Dec. 31, 1963 E. A. JOHANN 3,115,714

COMBINATION SNOW BLOWER-SNOW THROWER

Filed Aug. 15, 1962 4 Sheets-Sheet 1

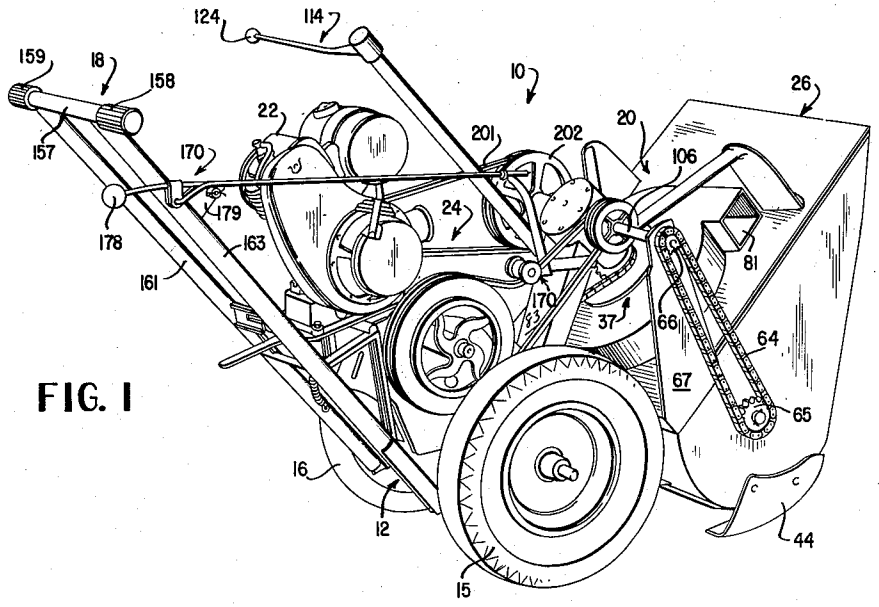
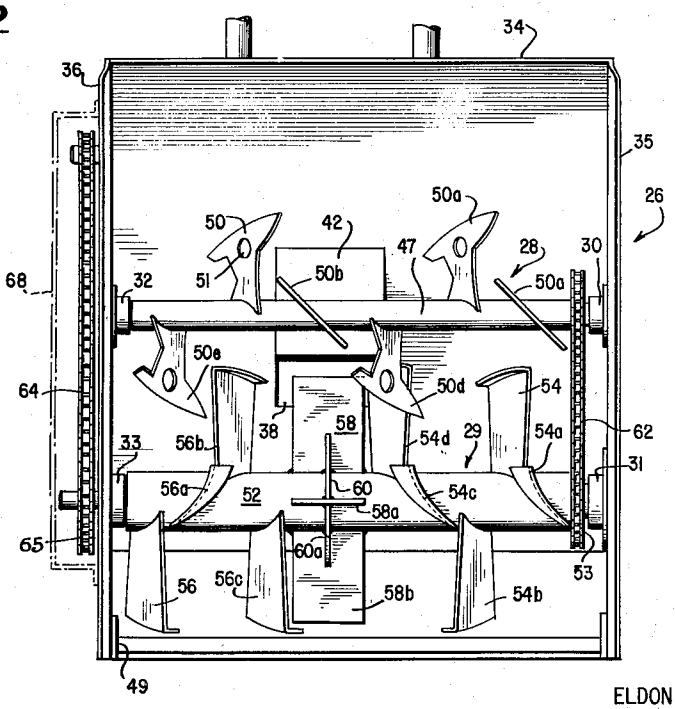


FIG. 1

FIG. 2



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COMBINATION SNOW BLOWER-SNOW THROWER

Filed Aug. 15, 1962 4 Sheets-Sheet 2

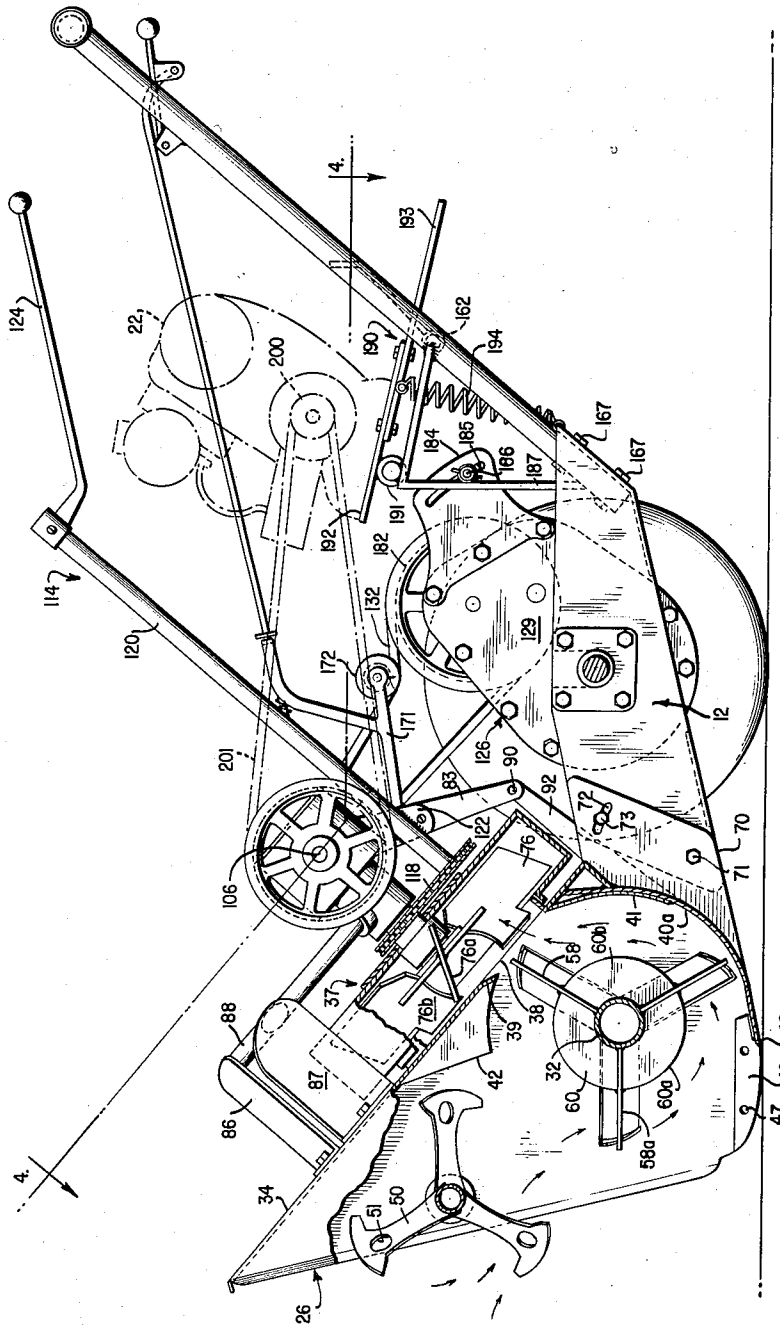

FIG. 3

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COMBINATION SNOW BLOWER-SNOW THROWER

Filed Aug. 15, 1962 4 Sheets-Sheet 3

FIG. 4

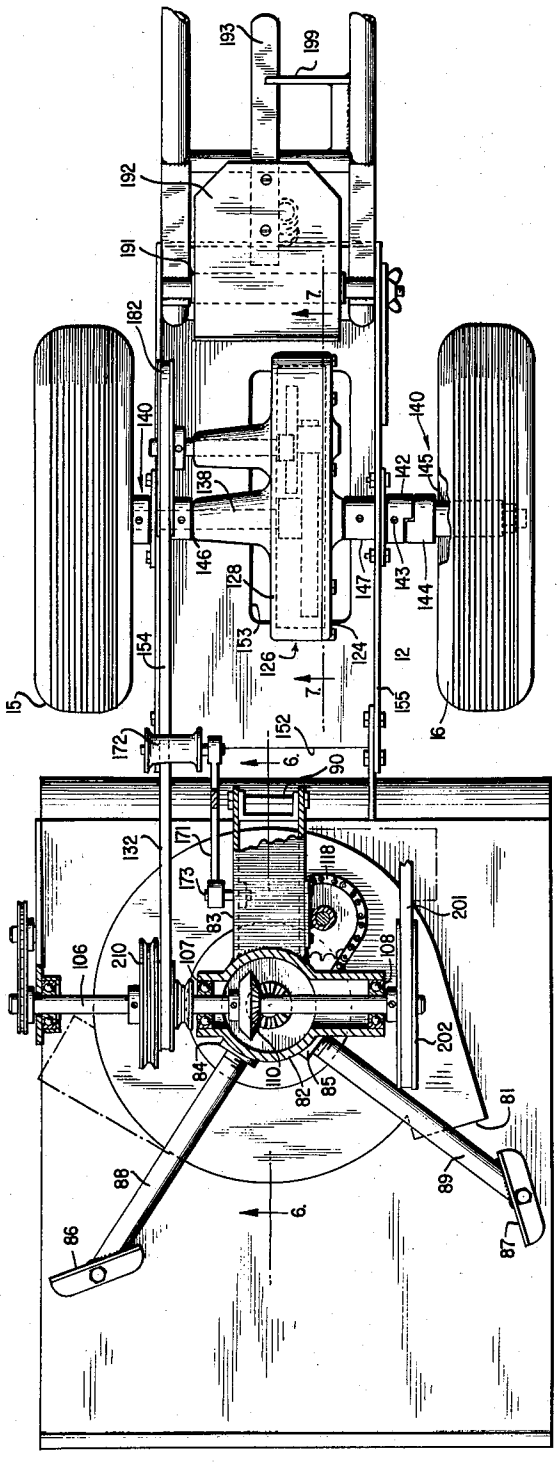


FIG. 8

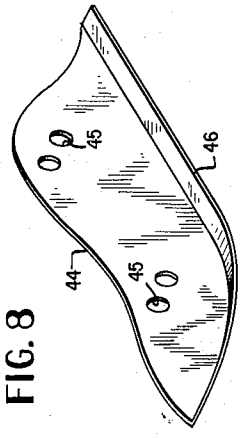
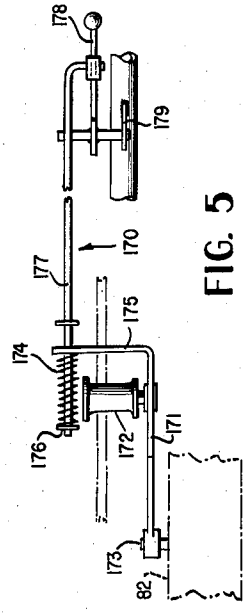


FIG. 5



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COMBINATION SNOW BLOWER-SNOW THROWER

Filed Aug. 15, 1962 4 Sheets-Sheet 4

FIG. 6

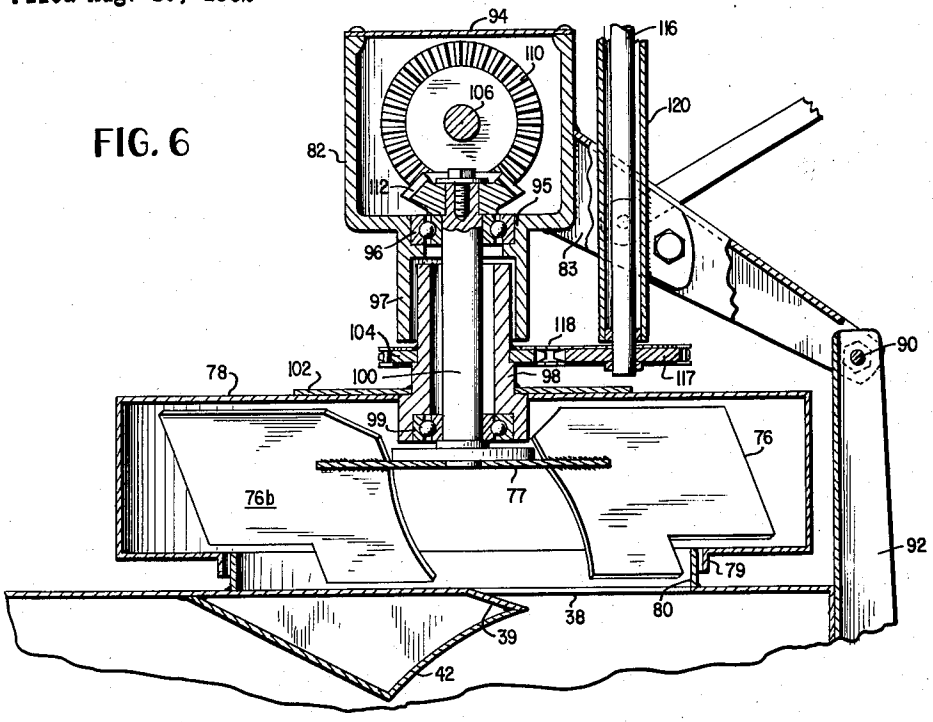
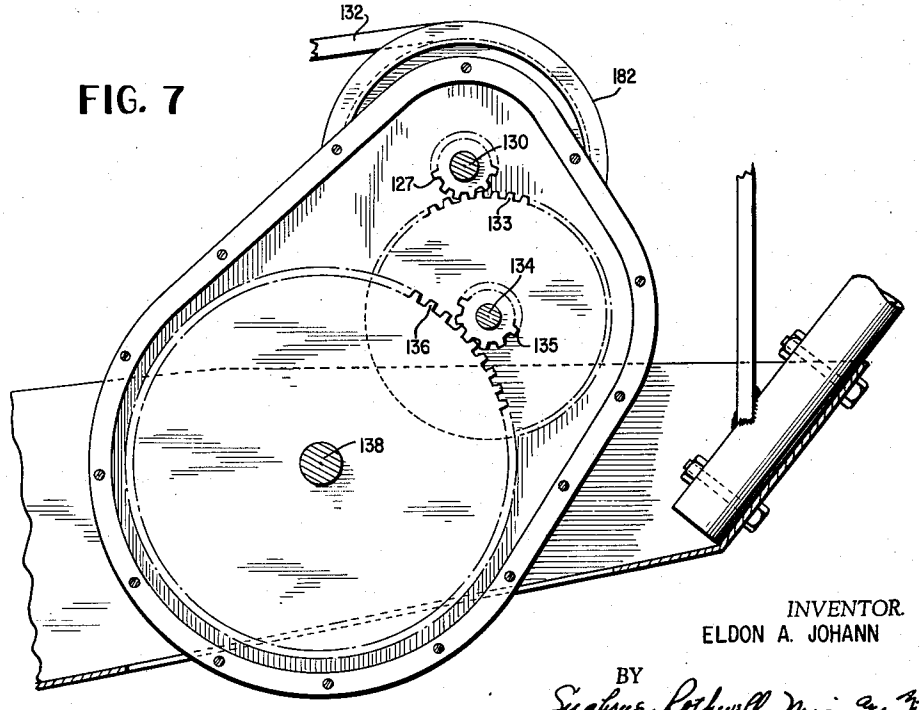


FIG. 7



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United States Patent Office 3,115,714 Patented Dec. 31, 1963

3,115,714

COMBINATION SNOW BLOWER-SNOW THROWER

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14 Claims. (Cl. 37—43)

This invention relates to improvements in snow removal apparatus; and more particularly to a power driven machine steered and controlled by a walking attendant and especially adapted for removing snow from all different types of surfaces, whether smooth or rough, and throwing the snow which is removed in a desired direction.

A snow removing machine of the power driven walking attendant steered type should be flexible in concept to operate over many different types of surfaces and in many different places. For example, it is important that a snow removing machine scrape a smooth sidewalk or similar surface clean while, when operating over gravel, roadways, grass or the like, the machine must remove the snow down to a predetermined level slightly above the rough surface. Furthermore, it is desirable that a machine of this type be able to discharge the removed snow around various obstacles and therefore in different directions. It is also a requisite of such a machine that it be rugged, relatively simple, and inexpensive in construction. This invention provides such a machine.

The snow removal apparatus of this invention can discharge snow at a high velocity in any direction under the control of an attendant and without the snow clogging during discharge. The machine will also operate over different ground surfaces, such as sidewalks, paved or graveled driveways, parking lots, rutted roadways, grass surfaces, etc., due to its unique construction. Furthermore, the construction is simple and uncomplicated so that it may accomplish the foregoing purposes while also being rugged and easy to manufacture and repair.

Other objects and advantages of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of example, the principles of the invention and the best mode which has been contemplated of applying these principles.

In the drawings:

FIG. 1 is a perspective view of the snow removal apparatus of this invention;

FIG. 2 is a front elevation view of the snow removal apparatus impeller casing showing the impellers therein;

FIG. 3 is a side elevation view of the snow removal apparatus, partly in section for the sake of explanation;

FIG. 4 is a plan sectional view taken along line 4—4 of FIG. 3;

FIG. 5 is a detail view of a pulley belt control;

FIG. 6 is a sectional view taken along line 6—6 of FIG. 4 showing a blower housing and blower drive; and

FIG. 7 is a sectional view taken along line 7—7 of FIG. 4 and illustrating a gear reduction assembly.

FIG. 8 is a perspective view of an auxiliary ski.

Referring now to the drawings, the general over-all assembly of the snow removal apparatus 10 of this invention is shown in FIG. 1. The apparatus includes a chassis assembly 12 rotatably supporting two driven wheels 15 and 16. The apparatus further includes a steering and control assembly 18 so that the apparatus may be steered and controlled by a walking attendant. A snow removing and adjustable snow throwing assembly 20 is carried by the chassis assembly 12. The apparatus is adapted to be motor driven by a small gasoline motor 22 which, when assembled on the apparatus with appropriate connection by driving means 24, drives the apparatus wheels and the various elements of the snow removing and throwing assembly.

Referring now more specifically to the snow removing and throwing assembly 20, it includes an impeller casing 26 mounted therein an upper impeller 28 and a lower impeller 29, FIG. 2. Upper impeller 28 is mounted somewhat forwardly in the casing 26, as shown in FIG. 3 and is rotatably supported in bearings 30 and 32. Lower impeller 29 is mounted rearwardly within the assembly and supported on bearings 31 and 33 in the impeller casing 26.

The impeller casing 26 includes a top 34 and sides 35 and 36, which may be formed from a single steel sheet. The top 34 has a snow passage opening or port 38 therein which is formed by removing a portion of the casing top and bending down a lip 39. Mounted on the top 34 of the impeller casing 26 above the opening 38 is an adjustable snow thrower assembly 37, FIGS. 1 and 3, which will be described in detail hereinafter. The impeller casing 26 includes a curved back section 40*a* and a backup plate 41 welded thereto. A scraper blade or plate 48 is welded to back section 40*a* and is positioned at the lower front end of impeller casing 26. A snow retainer bracket 42 may be separately formed and welded to the inside of the top of the impeller casing to further insure snow removal through the snow passage port 38. This backup plate keeps the snow in position to be thrown out and prevents clogging action of the snow, as well as directing the snow into the port 38.

Also attached to the casing at each side thereof are a pair of auxiliary skis 44, FIG. 1 and shown in detail in FIG. 8. Each ski 44 includes a turndowned bottom skid portion 46 and at least two pairs of mounting holes 45. The impeller casing in turn has a pair of shock skis 49 welded inside the casing 26 with mounting holes 47 in the sides thereof so that by choosing one or the other of the pairs of mounting holes 45 for mounting the auxiliary skis 44 by means of bolts to the impeller casing, the height of the impeller casing 26 and particularly the distance of the scraper plate or blade 48 above ground level may be predetermined. For example, if the snow removal apparatus 10 was used over gravel or rough ground, the auxiliary skis 44 would be set to have the scraper blade 48 at a greater height above the level of the ground, than would be the case if the snow removal apparatus were used on a smooth sidewalk. The apparatus could be used without the auxiliary skis, in which case the shock skis 49 also protect the impeller casing 26 from hard knocks and act as a bumper, as well as raise scraper blade 48 over uneven surfaces.

The upper impeller 28 includes six downthrow blades 50, FIGS. 2 and 3. These blades are welded in pairs at equal intervals around a tubular impeller shaft 47. For example, blades 50 and 50*a* are at one position, 50*b* and 50*c* at another position and 50*d* and 50*e* at a third equally spaced circumferential position. This arrangement keeps the impeller 28 in balance at high speed. The blades may have lightening holes 51 therein. This upper impeller 28 eats into a high bank of snow at its level and throws the snow down to the lower impeller 29, which in turn moves the snow toward the center of the impeller casing 26 and throws it up through snow port 38 into the blower assembly 37, for controlled discharge.

The lower impeller 29 includes a plurality of blades 54, 54*a*, 54*b*, 54*c*, 54*d* which are circumferentially welded around the periphery of a center pipe 52, as shown in FIGS. 2 and 3. The center pipe 52 of the lower impeller 29 has a pair of hub journals (not shown) for journalling the impeller in the bearings 31 and 33. Blades 56, 56*a*, 56*b*, 56*c* are the same as the corresponding blades 54, but have an opposite dish and form. Between the two sets of blades 54 and 56 are three throwup blades 58,

58*a* and 58*b* which are welded to the circumference of pipe 52 at equal angles. Supports 60, 60*a*, 60*b* are welded to brace and support the throwup blades 58. Snow in the path of blade 54*a*, for example, is thrown into the path of blade 54 which in turn throws it into the path of blade 54*b* onto the path of blade 54*c* and 54*d* wherein it is in the path of the thrower blades 58, 58*a* and 58*b*. Similar travel of the snow from outside to center is accomplished by the blades 56, 56*a*, 56*b* and 56*c*.

It can thus be seen that a high bank of snow will be contacted by the top impeller 28 and thrown downwardly by impeller blades 50 into the path of the lower impeller 29. A low level of snow will be directly contacted by lower impeller 29. The blades 54, 56 of the lower impeller cause the snow to travel from the outside ends of the impeller toward the center where the throwup blades 58 throw it through the opening 38 for discharge by the adjustable snow blower assembly 37. Any snow that enters the path of the upthrow blades too late to be thrown in the opening will be retained by the snow retainer bracket 42. This bracket also prevents snow from flying forward of the machine. The curved outer lip of the blades 54 and 56 also prevent forward castoff of the snow. The construction allows the impellers to be rotated at a relatively high rate, such as 300–400 r.p.m. The large center support pipe 52 of impeller 29 will prevent distortion at high speeds and prevent breakdown of the impeller in case foreign objects enter its path, such as ice, chunks, branches, stones and the like. The blower assembly 37 creates a lift on the snow and throws it outwardly as will be described hereinafter.

The upper impeller 28 is driven from the lower impeller 29 by a drive chain 62 trained over sprockets thereon. Lower impeller 29 is in turn driven by a drive chain 64 trained over a sprocket 65 outside of the impeller casing 26. Drive chain 64 is also trained over a drive sprocket 66 which is supported from a bearing support bracket 67. A chain guard casing 68 covers the drive chain 64 but this has been omitted from FIG. 1 for the sake of clarity, and is shown in dotted lines in FIG. 2.

As shown in FIG. 3, the impeller casing 26 has a mounting bracket 70 so that it may be adjustably tiltably mounted from the chassis assembly 12. The mounting bracket 70 is secured to chassis assembly 12 by a pivot bolt 71 on each side of the unit and the top of the mounting bracket includes an adjustable curved slot 72 with a bolt 73 for securing the impeller casing to the chassis at any adjusted position so that the impeller casing may be tiltable about the pivot bolt 71.

The blower assembly 37 includes three blower blades 76, 76*a* and 76*b*, FIGS. 3 and 6, which are welded to a blower flange 77. The blower blades 76 are specifically constructed to create an updraft or lift on the snow as it passes through port 38. The blower blades 76 are contained within an adjustably positionable blower casing 78 having a discharge spout 81, FIGS. 1 and 4. By rotating the blower casing 78, the discharge spout 81 may be positioned in any angular position within a range of 270° to discharge the snow at any desired position off to the side of the path of the apparatus. Thus the attendant can control the snow discharge to clear any obstacles at the side of the path from which snow is removed.

The blower casing 78 also includes a downturned edge flange 79 which is positioned outside of, but cooperates with a seal ring 80 on the top of the impeller casing 26. This effectively creates a seal which prevents leakage of snow and air to outside below the blower and creates more suction at the center entrance to the blower through port 38. Because the snow can be directed to any area within a wide range by merely turning the blower casing and positioning the discharge opening 81, the snow flies straight out of the blower at high speed with no choking or clogging.

The blower blades 76, which are of course rotatable, and the adjustably positionable casing 78, are both effectively supported from a gear housing 82, which may be an aluminum casting. The housing 82 includes a cast back support arm 83, FIGS. 4 and 6, as well as a pair of threaded hubs 84 and 85. A pair of support brackets 86 and 87 include support arms 88 and 89, respectively. These support arms may be pipes which are threaded into the hubs 84 and 85 and welded to the brackets 86 and 87 which in turn are secured to the top of the impeller casing 26. It is to be noted that the brackets 86 and 87 are mounted with their thin edges parallel with the blower discharge spout 81 as the spout passes them when turning and directing snow so as to not substantially obstruct the discharge of the snow, see FIG. 4.

A further support for the gear housing 82 is from the back support arm 83 which is connected by a pin 90 to a blower support bracket 92, see FIGS. 3, 4 and 6. The blower support bracket 92 serves both as a stabilizer for the blower gear box 82 and it in turn is welded to the back section 40*a* of the impeller casing 26.

The gear housing 82 further includes a removable top cover 94 and a boss 95 for containing a ball bearing 96. A depending section 97 of the housing 82 is adapted to enclose a blower hub 98.

The blower hub 98 itself contains a boss for a ball bearing 99 in line with ball bearing 96. These ball bearings support a blower drive shaft 100 for rotation to drive the fan blades 76. The blower hub 98 also has a blower hub flange 102 welded thereto and this flange is attached to the blower casing 78 so that upon rotation of the hub 98, the casing 78 may be also rotated. A sprocket 104 is further attached to the blower hub 98 for the purpose of rotating the hub 98.

The fan blades 76 may be rotated at high speed from a power drive shaft 106, see FIGS. 1, 3, 4 and 7, which is journalled in bearings 107 and 108 in the housing 82, FIG. 4. Within the housing 82 and mounted on power drive shaft 106 is a bevel gear 110 which in turn is in mesh with another bevel gear 112 secured to the blower drive shaft 100.

For turning the blower casing and positioning the discharge opening 81, a blower turning assembly 114 is provided, see FIGS. 1, 3 and 6. This blower turning assembly includes a blower turn shaft 116, FIG. 6, which has a sprocket 117 secured to the lower end thereon. Trained around sprocket 117 and sprocket 104 on hub 98 is a connecting chain 118, so that upon turning shaft 116, the hub 98 and fan casing 78 turn correspondingly. Surrounding the blower turn shaft 116 is a pipe-like casing 120 with ends which allow the pipe to turn in the casing. A support bracket 122 is welded to the casing 120 and to the back support arm 83 of gear housing 82, see FIG. 3. A long handle 124 is attached to the top of shaft 116 for turning the same and this handle normally extends rearwardly toward the steering and control assembly 18, FIG. 1.

For driving the machine by supplying power to the wheels 15 and 16, a gear reduction assembly 126 is provided, see FIG. 4 and FIG. 7 for details. The gear reduction assembly 126 includes a main housing casting 128 and a cover casting 129. Within these castings, there are suitable bushings for supporting rotatable shafts. Power is applied to a shaft 130 from pulley belt 132, FIG. 7, and shaft 130 carries a small pinion 127. Pinion 127 is in mesh with a large gear 133 on an idler shaft 134. A pinion 135 on the idler shaft is in mesh with a large gear 136 attached to a driven output shaft 138. As an example, the gear box would have a 40-to-1 reduction with a twelve-tooth pinion 127, a sixty-tooth gear 133 and a twelve-tooth gear 135 on shaft 134 and a ninety-six tooth drive gear 136 on driven shaft 138.

The driven shaft 138 extends through both sides of bushings in the gear reduction assembly 126 to drive both

of the wheels 15 and 16. However, the drive to each traction wheel is through an interlock assembly 140, FIG. 4. In turning a radius with the apparatus the interlock on the outside wheel of the turn allows it to turn forward on the axle. Thus, there has to be an interlock assembly 140 for each wheel; however, in FIG. 4 only one of the two interlock assemblies 140—140 is shown in detail. Each interlock assembly 140 includes a collar 142 secured to the drive axle by means of a set screw 143 or the like, while the wheel is mounted on a sleeve 145 which has a mating interlock collar 144 for cooperating with interlock collar 142 and providing a drive from the shaft 138 to the wheel, but also allowing the wheel to move faster than the drive from shaft 138 as would be necessary for the outside wheel in the situation of turning the apparatus when it is steered.

The machine is also provided with bearings 146 and 147 to support the axle and drive shaft 136 from the chassis frame assembly 12.

The chassis frame 12 has a base section 152 with a cutout 153 for clearance of the gear reduction assembly 126, see FIG. 4. The frame also includes upturned sides 154 and 155 from base 152 to support the driving wheels and the front ends of the sides support the impeller mounting bracket 70, while the rear end of the sides support the steering and control assembly 18.

The steering and control assembly 18 includes an operator handle 158 with suitable handle grips 159 on a tubular top cross-pipe 157. It also includes a pair of side support arms 161 and 163 and a cross-brace 162, see FIGS. 1, 3 and 4. The bottom ends of the side arms 161 and 163 are bolted to the chassis frame by suitable bolts 167, see FIG. 3.

The control assembly also includes means for controlling the pulley tension and thus controlling and starting the drive. This is the pulley control 170, see FIG. 1 and the detail in FIG. 5. A pivoted arm 171 supports a pulley belt idler roller 172. The arm 171 is pivotally hinged to the gear housing 82 by a hinge pin 173, see FIG. 5. A compression spring 174 is positioned between an extension 175 of arm 171, and an end collar 176 on a control rod 177, see FIG. 5. Control rod 177 is in turn fastened to a control handle 178 which is pivotally mounted from a support bracket 179 secured to the side support arm 163. As can be seen, pulling on handle 178 causes rod 177 to move rearwardly pivoting arm 171 and forcing idler pulley 172 into tighter engagement with belt 132 taking any slack out of the belt 132 for effecting the drive of pulley 182 and wheels 15, 16 through gear reduction assembly 126.

As shown in FIG. 3, attached to the gear reduction assembly 126 is a gear reduction box position lock plate 184. This lock plate has a slot 185 therein for engagement with a wing nut 186 supported from a bracket 187. By this arrangement, the gear reduction box can be locked in different positions when changing the belt 132 for various speed changes as will be described.

The gasoline motor 22, which is not per se a part of this invention, is supported on a motor mount assembly 190, see FIGS. 3 and 4. Bracket 187 carries a hinge assembly 191 and the pivotal portion of the hinge is a motor support plate 192, FIG. 3. The motor support plate 192 is attached to a handle 193 and the entire assembly is biased downwardly by means of a spring 194. Ordinarily, the spring 194 holds the motor in the position shown in FIG. 3 during operation, causing constant tension in a drive belt 201. However, to start the motor, the handle 193 is lifted upwardly, pivoting the motor about hinge 191, and the handle is held in this position by a handle lock bracket 199 allowing the drive belt 201 to be loose so that the motor may be started with no load upon it.

The drive means 24 and power train throughout the apparatus will now be described. The motor 22 has a drive pulley 200 around which a drive belt 201 is trained. Drive belt 201 is also trained around a large pulley 202 on the power drive shaft 106, see FIGS. 1, 3 and 4. The main power drive shaft 106 then drives the fan blades 76 through shaft 100, FIG. 6, while it also drives the impellers 28 and 29 in impeller casing 26 from the drive chains 62 and 64, FIGS. 1 and 2. The power shaft 106 further has a three-step pulley 210, FIG. 4, secured thereto. The wheel drive belt 132 is trained about this pulley in a selected groove thereof corresponding to the speed desired. Wheel drive belt 132 is also trained around the large pulley 182 secured to shaft 130, FIGS. 3 and 7, for driving the wheels through the gear reduction assembly 126. The pulley 182 may be a two-speed pulley so that a combination of pulleys 182 and 210 may provide six different speeds of wheel drive. Various speeds may be chosen depending upon the depth of the snow and the weight of the snow. To start the drive to the wheels by preventing slippage of the belt 132, the handle 178 must be pulled rearwardly. To disengage belt 132, the gear reduction assembly 126 may be loosened by means of bracket 184 and held in any desired position. The drive from pulley 182 of course is through the gear reduction assembly 126 and to the driven wheels 15 and 16. Due to the interlocks 140, one of the wheels may turn faster than the other when the apparatus is steered for turning corners.

When starting the engine, the handle 193 may be moved upwardly to allow the motor 22 to start without load. Further, to direct the discharge of the snow, the handle 124 may be turned to control the outlet 81 of the blower assembly 37.

It is believed the operation of the device is apparent from the foregoing; however, a summary of the operation will now be given.

The handle 193 is raised upwardly and held by bracket 199, loosening belt 201, and motor 22 is started without load. Handle 193 is then returned, allowing spring 194 to tension belt 201, causing a driving connection from the motor 22 through shaft 106 to the impeller blades 28 and 29, and the fan blades 76 of the blower assembly 37. Handle 178 is pulled back to connect the power to the drive wheels 15 and 16. The apparatus is steered by an attendant walking with it, who also controls the direction of discharge of the thrown snow by means of handle 124.

If a snow bank is higher than the height of impeller 29, the upper impeller 28 throws the snow down into the path of lower impeller 29 wherein the snow travels from the outside edges of the impeller toward the center and is thrown upwardly through the port 38 in impeller casing 26. The blower assembly 37 creates an exceptional lift and blows the snow at a high velocity through its unobstructed discharge spout 81. This discharge spout 81 may in turn be adjustably positioned by the blower turning assembly 114 so as to discharge the snow in any desired direction. Furthermore, for operating over different surfaces, the auxiliary skis 44 may be positioned at different heights.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to the preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

I claim:

1. A power driven snow removal apparatus consisting:
   (*a*) a chassis,
   (*b*) a pair of power driven wheels supported from the chassis,
   (*c*) a steering and control assembly attached to the rear of the chassis,
   (*d*) an impeller casing attached to the front of the chassis, the impeller case being open toward the front of the apparatus,
   (*e*) an upper impeller rotatably mounted in the impeller casing near the front open end thereof and in the upper portion thereof,

(*f*) a lower impeller rotatably mounted in the impeller casing generally below the upper impeller,

(*g*) means defining an opening in the top of the impeller casing for upward passage of snow thrown up by the lower impeller,

(*h*) a blower assembly including blower blades and a blower housing having an unobstructed discharge opening,

(*i*) means adjustably and rotatably supporting the housing on the top of the impeller above the snow opening therein,

(*j*) control means extending toward the steering and control assembly being available for continuously adjustably positioning the blower housing, and

(*k*) power drive means for driving the wheels, upper impeller, lower impeller, and blower blades.

2. A snow removal apparatus as defined in claim 1 wherein the impeller casing includes a scraper blade at the lower front end thereof and the lower front sides of the impeller casing include shock skis to protect the casing from hard knocks and act as a bumper.

3. A snow removal apparatus as defined in claim 2 further comprising a pair of auxiliary skis adjustably mounted to the shock skis on the impeller casing to adjustably position the height of the impeller casing above ground level.

4. A snow removal apparatus as defined in claim 1 further comprising means for mounting the impeller casing adjustably and pivotally to the chassis.

5. A snow removal apparatus as defined in claim 1 wherein the lower impeller further comprises a plurality of circumferentially positioned blades mounted on a large diameter tubular rotatable support shaft in a manner to force snow from the ends of the impeller toward the center as the impeller is rotated, and circumferentially spaced vertical throwup blades attached to the center of the tubular support shaft below the opening in the impeller casing.

6. A snow removal apparatus as defined in claim 5 wherein the upper impeller is mounted forwardly of the lower impeller and the upper impeller includes a plurality of blades equally circumferentially attached in a balanced manner to a rotatable tubular support, for eating into a high bank of snow and throwing the snow downward as the impeller is rotatably driven.

7. A snow removal apparatus as defined in claim 1 further comprising a snow retainer bracket attached to the inside of the impeller casing in front of the opening therein.

8. A snow removal apparatus as defined in claim 7 further comprising a seal provided by an upstanding flange on the top of the impeller casing around the opening therein, and a complementary depending flange on the blower housing.

9. A snow removal apparatus as defined in claim 8 wherein the means for supporting the blower assembly from the impeller casing present a minimum of obstruction to snow blown out the blower casing discharge opening.

10. A snow removal apparatus as defined in claim 6 further comprising a multispeed pulley and a gear reduction assembly through which the drive wheels are power driven.

11. A snow removal apparatus as defined in claim 10 wherein each of the driven wheels includes an interlock allowing an outside wheel on a turn to rotate faster than it is driven.

12. A snow removal apparatus as defined in claim 11 wherein the power drive is from a small gasoline motor having pulley belts adapted to be secured thereto, and further comprising means for selectively loosening the belts to start the motor and to change the speed and power of the drive.

13. A snow removal apparatus as defined in claim 1 wherein the blower assembly includes a stationary gear case that is supported and in turn supports the blower assembly, the gear case housing blower drive gears and a blower drive shaft, a blower hub surrounding the blower drive shaft and attached to the blower housing, the control means for adjustably positioning the blower housing discharge being connected to the blower hub.

14. A power driven snow removal apparatus comprising:

(*a*) a chassis,

(*b*) a pair of power driven wheels supported from the chassis,

(*c*) a steering and control assembly attached to the the rear of the chassis and extending upwardly and rearwardly therefrom,

(*d*) an impeller casing pivotally attached to the front of the chassis, the impeller casing opening toward the front of the apparatus and including a scraper blade on the lower front edge thereof,

(*e*) means for adjustably positioning the impeller casing and the scraper blade a predetermined distance above ground level,

(*f*) an upper impeller rotatably mounted in the impeller casing near the front end and in the upper portion thereof,

(*g*) blades on the upper impeller for contacting snow and throwing the snow downwardly,

(*h*) a lower impeller rotatably mounted in the impeller casing generally below the upper impeller,

(*i*) blades on the lower impeller to move snow contached by the impeller generally toward the center of the impeller and then throw the snow generally upwardly, means defining a snow passage opening in the top of the impeller casing for the upward passage of snow thrown by the blades of the lower impeller,

(*j*) a blower assembly including blower blades and a blower housing having an unobstructed discharge opening,

(*k*) means for adjustably and rotatably supporting the blower housing on the top of the impeller above the snow opening therein,

(*l*) a seal around the edge of the snow passage opening and between the blower housing,

(*m*) control means for adjustably positioning the blower housing to adjustably position the unobstructed discharge opening and control the direction of discharge of the snow thrown thereby,

(*n*) and a power drive means including a small motor connected to drive the wheels, upper impeller, lower impeller, and blower blades.

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