al.

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[45] **June 3, 1975**

[54] **ADJUSTABLE AUGER COVER FOR SNOW BLOWER**

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[73] Assignee: **Canron Inc.,** Phillipsburg, N.J.

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[21] Appl. No.: **471,127**

[52] **U.S. Cl.** ..... **37/25;** 37/43 R; 15/54; 198/213

[51] **Int. Cl.** **E01h 8/06**

[58] **Field of Search** ..... 37/20, 24, 25, 43 R, 43 E; 198/213; 15/54, 55

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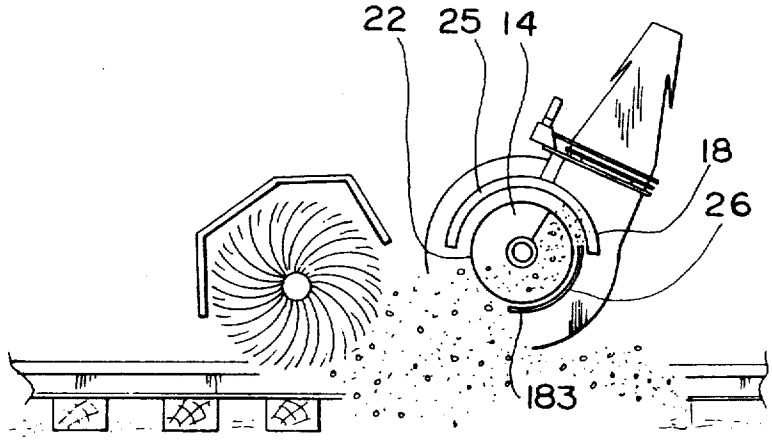
Primary Examiner—E. H. Eickholt

[57] **ABSTRACT**

A snow clearing machine capable of clearing snow from the roadbed of and from about the rails of railroad track having a rotary broom mounted across the front of rail vehicle. Mounted in front of this broom is a snow-removing horizontal auger enclosed in a shroud consisting of a first pivotable semi-cylindrical member and a second pivotable member including an arcuate plate subtending an angle of 90°. Power means are provided for pivoting the first pivotable member from a front position to a rear position and for raising and lowering the auger and shroud means. When the pivotable members are in a front position, the first pivotable member covers the top half of the auger and the second pivotable member covers the bottom of the front half of the auger. When the pivotable members are in a rear position, the first pivotable member covers the rear half of the auger and the second pivotable member is positioned adjacent the first member at the rear of the auger. With the members in the front position, the broom is used to sweep the snow on the track forwardly and upwardly to the auger which then discharges the snow via an impeller wheel at the centre of the auger to a suitable location. With the members in the rear position, the broom is not used and the snow is fed directly into the auger from the front thereof, this system being used when the snow is deep.

19 Claims, 14 Drawing Figures



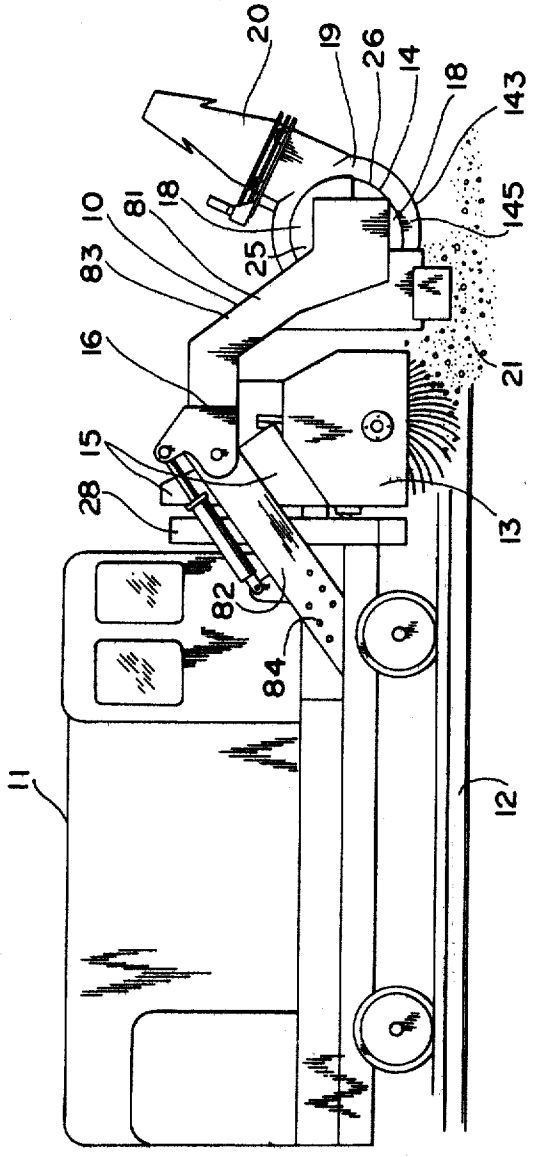


FIG. 1

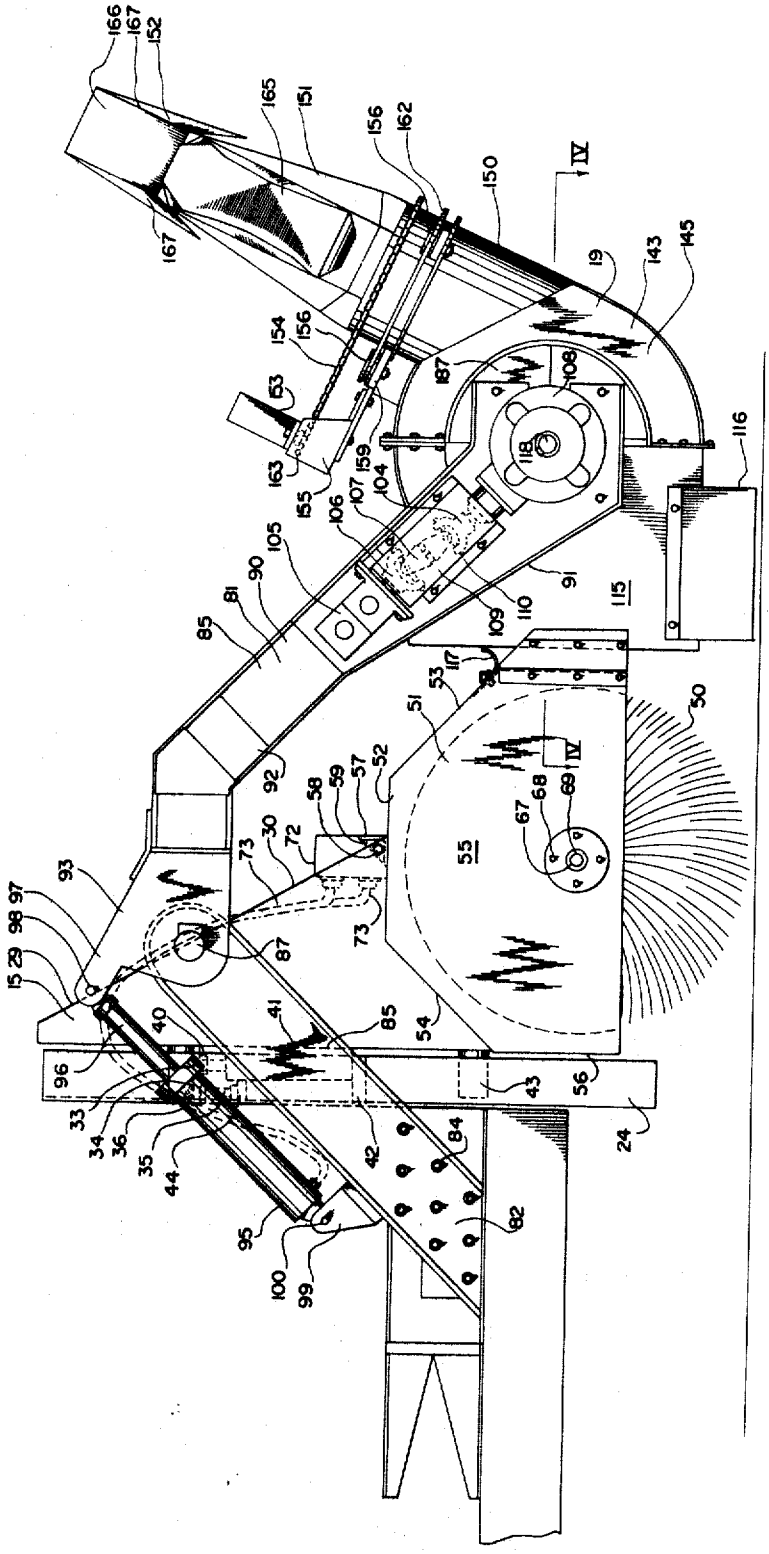

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FIG. 2

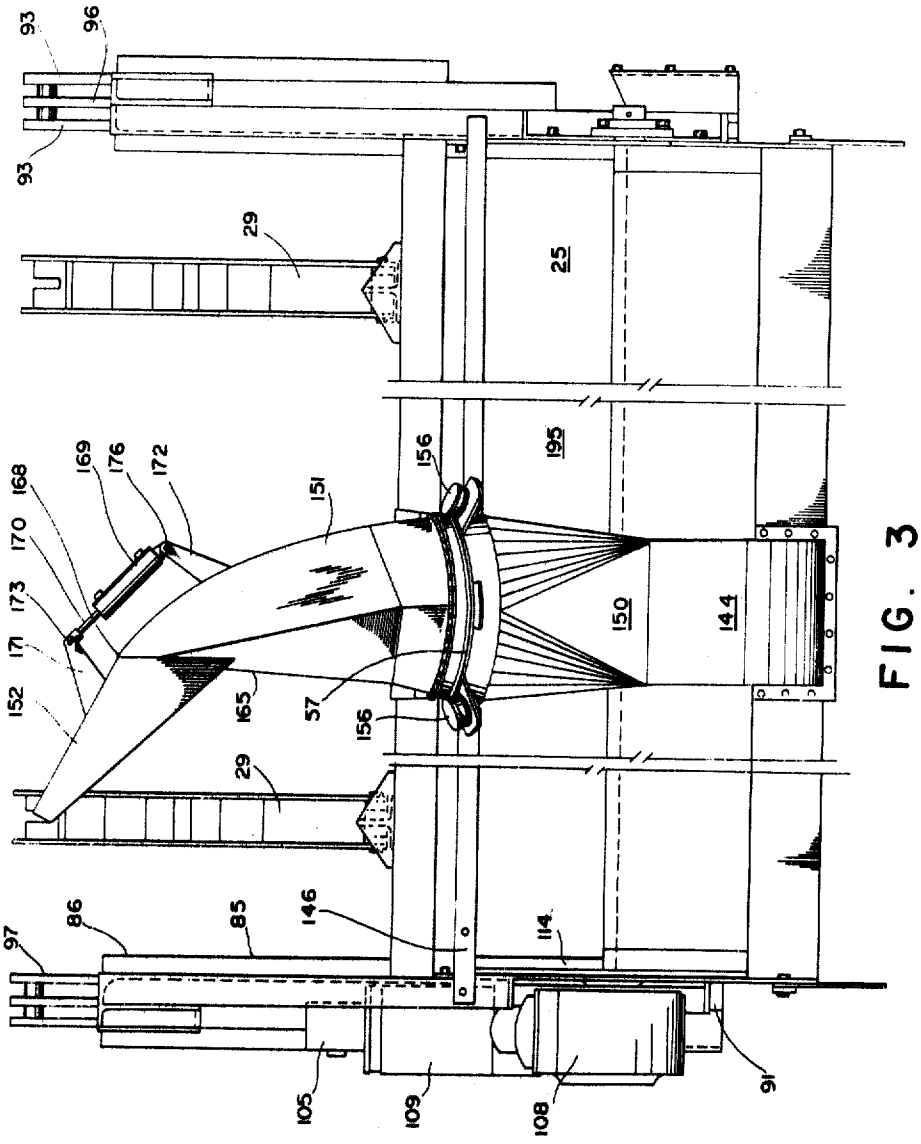
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FIG. 3

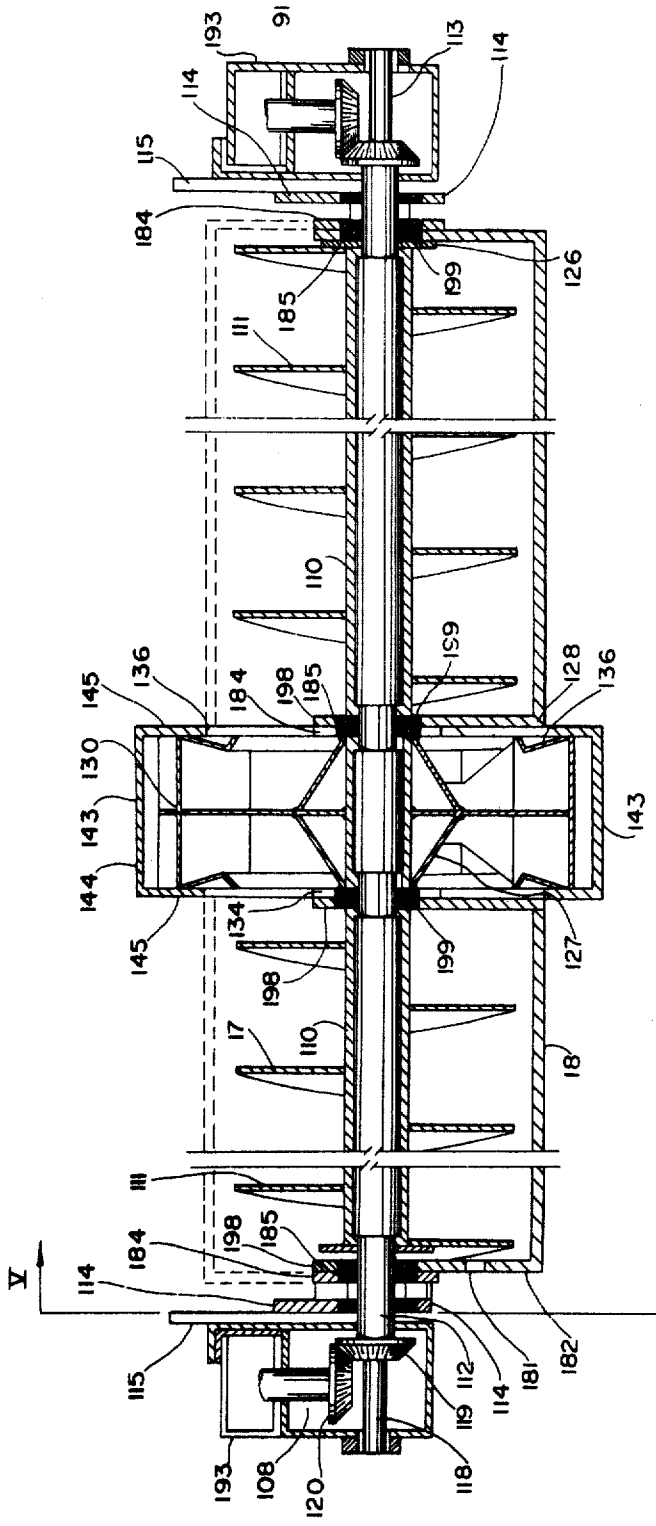
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FIG. 4

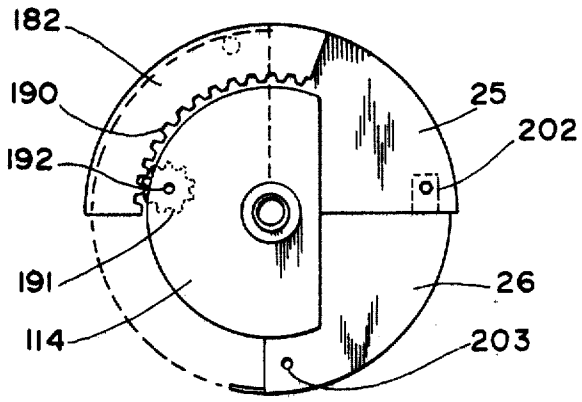
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FIG. 5

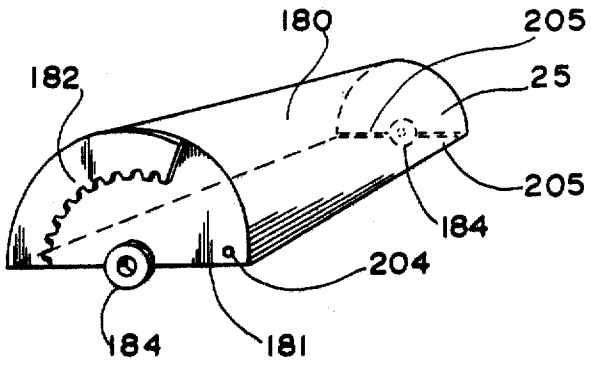
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FIG. 6

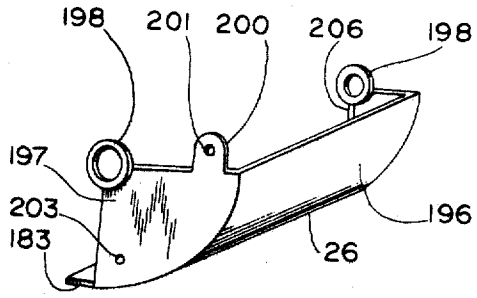

FIG.7

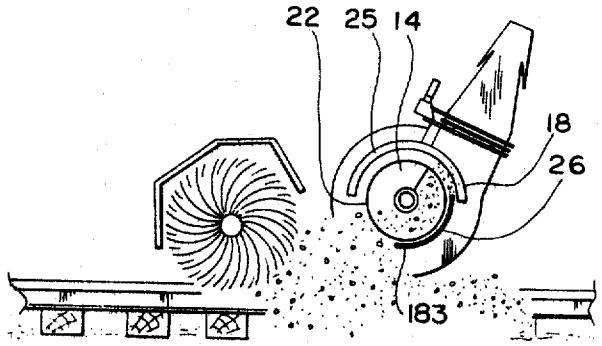

FIG. 8

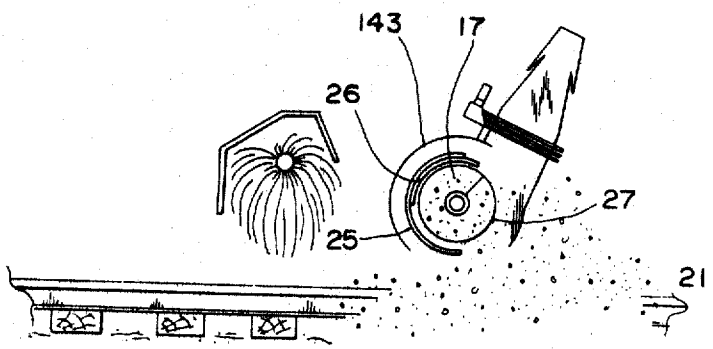

FIG. 9

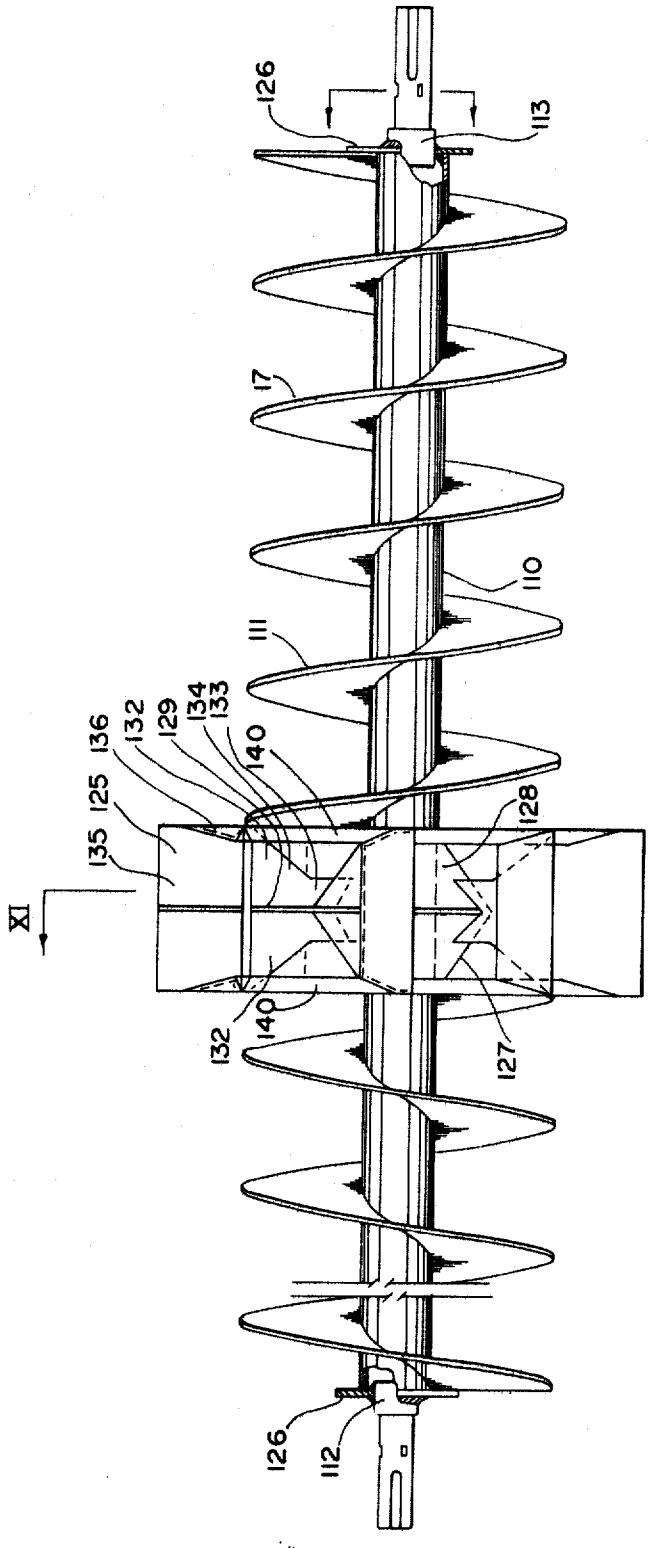
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FIG. 10

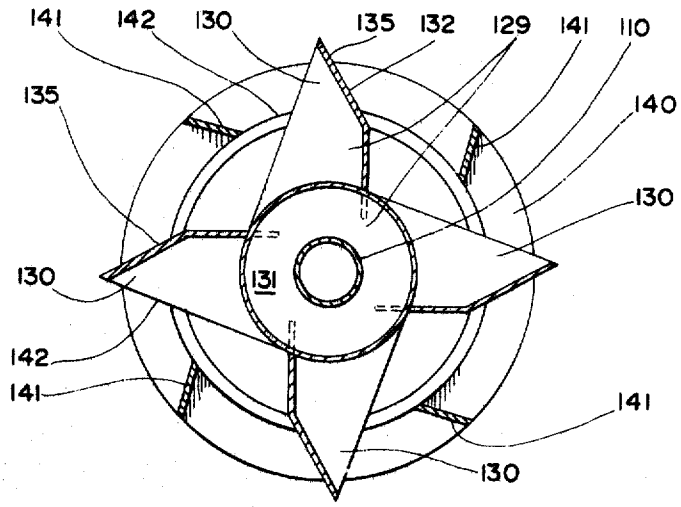
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FIG. 11

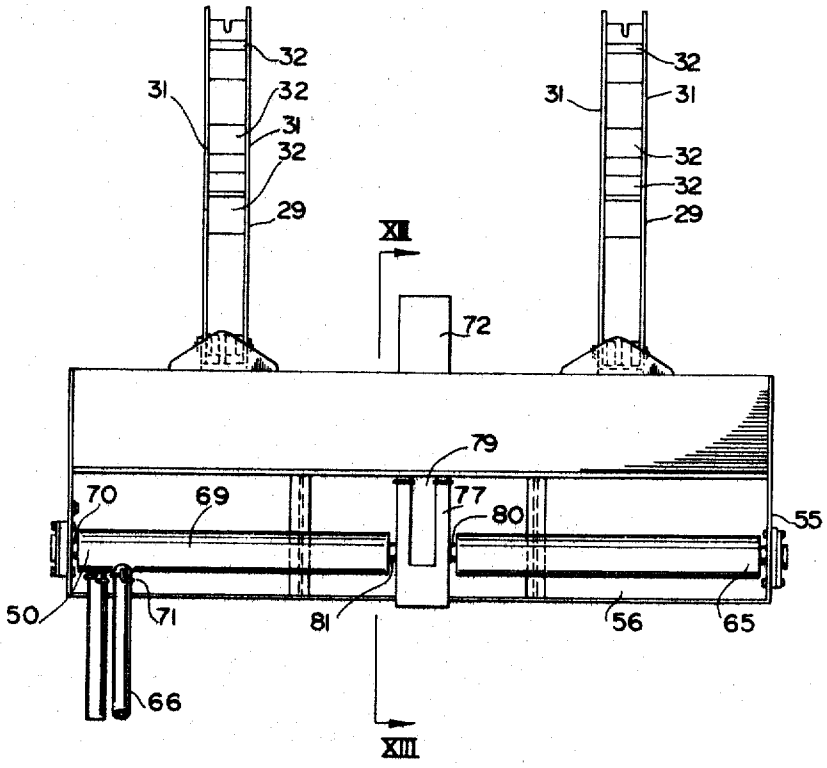
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FIG. 12

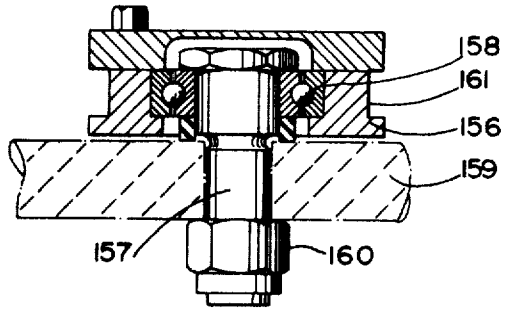

FIG. 14

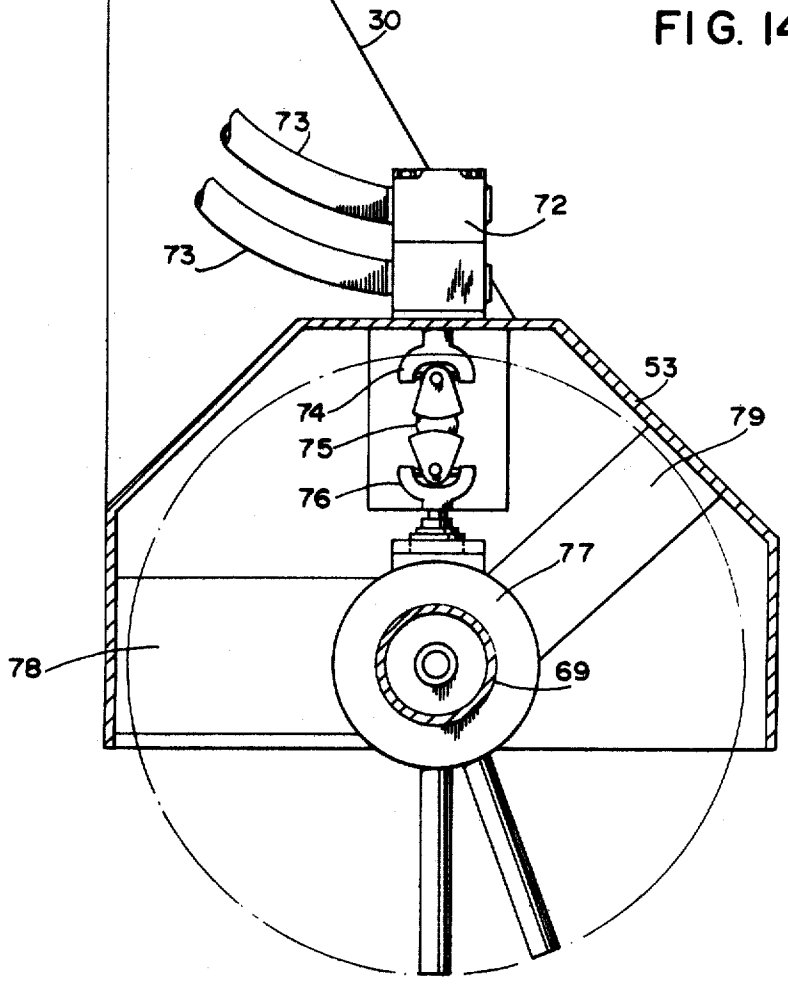

FIG. 13

ADJUSTABLE AUGER COVER FOR SNOW BLOWER

FIELD OF THE INVENTION

This invention relates to apparatus for clearing snow from the roadbed of railroad track and in particular to an improved auger apparatus for use in combination with a track sweeper mounted behind the auger apparatus.

BACKGROUND OF THE INVENTION

Machines for clearing snow from ordinary railroad track are well known, such machines including the familiar railroad snow plow and snow blower. However such equipment is not entirely satisfactory for or capable of clearing snow around sections of track where railroad track meet or where switches are located. In the past such sections of track have been cleared manually due to lack of suitable machines.

An apparatus for clearing snow from the roadbed of and about the rails of complex railroad track and switches is described in Canadian Patent No. 614,348 issued July 10, 1962 to Albert E. Pyke. This apparatus has an elongated sweeping device mounted at the front of a rail vehicle within sweeping reach of the roadbed. By rotation of the sweeping device, the snow is thrown forwardly and upwardly from the roadbed and from both sides of each rail. A disposal device comprising a horizontal auger rotatably mounted in a catcher or shroud catches the snow thus thrown and deposits it along and at one side of the railroad track. The forward portion of the catcher consists of a unitary curved plate member extending completely around the front half of the auger and extending the full width of the sweeper and auger. The catcher is rigidly fastened to two support bars at each end end of the catcher and the auger or rotary screw conveyor is rotatably mounted in the same bars.

The above-mentioned apparatus for clearing snow is generally satisfactory for complex railroad track if the snow is in excess of 8 to 10 inches and has not formed drifts but is generally inefficient or even useless where deep snow is encountered.

Accordingly it is an object of the present invention to provide a snow clearing machine for railroad track which is capable of either removing snow from the roadbed of and about the rails of complex railroad track or suitably disposing of deep snow located on railroad track.

Another object of the present invention is to provide an apparatus for clearing snow having a sweeping device and auger means mounted ahead of the sweeping device wherein the sweeping device and auger means can be used in combination to remove a relatively light amount of snow from railroad track and the auger means can be used alone to remove deep snow from the track.

Still another object of the present invention is to provide an auger apparatus including a horizontal auger and shroud means wherein the shroud means is capable of being pivoted to a front position for enclosing the front of the auger and leaving at least a portion of the rear of the auger open or to a rear position for enclosing the rear of the auger and leaving at least a substantial portion of the front of the auger open.

SUMMARY OF THE INVENTION

Accordingly the auger apparatus of the present invention is for use in combination with a snow clearing vehicle having a sweeping device mounted on the front of said vehicle for sweeping snow forwardly and upwardly from the roadbed of railroad track. The auger apparatus comprises support means, an auger mounted on said support means for rotation about a horizontal axis and shroud means for enclosing said auger including at least one pivotable shroud member. The pivotable shroud member is pivotable from a front closing position to a rear closing position. In operation the auger apparatus is mounted ahead of the sweeping device and the sweeping device sweeps snow forwardly and upwardly where it is caught by the auger and shroud means when the pivotable shroud member is in the front closing position. If the pivotable member is in the rear closing position, the auger apparatus engages snow entering the auger apparatus directly from the front. In either case, the snow caught in the auger is removed away from the track to a suitable location.

In a preferred embodiment the shroud means comprise two separately pivotable shroud members, one member subtending an angle of 180° and the other member subtending an angle of 90°, the centre of each angle being located along the center axis of the auger. The smaller member can be pivoted to a position within a portion of the larger pivotable member to permit the entire front of the auger to be open when the larger shroud member is in the rear closing position. Alternatively the smaller member can be pivoted to a position beneath the front half of the auger to enclose a portion of the front of the auger when the larger shroud member is in the front closing position.

Preferably the auger apparatus includes power means for adjusting the vertical position of the auger and the shroud means relative to the ground. This permits the auger to be moved vertically quickly and easily to clear deep snow away from the track when the pivotable shroud member is in the rear closing position.

Further embodiments, advantages, and objects of the present invention will become evident upon consideration of the accompanying drawings and the following detailed description of a preferred embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings,

FIG. 1 is a schematic side view of a preferred embodiment of the snow clearing apparatus of the present invention including a rail vehicle mounted on railroad track,

FIG. 2 is an enlarged side view of the front portion of the apparatus shown in FIG. 1,

FIG. 3 is an enlarged front view of the auger means shown in FIG. 2,

FIG. 4 is a sectional view of the auger means taken along the line IV—IV of FIG. 2,

FIG. 5 is a side detail of the auger shroud and the means for pivoting the pivotable shroud member about the axis of the auger, the view being taken along line V—V of FIG. 4,

FIG. 6, is a perspective view of the first pivotable shroud member for the auger,

FIG. 7 is a perspective view of the second, smaller pivotable shroud member,

FIG. 8 is a schematic illustration showing the manner in which the sweeping device and auger means cooperate to remove snow when the pivotable shroud members are in the front closing position,

FIG. 9 is a schematic illustration showing the manner in which the auger means can be used by itself to remove deep snow from the track when the pivotable shroud members are in the rear closing position,

FIG. 10 is a front view of the auger and impeller wheel separated from the rest of the auger means,

FIG. 11 is a sectional side view of the impeller wheel taken along the line XI—XI of FIG. 10,

FIG. 12 is a front view of the sweeping device and its support means,

FIG. 13 is a sectional elevation of the rotary broom and the drive means therefor, the view being taken along the line XIII—XIII of FIG. 12, and

FIG. 14 is a sectional elevation showing the construction of each guide wheel for the center portion of the discharge duct and the means for mounting the guide wheel, the section being taken along the center axis of the guide wheel.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a preferred embodiment of the snow clearing apparatus of the present invention generally designated by the numeral **10**. As shown, the snow clearing apparatus is mounted at the front of a suitable rail vehicle **11** which is travelling over railroad tracks **12**. The rail vehicle **11** is preferably self-propelled but it is possible to have the vehicle **11** propelled by an ordinary locomotive if desired. The rail vehicle **11** can then simply carry power means for driving the various components of the snow clearing apparatus itself.

The snow clearing apparatus **10** includes a rotatable elongated sweeping device generally designated by the numeral **13** and auger means **14** mounted ahead of the sweeping device **13**. The sweeping device **14** is mounted to the front of the vehicle **11** in the track sweeping position shown in FIG. **1** by first support means **15**. The auger means is mounted to the front of the vehicle **11** by second support means **16**. The auger means **14** includes at least one auger **17** which is mounted to rotate about a horizontal axis, this auger being shown in detail in FIGS. **4** and **10**, and shroud means **18**.

The shroud means **18** covers an area extending around a substantial portion of the circumference of the auger **17** to permit the auger to feed snow which is trapped between the helical blade of the auger **17** and the shroud means **18** inwardly to impeller means located at the center of the auger. A discharge duct **20** is mounted generally above the impeller means **19** which is adapted to throw snow, generally designated by the numeral **21**, rapidly out through the discharge duct **20** to a suitable location such as an area adjacent one side of the track.

Under the normal snow conditions shown in FIG. **1** wherein the snow on the track is not very deep, the sweeping device **13** is employed to sweep the snow **21** forwardly and upwardly from between the rails and from each side of the rails. The snow **21** is swept up into the auger means **14** through an opening **22** formed in the shroud means **18** as shown in FIG. **8**. The shroud means **18** preferably consists of a first pivotable shroud member **25** and a second, smaller pivotable shroud member **26**. The first shroud member **25** extends around the upper periphery of the auger **17** in this position and the shroud member **26** is pivotable from the front position shown in FIGS. **1** and **8** to the rear position shown in FIG. **9**.

In the rear position of the pivotable shroud members **25** and **26**, the front **27** of the auger is not covered by the shroud means **18** to permit snow **21** to enter the auger means directly from the front as shown in FIG. **9**. The auger **17** is then able to feed snow directly to the impeller means **19** for discharge to a suitable location. When the auger means is being used in this manner, the sweeping device **13** is not used and can be raised to the upper position illustrated in FIG. **9** by its support means **15** so that it does not interfere with the snow removing operation of the auger means **14** and to prevent the sweeping device from becoming unnecessarily worn or clogged with snow. The auger means **14** would normally be used by itself when the snow **21** is so deep that the sweeping device cannot operate effectively (for example, when the snow exceeds 8 to 10 inches in depth).

The sweeping device **13** and first support means **15** for the sweeping device will now be described in greater detail with reference to FIGS. **2** and **12**. Mounted to the front of the vehicle **11** are two rigid, upright support beams **28**, only one of which is shown in FIGS. **1** and **2**. To each support beam **28** there is adjustably connected a supporting member **29**, one side of which extends parallel and adjacent to the front of the support beam **28**. The leading edge **30** of each supporting member **29** is steeply inclined to form a member having a narrow top and wide base. As can be seen clearly from FIG. **12**, each supporting member **29** comprises two spaced apart and parallel plate members **31** which are rigidly connected to each other by interconnecting members **32**. Extending rearwardly from each of the plate members **31** is a supporting extension **33** which is rigidly connected to its plate member **31**. A horizontal plate **34** extends between each pair of extensions **33** and is rigidly connected along opposite sides to the inside of each of the adjacent extension members **33**. An adjustable bolt **35** extends through a hole in the rear of each of the horizontal plates **34**. The vertical height of the head of each bolt **35** can be adjusted by means of two nuts **36** which connect the bolt **35** to the plate **34**. A hydraulic jack consisting of a hydraulic piston **40** and a hydraulic cylinder **41** is securely fastened in an upright position in each of the beams **28** for moving the supporting member **29** upwardly or downwardly. The top end of the hydraulic piston **40** is securely fastened to the horizontal plate **34** while the bottom end of the hydraulic cylinder **41** is securely supported on a horizontal plate **42** contained approximately in the center of the beam **28**. It should be noted that each of the beams **28** consists of a channel member, the open side of which faces in the forward direction. Each of the extension members **33** is immediately adjacent the inside surface of one of the two sides of the channel formed by the beam **28**. Thus the movement of the extension members **33** in the vertical direction is guided by each of the beams **28**. To provide further guidance for the vertical movement of each of the supporting members, there is provided a second horizontal extension **43** near the bottom of each of the supporting members **29**. Eacn of the second extensions **43** also fits snuggly in the interior of the channel formed by one of the beams **28**. A further horizontal support

plate 44 is provided in each of the beams 28 near the top of the hydraulic cylinder 41 but to the rear thereof. The upper surface of the support plate 44 engages the head of the adjustable bolt 35 when the hydraulic piston is in its lowermost position. It will thus be seen that the lowermost position of the piston can be adjusted by adjusting the nuts 36 so that the head of the bolt 35 is raised or lowered with respect to the horizontal plate 34. Thus, means are provided for adjusting the lowermost position of the sweeping device 13 to suit the particular type of track being cleared of snow.

The rotary broom 50 of the sweeping device is enclosed and supported by a rigid outer casing 51. The casing 51 preferably comprises a horizontal roof member 52, a front inclined roof member 53, a rear inclined roof member 54, two vertical side walls 55, and a vertical rear wall 56, the adjoining edges of which are connected by suitable means such as welding. The front of the outer casing 51 remains open to permit the broom 50 to sweep the snow in the direction of the auger means 14. The front, bottom corner of each of the supporting members 29 is connected to the center of the top of the horizontal roof member 52 by means of a connecting lug 57 and a connecting bolt 58. The bolt 58 extends through holes formed in each of the plate members 31 of the supporting beam 29 and through a hole formed in a vertical portion 59 of the connecting lug 57. Each of the holes in the plate members 31 and in the vertical portion 59 may be strengthened by the use of ring-shaped members (See FIG. 12) extending about the circumference of one side of each of the holes. These ring-shaped members also center the vertical portion 59 between the plate members 31 on the connecting bolt. The bottom edge of each of the plate members 31 is cut to form an obtuse angle so that the bottom edge extends along the surface of both the rear roof member 54 and the horizontal roof member 52. These roof members need not be welded to the bottom edge of each of the plate members 31 and preferably are not so as to permit the sweeping device to be easily disconnected from the first support means 15. The only operation normally required to remove the sweeping device is the removal of each of the connecting bolts 58 from its respective holes and the disconnection of any hydraulic hoses connected to the sweeping device.

The rotary broom 50 consists basically of a horizontal axle 65 to which are attached hose stubs 66 only a couple of which are shown in FIG. 12 for the sake of simplicity. Each end of the axle 65 extends through a hole formed in the horizontal center of each of the side walls 55 of the casing and is supported in this hole. Bearing means may be connected to the outside of each of the side walls 55 around the hole for the axle and these bearing means 67 rotatably support the end of the axle so as to prevent undue wear as the broom rotates. Each of the bearing means 67 is connected to its respective side wall 55 by means of four bolts 68. The main portion of the axle 65 consists of a hollow tubular member 69 from each end of which extends a solid stub shaft member 70 which extends into the hole of the side wall.

The hose stubs 66 are individually attached to the tubular member 69 and extend therefrom more or less radially in continuous and uninterrupted columns or rows which are spaced circumferentially around the tubular member 69. The hose stubs are disposed and dimensioned to clear the snow from the roadbed of the track and in particular from each side of the two rails. The hose stubs are of relatively substantial length and weight so as to be able to strike the snow and ice with sufficient force to shatter and dislodge the snow and ice and to be able to throw this material forwardly to the auger means. The hose stubs should be relatively flexible at least for part of their length, so as to be able to pass over or around the railroad tracks themselves and other components making up the complete roadbed without substantially damaging any parts thereof themselves. Any suitable attachment means may be used for connecting each hose stub to the tubular member 69. As illustrated in FIG. 12, each hose stub is connected by means of a clip 71 which extends around the circumference of the hose stub adjacent the inner end so as to grab the end securely. The clip 71 is connected securely to the tubular member 69 so that it cannot be pulled therefrom.

Power means are provided for driving the rotary broom 50 and these means may either be connected to the broom at one end thereof or at the center thereof. In the illustrated embodiment, the power means are connected at the center of the broom to the tubular member 69. The power means preferably include a hydraulic motor 72 to the rear of which two hydraulic hoses 73 (see FIG. 13) are connected by suitable connection means which permit the hose to be disconnected easily when desired. The hydraulic motor 72 drives a shaft having a U-shaped connector 74. The U-shaped connector 74 is connected to rotate a short connecting link 75 which in turn is connected to another U-shaped connector 76. The U-shaped connector 76 is at one end of a shaft which extends vertically downwards to a universal coupling located in the housing 77. A housing 77 is rigidly supported by frame members 78 and 79 which extend from the rear wall 54 of the casing and from the front inclined member 53 respectively. It is thus readily seen that the hydraulic motor 72 is capable of rotating the tubular member 69 by means of the interconnecting shafts, link, and universal coupling. The speed of rotation of the broom 50 can be varied by varying the rate of flow of the hydraulic fluid through the hydraulic motor 72. The tubular member 69 is divided at the center to provide room for the housing 77 and the universal coupling. Short stub axles 80 extend from the center of each side of the housing 77. Each stub axle is rigidly connected to the adjacent end of tubular member 69.

The second support means 16 for the auger means 14 comprise basically two inverted U-shaped arms 81, each arm extending over the sweeping device 13 from the front end of the rail vehicle 11. Each arm 81 consists of a rigidly connected rear member 82 and a pivotably connected front member 83. Each rear member 82 is rigidly connected to the frame of the vehicle 11 by means of the bolts or rivets 84. The rear member 82 is connected at the side of the vehicle a short distance outwardly from the adjacent supporting member 29 for the sweeping device and its beam 28. Each rear member 82 is forwardly and upwardly inclined. The rear member 82 can consist of a suitably strong channel member with the open side of the channel member facing outwardly as shown in FIG. 2. The front end of member 82 has a hole herein for a short shaft 87 which connects the rear end of front member 83 to the rear member 82.

The front member 83 of the arm 81 also has a rear portion 90 and a front portion 91. The rear portion 90, which forms an obtuse angle, has parallel upper and lower surfaces and may be constructed from a couple of ordinary channel members. Two spaced-apart, flat plates 93 connect the rear end of member 83 to shaft 87. Each of these plates 93 is rigidly connected to the channel member forming the horizontal portion of front member 83. The plates 93 are arranged vertically and have suitable holes therein for the shaft 87. Suitable bearing means may be provided about the shaft 87 to prevent undue wear if desired. In this manner, the front member 83 is pivotably connected to the rear member 82 so as to permit vertical movement of the auger means 14.

With the present snow clearing apparatus, power means are provided to adjust the vertical position of the auger means 14 and in the preferred embodiment shown in FIG. 2, the power means comprise a hydraulic cylinder 95 and a hydraulic piston 96. The front end of the hydraulic piston 96 is pivotably connected to two upwardly extending arms 97 of the plates 93. The upper end of each arm 97 has a hole for a pin member 98. A ring may be welded to the outer end of the piston 96 and then fidded between the arms 97 so that the pin member 98 extends through the ring as well as the holes formed in the arms 97. The closed end of the hydraulic cylinder 95 is pivotably connected to a lug 99 which also forms a hole for a pin member 100. The pin member 100 can be attached to the closed end of the cylinder 95 and then inserted in the hole of the lug 99. Outward movement of the piston 96 with respect to the cylinder 95 will thus cause the auger means to move downwardly while the opposite movement will raise the auger means. Hydraulic hoses are of course connected to the hydraulic cylinder 95 but have not been shown in the drawings for the sake of simplicity.

The power means for rotating the auger 17 are basically the same as the power means for rotating the broom 50 and are shown in FIG. 2. Unlike the sweeping device however, the power means for the auger are mounted at the right hand end of the auger facing in the direction of travel of the snow removing apparatus. The front portion 91 of the front member 83 is formed with outwardly diverging front and bottom surfaces, except for the front end of the front portion 91 which is formed with horizontal surfaces. The power means for driving the auger 17 are situated between these surfaces and consist of a hydraulic motor 105 to which hydraulic hoses (not shown) may be connected, a shaft extending from this motor and having a U-shaped outer end 106, a connecting link member 107 connected to the U-shaped end 106, a further shaft having a U-shaped outer end 104 which is connected to the connecting link 107, and a combination of gears in a cylindrical housing 108. The link 107 and the two U-shaped ends 106 and 108 are protected by a surrounding channel-shaped housing 109. The open side of the housing 109 faces the inner wall of the front portion 91 of the front member 83. The housing 109 bolted to this inner wall by means of bolts extending through outwardly extending flanges 110 formed along each side of the housing 109.

The interior of the cylindrical housing 108 is shown in section in FIG. 4 of the drawings which also shows the bottom half of the auger 17 and shroud means 18. The auger 17 comprises basically a hollow tubular shaft member 110 and a spiral shaped auger blade or flute 111. Each end of the tubular member 110 is rigidly connected to a short stub shaft of smaller diameter 112 and 113. Each of the stub shafts is rotatably mounted in a hole formed in a vertical plate member 114. As shown in FIG. 4, bearing means may be inserted between each stub shaft and its plate member 114 to permit the stub shaft to rotate freely in the hole while the plate member 114 remains stationary. Each of the plate members 114 is positioned next to a large side plate 115 which is located to the rear of the adjacent stub shaft 112 or 113. The purpose of the plate 115 is to confine the snow swept forwardly and upwardly by the sweeping device to the space located immediately to the rear of the auger 17. Each plate 115 thus prevents the snow from spilling outwards to a location beside the track before it can be discharged by the auger means. Each side plate 115 is rigidly connected to the inner wall of adjacent front portion 91 of the front member 83. Each plate member 114 is likewise rigidly connected to the front portion 91 by means of bolts or rivets extending through the adjacent side plate 115.

Attached to the bottom of each side plate 115 is a flexible flap 116 which is connected to the bottom edge of the plate 115 by means of bolts or screws. The flap 116 also serves to contain the snow in the region immediately behind the auger 17. Because the flap 116 is flexible, it is not damaged by contact with the ground, ties or track and it in turn does not damage the track in any way. Preferably a spring member 117 is connected to each side of the front roof member 53 to resiliently engage the rear edge of the adjacent side plate 115. The spring member 117 prevents thhe side plate 115 from damaging the casing for the sweeping device when the auger means is lowered to the position shown in FIG. 2. The spring member 117 may consist of a U-shaped spring rigidly connected at the bottom edge to the roof member 53 by means of a bolt.

As illustrated in FIG. 4, the stub shaft 112 may be rigidly connected at its outer end to a further shaft 118 having a conical gear 119 rigidly connected thereto. The teeth of the gear 119 engage the teeth of a further conical gear 120 which is driven by the shaft having the U-shaped outer end 104 mentioned previously and shown in FIG. 2. It should be noted that the gear 120 and the shaft driving the gear have been rotated downwardly 45 degrees in FIG. 4 from the position shown in FIG. 2 for purposes of illustration. The gear 120 is thus driven by the hydraulic motor 105 by means of the connection means described above and the gear 120 in turn drives the auger 17 through the gear 119. The outer end of the shaft 118 is rotably mounted in the outer wall of the cylindrical housing 108 and is supported thereby.

The complete auger 17 along with an impeller wheel 125 is shown in FIG. 10 of drawings. It should be noted that when the shaft is rotated in the clockwise direction, locking from left to right in FIG. 10, the snow caught in between the auger blade 111 is forced inwardly towards the impeller wheel 125 which discharges the snow through the discharge duct 20.

From each end of the tubular shaft member 110, there extends a radially disposed flange 126, the inner edge of which is welded to one of the stub shafts 112 or 113. Each of these flanges serves as a smooth turning surface between the end of the auger and the adjacent member of the shroud means 18 described hereinafter.

The impeller wheel **125** is rigidly mounted to the hollow tubular shaft member **110**. Two conical support members **127** and **128** are rigidly attached at their narrow ends to the shaft member **110**. Each conical support member is inclined inwardly towards the center axis of the shaft member **110** and outwardly from the longitudinal center of the auger **17**. A center plate **129** extends radially outwardly from the center of the tubular member **110** and is rigidly attached thereto. The center plate **129** is cut to form four fins **130** (see FIG. **11**) which are distributed evenly about the circumference of a circular portion **131** of the plate **129**. The wide inner end of each of the conical support members **127, 128** is securely fastened to one side of this circular portion **131** at the outer periphery thereof. Large impeller blades **132** extend axially outwardly from the rear edge of the fins **130**. Each large impeller blade **132** is rigidly attached to the adjacent fin **130** and to the adjacent conical member **127** or **128**. The impeller blade **132** is formed with a relatively narrow bottom portion **133** having parallel sides, a diverging center section **134** having a narrow inner end adjacent the bottom portion **133** and a wide outer end extending substantially one half the width of the impeller wheel, and an outer section **135**. The outer section **135** is formed with a V-shaped notch **136** on its outer edge taken in the axial direction.

Two ring-shaped support members **140** are rigidly attached in the notches **136** to each side of the impeller wheel. Each support member **140** has a V-shaped cross section corresponding to that of the notches **136** to permit the support member to fit snuggly in the notches. The support members **140** provide additional support for the large impeller blades **132** and also provide support for four small impelller blades **141**. Each of the blades **141** is spaced approximately halfway between two outer sections **135** of the large impeller blades **132** and extends from one ring-shaped support member **140** to the other member **140**. Preferably each of the impeller blades is inclined to an angle to an imaginary radius extending outwardly from the center axis of the auger to the particular impeller blade. It should also be noted that each of the fins **130** is formed with a straight leading edge **142** which is also inclined at an angle from an imaginary radius extending from the center axis of the impeller wheel to the outermost point on the leading edge. The trailing edge of each fin **130** forms an obtuse angle as shown in FIG. **11** of the drawings. The bottom portion **133** and center section **134** of each large impeller blade extends along the innermost side of this angle while the outer section **135** of the larger impeller blade extends along the outermost side of this obtuse angle.

The impeller wheel **125** is substantially enclosed about its circumference except where the discharge duct is located by a cylindrical impeller casing **143** comprising a cylindrical outer wall **144** and two annular side walls **145** best shown in FIG. **2**. The annular side walls **145** can be formed in two sections with flanges at the end of each section to permit bolting of the two sections together as shown in FIG. **2** of the drawings. The impeller casing **145** is rigidly supported by one or more laterally extending supporting members such as support bar **146** shown in FIG. **3** of the drawings. The support bar **146** extends from each side of the casing to the top of each of the front portions **91** of the front member **83** in order to support the casing.

The discharge duct **20** which is attached to the front upper portion of the impeller casing **143** is inclined forwardly to some extent and is provided with means for adjusting the position of its various components so that the snow is discharged at the desired location. The discharge duct consists of a rigidly attached bottom portion **150**, a rotatable center portion **151**, and a pivotable chute **152** which is attached to the top end of the center portion **151**. Power means are provided for rotating the center portion **151** relative to the bottom portion **150** and preferably comprise a hydraulic or electric motor **153**, a drive chain **154**, suitable support means **155**, and suitable toothed driving and driven sheels for use with the drive chain **154**. Four guide wheels **156** are distributed evenly about the circumference of the upper end of the bottom portion **150**. Each of the guide wheels **156** engages a radially outwardly extending flange **162** extending about the circumference of the lower end of the center portion **151**.

FIG. **14** of the drawings shows the detailed construction of each of the guide wheels **156** and the means for supporting the guide wheel. The guide wheel is mounted on a bolt **157**, the head of which is located in the hollow interior of the guide wheel. A suitable ball bearing assembly **158** is mounted in the hollow interior of the guide wheel about the circumference of the upper end of the bolt **157** to permit wheel **157** to rotate freely about the upper end of the bolt **157**. The bolt **157** extends through a hole in a support lug **159** which is rigidly attached to the upper end of the bottom portion **150** of the discharge chute. A nut **160** is threaded onto the bottom end of the bolt **157** to hold the bolt securely in place. As can be seen clearly from FIG. **14**, the periphery of the guide wheel **156** is formed with an annular groove **161** and this groove engages the flange **162** on center portion **151** in order to prevent longitudinal displacement of the center portion with respect to the bottom portion **150** while enabling the center section to be rotated.

A toothed wheel (not shown) extends about the circumference of the center portion **151** near the bottom end thereof and its teeth engage the drive chain **154**. The motor **153** drives a small toothed wheel **163** shown schematically in dotted lines in FIG. **2**. It will be readily seen that rotation of this toothed wheel **163** by the motor will cause the drive chain to rotate the center portion of the discharge chute to the desired position. Thus, means are provided for discharging the snow on either side of the track or in some other suitable direction. The center portion **151** is formed with a generally rectangular shaped opening **165** located generally along one side of this portion. As shown in FIG. **3**, the wall of the center portion opposite the opening **165** is curved in the upwards direction towards the upper end of the opening **165** so that the same will flow smoothly through the center portion and out through the opening **165**.

The pivotable chute **152** is formed with a rectangular top portion **166** and two generally triangular sides **167**. The top edge of each side **167** is rigidly connected to one of the two sides of the top portion **166**. The two sides **167** diverge outwardly slightly from each other in the downwards direction so that they do not interfere with the center portion **151** at any time. The end of the top portion **166** adjacent the upper end of the center portion **151** is pivotally connected to this upper end by means of a hinge **168**. Power means are privided for

pivoting the chute **152** with respect to the center portion **151** and preferably comprise a hydraulic cylinder **169** and a hydraulic piston **170.** Hydraulic hoses (not shown) are of course attached to the hydraulic cylinder to conduct hydraulic fluid in and out of this cylinder. Lugs **171** and **172** are rigidly connected to the chute **152** and center portion **151** respectively. The outer end of the piston **170** is pivotably connected to the upper end of the lug **171** by means of a bolt **173** while the closed end of the hydraulic cylinder **169** is pivotably conected to the lug **172** by means of a pin **174.** Thus, outward movement of the piston **170** relative to the cylinder **169** will pivot the chute **152** in the anti-clockwise direction as seen in FIG. **3.** This will cause the snow to be directed in a direction closer to the horizontal rather than a more upwards direction. The opposite movement of the piston relative to the cylinder will pivot the chute in the clockwise direction and the snow will tend to shoot in a more upwardly direction.

The shroud means **18** for the auger **17** will now be described in greater detail with particular reference to FIGS. **4** to **7** of the drawings. The first and larger pivotable shroud member **25,** of which there are two in the illustrated embodiment, is shown by itself in FIG. **6** of the drawings and comprises an arcuate plate member **180,** an outer side plate **181,** a curved, toothed plate **182** is rigidly attached to the side plate **181** and two metal rods **205.** It will be seen that the arcuate plate member **180** encompasses an angle of approximately 180° with the center of the angle being located in the center of two ring members **184.** The side plate **181** has the shape of a semi-circle with the center of the straight edge of the side plate being located at the center of one of the ring members **184,** this ring member being rigidly attached to the side plate. The outer ring member **184** of each of the two first pivotable shroud members **25** is mounted to rotate about one of the stub shafts **112** or **113** of the auger. The inner ring member **184** is mounted between ends of rods **205** to rotate about the hollow tubular shaft member **110** near the impeller wheel as shown in FIG. **4.** The rods **205** extend along a diameter of the simi-cylindrical plate member **180** and rigidly connect the inner corners of member **180** to the inner ring member **184.** It will be understood that this construction is required to leave the inner side of shroud member **25** open. Snow can then pass through this side into the impeller means. Preferably bearing means **185** are inserted between the inner surface of each of the ring members **184** and the adjacent shaft or tubular member to permit the ring member to rotate freely on the shaft or tubular member without undue wear either to the shaft, ring member or tubular member.

Means are provided for pivoting each of the first pivotable shroud members **25** from the front position shown in solid lines in FIG. **5** to the rear position shown in dotted lines. The arcuate toothed plate **182** encompasses an angle of slightly more than **90** degrees, the center of this angle being located at the axial center of one of the stub shafts **112** or **113.** The entire inner edge of the plate member **182** is formed with suitable teeth **190,** these teeth being engaged by a pinion gear **191** mounted on a shaft **192.** The pinion gear **191** is located on the inside of the fixed plate member **114** just above the vertical center thereof and near the rear edge. The shaft **192** extends through a hole formed in the plate member **114** and is supported thereby. It will be readily seen that rotation of the shaft **192** will cause the pinion gear **191** to pivot the first pivotable shroud member **26** either forwardly or rearwardly to the front or rear position. Each of the two shafts **192** extends outwardly to a suitable motor **193** (such as an electrical or hydraulic motor) for rotating the shaft. It is of course possible to pivot both of the pivotable shroud members **25** with the use of only one motor **193** if desired. This could be done, for example, by mechanically connecting the two pivotable shroud members so that the shroud member which can be pivoted by the motor will in turn pivot the other shroud member **25.**

A second, smaller pivotable shroud member **26,** of which there are two in the illustrated embodiment, is shown by itself in FIG. **7** of the drawings and comprises an arcuate plate member **196,** a side plate **197** and two connecting rods **206.** A lip member **183** extends the width of the plate member **196.** When the second pivotable shroud member **26** is in the front position as shown in FIGS. **5** and **8,** the lip **183** helps to catch the snow swept forwardly and upwardly by the rotary broom. Returning now to FIG. **7,** it will be seen that the arcuate plate member **196** subtends an angle of approximately 90° (omitting the lip **183** as part of the plate member) with the center of the angle being located in the center of two ring members **198.** The side plate **197** has the shape of a sector with the two straight sides of the side plate forming a 90° angle. The center of the sector formed by the side plate is also located at the center of the outer ring member **198,** this ring member being rigidly attached to the side plate where the two straight sides of the side plate come together. The outer ring member **198** of each of the second pivotable shroud members **26** is mounted to rotate about one of the stub shafts **112** or **113** of the auger. The inner ring member **198** is mounted at the inner ends of the rods **206** to rotate about the hollow tubular shaft member **110** at a point immediately adjacent one of the ring members **184** for the pivotable shroud members **25** as shown in FIG. **4.** The radially extending rods **206** extend perpendicularly to one another and rigidly connect the inner corners of plate member **196** to the inner ring member **198.** Thus the inner side of shroud member **26** is left open to permit snow to pass freely through this side into the impeller means. Again bearing means **199** are preferably inserted between the inner surface of each of the ring members **198** and the adjacent or tubular member to permit the ring member to rotate freely on the shaft or tubular member.

As shown in FIGS. **5** to **7,** means are provided for rigidly connecting each of the second shroud members **26** to the adjacent first shroud member **25** whether the shroud members be in their front position or in their rear position. A lug **200** extends upwardly from the uppermost straight edge of the side plate **197.** The lug lies in the vertical plane of the side plate **197** to which the lug is rigidly connected. A suitable hole **201** is formed in the lug **200** and preferably is threaded in order to threadingly engage a stud or bolt **202** shown in FIG. **5.** A similar threaded hole **203** is formed near the bottom corner of each side plate **197** having a lug **200.** Another hole **204,** which may be either threaded or not, is formed in the front corner of the side plate **181** of each first shroud member **25** as shown in FIG. **6.** When the first and second pivotable shroud members are in the front position shown in FIG. **5,** the second shroud member **26** is rigidly connected to the first shroud

member **25** by screwing the stud or bolt through the hole **204** in the member **25** and into the hole **201** in the lug **200**. Additional studs, lugs, and holes may be used to rigidly connect the two pivotable shroud members if desired.

If the first and second pivotable shroud members **25** and **26** are to be pivoted to the rear position shown in FIG. **9** of the drawings, this can be done by first removing the stud or bolt **202**, at least from the hole **201** in the second shroud member **26**. As can be seen clearly from the drawings, each of the second pivotable shroud members is so constructed to permit the shroud member **26** to be pivoted to a position within and immediately adjacent the first pivotable shroud member **25** (see especially FIG. **9**). Thus the external radius of the arcuate plate member **196** of the member **26** is just slightly less than the internal radius of the acruate plate **180** of the member **25**. Also, the width of each of the second shroud members **26** is just slightly less than the distance between the inside surface of the side plate **181** of each first shroud member **25** and of the two rods **205**. Therefore, when the stud or bolt **202** is removed from the hole **201**, the second shroud member **26** is pivoted about its stub shaft and the tubular member **110** to a position inside of the first pivotable shroud member **25**. In the illustrated embodiment, the second shroud member is pivoted to a position immediately adjacent the front half of the first shroud member **25** as shown in FIG. **5** of the drawings. The stud or bolt **202** which extends through the hole **204** in the member **25** is then screwed into the bottom hole **203** of the shroud member **26** to again rigidly attach the member **26** to the member **25**. This operation is preferably carried out before the first shroud member **25** is pivoted from the front position shown in FIG. **5** of the drawings in order to permit easy access to the stud or bolt **202** and the holes into which it must be screwed. In the illustrated embodiment, the pivotable shroud member **26** is pivoted relative to the pivotable shroud member **25** by a manual operation. However, one could provide suitable power means for pivoting the member **26** relative to the member **25** if desired.

Once the second shroud member **26** has been fastened to the inside of the first shroud member **25**, the first shroud member **25** can be pivoted from a front position shown in FIG. **5** to the rear position shown in FIG. **9** by the pivoting means described above.

The use of a second pivotable shroud member **26** is not essential in the apparatus of the present invention for the present snow clearing apparatus could clear deep snow from the track with the use of only the auge means if only the bottom half of the front of the auger **17** is left open. Thus the pivotable shroud member **25** and **26** shown in FIGS. **6** and **7** of the drawings could be combined to form a single unitary pivotable shroud member whose arcuate plate member subtends an angle of 270°. With the use of this pivotable shroud member, the member in the front position would cover that portion of the periphery of the auger **17** which is shown covered in solid lines in FIG. **5** of the drawings. In the rear position, the 270° pivotable shroud member would enclose the rear half of the auger **17** plus the top half of the front half of the auger.

Another possible alternative construction of the shroud means **18** consists of a fixed shroud member covering the upper half of the auger **17** and a single pivotable shroud member somewhat similar to that shown in FIG. **7** of the drawings which can be pivoted from a front position where the entire front half of the auger is enclosed or to a rear position so that the entire rear half of the auger is enclosed.

Thus, the present invention provides an apparatus for clearing snow from the roadbed of and about the rails of railroad track and this apparatus is capable of removing the snow in a quick and efficient manner whether the snow is deep or not. When the snow is deep, the pivotable shroud members **25** and **26** can be pivoted to the rear position to permit the auger **17** to contact and remove snow entering the auger means directly from the front. This snow is moved to the center of the auger where the impeller means discharges the snow outwards through the discharge duct to a suitable location. If the snow is not very deep and the sweeping device consisting of the rotary broom **50** can be used effectively, the pivotable shroud members **25** and **26** are pivoted to the front position. In this position the snow passes under the auger to the rotating broom where it is swept forwardly and upwardly into the auger means. The auger means then operates in the same manner as before to remove the snow to a suitable location.

What I claim as my invention is:

1. An apparatus for clearing snow from the roadbed of and about the rails of railroad track comprising a rotatable, elongated sweeping device, first support means for mounting said sweeping device at the front of a rail vehicle in a track sweeping position, auger means including at least one auger rotatable about a horizontal axis, and shroud means, second support means for mounting said auger means on said vehicle in front of said sweeping device, said shroud means covering an area extending around a substantial portion of the circumference of said auger and including a first shroud member pivotable between a front and a rear position, whereby, in qperation, when said first shroud member is in said front position, said sweeping device sweeps snow forwardly and upwardly and said auger means catches snow swept by said sweeping device and removes the caught snow to a suitable location away from said track, and when said first shroud member is in said rear position, said auger means contacts snow entering said auger means directly from the front of said auger means and removes the snow to said suitable location.

2. An apparatus for clearing snow according to claim **1** wherein said second support means includes power means for adjusting the vertical position of said auger means.

3. An apparatus for clearing snow according to claim **2** wherein said auger means includes impeller means mounted at the centre of said auger and a discharge duct mounted generally above said impeller means, said auger extends outwardly from each side of said impeller means and in operation feeds snow inwardly to said impeller means, and said impeller means is adapted to throw snow rapidly out through said discharge duct to said suitable location.

4. An apparatus for clearing snow according to claim **3** wherein said auger is mounted on a shaft and said impeller means comprises an impeller casing and an impeller wheel rotatably mounted in said impeller casing on said shaft, said impeller wheel having impeller blades whose surfaces extend parallel to said shaft, and whereby said impeller wheel rotates with said auger.

5. An apparatus for clearing snow according to claim 1 wherein said second support means includes two support members rigidly connected to said rail vehicle and two pivotable arms, each side of said auger means being mounted at one end of one of said two pivotable arms, the other end of each pivotable arm being pivotably mounted to one of said support members and including hydraulic jack means for pivoting each pivotable arm relative to its respective support member.

6. An apparatus for clearing snow according to claim 1, including a second pivotable shroud member pivotable between a front and a rear position.

7. An apparatus for clearing snow according to claim 6 wherein, in said front position, said first shroud member covers the upper half of said auger and said second shroud member covers the front of the bottom half of said auger and, in said rear position, said first shroud member covers the rear half of said auger and said second member is adjacent said first shroud member at the rear of said auger.

8. An apparatus for clearing snow according to claim 7 wherein said first shroud member includes a semi-cylindrical plate member, the cylindrical axis of which corresponds to the center axis of said auger and said second shroud member includes an arcuate plate member subtending an angle of approximately 90° about said center axis of said auger.

9. An apparatus for clearing snow according to claim 8 wherein the radial distance from the center axis of said auger to the inner surface of one of said plate members is slightly greater than the radial distance from said center axis to the outer surface of the other of said plate members.

10. An apparatus for clearing snow according to claim 8 wherein said support means includes power means for adjusting the vertical position of said auger means.

11. An apparatus for clearing snow according to claim 10 wherein said second support means includes two support members rigidly connectd to said rail vehicle and two pivotable arms, each side of said auger means being mounted at one end of one of said two pivotable arms, the other end of each pivotable arm being pivotably mounted to one of said support members, and including hydraulic jack means for pivoting each pivotable arm relative to its respective support member.

12. In an apparatus for clearing snow from the roadbed and about the rails of railroad track having a rail vehicle, a rotatable, elongated sweeper mounted at the front of said vehicle in a track sweeping position, and auger means having an auger rotatable about a horizontal axis, said auger means being mounted on said vehicle in front of said sweeper and capable of disposing of snow swept forwardly and upwardly by said sweeper, the improvement comprising shroud means for said auger including a first pivotable shroud member and a second pivotable shroud member, both of said shroud members being mounted on support means, said shroud means being adjustable from a front closing position to a rear closing position, whereby in operation, when said shroud means is in said front closing position, said auger means catches snow swept forwardly and upwardly by said sweeper and disposes of the snow, and when said shroud means is in said rear closing position, said auger means disposes of snow entering said auger means directly from the front of said auger means.

13. An apparatus for clearing snow according to claim 12 including power means for adjusting the height of said auger and said shroud means relative to the rails over which said vehicle is moving.

14. An apparatus for clearing snow according to claim 13 wherein said first pivotable shroud member comprises a semi-cylindrical plate member the cylindrical axis of which corresponds to the center axis of said auger and said second pivotable shroud member comprises an arcuate plate member subtending an angle of about 90° about said center axis of said auger, and whereby, in said front closing position, said first shroud member extends about the periphery of the upper half of said auger and said second shroud member extends about the bottom half of the front of the auger and, in said rear closing position, said first shroud member extends about the periphery of the rear half of the auger and said second shroud member is moved away from the half of the auger.

15. An auger apparatus for a snow clearing vehicle having a sweeping device mounted at the front of said vehicle for sweeping snow forwardly and upwardly from the roadbed of railroad track, said apparatus comprising support means, an auger mounted on said support means for rotation about a horizontal axis, shroud means for said auger including a first pivotable shroud member pivotally mounted on said support means, said pivotable shroud member being pivotable from a front position to a rear position, whereby in operation said auger and shroud means is mounted ahead of said sweeping device, when said pivotable shroud member is in said front position said auger apparatus catches snow swept forwardly and upwardly by said sweeping device and removes the caught snow to a suitable location away from said track, and when said pivotable shroud member is in said rear closing position said auger apparatus engages snow entering said auger apparatus directly from the front of said auger apparatus and removes the snow to said suitable location.

16. An auger apparatus according to claim 15 including power means for adjusting the vertical position of said auger and said shroud means relative to the track over which the apparatus is transported whereby in operation, when said pivotable shroud member is in said rear closing position, said auger is movable vertically to clear deep snow away from the track.

17. An auger apparatus according to claim 15 including a second pivotable shroud member pivotally mounted on said support means and being pivotable from a front position to a rear position.

18. An auger apparatus according to claim 17 wherein said first pivotable shroud member comprises a semi-cylindrical plate member the cylindrical axis of which corresponds to the center axis of said auger and said second pivotable shroud member comprises an arcuate plate member subtending an angle of about 90° about said center axis of said auger, and whereby, in said front closing position, said first shroud member extends about the periphery of the upper half of said auger and said second shroud member extends about the bottom half of the front of the auger and, in said rear closing position, said first shroud member extends about the periphery of the rear half of the auger and said second shroud member is moved away from the front half of the auger.

19. An auger apparatus according to claim 18 including power means for adjusting the vertical position of said auger and said shroud means relative to the track over which the apparatus is transported whereby in operation, when said pivotable shroud members are in said rear closing position, said auger is movable vertically to clear deep snow away from the track.

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