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[54] **SNOWMOBILE TRAIL GROOMER**

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[52] **U.S. Cl.** **172/145;** 172/188; 172/197; 172/407; 172/784; 37/50

[51] **Int. Cl.** **A01b 51/00**

[58] **Field of Search** 172/145, 133, 140, 188, 172/197, 199, 387, 392, 393, 395, 407, 413, 781, 784, 789, 780, 795, 116; 37/41, 48–50, 10

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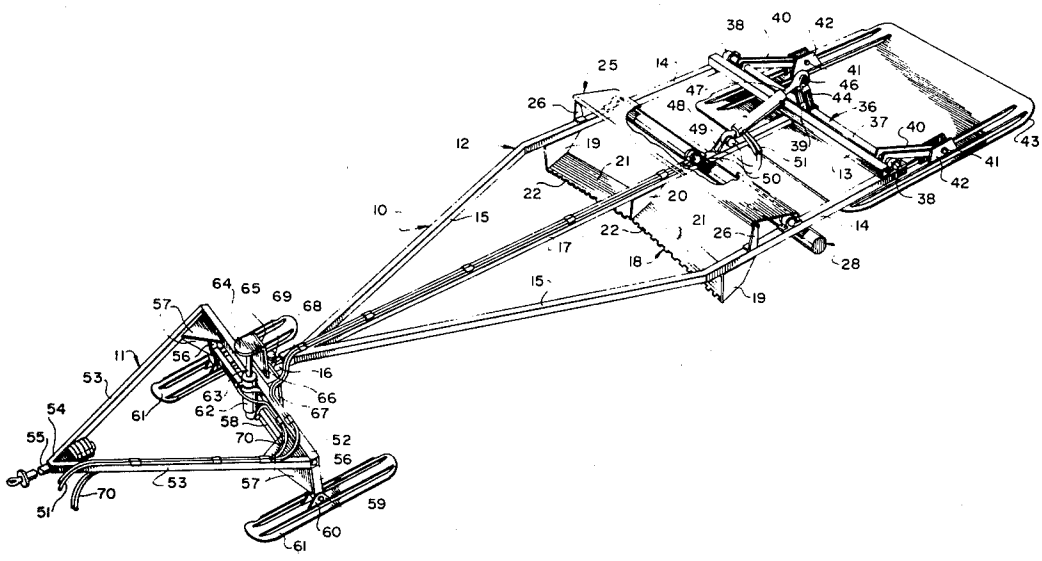
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Primary Examiner—Edgar S. Burr
Assistant Examiner—E. H. Eickholt

[57] **ABSTRACT**

A grooming apparatus for snow surfaces such as snowmobile trails comprises a heavy elongate frame having an articulated forward end supported on skis, and a rear end supported on a skid. Centrally of the frame is a transverse blade structure behind which is positioned a massive pivotally mounted compactor bar. In contrast to new equipment of this type, the present grooming apparatus provides for vertical adjustment of the frame relative to the front skis and the rear skid.

13 Claims, 4 Drawing Figures



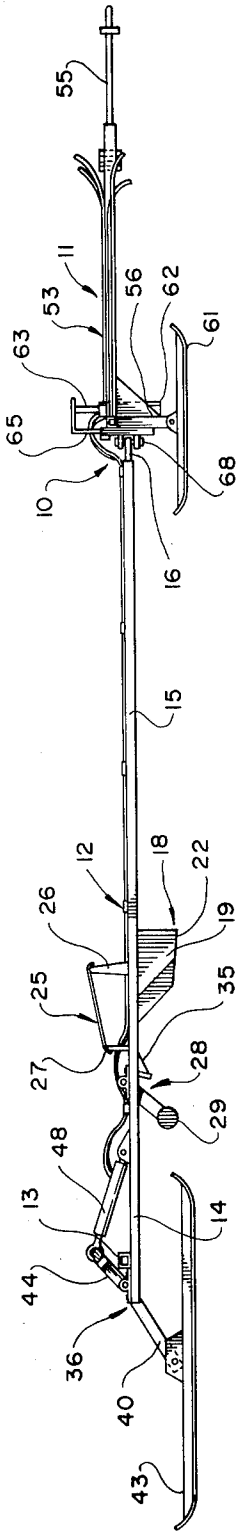

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FIG. 1

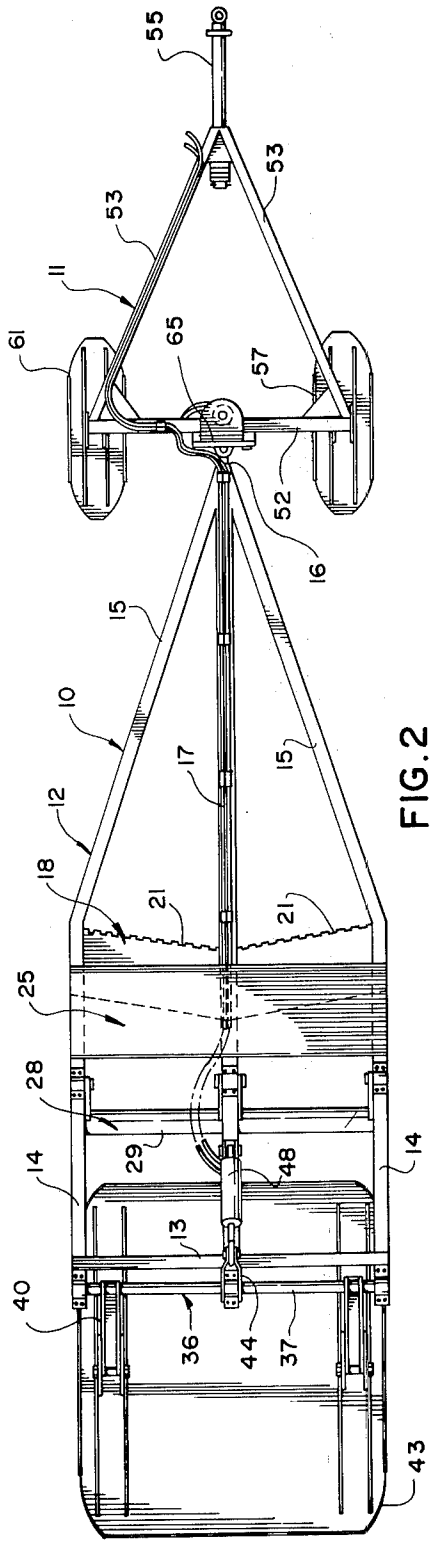

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FIG. 2

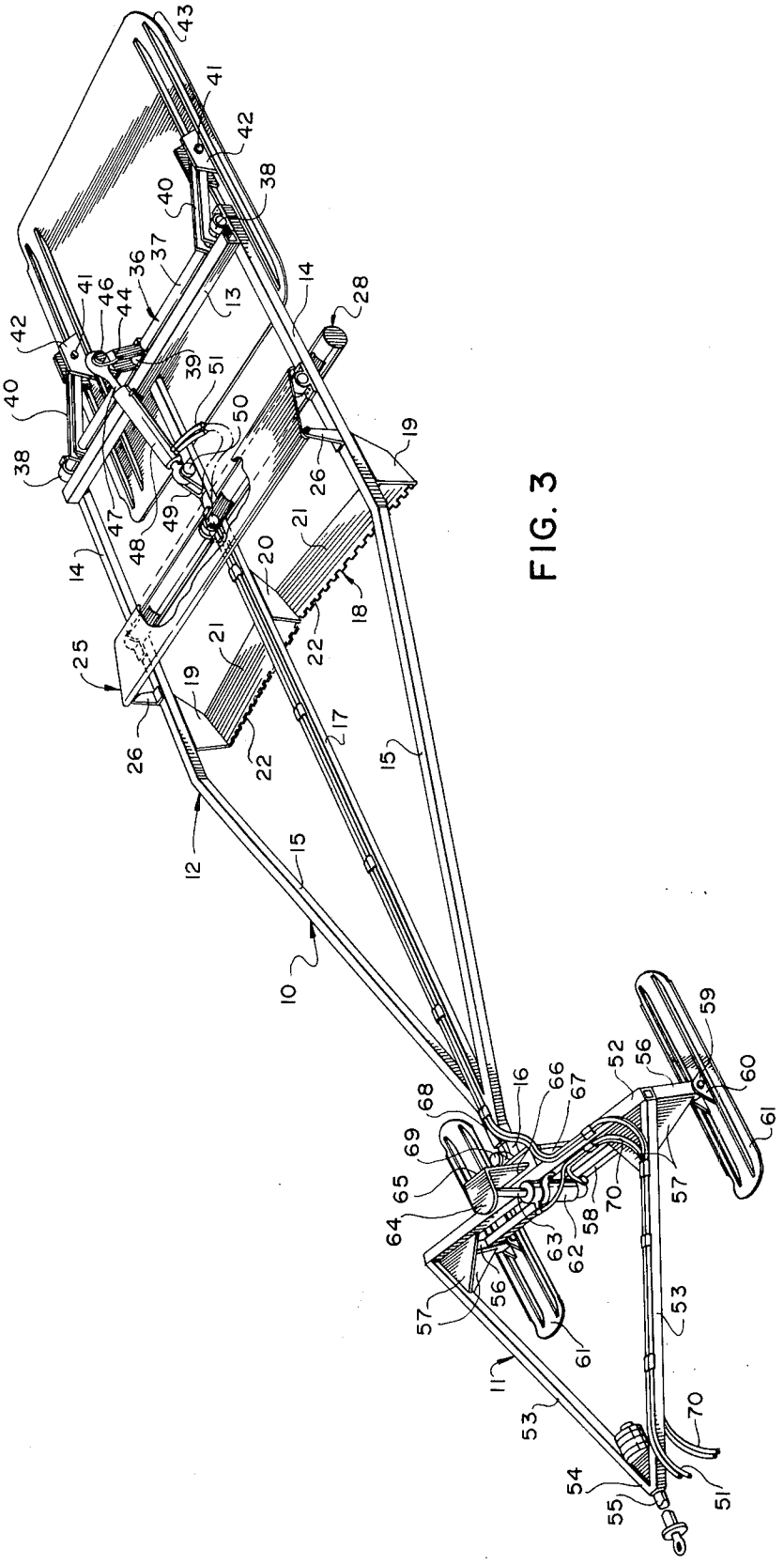


FIG. 3

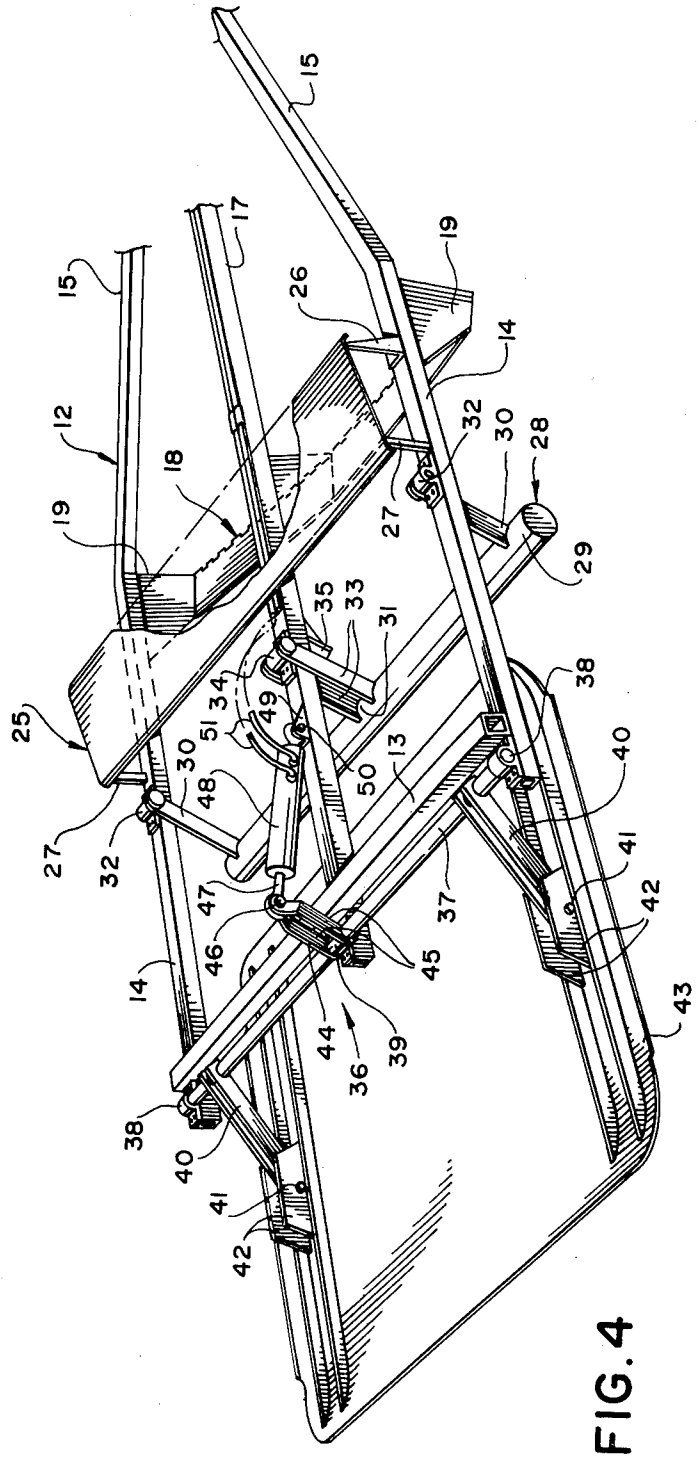

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FIG. 4

SNOWMOBILE TRAIL GROOMER

FIELD OF THE INVENTION

This invention relates to apparatus for conditioning or grooming snow surfaces for winter sports activities, for example surfaces such as ski slopes or snowmobile trails.

BACKGROUND OF THE INVENTION

Existing equipment for the grooming of snowmobile trails generally comprises light and fairly short frames which are dragged across the snow surface by snowmobiles and carry on their undersides one or more chopping blades. Such devices, being fairly light, can only chop off the tops of any moguls which may be present in the snow surface, and accordingly on a snow surface having large moguls numerous passes of such devices are required to achieve adequate grooming of the surface.

SUMMARY OF THE INVENTION

The present invention provides apparatus for grooming a snow surface comprising: an elongate frame having forward and rearward ends and skid means adjacent each end to support the frame for sliding movement upon the snow surface, a blade structure carried by said frame and extending transversely thereof, said blade structure having a generally horizontal lower edge, a horizontal compactor extending transversely of the frame and mounted thereon rearwardly of the blade structure, and means for adjusting the height of said frame relative to said skid means.

Preferably at least the lateral ends of the blade structure are angled forwardly so as to guide snow chopped from the snow surface towards the longitudinal center line of the frame. A transverse deflector plate may be provided, above and to the rear of the blade structure to direct snow from the blade structure downwards into the path of the compactor.

In a preferred embodiment the grooming apparatus comprises a large, heavy frame supported at the front upon a pair of skis and at the rear upon a skid plate and adjustable in height relative to the skis and skid plate so that the vertical position of the blade structure can be varied. The front skis are mounted on a hitch which is articulated with respect to the remainder of the frame to improve the steering characteristics of the apparatus. The compactor comprises a massive solid steel bar transversely arranged to the rear of the blade structure and pivotally supported from the frame by a trailing arm structure. The dimensions of the apparatus are relatively large, for example 30 ft. long and 5 ft. wide, so that the position of the blade structure is relatively insensitive to local variations in the contour of the snow surface.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will further be described, by way of example only with reference to the accompanying drawings in which:

FIG. **1** is a side elevation, and

FIG. **2** is a plan view of a preferred embodiment of snow grooming apparatus in accordance with the invention;

FIG. **3** is a front perspective view of the apparatus from above and one side; and

FIG. **4** is a rear perspective view from above and the other side showing the rear portions of the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, the snow grooming apparatus comprises a frame **10** having a forward hitch section **11** and a major rear section **12.**

As is best seen in FIG. **4,** the rear section **12** of the frame comprises a massive hollow steel beam **13** transversely arranged between a pair of spaced lateral frame members **14** and secured thereto by any suitable means, e.g. by welding. Connected to the front end of each of the lateral frame members **14** is an angularly arranged frame member **15,** the latter converging towards the front of the rear frame section and being connected together and to a clevis plate **16,** e.g. by welding. A central frame member **17** extends longitudinally in the rear frame section and is connected at its forward end to the clevis plate **16,** and at its rear end to the transverse beam **13.**

About two-thirds of the way between the front and rear of the frame **10,** a blade structure generally indicated at **18** is mounted on the rear frame section **12.** As is best seen in FIG. **3,** the blade structure comprises vertical end brackets **19** secured to the undersides of the lateral frame members **14,** and a central bracket **20** secured to the underside of the central frame member **17.** The lower ends of the brackets **19** and **20** incline downwardly and forwardly of the frame and support cutting blade sections **21** on each side of the central bracket. The cutting blade sections **21** are of rigid construction being fabricated for example in a suitable hardened steel, and have serrated lower cutting edges **22** and which extend in a generally horizontal plane, i.e. a plane parallel to that of the frame members **14,** 15 and **17.** Conveniently the cutting blade sections **21** may be detachably secured to the support brackets **19** and **20** so that they may be removed and replaced should they become defective through breakage or wear.

The cutting blade sections lie at an angle to the horizontal of approximately 45°, and the central support bracket **20** is positioned somewhat rearwardly of the end brackets **19** so that in plan view, the cutting blade sections appear in the form of a shallow V, the laterally outermost sections being inclined forwardly with respect to the central parts.

A snow deflector plate **25** is mounted on the rear frame section **12** above and to the rear of the blade structure **18.** From each of the lateral frame members **14** extends a pair of vertical lugs **26** and **27** to which the lateral ends of the deflector plate **25** are connected. It will be seem that the forwardmost lugs **26** are of greater height than the lugs **27** so that the deflector plate is supported at a downwards inclination towards the rear.

A snow compactor **28** is mounted on the rear frame section behind the blade structure and snow deflector.

As is best seen in FIG. **4** the compactor comprises a horizontally arranged massive steel bar **29** supported through trailing arms **30** and **31** on the structure of the rear frame section. The trailing arms **30** at the outer ends of the compactor bar are connected to co-axial pivotal mountings **32** on the lateral frame members **14,** whereas the central trailing arm **31,** which comprises a pair of spaced plates **33** which straddle the central frame member **17,** is connected to a pivotal mounting

34 carried on the central frame member and co-axial with the pivotal mounting 32. Thus the compactor bar 29 is free to swing about the pivotal axis of the mountings 32 and 34, the pivotal movement in the downward direction being limited by engagement of the central trailing arm 32 with an abutment plate 35 mounted on the central frame member 17. The abutment plate 35 therefore defines a limiting position for the compactor bar, and in this position, as seen in FIG. 1, the compactor bar is at the same horizontal level as the cutting edges 22 of the blade structure.

At the rear of the frame section 12 is a skid support 36 in the form of a transversely arranged horizontal tube 37 pivotally mounted at opposite ends in bearing supports 38 at the rear of the lateral frame members 14, and centrally in a bearing support 39 carried on the rear of the central frame member 17. A pair of radial arms 40 are integrally connected with the tube 37 near the ends thereof, and the lower end of each arm 40 is pivoted on a pin 41 supported between vertical mounting plates 42 secured at transversely spaced locations to the upper surface of a skid plate 43. The skid plate 43 extends the full width of the rear frame section 12 and has an upwardly curved front end.

Centrally of the tube 37 is a third radial arm 44 in the form of two plates 45 integrally connected to the tube 37 on opposite sides of the central bearing support 39. The upper end of the arm 44 is pivotally connected by means of a pin 46 to the end of a piston rod 47 of a hydraulic piston and cylinder assembly 48. The opposite end of the piston and cylinder assembly 48 is pivotally connected to a bracket 49 on the central frame member 17 through a pin 50. The piston and cylinder assembly 48 can be supplied with hydraulic fluid through hoses 51 to effect extension and retraction of the piston rod 47. As will be evident, movement of the piston rod 47 imparts a pivotal motion to the tube 37 and with it the arms 40 carrying the skid plate 43. As will be clear from FIG. 1, actuation of the piston and cylinder assembly 48 will vary the effective height between the skid plate 43 and the frame section 12, but the skid plate will be able to maintain a generally horizontal position during this movement because of its pivotal connection with the arms 40.

As is best shown in FIGS. 2 and 3, the forward hitch section 11 of the frame is of generally triangular configuration and comprises a transverse rear frame member 52 of hollow steel beam structure, from the ends of which a pair of lateral frame members 53 extend forwardly in convergent fashion to an apex 54 at which is provided a hitch connection 55 for attachment to a tractor vehicle (not shown).

The forward frame section 11 is of massive integral construction, the frame members preferably being hollow steel beams interconnected by welding. At each end of the rear frame member 52 is a downwardly extending post 56 rigidly attached thereto. Welded gusset plates 57 are provided to strengthen the connections between the frame members 52 and 53 and the posts 56, and a lower transverse beam 58 is connected between the posts 56. The lower end of each post is pivotally connected through a transverse pin 59 to a mounting bracket 60 on the upper side of a front ski 61, the skis 61 thus being capable of pivoting with respect to the forward frame section 11.

A hydraulic piston and cylinder assembly 62 is vertically arranged on and centrally attached to the rear frame member 52 and the lower beam 58, with the piston rod 63 extending upwardly therefrom.

The upper end of the piston rod is attached to a flange 64 carried by a vertically arranged plate 65 slidably received in a T shaped channel 66 of a guide block 67 mounted on the rear of the forward frame section. The plate 64 is thus guided for vertical movement in the channel 66 upon extension or retraction of the piston rod 63.

Attached to the rear face of the plate 65 is a bracket 68 which receives the clevis plate 16 of the rear frame section 12. A pin 69 received through aligned holes in bracket 68 and clevis plate 16 forms a pivotal connection between two frame sections allowing relative articulating motion therebetween about a vertical axis.

The piston and cylinder assembly 62 is supplied with hydraulic fluid through hoses 70 which are conducted to the forward end of the front frame section along the rear and lateral frame members 52 and 53. The hoses 51 supplying the piston and cylinder assembly 48 are conducted along the central frame member 17 of the rear section, and along the rear and lateral frame members of the front frame section so that both sets of hoses terminate adjacent the hitch connection 55 and may readily be coupled to a source of hydraulic cluid on the tractor vehicle (not shown).

In operation, when the apparatus is drawn over a snow surface to be groomed, for example, a snowmobile trail, the cutting edge 22 of the blade structure moves in a direction substantially parallel to that of the snow surface, irrespective of minor irregularities in that surface. This is because the blade structure is attached to the massive rear frame section 12, and the latter is retained in a generally horizontal position because of the wide track of the skis 61, and the large distance between the front skis 61 and the rear skid plate 43. Accordingly the grooming apparatus is most effective in levelling moguls which may occur on the snow surface. In operation, when the cutting edge 22 encounters a mogul it slices the top from it, the snow or ice thus loosened passing up over the inclined surfaces of the blade sections being directed generally inwardly of the track of the skis by virtue of the shallow V shaped arrangement of the blade sections.

The compactor 28 drags behind the cutting blade, and the heavy steel bar 29 is effective to compact snow severed by the cutting blade sections into any hollows which may exist in the snow surface.

The snow deflector plate 25 is effective to direct the snow severed by the cutting blade sections downwardly into the path of the compactor 28. By virtue of its pivotal mounting arrangement, the compactor 28, although normally effective to compact the severed snow, may swing upwardly and rearwardly to permit it to clear any large obstacle which may be encountered.

At the rear end of the grooming apparatus the rear skid 43 slides accross the compacted snow surface and effects a further compacting and grooming action.

Dependent upon the condition of the snow surface to be groomed, and the hardness of the snow, it may be desirable to vary the height of the cutting edges 22 of the blade structure in relation to the skis 61 and skid plate 43. This may be effected through actuation of the hydraulic cylinder 48 to pivot the ski support structure 36 to move the rear skid plate to the desired height, and by actuation of the cylinder 62 to adjust the height of

the plate **65**, and with it the front clevis **16** of the rear frame section in relation to the front skis **61**.

The articulated connection between the front frame section **11** and the rear frame section **12** provides the apparatus with high maneuverability despite its extended length.

What we claim as our invention is:

1. Apparatus for grooming a snow surface comprising an elongate frame having forward and rearward ends and skid means adjacent each end to support the frame for sliding movement upon the snow surface, a blade structure carried by said frame and extending transversely thereof, said blade structure having a generally horizontal lower edge, a horizontal compactor extending transversely of the frame and mounted thereon rearwardly of the blade structure, said compactor comprising a heavy, rigid, elongate member pivotally mounted on an axis transverse to said frame, abutment means on said frame defining a limiting position for said compactor, said limiting position being spaced rearwardly and downwardly of the pivotal axis such that the compactor is urged by gravity towards said limiting position but in operation may be displaced pivotally upwardly and rearwardly by the mass of snow to be compacted, and means for adjusting the height of said frame relative to said skid means.

2. Apparatus for grooming a snow surface comprising an elongate frame having forward and rearward ends and skid means adjacent each end to support the frame for sliding movement upon the snow surface, a blade structure carried by said frame and extending transversely thereof, said blade structure having a generally horizontal lower edge, a horizontal compactor extending transversely of the frame and mounted thereon rearwardly of the blade structure, a deflector plate mounted on said frame above and adjacent the rear of said blade structure, said deflector plate being of a length corresponding to that of the blade structure and being downwardly inclined in the rearward direction so that in operation it acts to deflect snow shaved by the blade structure downwards into the path of the compactor, and means for adjusting the height of said frame relative to said skid means.

3. Apparatus according to claim **2** wherein the blade structure is downwardly and forwardly inclined at an angle of approximately 45° to the vertical.

4. Apparatus according to claim **2** wherein said front skid means comprises a pair of spaced skis on the front portion of the frame adjacent the lateral edges thereof the rear skid means comprising a plate which extends the full width of the frame.

5. Apparatus according to claim **2** wherein said blade structure and said compactor extend over substantially the full width of the frame.

6. Apparatus according to claim **2** further comprising a support pivotally mounted on a transverse axis at the rear of said frame said support carrying a pair of spaced, downwardly extending arms and the lower end of each arm being pivoted to the rear skid means, and actuator means on said frame operative to pivot said support relative to said frame thereby to adjust the effective height of said frame relative to said rear skid means.

7. Apparatus according to claim **6** wherein said actuator means comprises a fluid pressure operated piston and cylinder assembly connected at one end to said frame and at its opposite end of said support at a location spaced from the pivotal axis of the latter.

8. Apparatus according to claim **6** wherein said frame has a forward section upon which said front pair of skis is mounted and which is articulated with respect to the remainder of said frame upon which said blade and said compactor are mounted, said forward section of the frame being adjustable in the vertical direction with respect to the remainder of said frame thereby to vary the effective height of the latter with respect to the front skid means.

9. Apparatus according to claim **8** wherein said vertical adjustment is effected through a fluid pressure operated piston and cylinder assembly connected between the forward section of said frame and the remainder of the frame.

10. Apparatus according to claim **2** wherein at least the lateral end portions of said blade structure are forwardly inclined with respect to said transverse direction.

11. Apparatus according to claim **2** wherein said blade structure comprises two blade sections which meet centrally of the frame and extend laterally therefrom at a slight forward inclination.

12. Apparatus according to claim **5** wherein the front skid means comprises a pair of spaced skis on the front portion of the frame adjacent the lateral edges thereof, the rear skid means comprising a plate which extends the full width of the frame.

13. Apparatus according to claim **1** wherein the front skid means comprises a pair of spaced skis on said forward frame section adjacent the lateral edges thereof, the rear skid means comprising a plate which extends the full width of the frame and which has an upwardly curved front end.

* * * * *