(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 735 196 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.10.1996 Bulletin 1996/40

(51) Int. Cl.[6]: **E01H 4/02**

(21) Application number: **96104745.3**

(22) Date of filing: **26.03.1996**

(84) Designated Contracting States:
AT CH DE FI FR IT LI SE

(30) Priority: **30.03.1995 JP 72703/95**
10.11.1995 JP 292588/95
12.03.1996 JP 55199/96

(71) Applicant: **MHI SAGAMI TECHNOLOGY & CONTROL ENGINEERING CO., LTD.**
Sagamihara-shi, Kanagawa-ken (JP)

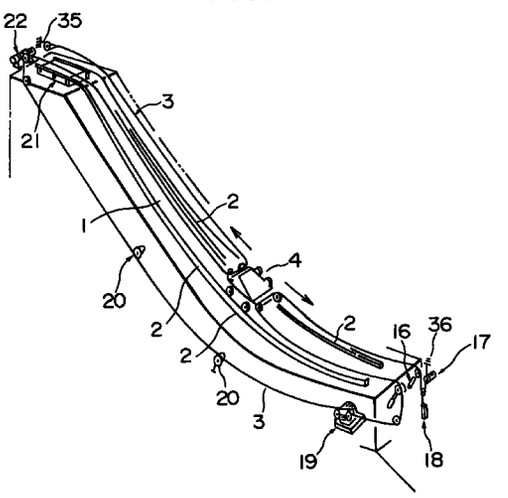
(72) Inventor: **Hangai, Kousei,**
c/o General Purpose Mach. Div.
Sagimihara-shi, Kanagawa-ken (JP)

(74) Representative: **Blumbach, Kramer & Partner**
Patentanwälte
Radeckestrasse 43
81245 München (DE)

(54) In line sliding surface forming apparatus for schanze, groove forming apparatus for in line sliding surface, in line sliding surface adjusting method, and groove forming method

(57) An in line sliding surface forming apparatus for a schanze comprises a cable extending along two parallel rails (2) disposed on both sides of the in line sliding surface (1) for the schanze, an in line unit (4) for traveling on the guide rails (2), a snow removing/pressing plate (5) disposed at a lower edge portion on a valley side of the in line unit and adapted for removing excessive snow on the in line sliding surface and for pressing and smoothing the remaining snow on the in line sliding surface, the snow removing/pressing plate (5) being raised and lowered, two rotating cutters (6) disposed at upper edge portions on a mountain side of the in line unit (4) and adapted for forming two parallel approach grooves (7) along the in line sliding surface being pressed and smoothed, an in line unit driving unit (16) disposed on the in line unit (4), linked with the cable (3), and upward and downward traveled along the in line sliding surface, and a rotating cutter driving unit for driving the rotating cutters (6), wherein the in line unit is upward and downward traveled through the cable so as to form the in line sliding surface.

FIG. I



EP 0 735 196 A1

Description

The present invention relates to an in line sliding surface forming apparatus for removing and pressing snow on an in line sliding surface of a schanze so as to form an in line sliding surface, a groove forming apparatus for the in line sliding surface, a sliding surface adjusting method, and a groove forming method.

Although many schanzes are formed of natural steep slops, artificial schanzes made of steel frames have been built in recent years. Much snow is stacked on a schanze so as to form a long steep slope. For example, the length of only an in line sliding surface is normally in the range from 70 m to 90 m.

To improve records of ski jumping events, increase the ski players, and reinforce the skills of the ski players, they should have enough exercises. To do that, an in line sliding surface with excellent sliding characteristics such as smoothness should be quickıy, safely, and securely provided.

The in line sliding surfaces of the schanzes for jumping events are not mechanically formed. In other words, snow on the in line sliding surfaces is not mechanically removed. In addition, approach grooves are not mechanically formed. Although the work for forming an in line sliding surface and approach grooves is dangerous, it should be manually performed by many workers who wear climbing irons and lifelines. They should remove snow on both sides of the in line sliding surface. Thereafter, they adjust and press the snow until a predetermined height of snow is obtained. Next, a test skier should slide on the formed in line sliding surface several times so as to form approach grooves.

When the in line sliding surface of the schanze is manually formed, the following problems will arise.

(1) To form the in line sliding surface, many workers should be employed for a long time. Thus, the in line sliding surface cannot be quickly formed. In addition, since the in line sliding surface should be manually formed, it may be damaged by the workers.

(2) Since the in line sliding surface should be formed on a steep slope, the workers should work in a dangerous working condition. In addition, due to such a bad working condition, the in line sliding surface cannot be precisely formed.

(3) Since the in line sliding surface is manually formed by many workers, it cannot be equally adjusted. Thus, the approach grooves are deformed and unsmoothed to some extent. Consequently, when the players slide on the in line sliding surface, the ski boards vibrate. Thus, it is difficult to improve the records of games. In particular, it is difficult to form approach sliding grooves with a constant depth on the in line sliding surface.

(4) When the sliding surface is manually formed and adjusted, it takes a long time. Thus, the ski jumping events are largely affected by weather conditions. Consequently, the players cannot have enough exercises. In addition, equal game conditions cannot be satisfied.

Thus, since the in line sliding surface should be manually formed by many workers, the construction cost becomes high. In addition, the approach sliding grooves should be equally formed. Consequently, the needs for mechanically forming the in line sliding surface are strong.

In other words, to improve the records of the jumping events, increase the jump players, and reinforce the skills of the jump players, in line sliding surfaces with excellent sliding characteristics and much exercise time are required for the jump players. Many concerned people have pointed out the necessity of facilities that can quickıy, safely, and securely form in line sliding surfaces.

According to the decision of International Ski League about the duty of mechanical forming of in line sliding surfaces for jumping events, individual national ski leagues should provide such facilities.

By solving the problems of the jump facilities such as preparation of mechanical facilities, labor reduction, and quick and safety formation of in line sliding surface, the improvement of the records of the jumping events, the increase of the exercise time, and the increase of jump players will be accomplished.

To solve such problems, the inventor of the present invention proposed an in line sliding surface forming apparatus for a schanze and an in line sliding surface adjusting method as Japanese Patent Application No. 7-72703.

However, according the art, when approach sliding grooves are formed, groove shoulder portions and groove bottom edge portions are clogged with cut snow powder. Thus, the grooves cannot be precisely formed.

It is preferable for jumping events to form all the approach sliding grooves in the entire length of the in line sliding surface with unsmoothed snow. However, it is difficult to manually adjust the groove bottom portions in equal conditions.

To solve such a problem, the inventor of the present invention further proposed as a modification of Japanese Patent Application No. 7-72703 a groove forming apparatus for an in line sliding surface of a schanze and an approach sliding groove forming method as Japanese Patent Application No. 7-292588.

However, although snow conditions vary such as new snow, dried snow, watery snow, and unsmoothed snow, the in line sliding surface should be equally formed regardless of the snow conditions.

The present invention is made from the above-described point of view.

A first object of the present invention is to provide an in line sliding surface forming apparatus, an approach sliding groove forming apparatus, a sliding surface forming method, and a groove forming method for mechanically forming an in line sliding surface for a schanze without manual work.

A second object of the present invention is to provide an in line sliding surface forming apparatus, an approach sliding groove forming apparatus, a sliding surface forming method, and a groove forming method for quickly and safely forming an in line sliding surface without labor work.

A third object of the present invention is to provide an in line sliding surface forming apparatus, an approach sliding groove forming apparatus, a sliding surface forming method, and a groove forming method for precisely forming an in line sliding surface regardless of the snow conditions.

A first aspect of the present invention is an in line sliding surface forming apparatus for a schanze, comprising a cable extending along two parallel rails disposed on both sides of the in line sliding surface for the schanze, an in line unit for traveling on the guide rails, a snow removing/pressing plate disposed at a lower edge portion on a valley side of the in line unit and adapted for removing excessive snow on the in line sliding surface and for pressing and smoothing the remaining snow on the in line sliding surface, the snow removing/pressing plate being raised and lowered, two rotating cutters disposed at upper edge portions on a mountain side of the in line unit and adapted for forming two parallel approach grooves along the in line sliding surface being pressed and smoothed, an in line unit driving unit disposed on the in line unit, linked with the cable, and upward and downward traveled along the in line sliding surface, and a rotating cutter driving unit for driving the rotating cutters, wherein the in line unit is upward and downward traveled through the cable so as to form the in line sliding surface.

A second aspect of the present invention is an in line sliding surface forming method for a schanze, comprising the steps of disposing guide rails on both sides of the in line sliding surface for the schanze, traveling an in line unit on the in line sliding surface for the schanze, the in line unit having a snow removing/pressing plate and rotating cutters, the snow removing/pressing plate being adapted for removing excessive snow on the in line sliding surface and for pressing and smoothing the remaining snow on the in line sliding surface, the rotating cutters being adapted for forming two ski sliding grooves on the in line sliding surface being pressed and smoothed, lowering the snow removing/pressing plate and raising the rotating cutters so as to remove and press the snow on the in line sliding surface when the in line unit is traveled downward from a mountain side to a valley side, and raising the snow removing/pressing plate and lowering the rotating cutters so as to form the ski sliding grooves when the in line unit is traveled upward from the valley side to the mountain side.

A third aspect of the present invention is a groove forming apparatus for forming grooves on an in line sliding surface formed by an in line sliding surface forming apparatus for a schanze, having a cable extending along two parallel rails disposed on both sides of the in line sliding surface for the schanze, an in line unit for traveling on the guide rails, a snow removing/pressing plate disposed at a lower edge portion on a valley side of the in line unit and adapted for removing excessive snow on the in line sliding surface and for pressing and smoothing the remaining snow on the in line sliding surface, the snow removing/pressing plate being raised and lowered, two rotating cutters disposed at upper edge portions on a mountain side of the in line unit and adapted for forming two parallel approach grooves along the in line sliding surface being pressed and smoothed, an in line unit driving unit disposed on the in line unit, linked with the cable, and upward and downward traveled along the in line sliding surface, and a rotating cutter driving unit for driving the rotating cutters, wherein the in line unit is upward and downward traveled through the cable so as to form the in line sliding surface, the groove forming apparatus comprising, groove shaver holders traveled in the same direction as the rotating cutters, disposed at lower edge portions of the in line unit, the groove shaver holders being raised and lowered, the width of each of the groove shaver holders being larger than each of the grooves formed by the rotating cutters, the groove shavers being formed in a sled shape, and groove shavers secured to lower surfaces of the groove shaver holders, the width of each of the groove shavers being nearly the same as the width of each of the grooves formed by the rotating cutters, the groove shavers having lattice shaped saw teeth.

A fourth aspect of the present invention is a groove forming method for forming grooves on an in line sliding surface for a schanze, comprising the steps of disposing two parallel guide rails on both sides of the in line sliding surface for the schanze, traveling an in line unit on the in line sliding surface for the schanze through a cable, the in line unit having rotating cutters, a snow removing/pressing plate, and groove shaver holders, lowering the snow removing/pressing plate disposed at a lower edge portion of the in line unit and raising the rotating cutters disposed at an upper edge portion of the in line unit and the groove shaver holders disposed at lower edge portions of the in line unit, traveling the in line unit to the top on a mountain side of the schanze, traveling the in line unit downward along the guide rails along the in line sliding surface of the schanze so as to remove excessive snow on the in line sliding surface, pressing and smoothing the remaining snow on the in line sliding surface, traveling the in line unit downward on a valley side of the in line sliding surface, raising the snow removing/pressing plate disposed at the lower edge portion of the in line unit when the in line unit reaches a lower edge portion on the valley side of the in line sliding surface, lowering the rotating cutters disposed at the upper edge portions of the in line unit and the groove shaver holders disposed at the lower edge portions thereof, reversely driving the guide rope, forming approach grooves along the in line sliding surface by a drive force of the rotating cutters, pressing groove shoulder portions and groove bottom edge portions of the approach grooves with the groove shaver holders,

and forming unsmoothed snow on approach groove bottom portions with groove shavers.

According to the present invention, the in line unit is disposed at the top portion on the mountain side of the schanze. At this point, the snow removing/pressing plate disposed at the lower edge portion of the in line unit is lowered. The cable is driven along the guide rails so as to travel the in line unit to the valley side. Thus, excessive snow on the in line sliding surface is removed and the remaining snow is pressed so that a predetermined height of snow is obtained.

When the angle of the snow removing/pressing plate 5 is varied while the in line unit is being traveled downward to the valley side, the cutting edge 5b and the press plate 5c disposed at the lower edge portion of the snow removing/pressing plate 5 can equally remove and press snow regardless of snow conditions such as new snow, dried snow, watery snow, and unsmoothed snow.

The rotating cutters of the in line unit are lowered so as to form two parallel approach grooves on the in line sliding surface from the valley side to the mountain side.

When the in line unit is traveled upward from the valley side to the mountain side, the rotating cutters and the groove shaver holders are lowered. The side walls of the grooves formed by the rotating cutters are pressed by the groove shaver holders and the groove shavers so as to round the groove shoulders. In addition, the groove bottom edge portions are flatly formed. Moreover, the groove bottom portions are formed of unsmoothed snow.

When the in line unit is traveled upward from the valley side to the mountain side, the snow removing plates disposed before and after wheels are lowered so as to remove excessive snow produced by the rotating cutters. The groove side walls and the groove upper edge portions are pressed by the groove shaver holders and the groove shavers so as to form the groove bottom portions with unsmoothed snow so as to improve the accuracy of the sliding grooves 7.

These and other objects, features and advantages of the present invention will become more apparent in light of the following detailed description of a best mode embodiment thereof, as illustrated in the accompanying drawings.

Fig. 1 is a perspective view showing the overall structure of an in line sliding surface forming apparatus for a schanze according to the present invention;

Fig. 2 is a perspective view showing the in line sliding surface forming apparatus according to the present invention;

Fig. 3 is a partial perspective cut-out view showing the in line sliding surface forming apparatus according to the present invention;

Fig. 4 is a top view showing the in line sliding surface forming apparatus according to the present invention;

Fig. 5 is a side view showing the in line sliding surface forming apparatus according to the present invention;

Fig. 6 is an enlarged view for explaining a snow removing/pressing plate;

Figs. 7A and 7B are schematic diagrams for explaining changes of the snow removing/pressing plate;

Fig. 8 is a side view showing an approach groove forming apparatus according to the present invention;

Fig. 9 is a partial cut-out view showing the approach groove forming apparatus according to the present invention;

Fig. 10 is a bottom view showing groove shaver holders and groove shavers according to the present invention;

Fig. 11 is an enlarged perspective view showing the bottom of the groove shaver according to the present invention;

Fig. 12 is an enlarged sectional view taken along line A - A shown in Fig. 10;

Fig. 13A is a schematic diagram for explaining approach grooves according to the present invention in the case that the grooves have not been formed;

Fig. 13B is a schematic diagram for explaining a groove forming operation; and

Fig. 13C is a schematic diagram for explaining the grooves that have been formed.

Fig. 1 shows an in line sliding surface forming apparatus for a schanze according to the present invention. Referring to Fig. 1, a pair of parallel guide rails 2 are disposed on both sides of an in line sliding surface 1 of a schanze. A cable 3 extends along the guide rails 2. An in line unit 4 of the sliding surface forming apparatus is traveled by the cable 3 from the mountain side to the valley side and vice versa along the in line sliding surface 1 so as to remove and press snow on the in line sliding surface 1 and form approach grooves.

The in line unit 4 has a snow removing/pressing plate 5, a pair of rotating cutters 6, a pair of groove shaver holders 8, and a pair of groove shavers 9. The snow removing/pressing plate 5 presses and smooths snow on the in line sliding surface 1. The rotating cutters 6 form two approach grooves 7 on the in line sliding surface 1. The groove shaver holders 8 travel in the same direction as the rotating cutters 6. The groove shaver holders 8 press approach grooves 7 so as to round the shoulders thereof and smooth the edge portions thereof. In addition, the groove shaver holders 8 form the groove bottom portions with unsmoothed snow. In Fig. 1, reference numeral 16 is a pulley expanding/shrinking unit. Reference numeral 17 is a winch. Reference numeral 18 is a tension of the cable 3. Reference numeral 19 is a driving unit of the cable 3. Reference numeral 20 is a guide pulley of the cable 3.

Reference numeral 21 is a storage table of the in line unit 4. Reference numeral 22 is an emergency winch.

As shown in Figs. 2 to 5, the in line unit 5 according to the embodiment is disposed on the parallel guide rails 2 on both the sides of the in line sliding surface 1 through four wheels 13. The snow removing/pressing plate 5 is disposed at the lower edge portion on the valley side of the in line unit 4. The snow removing/pressing plate 5 removes excessive snow on the in line sliding surface 1 and presses and smooths the rest of the snow thereon. The snow removing/pressing plate 5 can be raised and lowered. With an angle adjusting unit 40, the angle of the snow removing/pressing plate 5 can be adjusted corresponding to the snow conditions. A pair of rotating cutters 6 are disposed at the upper edge portion on the mountain side of the in line unit 4. The rotating cutters 6 form the pressed and smoothed snow surface - namely, the two approach grooves 7 in parallel with the in line sliding surface 1. The rotating cutters 6 can be raised and lowered. The groove shaver holders 8 are disposed at the lower edge portions of the in line unit 4 and on the rear side of the snow removing/pressing plate 5. The groove shaver holders 8 are traveled in the same direction as the rotating cutters 6. The groove shaver holders 8 have relevant groove shavers 9. The groove shavers 9 have lattice shaped saw teeth. The driving unit 19 of the cable 3 travels the in line unit 19 upward and downward along the in line sliding surface 1 so as to form the in line sliding surface 1 and the approach grooves 7. In Fig. 2, reference numerals 37 and 38 are pulleys of the cable 3. The pulleys 37 are disposed on the in line unit 4.

As shown in Figs. 2 to 7, the snow removing/pressing plate 5 according to the embodiment is disposed at the lower edge portion on the valley side of the in line unit 4. The snow removing/pressing plate 5 has a blade 5a, a cutting edge 5b, and a press plate 5c. The snow removing/pressing plate 5 removes snow on the in line sliding surface 1. The snow removing/pressing plate 5 is disposed on a lift guide 10a of the in line unit 4 through a lift bracket 50. The snow removing/pressing plate 5 can be raised and lowered. In other words, the snow removing/pressing plate 5 is disposed to an upper blade 51 and a lower blade 52 secured to the lift bracket 50 with an upper guide 53 and a lower guide 54. The angle of the snow removing/pressing plate 5 is adjusted with a fulcrum of a fulcrum pin 55 of the lower blade 52 and the lower guide 54. The upper blade 51 has a plurality of insertion holes 51a used to vary the angle of the snow removing/pressing plate 5. By selecting one of the insertion holes 51a, the angle of the snow removing/pressing plate 5 can be varied.

As described above, the snow removing/pressing plate 5 has the blade 5a, the cutting edge 5b, and the press plate 5c. The blade 5a is disposed at the lower edge portion on the valley side of the in line unit 4. The blade 5a removes snow on the in line sliding surface 1 from the mountain side to the valley side. The cutting edge 5b is disposed at the lower edge portion of the blade 5a. The cutting edge 5b removes snow on the in line sliding surface 1. The press plate 5c is disposed behind the cutting edge 5b. The press plate 5c has a lightly curved surface. The width of the blade 5a is wider than the width of each of the two guide rails 2 so as to equally remove and press the snow. Thus, snow on the in line sliding surface 1 is removed by the blade 5a. While the in line unit is traveled downward, the in line sliding surface is cut with a predetermined height by the cutting edge 5b of the blade 5a. Thereafter, the curved surface of the press plate 5c behind the cutting edge 5b presses the snow surface and presses the snow on the in line sliding surface 1.

Although the snow removing/pressing plate 5 may be fixed, since the snow on the in line sliding surface 1 varies as in new snow, dried snow, watery snow, and unsmoothed snow, the angle of the snow removing/pressing plate 5 is varied by the angle adjusting unit 40. Thus, the snow removing/pressing plate 5 can be varied corresponding to the snow conditions.

As shown in Fig. 6, the angle adjusting unit 40 is rotatably secured at the lower edge portion on the valley side of the in line unit 4 through the lift bracket 50 with the link pin 55. The cutting edge 5b and the press plate 5c are integrally disposed at the lower edge portion of the snow removing/pressing portion 5. The upper blade 51 is disposed at the upper portion of the snow removing/pressing plate 5. A bracket 56 is disposed at the lower blade 52. By inserting the pin 57 into a proper one of the pin insertion holes 51a, the angle of the snow removing/ pressing plate 5 can be varied. With the pin 57, the snow removing/pressing plate 5 is stably secured. In addition, by selecting a proper one of the pin insertion holes 51a, the angle of the snow removing/pressing plate 5 can be varied. It should be noted that the angle of the snow removing/pressing plate 5 may be varied with a hydraulic jack, a turn buckle, or the like.

By selecting a proper one of the stopper pin insertion holes 51a corresponding to the snow conditions, the angle of the snow removing/pressing plate 5 can be freely varied. For example, as shown in Fig. 7A, when the snow on the sliding surface is unsmoothed snow in early spring, the pin 57 is inserted into an outer one of the stopper pin insertion holes 51a. Thus, the cutting edge 5b is raised and the snow pressing force is decreased. On the other hand, as shown in Fig. 7B, when the snow on the sliding surface is new snow or frozen, the pin 57 is inserted into an inner one of the stopper pin insertion holes 51a. Thus, the snow pressing force is increased.

The snow removing/pressing plate 5 is raised and lowered by a lifting unit 10 of the in line unit 4. The lifting unit 10 supports the lift bracket 50. The lifting unit 10 has a roller 10b, a lift rod 10c, a lift jack 10d, and a handle 10e disposed on the lift guide 10a. The lifting unit 10 is disposed at the lower edge portion on the valley side of the in line unit 1. By turning a handle 9a, the snow removing/pressing plate 5 is raised or lowered. As the

snow removing/pressing plate 5 is raised or lowered, the angle of the blade 5a is adjusted by the angle adjusting unit 40 corresponding to the snow conditions. Thus, the in line sliding surface 1 can be precisely adjusted corresponding to the snow conditions.

Each of the rotating cutters 6 is driven by a driving unit 8 and a lifting unit 11. The driving unit 8 drives the rotating teeth 6d that forms the approach groove 7 on the in line sliding surface 1. The lifting unit 11 raises and lowers the rotating teeth 6d along with the driving unit 8. The rotating cutters 6 are disposed at the upper edge portions on the mountain side of the in line unit 4 through the lifting unit 11, which has the roller 6b, the lift rod 6c, the lift jack 6f, and the handle 6g that disposed on the lift guide 6a. The rotating cutters 6 are raised and lowered by the lifting unit 11. By the driving unit 8, two parallel approach grooves 7 are formed on the in line sliding surface 1. By adjusting the lifting unit 11, the depth of the approach grooves 7 is adjusted. By the driving unit 8, the groove forming operation is controlled.

The rotating cutters 6 are connected to the driving unit 8 through a reduction gear 15. As the cutter teeth 6d rotate in the arrow direction, the rotating cutters 6 cut the approach grooves 7. Cut snow powder produced by the rotating cutters 6 is stored in trays 16 disposed on the rear side of the rotating cutters 6. The trays 16 prevent cut snow powder produced by the rotating cutters 6 from entering the approach grooves 7.

As shown in Fig. 3, the approach grooves 7 are formed by the groove shaver holders 8 and the groove shavers 9. The groove shaver holders 8 are disposed at the lower edge portions of the in line unit 4 and formed in a sled shape. The groove shaver holders 8 can be raised and lowered. The width of each of the groove shaver holders 8 is wider than the width of each of the approach grooves 7. Each of the groove shavers 9 is disposed on the lower surface of the relevant groove shaver holder 8. The width of each of the groove shaver holder 8 and the groove shaver 9 is nearly the same as the width of each of the rotating cutters 6 disposed on the lower surfaces of the groove shaver holders 8. The groove shaver holders 8 are secured to the groove shavers 9 having lattice shape saw teeth. In Fig. 3, reference numeral 12c is a lift rod. Reference numeral 12d is a roller. Reference numeral 12e is a link bracket. Reference numeral 12f is a link. Reference numeral 12g is a link bar. Reference numeral 12h is a universal rod. Reference numeral 12i is a worm. Reference numeral 12j is a machine screw for securing the groove shaver 9 to the groove shaver holder 8. Reference numeral 12k is a snow removing plate for removing snow powder produced by the pressure and friction of the groove shaver holder 8 and the groove shaver 9.

The groove shaver holders 8 are secured to the lift bracket 50 on the rear side of the snow removing/pressing plate 5 of the in line unit 4. The groove shaver holders 8 are secured to the lift bracket 50 through the link bracket 12e and the link 12f. The pressure for forming the approach grooves 7 is controlled by the handle 12b that is connected to the link 12f and that changes the position of the groove shaver holders 8 through the reduction gear, the universal rod 12h, the link lever 12g, and the link rod 12a. The groove depth is controlled by changing the thickness of the groove shavers 9. When the approach grooves 7 are not formed, the handle 12b is operated through the link 12f so as to raise the in line unit from the snow surface on the cut surface of the snow removing/ pressing plate 5. The sled shape grooves are formed by the shaver holders 8 through the machine screw 12i. The groove shaver holders 8 are slidably disposed on the in line unit through the link 12f corresponding to the change of curvature of the approach surface 1.

With the lifting units 10, 11, and 12, the snow removing/pressing plate 5, the rotating cutters 6, and the groove shaver holders 8 are raised and lowered against the snow surface of the in line sliding surface 1. The lifting unit 10, which raises and lowers the snow removing/pressing plate 5, has the guide plate 5b of the lift jack on the rear surface of the snow removing/pressing plate 5. With the handle 9a, the lift jack 50 is raised and lowered so as to adjust the raising/lowering operation and the height of the snow removing/pressing plate 5. With the angle adjusting unit, the angle of the snow removing/pressing plate 5 is varied. The lifting unit 11, which raise and lowers the rotating cutters 6, has a lift jack 10a that raises and lowers the rotating cutters 6. By turning the handle 10b, the lift jack 10a is raised and lowered so as to control the raising/lowering operation and the groove depth of the rotating cutters 6. The lifting unit 12, which raises and lowers the groove shaver holders 8, has the lift rod 12a that raises and lowers the groove shaver holders 8. By turning the handle 12b, the lift rod 12a is raised and lowered so as to control the raising/lowering operation and the groove pressure of the groove shaver holders 8.

The in line unit 4 is traveled on the guide rails 2 with the wheels 13 from the mountain side to the valley side and vice versa by a drive force of the cable 3. The snow removing plates 31 that remove snow on the guide rails 2 are disposed before and after the wheels 13. If the remaining snow or cut snow powder resides on the guide rails 2, the approach grooves 7 become irregular. Thus, the approach sliding grooves 7 cannot be equally formed. In other words, when the guide rails 2 become irregular due to the remaining snow, the groove depth of the approach grooves 7 does not become equal and the groove forming operation is not equally performed. Consequently, the accuracy of the grooves is deteriorated. To prevent such a situation, the remaining snow on the guide rails 2 is removed as much as possible.

Next, the groove forming method of the in line sliding surface for the schanze according to the present invention will be described along with the operation thereof.

As shown in Fig. 1, the in line unit 4 is traveled by the driving unit (winch) 19 that drives the cable 3 through the wire rope 3 and the pulleys 37 and 38 dis-

posed at the four corners of the in line unit 4. The cable 3 is secured on the mountain side 35 of the schanze and the valley side 36 thereof. The looseness of the wire rope 3 is adjusted by the weight 18.

The two parallel guide rails 2 are disposed on both sides of the in line sliding surface 1 of the schanze. The in line unit 4, which has the rotating cutters 6, the snow removing/pressing plate 5, and the groove shaver holders 8, is disposed on the guide rails 2 through the wheels 13. The in line unit 4 is traveled by the drive force through the cable 3 from the mountain side to the valley side and vice versa. The snow removing/pressing plate 5 disposed at the lower edge portion on the valley side of the in line unit 4 is lowered. In addition, the rotating cutters 6 at the upper edge portions on the mountain side and the groove shaver holders 8 disposed at the lower edge portions are raised. In these conditions, the in line unit 4 is disposed at the top position on the mountain side of the schanze.

By selecting a proper one of the stopper pin insertion holes 51a corresponding to the snow conditions, the angle of the snow removing/pressing plate 5 can be freely varied. For example, as shown in Fig. 7A, when the snow on the sliding surface is unsmoothed snow in early spring, the pin 57 is inserted into an outer one of the stopper pin insertion holes 51a. Thus, the cutting edge 5b is raised and the snow pressing force is decreased. On the other hand, as shown in Fig. 7B, when the snow on the sliding surface is new snow or frozen, the pin 57 is inserted into an inner one of the stopper pin insertion holes 51a. Thus, the snow pressing force is increased. In this state, the in line unit 4 is traveled downward along the guide rails 2 on the in line sliding surface 1 of the schanze. The excessive snow on the sliding surface 1 is scraped out and cut. Thus, the snow on the in line sliding surface 1 is removed and the remaining snow thereon is pressed and smoothed by the press plate 5c. In this condition, the in line unit 4 is traveled downward to the bottom of the valley side. The downward traveling speed of the in line unit 4 is preferably in the range from 3 to 10 m/min. and more preferably in the range from 4 to 7.5 m/min.

When the in line unit 4 reaches the lower edge portion on the valley side of the in line sliding surface 1 of the schanze, the snow removing/pressing plate 5 at the lower edge portion on the valley side of the in line unit 4 is raised. In addition, the rotating cutters 6 at the upper edge portions on the mountain side and the groove shaver holders 8 at the lower edge portions on the valley side of the in line unit 4 are lowered. When the driving unit 19 is reversely driven, the in line unit 4 is gradually traveled upward along the guide rails 2 through the cable 3. Thus, the approach grooves 7 are formed by the rotating cutters 6. The side walls and the upper side edge portions of the approach grooves 7 are pressed by the groove shaver holders 8. In addition, the bottom portions 7c of the approach grooves 7 are formed as unsmoothed snow by the groove shavers 13.

The cut snow powder is removed by the holders 16 and the snow removing plates 31 from the approach grooves 7 formed by the rotating cutters 6. However, as shown in Fig. 13A, the remaining cut snow powder resides in the approach grooves 7 as groove shoulders 7a and groove edge portions 7b. In addition, bottoms 7c are not always proper as the approach grooves 7. To prevent such problems, as shown in Fig. 13B, the groove shaver holders 8, each of which is formed in a sled shape and wider than each of the approach grooves 7 formed by the rotating cutters 6, and the groove shavers 9 that are detachably disposed on the lower surfaces of the groove shaver holders 8 press the groove shoulders 7a and the groove edge portions 7b. Thus, the groove shoulders 7a are rounded and the edge portions 7b of the grooves 7 are smoothed. The cut snow powder produced by the groove shaver holders 8 and the groove shavers 9 are removed by the snow removing plate 12k. As shown in Fig. 13C, the groove shavers 9 have lattice shaped saw teeth. Thus, the groove shavers 9 slide and thereby forme unsmoothed snow at the groove bottoms 7c. When the approach grooves 7 are formed, the upward traveling speed of the in line unit 4 is slower than the downward traveling speed. The upward traveling speed of the in line unit 4 is preferably in the range from 2 to 6 m/min. and more preferably in the range from 3 to 4 m/min.

Although the width of the groove shaver holders 8 has been standardized for jumping events, it can be properly adjusted corresponding to player classes such as junior class and senior class.

Since the approach grooves 7 are formed by the rotating cutters 6 of the groove shaver holders 8 with the groove shavers 9, the strength of the side walls of the approach grooves 7 is improved and the groove shape that allows derailed ski boards to restore is accomplished. In addition, since the groove shavers 9 with lattice shaped saw teeth press the bottom portions 7c of the approach groove so as to form unsmoothed snow, the sliding performance is improved. Thus, bad influences to records of jumping events due to vibrations, derailment of ski boards, and sliding defects can be alleviated. Moreover, since the approach grooves are formed while the in line sliding surface 1 is being formed. Thus, the time necessary for forming the approach grooves is substantially omitted.

According to the groove forming apparatus for forming the in line sliding surface for the schanze and the groove forming method according to the present invention, the in line sliding surface 1 can be accurately and quickly formed unlike with the conventional in line sliding surface forming method.

When the in line unit is traveled downward, by varying the angle of the snow removing/pressing plate, the snow on the in line sliding surface 1 can be equally removed and pressed regardless of the snow conditions such as new snow, dried snow, watery snow, and unsmoothed snow.

In addition, since the approach sliding grooves are cut by the rotating cutters, they can be equally and stably formed on the entire in line sliding surface 1. Moreover, the approach sliding grooves can be equally and straightly formed with small labor work in a short time (with two workers for two hours).

Furthermore, since the groove shaver holders are provided, the strength of the side walls of the approach sliding grooves can be improved. The sliding grooves can restore derailed ski boards.

In addition, since the groove shaver holders and the groove shavers press the bottom portions of the approach sliding grooves, unsmoothed snow is formed. Thus, the sliding characteristics are improved.

Consequently, the bad influences against the records of the jumping events due to vibrations of ski boards, derailment thereof, and sliding defects can re alleviated. In addition, since the approach sliding grooves are formed while the in line sliding surface 1 is being formed, the working time necessary for forming the approach sliding grooves is substantially omitted.

Although the present invention has been shown and described with respect to a best mode embodiment thereof, it should be understood by those skilled in the art that the foregoing and various other changes, omissions, and additions in the form and detail thereof may be made therein without departing from the spirit and scope of the present invention.

Claims

1. An in line sliding surface forming apparatus for a schanze, comprising:

   a cable extending along two parallel rails disposed on both sides of the in line sliding surface for the schanze;

   an in line unit for traveling on the guide rails;

   a snow removing/pressing plate disposed at a lower edge portion on a valley side of said in line unit and adapted for removing excessive snow on the in line sliding surface and for pressing and smoothing the remaining snow on the in line sliding surface, said snow removing/pressing plate being raised and lowered;

   two rotating cutters disposed at upper edge portions on a mountain side of said in line unit and adapted for forming two parallel approach grooves along the in line sliding surface being pressed and smoothed;

   an in line unit driving unit disposed on said in line unit, linked with said cable, and upward and downward traveled along the in line sliding surface; and

   a rotating cutter driving unit for driving said rotating cutters,

   wherein said in line unit is upward and downward traveled through said cable so as to form the in line sliding surface.

2. The in line sliding surface forming apparatus as set forth in claim 1, further comprising:

   a cutting edge and a press plate disposed at a lower edge portion of said snow removing/pressing plate; and

   an angle adjusting unit for adjusting the pressure applied to said cutting edge and said press plate corresponding to the angle of said snow removing/pressing plate.

3. The in line sliding surface forming apparatus as set forth in claim 1 or 2,

   wherein said snow removing/pressing plate and said rotating cutters have relevant lifting units for raising and lowering said snow removing/pressing plate and said rotating cutters against the in line sliding surface.

4. The in line sliding surface forming apparatus as set forth in one of claims 1 to 3, further comprising:

   snow removing plates disposed before and after wheels of said in line unit and adapted for removing snow on the guide rails.

5. An in line sliding surface forming method for a schanze, comprising the steps of:

   disposing guide rails on both sides of the in line sliding surface for the schanze;

   traveling an in line unit on the in line sliding surface for the schanze, the in line unit having a snow removing/pressing plate and rotating cutters, the snow removing/pressing plate being adapted for removing excessive snow on the in line sliding surface and for pressing and smoothing the remaining snow on the in line sliding surface, the rotating cutters being adapted for forming two ski sliding grooves on the in line sliding surface being pressed and smoothed;

   lowering the snow removing/pressing plate and raising the rotating cutters so as to remove and press the snow on the in line sliding surface when the in line unit is traveled downward from a mountain side to a valley side; and

   raising the snow removing/pressing plate and lowering the rotating cutters so as to form the ski sliding grooves when the in line unit is traveled upward from the valley side to the mountain side.

6. The in line sliding surface forming method as set forth in claim 5, further comprising the step of:

   varying the angle of the snow removing/pressing plate so as to adjust the pressure applied to a cutting edge and a press plate disposed on the snow removing/pressing plate.

7. A groove forming apparatus for forming grooves on an in line sliding surface formed by an in line sliding surface forming apparatus for a schanze, having a cable extending along two parallel rails disposed on

both sides of the in line sliding surface for the schanze, an in line unit for traveling on the guide rails, a snow removing/pressing plate disposed at a lower edge portion on a valley side of the in line unit and adapted for removing excessive snow on the in line sliding surface and for pressing and smoothing the remaining snow on the in line sliding surface, the snow removing/pressing plate being raised and lowered, two rotating cutters disposed at upper edge portions on a mountain side of the in line unit and adapted for forming two parallel approach grooves along the in line sliding surface being pressed and smoothed, an in line unit driving unit disposed on the in line unit, linked with the cable, and upward and downward traveled along the in line sliding surface, and a rotating cutter driving unit for driving the rotating cutters, wherein the in line unit is upward and downward traveled through the cable so as to form the in line sliding surface, said groove forming apparatus comprising:

groove shaver holders traveled in the same direction as the rotating cutters, disposed at lower edge portions of the in line unit, said groove shaver holders being raised and lowered, the width of each of said groove shaver holders being larger than each of the grooves formed by the rotating cutters, said groove shavers being formed in a sled shape; and

groove shavers secured to lower surfaces of said groove shaver holders, the width of each of said groove shavers being nearly the same as the width of each of the grooves formed by the rotating cutters, said groove shavers having lattice shaped saw teeth.

8. The groove forming apparatus as set forth in claim 7,

wherein said groove shaver holders are disposed at lower edge portions of the in line unit between the in line unit and the snow removing/pressing plate, said shaver holders being raised and lowered.

9. The groove forming apparatus as set forth in claim 7 or 8,

wherein the snow removing/pressing plate, the rotating cutters, and said groove shaver holders have relevant lifting units for raising and lowering the snow removing/pressing plate, the rotating cutters, and said groove shaver holders against the in line sliding surface.

10. The groove forming apparatus as set forth in one of claims 7 to 9, further comprising:

wheels disposed on the in line unit and adapted for traveling the in line unit; and

snow removing plates disposed before and after wheels of said in line unit and adapted for removing snow on the guide rails.

11. The groove forming apparatus as set forth in one of claims 7 to 10, further comprising:

a cutting edge and a press plate disposed at a lower edge portion of said snow removing/pressing plate; and

an angle adjusting unit for adjusting the pressure applied to said cutting edge and said press plate corresponding to the angle of said snow removing/pressing plate.

12. The groove forming apparatus as set forth in one of claims 7 to 11, further comprising:

a cutting edge and a press plate disposed at a lower edge portion of said snow removing/pressing plate; and

an adjusting unit for adjusting the pressure applied to said cutting edge and said press plate corresponding to the angle of said snow removing/pressing plate.

13. A groove forming method for forming grooves on an in line sliding surface for a schanze, comprising the steps of:

disposing two parallel guide rails on both sides of the in line sliding surface for the schanze;

traveling an in line unit on the in line sliding surface for the schanze through a cable, the in line unit having rotating cutters, a snow removing/pressing plate, and groove shaver holders,

lowering the snow removing/pressing plate disposed at a lower edge portion of the in line unit and raising the rotating cutters disposed at an upper edge portion of the in line unit and the groove shaver holders disposed at lower edge portions of the in line unit;

traveling the in line unit to the top on a mountain side of the schanze;

traveling the in line unit downward along the guide rails along the in line sliding surface of the schanze so as to remove excessive snow on the in line sliding surface;

pressing and smoothing the remaining snow on the in line sliding surface;

traveling the in line unit downward on a valley side of the in line sliding surface;

raising the snow removing/pressing plate disposed at the lower edge portion of the in line unit when the in line unit reaches a lower edge portion on the valley side of the in line sliding surface;

lowering the rotating cutters disposed at the upper edge portions of the in line unit and the groove shaver holders disposed at the lower edge portions thereof;

reversely driving the guide rope;

forming approach grooves along the in line sliding surface by a drive force of the rotating cutters;

pressing groove shoulder portions and groove bottom edge portions of the approach

grooves with the groove shaver holders; and

forming unsmoothed snow on approach groove bottom portions with groove shavers.

14. The approach groove forming method as set forth in claim 13, further comprising the steps of:

removing the remaining snow in the approach grooves with snow removing plates disposed before and after wheels of the in line unit; and

forming the approach grooves with the groove shaver holders and the groove shavers.

15. The approach groove forming method as set forth in claim 11 or 12, further comprising the step of:

varying the angle of the snow removing/pressing plate so as to adjust a cutting edge and a press plate of the snow removing/pressing plate.

FIG. 1

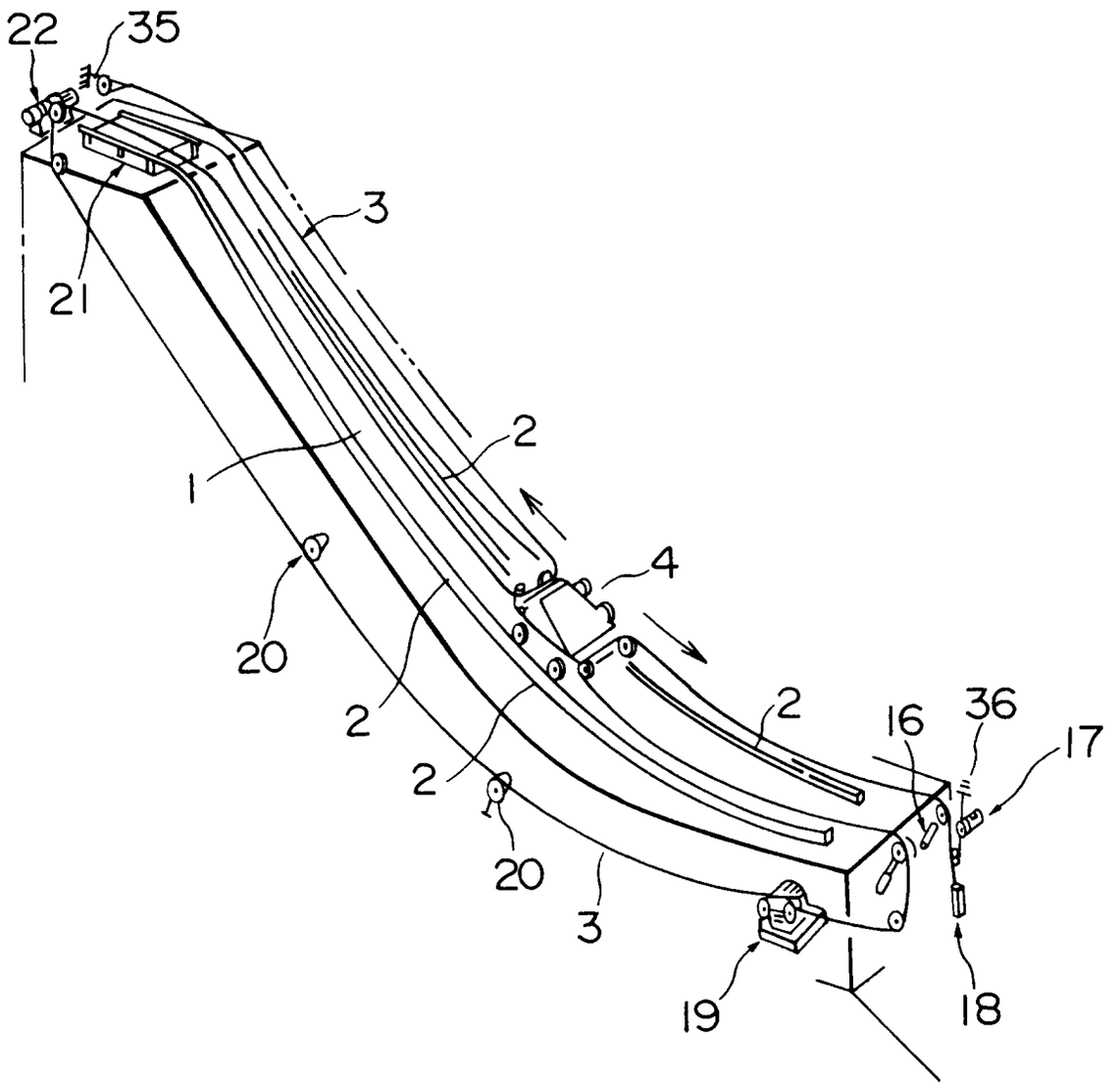


FIG. 2

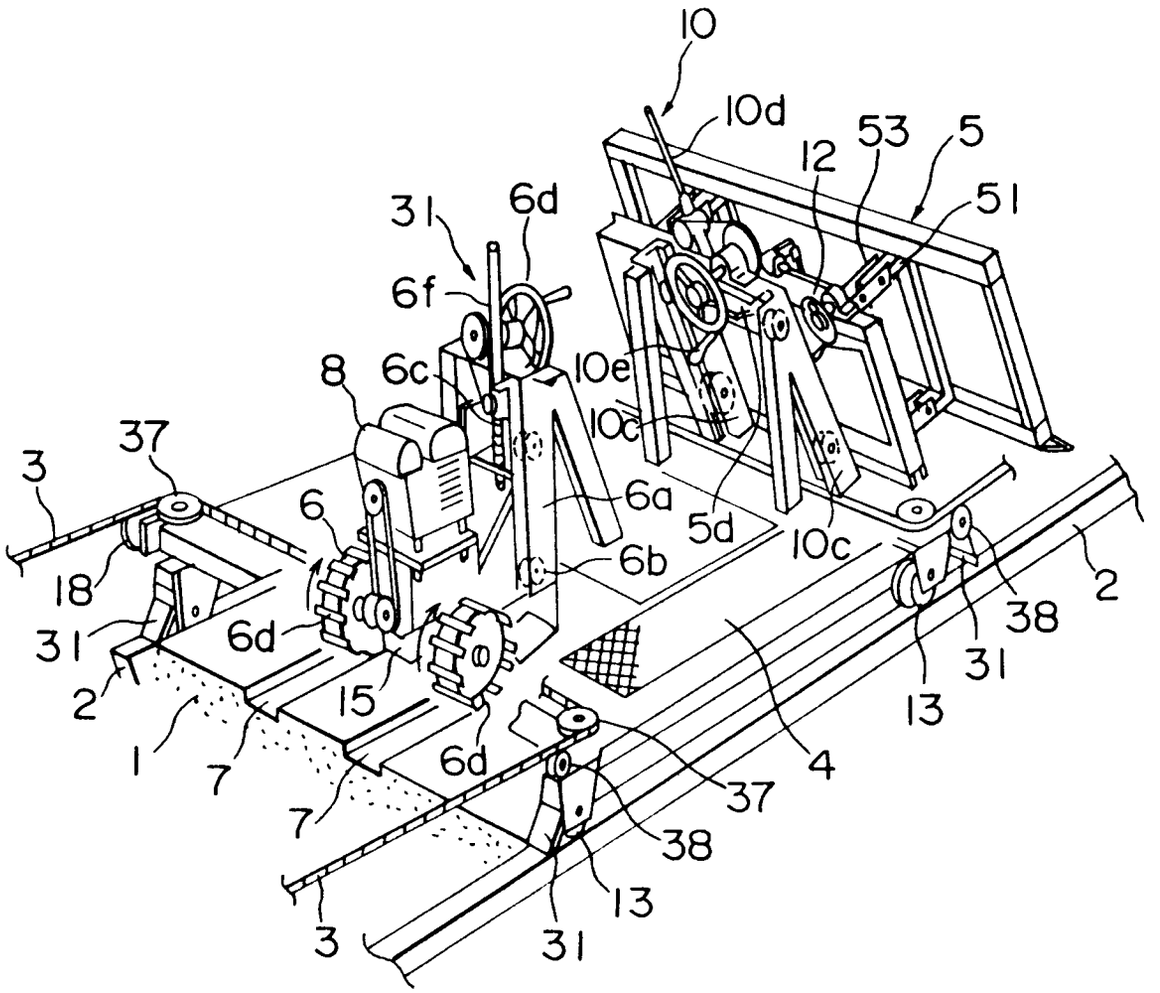

10
10d
12
53
5
51
31
6d
6f
8
6c
10e
10c
37
3
6a
6
5d
10c
6b
18
31
6d
2
15
1
7
6d
7
37
4
38
13
31
3
31
13
38
2

FIG. 3

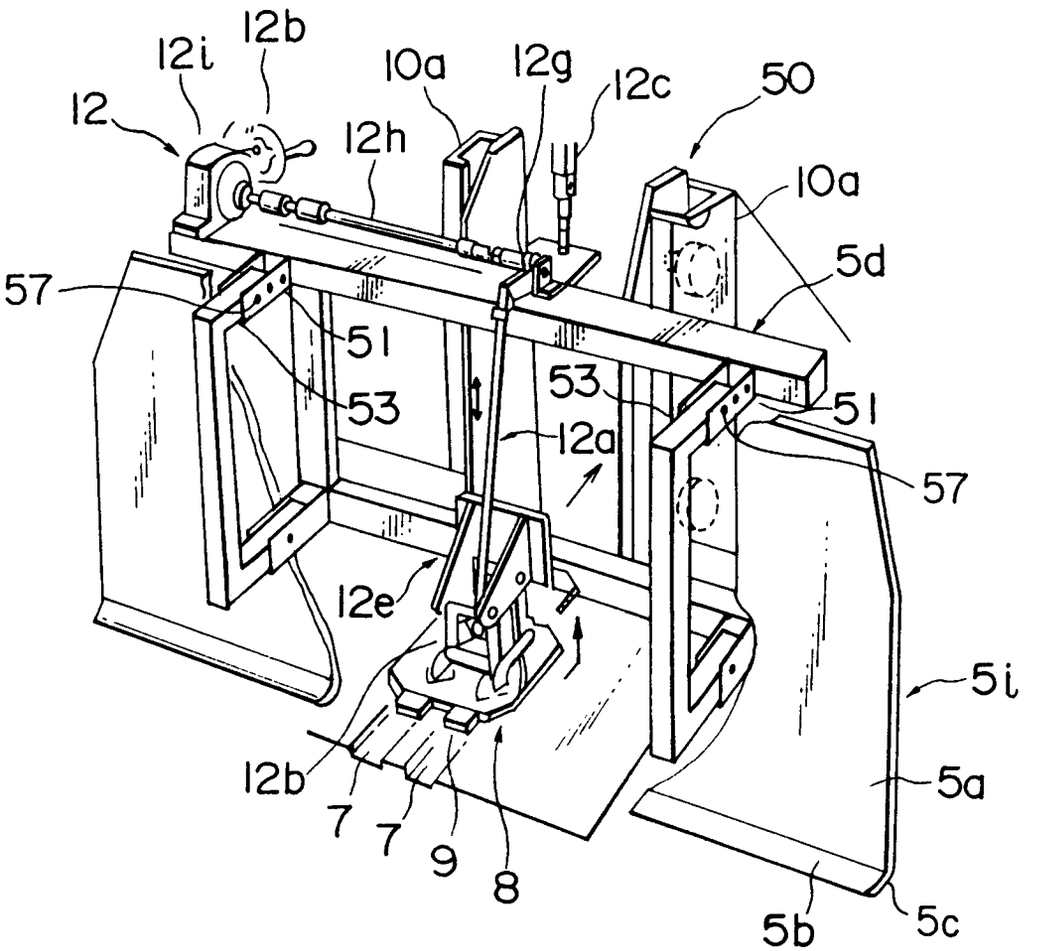

12b
12i
12
10a
12g
12c
50
12h
10a
5d
57
51
53
53
51
12a
57
12e
5i
12b
5a
7
7
9
8
5b
5c

FIG. 4

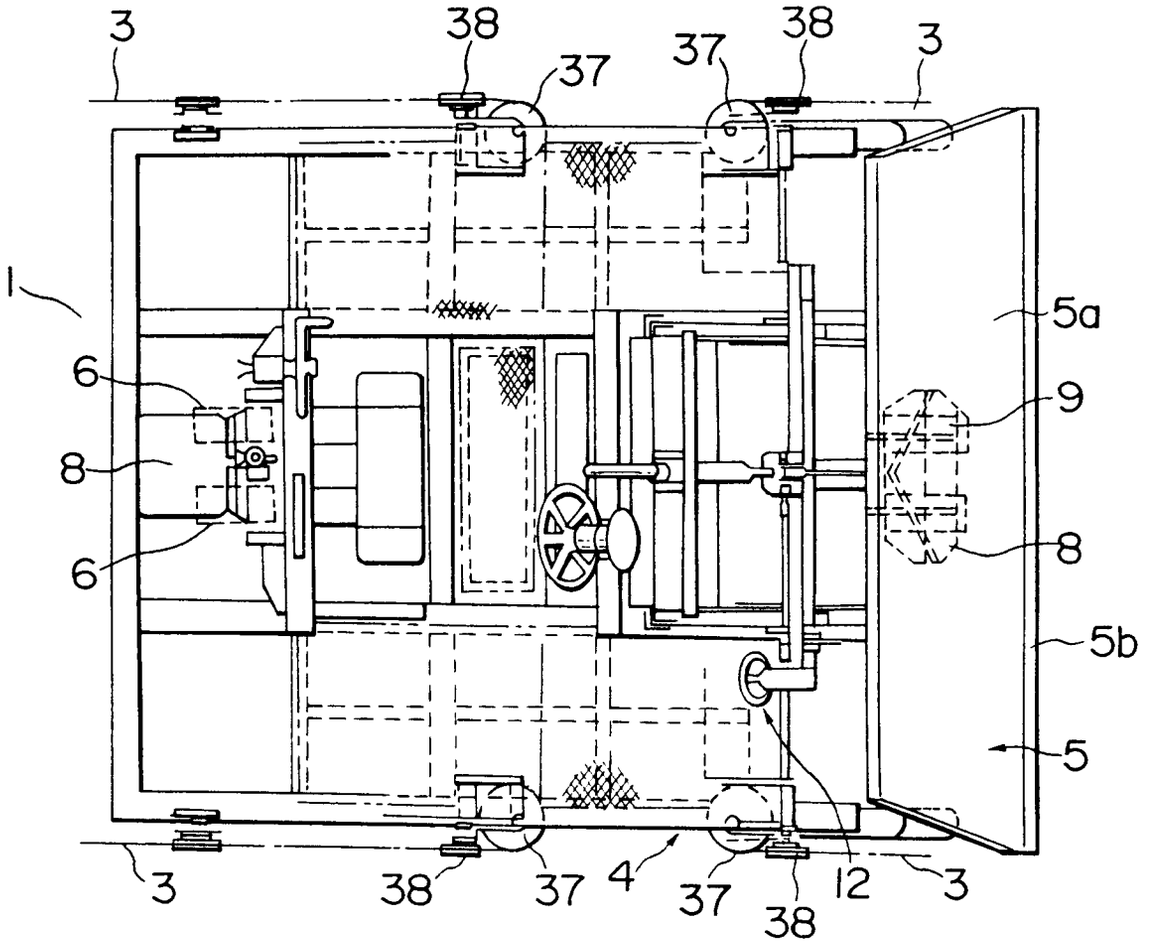

3
38
37
37
38
3
1
5a
6
9
8
8
6
5b
5
3
38
37
4
37
38
12
3

FIG. 5

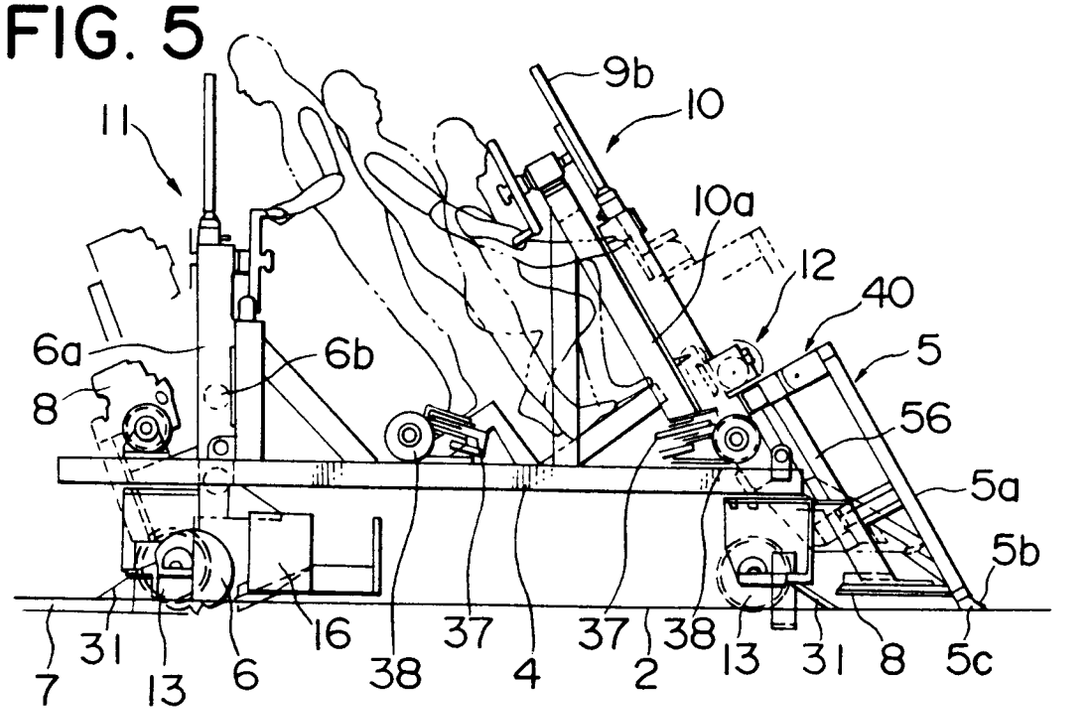

9b
10
11
10a
12
40
6a
6b
5
8
56
5a
5b
7
31
13
6
16
38
37
4
37
2
38
13
31
8
5c

FIG. 6

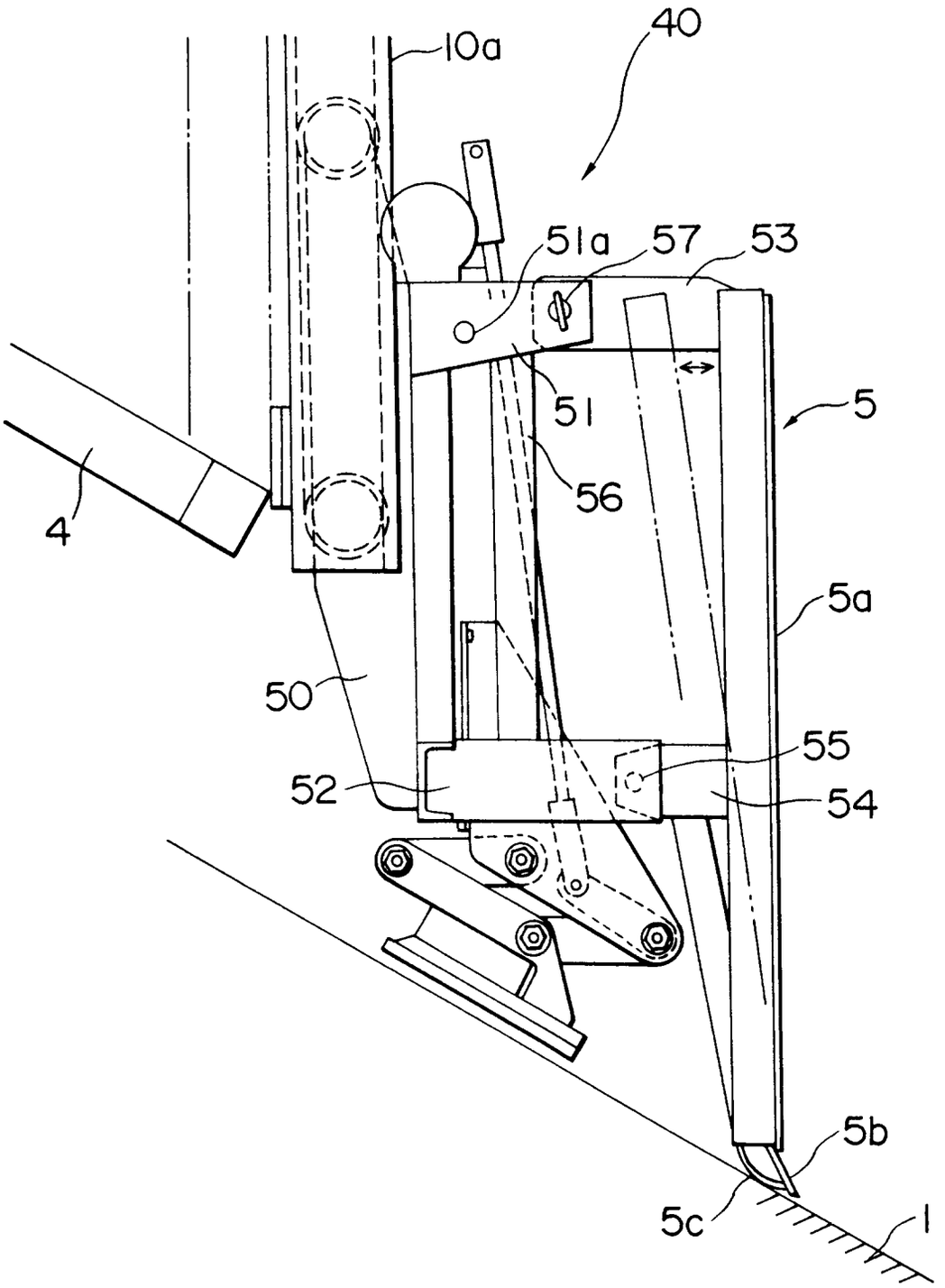


FIG. 7A

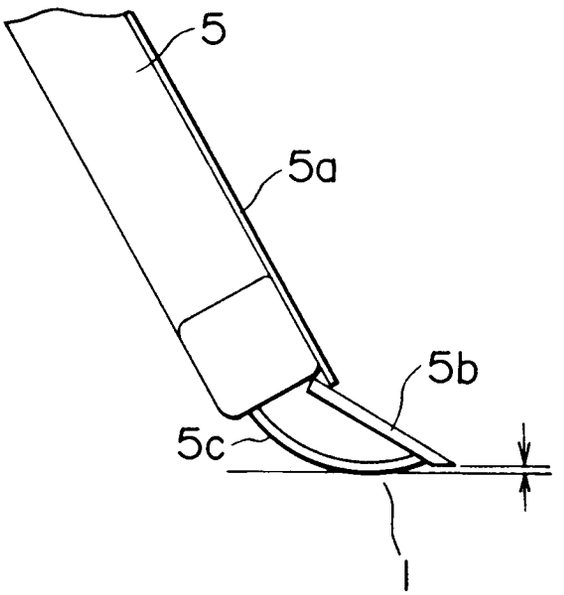


FIG. 7B

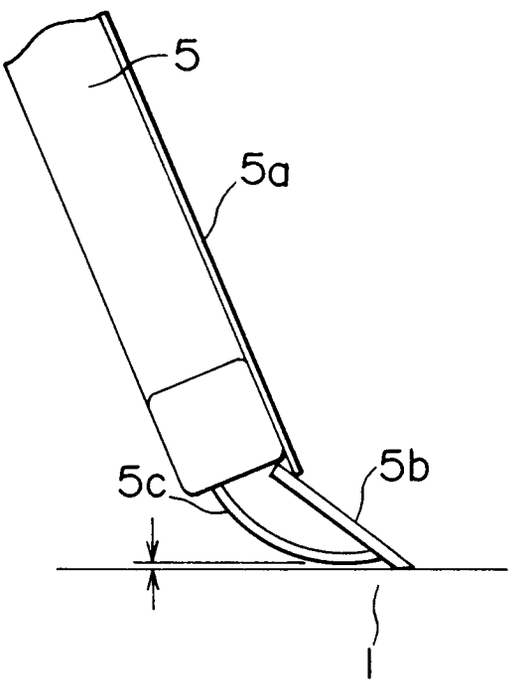


FIG. 8

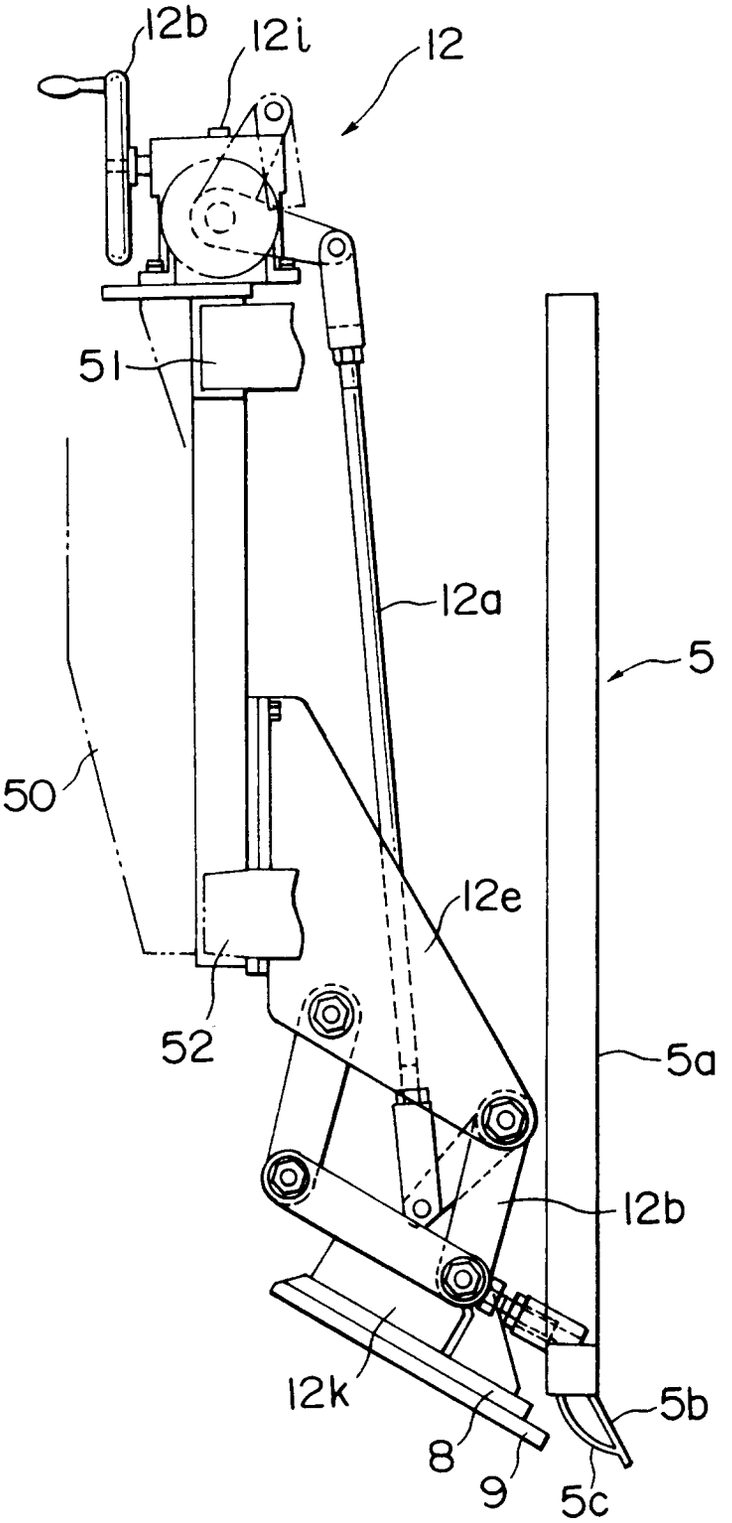


FIG. 9

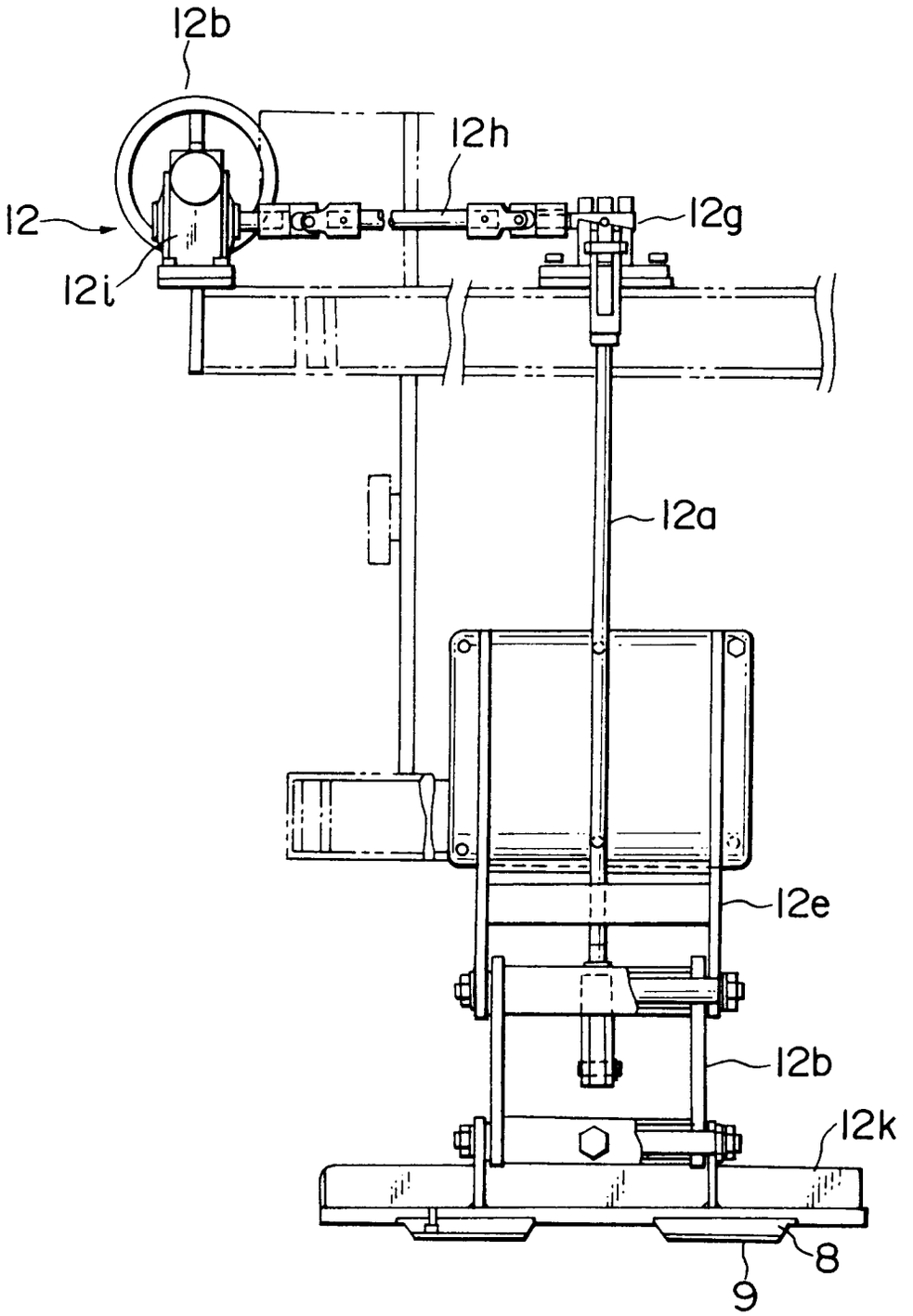


FIG. 10

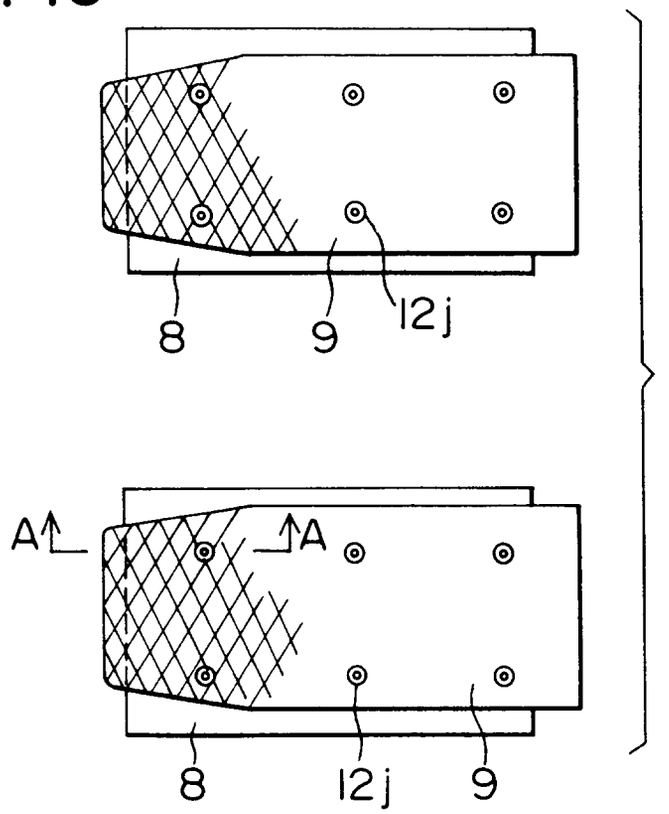


FIG. 11

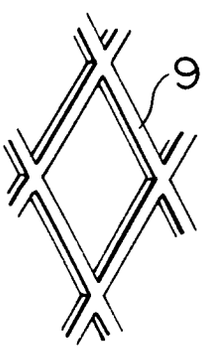


FIG. 12

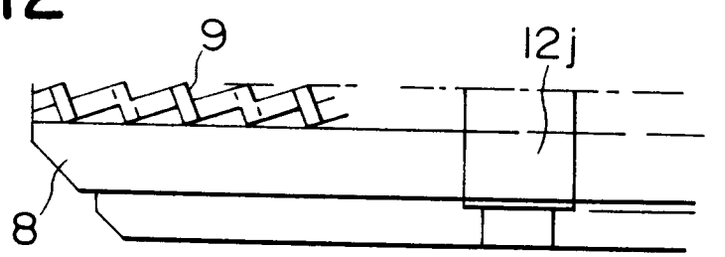


FIG. 13A

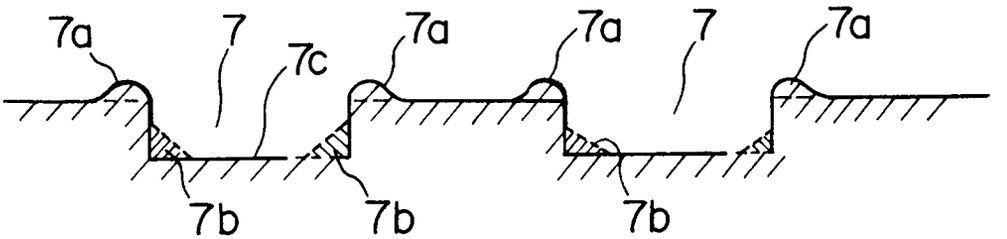


FIG. 13B

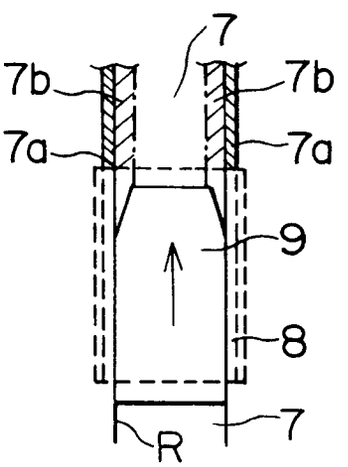
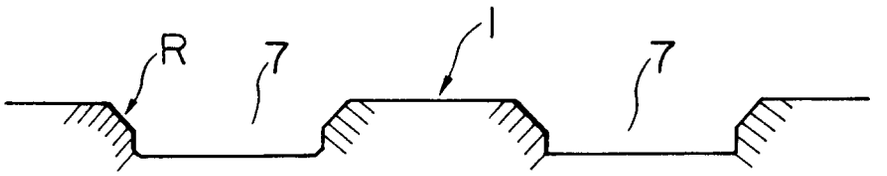


FIG. 13C



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 10 4745

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US-A-3 692 119 (TUCKER JASPER J) 19 September 1972 * the whole document *	1,5,7,13	E01H4/02
A	FR-A-2 502 020 (KEMPF & CO AG) 24 September 1982 * the whole document *	1,5,7,13	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

E01H
A63C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	4 July 1996	Dijkstra, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)