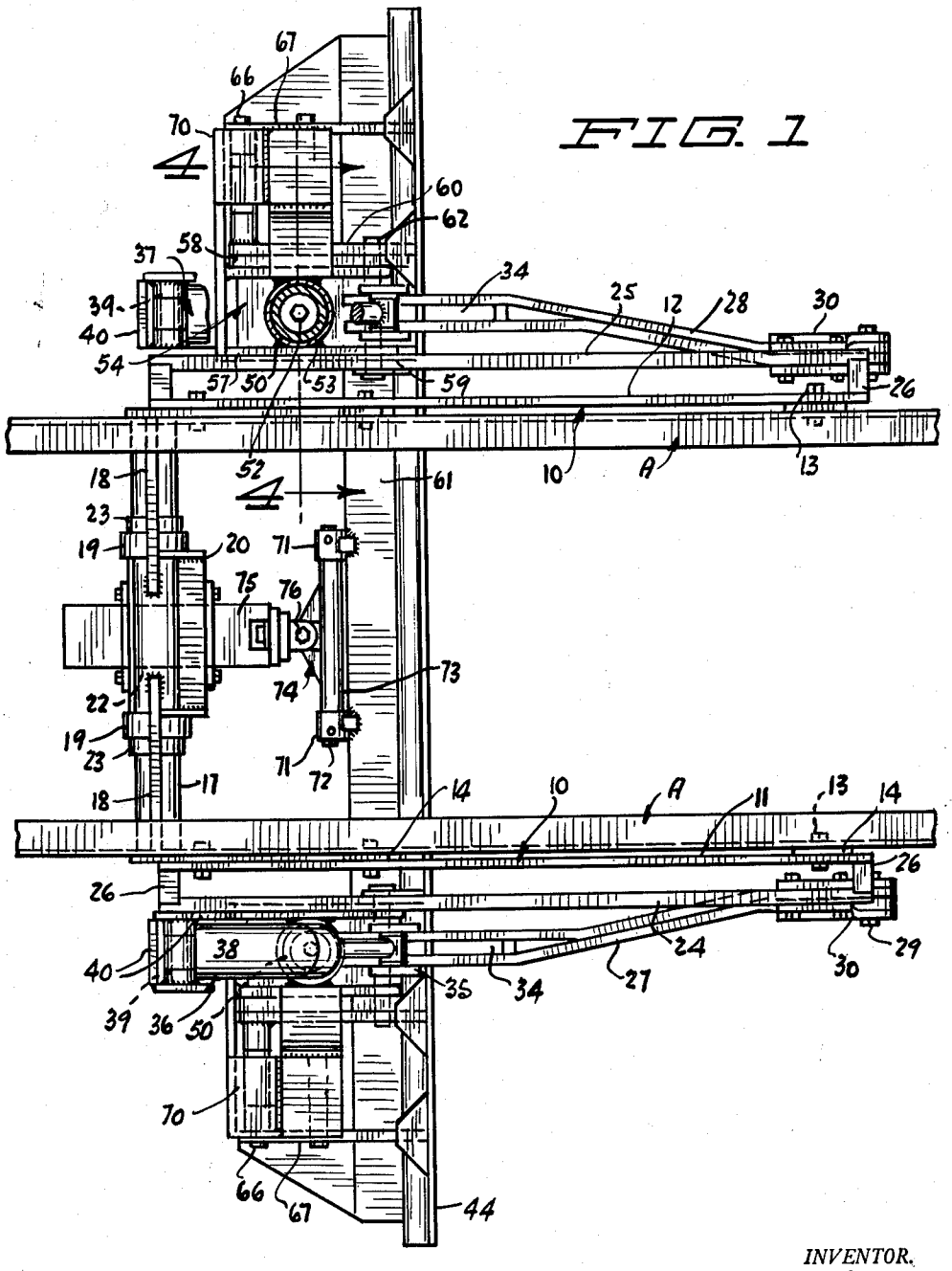
March 7, 1961 LE GRAND H. LULL 2,973,591

ICE CRUSHING AND BLADING MECHANISM

Filed July 30, 1956 7 Sheets-Sheet 1

FIG. 1



INVENTOR.
LE GRAND H. LULL
BY Carlson & Hayes
ATTORNEYS

March 7, 1961 LE GRAND H. LULL 2,973,591

ICE CRUSHING AND BLADING MECHANISM

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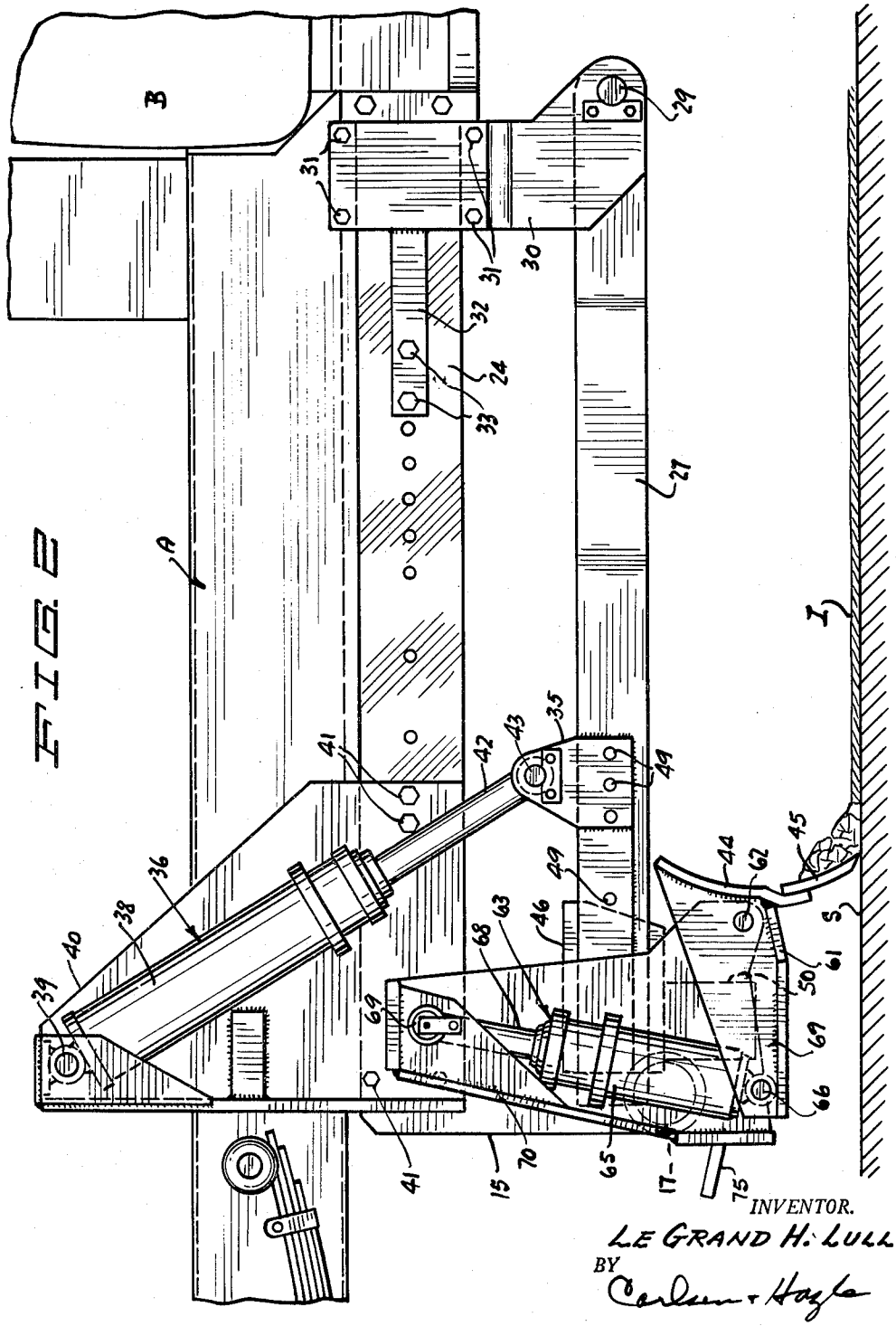


FIG. 2

INVENTOR.
LE GRAND H. LULL
BY
Carlson & Hayes
ATTORNEYS

March 7, 1961 LE GRAND H. LULL 2,973,591

ICE CRUSHING AND BLADING MECHANISM

Filed July 30, 1956 7 Sheets-Sheet 3

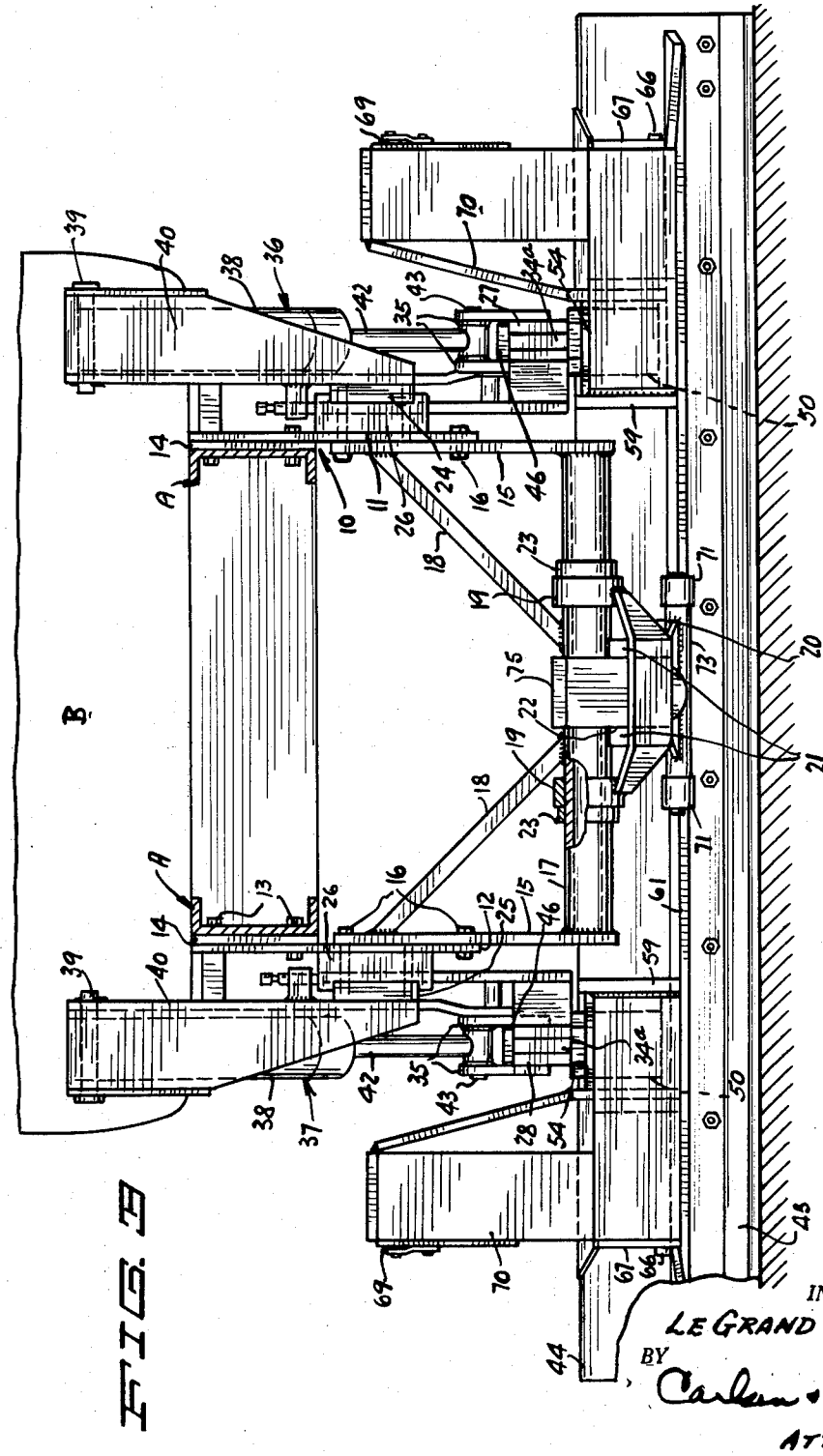


FIG. 3

INVENTOR.
LE GRAND H. LULL
BY
Carlson & Hogle
ATTORNEYS

March 7, 1961 LE GRAND H. LULL 2,973,591

ICE CRUSHING AND BLADING MECHANISM

Filed July 30, 1956 7 Sheets-Sheet 4

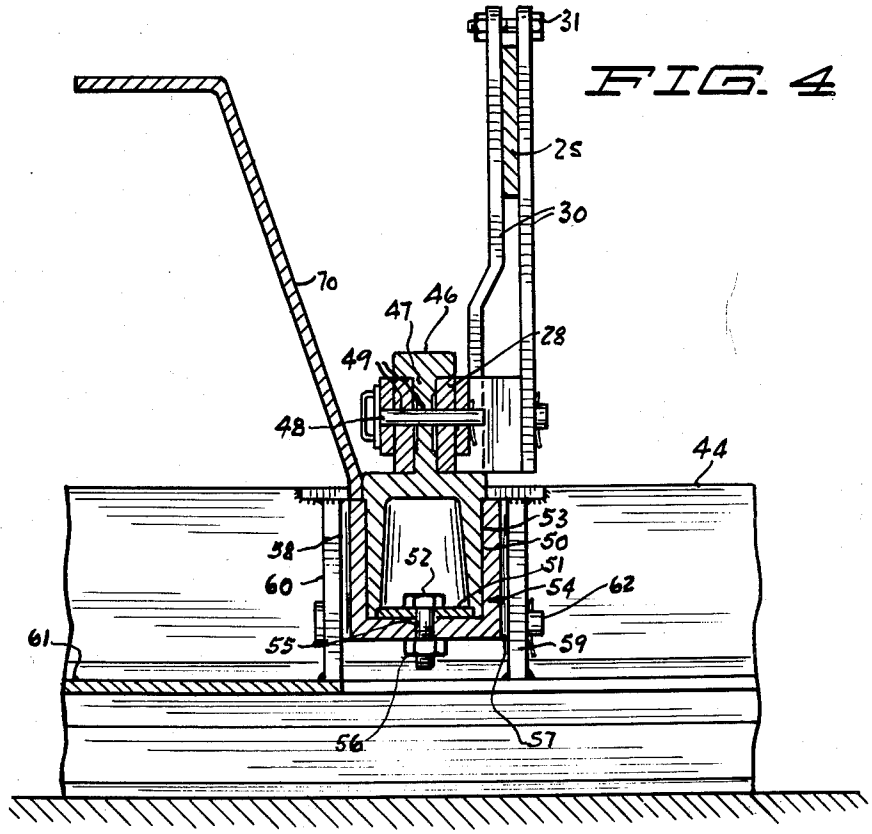


FIG. 4

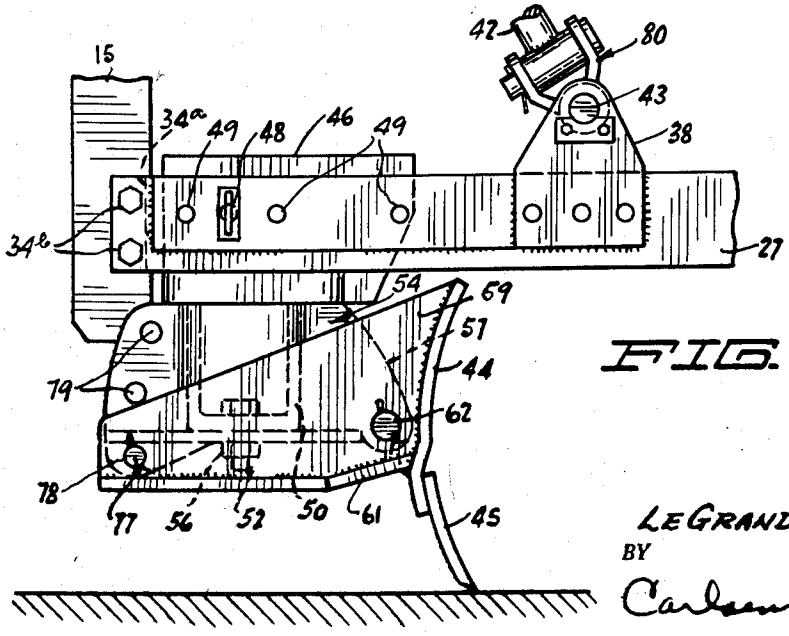


FIG. 5

INVENTOR.
LEGRAND H. LULL
BY
Carlson & Hayes
ATTORNEYS

March 7, 1961 LE GRAND H. LULL 2,973,591

ICE CRUSHING AND BLADING MECHANISM

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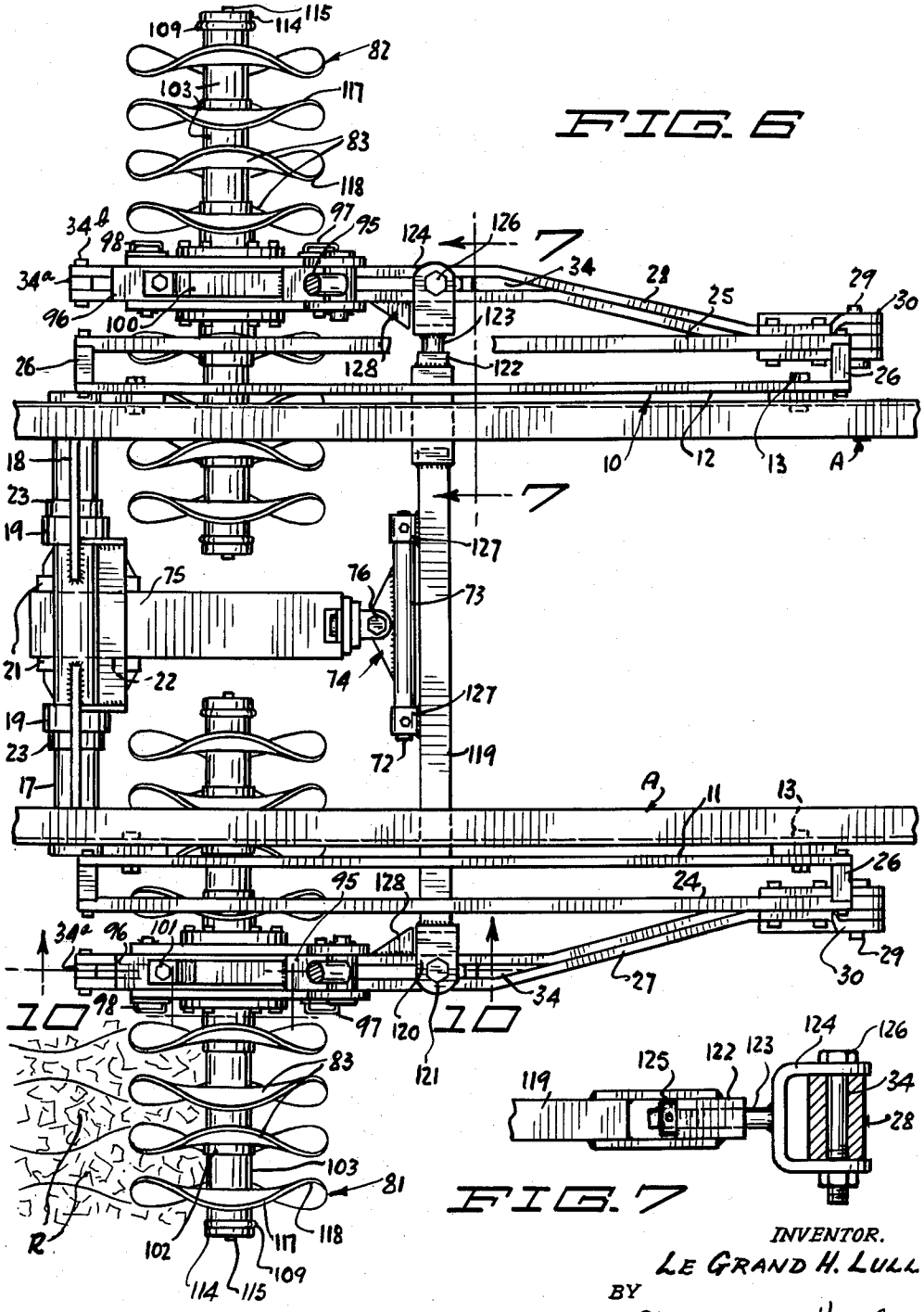


FIG. 6

FIG. 7

INVENTOR.
LE GRAND H. LULL
BY
Carlson + Hazle
ATTORNEYS

March 7, 1961 LE GRAND H. LULL 2,973,591

ICE CRUSHING AND BLADING MECHANISM

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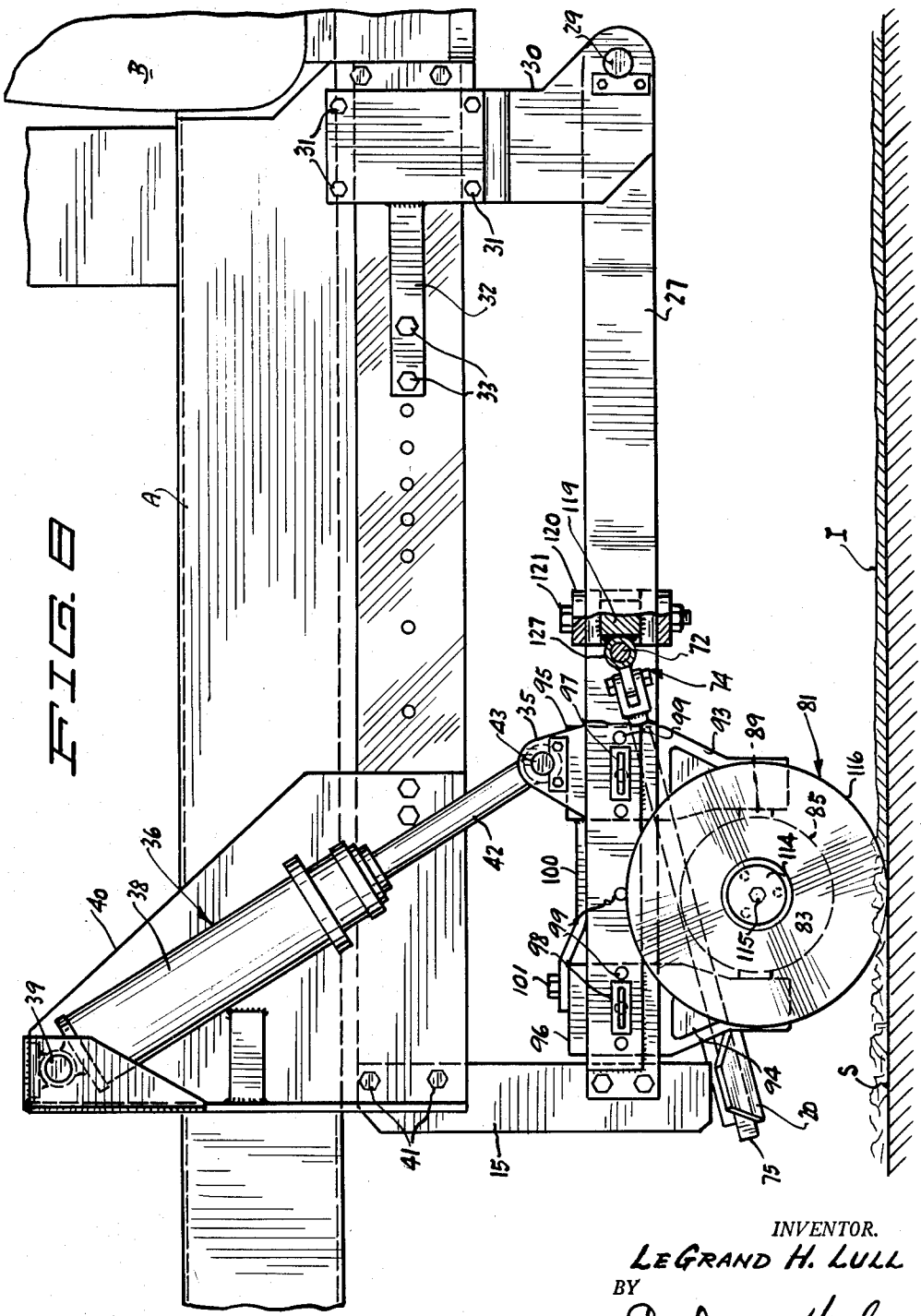


FIG. 8

INVENTOR.
LEGRAND H. LULL
BY
Carlson & Hayes
ATTORNEYS

March 7, 1961 LE GRAND H. LULL 2,973,591

ICE CRUSHING AND BLADING MECHANISM

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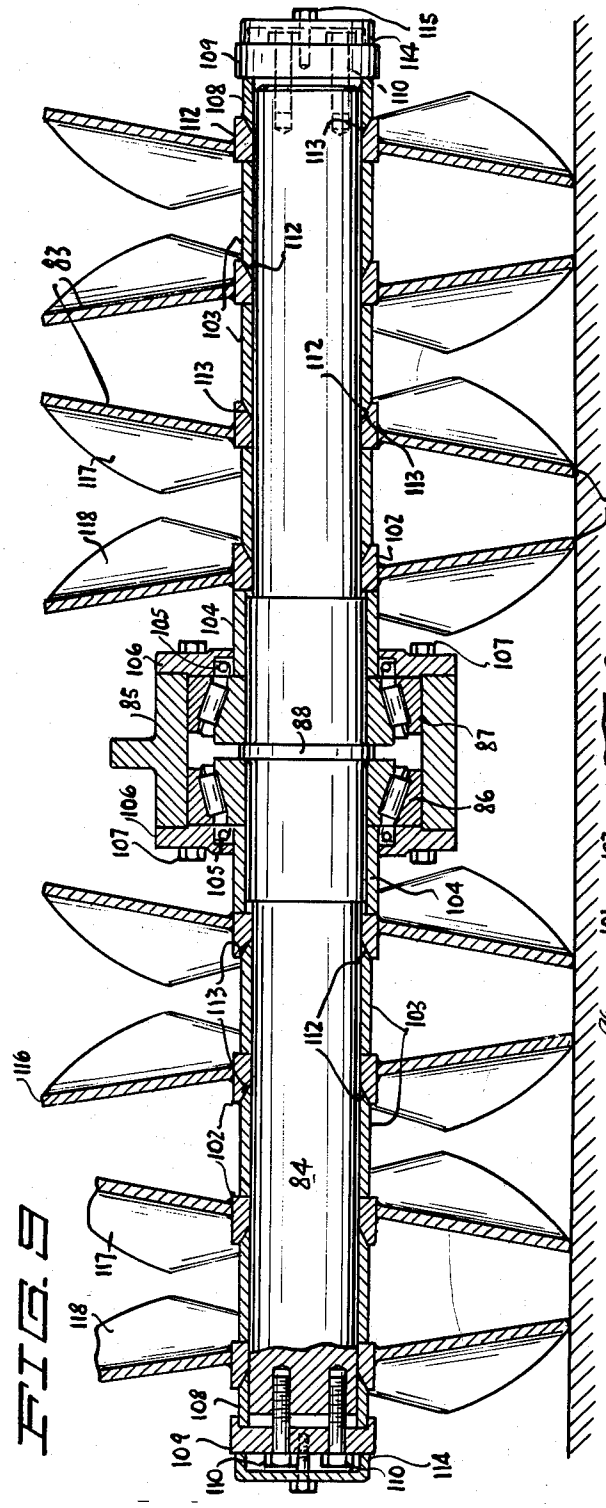


FIG. 9

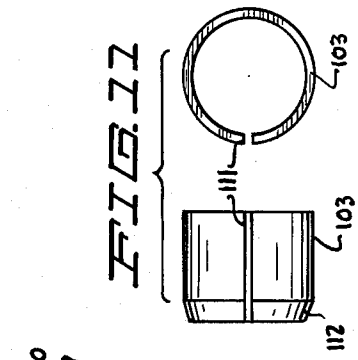


FIG. 11

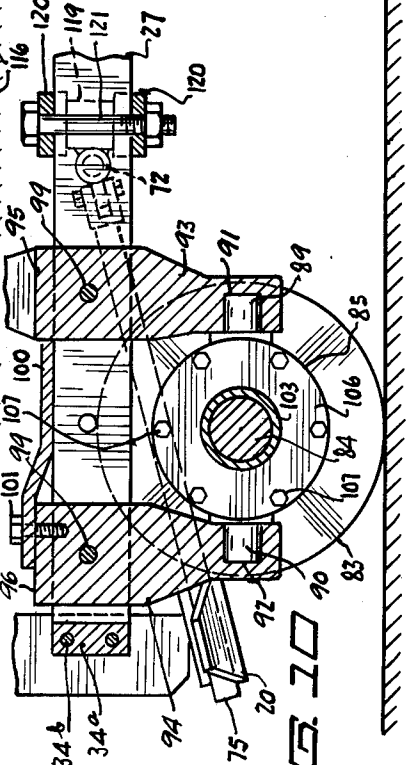


FIG. 10

INVENTOR.
LEGRAND H. LULL
BY Carlson & Hayes
ATTORNEYS

United States Patent Office

2,973,591

Patented Mar. 7, 1961

2,973,591

ICE CRUSHING AND BLADING MECHANISM

Le Grand H. Lull, 7716 S. Cedar Ave., Minneapolis, Minn.

Filed July 30, 1956, Ser. No. 600,881

10 Claims. (Cl. 37—41)

This invention relates generally to improvements in equipment for crushing or shattering and blading ice and compacted snow off street, highway or airport runway surfaces, and the like.

The effective removal of ice and compacted snow from such surfaces in order to permit the safe travel of traffic thereover has long been a problem in those sections of the country where such conditions all too frequently occur and many solutions for this problem have been suggested, without much success. Where the snow falls to a considerable depth the ordinary snow plow is practical but such equipment is of little or no utility where ice freezes on the surfaces of the roadways, runways, etc., or where a thin layer of the snow becomes compacted to practically the consistency of ice by traffic, and such ice or compacted snow sometimes offers an even greater hazard to traffic than does the ordinary heavier snow fall as is well known.

It is the primary object of my invention to provide equipment suitable for underbody mounting upon a truck or the like, which will permit the rapid, effective and safe removal of compacted snow or ice from surfaces over which vehicles travel, and which equipment consists of interchangeable ice blades for scraping the surface, and roller crushers for crushing the ice or hard compacted snow, either to facilitate blading or making salting more effective.

Another object is to provide an improved underbody mounting for connecting either the blade or roller crushers to the truck frame and which is so designed that it will withstand all stresses to which it is subjected in use while actually reinforcing and stiffening the truck chassis, and which will permit the change from blade to roller crushers in a very short time. In connection with this object of my invention I provide pivoted, cross connected drawbars on which the blade or roller crushers are mounted, with hydraulic rams connected to said drawbars to raise and lower the blade or crushers as required, and also provide for either mechanical or hydraulic tilting of the blade for best operation under all conditions.

Another and important object of my invention is to provide an improved ice roller crusher made up of a series of disks the peripheral edges of which are adapted to roll in contact with the iced surface to crush and crack the same. In accordance with my invention these peripheral edges of the disks are wrinkled or undulated so that they will form irregular ruts in the surface over which they travel, making traffic over the ice safer and overcoming the tendency of straight edged disks to cause the truck to move sidewise off the intended path of travel. Also in accordance with this object of my invention the disks are arranged in sections or gangs each of which is oscillatably supported from the drawbars to accommodate itself to the road surface, and such gangs are assembled on center support shafts in such fashion that the disks are firmly held in place to rotate as a unit but are readily removable or replaceable, as

well as adjustable about their axes to bring their wrinkled edges into the best relative positions.

These and other more detailed and specific objects will be disclosed in the course of the following specification, reference being had to the accompanying drawings, in which—

Fig. 1 is a top plan view of the ice blade version of my invention, showing the same in association with the side channels of a vehicular body or truck frame which transports and operates the blade. In this view one of the hold-down rams for the blade is shown as broken away in order to illustrate in horizontal section one of the pivot connections between the blade and the associated drawbar.

Fig. 2 is a side elevation of the structure shown in Fig. 1 on an enlarged scale and showing a part of the cab as well as the rear wheel suspension for the truck or vehicle operating the blade.

Fig. 3 is a rear elevation of the assembly of Figs. 1 and 2, with the small portion of the transverse tie frame structure shown in section.

Fig. 4 is a vertical transverse sectional view through one of the vertical pivot connections for the blade and associated parts, this view being taken substantially along the line 4—4 in Fig. 1.

Fig. 5 is an enlarged fragmentary side elevation, similar to the lower lefthand portion of Fig. 2, but illustrating the arrangement by which the blade may be mechanically or manually adjusted as to tilt.

Fig. 6 is a top plan view similar to Fig. 1, but showing the ice roller crushers which are employed upon the same mounting frame and drawbar structure as the ice blade, and with the hold-down rams and their mounts broken away for clarity.

Fig. 7 is an enlarged transverse sectional detail view taken substantially along the line 7—7 in Fig. 6.

Fig. 8 is a side elevation like Fig. 2 but showing the ice roller crusher assembly. In this view one of the drawbars is broken away and the sway bar connection to the cross member which ties the drawbars together is shown in section.

Fig. 9 is an enlarged transverse sectional view through one of the sections or assemblies of disks which go to make up the ice roller crusher mechanism.

Fig. 10 is an enlarged longitudinal sectional and detail view showing the trunnion or oscillatable mounting for one of the disk sections as viewed substantially along the line 10—10 in Fig. 6.

Fig. 11 is a composite side elevation and end view of one of the spacer collars located between the disks.

Referring now more particularly and by reference characters to the drawing, it will be understood that the mechanism going to make up my present invention is carried and operated by a vehicular frame, such as a truck, only the side channels A and cab B of which appear in the drawing. My ice blading and crushing mechanism is underbody mounted, that is, it extends crosswise beneath the body or chassis frame of the truck, and in Figs. 1 and 6 the direction of travel is toward the right so that front and rear designations of the parts as hereinafter described will be understood. Also the right and left hand designations of certain parts will be understood if it is assumed that these parts are viewed from the rear of the machine.

In accordance with my invention a mounting frame, designated generally at 10, is secured to the channels A and the same includes side plates 11 and 12 which parallel the channels A and are secured thereto by bolts, designated collectively at 13, with intermediate spacers 14 which space the side plates outward from said channels. In addition there is a transversely extending tie frame forming part of the mounting frame structure 10

and comprising end plates 15 which are bolted at 16 to the aforesaid side plates 11—12 and which depend well below the level of such side plates as is best seen in Fig. 3. At their lower ends the plates 15 are rigidly joined by a tubular tie member 17 diagonally braced at 18 to the upper parts of the plates and pivotally mounted by means of sleeves 19 upon this member 17 is a center frame 20 provided with spaced side rails 21 which define therebetween a generally forwardly and rearwardly extending guideway 22. This center frame structure, as well as the guideway, is thus permitted oscillating movement about a transverse axis for a purpose presently to appear and in order to restrain the center frame from movement toward either side lock collars 23 are suitably secured to the member 17 outwardly of the sleeves 19. In addition the mounting frame structure 10 includes side bars 24 and 25 which parallel the side plates 11—12 and are secured thereto with intervening spacers 26 which space the side bars in an outward direction, as is clearly apparent in Fig. 1.

In accordance with my invention the mounting frame 10 also comprises drawbars 27 and 28, each made up of two rigidly connected plies of suitable bar material, and at their forward ends these drawbars 27—28 are pivotally mounted by pins 29 between the ends of heavy brackets 30 which are clamped to the forward ends of the side bars 24—25 and held thereto by means of bolts indicated throughout at 31. Rearward displacement of the drawbars 27—28 under draft is prevented by means of rearwardly extending portions 32 of the brackets 30 which are bolted at 33 to the side bars 24—25 themselves. As is shown to best advantage in Fig. 1 the drawbars 27—28 angle outwardly at a point rearward of the brackets 30 and then extend in planes parallel with the side bars 24—25, with these parallel rear portions of the drawbars bifurcated to provide an intermediate space or channel in each, as designated at 34. The open rear ends of the drawbars are normally closed by blocks 34a (Figs. 3 and 5) removably held in place by bolts 34b. At some distance forwardly of their rear ends the drawbars 27—28 are fitted with apertured lugs 35 welded or otherwise suitably secured in place and forming attachment points for the lower ends of hold-down rams 36—37, one at each side of the assembly. These rams 36—37 each comprise a cylinder 38 the upper end of which is pivoted by a pin 39 in the upper end portion of a saddle bracket 40, one of which is secured (as by bolts 41) to the rear end of each of the side bars 24—25. The rams, of course, include the usual pistons which do not appear herein but from which there downwardly extend reciprocatable piston rods 42 the lower ends of which are pivoted by pins 43 to the aforesaid lugs 35. Thus it will be seen that the hold-down rams 36—37 are in effect braced between the stationary portions of the mounting frame 10 and the drawbars 27—28 so that the selective admission of fluid to the upper and lower ends of the ram cylinders 38 will raise and lower the drawbars and parts carried thereby with respect to the mounting and vehicle frames as well as the surface over which the machine travels.

In the structure as shown in Figs. 1 through 5 the drawbars 27—28 carry an ice scraper blade 44 which also acts as a cross member to tie together and space the rear end portions of the drawbars. The blade 44 is itself out of conventional configuration having a removable cutting edge 45 and as will now be described this blade is pivotally carried by the drawbars 27—28 for movements about a generally upright axis, as well as in such fashion as to permit either end of the blade to be arranged in advance of the other to thus adjust the blade angle according to the nature of the work being done. Also as will now be described and as seen in Figs. 1 through 4 the blade 44 is arranged to be hydraulically tilted in a vertical plane paralleling the direction of travel so that the angle of the cutting edge to the surface traveled by the machine may be adjusted as working conditions may dictate.

The blade mountings comprise for each end of the blade a slide 46 which is substantially I-shaped in cross section, as seen in Fig. 4, with a center web 47 adapted to slidably enter the spaces 34 in the bifurcated rear end portions of the drawbars 27—28. Also as is clearly shown in Fig. 4 the slides 46 overlie both the upper and lower edges of the bifurcated drawbars, thus to prevent any tendency of the assembly to tilt in a transverse direction, while permitting the slides to be adjusted forwardly and rearwardly in the spaces 34 in adjusting the working angle of the blade. The slides 46 are locked in adjusted positions by means of lock pins 48 which may be thrust through any of a series of registering openings in the rear portions of the drawbars and the webs 47 of the slides, these openings being indicated throughout at 49. Cast integrally with each slide 46 or otherwise suitably secured thereto is a large hollow pivot stub or sleeve 50 which is circular in horizontal section and the open lower end of which is closed by a circular bottom plate 51 in which is a cap screw 52 welded to said bottom plate 51. These pivot stubs 50 are journaled or oscillatably mounted down into upwardly opening bearing sockets 53 which are formed in bearing members 54, the lower ends of such sockets 53 being closed except for central apertures 55 to pass the aforesaid cap screws 52, so that when the nuts 56 are screwed upon the lower ends of the cap screws then these bearing assemblies will be held against relative vertical displacement of the parts as will be readily understood. As is seen in Fig. 1 each bearing member 54 is provided with side plates 57 and 58 extending generally forwardly and rearwardly and the forward ends of these side plates fit between brackets 59 and 60 which are welded to the upper rear portion of the blade 44 adjacent each end thereof and above the rearwardly extending stiffening flange 61 which extend substantially the full length of the blade. A main pivot pin 62 then fits through the forward lower corners of the sides 57—58 of each bearing member 54 and through the brackets 59 and 60 so that the blade may tilt about the generally transverse axis of these main pivot pins 62 in order to adjust the tilt of the blade as aforesaid.

At the sides of the machine, outwardly of the bearing structures just described, there are hydraulic tilting rams only one of which appears at 63 and each of which has a cylinder 65 with its lower end pivotally attached by a pin 66 between the outer brackets 60 aforesaid and additional brackets 67 which are secured to the back of the blade 44 and extend rearwardly therefrom, parallel to the brackets 60. The cylinders 65 contain the usual pistons (not shown) from which are upwardly extended piston rods 68 the upper ends of which are pivoted by pins 69 in the upper portions of upright brackets 70 welded to the bearing members 54 aforesaid. Thus the admission of fluid to the upper or lower ends of the cylinders 65 to retract or extend the piston rods 68 will swing the blade about the axes of the pivot pins 62 and adjust the tilt of the blade to thereby provide the best angle of attack upon the ice or compacted snow I (Fig. 2) on the road surface S (Fig. 2). In combination with the raising and lowering of the blades by the hold-down rams 36—37 and the angling of the blade by adjustment of the slides 46 on the drawbars 27—28 this tilting adjustment provides for all necessary adjustments of the blade and I find that it is very effective in removing snow and ice from roads, streets, runways under most conditions.

At its center the blade 44 is provided with transversely spaced apertured lugs 71, projecting rearwardly, to receive a transversely extending pin 72 which pivotally mounts the long bearing tube 73 of a clevis 74. A sway bar 75 dimensioned to slidably fit rearwardly into and be laterally restrained by the aforesaid guideway 22 is pivoted upon a generally upright axis 76 (Fig. 1) to the clevis

74. As the blade is raised and lowered the sway bar 75 moves forwardly and rearwardly in the guideway 22, which tilts as necessary by virtue of its pivotal supporting sleeves 19, and such sliding motion also occurs as the blade is angled and tilted. However, the sway bar being laterally confined in the guideway, it effectively functions to overcome any tendency of the entire blade assembly to sway or move toward either side of the vehicle, holding it to the path traveled by the vehicle as will be readily understood.

In Fig. 5 the blade 44 is shown as arranged to be tilted mechanically by contrast with the hydraulic tilting afforded by the rams 63 as just described. Where the parts correspond in both structures they are designated by the same reference characters but it will be noted that in this instance the outer brackets 67 and upright brackets 70 are entirely omitted. The brackets 59 are, however, provided at their lower rear corners with openings 77 to receive locking pins 78 and the rear edges of the sides of the bearing members 54 are provided with a series of openings 79 spaced apart on arcs centered on the pivot pins 62 so that the blade may be tilted with respect to the bearing members and then locked in position by thrusting the pins 78 through any of these openings 79. As here shown there are three of such openings 79 in each bearing member permitting the blade to be tilted to and locked in any one of three different positions. Also in Fig. 5 I illustrate a universal joint connection at 80 between the hold-down ram piston rod 42 and the pin 43 on the drawbar 27, which may be used throughout if desirable.

Referring now to Figs. 6 through 11 I will describe what I refer to herein as the ice crushing mechanism or ice roller crusher forming a part of my present invention. This mechanism is arranged in conjunction with a mounting frame and tie bar assembly identical to that previously described with reference to Figs. 1 through 5 and all corresponding parts are accordingly designated by the reference numerals heretofore used. This mechanism comprises two rotatably and oscillatably mounted disk gangs or sections, designated generally at 81 and 82, each of which is made up of a series of circular disks designated throughout at 83 and arranged side by side upon a common shaft 84, as is seen to best advantage in Fig. 9. As here shown the disks 83 are arranged in groups of four upon opposite end portions of the shaft 84 and at opposite sides of a center bearing housing 85 within which are opposed thrust bearings 86 and 87 rotatably supporting the shaft 84 and bearing against the opposite sides of a diametrically enlarged center rib 88 thereon. These bearings 86—87 thus are effective to absorb opposite endwise thrust forces upon the shaft 84 and each bearing housing 85 is provided with forwardly and rearwardly extending trunnions 89 and 90, as seen in Fig. 10, which are oscillatably mounted in bearing sockets 91 and 92 formed in trunnion bearings 93 and 94 depending from slides 95 and 96, which otherwise are identical to the slides 46 heretofore described. These slides 95—96 are positioned in the spaces 34 in the bifurcated rear ends of the drawbars 27—28 and are held in properly spaced-apart relation to support the bearing housings 85 by means of removable lock pins 97 and 98 thrust through suitable openings formed in the rear ends of the drawbars and in the webs of the slides and indicated throughout at 99. There are several of such openings 99 in the drawbars so that the disk gangs or sections may be adjusted forwardly or rearwardly as may be required and the forwardmost slide 95 is provided with a rearward extension 100 which is secured by a cap screw 101 to the rear slide 96 as a further aid in holding the slides and their associated trunnion bearings against spreading apart in a forward or rearward direction. This trunnion support for the disk gangs 81—82 permits each to oscillate in a generally transverse and vertical plane so that its disks 83 may accommodate themselves to irregular or sloping highway or runway surfaces as will be readily understood.

Turning back to Fig. 9 it will be noted that each of the disks 83 is provided with a center hub 102 having an internal diameter such as to properly fit the end portions of the shaft 84 and that the disks are spaced apart by spacer collars 103 located between said hubs. In addition the disks nearest the bearing housings 85 are butted against center collars 104 engaging the inner races of the thrust bearings 86—87 and entering the bearing housings 85 through dust and oil seals 105 provided in end plates 106 which are held by cap screws 107 to the opposite ends of the housings. The outermost disks 83 are held in place by outer collars 108 which slip over the extremities of the shaft 84 and which are forced into place by circular, marginally flanged retainer plates 109 held upon the ends of the shaft 84 by means of cap screws 110 passing through the retainers and threaded into the shaft. It is important to note that the collars 103 and 108 are all split longitudinally, as is designated at 111 in Fig. 11, and that each of these collars is beveled off on one end at 112 to fit internal bevels 113 in the outer edges of the disk hubs 102. It will thus be evident that when the disks and collars are arranged upon the shaft 84 as shown and described herein the retainer plates 109 may bring endwise pressure on the assemblies at each side of the bearing housings 85 as the cap screws 110 are bolted tight. The interfitting bevels 112—113 on the collars and hubs will then cause the collars 103 and 108 to be constricted on the shaft and will firmly lock all of the disks to the shaft to rotate as a unit therewith. It will, however, be also understood that the disks may be freed for relative angular adjustment about the axis of the shaft merely by slightly loosening the cap screws 110. The cap screws are protected by cover caps 114 held in place by cap screws 115, in order to protect them, as well as the ends of the shaft, and the collar assemblies from the entrance of foreign matter of any kind.

I am aware that it has been proposed heretofore to crush or remove ice from vehicular surfaces by the use of disks, the peripheral edges of which are caused to roll over the iced surface. In accordance with my invention, however, these peripheral edges 116 of the disks are not straight, as viewed from the edge, but instead are wrinkled or undulated so that alternate portions of the disks are offset in opposite directions, entirely around the disks as designated at 117—118. The disks, however, are true circles as viewed in an axial direction, and these wrinkled or undulated edges have a shattering effect upon the iced surface due to the lateral stresses to which the ice is subjected as the opposite undulations of the edges of the rolling disks come into contact therewith. Not only does this configuration of the disks thus have an increased shattering and crushing effect upon the ice but it has the advantage of forming ruts R of repeatedly varying widths in the ice as seen in Fig. 6 so that traffic may proceed with greater safety, in addition to which the shape of the disk edges overcomes any tendency of the disk gangs to tend to displace the carrying vehicle laterally with respect to the desired path of travel. While I prefer, as shown in Fig. 6, to arrange correspondingly undulated portions of the disk edges on adjacent disks in directly opposing relation the disks may as aforesaid be readily turned and adjusted about the axes of the shafts 84 in order to set up the disks in any desired relative positions which may be desired upon the part of the operator. This is one reason for the beveled hub and collar mounting for the disks upon the shafts 84, in addition to which this mounting provides for the convenient replacement of the disks when necessary, as well as for variations in the distance between adjacent disks merely by using spacer collars 103 of varying lengths.

In order to tie the drawbars 27—28 together transversely and to attach them to the sway bar 75 I provide a tie bar or cross member, designated generally at 119. At one

end this tie bar 119 has a fork 120 to fit over upper and lower edges of the drawbar 27 to which this fork is then held by means of a bolt 121 passing through the space 34 in the drawbar. At the opposite end the tie bar is fitted with a tubular sleeve 122 in which the shank 123 of a similar fork 124 is fitted and held in any adjusted position by means of a lock collar 125 pinned to the shank inwardly of such sleeve, as is best seen in Fig. 7. The fork 124 is then attached by means of a bolt 126 to the other drawbar 28 in order to prevent the drawbars from spreading or moving relative to the other at their rear ends. At its center the tie bar is then provided with apertured lugs 127 to receive the aforesaid pin 72 by which the clevis 74 of the sway bar 75 is attached, as a further guard against transverse swaying motion of the assemblies with respect to the mounting frame and the vehicle. Stops 128 on the drawbars 27—28 prevent rearward displacement of the tie bar as well be readily evident.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. In an ice and snow loosening mechanism of the character described for mounting beneath the body of a vehicle, a mounting frame secured to said body and including a rearwardly located tie frame having a forwardly and rearwardly extending guideway, forwardly and rearwardly extending drawbars pivoted at their forward ends to said mounting frame for upward and downward movements at their rear ends, means connected between the mounting frame and the drawbars for moving the latter upwardly and downwardly at their rear ends, apparatus mounted on the drawbars for loosening ice and snow over which the vehicle travels, a member extending in a generally crosswise direction beneath the vehicle body and secured to said drawbars between their front and rear ends, and a sway bar pivotally attached to said last mentioned member for movement about a generally crosswise pivot axis and extending rearwardly therefrom and into said guideway for longitudinal sliding movement therein.

2. In an ice and snow loosening mechanism of the character described for mounting beneath the body of a vehicle, a mounting frame secured to said body and including a rearwardly located tie frame including a part pivoted on a transverse axis and having a forwardly and rearwardly extending guideway, forwardly and rearwardly extending drawbars pivoted at their forward ends to said mounting frame for upward and downward movements at their rear ends, hydraulic rams connected between the mounting frame and the drawbars for moving the latter upwardly and downwardly at their rear ends, means mounted on the drawbars for loosening ice and snow on a surface over which the vehicle travels, a member extending in a generally crosswise direction beneath the vehicle body and pivotally attached to said drawbars between their front and rear ends, and a sway bar universally pivoted to said last mentioned member and extending rearwardly therefrom and into said guideway for longitudinal sliding movement therethrough, said guideway having a transverse dimension such as to engage the sides of the bar to restrict such sliding movement to a fore and aft path.

3. In an ice and snow cutting mechanism of the character described for mounting beneath the body of a vehicle, a mounting frame secured to said body and including a rearwardly located tie frame having a forwardly and rearwardly extending guideway, forwardly and rearwardly extending drawbars pivoted at their forward ends to said mounting frame for upward and downward movements at their rear ends, means connected between the mounting frame and the drawbars for moving the latter upwardly and downwardly at their rear ends, a member extending in a generally crosswise direction beneath the vehicle body and secured to said drawbars between their front and rear ends for vertical movement with the drawbars relative to said guideway, a sway bar pivotally attached on a crosswise pivot axis to said last mentioned member and extending rearwardly therefrom slidably into the guideway and laterally confined by said guideway, a generally transversely extending device for working upon ice and compacted snow over which the vehicle travels, mounting means for attaching said device to the drawbars, said mounting means including slides engaging the drawbars and movable forwardly and rearwardly thereon, means for securing said slides in adjusted positions upon said drawbars.

4. An underbody ice blade mechanism for mounting beneath a vehicle body, comprising a mounting frame secured to said vehicle body, a drawbar at each side of the frame and said drawbars being pivoted at forward ends to the frame for upward and downward swinging movements at their rear ends, slides on the rear end portions of the drawbars and adjustable forwardly and rearwardly thereupon, means for locking the slides in adjusted positions on the drawbars, an ice blade extending crosswise beneath the drawbars, a pair of brackets secured to the blade adjacent each end, a bearing member pivoted between each pair of brackets and said bearing members having upwardly opening sockets, pivot means extending downwardly from the slides and oscillatably mounted about generally upright axes in said sockets to pivotally connect the blade to the drawbars through said slides, means connected between the mounting frames and the drawbars to swing the latter upwardly and downwardly and vertically adjust the blade with respect to the vehicle body, a tie frame forming a rear part of the mounting frame and having a forwardly and rearwardly extending guideway, a sway bar slidable in said guideway and pivotally connected at its forward end to the back of the blade, and means for pivotally adjusting and locking the bearing members with respect to said brackets and the blade to thereby vary the tilt of the blade.

5. In an ice blade mechanism for mounting beneath a vehicle body, a mounting frame secured to said vehicle body, a drawbar at each side of the frame and said drawbars being pivoted at forward ends to the frame for upward and downward swinging movements at their rear ends, slides on the rear end portions of the drawbars and adjustable forwardly and rearwardly thereupon, means for locking the slides in adjusted positions on the drawbars, an ice blade extending crosswise beneath the drawbars, a pair of brackets secured to the blade adjacent each end, a bearing member pivoted between each pair of brackets and said bearing members having upwardly opening sockets, pivot means extending downwardly from the slides and oscillatably mounted about generally upright axes in said sockets to pivotally connect the blade to the drawbars through said slides, means connected between the mounting frame and the drawbars to swing the latter upwardly and downwardly and vertically adjust the blade with respect to the vehicle body, said bearing members having a series of openings and pins for locking the bearing members through said openings to the brackets to thereby vary the tilt of the blade.

6. An underbody ice blade mechanism for mounting beneath a vehicle body, comprising a mounting frame secured to said vehicle body, a drawbar at each side of the frame and said drawbars being pivoted at forward ends to the frame for upward and downward swinging movements at their rear ends, slides on the rear end portions of the drawbars and adjustable forwardly and rearwardly thereupon, means for locking the slides in adjusted positions on the drawbars, an ice blade extending crosswise beneath the drawbars, a pair of brackets secured to the blade adjacent each end, a bearing member pivoted between each pair of brackets and said bearing

members having upwardly opening bearing sockets, pivot means extending downwardly from the slides and oscillatably mounted about generally upright axes in said sockets to pivotally connect the blade to the drawbars through said slides, hydraulic rams connected between the mounting frame and the drawbars to swing the latter upwardly and downwardly and vertically adjust the blade with respect to the vehicle body, a tie frame forming a rear part of the mounting frame and having a forwardly and rearwardly extending guideway, a sway bar slidable in said guideway and pivotally connected at its forward end to the back of the blade, supports connected to and extending upwardly from the bearing members, and hydraulic rams connected between said supports and the blade to vary the tilt of the blade.

7. In an underbody ice blade mechanism for mounting beneath a vehicle body, a mounting frame secured to said vehicle body, a drawbar at each side of the frame and said drawbars being pivoted at forward ends to the frame for upward and downward swinging movements at their rear ends, slides on the rear end portions of the drawbars and adjustable forwardly and rearwardly thereupon, means for locking the slides in adjusted positions on the drawbars, an ice blade extending crosswise beneath the drawbars, a pair of brackets secured to the blade adjacent each end, a bearing member pivoted between each pair of brackets and said bearing members having upwardly opening bearing sockets, pivot means extending downwardly from the slides and oscillatably mounted about generally upright axes in said sockets to pivotally connect the blade to the drawbars through said slides, means connecting the said pivot means in the bearing sockets to lock the bearing members against downward movement, means connected between the mounting frame and the drawbars to swing the latter upwardly and downwardly and vertically adjust the blade with respect to the vehicle body, and means for pivotally adjusting and locking the bearing members with respect to said brackets and the blade to thereby vary the tilt of the blade.

8. Mechanism for use upon a traveling frame and for crushing ice upon a surface traveled by said frame, comprising an assembly of circular disks, a shaft on which the disks are mounted in spaced apart relation, means connecting the shaft to said frame so that the peripheral edges of the disks will roll on and crush the ice on said surface, the peripheral edges of the disks being wrinkled and undulating from side to side entirely around the disks whereby to form ruts in the ice of varying widths, said disks having hubs to fit said shaft and one end of each of said hubs being internally beveled, split spacer collars located on the shaft between said hubs and each collar having an end externally beveled to fit the internally beveled end of the hubs, and means for exerting endwise pressure along the shaft on the assembly of hubs and collars to constrict the beveled ends of the collars within the beveled ends of the hubs and tightly around the shaft to lock the disks to the shaft.

9. Mechanism for use upon a traveling frame and for crushing ice upon a surface traveled by said frame,

comprising an assembly of circular disks, a shaft on which the disks are mounted in spaced apart relation, means connecting the shaft to said frame so that the peripheral edges of the disks will roll on and crush the ice on said surface, the peripheral edges of the disks being wrinkled and undulating from side to side entirely around the disks whereby to form ruts in the ice of varying widths, said disks having hubs to fit said shaft and one end of each of said hubs being beveled, split spacer collars located on the shaft between said hubs and each collar having an end beveled to fit the beveled end of the hubs, means for exerting endwise pressure on the assembly of disks, hubs and collars whereby said beveled ends of the hubs and collars will lock the disks to the shaft, said last mentioned means comprising caps at the ends of the shaft, cap screws passing through the cap into the shaft to crowd the caps endwise against the assembly of disks, hubs and collars thereon, and covers removably mounted over the caps and enclosing the cap screws.

10. In an ice and snow crushing mechanism of the character described for mounting beneath the body of a vehicle, a mounting frame secured to said body, forwardly and rearwardly extending drawbars pivoted at their forward ends to said mounting frame for upward and downward movements at their rear ends, means connected between the mounting frame and the drawbars for moving the latter upwardly and downwardly at their rear ends, a member extending in a generally crosswise direction beneath the vehicle body and secured to said drawbars between their front and rear ends, a pair of disk assemblies for working upon ice and compacted snow over which the vehicle travels, mounting means for attaching said disk assemblies one to each of the drawbars, said mounting means including slides engaging the drawbars and movable forwardly and rearwardly thereon, means for securing said slides in adjusted positions upon said drawbars, and trunnions connecting said disk assemblies to the slides for oscillating movement of the assemblies in generally transverse and upright planes.

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