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BLADE FOR SNOWFLOWS AND SIMILAR DEVICES

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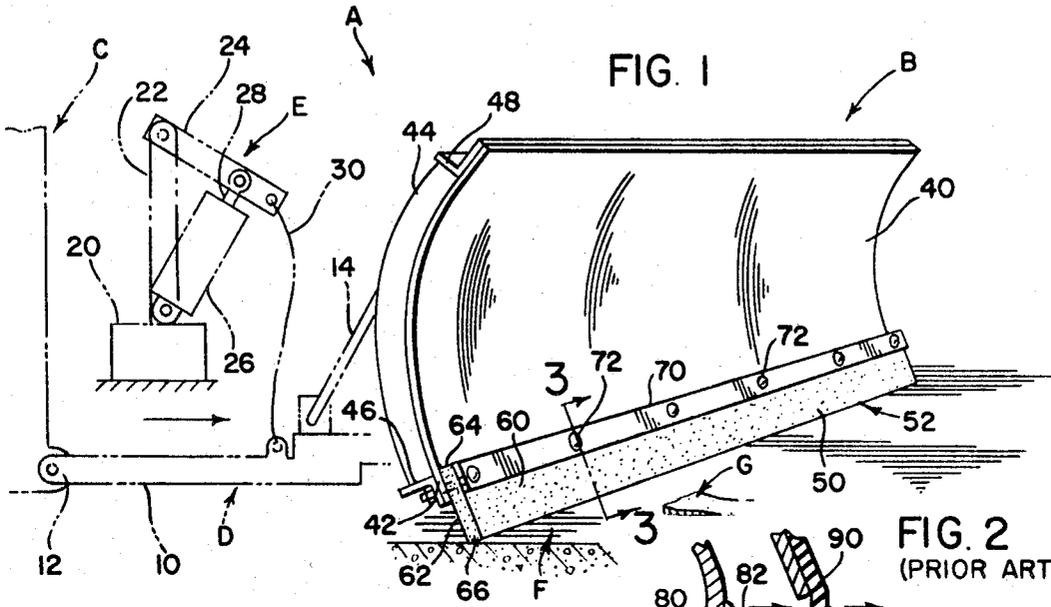


FIG. 1

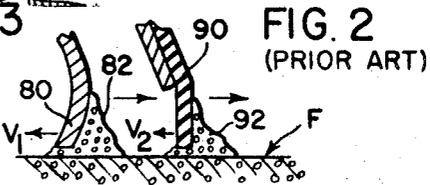


FIG. 2  
(PRIOR ART)

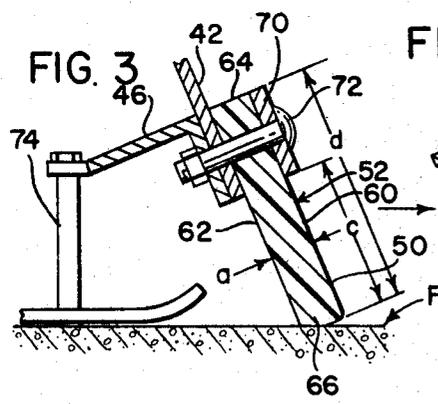


FIG. 3

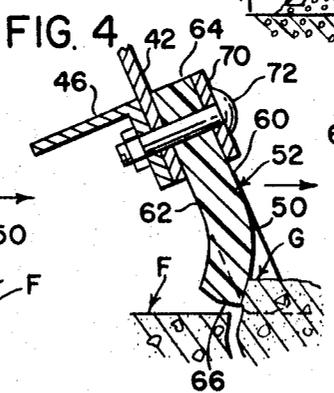


FIG. 4

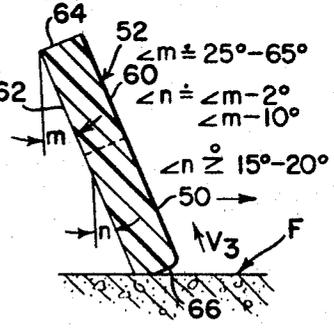


FIG. 5

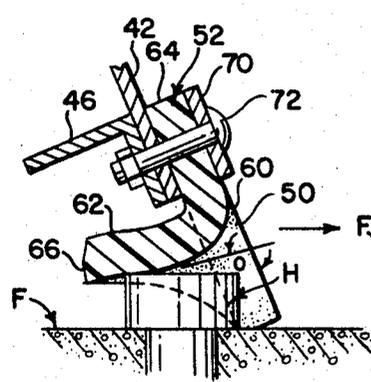


FIG. 7

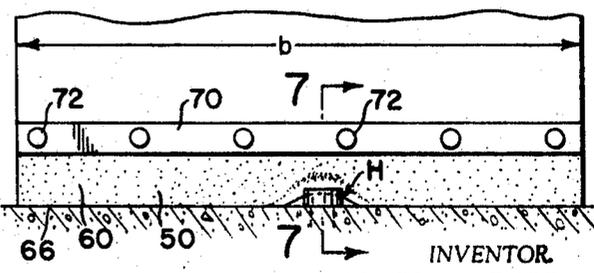


FIG. 6

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## BLADE FOR SNOWPLOWS AND SIMILAR DEVICES

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3 Claims

### ABSTRACT OF THE DISCLOSURE

A snowplow of the like includes a moldboard having a cutting edge of elastomeric material attached to the lower edge thereof. The elastomeric cutting edge slopes downwardly and forwardly from the lower edge of the moldboard and is sufficiently rigid to stay in its static position when subjected to horizontal forces defined by friction and loose material being plowed. The elastomeric cutting edge is sufficiently flexible to bend backwardly when striking a substantially immovable object projecting up from a roadway.

The present invention pertains to the art of plows to clear snow and other debris from roadways and similar surfaces, and more particularly to an improved blade for snowplows and similar devices.

The invention is particularly applicable to a blade which is used to plow or remove snow from a roadway, and it will be described with particular reference thereto; however, it will be appreciated that the invention has much broader applications and may be used for blades which perform other functions, such as clearing or removing miscellaneous materials from a generally planar surface.

A plow of the type used to remove snow from a roadway must include a blade which first moves the snow upwardly and then rolls it transversely away from the plow. To accomplish this, the blade includes a body portion having a curvilinear configuration which terminates in a lower plowing edge. The plowing edge usually extends in a forward direction and, in effect, digs into the snow and forces the snow onto the curvilinear body of the blade. The contour of this body portion imparts a rolling action to the upwardly moving snow and forces the snow transversely across the face of the blade and to the side of the plow. For efficient plowing action, the lower plowing edge must be as close as possible to the surface of the roadway. Otherwise, a layer of snow remains on the roadway, and subsequent removal operations are required. Maintaining the plowing edge of the blade close to the roadway has one distinct disadvantage. The plowing edge often collides with obstructions, such as upwardly extending manhole covers and protruding faults in the roadway. At one time these collisions caused damage to the snowplow and sometimes even injured persons operating the plow. This hazard has been generally overcome by subsequent developments in the art of manufacturing snowplows.

A number of years ago, a snowplow blade was developed which included a lowermost plowing edge that included in a rearward direction. As the blade was being used to remove snow, the snow would build up and compact itself in the cavity created at the front of the plowing edge by the inclination of the plowing edge. This build up of snow formed an effective plowing wedge which forced the snow upwardly onto the curvilinear body of the blade. When this type of blade contacted an obstruction in the roadway, the rearward inclination of the plowing edge raised the blade over the obstruction and prevented the difficulties and hazards resulting from a direct collision with such obstructions. However,

when the blade was raised, it did not plow. For this reason, ridges of snow were left in the roadway at various intervals. This type of plowing blade had another disadvantage. As the snow built up and compacted under the blade it also tended to wedge the blade upwardly. Consequently, the effective plowing position of the blade continued to raise until efficient removal of snow from a roadway was impaired.

To overcome the above-mentioned difficulty of gradually raising the snowplowing blade as snow built up and compacted under the blade, it becomes somewhat common practice to provide a pivoted lower plowing section on the blade, with the lower edge of the plowing section facing forwardly. An obstruction in the roadway tripped the lower pivoted plowing section and ridges of snow deposits were left on the roadway. In addition, the tripping force was relatively high since a substantial force was required to cause the plowing section to trip backwardly. The tripping section was below the mounting point of the blade; therefore, the tripping force was multiplied at the blade mounting point, and relatively high stresses were created on the structural members used to mount the blade onto an appropriate vehicle. This latter-mentioned disadvantage was substantially eliminated by providing a snow plowing blade wherein the whole blade tripped. In this manner, the tripping point was aligned with the blade mounting point to reduce transmitted forces and stresses on the mounting structure during tripping of the snowplow. This latter type of snowplow blade is now in general use; however, it requires a somewhat expensive tripping mechanism, and it still leaves ridges of snow when the plow is tripped by a roadway obstruction. In addition, it has been found that the blade can, in rare instances, remove a manhole cover instead of tripping over the cover. When this happens, a relatively large, and potentially dangerous, opening is left in the roadway. Another vehicle travelling behind the snowplow could conceivably drop into the open manhole, although no actual instances of this are known.

It has been suggested that a snowplow having a tripping mechanism could be provided with a strip of rubber along the plowing edge; however, this construction exhibits serious disadvantages, and it does not efficiently remove snow from a roadway. When the weight of the blade, which is generally 50-75 pounds per linear foot of plowing edge, is imposed upon the lower rubber strip, the rubber strip collapses. Thus, the blade must be held up by appropriately positioned shoes riding along the roadway. During plowing with this type of blade, the rubber strip folds backwardly and acts as a squeegee. This, in essence, forms a backwardly inclined plowing edge similar to one of the previously discussed plowing blades. Snow removal is effected by an accumulation of compacted snow in front of the rubber blade which forms a plowing edge. As mentioned before, accumulation of snow in a cavity forward of a backwardly or vertically inclined plowing edge gradually raises the blade and prevents efficient plowing of snow. Thus, this rubber strip on the plowing edge of a tripping plow exhibits the same disadvantages of previously described prior snowplowing blades, although such a blade does allow certain obstructions to be passed without tripping the blade or raising the blade. In addition, a rubber strip on the plowing edge of a snowplow blade becomes brittle in cold weather and deteriorates from exposure to light and oil.

These rubber strips on the plowing edge of a blade are always used in a vertical position or in a backwardly inclined position. Consequently, a blade with a rubber strip has been used only for the purpose of allowing the blade to pass over obstructions without regard to the serious limitations which a backwardly folded plowing edge pre-

sents in the actual plowing of snow. The inherent characteristics of rubber dictate that only a squeegee type of action can be accomplished. This squeegee action, which is contemplated by these rubber edged blades, causes vibration of the blade in a vertical direction during snow plowing. This results in a "washboard" plowed surface which, of course, is unsatisfactory. A rubber edged snowplow is illustrated in Brochure No. 821-947-694, dated of The Goodyear Tire and Rubber Company of Akron, June 1966 and published by Industrial Products Division Ohio. The present invention as defined later was invented before this article was published; therefore, a discussion of this article, or the blade disclosed therein, is not intended to admit that either is statutory prior art.

The present invention is directed toward an improved blade for snowplows or similar devices which blade overcomes the various difficulties discussed in the previous paragraphs.

In accordance with the present invention, there is provided an improvement in a snowplow blade of the type used to clear snow and debris from roadways and similar surfaces, which blade includes a generally curvilinear body portion terminating in a lower, generally straight plowing edge portion. This improvement comprises forming the plowing edge portion of the blade from an elongated strip of plastic material having a front surface, a rear surface, a top edge portion, and a bottom edge portion, and means for securing the top edge portion onto the body portion with the bottom edge portion of the strip forming the surface engaging plowing edge for the blade. The plastic material, contemplated by the present invention, has a sufficient flexibility and memory to allow at least a 90° backward deflection of the strip at -20 F. with substantially complete recovery and sufficiently rigid to support at least 50 pounds per linear foot of the strip during normal, unobstructed plowing with less than approximately 10° backward deflection of the strip.

Stated another way, the plastic strip is formed from a material having sufficient rigidity to allow only a slight deflection of the strip as the weight of the blade is imposed thereon and a sufficient flexibility to allow the strip to deflect as the blade passes over an obstruction in a roadway.

In accordance with the preferred embodiment of the present invention, the plastic material supported on the lower end of the snowplowing blade is formed from a cast polyurethane having a hardness of approximately 90-95 durometers.

By constructing a snowplow blade in accordance with the invention described above, the plastic material forms and retains an outwardly extending plowing edge quite analogous to a steel edge, during normal plowing, which function is not possible, or even contemplated, by a blade formed from rubber wherein the blade folds backwardly and acts as a squeegee. "During normal plowing" means plowing on a surface having no upwardly projecting obstructions.

The primary object of the present invention is the provision of an improved blade of the type used to remove snow and debris from a roadway or a similar surface, which blade is relatively simple to produce and install and is durable in use.

Another object of the present invention is the provision of an improved blade of the type used to remove snow and debris from a roadway or a similar surface, which blade includes a plowing edge formed from a plastic material that holds an outward disposition during normal plowing and flexes backwardly upon striking an obstruction in the roadway.

Still another object of the present invention is the provision of an improved blade, of the type described above, which blade is formed from a cast polyurethane.

Still another object of the present invention is the provision of an improved blade, of the type described above, which blade passes over obstructions without tripping

the blade backwardly and, thus, leaving unplowed ridges of snow. Accordingly, in normal situations, the tripping mechanism may be eliminated.

These and other objects and advantages will become apparent from the following description used to illustrate the preferred embodiment of the invention as read in connection with the accompanying drawing in which:

FIGURE 1 is a side elevational view showing, somewhat schematically, in solid lines a blade constructed in accordance with the present invention and in phantom lines certain auxiliary equipment associated with the blade;

FIGURE 2 is a partial schematic view illustrating two blades of which the present invention is an improvement;

FIGURE 3 is an enlarged partially cross-sectioned view taken generally along line 3-3 of FIGURE 1;

FIGURE 4 is an enlarged cross-sectional view, similar to FIGURE 3, showing an operating characteristic of the present invention;

FIGURE 5 is a schematic view illustrating certain geometrical relationships of the present invention;

FIGURE 6 is a front elevational view illustrating the preferred embodiment of the present invention as it passes over an obstruction; and,

FIGURE 7 is an enlarged cross-sectional view taken generally along line 7-7 of FIGURE 6.

Referring now to the drawing wherein the showings are for the purpose of illustrating a preferred embodiment of the invention only and not for the purpose of limiting same, FIGURE 1 shows a snow plowing mechanism A including the forward blade B, a driving vehicle C, blade support structure D, and a blade B, a driving vehicle C, blade support structure D, and a blade lifting mechanism E. The plowing mechanism A is used, to clear snow or other debris from a roadway F having various obstructions, represented by a roadway fault G.

In accordance with the illustrated embodiment of the invention, the blade support structure D includes a forwardly extending support arm 10 pivotally mounted on the vehicle at journal 12. The support arm is pivotally secured onto the blade by a structure, not shown, and a rigid strut 14 holds the blade in its plowing position. By using the rigid strut 14, blade B does not pivot around the support arm 10; therefore, the blade is considered a rigid blade. Of course, the support mechanism is provided with a device for changing the transverse angle of the blade, and it may also be provided with a normal tripping mechanism, if desired. However, the present invention generally eliminates the need for a tripping mechanism. These actual structural support structures and turn-over structures do not form a part of the invention; therefore, they have been omitted for the purposes of simplicity.

The blade lifting mechanism E includes a support base 20 having an upright beam 22. Pivotally secured on the top of the beam is a control arm 24 which may be pivoted upwardly or downwardly by a cylinder 26 and a hydraulically controlled piston rod 28. As is normal practice, a chain or cable 30 connects the control arm 22 with the support arm 10 so that the blade may be raised or lowered by the chain upon movement of the control arm. When lowered, the chain 30 has a certain amount of slack so that the downwardmost position of the blade is generally determined by the weight of the blade and the position of the roadway F. In operation, the blade lifting mechanism E drops the blade into its plowing position, as shown in FIGURE 1, and the vehicle C pushes the blade B along the roadway F to remove snow or other debris therefrom. As so far described, the plowing mechanism A does not differ substantially from known mechanisms, and various changes in the described mechanisms may be made without departing from the intended spirit and scope of the present invention.

Referring now to the blade B, the blade includes a generally curvilinear body portion 40 having a lower

terminal end 42, which is generally straight. Vertical supports 44, only one of which is shown, extend along the back of the blade. Transverse supports 46, 48 extend transversely across the back of the blade to combine with the vertical support for rigidifying the body portion 40. In accordance with the present invention, the blade plowing edge 50 is formed from a strip 52 of plastic material having characteristics, hereinafter described in detail. The plastic strip 52 includes a front surface 60, a rear surface 62, a top edge 64, and a bottom edge portion 66. A transversely extending plate 70 secures the strip 52 onto the terminal end 42 by use of spaced bolts 72. As shown in FIGURE 3, a rearward shoe 74, a plurality of which may be used, is secured onto the transverse support 46 to ride above the roadway F. These shoes remain spaced from the roadway during normal use so that the weight of the blade B is essentially on the strip 52. In this manner, the blade B is stabilized on the roadway.

In accordance with the preferred embodiment of the present invention, the strip 52 is formed from a cast polyurethane material, such as "Vulkollan." This material has sufficient rigidity and flexibility at both high and low temperatures so that the strip 52 extends forwardly like a steel member during normal plowing conditions. The hardness of the cast polyurethane should be in the range of 80-100 durometers. In practice, the strip 52 has a hardness of 90-95 durometers. In accordance with the invention, the plastic material used for the plowing edge 50 has the characteristics as illustrated in FIGURE 5. In this figure, the strip 52 is shown in its normal plowing position. The angle  $m$  represents the mounting angle of the blade which can be termed the static plowing angle of the edge 50. In accordance with the invention, this angle is generally within the range of (25-65)°. Preferably, angle  $m$  is (30-35)°. Angle  $n$  is the normal plowing angle for the edge 50, or strip 52. Because of the physical characteristics of the plastic material, the angle  $n$  is generally equal to the angle  $m$  minus (2-10)°. Preferably, the angle  $n$  is equal to the static plowing angle  $m$  minus approximately (2-5)°. In other words, the material of strip 52 has sufficient rigidity and hardness that the weight of the blade upon the strip changes its static plowing position only a slight amount. This characteristic is critical since a complete fold-back of the strip 52 would preclude a normal plowing angle close to the static plowing angle, which should be in the range of (25-65)° with a vertical axis. In addition, the normal plowing angle  $n$  should be greater than approximately (15-20)°. Preferably, the angle  $n$  is within the range of (30-35)° which is also the preferred range of the static plowing angle. It must be remembered that the weight of the blade itself is generally in the range of 50-75 pounds per linear foot of the plowing edge 50. This is a relatively high load and only certain selected materials will absorb this load and plow snow or other debris within the angular limitations stated above and exhibited in FIGURE 5.

The material of the strip 52 also has sufficient flexibility to allow backward deflection upon contacting an obstruction G, as shown in FIGURES 1 and 4, or an upwardly extending member such as a pin H, as shown in FIGURES 6 and 7. To define the physical characteristics that are required to allow this particular function, it can be stated, in accordance with the invention, that the strip 52 must have sufficient flexibility at low temperature to deflect backwardly at least an angle  $\sigma$ , as shown in FIGURE 7, which angle is at least 90°. This amount of backward deflection must be possible with a temperature of -20° F., or more. The flexibility and memory of the plastic material must be such that after the obstruction has been passed the strip 52 returns to its normal plowing angle or position, as shown in FIGURE 3. It has been found that cast polyurethane having dimensions hereinafter described will possess such

deflection and recovery properties when its temperature approaches -70° F.

Referring now to FIGURES 3 and 6, in accordance with the preferred embodiment of the present invention, the strip 52 has a thickness  $a$  which is in the range of  $\frac{3}{4}$ - $\frac{1}{4}$  inch, a length  $b$  which is in the range of 5-12 feet, an unsupported width  $c$  which is in the range of 3-5 inches, and a total width  $d$  which is in the range of 6-7 inches. The thickness  $a$  is somewhat dependent upon the length  $b$ . For instance, the length is 5-6.5 feet the thickness is  $\frac{3}{4}$ -1 inch, when the length is 7-9 feet the thickness is 1 inch, and when the length is 10-12 feet, the thickness is  $1\frac{1}{4}$  inches. In other words, the ratio of thickness to length for strip 52, in practice, is within the range of approximately 60-115. This ratio has been developed empirically.

From the above discussion the characteristics of the material forming strip 52 become readily apparent; therefore, various materials, other than cast polyurethane, which is used in practice, could be employed. Essentially, the strip 52 has physical characteristics which will allow the strip to remain in a normal plowing angle  $n$  which is not substantially different from the static plowing angle  $m$ . The weight of the blade and the normal unobstructed, plowing of snow does not drastically change the outward facing angle of the plastic strip 52. However, upon meeting an obstruction, the blade flexes backwardly and recovers to its original position. These properties may be stated in various ways. The strip 52 does not buckle under the vertical weight of the blade, although it does flex backwardly upon meeting an obstruction. In addition, the material forming strip 52 has sufficient flexibility and memory to allow at least a 90° backward deflection at -20° F. with substantially complete recovery and sufficiently rigid to support at least 50 pounds per linear foot of the strip during normal, unobstructed plowing with less than approximately 10° backward deflection during plowing. The plastic material has sufficient rigidity to allow only a slight deflection of the strip 52 as the weight of the blade B is imposed thereon and a sufficient flexibility to allow the strip to deflect as the blade passes over an obstruction on a roadway.

This performance is completely different from the performance of any blade heretofore used or suggested. For instance, referring to FIGURE 2, blade 80 has a backwardly inclined plowing edge. This allows snow 82 to accumulate under the blade during plowing. Consequently, the blade is raised from the roadway F and efficient plowing is difficult. If a rubber plowing edge or a plowing edge formed from a material not having the characteristics defined above were used, the same general condition would result. This is illustrated on the right of FIGURE 2. A rubber blade 90 folds backwardly during plowing. This gives a squeegee action and causes accumulation of snow 92 in front of the blade. In both instances shown in FIGURE 2 the force vector  $V_1, V_2$  of the snow against the blade is directed substantially toward the rear of the blade. As shown in FIGURE 5, with a plastic material having the characteristics defined in this application, the force vector  $V_3$  is substantially up the inclined plowing edge 50 so that snow or other debris is forced onto the body portion of the blade by riding over the plowing edge 50 as it remains in a forward disposition. It is seen that the plowing action of the present invention is entirely different to the plowing action created by either of the blades shown in FIGURE 2.

During experiments, a blade constructed in accordance with the present invention was driven into a pile of slag. The blade edge 50 remained inclined outwardly, and it acted as a cutting edge. The blade was provided with the standard tripping mechanism; however, the resiliency of the strip 52 absorbed the resulting shock, and the blade was not tripped. When a standard steel blade with the same mechanism was used, the tripping mechanism tripped the blade. This test indicates that the present invention

is useful without a tripping mechanism to do heavy duty jobs, besides snow plowing.

The present invention has been described in connection with one structural embodiment; however, it is appreciated that various structural embodiments may be used without departing from the intended spirit and scope of the present invention as defined in the appended claims.

Having thus defined my invention, I claim:

1. In a plow of the type used to clear snow and debris from roadways and similar surfaces, said plow including a moldboard having an elongated upper edge, an elongated horizontal lower edge and an inwardly curved forward surface between said upper and lower edges, an elongated cutting edge member attached to said moldboard adjacent said lower edge, said cutting edge member having a thickness not substantially less than three-fourths of an inch and projecting downwardly from said lower edge an unsupported free distance not substantially less than three inches, said cutting edge member having top and bottom edges and front and rear surfaces, said rear surface intersecting said bottom edge at a corner, said cutting edge member extending forwardly and downwardly from said lower edge of said moldboard with said corner contacting a surface to be plowed and with said front and rear surfaces inclined rearwardly from said bottom edge to said top edge at an angle substantially less than ninety degrees with respect to a vertical plane passing through said corner, said cutting edge member being subjected to horizontal forces tending to deflect said bottom edge corner rearwardly and decrease the rearward inclination angle of said front surface, a first horizontal force being defined by friction acting between said bottom edge corner and a roadway or the like as said plow is moved forwardly along a roadway with the weight of said moldboard pressing said bottom edge corner against the roadway, a second horizontal force being defined by the weight and resistance to movement of snow or debris acting against said front surface, a third horizontal force being defined by substantially immovable obstructions projecting up from a roadway or the like and acting against said front surface, said cutting edge member being formed of elastomeric material having mechanical properties similar to cast polyurethane of at least 70 durometer hardness and having sufficient rigidity to prevent rear-

ward deflection of said front surface to a vertical position under action of said first and second forces so that said second force normally has a component acting upwardly along said front surface, said cutting edge member being resiliently deformable so as to deform rearwardly under action of said third force to a position in which at least a portion of said front surface is facing downwardly and having sufficient resilient memory for returning to its original position when said third force is removed.

2. The plow of claim 1 wherein said front surface of said cutting edge member slopes rearwardly from said bottom edge to said top edge at an angle not less than twenty-five degrees with respect to a vertical plane passing through said corner and said angle is reduced not greater than ten degrees when said cutting edge member deforms rearwardly under action of said first and second forces.

3. The plow of claim 1 wherein said cutting edge member is deformable rearwardly under action of said third force at least ninety degrees at twenty degrees below zero Fahrenheit and automatically recovers to its original position when said third force is removed.

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