An ice resurfacing machine having a sled or housing that mounts a brush or auger and an ice shaving assembly which is mounted in the housing for pivotal movement about a first transverse axis to adjust the depth of cut and a second transverse axis to adjust the angle of cut. The shaving assembly includes a blade, a blade holder and a clamp bracket that are secure together to hold the blade, and permit easy replacement of the blade. In one embodiment the blade holder has protrusions or inserts extendable through apertures in the blade to facilitate holding the blade in position during the time the blade holder, clamp bracket and blade are attached to and removed from the angle support or mounting bracket, or permit replacement of the blade while the clamp bracket and blade holder are still attached to the angle support. In another embodiment the blade holder and clamp bracket have protrusions extendable into slots in the blade while in a further embodiment a cam member is provided for moving the clamp bracket relative to the blade holder for releasably clamping a blade. Preferably the transverse outer, bottom surfaces portions of the blade support, blade holder or clamp bracket are machined away so that the blade in vertical, transverse cross section and its cutting edge will extend upwardly and outwardly relative the transverse intermediate portion thereof.
ICE RESURFACER CUTTING BLADE APPARATUS

BACKGROUND OF THE INVENTION

A blade assembly that includes a blade, a blade holder and a clamp bracket.

In ice resurfacing machines, a dull ice shaving blade does not tend to penetrate the ice and accordingly lifts the sled which results in wavy ice, wavy ice being undesirable. A sharp blade cuts the ice instead of tearing the ice, and as a result less power is required to operate the ice resurfacing machine then when it has a dull blade.

In each of U.S. Pat. Nos. 2,763,939 and 3,475,056 there is disclosed an ice resurfacing machine having a blade support and an ice shaving blade secured thereto. However, each of the blades is of a relatively heavy construction that is not of the disposable type, and it is a relatively time consuming operation to replace such a blade. Further, blades such as disclosed in the above mentioned patents are of the type that are normally removed after about two to ten days usage and sent out to be resharpened. Additionally, usually three or four blades are needed, i.e., two sent out for being resharpened, one on the machine and one for replacement on the machine until the other two are returned from being resharpened. Also resharpened blades are not of uniform sharpness, for example, as a result of non-uniform honing. In order to overcome problems such as the above, this invention has been made.

SUMMARY OF THE INVENTION

Apparatus for shaving ice or the like that includes a transversely elongated thin, disposable blade, a blade holder having a blade mounting surface and a clamp bracket securable to the blade holder to abut against the holder on the opposite side from the blade mounting surface and against the blade for releasably retaining the blade in a fixed position relative the holder.

One of the objects of this invention is to provide for an ice resurfacing machine or the like, a new and novel blade assembly that permits the easy replacement of a blade and the use of a thin, disposable blade. Another object of this invention is to provide in a blade assembly, a new and novel blade holder for supporting a blade in a given position relative thereto and a clamp bracket cooperating therewith for releasably retaining the blade in a fixed position relative the holder.

A further object of this invention is to provide a new and novel clamp bracket and blade holder for cooperatively holding a blade and that are releasably retainable in a blade clamping position by the same fasteners that mount the clamp bracket and blade holder on a mounting bracket or angle support. In furtherance of the last mentioned object, it is another object of this invention to provide a clamp bracket and blade holder that permits replacement of the blade while the fasteners still retain the clamp bracket and blade holder on the angle support. Another object of this invention is to provide a new and novel blade assembly that includes a blade holder, a clamp bracket secured thereto, and cam means for relatively moving the clamp bracket and blade holder between a blade clamping and a blade release position. An additional object of this invention is to provide a new and novel blade assembly to mount a blade so that the depth of cut of ice is of progressively smaller depths transversely outwardly of the transverse intermediate part of the cut.

As used herein, a "thin, disposal blade" refers to one that is of a thickness many times thinner than those conventionally used on ice resurfacing machines, many times lighter per linear foot of transverse width than such conventional blades, and is of a construction to be thrown away rather than being resharpened as now done with such conventional blades.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view of a conventional ice resurfacing machine which may use an ice shaving blade assembly of this invention;

FIG. 2 is a fragmentary vertical cross sectional view of the sled of the machine of FIG. 1, said view being generally taken along the line and in the direction of the arrows 2-2 of FIG. 3 to show the mounting of an ice shaving blade assembly of this invention;

FIG. 3 is a fragmentary transverse cross sectional view of the sled, said view being generally taken along the line and in the direction of the arrows 3-3 of FIG. 2 to more clearly illustrate the adjustable mounting of a blade assembly of this invention on the sled;

FIG. 4 is a fragmentary longitudinal cross sectional view of a second form of sled looking toward one side wall thereof, said view showing structure for mounting a blade assembly of this invention;

FIG. 5 is a fragmentary longitudinal cross sectional view of the sled of FIG. 4 looking toward the other side wall;

FIG. 6 is a fragmentary longitudinal cross sectional view of the sled of FIG. 4 showing structure for adjusting the angle of an ice shaving blade;

FIG. 7 is an enlarged longitudinal cross sectional view of the first embodiment of a blade assembly of this invention, said view being generally taken along the line and in the direction of the arrows 7-7 of FIG. 3;

FIG. 8 is an enlarged fragmentary longitudinal cross sectional view of the structure of FIG. 7 that is taken transversely spaced from the sectional plane of FIG. 7 to more clearly show the mounting of the blade;

FIG. 9 is a longitudinal cross sectional view of the second embodiment of a blade assembly of this invention and part of the assembly mount, said view being generally taken along the line and in the direction of the arrows 9-9 of FIG. 10;

FIG. 10 is a fragmentary front view generally taken along the line and in the direction of the arrows 10-10 of FIG. 9;

FIG. 11 is a longitudinal cross sectional view of the third embodiment of a blade assembly of this invention and part of the assembly mount, said view being generally taken along the line and in the direction of the arrows 11-11 of FIG. 12;

FIG. 12 is a fragmentary plan view of the blade holder of FIG. 11;

FIG. 13 is a fragmentary longitudinal cross sectional view of the fourth embodiment of a blade assembly of this invention;

FIG. 14 is a fragmentary, vertical cross sectional view generally taken along the line and in the direction of the arrows 14-14 of FIG. 7;

FIG. 15 is a fragmentary longitudinal cross sectional view of the fifth embodiment of this invention;

FIG. 16 is a fragmentary vertical cross sectional view of the sixth embodiment of this invention; and

FIG. 17 is a front view of the blade edge of a blade mounted in accordance with this invention.
Referring to FIG. 1 there is shown a self-propelled ice resurfacing machine, generally designated 10, that advantageously may be of the same construction as that described in U.S. Pat. No. 3,475,056, other than for the ice shaving blade assemblies that will be described hereinafter. The machine 10 includes a body 12 mounted on a frame 11, wheels 13 being journaled on the frame. Extending rearwardly from the machine is a platform 14. Power operated linkage mechanism 21 dependingly mounts a sled 16 for movement between a raised transport position and a lowered operating position riding on the surface of the ice, the linkage mechanism being connected to the sled to push it over the ice when the machine is being moved in a normal forward direction (arrow 23) and the sled is in the operating position of FIG. 2.

The ice is shaved by a blade 28 of the first embodiment of the assembly 25 of this invention (or one of the other embodiments), the blade extending transversely of the sled 16 and being mounted on the lower flange of an angle or assembly support 29 by structure described hereinafter. The forward portion of the lower flange of angle support 29 is pivotally connected to the central portion or arms 30, while the forward ends of the arms 30 are pivotally connected to the side walls 17 of the sled at 27. Pivotingally connected to the rear ends of arms 30 at 20 are vertical supports 31 which extend upwardly adjacent the rear wall 19 of the sled. The upper end of each vertical support 31 carries a nut 32 and an adjusting screw 33 is threaded within a boss in the top wall 18 of the sled as well as in the nut 32, so that threading of the screw 33 will tend to pivot the arms 30 to thereby raise and lower the blade 28. To guide the adjusting screws in movement, the lower end 34 of each screw has a reduced diameter and is slidably received within a guide ring mounted on the central portion of each vertical support 31.

In addition to the adjustment for blade height which determines the depth of cut, a second adjustment is provided to vary the angularity of the blade with respect to the ice. In this regard an adjusting screw 36, as shown in FIG. 3, is located centrally of the width of the sled 16 and is threaded with a boss formed on the top wall 18 of sled 16 and within a nut 37 which is pivotally connected to angle brackets 38 mounted on the vertical flange of the blade support 29. By threading the adjusting screw 36 into the nut 37, the angularity of the blade 28 can be varied as desired. The above structure mounts the assembly 25 longitudinally rearwardly of and adjacent a brush 26 that is mounted in the sled housing.

Referring to FIGS. 4-6, there is in part illustrated a second type of sled, generally designated 75, with which the blade assemblies of this invention may be used. Sled 75 being of a construction more fully described in U.S. Pat. No. 2,763,939. Sled 75 includes a generally upside down T-shaped assembly mount 76 disposed directly rearwardly of a worm screw conveyor 77. The transverse opposite ends of mount 76 are pivotally mounted by the midportions of arms 78 and 79 which in turn have their front ends pivotally attached at 82 to the sled housing side walls 80 and 81 respectively. A tube 85 is pivotally mounted in the sled housing and is pivoted by a hand wheel (not shown) that is connected through suitable linkage (not shown). An arm 86 is fixed to tube 85 and pivotally connected to a link 87 which in turn is pivotally connected to the rear end of arm 78. By turning the hand wheel, through the above structure, the rear end of arm 78 may be raised and lowered.

Referring to FIG. 5, the rear end of arm 79 is vertically adjusted by a hand wheel 90 fixed to a screw shaft 91 which is rotatably mounted in a bearing 92 that is mounted by the sled housing top wall 93 to prevent axial movement of the shaft. A nut 94 is screwed on the threaded part of shaft 91 and has a bar 95 welded thereto which is pivotally connected at 96 to lugs 99 that are welded to the rear end of arm 79. This structure permits vertically adjusting the rear end of arm 79.

The rear portions of both of arms 78, 79 are resiliently urged downwardly by leaf springs 97 which are secured by brackets 98 to the sled side walls.

Referring to FIG. 6, for varying the angle of the blade relative the ice there is provided a hand wheel 100 fixed to a screw shaft 101 which is rotatably mounted in a bearing 102 that is mounted by the sled housing top wall to prevent axial movement of the shaft. A nut 104 is screwed on the threaded part of shaft 101, the nut being pivotally connected at 105 to a lug 106 that is fixed to the rear section of the assembly mount 76.

Referring now in particular to FIGS. 7 and 8, the first embodiment of the blade assembly of this invention, generally designated 25, not only includes blade 28, but also a transversely elongated blade holder H that is of a longitudinal length of a dimension substantially smaller than its transverse width and many times greater than the maximum height of the holder. The holder in an unmounted condition has a bottom planar surface 42, a longitudinally intermediate top surface 43, a rear land 44 extending the width of the holder that has top surface more remote from the surface 42 than the surface 43, a planar blade mounting surface 45 that is inclined at an acute angle (preferably substantially smaller than a 45° angle) relative surface 42 to extend longitudinally rearwardly in diverging relationship to surface 42, and a shoulder 46 that extends upwardly at about a right angle to surface 45 to intersect the front transverse edge of surface 43 and the rear transverse edge of the blade mounting surface 45. Longitudinally intermediate the front and rear transverse edges of surface 45, the holder is provided with a plurality of transversely disposed insert mounting apertures 48 having central axes generally perpendicular to surface 45. Mounted in each of the apertures 48 is a mounting guide or insert 49 to extend upwardly above surface 45 at generally right angles thereto to have protruding portions of heights substantially greater than the thickness of the blade 28.

The blade 28 in an unmounted condition has generally planar top and bottom surfaces that are parallel to one another, and spaced from one another by a thickness dimension that is less than the height of shoulder 46, and a front transverse cutting edge E. The cutting edge may be formed as shown in FIG. 8 by having both surfaces 51, 52 tapered relative the top and bottom parallel planar surfaces of the blade, or have a tapered surface that intersects the top surface of the blade to provide the cutting edge E, or have a tapered surface that intersects the bottom surface of the blade to form a cutting edge. The longitudinal length of the blade is substantially greater than the corresponding dimension of the holder surface 45 whereby, when surface 42 is horizontal, the cutting edge is located substantially forwardly of the front transverse edge 58 of the holder and at a lower elevation than surface 42. The distance that the blade extends longitudinally forwardly of the holder
front edge, when mounted on the holder, is many times less than the distance the blade extends rearwardly of the holder front edge.

The longitudinally intermediate portion of the blade has a plurality of transversely spaced apertures 50 along the transverse width thereof, being one aperture for each insert to have the inserts extend therethrough when the blade is positioned on surface 45 with the blade rear edge closely adjacent or abutting against shoulder 46. Each aperture 50 is of a size and shape to provide a slight longitudinal clearance with respect insert, for example about 1/32 of an inch, and a somewhat greater transverse clearance, for example about 1/16 of an inch. The central axis of each aperture is substantially perpendicular to the top and bottom surface of the blade.

In order to clamp the replaceable blade in an ice shaving position on the assembly mount 25 such as indicated in FIGS. 7 and 8, (or assembly mount 76 of FIGS. 4-6), there is provided a clamp bracket B that includes a plate portion 44 which is of a greater longitudinal length than the holder top surface 43, and an inclined portion 55 that has a lower surface 55A that is of about the same longitudinal length as surface 45, and that in a position of use, is inclined downwardly relative to portion 54 at an angle a that is somewhat greater than the angle of intersection of holder surfaces 42, 45. The longitudinally intermediate part of inclined portion 55 has a plurality of transversely spaced apertures 56 extending therethrough substantially perpendicular to the top and bottom surfaces thereof, the apertures 56 being of a cross sectional size and shape substantially greater than the corresponding size and shape of the inserts. There is an aperture 56 for each insert to extend thereinto.

The clamp bracket has a planar front ramp surface 60 that is inclined upwardly and rearwardly relative the bottom surface 55A to provide a front transverse edge 61 at the juncture with surface 55A that is abutting against the blade top surface for clamping the blade against holder surface 45. In a blade assembly assembly position, edge 61 abuts the blade perpendicularly opposite the front transverse edge 58 of the holder or slightly rearwardly thereof so that substantially the entire bottom surface of the blade rearwardly of the holder front edge abuts against surface 45. Edge 58 is formed by the juncture of surfaces 45, 42. In a position of use of the ramp surface 60 forms an obtuse angle with the part of the blade extending rearwardly thereof to permit shaved ice sliding upwardly therealong.

In order to retain the clamp bracket B in a position to clamp the blade against the holder surface 45 and mount the clamp bracket and holder on the angle support 29, there are provided a plurality of transversely spaced flat head screws 64 that are extended upwardly through the longitudinally central portion of the holder to have their heads abut thereagainst, said screws also being extended through the longitudinally intermediate portion 54 of the clamp bracket, and threaded into the forward end portion of the generally horizontal leg of the angle support to releasably retain the major part of the top surface of clamp bracket portion 54 in abutting relationship to the front, generally planar bottom surface portion 29A of the angle support. As may be noted in FIG. 7, the inclined portion 55, the blade, and holder surface 45 are located a substantial distance longitudinally rearwardly of the horizontal leg of the angle support in a blade assembly 25 assembled condition. Further, as may be noted in FIG. 7, in an assembled condition, the holder land 44 abuts against the rearward edge portion of bracket portion 54 a substantial distance rearwardly of screws 64, and the bracket front edge 61 abuts against the blade a substantial distance longitudinally forwardly of screws; but longitudinally between the land 44 and edge 61, the clamp bracket does not abut against either the blade or the holder. As a result, in threading the screws into the angle support, the clamp bracket is moved to have its top surface abut against the bottom surface of the horizontal leg of the support, and upon the top surface of land 44 abutting against the clamp bracket, the holder and clamp bracket pivotally slide relative one another about the location the land and bracket abut to move edge 61 to tightly clamp blade 28 against the blade mounting surface 45.

For replacing blade 28, the sled is raised and then screws 64 are unthreaded an amount that the bracket B may be pivoted about land 44 to separate edges 58, 61 sufficiently that the blade may be moved away from surface 45 to clear water 49 and thence moved from between the bracket and holder, but at the same time supportingly hold the holder 42 in dependingly relationship to the angle support. In this connection the depth of threading of the screws 64 into the angle support and the distance the insert extend above surface 45 are such to permit the above type of removal of the blade. That is, when the screws are unthreaded sufficiently, but still are threaded into the support 29, the holder and bracket are pivotally slidably movable relative another to permit the spreading of edges 58, 61 and the top of the inserts being spaced from the bottom surface of inclined portion 55 by distances greater than the thickness of the blade.

In mounting a new blade 28, with edges 58, 61 spread, the new blade is slipped into the space between the tops of the inserts and the bottom surface 55A of the bracket and moved to align the blade apertures 50 with the inserts 49. Now the blade is moved downwardly relative the inserts to bear against the blade mounting surface. Due to the top portions of the inserts being of a generally semi-spherical shape and being located more remote from surface 45 than the height of shoulder 46, the inserts facilitate the mounting of the blade and act to guide the blade to position the rear edge of the blade closely adjacent to shoulder 46 as the blade is moved toward its seating position against surface 45. Further, the inserts retain the blade on the holder in a position upon that again tightening the screws 64, the edge 61 moves relative surface 45 to tightly clamp the blade therebetween in a proper assembled condition, and there is no need to hold the blade while the screws are being tightened as the inserts extending through apertures 50 retain the blade in a proper position on the holder. With reference to the inserts 49, they extend away from surface 45 a distance substantially greater than the height of shoulder 46 and the thickness of the blade, but desirably a distance less than one-half the axial length of apertures 56. Further, the apertures 56 are of size to permit the above described spreading of edges 58, 61 without binding against the walls defining apertures 56 as the clamp bracket is moved relative the holder between a blade removable position and a blade clamping position.

Even though the above describes replacing the blade without removing the assembly mount from the sled, it is to be understood the assembly mount may be re-
moved from the sled, then the blade replaced, and thereafter the assembly mount replaced.

Referring now to FIGS. 9 and 10, the second embodiment of the blade assembly of this invention, generally designated 110 includes a transversely elongated blade holder M that has a rear part of the generally planar top surface 113 retained against the assembly support A (either 29 or 76) by a plurality of screws 111 extended through the rear portion of the holder M. The blade holder includes a downwardly opening recess 112 that extends transversely thereacross. The recess is defined by a generally vertically rear wall 112a that joined to one axial edge of a semicircular wall 112b, the other axial edge being joined to a generally vertically front wall 112c of substantially smaller height than wall 112a. The lower edge of wall 112c is joined to the rear edge of a generally planar top wall 112d that for at least the major portion thereof is parallel to surface 113, the front edge of wall 112d being joined to the rear edge of a downwardly and forwardly inclined generally planar wall 112e that provides a blade mounting surface. Walls 112b and 112c, together with the upper part of wall 112a, define a cam mounted recess portion that extends transversely across the blade holder and opens directly downwardly to the rear part of the clamp bracket recessed portion formed by remainder of the recess 112.

A clamp bracket N is mountable in the clamp bracket recessed portion and includes a vertical rear wall abuttable against wall 112a, a planar top surface 114 of a longitudinal length substantially the same as the spacing of wall 112a from the rear edge of wall 112c, and a downwardly and forwardly inclined blade mounting surface 115 and a shoulder 116 that extends upwardly at about right angles to surface 115 to intersect the front edge of surface 114 and the rear edge of surface 115. A plurality of transversely aligned and spaced screws 117 are extended through the longitudinally intermediate part of the clamp bracket (a substantial distance rearwardly of shoulder 116) and threaded into the blade holder M a substantial distance forwardly of the cam recessed portion. When surfaces 112d and 114 are parallel, surfaces 112e, 115 are either parallel or diverge slightly in a rearward direction.

Realistically clamped between surfaces 112e, 115 is a blade 120 to have its cutting edge extend forwardly and below the holder M and holder N, holder M extending longitudinally forwardly of bracket N. Mounted in the blade holder cam mounting recess is a transversely elongated cam rod 121 that is of a greater transverse width than the blade holder, the maximum thickness of the rod being substantially greater than the height of the recessed portion, while the maximum width w of the rod at right angles to dimension h is no greater than the height of said recess. A crank 122 is keyed to rod 121 for turning it between a blade release position wherein dimension w extends perpendicular to surface 112a and a clamp position that dimension h extends perpendicular to surface 112d. With screws 117 being threaded into the blade holder to permit slight play between the clamp bracket and the blade holder and crank 122 in a blade release position, the forward end portions of the blade holder and clamp bracket may be spread sufficiently to permit the blade being slid between surfaces 112e, 115 to have the rear edge thereof abutting against or closely adjacent shoulder 116. Now upon turning the crank to a clamp position the rod forces the rear portion of the clamp bracket away from surface 113 which results in surface 115 being moved toward surface 112e to clamp the blade between surfaces 112e, 115. It is to be noted that the blade 120 does not have any slots or apertures therein, nor are any recesses or protrusions provided on surface portions 112e, 115.

Referring to FIGS. 11 and 12, the third embodiment of the invention, generally designated 130, includes a blade holder P having a bottom planar surface 131, a rear end portion having a top planar surface 132 parallel to surface 131, a surface 133 forwardly of surface 132 that other than the possible exception of the transverse outer portions thereof is parallel to surface 131 and more closely adjacent surface 131 then surface 132, a surface 134 forwardly of surface 133 that is parallel to surface 131 and more closely adjacent surface 131 than surface 132, a forwardly and downwardly inclined blade mounting surface 135, a shoulder 136 extending at about right angles to surface 135 that extends between the rear edge of surfaces 135 and the front edge of surface 134, a shoulder 137 extending perpendicular to surface 134 and between surfaces 134, 133, and a shoulder 138 extending perpendicular to surface 133 and between surfaces 133, 132. A clamp bracket R in an unmounted condition has a rear portion that has a bottom planar surface 140 and a front portion having a bottom planar surface 141 that when the bracket is in an assembled condition is inclined downwardly and forwardly relative to surface 135 to progressively more closely surface in a forward direction. The clamp bracket is of a longitudinal length that when the front edge 142 thereof is adjacent the front edge of the blade holder, the clamp bracket rear portion abuts against surface 133.

A plurality of transversely spaced screws 145 are extended through the rear portion of the clamp bracket adjacent the front portion and threaded into the blade holder between surface 135 and shoulder 137 for securing the clamp bracket and blade holder together to tighten hold the ice shaving blade 147 with the edge 142 holding the blade against surface 135, surfaces 134, 140 substantially spaced, and surface 140 abutting against surface 133.

The rear portion of the blade holder is provided with a plurality of longitudinally elongated, transversely spaced slots 149 that open through the rear edge of the blade holder. Each slot has an upper portion 149a that opens through the top surface 132 and a lower slot portion 149b that opens through the bottom surface 131. Slot portion 149a is of a smaller longitudinal length and a smaller transverse width than slot portion 149b, and opens to slot portion 149b to form a U-shaped shoulder 149c. Bolts 150 extend through the slots and are threaded into the assembly support 151 with the head ends of the bolts abutting against shoulders 149c. By slightly loosening the bolts, the blade holder may be slid forwardly to be separated from the assembly support A. To be noted is in a normally mounted position, the blade holder shoulder 138 is located forwardly of the assembly support.

Referring now to FIG. 13, the fourth embodiment of the invention, generally designated 157, may be of the same construction as the first embodiment, except for the differences set forth hereinafter. That is the assembly 157 includes a blade holder R, a clamp bracket T and a blade W. The holder R in an unmounted condition has a longitudinally intermediate portion that has a planar top surface 161 which intersects with the rear
transverse edge of a downwardly and forwardly inclined blade mounting surface 152 that is planar except for a transversely elongated protrusion 153 that is longitudinally intermediate the front and rear edges of the blade mounting surface.

A clamp bracket T in a blade clamping position has a longitudinally intermediate bottom surface 155 substantially parallel to and spaced from surface 161, and a front blade clamping surface 156 that is generally planar and is inclined downwardly and forwardly to converge with the non-protruding part of surface 152, except for the transversely elongated protrusion 158 that is intermediate the front and rear edges of the inclined surface, and extends transversely across the holder. The blade W has a transverse groove 159 to receive the protrusion 153 to permit the blade bottom surface on either side of the groove abut against the planar parts of the blade mounting surface 152 and block rearward movement of the blade relative the blade holder when clamped thereto. A transverse portion 159a against which the shoulder 153a of the protrusion 153 abuts. The top surface of the blade also has a transverse groove 160 to have the protrusion 158 which extends transversely thereacross to extend into it. It is to be understood either groove 160 and protrusion 158, or groove 159 and protrusion 153 may be eliminated, although it is preferable not to do so. As may be noted, the fourth embodiment does not have a shoulder such as shoulder 46 of the first embodiment joining the inclined and intermediate top surface of the blade holder. Further the blade W has two cutting edges 172 and 173 respectively at longitudinally opposite ends of the blade. Thus when edge 172 gets dull a shoulder may be removed and replaced to have edge 173 extend forwardly of the clamp bracket and the blade holder.

In order to avoid a "step" between the part of the ice a shaving cut has been made and the part transversely adjacent thereto, the transverse outer, bottom surface portions of the blade assembly support, or clamp bracket may be machined away. Thus for example with reference to the first embodiment (see FIG. 14), the blade support 29 along at least the length thereof that the clamp bracket abuts against has transverse outer bottom surfaces portions 29m and 29n that are tapered to extend transversely inwardly and downwardly and are joined to the planar transverse intermediate portion 29r. The outer longitudinal extending edge of each of the tapered portions 29m, 29n is desirably at a higher elevation than surface 29r by an amount Z that is greater than the maximum depth of shaving cut normally made during an ice resurfacing operation. When the screws 64 are tightened the blade holder H and clamp bracket B and the blade are bent along the longitudinal length thereof of the cutting edge of the blade has its transverse outer portions tapered upwardly and outwardly at substantially the same angle of tapers as that of surface portions 29m, 29n (see FIG. 17). Each of the surfaces 29m, 29n may be planar or may be of a shallow curvature so as not to provide a sudden transition from the maximum depth of cut and the parts of the ice on either transverse side of the art.

In order to mount the blade so that it assumes the configuration referred to in the above paragraph, instead of providing a blade support having tapered surface portions, either of assembly supports 29 or 76, referred to as 229 (see FIG. 16), may have a planar bottom surface, and a clamp bracket 230 in conjunction therewith and a blade holder H. The clamp bracket 230 has a planar top surface portion where it abuts against the bottom planar surface of support 229, transverse outer bottom surface portions 230a, 230b and a transverse intermediate portion 230c that are in the same relationship to one another as surface portions 29m, 29n and 29a. Upon tightening the parts of the holder H abutting against the clamp bracket are bent to the blade as shown in FIG. 17.

As an alternate to that set forth in the above paragraph, instead of the clamp bracket (in an unmounted condition) having a planar top surface, the clamp bracket can be formed with a planar bottom surface throughout the transverse width of portions 230a, 230b, 230c. In such a case the modified clamp bracket would be provided with a transversely elongated intermediate portion 230p (see FIG. 17) and transverse outer portions 230m and 230n that are tapered downwardly in transverse outward directions from their junctures with portions 230p. Upon mounting the blade holder and the thus modified clamp bracket on support 229 and tightening screws 299, 29a further for wardly from that shown in FIG. 8 that with either one of the edges extending forwardly, the opposite edge
would be forward of shoulder 46, and the walls defining the insert apertures would prevent the blade moving rearwardly to abut against the shoulder 46. Also either of the second and third embodiments may be modified to provide blade holder and clamp bracket protrusions and the blade with two cutting edges and protrusion grooves such as described with reference to the fourth embodiment.

Additionally the blade holder of each of the first and third embodiments may be provided with slots such as slots 149 of FIG. 11 and bolts for securing the respective blade assembly to the assembly support. Further, instead of screws or bolts being threaded into the assembly support, in each of the embodiments nuts may be welded to the top surface of the assembly support and bolts slidably extended through non-threaded apertures in assembly support and threaded into said nuts.

Each of the blade assemblies may be mounted on either of the assembly supports of the sleds described herein, or other ice resurfacing machine sleds.

As an example of the invention, but not otherwise as a limitation thereon, the blade 28 may be of a transverse width of about 77 inches, a thickness of about 1/32 of an inch, a longitudinal length of about three-fourth of an inch, and of a weight of less than a pound. This compares to conventional ice shaving blades for the same machine that are of substantially the same length which weigh about 45 pounds. The holder and clamp bracket are of about the same transverse width as the blade.

Assuming the blade is of a size indicated in the above paragraph, the dimension Z of FIG. 14 advantageously is about 1/32 to 1/16 of an inch, and the transverse horizontal dimension Y of each of the tapered surfaces is about 6 inches to 1 foot.

The cost of suitable blades 28 is expected to be about half of the cost of sharpening conventional blades. When it is considered that most ice rinks send out their conventional blades to be resharpened, and such conventional blades have an edge life of about 2 to 10 days of normal usage, depending on the original sharpness of the blade, and since the blade 28 has about the same edge life, it is believed it is apparent blade 28 is a disposable blade. Further, the weight of the combination of the blade holder and clamp bracket of the present invention is about the same as a conventional ice resurfacing blade used on the same ice resurfacing machine.

Additionally the cost of the combination of the clamp bracket and blade holder of this invention is about the same as the cost of a conventional blade for an ice resurfacing machine. This, together with being able to use a disposable blade 28, over a period of time results in a considerable saving over that where conventional ice resurfacing blades are used.

What is claimed is:

1. An ice resurfacing machine comprising a self-propelled vehicle that normally travels in a forward direction, said vehicle having a frame, a sled dependingly attached to said frame, an ice shaving blade assembly that includes a transversely elongated blade support having a longitudinally front end portion and a rear end portion, a transversely elongated blade having a longitudinally rear end portion, intermediate portion and a front cutting edge portion, a blade holder having a first surface, a blade mounting surface inclined relative to and intersecting with said first surface and a surface portion opposite said first surface, a clamp bracket having one side thereof abutting against said surface portion and said blade, and fastening means for mounting the holder and the bracket on the support member and releasably retaining the clamp bracket and holder in abutting relationship to clampingly hold the blade in abutting relationship to the blade mounting surface, first adjustment means mounted on the sled for pivotally mounting the blade assembly and selectively varying the blade height and second adjustment means mounted on the sled and pivotally connected to the support member for selectively varying the blade angle.

2. The apparatus of claim 1 further characterized in that the blade holder has a longitudinally intermediate surface, the blade mounting surface extending longitudinally forwardly of the intermediate surface, that the bracket has a front end portion, that the blade mounting surface is inclined at a substantial angle relative the holder intermediate surface, and that the bracket includes an intermediate portion joined to the bracket front end portion and is inclined relative the bracket end portion at a greater angle than the angle of inclination of the blade mounting surface to extend increasingly more closely adjacent to blade mounting surface in a longitudinally forward direction.

3. The apparatus of claim 2 further characterized in that the holder and bracket have longitudinally rear portions, the holder rear portion having said surface portion, that the bracket has a longitudinally intermediate portion, that the holder and bracket intermediate portions have generally planar surfaces substantially spaced from one another, and that one of the holder and bracket rear portions has a land for abutting against the other to retain the planar surfaces spaced from one another.

4. The apparatus of claim 1 further characterized in that each of the blade holder, clamp bracket and blade has transverse outer portions and a transverse intermediate portion, said holder and clamp bracket outer portions having surfaces abutting against the blade that are inclined to extend downwardly and transversely inwardly toward the respective transverse intermediate portion to retain the blade outer portions inclined downwardly and inwardly toward the blade transverse intermediate portion.

5. An ice resurfacing machine comprising a self-propelled vehicle that normally travels in a forward direction, said vehicle having a frame, a sled attached to said frame to move therewith, and an ice shaving blade assembly that includes a transversely elongated assembly support, a transversely elongated, thin, disposable blade having a longitudinal rear end portion, intermediate portion and a front cutting edge portion, a blade holder having a longitudinally rear portion, an intermediate portion and a front blade mounting surface, a clamp bracket having a longitudinally rear portion, intermediate portion, and front portion, and means for releasably securing the blade holder and clamp bracket in clamping relationship to retain the blade between the holder front surface and the clamp front portion and mounting the combination of the blade, blade holder and clamp bracket in the assembly support.

6. The apparatus of claim 5 further characterized in that the blade intermediate portion has a transversely elongated groove and that the blade holder has a transversely elongated protrusion extended into said groove, said blade mounting surface having planar parts on either side of said protrusion abutting against the blade.

7. The apparatus of claim 6 further characterized in that each of the blade front and rear portions has a cut-
ting edge.

8. The apparatus of claim 5 further characterized in that the blade holder has a bottom surface, that the holder intermediate portion has a top surface, that the blade holder rear portion has a land abutting against the clamp bracket rear portion and that extends more remote from the bottom surface than the intermediate portion top surface, and that said means comprises first fastening means extended through the holder and bracket intermediate portions for securing the holder and bracket together in a blade clamping position with said land abutting against the clamp bracket rear portion and second fastening means longitudinally rearwardly of the first fastening means for securing the holder rear portion to the assembly support.

9. The apparatus of claim 5 further characterized in that the blade holder has a downwardly opening, transversely elongated clamp bracket recess for receiving the clamp bracket therein, the above recess in part being defined by the blade mounting surface, and a transversely elongated cam member recess opening directly to the bracket recess a substantial distance rearwardly of the blade mounting surface, and that said means includes fastener means extended through the clamp bracket intermediate portion for securing the clamp bracket in the clamp bracket recess and to the blade holder while permitting limited separating movement between the blade holder surface and the clamp bracket front portion, and cam means mounted in the cam recess for movement between a position relative the cam bracket rear portion to permit sufficient separating movement of the holder and bracket for withdrawing the blade, and a second position abutting against the clamp bracket rear portion to retain the holder and bracket in a blade clamping position.

10. The apparatus of claim 5 further characterized in that said means comprises fasteners extended through the clamp bracket and blade holder and into the assembly support a substantial distance rearwardly of the blade for mounting the holder and bracket on the assembly support.

11. The apparatus of claim 5 further characterized in that each of the blade holder, clamp bracket and blade has transverse outer portions and a transverse intermediate portion, said holder and clamp bracket outer portions having surfaces abutting against the blade that are inclined to extend downwardly and inwardly toward the respective transverse intermediate portion to retain the blade outer portions inclined downwardly and inwardly toward the blade intermediate portion.