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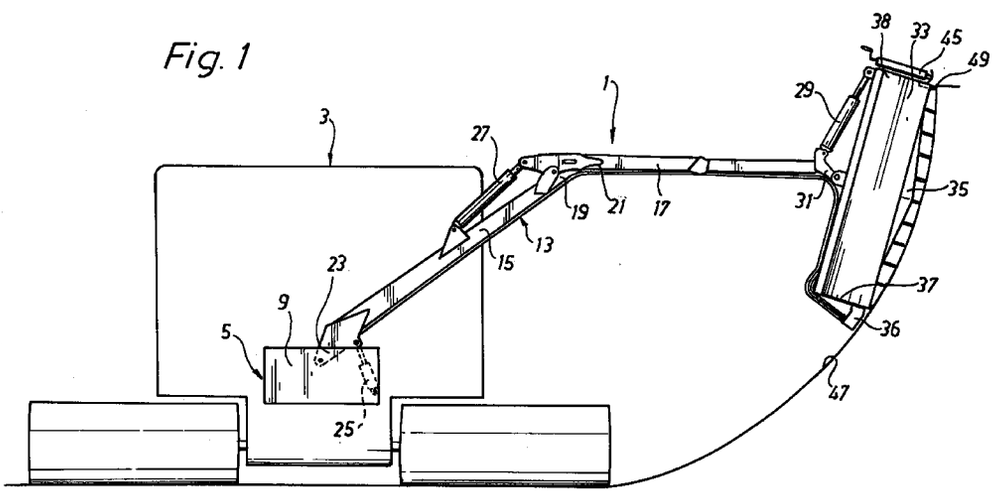
(54) Device, working roll and method for working snow

(57) The invention relates to a device for forming a curved snow surface. The device (1) comprises an arm (13) which has at least two subarms (15, 17), which are hingedly interconnected for relative angling thereof in one plane, a connecting means (5) fixed to one end (23) of the arm and adapted to connect the device to a piste vehicle, a holder (43) which is hingedly fixed to the other end (31) of the arm for angling, in said plane, the holder in relation to the arm, and a working roll (35) which is rotatably suspended from the holder and is rotatable about its own axis which is parallel with said plane. The circumferential surface of the working roll is provided with working projections (43) which are designed and arranged in such manner that their tips, as the working roll rotates, touch a fictitious, spool-shaped surface surrounding the roll.

The invention also concerns a method and a working roll for forming a curved snow surface.

Fig. 1



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Description

Field of the Invention

The present invention relates to a device for working snow, and more specifically a device and a working roll for forming a curved snow surface according to the preambles to claims 1 and 5, respectively. The invention also concerns a method for forming a curved snow surface according to claim 9.

Background Art

Prior-art devices for forming curved snow surfaces are used above all to form and condition ramp-shaped and approximately semicylindrical snow formations for snow-board racing.

A prior-art device of this type is supported by a caterpillar vehicle intended for use on pistes and comprises an endless belt which is provided with cams and which travels over rolls arranged in an arch. The arch has the radius of curvature that is desired for the snow surface. The length of the arch corresponds to the height of the curved snow surface. The cams scrape the snow surface from below upwards and thereby form an even, curved surface in a portion corresponding to the total engaging surface of the belt. With a view to forming a ramp with a greater length in the line of slope of the piste than the width of the belt, the vehicle is advanced along the snow surface while simultaneously scraping the surface.

Unfortunately the device functions unsatisfactorily on a hard base. This is due to the cams not managing to break ice and snow that is frozen hard, largely because the engaging force will be insignificant as the total engaging surface of the cams is large, but also due to the fact that the abutment force against the hard projections protruding from the snow is relatively small since the speed at which the belt travels is fairly low. The large engaging surface and the total size and weight of the device also causes considerable forces in the attachment of the device to the vehicle. Moreover, the device is inflexible in so far as it can only be used to produce a single shape, i.e. a single radius of curvature and a single height of the snow formation.

Another known device is also intended to be supported by a piste vehicle and has a large number of short rolls which are interconnected so as to form a chain. The chain is formed to an arch having the radius of curvature that is desired for the snow surface. Like the other known device, this device covers the entire height of the surface. Each roll rotates about its own axis and is provided with many small projections which tear up and level the surface. This device is more effective on a hard base thanks to the rapidly rotating rolls and the more effective projections. All the same, the device is not as effective as is desirable. Further it is complicated with its many small rolls and is therefore very expensive. The mutual connections of the rolls are fragile and unprotected and are frequently damaged. The device is large and heavy and suffers, like the other known device, from drawbacks related thereto. Like the other known device, this too is inflexible.

Summary of the Invention

The objects of the invention are to provide a device for working a curved snow surface, said device being simple, light and small as well as inexpensive and functioning in a better way than the known devices on a hard base and not being limited to the forming of a single shape or a single height of the surface.

The objects are achieved by a device according to claim 1 of the appended claims.

In working the snow surface, the spool shape results in a curved surface. By the subarms being hingedly connected, a foldable arm is obtained, by means of which the working roll can be set in different positions. As a result, a single roll is sufficient, which need not cover the entire height of the surface but can be made considerably shorter so as to form a large, curved surface, such as a side of a half pipe. The roll is moved back and forth across the surface, one subportion at a time, while adjusting the angle between the subarms before forming a new subportion. In contrast to the prior-art devices, the present device is usable for forming surfaces of different height and surfaces with different radii of curvature.

Brief Description of the Drawings

The invention and additional advantages will now be described in more detail by way of embodiments and with reference to the accompanying drawings, in which

Fig. 1 is a schematic view of an embodiment of the device mounted on a piste vehicle;
Fig. 2 is a schematic top plan view of a working roll which constitutes a part of the device in Fig. 1; and
Fig. 3 is a schematic cross-sectional view of the roll.

Description of Embodiments

The inventive device is used above all for forming so-called half pipes. A half pipe is a furrow extending in the line of slope of the piste and often being essentially semicylindrical. In any case, it has side walls, whose surfaces are curved with a certain radius of curvature. The furrow is used by people practising snowboard racing. A variant is a ramp whose surface is curved in a corresponding fashion. The device is also generally usable for forming curved snow surfaces.

A preferred embodiment of the device is, as shown in Fig. 1, formed as an apparatus 1, which is connectible to a piste vehicle. The piste vehicle is indicated at 3. The apparatus therefore has a connecting means or vehicle

mounting 5 which is connectible to the apparatus mounting of the piste vehicle or piste caterpillar 3. The vehicle mounting 5 comprises in conventional manner a coupling plate 9 and hydraulic connections. The device 1 further comprises an arm 13 which is made in two pieces with a first subarm 15, which by those skilled in the art and below is referred to as a boom, and a second subarm 17, which by those skilled in the art and below is referred to as a stick. The boom 15 and the stick 17 are hingedly connected to each other at first ends 19, 21, respectively.

At the other end 23 of the boom 15, the vehicle mounting 5 is hingedly attached, and a first piston-and-cylinder assembly 25 is at its ends hingedly fixed to the plate 9 and the boom 15, respectively, at a distance from said other end 23. The boom 15 and, thus, the entire arm 13 are consequently vertically adjustable. A second piston-and-cylinder assembly 27 is fixed between the boom 15 and the stick 17 and is used to adjust the angle therebetween.

At the other end 31 of the stick 17, a holder 33 is hingedly attached. A working roll 35 is rotatably suspended from the holder 33. The working roll 35 is caused to rotate by a hydraulic engine 36 which is mounted in the holder 33 at one end 37 thereof. Suitable speeds of rotation are about 1000-1500 rpm. A third piston-and-cylinder assembly 29 is hingedly fixed between the other end 37 of the holder 33 and the stick 17 and is used to adjust the angle between the stick 17 and the holder 33.

The piston-and-cylinder assemblies 25, 27, 29 constitute hydraulic control means which are connected to the hydraulic system of the piste vehicle 3 via the hydraulic connections of the vehicle mounting 5.

The working roll 35, which is also called snow cutter, has a body 39 in the form of two identical truncated cones which are joined base to base. In other words, the working roll has a maximum diameter in the centre and tapers conically towards its ends. The body 39 is at its ends fixed to a central tube 42. Besides the body 39 is connected to the central tube via three disks 40 which are arranged transversely of the body 39 at 1/4, 1/2 and 3/4 of the length of the body 39. The disks 40 ensure that the body 39 is positioned concentrically so as to avoid lack of equilibrium as the roll 35 rotates. Through the central tube 42 extends the shaft 41 of the working roll 35, one end of the shaft being connected to the hydraulic engine 36 via a coupling. The shaft 41 is fixedly connected to the central tube 42. From the circumferential surface of the body 39 extend a number of projections 43 radially outwards. The projections or teeth 43 are helically arranged round the working roll 35. They are plate-shaped with a maximum width in the circumferential direction or somewhat obliquely in relation thereto. The lengths of the teeth 43 are adjusted such that, as the working roll 35 rotates, their free ends touch a fictitious surface which surrounds the working roll 35 and which is curved in the longitudinal direction of the working roll 35. The surface is preferably spool-shaped. The radius of curvature is suitably selected such that a range of radii of a half pipe can be achieved. A surface supporting means 45 which is extendible and retractable, preferably telescoping, is mounted at the other end of the holder 33 and, more specifically, on the end wall thereof.

Below follows a description of the use of the device, with reference to the illustrated and preferred embodiment.

The curved snow surface which is to be formed, for example, levelled, is designated 47. The working roll 35 is caused to rotate by means of the hydraulic engine 36. First the arm 36 is adjusted by means of the hydraulics operating the control means 25, 27, 29, such that the upper end of the roll 35 is on a level with the upper edge 49 of the snow surface 47. The holder 35 is angled such that a portion of the snow surface closest to its upper edge 49 becomes vertical by the forming. The driver of the piste vehicle 3 then drives along the surface 47, downhill or uphill. This results in a completed subportion, below referred to as a band, of the surface 47. When the end of the surface is reached, the stick 17 is angled downwards such that the upper end of the roll 35 is on a level with the lower edge of the formed band. A new band is formed. The entire surface 47 is formed correspondingly.

To facilitate the orientation of the roll 35 so as not to remove too much snow, the driver can extend the supporting means 45, which at its end has a slide member 46, such that it abuts against the completed part of the surface.

By the teeth 43 being helically arranged, torn-up snow is moved in the longitudinal direction of the roll 35. In this connection, the roll should be arranged such that the snow is moved upwards.

The easiest surface to form is one having precisely the radius of curvature for which the teeth 23 are adapted. The lengths of the boom 15 and the stick 17 are adjusted to that radius, such that, when adjusting the arm 13 to form a new band, it is only necessary to change the angle between the boom 15 and the stick 17 by means of the piston-and-cylinder assembly 27. However, in contrast to the use of the prior-art devices, it is quite possible and almost as easy to form surfaces with other radii of curvature within a wide range. This only requires compensation by adjusting the holder 25 and the boom 15 by means of the piston-and-cylinder assemblies 29 and 25, respectively.

Alternative Embodiments

The above specification constitutes but a non-limiting example of how the inventive device can be designed. Many modifications are feasible within the scope of the invention as defined in the appended claims. Below follow some examples of such modifications.

Another alternative embodiment has a working roll with a circumferential surface which is curved in the longitudinal direction with a suitable radius of curvature. The preferred embodiment as illustrated, however, is easier and consequently less expensive to manufacture. Admittedly, teeth of different lengths are instead necessary, but this is less costly to accomplish.

Another alternative embodiment has teeth mounted in rows which extend along the working roll. However, this does not have the advantage of being able to feed the snow along the working roll.

Further alternative embodiments have spokes or the like instead of the disks 40.

Claims

1. A device for forming a curved snow surface, **characterised** in that it comprises an arm (13) having at least two subarms (15, 17), which are hingedly interconnected for relative angling thereof in one plane, a connecting means (5) fixed to one end (23) of the arm and adapted to connect the device to a piste vehicle (3), a holder (33) which is hingedly attached to the other end (31) of the arm for angling, in said plane, the holder (33) in relation to the arm (13), and a working roll (35) which is rotatably suspended from the holder (33) for rotation about its own axis, which is essentially parallel with said plane; and that the circumferential surface of the working roll (35) is provided with working projections (43) which are designed and arranged in such manner that their tips touch a fictitious, spool-shaped surface surrounding the working roll (35).

2. A device as claimed in claim 1, **characterised** in that the connecting means (5) is hingedly connected to the arm (13), and that a piston-and-cylinder assembly (25) is at its ends hingedly fixed to the connecting means (5) and the arm (13), respectively, at a distance from the one end (23) thereof.

3. A device as claimed in claim 1 or 2, **characterised** in that a piston-and-cylinder assembly (29) is at its ends fixed to the holder (33) at one end (38) thereof and to the arm (13), respectively, at a distance from the other end (31) thereof.

4. A device as claimed in any one of the preceding claims, **characterised** in that it comprises a surface supporting means (45) which is extendible and retractable transversely of the working roll (35).

5. A working roll for forming a curved snow surface, which is adapted to rotate about its own axis, **characterised** in that the circumferential surface of the working roll (35) is provided with working projections (43) which are designed and arranged in such manner that their tips, as the working roll (35) rotates, touch a fictitious, spool-shaped surface surrounding the working roll (35).

6. A working roll as claimed in claim 5, **characterised** in that it has a maximum diameter in the centre and tapers conically towards its ends.

7. A working roll as claimed in claim 5 or 6, **characterised** in that the working projections (43) are helically arranged round the circumferential surface.

8. A working roll as claimed in any one of claims 5-7, **characterised** in that it comprises a central tube (42) extending between its ends, a shaft (41) which extends through the central tube (42) and projects from the ends of the central tube (42), and a sleeve-shaped body (39) which is fixed to the central tube (42) and whose circumferential surface constitutes the circumferential surface of the working roll (35).

9. A method for forming a curved snow surface, **characterised** by the step of moving a rotating working roll (35), which is provided with working projections (43) and is mounted on a movable arm (13) connected to a piste vehicle (3), across the snow surface, the working projections (43) engaging the snow surface, along juxtaposed subportions of the snow surface, one subportion at a time, the working projections (43) being designed and arranged on the circumferential surface of the working roll (35) in such manner that their tips touch a fictitious, spool-shaped surface surrounding the working roll.

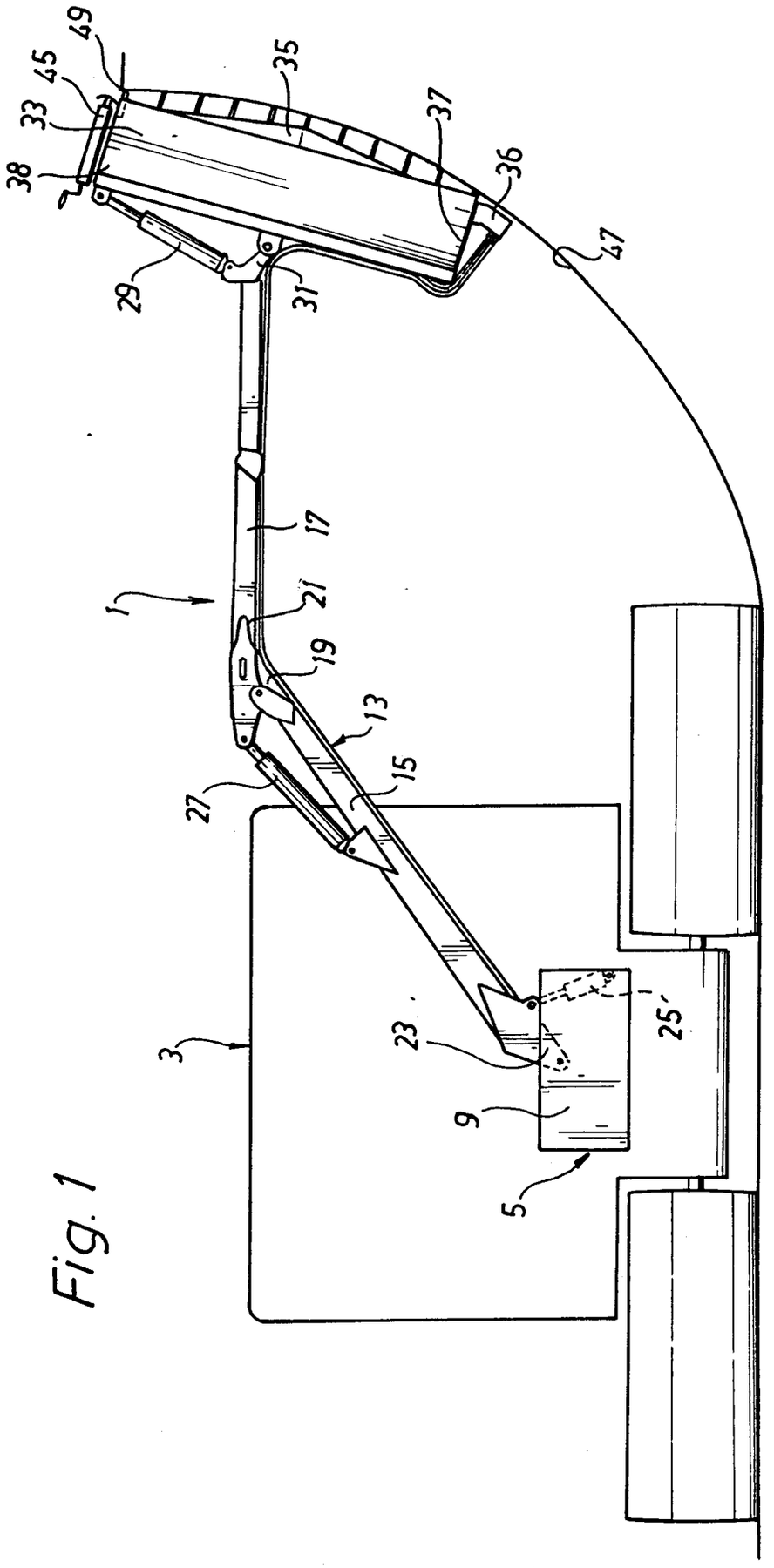

Fig. 1

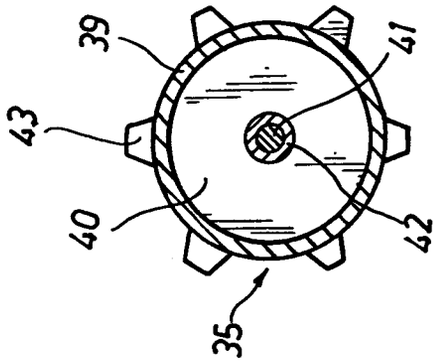

Fig. 3

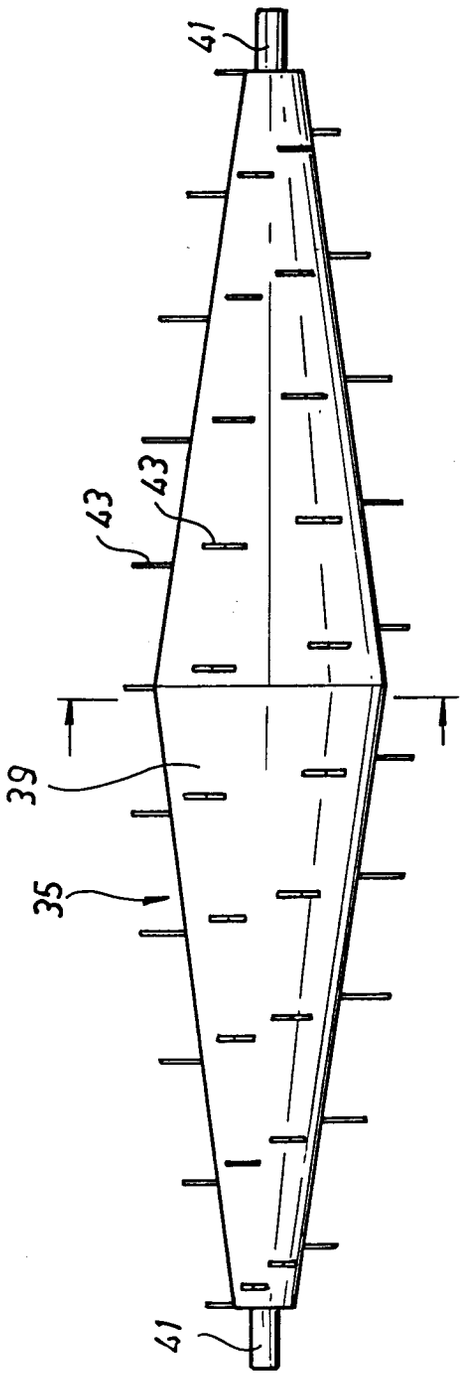

Fig. 2