Jan. 31, 1956 K. J. G. LEUFVENIUS 2,732,638

ROTARY SNOW PLOW

Filed April 12, 1952 3 Sheets-Sheet 1

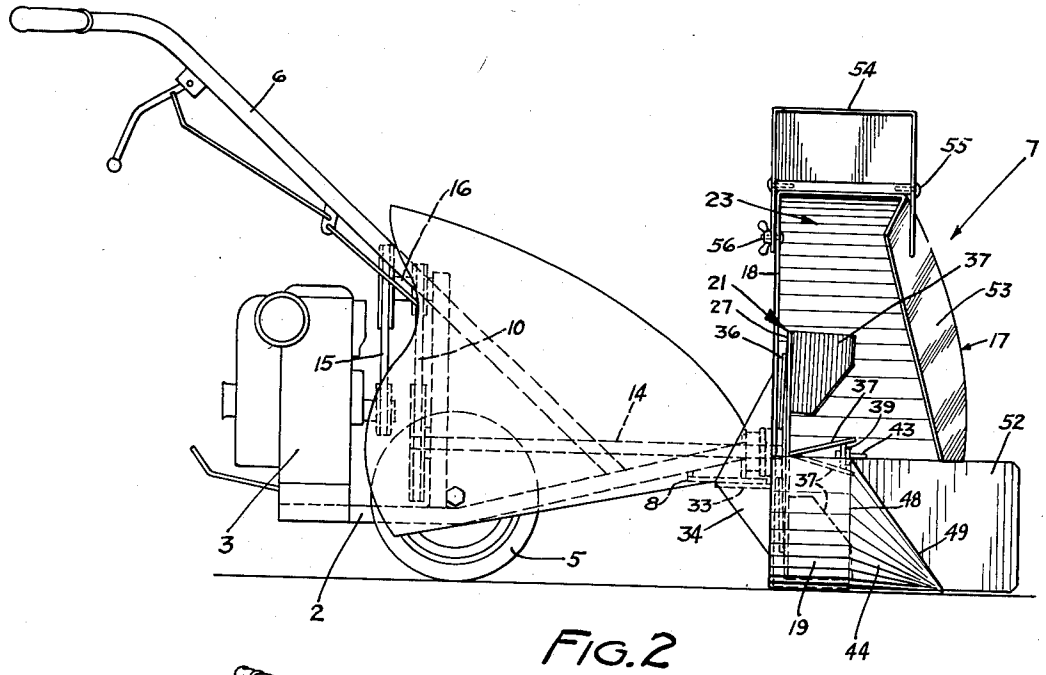


FIG. 2

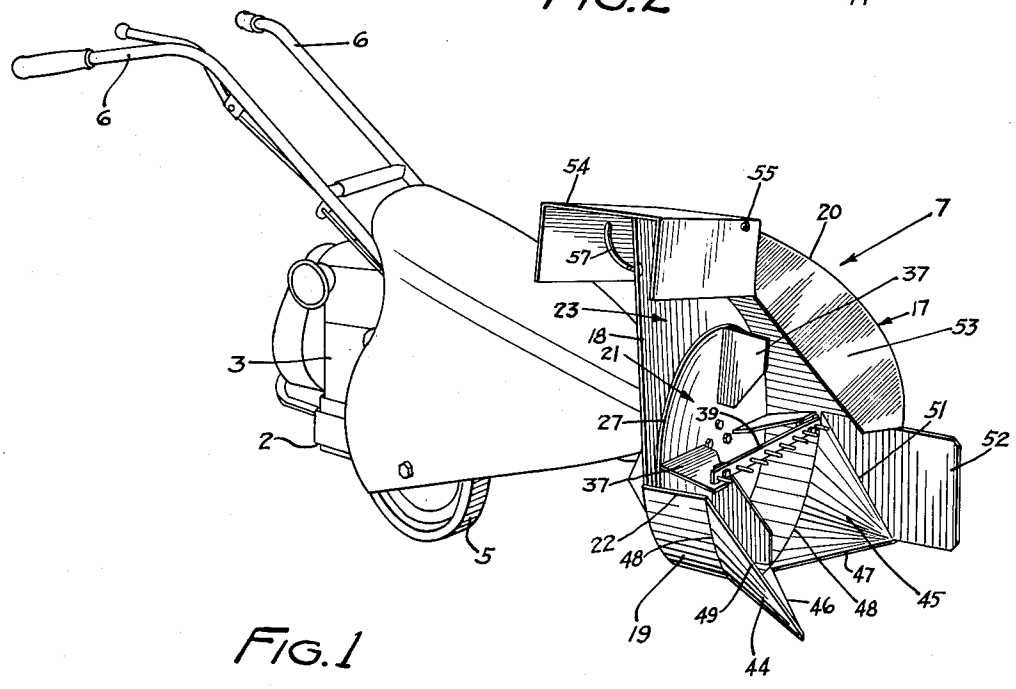


FIG. 1

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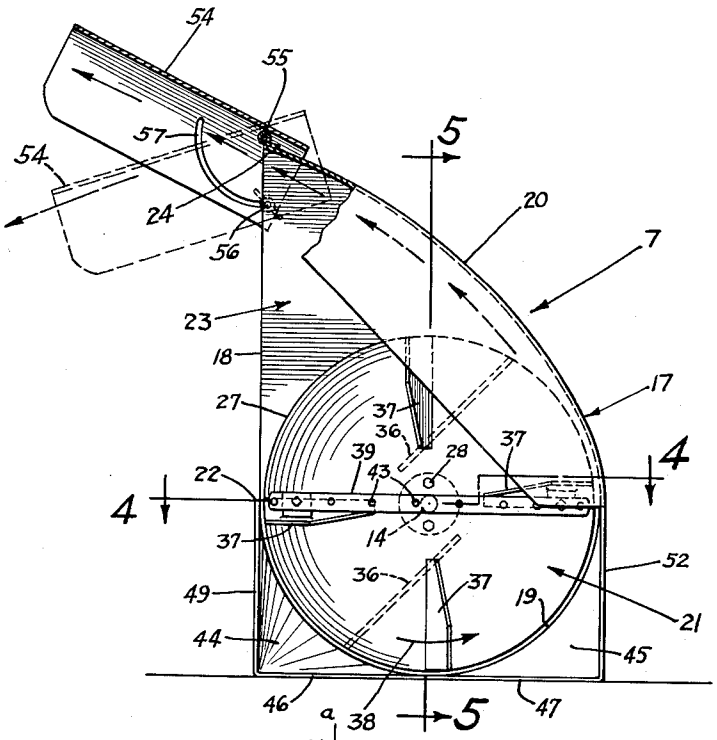


FIG. 3

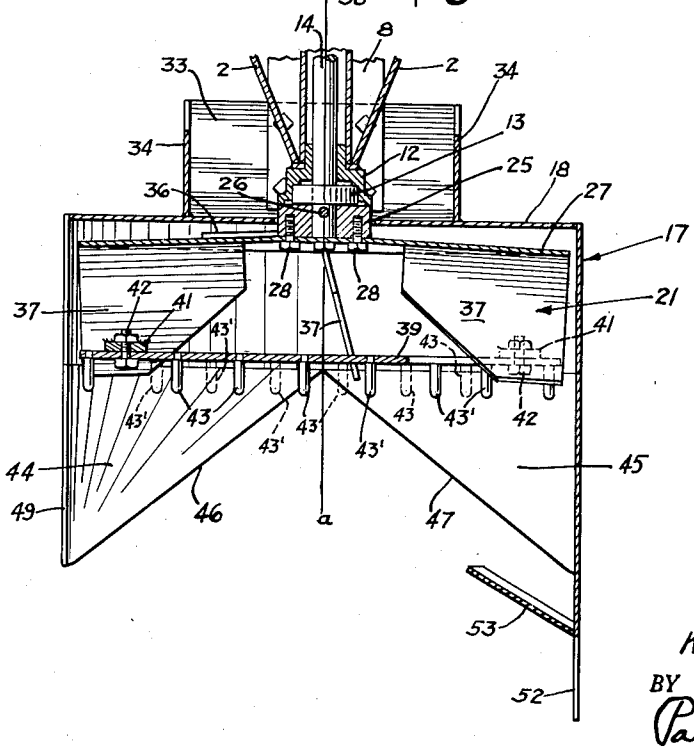


FIG. 4

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ROTARY SNOW PLOW

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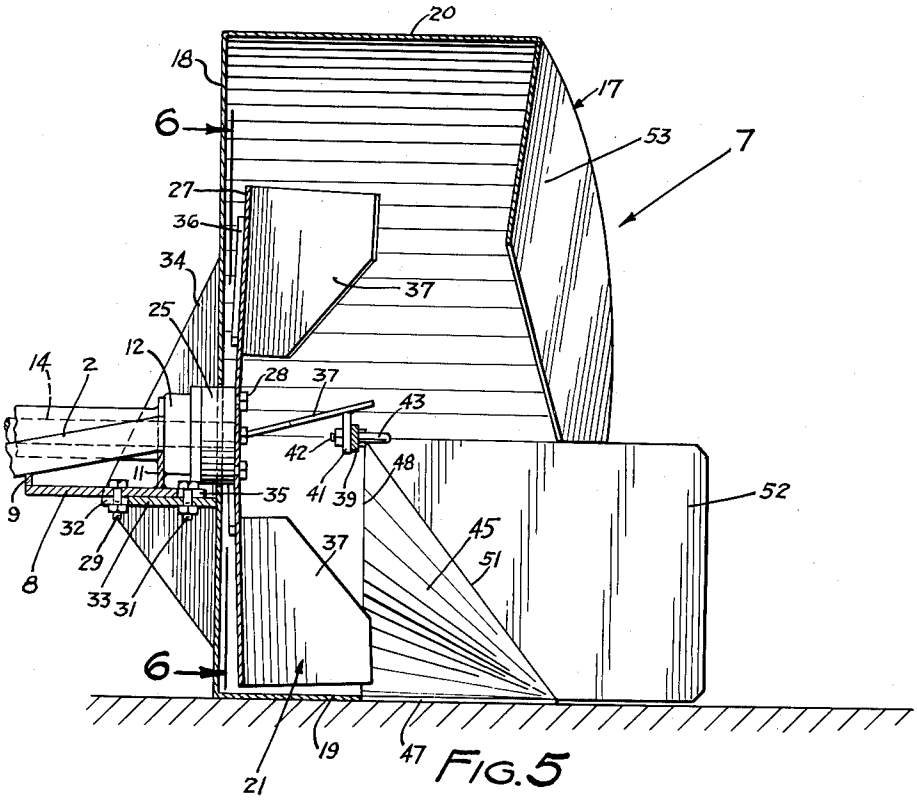


FIG. 5

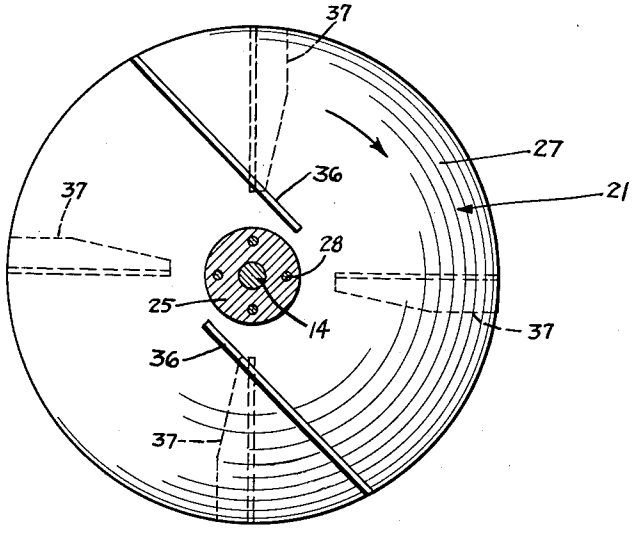


FIG. 6

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2,732,638

ROTARY SNOW PLOW

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4 Claims. (Cl. 37—43)

This invention relates to new and useful improvements in rotary snow plows, and more particularly to such plows adapted for removing snow from sidewalks, driveways and other restricted areas.

Numerous attempts have heretofore been made to develop a snow plow of this general type, but to the best of my knowledge none of these have proven entirely satisfactory, primarily because they usually have a tendency to become clogged with snow, particularly when operating in wet, heavy snow. In the operation of conventional plows of this general type, such snow often accumulates in a mass ahead of the plow, whereby the efficiency of the plow may be greatly impaired, and in some instances, may be rendered completely ineffective to remove snow. In other instances, sticky wet snow may accumulate within the housing, and particularly in the discharge opening thereof and surround the impeller or blower which may then become clogged and render the entire unit inoperative.

The novel snow plow herein disclosed is the result of considerable research and experimental work in an attempt to provide such an apparatus which is capable of handling and efficiently removing snow regardless of the nature thereof, with the assurance that the impeller and housing will not become clogged with accumulated snow, and it is therefore an object of the present invention to provide such a plow comprising a uniquely constructed housing and impeller which are so designed and oriented that snow, ice or other debris directed into the housing by the forward movement of the plow, is engaged by the impeller blades and thrown upwardly thereby along a normal trajectory path, defined by the upper wall of the housing, and outwardly through the enlarged discharge opening of the housing with a minimum of friction and resistance, whereby the impeller may be operated with a minimum of power.

A further object of the invention is to provide a snow plow comprising a housing having substantially its entire front end open for the reception of snow, and said open front being flanked at each side by forwardly extending guide wall members arranged to engage the snow and inwardly direct it into the lower central portion of the housing, whereby the impeller blades may readily pick up the snow and upwardly direct it through the upper portion of the housing and outwardly through the enlarged discharge opening thereof wtih a minimum of resistance, and the forwardly extending wall member at the side of the housing opposite from the discharge opening being provided with a vertically disposed, forwardly extending plate element which serves as a cutter for shearing crusted and solidly packed snow to cause it to freely enter the front end of the housing, and also to prevent a back flow of the snow at the loading side of the impeller, during operation of the plow.

A further object is to provide a rotary snow plow comprising a housing having an impeller mounted for rotation therein, and the front end of the housing being open the

full width thereof adapted to receive snow, whereby the snow is delivered to the entire lower portion of the impeller which is quickly loaded and upwardly conveys the snow and outwardly throws it through the enlarged discharge opening of the housing by centrifugal force, into the atmosphere.

A further object resides in the unique construction of the impeller housing which has its entire front end open to the admission of snow, and whereby the entire lower half of the impeller is always exposed to the snow entering the housing so that the impeller is quickly loaded and discharges the snow from the housing through the enlarged discharge opening thereof, the open front of the housing, and the size of the discharge opening relative thereto providing free passage of snow into and out of the housing with a minimum of resistance, whereby the impeller blades may be operated with a tip speed of approximately one-half that of conventional snow plow impellers or blowers or, in other words, at a speed of approximately 2000 feet per minute, as compared to one mile per minute, now considered necessary in conventional rotary plows of this general type, resulting in a substantial decrease in the amount of power required to efficiently operate the impeller of the present invention.

A further object is to provide an impeller having a plurality of blades for engaging the snow delivered into the housing and outwardly throwing it through the discharge opening in the housing, said impeller having a plurality of forwardly extending pins or teeth secured to its forward end which are so disposed as to thoroughly disintegrate sticky or hard crusted snow to assure free entry of the snow into the housing at all times, as the plow is advanced against the snow.

Other objects of the invention reside in the unique construction of the impeller which comprises a backing plate or disk having a plurality of snow-engaging blades secured to its front side with their leading edges inclined slightly forwardly in the direction of rotation of the impeller, thereby to direct the snow rearwardly against the backing plate or disk, and a plurality of tangential scraper ribs or fins being secured to the back side of the impeller backing plate for preventing wet snow and slush from accumulating between the backing plate and rear wall of the housing; in the V-shaped front bottom edge of the housing which prevents the snow from being pushed ahead of the plow because of the frictional contact of the snow with the surface of the sidewalk or ground until it is about to enter the housing between the impeller blades, and whereby the snow will readily enter the housing when the plow is moved forwardly against the snow; in the depending rearwardly inclined wall member provided at the front of the housing for directing the snow into the housing, particularly when operating in deep snow; in the wide open front of the housing whereby the snow entering the housing is engaged and picked up by the entire lower portion of the impeller and conveyed upwardly and outwardly through the enlarged discharge opening of the housing; and in the unique arrangement of the hood provided at the upper end of the discharge opening for controlling the directional movement of the snow from the housing.

These and other objects of the invention and the means for their attainment will be more apparent from the following description taken in connection with the accompanying drawings.

In the accompanying drawings there has been disclosed a structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not confined to the exact features shown, as various changes may be made within the scope of the claims which follow.

In the drawings:

Figure 1 is a perspective view of a snow plow embodying the invention;

Figure 2 is a side elevational view of the apparatus looking into the housing through the enlarged discharge opening;

Figure 3 is a front view of the housing, partially broken away, to show the adjustable mounting of the hood at the top of the discharge opening;

Figure 4 is a sectional plan view on the line 4—4 of Figure 3, showing the arrangement of the scarifier or rake teeth at the forward end of the impeller;

Figure 5 is a vertical sectional view on the line 5—5 of Figure 5; and

Figure 6 is a sectional view on the line 6—6 of Figure 5, showing the tangential ribs provided on the back side of the impeller.

In the selected embodiment of the invention herein disclosed there is illustrated, in Figures 1 and 2, a power unit such as utilized with small rotary plows, shown comprising a supporting frame **2** having an internal combustion engine **3** mounted thereon. The frame **2** is mounted upon suitable traction wheels **5** having a driving connection with the engine **3** through a suitable clutch mechanism, not shown in the drawings, whereby the apparatus may be propelled by the power of the engine, as is well known in structures of this general type. A pair of operating handles **6** are secured to the supporting frame for manually guiding the apparatus in its traveling movement.

An important feature of the present invention resides in the construction of the front end or snow-engaging portion of the apparatus, generally designated by the numeral **7**, which in the present instance is detachably secured to the forward end of the supporting frame of the power unit, as best illustrated in Figures 4 and 5. The supporting frame it will be noted by reference to Figure 5 has a plate **8** fixed to its forward end by such means as welding, ribs **9** and **11** having their lower ends welded to the plate **8** and their upper ends to the frame **2**, as will readily be understood by reference to Figure 5. A suitable hub **12** is provided at the forward end of the frame member **2** and has a bearing **13** mounted therein for supporting the forward end of shaft **14**, the rear end of which is drivingly connected to the power take-off shaft of the engine **3** through suitable belt drives **10** and **15** and a countershaft **16**, as indicated in dotted lines in Figure 2.

The front end or snow-engaging portion **7** of the apparatus comprises a housing, generally designated by the numeral **17**, having a back wall **18**, a semi-cylindrical bottom wall **19**, and an upwardly curved top wall **20** which is shaped to follow the natural trajectory path of the snow discharged from the housing by the impeller **21**, as will subsequently be described. The cylindrical wall portion **19** of the housing terminates at substantially a horizontal line drawn through the axis of the impeller **21**, as shown at **22** in Figure 1, and defines the bottom of a discharge opening **23** which extends from the edge **22** to the uppermost portion **24** of the parabolically formed top wall **20** of the housing.

The impeller **21**, as best illustrated in Figure 4, is secured to a cylindrical hub **25** mounted on the forward end of shaft **14** and secured thereto by such means as a pin or set screw **26**, or by a shrink fit. The impeller **21** comprises a circular disk-like back plate **27** which preferably is dished, as illustrated in Figures 4 and 5 to reinforce it against flexing when in operation, as will readily be understood. The impeller back plate **27** is secured to the cylindrical hub **25** by suitable bolts **28** whereby the impeller may readily be detached from the shaft **14** and its hub **25**, when necessary. The housing **17** is detachably secured to the forward end of the power unit frame by suitable bolts **29** and **31**, the bolts **29** having their upper ends received in apertures in the plate **8** and their lower end portions in re-entrant slots **32** provided in a horizontal plate **33** welded to the rear wall **18** of the housing **17** and to a pair of spaced gusset plates **34**, best illustrated in Figures 4 and 5.

The bolts **31**, it will be noted, have their lower end portions received in apertures provided in the plate member **33** and have their upper end portions received in re-entrant slots **35** provided in the plate **8** of the frame of the power unit. The slots **32** and **35** provide means whereby the housing **17** may readily be detached from the power unit by simply loosening the bolts **29** and **31** and removing the impeller from the cylindrical hub **25** secured to the forward end of the shaft **14**. The slots **32** and **35** also provide means whereby the back wall **18** of the housing may be adjusted relative to the back plate **27** of the impeller to provide the most efficient operating space therebetween.

Means is preferably provided on the back side of the impeller back plate to prevent snow and other foreign matter from accumulating in the space between the impeller back plate **27** and the back wall **18** of the housing. Such means is shown comprising at least two tangential ribs **36** secured to the back side of the back plate **27** by welding, and disposed as best illustrated in Figure 6. These webs or ribs may serve as blower blades to create a circulation of air in the space between the back of the impeller and the rear wall **18** of the housing to prevent snow and other matter from accumulating in said space and interfering with the operation of the impeller. The webs or ribs, **36** also function as scrapers to remove freezing slush and ice from the back wall **18** of the housing, as will be understood.

The impeller **21**, as best illustrated in Figures 4 and 5, is shown comprising a plurality of radially disposed blades **37** which are preferably configurated as shown in Figure 5, and are slightly forwardly inclined in the direction of rotation, indicated by the arrow **38** in Figure 3. By thus forwardly inclining the impeller blades the snow delivered into the impeller by the forward movement of the apparatus is compacted against the backing plate **27** by the impeller blades and is thrown upwardly and outwardly through the discharge opening **23** in a trajectory path along the top wall **19** of the housing, as indicated by the arrows in Figure 3.

To prevent clogging of the impeller, should the impeller blades tend to glaze the snow by the formation of ice therein, as a result of friction, means is provided on the forward portion of the impeller for engaging and thoroughly breaking up and disintegrating any sticky crusted or hard snow with which the impeller may come in contact. Such means is shown comprising a bar **39** shown secured to opposed blades **37** of the impeller by suitable brackets **41** and bolts **42**. A plurality of elongated pins **43** and **43'** are fixedly secured to the bar **39** in longitudinally spaced relation and project forwardly therefrom to engage the snow in advance of the impeller blades during operation of the plow, thereby to thoroughly disintegrate and break up any hard or ice crusted snow so that it may freely enter the housing and the impeller to be conveyed upwardly thereby and thrown outwardly through the enlarged discharge opening **23**.

Another important feature of the invention resides in the unique arrangement or grouping of the forwardly extending pins **43** and **43'** on the bar **39**, whereby when the impeller and said bar are rotated as a unit during forward movement of the plow, the two groups of pins **43** and **43'** will cooperate to produce a staggered effect, as illustrated by the full and dotted lines in Figure 4. This effect results because the group of pins **43** at the lefthand side of the impeller axis *a—a*, when viewed as shown in Figure 4, are disposed relatively closer to said axis than the group of pins **43'** at the righthand side of the impeller axis, whereby when the impeller is rotated the two groups of pins will cooperate to thoroughly and completely break up and disintegrate ice and hard crusted

snow so that it may readily enter the housing and impeller, as will be understood by reference to Figure 1.

Another feature of the invention resides in the construction of the forward lower end of the housing **17**, whereby a re-entrant V-shaped throat is provided for guiding the snow inwardly toward the center of the lower portion of the impeller. By thus shaping the lower forward ground-engaging edge of the housing, the snow to be removed will remain in direct contact with the surface of the walk or ground until it is about to enter the impeller, whereby it is not likely to be pushed along on the walk or ground ahead of the plow, as frequently occurs when utilizing a conventional snow plow of this general type. This greatly increases the efficiency of the plow in that it assures free movement of the snow into the housing and impeller, even though the snow may be sticky and wet and otherwise hard to handle.

The housing comprises forwardly extending V-shaped side wall portions **44** and **45**, having their bottom edges **46** and **47**, respectively, extending rearwardly from the foremost terminals of said wall portions to the line **48** where the rear edges of the wall portions **44** and **45** are connected to the cylindrical wall portion **19**. See Figures 1, 2 and 5. The side edges **49** and **51** of the wall portions **44** and **45** extend upwardly and rearwardly from the terminals of said wall portions to a horizontal line drawn through the axis of the shaft **14**, whereby said wall portions are so shaped as to readily guide the snow into the housing and impeller substantially without resistance, the frictional engagement of the snow with the ground in the V-shaped throat of the housing positively preventing the snow from being relatively pushed or moved forwardly on the walk or ground ahead of the housing, as hereinbefore stated.

A forwardly extending plate **52** is provided at the left hand side of the housing, as shown in Figures 1, 2, 4 and 5, for preventing the snow engaged by the forward ends of the impeller blades from being blown out of the housing at the left hand side thereof. Plate **52** may also serve to shear or cut hard crusted snow to facilitate the operation of advancing the plow forwardly against the mass of snow to be removed. To confine the snow within the housing during its upward movement therein, to the discharge opening **23**, a wall member **53** is shown depending from the upper parabolically shaped top wall of the housing and extends from substantially the top of the plate **52** to the top of the discharge opening. Plate **52** is rearwardly inclined, as shown in Figure 4, to cleave through high snow drifts, and it also cooperates with the top wall **20** of the housing to form a partially enclosed path for the trajectory travel of the snow upwardly through the housing, as it is thrown from the impeller blades by centrifugal force.

By forming the housing as hereinbefore described, substantially the entire front end and one side thereof are open to the atmosphere whereby there is no tendency for the impeller to develop an air pressure therein. The plow herein disclosed distinguishes from conventional rotary plows in that it does not utilize a high velocity air current for removing the snow as in blower type plows. In the plow herein disclosed, the snow is removed by centrifugal force when it comes in contact with the impeller, the entire front end of the impeller being exposed to the snow entering the open forward end of the housing, as will readily be understood by reference to Figures 1 and 3. As the snow is engaged by the impeller blades **37**, it is picked up and thrown upwardly in a direction towards the upper curved wall **20** of the housing, and follows a natural trajectory path upwardly therethrough and out through the enlarged discharge opening **23**.

Should the impeller encounter ice or hard crusted snow, the scarifier bar **39** will completely break up and disintegrate such snow whereby it may readily be picked up by the impeller as hereinbefore described. Because

of the entire front of the housing being substantially open for the free entrance of snow, the rotor blades freely pick up the snow and conveys it upwardly and outwardly throws it through the discharge opening **23** by centrifugal force, whereby the plow is not likely to become choked or clogged with snow, as frequently occurs in the operation of conventional snow plows of this general type which utilize a closed housing and a blower for blowing the snow upwardly through the discharge duct or chute thereof.

A suitable hood or chute **54** is pivoted to the uppermost portion of the housing as shown at **55** and is adjustably secured in position by an adjusting screw **56** mounted in the rear wall of the housing and traversing an arcuately formed slot **57** in the hood **54**. By thus adjustably mounting the hood on the housing, the snow discharging from the plow may be thrown outwardly a considerable distance, as indicated by the solid arrows in Figure 3. If it is desired to discharge the snow on the ground relatively close to the path of travel of the plow or adjacent to the sidewalk or other area being plowed, the hood or chute **54** may be positioned, as indicated by the dotted lines in Figure 3, whereby the discharging snow will be directed downwardly, as indicated by the dotted line arrow.

The novel snow plow herein disclosed has been found extremely efficient in actual operation. By constructing the front end of the housing as herein described, the major portion of the impeller is constantly exposed to the incoming snow whereby the impeller quickly loads and conveys the snow upwardly and outwardly through the discharge opening substantially without effort. This feature in conjunction with the open discharge side of the housing has made it possible to reduce the tip speed of the impeller to approximately one-half of that considered necessary in the operation of conventional blower type rotors or fans, such as utilized in conventional rotary snow plows of this general type. By operating the impeller at a relatively lower speed, as above described, it quickly loads to full capacity, as the snow is continually directed into it through the open front of the housing, as the plow moves forwardly, whereby there is little danger of the plow becoming clogged or stalled, even when moved into deep snow or drifts.

The low speed impeller employed also makes it possible to operate the plow with relatively less power than is possible with plows utilizing blowers or impellers which must be rotated at a tip speed of approximately one mile a minute in order to effectively remove the snow, resulting in the provision of such an apparatus which is comparatively light in weight, is inexpensive in construction, and provides the utmost in efficiency, regardless of snow conditions provided, of course, that the depth of the snow is within the capacity of the plow. The unique construction of the forward end of the housing in conjunction with the toothed bar **39** also makes it practically impossible for snow to accumulate forwardly of the plow and clog its operation. It will be noted by reference to the drawings that the housing and impeller may readily be constructed as a unit independently of the power unit, and may be quickly attached thereto as hereinbefore described.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, but the appended claims should be construed as broadly as permissible in view of the prior art.

What I claim is:

1. A snow plow of the class described, comprising a housing having means for removably attaching it to the forward end of a power unit provided with a drive shaft, said housing comprising an upright back wall, a top wall, a bottom wall and opposed side walls, one of which has a discharge opening therein, said back plate having an opening therein for receiving the forward end of said

drive shaft, an impeller secured to the drive shaft within the housing, said impeller comprising a disc positioned in proximity to the back wall of the housing and having a plurality of blades secured to and extending forwardly from the front face of said discs, said blades being inclined in the direction of rotation of the impeller whereby snow and other material engaged thereby is urged towards said disc while being thrown outwardly by the centrifugal action of the impeller through the discharge opening of the housing, the front end of said housing being open to permit free entry of snow and other material thereinto and into engagement with the impeller, and a front wall portion secured to and depending from the top wall of the housing over a portion of the upper half of the impeller, said depending wall portion being inclined rearwardly and cooperating with said top wall to provide a trajectory path for the snow as it is discharged from the housing through said discharge opening.

2. A snow plow according to claim 1, wherein one of said side walls is provided with a forwardly extending plate member adapted to engage the snow in advance of the plow to prepare it for entry into the plow housing.

3. In a snow plow of the class described, a power unit including a supporting frame having a longitudinally extending drive shaft mounted therein, a horizontal plate secured to the forward end of said frame and having bearing means thereon for rotatably supporting the forward end of the drive shaft, a housing comprising an upright back wall having a rearwardly extending horizontal plate element fitted against the horizontal plate of said frame and adjustably secured thereto whereby the housing may be relatively adjusted in an axial direction with respect to said supporting frame, an impeller within the housing comprising a disc having means for securing it to the front end of said drive shaft for direct rotation therewith, said disc having a plurality of blades secured thereto and extending outwardly therefrom in a forward direction, said housing including top, bottom and side walls, one of said side walls having a discharge opening therein through which snow may be discharged from the housing by the centrifugal action of the impeller, and the bottom wall of said housing and the leading edge of said bottom wall being V-shaped in configuration having its apex disposed adjacent to the plane of the forward edges of the impeller blades, whereby when the plow is moved forwardly against a mass of snow, the snow may remain in engagement with the ground surface until engaged by the impeller blades, whereby the danger of the snow being pushed forwardly of the plow is completely eliminated.

4. In a snow plow of the class described, a power unit including a supporting frame having a longitudinally extending drive shaft mounted therein, a housing comprising a back wall having means for securing it to the forward end of the supporting frame, said housing also having top, bottom and side walls, and having a discharge opening in one side thereof and an open front for the reception of snow and other material to be removed, an impeller secured to the drive shaft within the housing and adapted for direct rotation with said shaft, said impeller comprising a back plate positioned in close proximity to the back wall of the housing and substantially parallel thereto, said impeller back plate having a plurality of forwardly extending radial blades secured thereto and inclined in the direction of rotation to facilitate picking up snow and throwing it outwardly through said discharge opening, the back plate of the impeller being slightly dished in a forward direction to reinforce it against deflection, caused by the centrifugal force imposed thereon when rotated at high speed against a mass of snow, said bottom and side walls having opposed forwardly extending and outwardly directed guide elements secured thereto and normally positioned with their bottom edges engaging the surface to be cleaned and cooperating to engage and inwardly direct snow and other material to the impeller, and a plurality of narrow elongated scraper bars being secured to the back side of the impeller back plate and disposed at a tangent to said shaft in a direction to prevent snow and slush from accumulating in the restricted space between the back wall of the housing and the back wall of the impeller.

References Cited in the file of this patent

UNITED STATES PATENTS

1,457,113	Langworthy	May 29, 1923
1,561,007	MacGregor	Nov. 10, 1925
1,586,209	Mayer	May 25, 1926
1,784,331	Brattlien	Dec. 9, 1930
1,822,827	Shappell	Sept. 8, 1931
1,848,554	Smith et al.	Mar. 8, 1932
2,075,581	Jeswine	Mar. 30, 1937
2,093,758	Hansen	Sept. 21, 1937
2,175,542	Robarge	Oct. 10, 1939
2,234,176	Jensen	Mar. 11, 1941
2,315,007	Morse et al.	Mar. 30, 1943
2,536,166	Garland	Jan. 2, 1951
2,536,638	Greene	Jan. 2, 1951
2,546,339	Greer	Mar. 21, 1951
2,605,561	Maynard et al.	Aug. 5, 1952
2,650,439	Hickman	Sept. 1, 1953

FOREIGN PATENTS

114,926	Great Britain	Apr. 25, 1918
64,140	Norway	Nov. 10, 1941