June 4, 1957 F. F. WALLACK 2,794,271

THROW WHEEL FOR SNOW REMOVERS

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Fig. 1

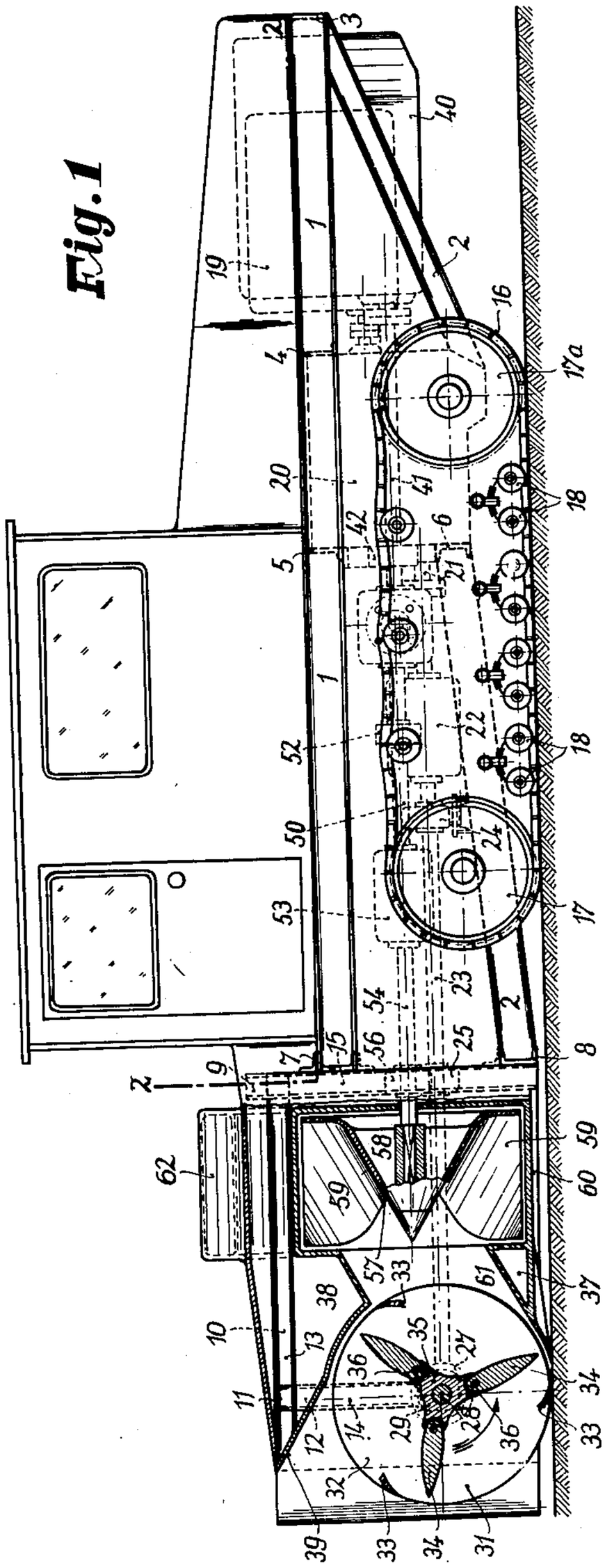
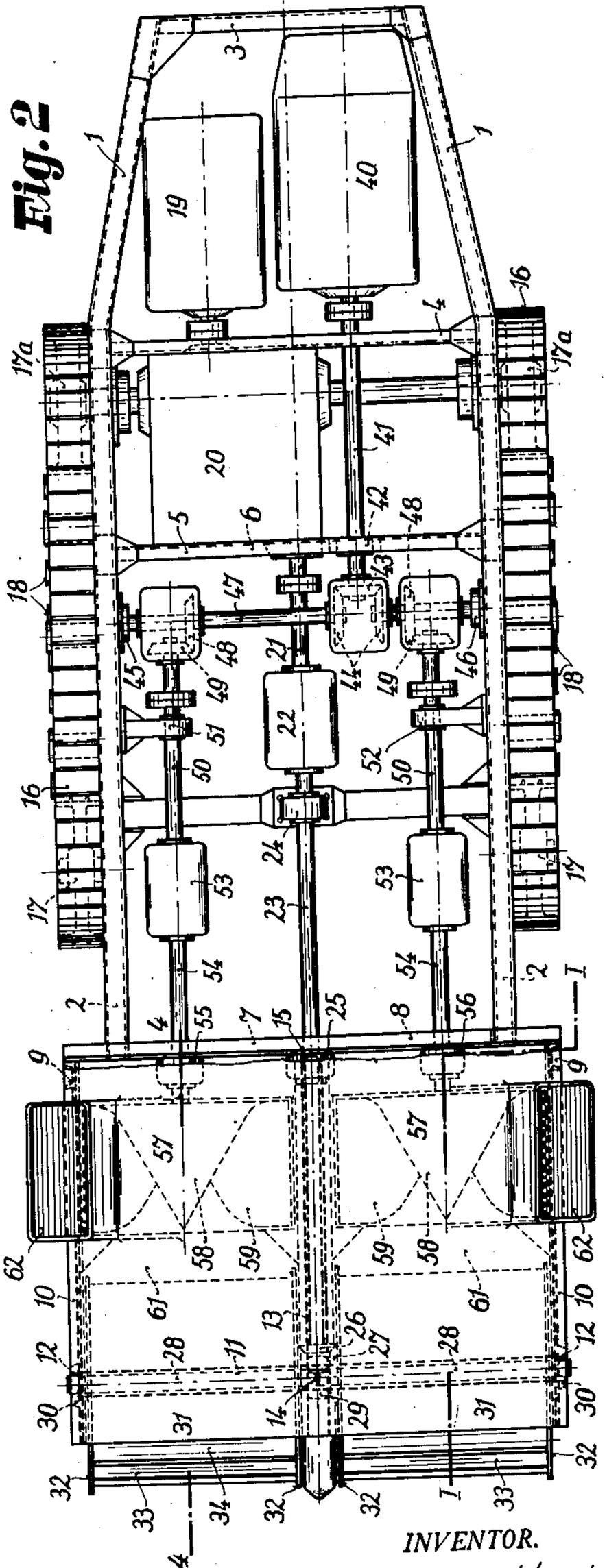


Fig. 2



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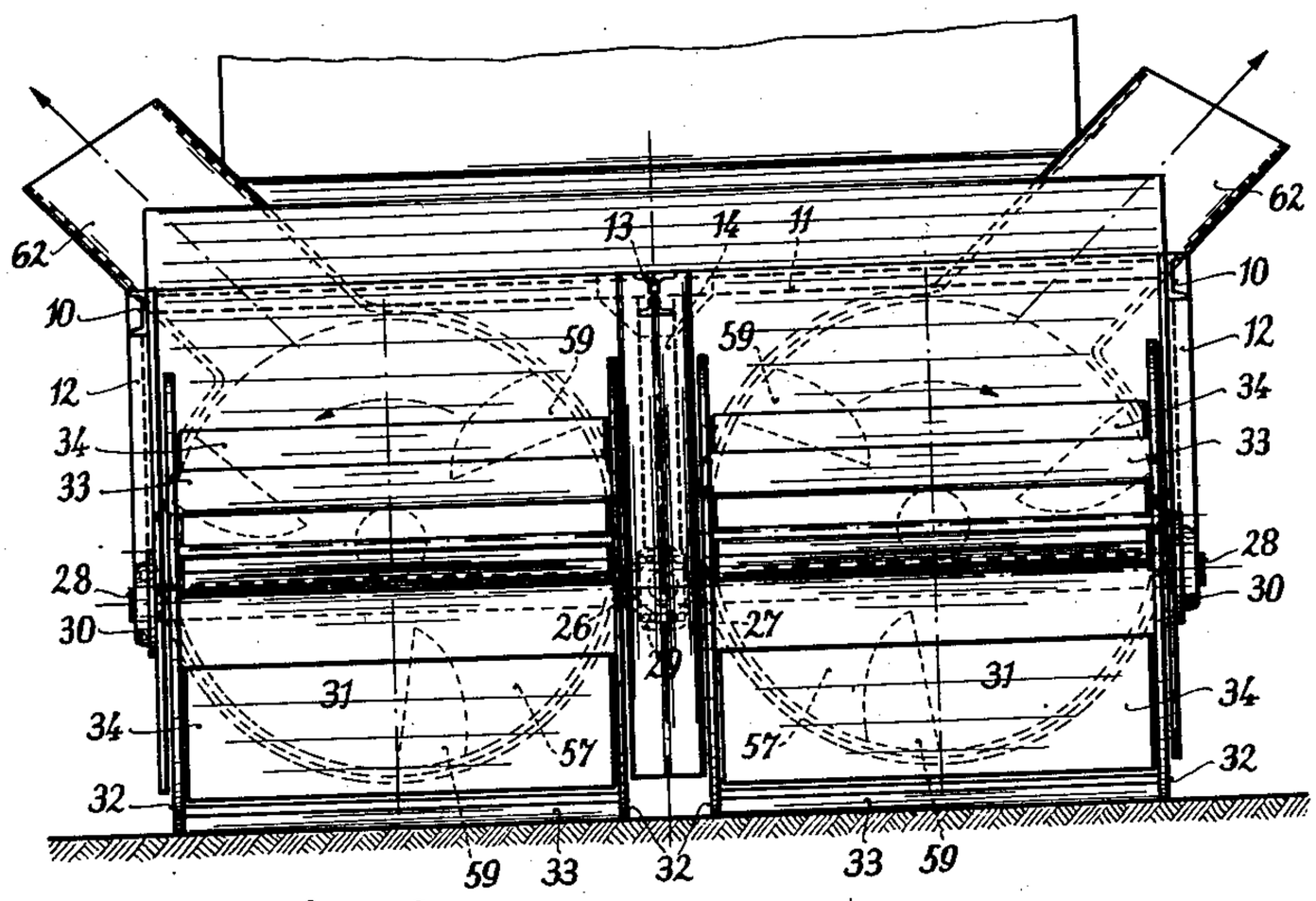


Fig. 3

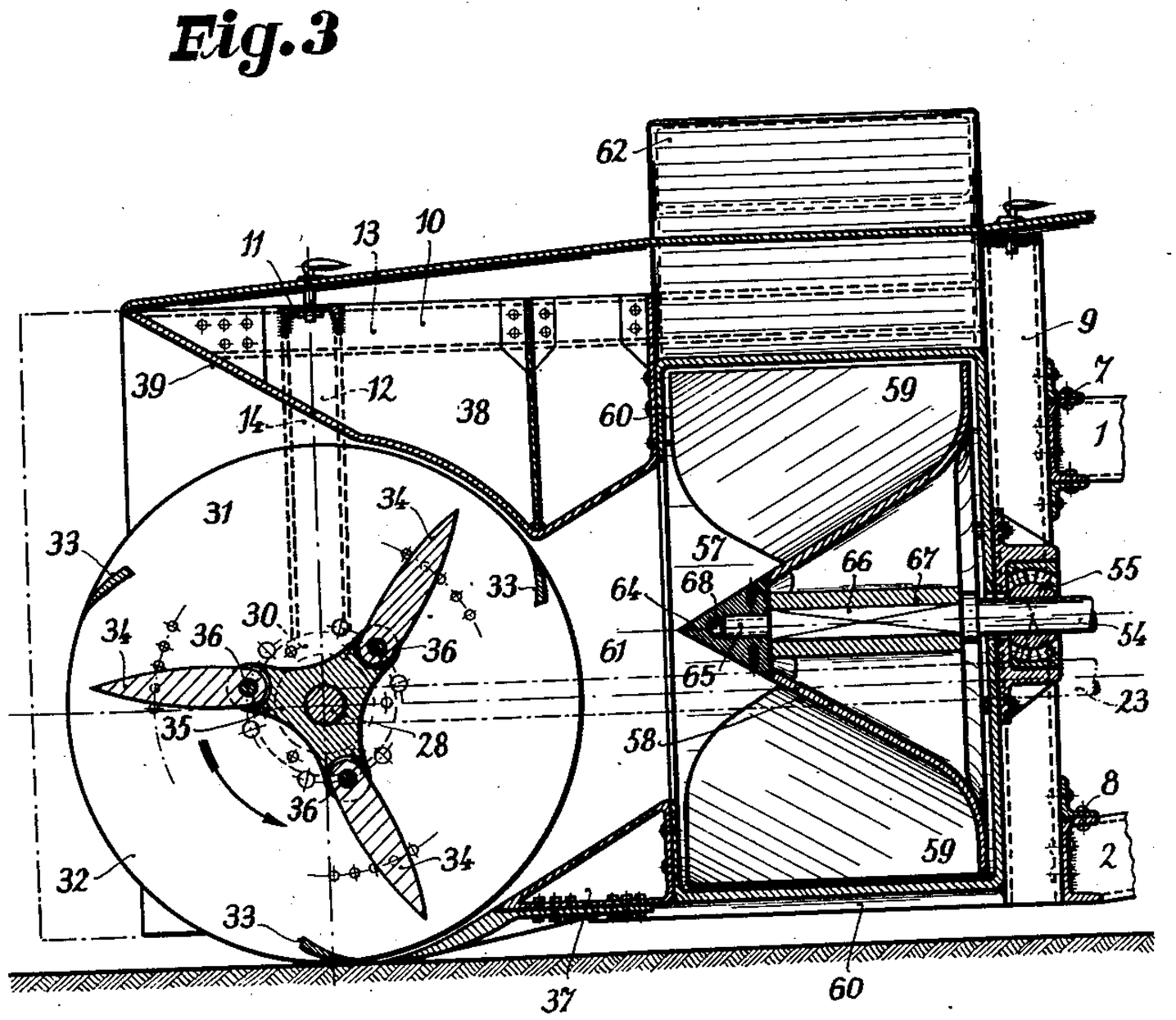


Fig. 4

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THROW WHEEL FOR SNOW REMOVERS

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Fig.5

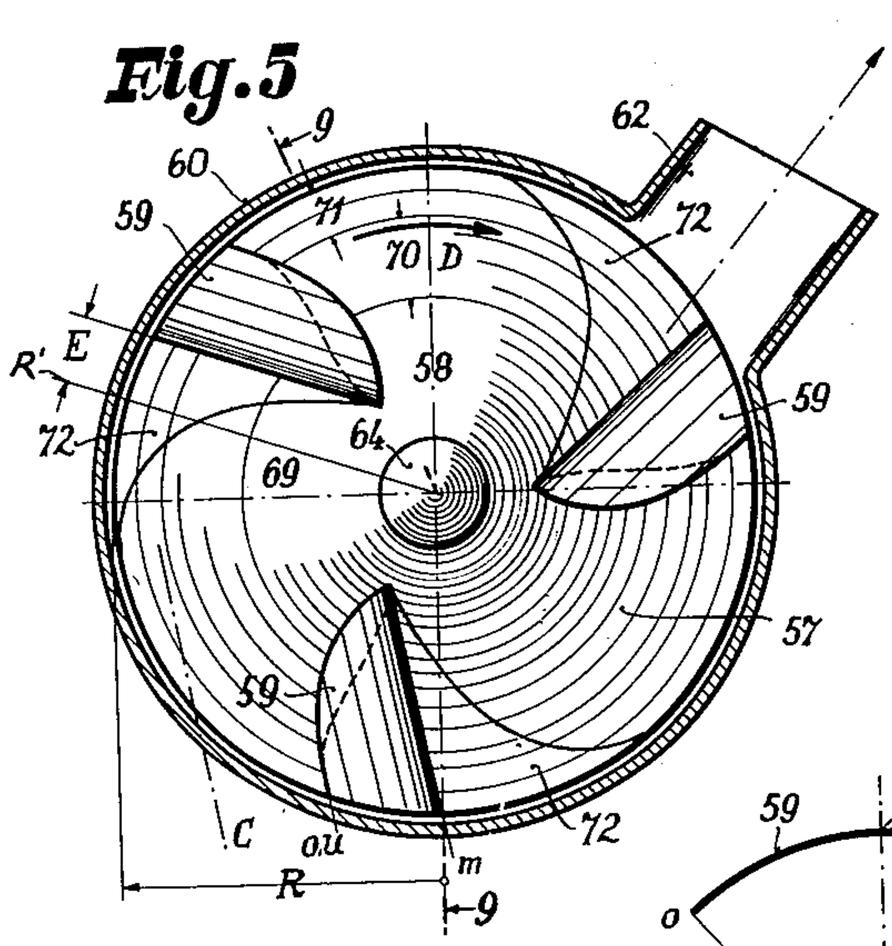
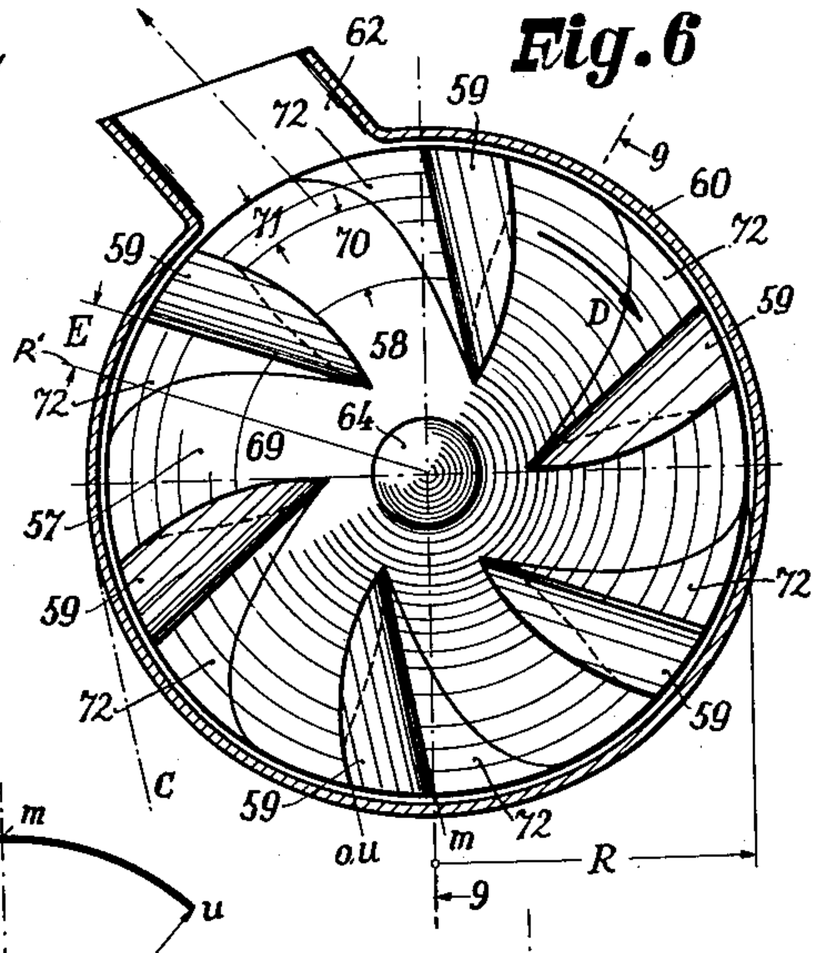


Fig.6



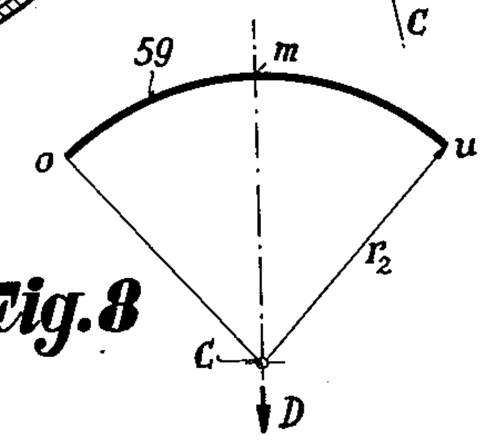


Fig.8

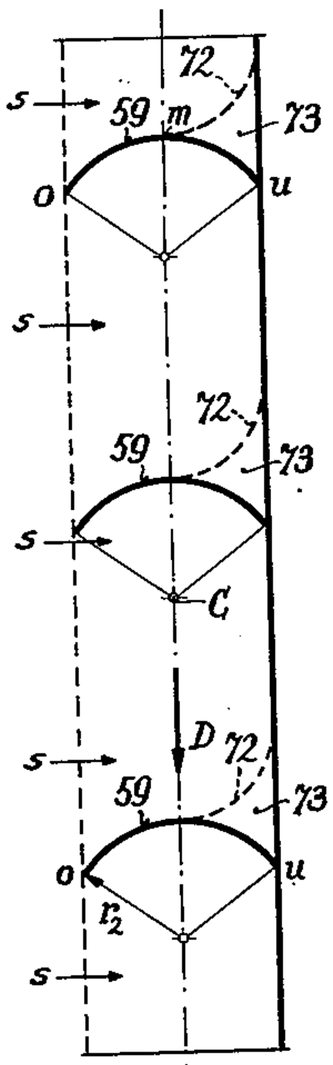


Fig.10

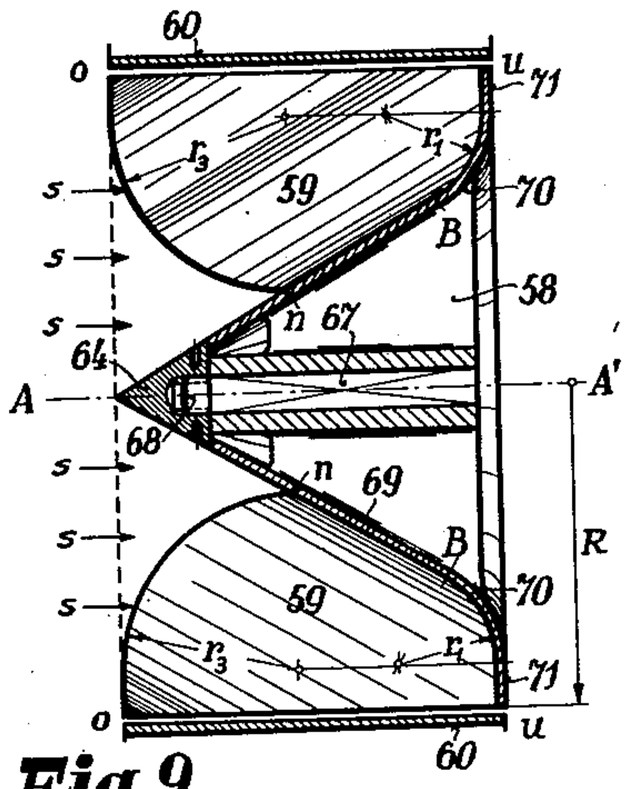


Fig.9

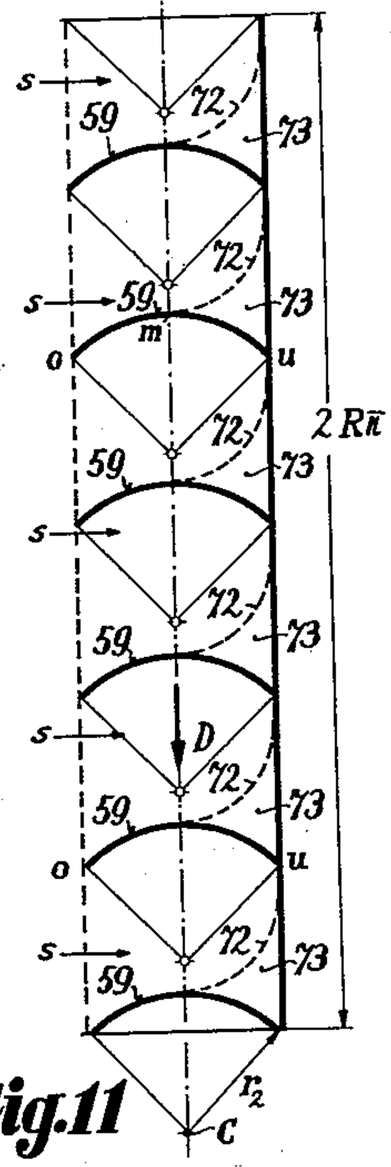


Fig.11

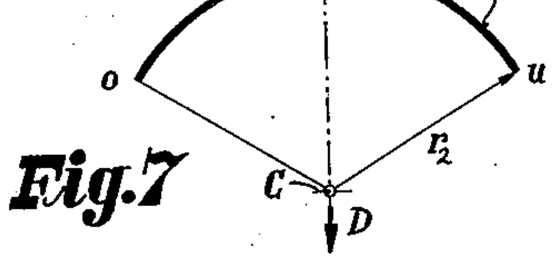


Fig.7

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Fig.12

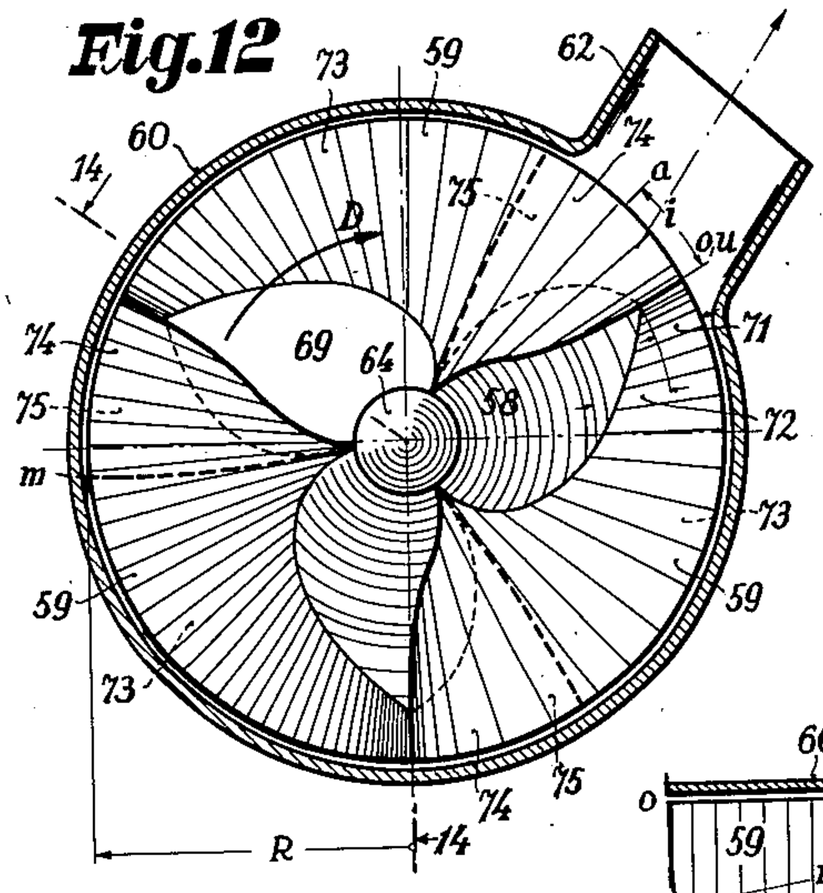
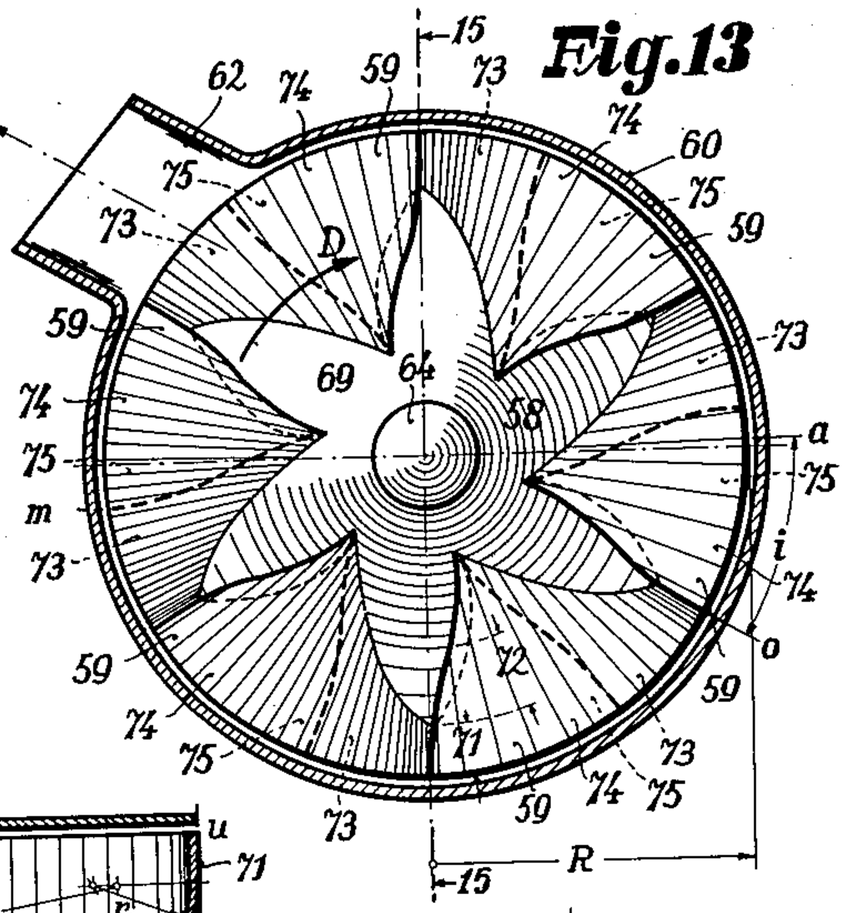


Fig.13



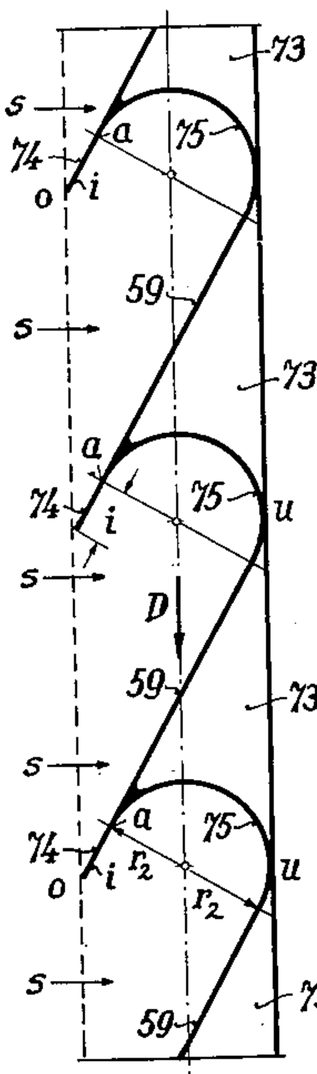


Fig.16

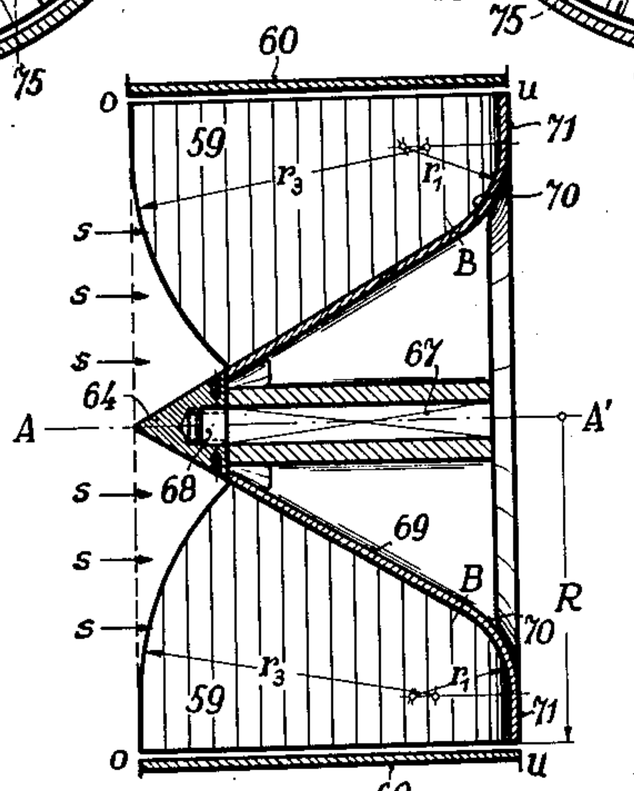


Fig.14

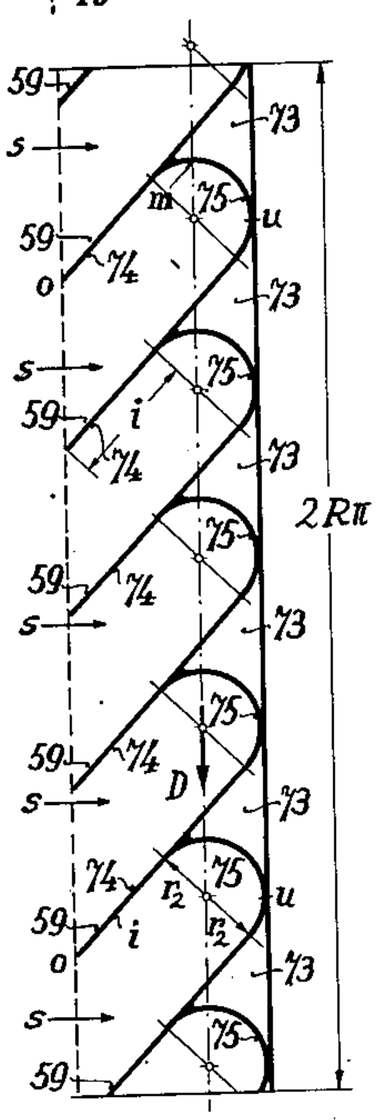


Fig.17

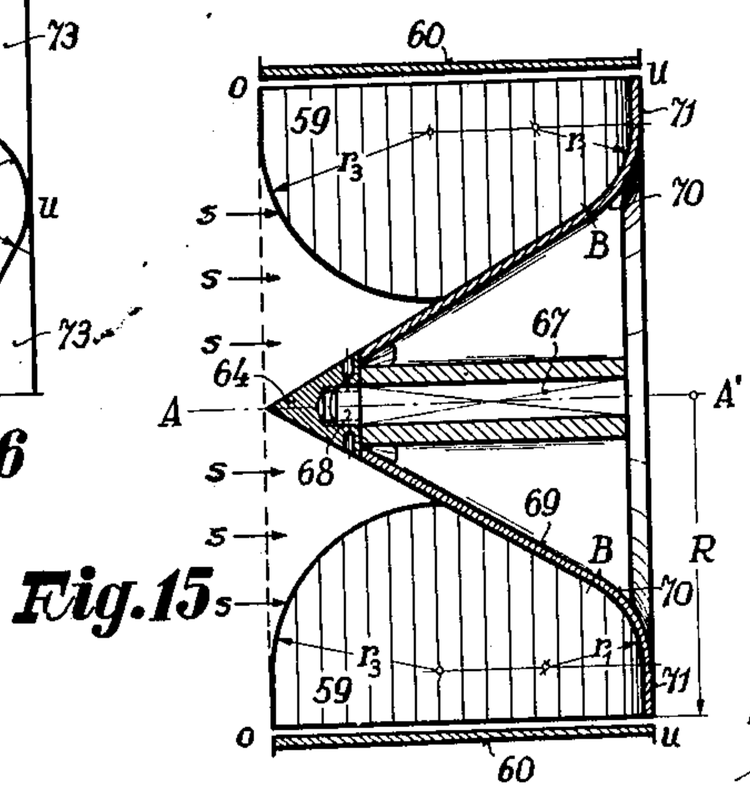


Fig.15

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THROW WHEEL FOR SNOW REMOVERS

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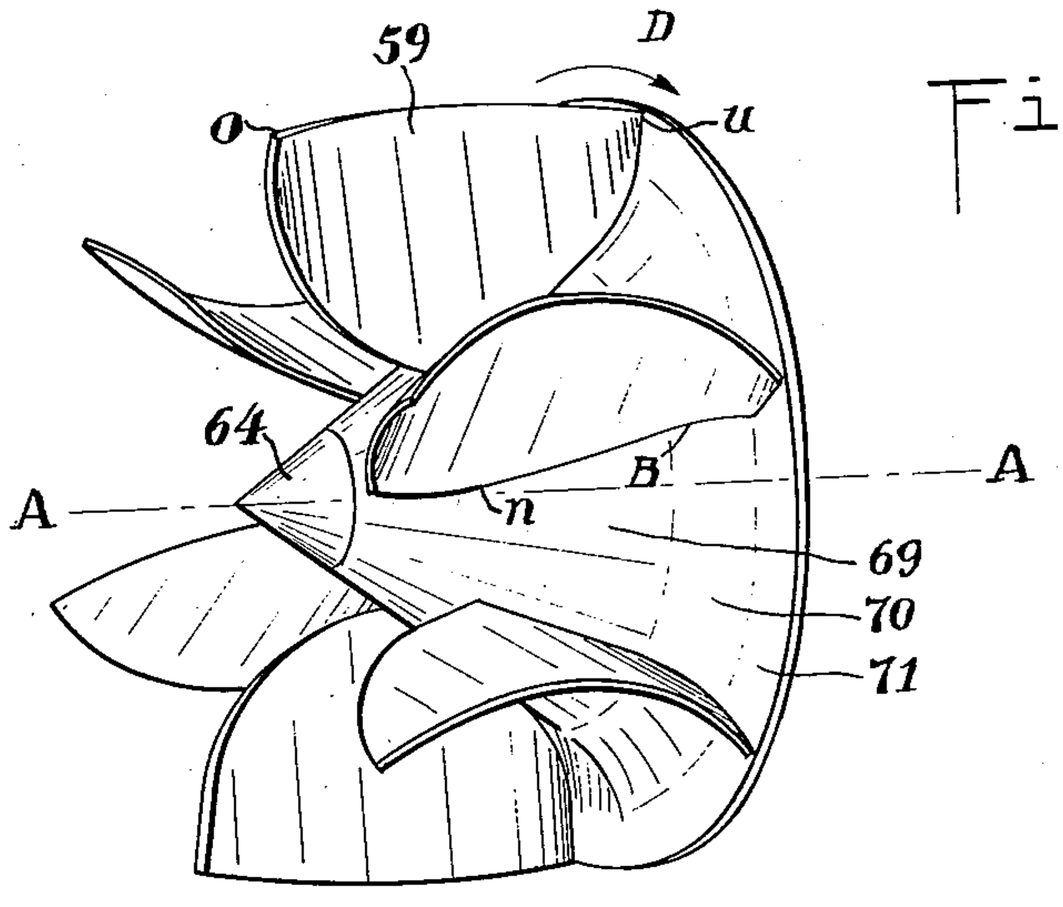


Fig. 18.

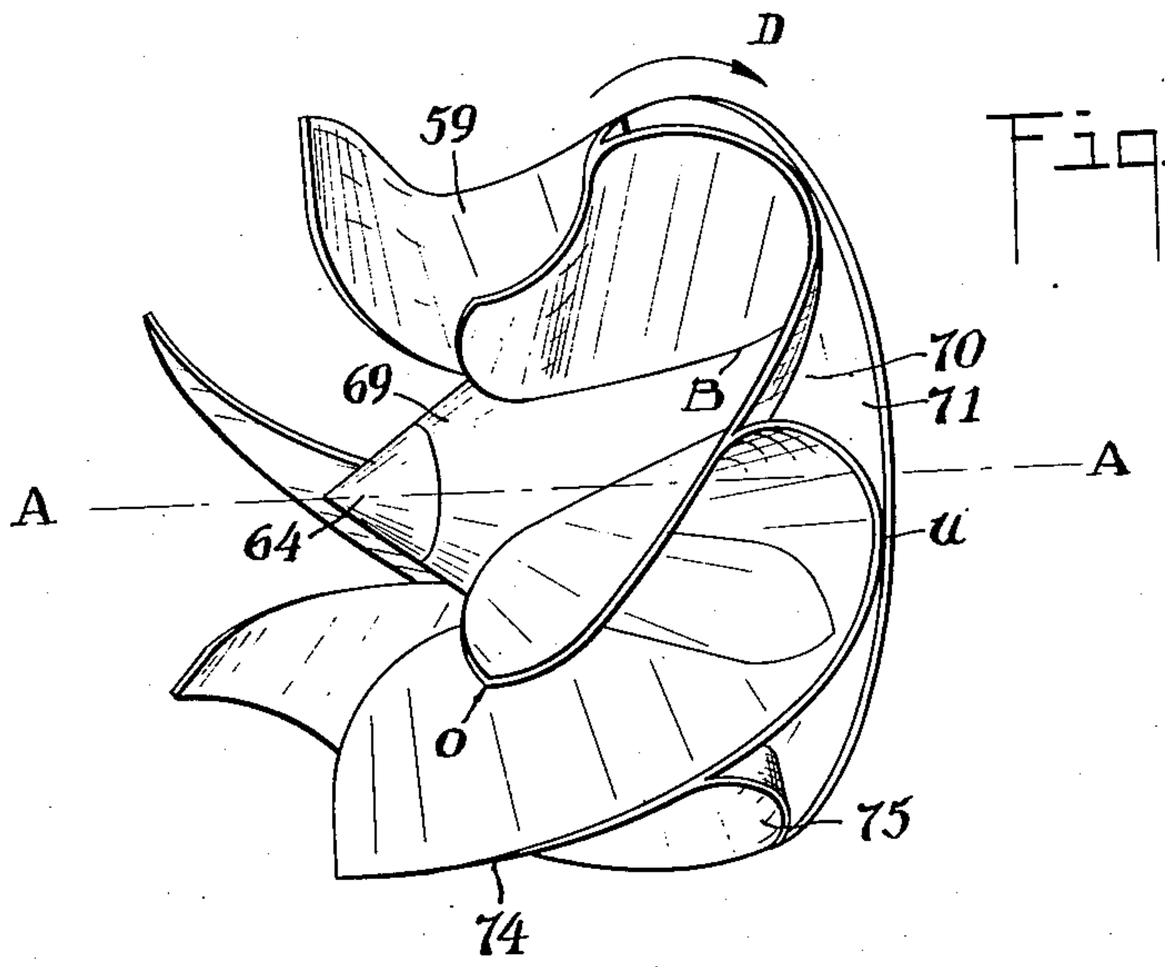


Fig. 19.

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United States Patent Office

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Patented June 4, 1957

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THROW WHEEL FOR SNOW REMOVERS

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Application December 8, 1950, Serial No. 199,741

Claims priority, application Austria December 9, 1949

9 Claims. (Cl. 37—43)

This invention relates to centrifugal snow removers which comprise means for cutting the snow and conveying it to throw wheels which rotate and cause the snow to be hurled out through an opening in the throw wheel casing. In snow removers of this type the throw wheel comprises a plurality of throw blades fixed to a carrier which consists of a tapering body which is rotatable within a stationary cylindrical drum which forms the throw wheel casing. The apex of the blade carrier faces against the direction in which the snow is admitted into the drum.

It is an object of the invention to provide a throw wheel of the type described which is designed for improved efficiency so that the snow handled by the wheel does not undergo directional changes caused by impact.

Other objects of this invention will become apparent as the specification proceeds.

One feature of this invention resides in the fact that the blade carrier has a toroidal surface portion to which the tapering surface portion of the carrier is tangential and which adjoins the base of the carrier. Preferably there is only a small clearance between the outer edges of the blades and the drum, whereas the inner edge sections of the blades which face toward the direction of snow admission are curved inwardly so as to join the blade carrier a short distance below the apex of the carrier, the outer portion of the blades thus standing free. To provide for ready installation and removal of the throw wheel, its apex portion may be screwed into place. A suitable carrier for the throw blades may comprise a cone surface portion, or a conoid surface portion, that is, a surface portion the describing line of which, instead of being a straight line, is curved.

The blades may have any suitable form. Advantageously, the throw portions of the blades may consist, as is known per se, of sections of hollow cylinders the describing lines of which are parallel to the base of the blade carrier. According to the invention the most rearward portions of the surface of the blades in the direction of rotation lead the throw wheel radius with which they are parallel by a predetermined eccentricity in the direction of rotation. Other blade types, however, may be also used. For instance, the throw blades may comprise a guide portion consisting of a helical surface the describing line of which is substantially parallel to the base plane of the blade carrier, and a throw portion adjoining the guide portion and consisting of a half cylinder or of a half frustum of a cone. In each case the re-entering spaces behind the blades are suitably covered, either by special covering surfaces or by an arrangement such that two adjacent blades partially overlap.

By the use of a throw wheel having the above-described structural characteristics of the invention, all losses of power which would otherwise occur as a result of directional changes of the snow caused by impact are avoided, and the efficiency of the snow remover is substantially improved.

In the accompanying drawings several embodiments of the invention are shown by way of example.

Figure 1 is an overall side view, partly in section, showing a snow remover embodying features of the invention;

Figure 2 is an overall top plan view, with parts removed, of the snow remover of Fig. 1, as seen approximately along the line 2—2;

Figure 3 is an enlarged front view of the snow remover shown in Figs. 1 and 2;

Figure 4 is an enlarged sectional view taken approximately along a vertical plane passing through the center of a throw wheel approximately along the line 4—4 in Fig. 2, showing the snow removal cylinder in association with the throw wheel;

Figure 5 is a front view showing an embodiment of the throw wheel having three cylindrical blades;

Figure 6 is a similar front view showing a throw wheel having six cylindrical blades;

Figures 7 and 8 are cross sectional views of the blades of the throw wheels shown in Figures 5 and 6, respectively.

Figure 9 is a central sectional view taken approximately along the lines 9—9 of Figs. 5 and 6;

Figures 10 and 11 are diagrammatic views showing the unwound cylinder described around the throw wheel and indicating the form of the throw blades shown in Figures 5 and 6, respectively;

Figures 12 and 13 are front views showing throw wheels having three and six helical blades, respectively;

Figure 14 is a central sectional view taken approximately along the line 14—14 of Figure 12;

Figure 15 is a similar central sectional view taken approximately along the line 15—15 of Figure 13;

Figure 16 is a diagrammatic view showing the unwound cylinder described around the throw wheel and indicating the form of the throw blades shown in Figure 12;

Figure 17 is a similar diagrammatic view of the blades of Fig. 13;

Figure 18 is a perspective view of the throw wheel shown in Fig. 6; and

Figure 19 is a similar perspective view of the throw wheel of Fig. 13.

In the embodiment shown in Figs. 1 to 3, the snow remover is mounted on the frame of an endless track type driven vehicle. The frame of the vehicle comprises two upper longitudinal girders 1 and two longitudinal girders 2 which are obliquely inclined downwardly in front. Longitudinal girders 1 and 2 are interconnected by cross bearers 3, 4, 5, 6, 7 and 8. Uprights 9, upwardly protruding somewhat over the longitudinal girders 1, are secured to the front ends of the longitudinal girders 1. Two lateral horizontal longitudinal girders 10 are secured to the two uprights 9 and interconnected at their front ends by a front cross bearer 11. Uprights 12 protrude somewhat downwardly at the ends of the longitudinal girders 10 and the cross bearer 11 and in the center of the vehicle the cross bearers 11 and 7 are interconnected by a central longitudinal girder 13. Short uprights 14 and 15 extend downwardly, respectively, from the junction points of the members 11 and 13, and 7 and 13.

The endless track drive is provided on the vehicle frame, the endless track chains 16 running over two chain wheels 17 and 17*a*, and rollers 18. The motor 19 for driving the vehicle is mounted on the frame and drives, by means of gearing 20, the rear wheels 17*a* for the endless track chains. A shaft 21 leads from the gearing 20 to a transmission 22. The output shaft 23 of the transmission 22 is journalled in the vehicle frame by means of bearings 24 and 25 and carries a bevel gear 26 which meshes with a bevel gear 27. The latter is secured to a horizontal shaft 28 which is journalled in two end bearings 30 and a central bearing 29 and extends transversely of the longitudinal axis of the vehicle. Laterally of the central plane of the vehicle the shaft 28 carries two snow removal cylinders 31. Each snow removal cylinder comprises two end flanges 32 which carry at their perimeters three plow shares 33 for plowing off the snow when the snow

removal cylinder rotates. The flanges **32** also carry a central core member **35** and three guide blades **34** which are pivotally connected to the core member **35** at **36**, the core members **35** are rotatably adjustable relatively to the shaft **28**. Each snow removal cylinder **31** is surrounded from below by a casing **37** and from above by a casing **38**, the latter having a guide surface **39**. These casings communicate with the casing which surrounds the throw wheels through an admission opening **61**, to be described in more detail below. In the embodiment shown, the snow removal cylinders convey the snow from the bottom to the top as a result of the direction of rotation indicated by the arrow.

In the embodiment illustrated, a separate motor **40**, also mounted on the vehicle frame, is provided for driving the two throw wheels mounted behind the snow removal cylinders **31**. However, the throw wheels could be driven by the vehicle motor **19** by means of a separate gearing. The motor **40** for driving the throw wheels comprises a shaft **41** journalled in a bearing **42** and carrying at its front end a bevel gear **43** which meshes with a bevel gear **44** which is secured on a transverse shaft **47** journalled in the vehicle frame by means of bearings **45** and **46**. At each end the transverse shaft **47** carries a bevel gear **48** in meshing engagement with a bevel gear **49** on a shaft **50** which is journalled in bearings **51** and **52**. The shaft **50** is connected with a transmission **53**, the output shaft **54** of which is journalled by means of bearings **55** and **56** in the vehicle frame and carries at its front end a throw wheel **57**. In all embodiments throw wheel **57** comprises a cone **58** which is secured on the shaft **54** and carries blades **59**. Each of the two throw wheels is surrounded by a casing **60** which communicates, through an admission opening **61**, with the casing **37**, **38** of the snow removal cylinders, and each casing **60** has a discharge passage **62**.

The main component of the throw wheel is a throw wheel cone **58** having a radius R and serving as a carrier for the throw wheel blades. The apex **64** of the throw wheel cone **58** faces toward the direction *s* in which the cut-off snow is admitted. The shaft **54** has at its front end a thread **65** and behind this thread a square portion **66**. The apex portion **64** of the cone **58** has a female thread **68**, which is engaged with the thread **65**. The throw wheel also has a square central opening **67** to permit it to be mounted on the square portion **66** of the shaft **54**. This arrangement facilitates the selective mounting of any of a number of different throw wheels on the same throw wheel shaft **54**. The conical surface portion **69** of the throw wheel being tangential to the toroidal surface portion **70**, the conical surface portion **69** passes over at the point B into toroidal surface portion **70**, having the radius r_1, which toroidal surface portion in turn passes over into a circular ring surface portion **71**. The throw wheel portions **69**, **70**, **71** cause the snow admitted to the throw wheel to be deflected toward the outer circumference of the throw wheel.

In the embodiment shown in Figure 5, three throw blades **59** are secured on the throw wheel portions **69**, **70**, **71** in such manner that their forward inner edge section, which is inwardly and rearwardly curved along an arc of a circle having the radius r_3, is clear of the conical surface **69** of the throw wheel up to a point *n* situated below the apex **64** of the cone, whereas beginning at point *n* the blade is joined to conical surface **69**, the toroidal surface **70**, and the circular ring surface portion **71**, which latter defines the base of the throw wheel. The cylindrical surface described around the throw wheel and having the describing line *o*—*u* constitutes the outer limit for the throw wheel blades **59**. Blades **59** have the function of engaging the snow which has been deflected by the throw wheel portions **69**, **70**, **71** toward the periphery of the throw wheel, of accelerating the snow until it has assumed the circumferential speed of

the throw wheel, and of throwing the snow, in a substantially radial direction, out of the cylindrical casing drum **60** surrounding the throw wheel through the opening **62** provided in the casing.

To fulfil this function the throw wheels may have blades of different forms. In the embodiments shown in Figures 5 to 11 the blades have the form of sections of hollow cylinders. The describing lines of the throw blades **59**, curved according to a hollow cylinder having the radius r_2, are parallel to the throw wheel radius R' with which they are associated, and lead in advance of said radius in the direction of rotation by the eccentricity E. The axes C of the hollow cylinders are half the height of the throw wheel, when considered inclusively of its apex portion **64**. As mentioned above, the portions of the several blades which adjoin the throw wheel are firmly joined to the throw wheel portions **69**, **70**, **71**, whereas their arcuate portion, facing the side on which the snow is admitted, and the portion adjoining the theoretical circumference of the snow wheel cylinder, stand free. Hence, the limiting edges of the throw blades **59** stand free from *o*, along the arc having the radius r_3 to *n*, and from *o* to *u*, whereas they are firmly joined to the throw wheel from *n*, along the arc having the radius r_1, to *u*.

To prevent a whirling motion of air or undesirable accumulations of snow at the back of the throw blades **59**, cylindrical cover surfaces **72** which are curved in the opposite direction may be provided, as shown in Figures 5, 6, 10 and 11, for covering up the re-entering dead spaces **73**. Instead of these oppositely curved cylindrical cover surfaces, cover surfaces of other suitable shape may be provided. Seen from the front (Figure 5) the leading corner *o* and the rear corner *u* of each blade **59** lie in a line perpendicular to the base of the throw wheel **58**, whereas the center line *m* of the throw blade lags behind in the direction of rotation of the throw wheel and is spaced from the axis A—A' by the eccentricity E. Figure 10, showing the unwound cylinder described around the throw wheel, indicates the direction of rotation D of the throw wheel, the direction of admission *s* of the snow cut loose and admitted to the throw wheel, the form of the throw blades **59** from *o* to *u*, the radius r_2 of the throw blades, the cover surfaces **72** to be provided adjoining the throw blades **59**, and the re-entering spaces **73** covered up by the cover surfaces. The sectional views taken at right angles to the describing lines of the hollow cylinders (Figure 7) show the continuous curvature of the throw blades **59** from their upper end *o* through the central point *m* to the lower end *u*, with the radius r_2, and the direction of rotation D of the throw wheel.

The embodiment of the throw wheel shown in Figures 6, 8, and 11 differs from that shown in Figures 5, 7, and 10 only in that each throw wheel carries six instead of three throw blades **59**. Figure 6 is a front view, Figure 8 a central section and Figure 11 a diagram showing the unwound cylinder described around the throw wheel.

In the embodiment shown in Figures 12, 14, and 16 the blades **59** consist of guide portions **74** and adjoining throw portions **75**. The guide portions **74** consist of helical surfaces the describing lines of which are substantially parallel to the base plane of the blade carrier **59** whereas the throw portions have the shape of hollow half cylinders. The throw portions, however, may also be shaped as half frustums of cones. In this modification the describing lines of the guide portions **74** pass through the axis A—A' of the throw wheel, the outside of which has the radius R, and are parallel to the base plane *u*—*u* of the throw wheel. The edge section of the several throw wheel blades **59** adjoining the throw wheel is firmly joined to the latter whereas their arcuate edge section, facing the side on which the snow is thrown in, and the edge section adjoining the theoretical cylinder circumference, stand free. Hence, there are in this modification, as in that

shown in Figures 5 to 11, blade edge sections which stand free, and blade edge sections joined to the throw wheel. In the modification shown in Figures 12, 14, and 16, however, the radius r_3 of the curvature of the forward inner edge of the blades varies with the number of throw blades provided on the throw wheel.

The diagrammatic view showing the unwound cylinder described around the throw wheel (Figure 16) shows that each throw blade **59** has a guide portion **74**, which begins at *o* and comprises a helical surface, the describing line of which passes through the axis A—A′ of the throw wheel and is parallel to the base plane *u*—*u* of the throw wheel, and a cylindrically curved throw portion **75** adjoining guide portion **74**. The surface portion *i* of the blades, facing the side on which the snow is admitted, is identical for each two adjacent blades **59**, which do not separate until the point *a* is reached and at which the throw portion, having a curvature of the radius r_2, adjoins. The re-entering spaces **73** at the back of the throw portions are covered by the guide portion of the next following throw blade. In the front view of Figure 12, the leading corner *o* of each throw blade **59** and the rear corner *u* of the next preceding throw blade **59**, which edge adjoins the base of the carrier, lie on a line perpendicular to the base of the throw wheel. On the other hand, the most rearward part *m* of the cylindrical throw portion **75** in the direction of rotation is covered by the helical guide portion of the next following throw blade **59**. The diagrammatic view of Figure 16 showing the unwound cylinder described around the throw wheel, indicates as in Figures 10 and 11, the direction of rotation D of the throw wheel, the direction of admission *s* of the snow, the form of the throw blades **59** with the guide portions **74** and the throw portions **75**, and the covered-up re-entering spaces **73**. The size of these re-entering spaces is reduced as the number of throw blades **59** on the wheel is increased.

The modification of the throw wheel shown in Figures 13, 15, and 17 differs from that shown in Figures 12, 14, and 16 only in that each throw wheel carries six throw blades **59** instead of three.

Throw wheels of other forms may be conceived, within the scope of this invention, which are suitable for fulfilling the requirements set forth hereinbefore. As has been mentioned hereinbefore, the throw portions may have the shape of a half frustum of a cone. The guide surfaces may constitute helical surfaces the describing line of which is inclined to the axis of the throw wheel cone. The essential feature is the taper of the blade carrier, and the construction of the carrier and of the blades so that the snow admitted to the wheel is not subjected to directional changes caused by impact.

In the appended claims, the term "arcuate," which is used generically to define the shape of the throw blades, includes the term "half frustum of a cone" and the term "half cylinder."

What I claim is:

1. A throw wheel for a snow plow adapted to receive and throw the snow directed inwardly toward it from the front of the plow, comprising a conical hub adapted to be rotatably mounted on an axis with its apex in opposition to the direction of inward movement of the snow, and a plurality of separate uniformly-dimensioned arcuate throw blades extending outwardly from said hub, said hub having a conical surface portion extending from the apex substantially to the base portion of the hub and a toroidal surface portion merging with said conical surface portion substantially only at said base portion, said conical surface portion being the predominant portion of said hub, all of said throw blades being connected to said hub along said conical surface portion and along said toroidal surface portion merging with said conical surface portion, and portions of the free edges of all of said throw blades extending outwardly toward said apex beyond the outermost point of connection to said conical surface portion.

2. A throw wheel as defined in claim 1, wherein the forward edges of said throw blades are arcuate in form and curve radially inwardly toward the hub, whereby said forward edges merge with the hub at a point which is spaced axially of the hub from the outermost point of said edges.

3. A throw wheel as defined in claim 1, wherein the throw blades are in the form of sections of hollow cylinders having a surface parallel to the base of the conical hub, and the blades are mounted on the hub in such manner that the portions of the surfaces of the cylinders which are rearwardmost in the direction of rotation of the hub are parallel to the radius of the hub but are offset therefrom by a predetermined eccentricity in the direction of rotation of the hub.

4. A throw wheel as defined in claim 3, wherein the axes of said cylinder sections intersect the surface of the hub at a point approximately at half the height of the hub.

5. A throw wheel as defined in claim 3, wherein the rear portions of the blades in the direction of rotation are shielded by means providing a deflecting surface for preventing accumulation of snow thereagainst.

6. A throw wheel as defined in claim 5, wherein the means defining the deflecting surface comprise members having cylindrical surfaces having a curvature opposite to that of the throw blades.

7. A throw wheel for a snow plow adapted to receive and throw the snow directed inwardly toward it from the front of the plow, comprising a conical hub adapted to be rotatively mounted on an axis with its apex in opposition to the direction of inward movement of the snow, and arcuate throw blades extending outwardly from said hub, said hub having a conical surface extending from the apex substantially to the base of the hub and a toroidal surface merging with said conical surface substantially only at said base, and said throw blades comprise guide portions having helical surfaces, the describing line of which is substantially parallel to the base of the conical hub, and adjoining throw portions having surfaces corresponding to the external surfaces of axially bi-sected conical frustums.

8. A throw wheel as defined in claim 7, wherein the guide portion and the throw portion of each blade are united at their ends adjacent the apex of the hub.

9. In a snow plow having means for engaging the snow and directing it inwardly of the plow, a throw wheel adapted to receive and throw said snow, said throw wheel comprising a conical hub rotatably mounted in said plow with its apex in opposition to the direction of inward movement of the snow and arcuate throw blades extending outwardly from said hub, said hub having a conical surface portion extending from the apex substantially to the base portion of the hub and a toroidal surface portion merging with said conical surface portion substantially only at said base portion, said conical surface portion being the predominant portion of said hub, all of said throw blades being connected to said hub along said conical surface portion and along said toroidal surface portion merging with said conical surface portion, and portions of the free edges of all of said throw blades extending outwardly toward said apex beyond the outermost point of connection to said conical surface portion.

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