Jan. 13, 1953 S. VAN VOORHEES 2,625,229

POWER-DRIVEN SKI

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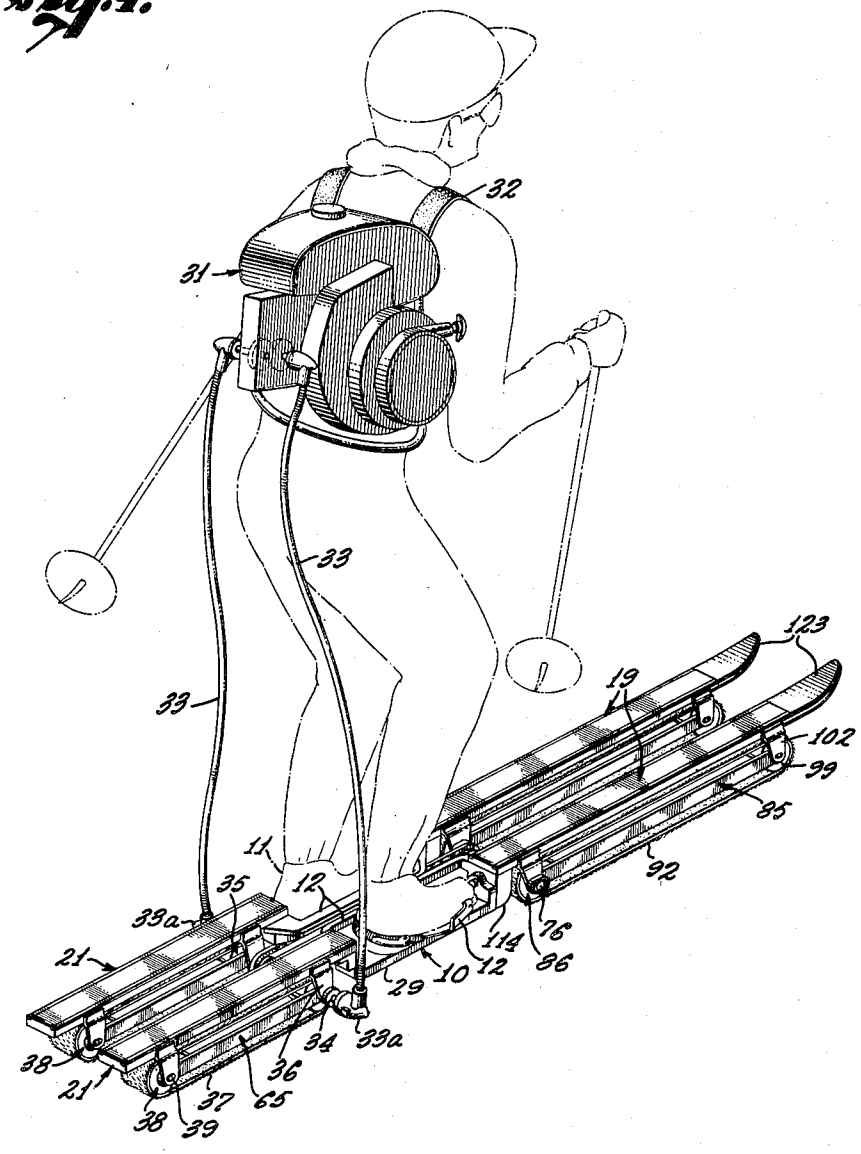
Fig. 1.



STANLEY VAN VOORHEES,
INVENTOR.

BY George J. Smyth

ATTORNEY.

Jan. 13, 1953 S. VAN VOORHEES 2,625,229

POWER-DRIVEN SKI

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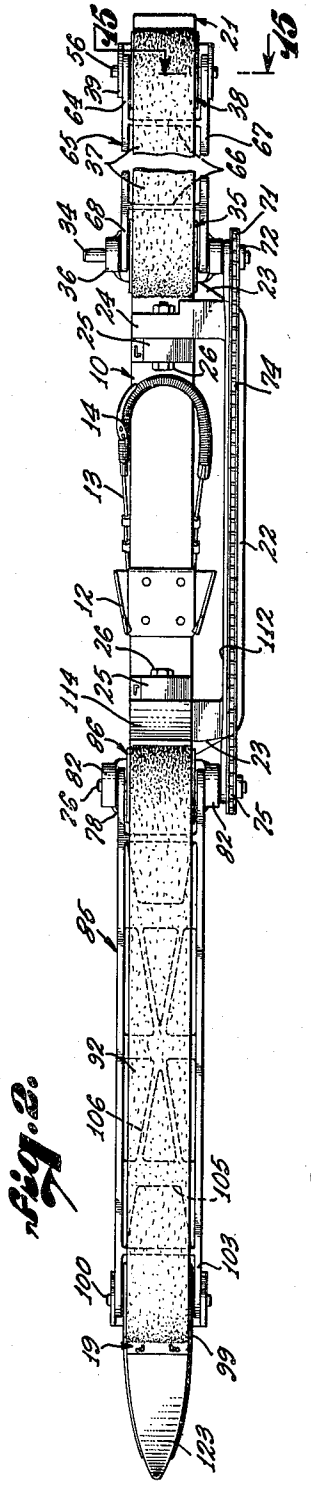


Fig. 3.

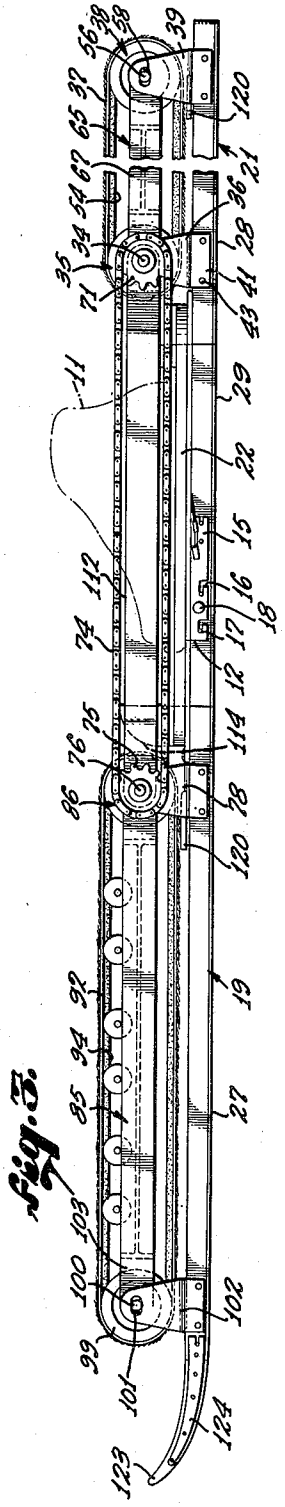
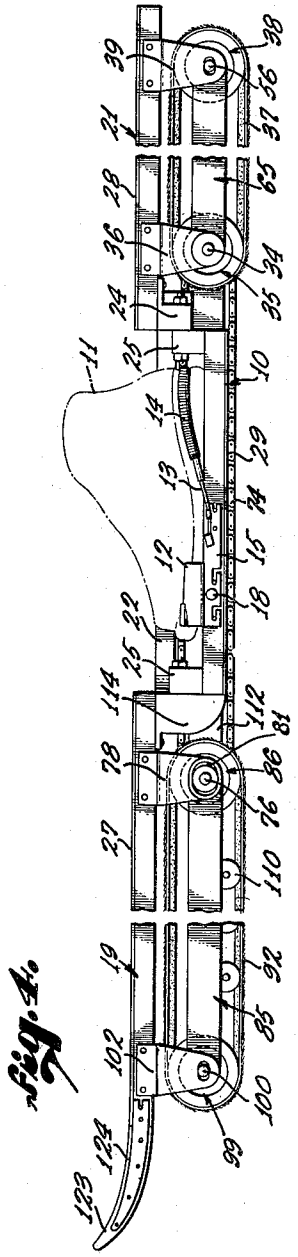


Fig. 4.



STANLEY VAN VOORHEES,
INVENTOR.

BY George J. Smyth

ATTORNEY.

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POWER-DRIVEN SKI

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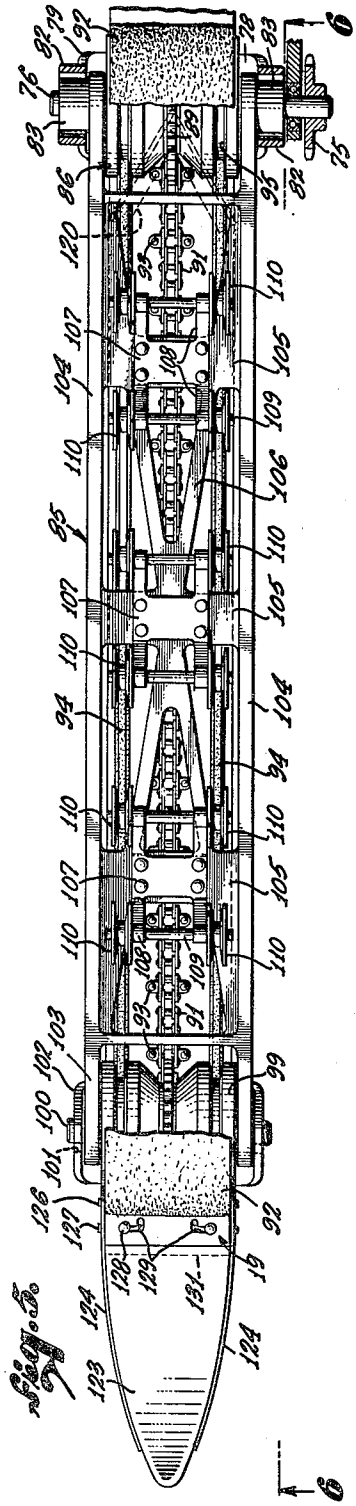

Fig. 5.

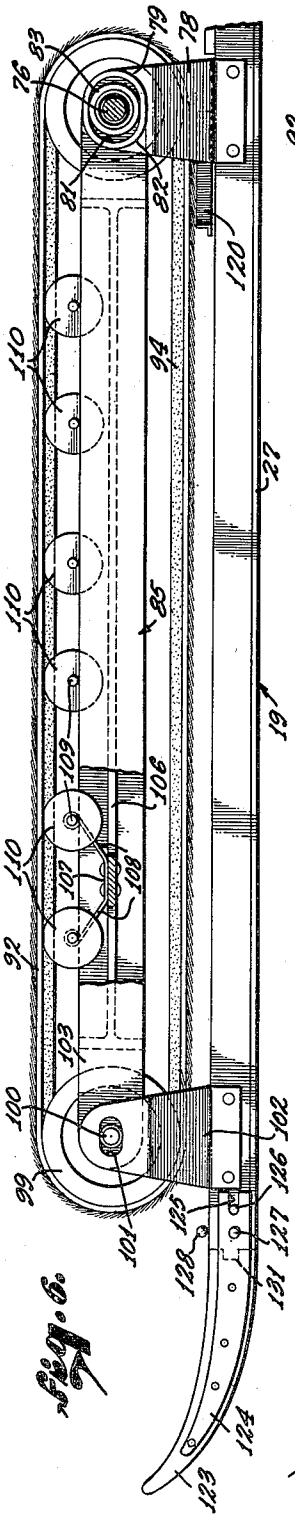

Fig. 6.

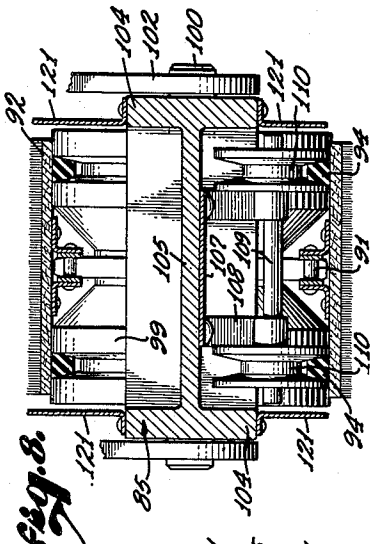

Fig. 8.

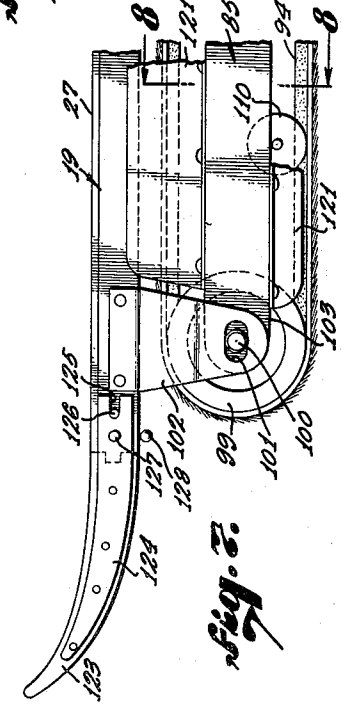

Fig. 7.

STANLEY VAN VOORHEES,
INVENTOR.

BY George S. Smyth.

ATTORNEY.

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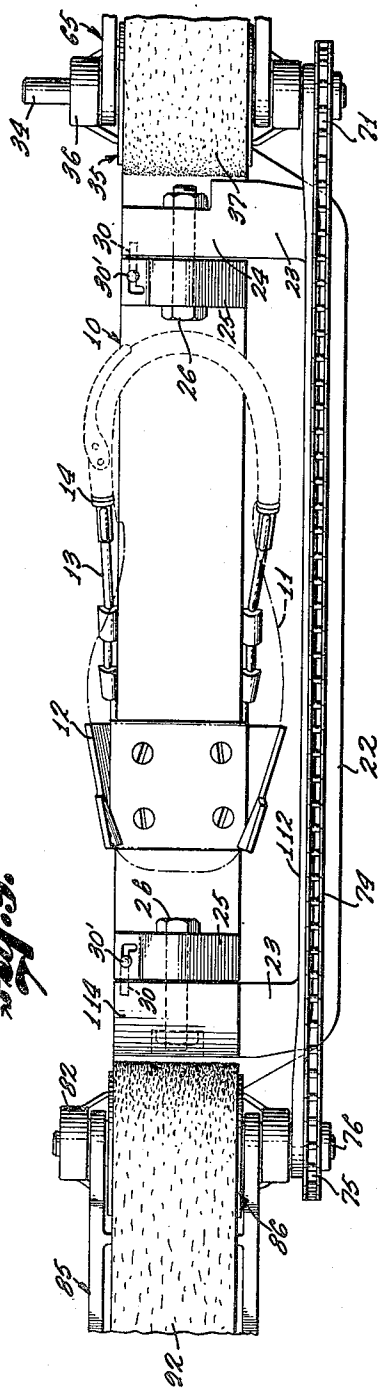

Fig. 9.

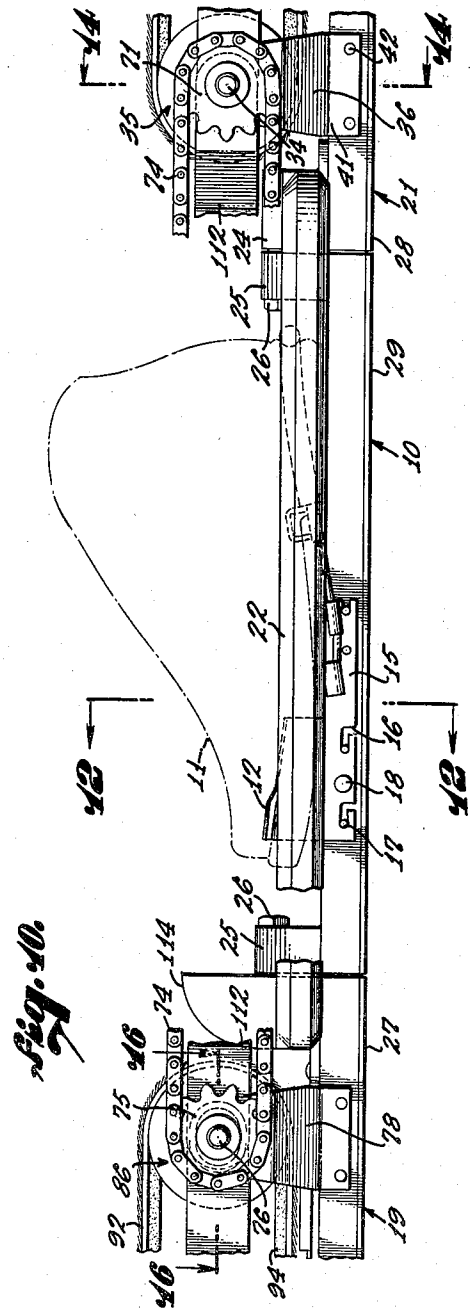

Fig. 10.

STANLEY VAN VOORHEES,
INVENTOR.

BY George J. Smyth

ATTORNEY.

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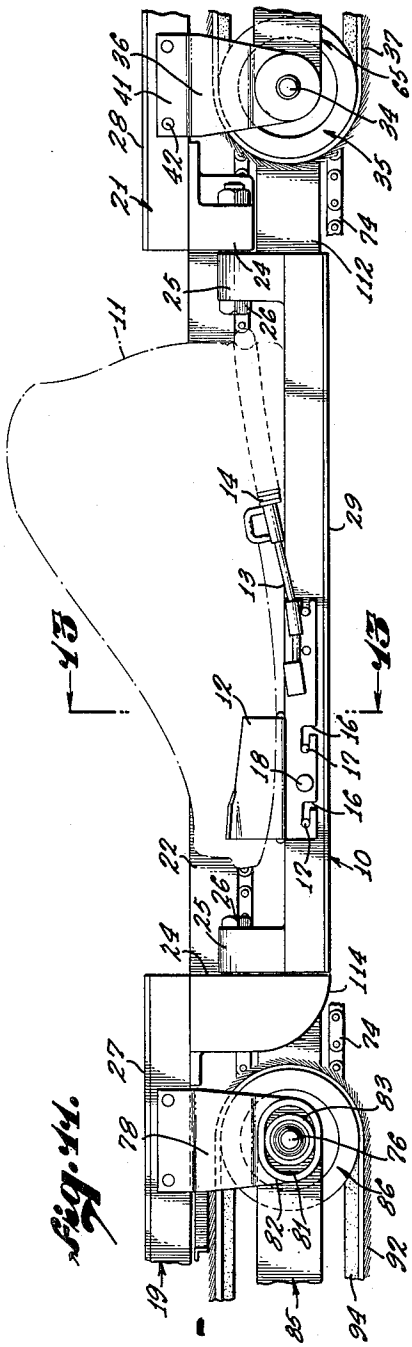

Fig. 11.

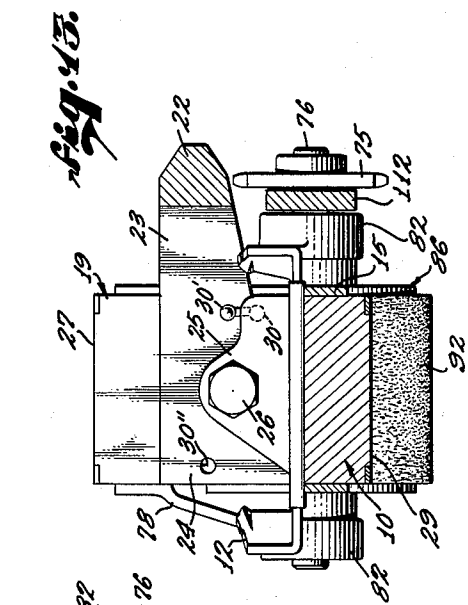

Fig. 13.

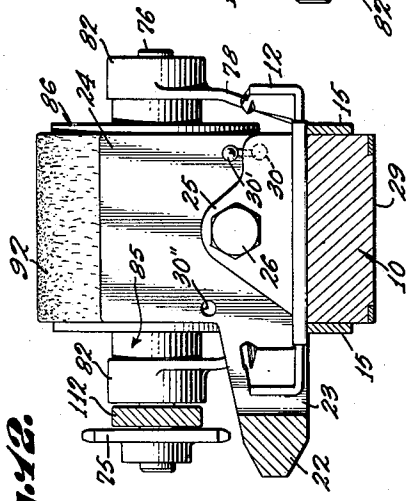

Fig. 12.

STANLEY VAN VOORHEES,
INVENTOR.

BY George J. Smyth

ATTORNEY.

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Fig. 14.

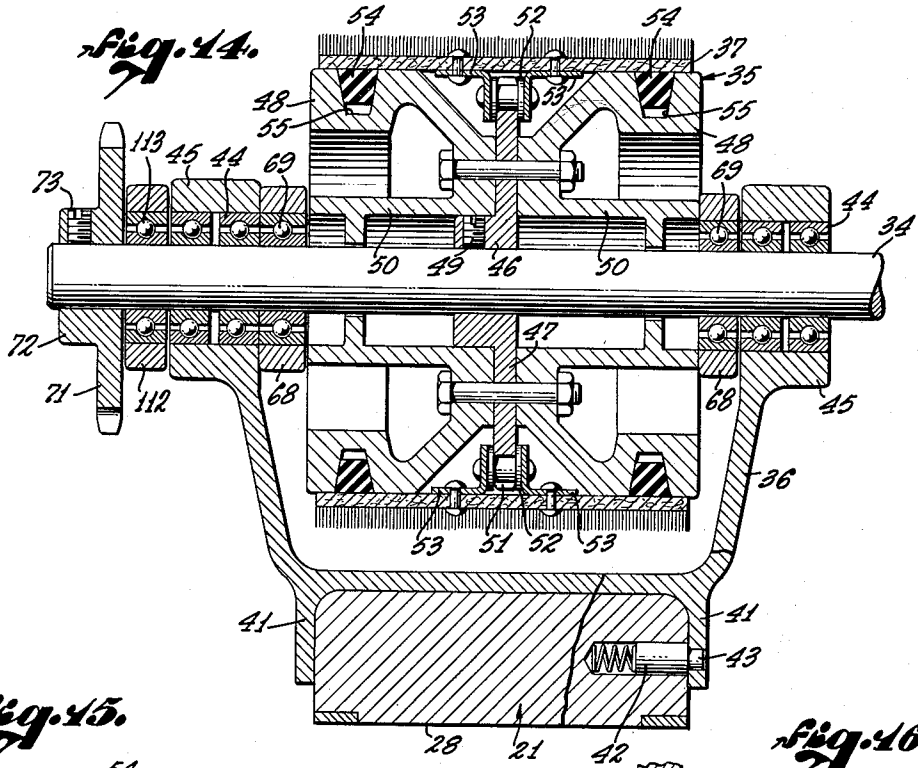


Fig. 15.

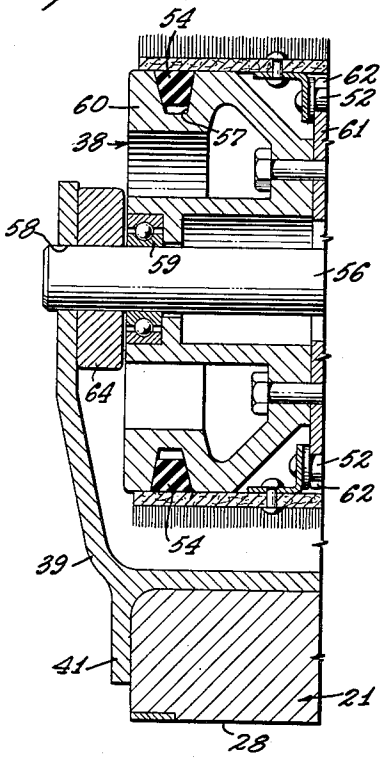
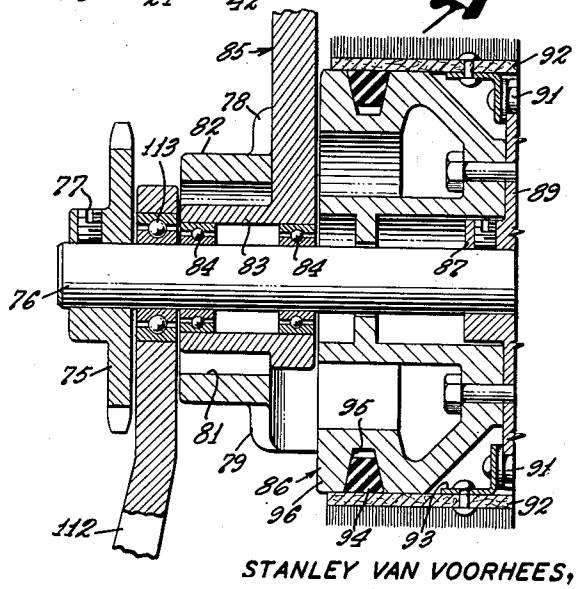


Fig. 16.



STANLEY VAN VOORHEES,
INVENTOR.

BY Hedge & Smyth

ATTORNEY.

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Fig. 17.

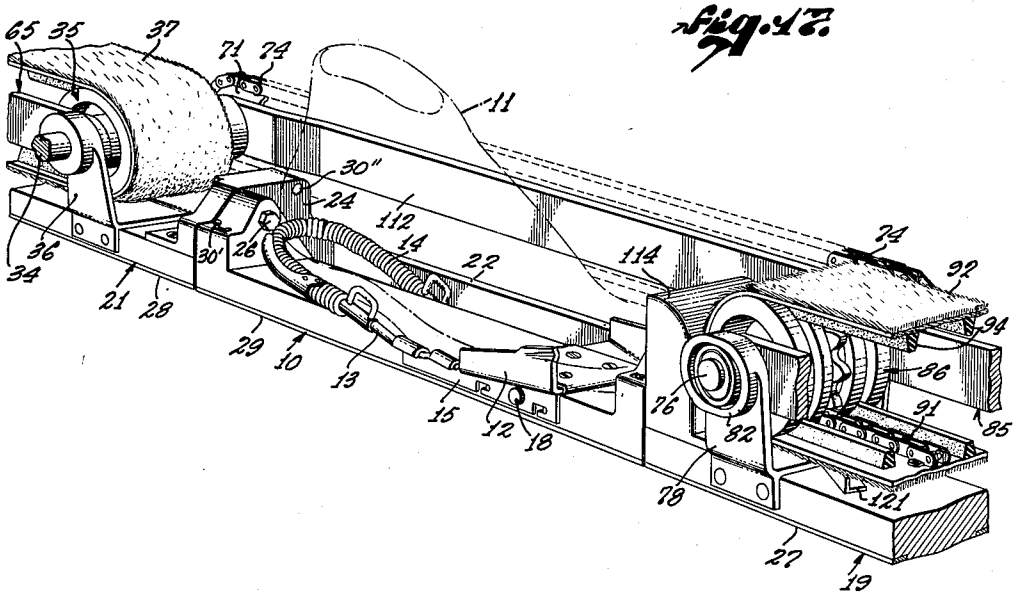
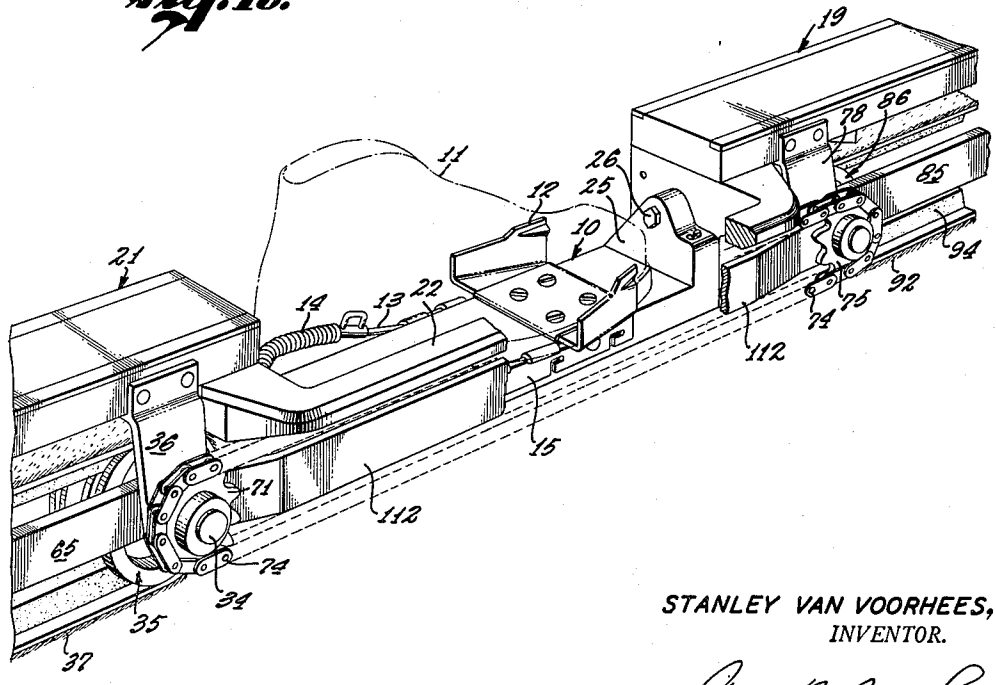


Fig. 18.



STANLEY VAN VOORHEES,
INVENTOR.

BY George J. Smyth

ATTORNEY.

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Fig. 19.

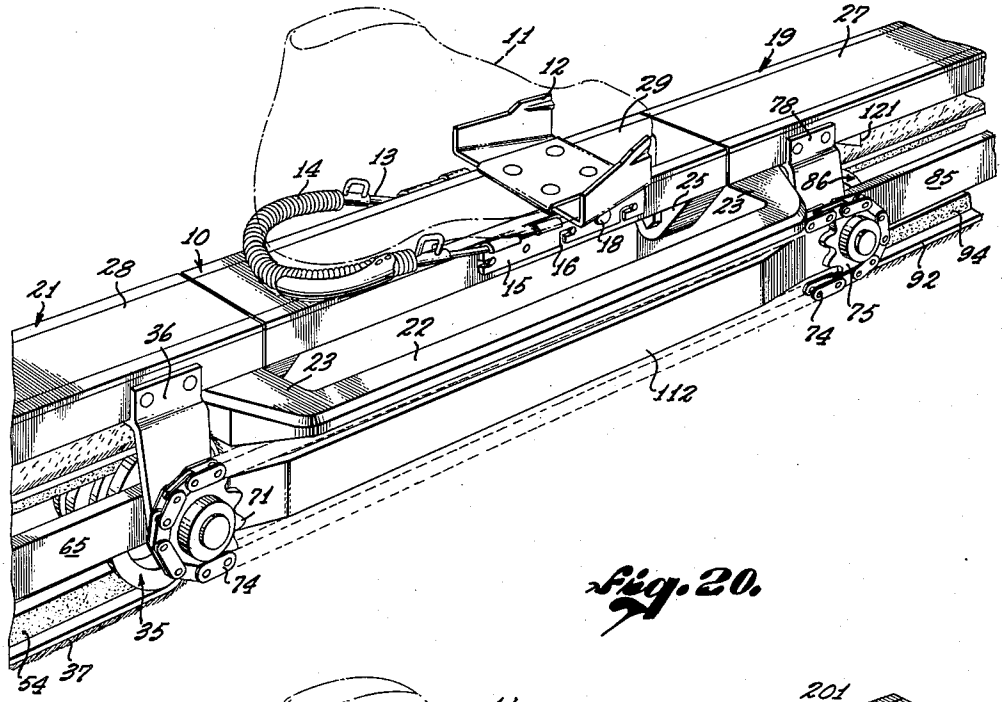
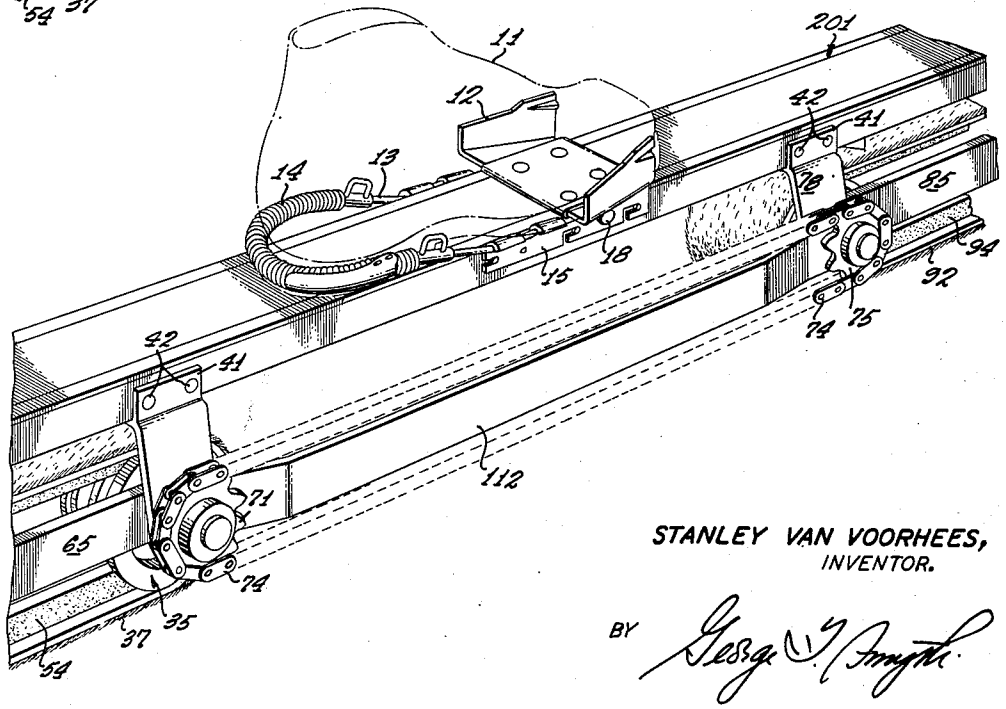


Fig. 20.



STANLEY VAN VOORHEES,
INVENTOR.

BY George U. Smyth

ATTORNEY.

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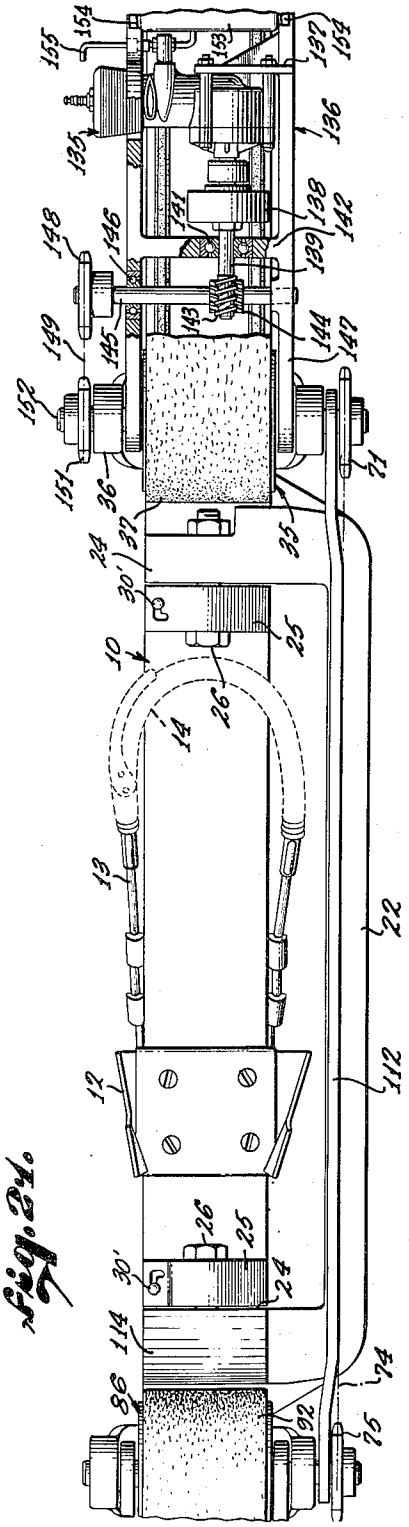

Fig. 21.

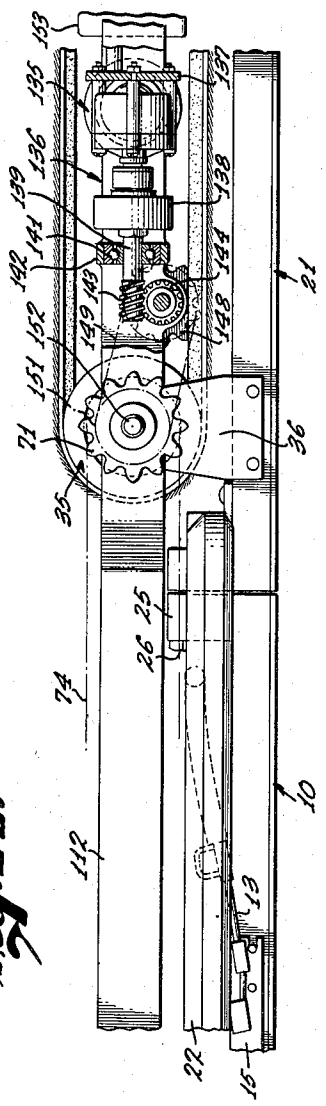

Fig. 22.

STANLEY VAN VOORHEES,
INVENTOR.

BY George J. Smyth

ATTORNEY.

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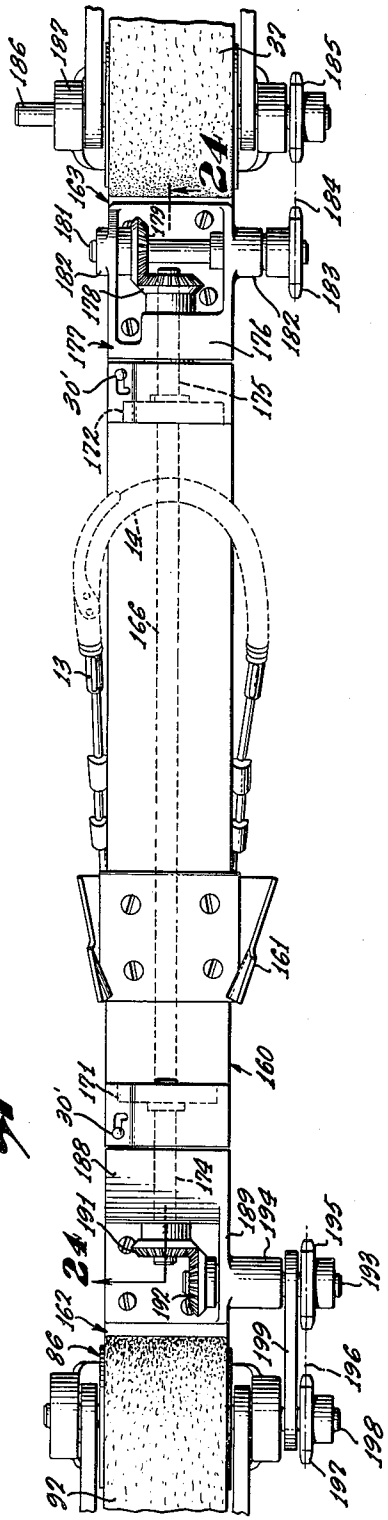

Fig. 23.

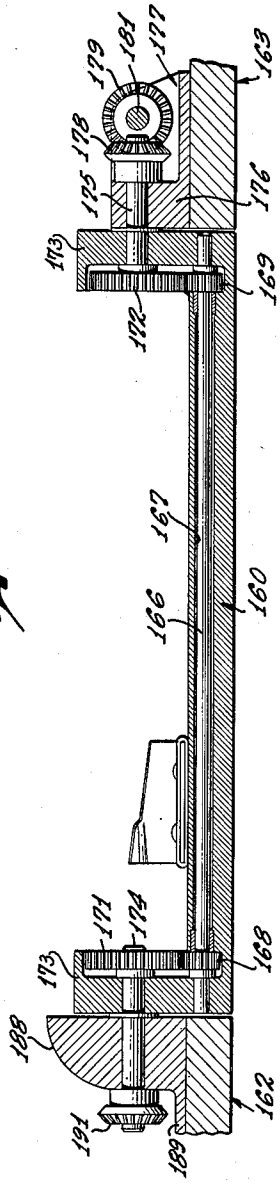

Fig. 24.

STANLEY VAN VOORHEES,
INVENTOR.

BY George V. Smyth

ATTORNEY.

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Fig. 27.

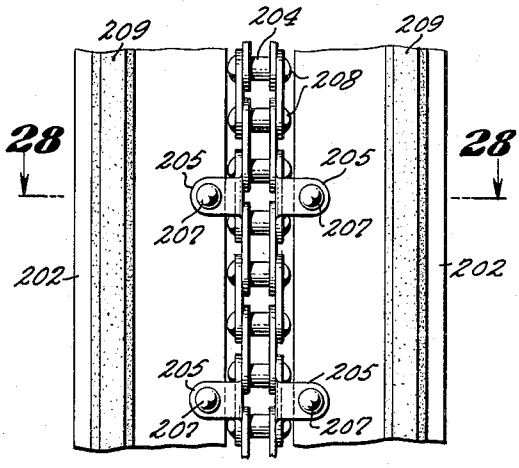


Fig. 28.

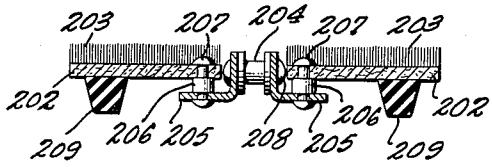


Fig. 30.

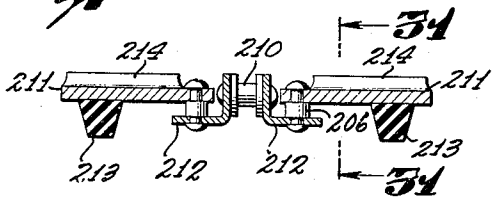


Fig. 29.

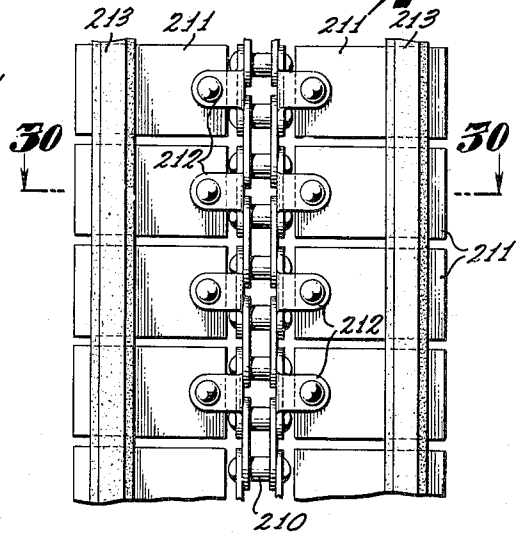


Fig. 31.

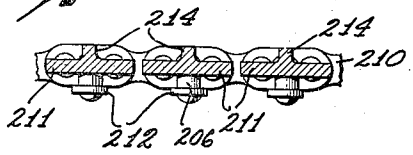


Fig. 25.

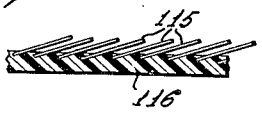
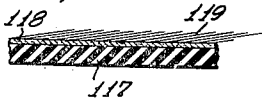


Fig. 26.



STANLEY VAN VOORHEES,
INVENTOR.

BY George V. Smyth

ATTORNEY.

Patented Jan. 13, 1953

2,625,229

UNITED STATES PATENT OFFICE

2,625,229

POWER-DRIVEN SKI

Stanley Van Voorhees, West Los Angeles, Calif.

Application May 19, 1950, Serial No. 162,982

24 Claims. (Cl. 180—1)

1

This invention relates to skis and more particularly to a ski having power means for propelling or driving the ski over a snow covered surface.

Various means have been heretofore proposed for either assisting the skier upwardly over a snow covered slope or for carrying him upward over an inclined terrain. In the first category may be mentioned removable "climbers" which consist of devices adapted to be slipped over or detachably mounted over the gliding surface of the ski. These "climbers" are provided with bristle-like elements which are adapted to lay substantially flat against the snow-engaging surface as long as the ski is forwardly moving but which move into an outwardly extending position relative to the surface upon backward movement of the ski. The bristles, in the outwardly extending position, form friction elements which bite into the snow to at least retard backward movement of the ski to which they are attached.

Skis equipped with such "climbers" aid the skier in climbing for, although they do not appreciably retard forward movement of the skis, they do act to resist backward movement of the skis. Thus a skier may, by alternately forcing his skis forwardly over an inclined terrain, climb that terrain. Obviously all energy required to lift the skier and his equipment up the terrain must come from the skier himself. Needless to say climbing a slope with even skis equipped with "climbers" is a laborious effort.

Ski tows and other similar facilities have been introduced for carrying skiers upwardly over inclined terrain. Although such facilities are extremely costly, they are widely used today in all popular skiing resorts. A skier using such facilities must obviously limit his skiing activities to the terrain immediately adjacent the same unless he wishes to laboriously climb slopes by the use of "climbers."

It has long been an appetency of the art to provide a ski which in itself provided means for driving the skier either forwardly over level terrain or upwardly over inclined terrain with little or no exertion of energy on the part of the skier. The ski of the present invention fulfills this long felt want for, without in any way impairing the gliding action thereof, the ski includes means for driving the same forwardly even over upwardly inclined snow covered surfaces.

The skis of the present invention, like conventional skis, are each formed with the usual surface for gliding over snow covered terrain and this surface is used in traveling downwardly over inclined surfaces in exactly the same manner as conventional skis are used. In all embodiments of the present invention herein illustrated, however, the gliding surface of the ski is displaced from its operative position for replacement by a driving or propelling surface whenever the terrain is such that the skier can no longer glide under the action of gravity.

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The driving or propelling surface is actuated by a suitable source of power capable of supplying energy sufficient to propel the skier forwardly and upwardly on an inclined snow covered surface without the exertion of energy by the skier. Once the skier has been propelled to terrain down over which he may glide, the gliding surface is again brought into operative position and the driving means rendered inoperative to permit the skier to glide downwardly as with conventional skis.

The driving unit in all illustrated embodiments of the present invention comprises a pair of endless driving belts longitudinally arranged on each ski and spaced apart to permit the skier's boot to be mounted intermediate the adjacent ends of the longitudinally arranged belts. A suitable motor supplies power to one belt and power is preferably taken from the driving means of that belt to drive the other belt through a conventional power transmitting means suitably arranged to carry out the desired end result.

The motor may be mounted directly on each ski or may be supported by a shoulder pack and connected through a flexible drive shaft to the drive element of the belt to be driven thereby. In the latter case, a motor for each ski might be used or, if desired, a single power unit could be provided for driving both skis. Obviously where the power unit is not separate from the ski, a unit for each ski must be provided.

The driving belts of each ski are supported by pulleys carried by bracket members detachably mounted to the body member of the ski to the end that the entire driving unit can be removed if desired. Thus a skier may remove from each ski its driving unit and, once the driving unit is removed, the ski of the present invention very closely resembles a conventional ski and can be used as such.

The pulley of the driving unit which is driven by the power unit is held against movement relative to the ski body by the bracket member which supports the same for rotation. The remaining pulleys of the driving unit, on the other hand, are each movable relative to the bracket to which each pulley is mounted for rotation. To fix the distance between the axes of rotation of each pair

of pulleys and to hold the belt running thereover substantially taut in all positions of the pulleys relative to the body member of the ski, rigid frame members interconnect the axles of each pair of pulleys and thus prevent relative movement of the pulleys of each pair. The adjacent pulleys of the two sets of pulleys are interconnected by a rigid link in those embodiments of the invention where the one belt is driven by a chain drive from the driven pulley of the other belt.

As only the pulley which is driven by the motor unit is held against movement longitudinally of the ski, all stresses imposed by the belts are taken by the body member of the ski through the bracket which mounts the driven pulley. As the brackets carrying the other pulleys of the drive unit permit some movement of the pulleys relative to the body member of the ski, the latter may flex in the same manner that a conventional ski will flex as it moves over irregular terrain.

In some embodiments of the invention herein illustrated and described, the fore and aft end portions of the body member of the ski are pivotally mounted relative to that portion of the ski body to which the boot of the skier is mounted. In these embodiments, the fore and aft segments can be moved at least 180 degrees to present either the gliding surfaces of the segments or the driving surfaces to the snow covered terrain over which the skier desires to move.

In another embodiment herein illustrated, the fore and aft sections of the ski body are not movable relative to the section to which the boot is clamped and in this embodiment, the entire ski is pivotally moved about its longitudinal axis to present one or the other of the surfaces. In the embodiment of the invention just mentioned, the boot clamping means must be inverted as the ski is inverted.

Other features and advantages of the present invention will be hereinafter apparent from the following description, particularly when taken in connection with the accompanying drawings, in which

Figure 1 is a sketch showing a skier equipped with the embodiment of the invention in which the motive power is carried by the skier and is transmitted to each ski through a flexible shaft;

Figure 2 is a top plan view of the left ski in the gliding position;

Figure 3 is an elevational view of the ski of Figure 2 in the gliding position;

Figure 4 is an elevational view of the ski of Figure 2, but here shown in the climbing position;

Figure 5 is a plan view on an enlarged scale of the forward segment with a portion of the driving belt removed to more clearly illustrate parts hidden thereby;

Figure 6 is a section taken along line 6—6 of Figure 5;

Figure 7 is a fragmentary view of the forward end of the ski showing the tip member reversed for climbing use;

Figure 8 is a section taken on line 8—8 of Figure 7;

Figure 9 is a plan view of the central portion of the ski showing the binding plate in a gliding position;

Figure 10 is an elevational view of the central portion of the ski showing the binding plate in the gliding position;

Figure 11 is a view similar to Figure 10 but showing the driving belts in operative position;

Figure 12 is a section taken along line 12—12 of Figure 10;

Figure 13 is a section taken along line 13—13 of Figure 11;

Figure 14 is a section on an enlarged scale taken along line 14—14 of Figure 10;

Figure 15 is a section on an enlarged scale taken along line 15—15 of Figure 2;

Figure 16 is a section on an enlarged scale taken along line 16—16 of Figure 10;

Figure 17 is a fragmentary perspective view of the medial portion of the ski with the binding plate shown in a gliding position;

Figure 18 is a perspective view showing the driving belts in operative position and the binding plate in the low position for climbing;

Figure 19 is a view similar to Figure 18 but showing the binding plate in the high position for climbing;

Figure 20 is a fragmentary, perspective view of a driving unit of the present invention mounted to a conventional ski;

Figure 21 is a top plan view of the central section of a modified form of the ski in which the power unit is carried by the ski;

Figure 22 is a fragmentary elevational view partly in section further illustrating the power unit of the embodiment of the ski shown in Figure 21;

Figure 23 is a view similar to Figure 21 but showing a modified form of the ski;

Figure 24 is a section taken along line 24—24 of Figure 23;

Figure 25 is a longitudinal section of one form of the driving belt;

Figure 26 is a view similar to Figure 25 but showing a modified form of the belt;

Figure 27 is a fragmentary plan view of the inner surface of a modified form of the driving belt;

Figure 28 is a section taken along line 28—28 of Figure 27;

Figure 29 is a view similar to Figure 27 but showing a still further modified form of the driving belt;

Figure 30 is a section taken along line 30—30 of Figure 29; and

Figure 31 is a section taken along line 31—31 of Figure 30.

Referring now to the drawing, Figure 1 illustrates a skier equipped with a pair of skis of one embodiment of the present invention. Each ski of the embodiment of the invention shown in Figure 1 comprises a body member including a binding plate 10 for supporting the boot 11 of the skier. The boot is clamped to the plate 10 by means of an adjustable width toe iron 12 detachably mounted to the binding plate and adapted to receive the toe of the boot. A cable binding 13, which includes a resilient section 14, is adapted to extend about the heel of the boot to removably hold the toe of the boot 11 within the toe iron.

The toe iron 12 comprises a substantially U-shaped body member, the flanges 15 of which engage the opposite edge faces of the binding plate 10. Each flange 15 is formed with a pair of L-shaped slots 16 adapted to receive spaced pins 17 outwardly projecting from each edge face of the binding plate 10. The one leg of each slot 16, as clearly shown in Figure 2, opens onto the lower edge of the flange 15. Thus, the pins 17 projecting from each edge face may be simultaneously engaged within the leg opening onto the edge of the flange, after which the toe iron is forced downwardly and then rearwardly to rela-

tively move the pins 17 simultaneously into the other leg of each of the slots 16. After the binding plate has been thus attached, a threaded stud or bolt 18 is threaded into a tapped opening formed in the edge face of the binding plate to lock or hold the toe iron against movement.

It should now be seen that the toe iron can be quickly removed from the binding plate by merely threading out the bolt 18 and then sliding the toe iron forwardly to move each pin 17 rearwardly in the one leg of each L-shaped slot after which the toe iron may be merely lifted from the binding plate. The pins are so carried by the binding plate 10 that the toe iron can be mounted to either face of the plate. The reason for this arrangement will be further explained hereinafter.

The binding plate 10 is pivotally mounted between the adjacent ends of a pair of ski segments 19 and 21 held in a spaced apart but longitudinally aligned attitude by a rigid yoke 22. The opposite ends of the yoke 22 are formed with gusset plates 23 which are rigidly fixed by some conventional fastening means, such as cap screws or the like, to the adjacent ends of the ski segments 19 and 21. Each gusset plate 23 is formed with an upstanding flange 24 presenting inwardly facing planar surfaces facewisely engaged by pivot plate 25 carried at the opposite ends of the binding plate 10. The pivot plates 25 are each formed with an aperture which, when brought into registry with an aperture formed in each of the flanges 24, form a passageway for receiving an elongate shoulder bolt 26. The bolts, when received within the passageway, form aligned pivot pins for mounting the binding plate 10 for pivotal movement upon an axis substantially coincident with the longitudinal axis of the aligned ski segments 19 and 21. Each of the bolts 26 are secured against accidental withdrawing movement by a conventional nut as shown, although other means obviously could be used.

The ski segments 19 and 21 are formed with gliding faces 27 and 28 respectively, as are conventional skis today. The binding plate 10 is also formed with a smooth planar surface 29 which, when the binding plate is in the position shown in Figure 3, forms a substantial continuation of the gliding surfaces of the ski segments 19 and 21. It should now be seen, referring particularly to Figure 3, that when the binding plate 10 is in the position shown in that figure, the ski segments 19 and 21 and the binding plate 10 present at the lower face thereof a conventional gliding surface adapted to be brought into engagement with a snow covered terrain to permit the skier to glide downwardly thereover. Thus a skier, by securing his boots in toe irons secured to the binding plate as shown in Figure 3, may use the ski of the embodiment of the present invention now being described, in exactly the same way as conventional skis are used.

To hold the binding plate 10 in the position desired, the flanges 24 of the gusset plates 23 are preferably formed with spaced openings 30'' adapted to receive spring-loaded pins 30 slidably carried by the pivot plates 25 of the binding plate 10. The pins are formed with upstanding actuators 30' passed through slots formed in the pivot plates 25. The actuators permit the pins to be easily withdrawn from the openings in the flanges 24 to free the plate 10 for pivotal movement. The pins 30, however, when engaged in the openings of the flanges 24 will hold the plate 10 in either one of the two alternate positions

relative to the ski segments 19 and 21. These two positions will be clear from a comparison study of Figures 3, 4, 12, and 13.

A skier today equipped with conventional skis to climb a slope must either use the so-called "climbers" or ski tows or other facilities for bodily carrying skiers upwardly over inclined terrain. The skier thus is limited to either a slope which he can himself climb, or to slopes over which he may be mechanically towed or carried. This obviously limits the activities of the skier. A skier equipped with the skis of the present invention is not so limited for, in all embodiments herein illustrated, means are provided for driving the skier either forwardly over level terrain or upwardly over inclined terrain.

This means, in the embodiment of the present invention now being described, comprises an endless traction belt mounted to each ski segment and driven by a power source carried by the skier. Returning now to Figure 1, a small gasoline-powered motor may be used to drive the belt and such a motor is shown at 31 in the figure referred to. The motor 31 may be conveniently mounted by a suitable shoulder pack 32 to the body of the skier and its power output carried to each ski by a conventional power transmitting flexible shaft 33. The one end of each flexible shaft 33 is suitably connected to the driven element of the motor while the opposite end of each shaft carries a disconnect 33a adapted to be drivingly connected to an axle 34 of a pulley 35 mounted to the aft segment 21 through a U-shaped bracket 36. An endless belt 37, passed around the pulley 35, is also passed around a second pulley 38 rotatably supported by a bracket 39 mounted adjacent to the trailing edge of aft segment 21. The belt 37 is, therefore, mounted to the segment to extend longitudinally thereof, but spaced from the surface thereof opposite to the gliding surface 28.

Each of the brackets 36 and 39 is removably secured to the ski segment by identical means and, to simplify the disclosure of the present invention, the now preferred means used to secure the bracket 36 will only be described. The securing means, as best shown in Figure 14, comprises a pair of flanges 41 adapted to engage the opposite edge faces of the ski segment. The segment carries, at least on one side thereof, a pair of spaced spring-loaded pins 42, each having a longitudinally extending finger 43 adapted to be secured in an opening formed in the flange 41 engageable with the edge face of the segment. To mount the bracket to the segment, the fingers 43 of the pins 42 are forced inwardly against the springs urging the pins 42 outwardly until the end faces of the fingers are substantially flush with the edge face of the segment. The flanges 41 may now be slipped over the segment and the openings in the flange brought into registry with the fingers 43. Once the openings in the flange are brought into registry with the fingers 43 and the latter released, the springs will urge the same outwardly to dispose the fingers within the openings of the flange. It should be obvious that to remove the bracket, it would only be necessary to again urge the pins inwardly to clear the fingers 43 from the openings in the flange 41, after which the bracket can be merely lifted from the segment.

Referring again to Figure 14, it will be seen that the opposite ends of the axle or shaft 34 are journaled in bearing elements 44 carried by bosses 45 forming the terminal portions of the arms of

the U-shaped bracket 36. The pulley 35 includes a hub member 46 having an annular flange 47 to the opposite faces of which are bolted or otherwise secured sheave-like members 48 which form the body of the pulley 35. The hub member 46 may be fixed to the axle 34 for rotation therewith by a set screw, such as indicated at 49, although other conventional means obviously could be used. Each member 48 also includes a cylindrical element 50 which loosely sleeves the axle 34.

The periphery of the flange 47 is serrated or toothed, as indicated at 51, and forms a sprocket wheel drivingly engaging a chain 52 fixed to the medial portion of the inner surface of the belt 37 by means of spaced angle bars 53 which support the hinge or pivot pins interconnecting the links of the chain, the bars 53 being riveted or otherwise secured in spaced relationship around the belt 37. Also fixed to the inner face of the belt 37 are a pair of endless V-belts 54 of some suitable material, such as rubber. The V-belts 54 are fixed at opposite edges of the inner surface of the driving belt 37 and track in V-shaped grooves 55 formed in the cylindrical surface of each sheave-like member 48.

The bracket 39, which rotatably supports the pulley 38, referring now to Figure 15, also comprises, as will be remembered, flanges identical to the flanges 41 of the bracket 36. The bracket 39 is thus removably mounted to the ski segment by means identical to the means used to mount bracket 36. The pulley 38 is rotatably mounted to a fixed or stationary axle 56, the opposite ends of which are passed through aligned elongate openings 58 formed in the opposite arms of the bracket 39. The pulley 38 is rotatably mounted on the axle 56 through bearing members 59 fixed to the opposite sides of sheave-like members 60, bolted or otherwise secured to a sprocket wheel 61, the teeth 62 of which are adapted to engage the drive chain 52. The sheave-like members 60, like the members 48, are each formed with a V-shaped groove 57 for receiving the endless V-belts 54 secured to the inner surface of the driving or traction belt 37.

The opposite end portions of the axle 56 are fixed in aligned openings formed in rearwardly extending arms 64, arranged at opposite ends of the pulley 38 by any conventional means desired, such as set screws similar to that used to fix the hub 46 to the axle 34. The arms 64 form a part of a rigid frame member 65 provided with laterally arranged web elements 66 joining longitudinally extending elements 67. It will be seen, referring now to Figure 2, that the longitudinally extending elements 67 are arranged at opposite sides of the driving belt 37 and that the laterally extending web elements 66 are arranged intermediate the two stretches of the belt 37.

The frame member 65 also includes a pair of arms 68 carrying bearing members 69 rotatably engaged with the axle 34. Thus the frame member rigidly interconnects the axles 34 and 56 and fixedly determines the distance between the axes of rotation of the pulleys 35 and 38.

It should now be seen that the output of the gasoline motor 31, transmitted by the flexible shaft 33 to the axle 34, will drive the axle 34 and consequently the pulley 35. As the pulley 35 is rotatably driven, the teeth of the flange 47, engaging the links of the chain 52 fixed to the inner surface of the belt 37, will drive the belt in the path defined by the pulleys 35 and 38.

Referring now again to Figure 14, the axle 34 at the end opposite to the end connected to the flexible shaft 33 carries a sprocket wheel 71, the hub 72 of which is fixed to the axle 34 by a set screw 73. The teeth of the sprocket wheel 71 are adapted to engage and drive a sprocket chain 74 also passed about a sprocket wheel 75, the hub of which is fixed to an axle 76 by a set screw 77. The axle 76 is rotatably supported by a U-shaped bracket 78, removably mounted to the end portion of the ski segment 19 by spaced flanges identical to the mounting flanges 41 of the bracket 36. Spring-pressed pins, identical to the pins 42, hold the mounting flanges of the bracket 78 to the ski segment 19 but yet permit its removal therefrom as is bracket 36 removable from ski segment 21.

Bracket 78 differs from bracket 36 in that the arms 79 of the former are provided with aligned elongate openings 81 for passing the opposite ends of the axle 76 and carriage hub. The major axis of the openings 81, as clearly shown in Figure 4, are substantially parallel with the fore and aft axis of the ski. To reinforce the defining edges of the openings 81, outturned flanges 82 are formed on each arm of the bracket. Nested within each elongate opening 81 is a cylindrical bearing support 83 in which is fitted a pair of bearing members 84 for rotatably supporting the opposite ends of the axle 76. The bearing supports 83 form a part of a frame member 85 which will be hereinafter more fully described.

Fixed to the axle 76 is a pulley 86, identical to the pulley 35 previously described. The pulley 86, like the pulley 35, comprises a hub member 87 fixed to the shaft or axle 76 by a set screw and includes an annular flange 89, the periphery of which is formed as a sprocket wheel. The teeth of this sprocket wheel engage a sprocket chain 91 fixed to the inner side of a traction belt 92 through spaced angle bars 93 as was the chain 52 of the belt 37. The belt 92 is identical to the belt 37 and includes a pair of spaced V-belts 94 adapted to engage in their travel about the pulley 86 in V-shaped grooves 95 formed in the cylindrical surfaces of sheave-like members 96 bolted or otherwise secured to the opposite faces of the annular flange 89.

The belt 92 extends forwardly of the ski segment 19 and is rotatably supported at its forward end by a pulley 99 identical to the pulley 38 and supported for rotation on an axle 100, the opposite ends of which are passed through elongate openings 101 formed in a bracket 102 identical in all respects to the bracket 39. As the bracket 102 is identical to the bracket 39 and as it supports the pulley 99 in exactly the same way that the bracket 39 supports pulley 38, the structure thereof will not be again described.

The axle 100, like the axle 56, is actually stationary for the opposite ends thereof are suitably secured to forwardly extending arms 103 of the frame member 85, which, it will be remembered, carried the bearing supports 83 to which the bearing members 84 supporting the axle 76 were carried. The frame member 85 comprises longitudinally extending elements 104 arranged on opposite sides of the belt 92 and joined by transversely, as well as diagonally extending, web members 105 and 106 respectively. It should be seen now that the frame member 85 fixes the distance between the axes of rotation of the pulleys 86 and 99.

Fixed to each cross web 105 of the frame 85 are bracket members 107, each formed with oppositely extending pairs of arms 108. Each pair of arms 108 rotatably support an axle 109

carrying at the opposite ends thereof idler pulleys 110 adapted to receive and support the V-belts 94 secured to the inner surface of the belt 92. The arms 108 of each bracket 107 are resilient and tend to hold the V-belts 94 and consequently the driving belt 92 outwardly or away from the ski segment. The purpose and function of the spring mounted idler pulleys 110 will be made clear after the function of the driving belt 92 is understood.

Although not shown, identical spring mounted idler pulleys are also mounted by bracket members, identical to bracket members 107, to the frame 65 and cooperate with the V-belts 54 to hold the traction belt 37 outwardly or away from the ski segment 21.

To fix the distance between the axes of rotation of the pulleys 35 and 86, a rigid stress-carrying link 112, carrying at its opposite ends identical bearing members 113 which rotatably engage the axles 34 and 76, is used. The bearing member 113, engaging the axle 34 as clearly shown in Figure 14, is disposed between the sprocket wheel 71 and the boss 45 while the bearing member 113, rotatably engaging the shaft 76, is disposed between the sprocket wheel 75 and the bearing support 83 in which is fitted the bearing member 84. The link 112 extends between the axles 34 and 76 in a position overlaying the yoke 22 and, as will be understood, rigidly fixes the distance between the axes of rotation of the pulleys 35 and 86.

In the use of the skis of the embodiment of the invention shown in Figure 1, it has already been explained that when the mounting or binding plate 10 is in the position shown in Figure 3, that is, with the gliding surface 29 thereof substantially flush with the gliding surfaces 27 and 28 of the ski segments 19 and 21 respectively, the ski is used as a conventional ski.

It might be mentioned here that the yoke 22, the link 112, as well as the chain 74 are all carried to the outside of the ski in this use of the ski. Thus when the ski of the present invention is being used as a conventional ski, these laterally projecting elements of one ski cannot interfere with the same elements of the other ski. When the ski is being used as a conventional ski, disconnects 33*a* can be removed from the axles 34 to permit the flexible shafts 33 to be stowed in any position desired on the pack 32. Thus with the flexible shafts 33 disconnected from the axles 34, the ski is freed of the restraint of the flexible shafting while the skier is executing downhill maneuvers. A skier may thus glide down through the action of gravity over a snow covered terrain in exactly the same manner as he would if he was equipped with conventional skis.

With the ski of this embodiment, once he has reached the lowermost extent of the terrain over which he has glided and now wishes to climb an upwardly inclined surface, he may, by retracting the pair of spring-urged locking pins 30, pivotally move the fore and aft ski segments 19 and 21 of each ski about the axis established by the bolts 26 to bring the belts 37 and 92 into engagement with the terrain up which he desires to climb. The pins 30 will snap into the openings formed at the opposite sides of the flanges 24 to hold the ski segment in the desired position with the belts 37 and 92 in their operative driving positions. The motor 31 can now be started to drive the sprocket member 47 of the pulley 35 which in turn drives the belt 37. The belt 92 is, of course, simultaneously driven through the sprocket 71 and chain 74 which is passed about the sprocket 75 carried by the axle 76 to which the pulley 86 is fixed.

In this particular use of the embodiment of the invention now being described, the boot 11 of the skier is held close to the terrain so that the center of gravity is maintained low. This is the preferred position for hard packed snow or at least snow into which the skis do not sink to any appreciable extent as the skier moves over the same. As the skier will sink into the snow to some extent, means are preferably provided to reduce the drag of the binding plate as the ski is moved forwardly through the action of the driving belts. This means, in the now preferred embodiment of the invention, comprises a fairing member 114 fixed to the gusset plate 23 of the leading edge of the yoke 22 through bolts or some similar fastening means. It will be seen, referring again to Figure 11, that the leading face of the fairing member 114 is smoothly curved and fairs into the gliding surface 29 of the binding plate 10. It should be obvious that the fairing member 114, because of its particular location and contour, will tend to reduce the drag which otherwise might have been caused by the binding plate and its mounting means.

The outer surface of each driving belt is preferably formed with some traction inducing means and each belt may, if desired, comprise a plurality of bristle-like elements embedded within the outer surface thereof. In one form of the belt, referring now to Figure 25, these bristle-like elements might consist of short, relatively rigid strands 115 of a suitable plastic, such as nylon, anchored within the material of the belt 116 during the operation of forming the same. The bristles should extend obliquely and rearwardly to the surface of the belt to the end that they would not materially impede forward gliding movement of the skis if the belts were engaging the terrain, but would bite into the snow covered surface where the belt was actually being used to drive the skis forwardly.

In Figure 26 there is shown a modified form of the driving belt in which the belt comprises an endless loop 117 of an elastically deformable material to the outer surface of which is secured a second loop 118 of sealskin, such as is used today to form the "climbers" previously mentioned. The hair bristles 119 of the sealskin, in this embodiment of the belt, perform the same function in exactly the same way as the plastic bristles of the previously described embodiment of the belt.

The bristles of either form of the driving belt will tend to pick up and carry snow and, to prevent this snow from packing or accumulating between the one stretch of the belts and the adjacent faces of the ski segments forming the body member, it is now preferred to mount between pulleys 86 and 38 and the adjacent surfaces of the ski segments 19 and 21, respectively, small scrapper blades 120, preferably V-shaped, as clearly shown in Figure 5. These blades will remove snow from the bristles of each of the belts as the belts move around pulleys 86 and 38. The scrapper blades 120 can be mounted either to the brackets 78 and 39 or to the ski segments so long as they act to remove snow from the belts as they are carried around the pulleys.

If it is desired to provide means for preventing the entry of snow between the two stretches of

each belt, cover elements can be provided which would consist of plate-like elements 121, preferably secured to the upper and lower edge faces respectively of the longitudinally extending elements 104 and 67 of the frames 85 and 65, respectively. These cover plates have been shown in Figures 7 and 8 only, as their inclusion in the other figures of the drawing would obviously complicate the disclosure of elements carried between the two stretches of the belt.

It will now be seen that the belts, as they are driven in the direction necessary to force each ski forwardly, will carry the skier forwardly and upwardly of the slope with little, if any, exertion on his part. As the traction surfaces of the belt do not impede forward movement of the belt, the ski segments do not have to be inverted if the skier, because of the terrain, is required to glide forwardly and downwardly over a relatively short inclined slope. This is done by merely gliding downwardly with the belts in engagement with the snow covered surface of the slope in exactly the same manner as he would if the gliding surfaces were engaging the terrain.

It might be mentioned here that the extreme forward tip of the skis of the present invention are reversible so that the extreme tip portions may be adjusted so as to extend upwardly regardless of whether the belts are engaging the snow covered terrain or whether the skis are being used with the gliding surfaces in action. Although a number of different means can be used for reversing the tip of the ski, in the embodiment of the invention now preferred, the extreme tip portion of the ski segment 19 is formed as a separate member 123 which is detachably mounted to the segment.

The means used to mount the tip member 123 may comprise a pair of plates 124 secured to the opposite edge faces of the tip member 123 by conventional securing means. The plates 124 extend beyond the inner face of the tip member 123 and the extending portions are each formed with a slot 125 extending inwardly from the free edge thereof. The slots 125 are adapted to receive pins 126 projecting outwardly from the opposite edge faces of the ski segment 19 and the pins coact with the defining edges of the slots 125 to align the tip member 123 with the ski segment 19.

The segment carries within suitable channels a pair of pins 127 mounted for sliding movement transversely of the ski segment. The opposite or outer ends of the pins 127 are adapted to be engaged in openings formed in the extending portions of the plates 124. Springs, not shown but carried within the channels within which the pins are mounted, normally urge the pins outwardly and into engagement with the openings formed in the plates 124. Thus it will be seen that when the pins 127 are engaged or received in the openings of the plates 124, the tip member 123 will be rigidly held to the ski segment.

To reverse the relative positions of the ski segment and tip, the pins 127 can be easily retracted by merely forcing together the actuators 128 laterally projecting from the pins 127 and slidable in L-shaped slots 129 formed in the one face of the ski segment 19. Once the pins 127 are retracted and are no longer engaged in the openings in the plates 124, the tip member can be separated from the ski segment by an axially applied force, inverted, and again mounted to the segment. To hold the pins 127 in their retracted position during the inverting operation, the actuators 128 can be moved into the laterally extending legs of the slots 129. After the tip member has been inverted and again mounted to the ski segment, merely moving the actuators out of the laterally extending legs of the slots 129 will permit the springs to move the pins 127 into engagement with the openings formed in the plates 124.

If desired, the leading edge of the ski segment 19 can be formed with a tongue or tenon 131 which is adapted to engage in a groove or rabbet formed in the adjacent face of the tip member 123.

With the tip member 123 removable for the purpose of inverting the same relative to the ski segment, the tip member can be mounted to extend upwardly when the gliding surfaces of the ski segments are in action as well as when the driving belts are being used to propel the skis forwardly. This feature of the ski of the embodiment now being described will be best understood from a comparison study of Figures 6 and 7 of the drawing.

With the traction belts 37 and 92 engaging the snow covered terrain, it should be appreciated that the power output from the motor 31 will drive the skis forwardly over the snow covered terrain. All of the power transmitted by each flexible shaft 33 to each ski is taken by the axle 34 and thus the driving forces are directly transmitted to the ski by the bracket 36 which directly supports the axle 34 for rotation. The driving forces transmitted to the belt 37 by the sprocket wheel 47 and chain 52 are not transmitted to the ski through the bracket 39 for it will be remembered that the axle 56 is not fixed to the bracket 39 but rather to the arms 64 of the frame 65. The axle 56 actually floats relative to the bracket 39 as the elongate openings 58 permit the axle 56 to move relative to the bracket.

All driving forces created therefor by the belt 37, which might be likened to pushing forces urging the ski segment forwardly, are transmitted to the ski segment through the bracket 36. This is also true of the forces created by the belt 92 for neither axle 76 nor 100 is immovably held by the brackets 73 and 102, respectively, but rather by the frame member 85 interconnecting and rigidly fixing the distance between the axles 76 and 100. This is so for both axles 76 and 100 can simultaneously move relative to their respective brackets because of the elongate openings of the brackets through which the opposite ends of the axles project. Reaction forces generated by driving movement of the belt 92 are, therefore, transmitted to the frame 85 and from the frame 85 to the bracket 36 by the stress-carrying link 112 which fixes the distance between the axles 76 and 34. Thus the forces propelling the ski forwardly due to engagement of the belt 92 with the snow surfaces, which forces can be likened to pulling forces which pull the ski forwardly, are also taken by the bracket 36.

This structure is used to render the entire ski flexible so that the ski may flex as it moves over irregular terrain. It should be appreciated that if the axles 56, 34, 76, and 100 were supported directly by their respective brackets, the ski would be extremely rigid for then the brackets and the frame members would form a truss-like structure which would reinforce the ski against bending moments and prevent the ski from flexing as it moved over terrain which was not a substantially planar surface.

Thus if the ski of the present invention is being

used as a conventional ski, that is, with the gliding surfaces 27, 29, and 28 engaging the snow, both the fore and aft segments may flex, as well as the plate 10, in exactly the same way as conventional skis will flex as they move over irregular surfaces.

This feature of the present invention is, of course, also had where the traction belts 37 and 92 are engaged with the snow surface and are being used to propel the ski forwardly. The skis are not subjected to the same bending or flexing forces when the belts are being used to propel the ski forwardly for the belts, as they are pliant, will tend to assume the shape or contour of the surface over which they are moving. The purpose and function of the resiliently mounted idler pulleys 110 should now be clearly understood for these pulleys obviously will tend to hold the belts 92 and 37 in good driving engagement with the surface of the snow regardless of the particular contour of the surface.

In the previous description of the use of the embodiment of the ski now being described, the position of the toe iron 12 was not changed relative to the binding plate 10 when the ski segments were pivotally moved relative to the binding plate. In this use of the ski, it will be remembered, the binding plate occupied the position shown in Figure 4 of the drawing. As the toe iron is detachably mounted to the binding plate and as it can be attached to either face of this plate, the toe iron can be removed from the binding plate and attached in the position shown in Figure 19. In this use of the ski of the present invention, during the time the driving or traction belts are in use, the boot 11 of the skier is held at a relatively greater distance above the surface of the snow than in the use of the ski illustrated in Figure 4 of the drawing. The ski could be so used in relatively deep powder snow and into which the skis would sink to a relatively great depth as the skier moved over the same.

There is shown in Figure 21 a modified form of the ski of the present invention in which elements identical in shape and purpose to elements previously described in connection with the embodiment of the invention shown in Figure 1 have been given the same reference characters. In this embodiment of the invention, the power source is actually carried by the skit itself and comprises a small gasoline motor 135 mounted to the frame 136 which is similar to and performs the same function as the frame member 65 of the previously described embodiment of the invention. The bracket 137, used to support the motor 135 on the frame 136, also supports a small flywheel and clutch 138 which includes a driven shaft 139 supported for rotation in bearings 141 carried by the web member 142 of the frame 136. The driven shaft 139 carries at the free end thereof a worm 143 engaging and driving a gear 144 fixed to a shaft 145. The shaft 145 extends transversely of the frame 136 and is journaled at its opposite ends in bearing members 146 carried by the longitudinally extending members 147 of the frame 136. Fixed to the one end of the shaft 145 is a sprocket wheel 148, the teeth of which engage and drive a sprocket chain 149 which is also passed around a sprocket wheel 151 fixed to the axle or shaft 152 rotatably supported by a bracket identical in all respects to bracket 36 of the earlier described embodiment of the invention.

The pulley member fixed to the axle 152 is identical to the pulley 35 and will not be again described. In fact, the remainder of the ski of the embodiment now being described is identical to the previously described embodiment of the invention and is used in the same manner. Actually, as should now be appreciated, the only difference between the embodiment of the invention now being described and that previously described is in the power source used to drive the traction belts. Not only is this power source carried by the ski, but the fuel supply as well. The fuel supply is held by a small tank 153 supported through brackets 154 on the frame member 136. Thus each ski includes a complete power source, the output of which can be conveniently varied through a throttle member 155 which may be operated by the skier through some suitable shafting means not shown.

There is shown in Figure 23 a further modified form of the ski of the present invention. In this form of the invention, the binding plate 160, to which the toe iron 161 is secured in the same manner as was the toe iron 12, is pivotally mounted between the ski segments 162 and 163 by power transmitting means for transmitting power from an axle 186 to the axle 198. This power transmitting means comprises a shaft 166 passed through a longitudinally extending bore 167 formed in the binding plate 160. The shaft 166 is suitably journaled within the bore and carries at its opposite ends pinions 168 and 169 engaging gears 171 and 172, respectively, housed within laterally extending flanges 173 formed at opposite ends of the binding plate 160.

The gears 171 and 172 are carried by stub shafts 174 and 175, respectively, journaled within the flanges 173. The shaft 175 extends rearwardly through a bore formed in a flange 176 forming a part of a bracket member 177 fixed to the one face of the ski segment 163. This shaft carries at the end extending beyond the flange 176 a bevel gear 178 which engages with a second bevel gear 179 carried by a shaft 181 journaled at its opposite ends in bearing members 182 carried by the bracket 177. Fixed to the one end of the shaft 181 is a sprocket wheel 183, the teeth of which engage a sprocket chain, schematically indicated at 184, and passed about a second sprocket wheel 185. The sprocket wheel 185 is fixed to an axle 186, identical to the axle 34, rotatably supported in a bracket 187, identical to bracket 36. As the pulley fixed to the axle 186 is identical to pulley 35, its structure will not again be described. The other elements associated with the ski segment 163 are also identical to the elements carried by ski segment 21 and, to simplify the disclosure of the embodiment now being described, reference is had to the description of the elements of ski segment 21.

It will be seen that as axle 186 is rotatably driven, the sprocket chain 184 will drive the shaft 181 which shaft, through the bevel gears 179 and 178, will drive the elongate shaft 166. This shaft, it will be remembered, carries the pinion 168 engaging and driving the gear 171 fixed to the shaft 174. The shaft 174 is partially supported by a fairing member 188 forming a part of a bracket member 189 secured to the one face of the ski segment 162. Fixed to the end of the shaft 174 projecting beyond the leading face of the fairing member 188 is a bevel gear 191 which engages and drives a bevel gear 192 fixed to a stub shaft 193. The shaft 193 is journaled in a bearing member 194 carried by the bracket 189 and this shaft carries at its

outer end a sprocket wheel 195, the teeth of which engage and drive a sprocket chain, schematically indicated at 196. The sprocket chain 196 is also passed about a sprocket wheel 197 fixed to an axle 198, identical in all respects to the axle 76 of the previously described embodiment of the invention. The axle 198, like the axle 76, carries a pulley identical to pulley 86 and identified in Figure 23 by that reference character. A short stress-carrying link 199 having bearing members 200 at the opposite ends thereof engaged with the axle 198 and shaft 193, respectively, fixes the distance between the latter and maintains the chain 196 taut.

It should be seen now that as axle 196 is rotatably driven to drive the belt 37, the belt 92 will be simultaneously driven in the same direction through the drive connection just described to produce the same result as in earlier described embodiments of the invention.

The binding plate 160 is actually supported for pivotal or rotational movement between the ski segments 162 and 163 by the stub shafts 174 and 175 and the binding plate 160 can be moved about the pivotal axis established by these shafts in exactly the same manner as was binding plate 10 movable about the axes established by the bolts 26. To hold the binding plate 160 in the desired position relative to the ski segments 162 and 163, spring-loaded pins, identical to the pins 30, are used. These pin actuators, identified in Figure 23 by the reference character 30' and pins 30, will hold the binding plate 160 in either one of two alternate positions corresponding to the alternate positions of binding plate 10. It should be understood that when the binding plate 160 is moved from one alternate position to the other, the ski segments 162 and 163 are actually moved independently to present to the snow covered terrain either the conventional gliding surfaces formed on the one face of each segment as well as the binding plate 160 or the driving belts 37 and 92.

The ski of this embodiment of the invention can, therefore, be used in the same manner as the embodiment shown in Figure 1 and no further description of the manner of use of this form of the invention is believed necessary.

Although in most uses of the ski of this embodiment of the invention, the ski will be used either as a conventional ski or with the segments 162 and 163 inverted to place the driving belts thereof in engagement with the snow covered surface. However, the ski of this embodiment can be used with one ski segment inverted with its driving belt in engagement with the snow covered surface while the other segment could be disposed with the gliding surface thereof engaging the surface. This is possible because of the particular power transmitting means here employed which permits independent pivotal movement of the ski segments 162 and 163.

In all of the embodiments of the present invention hereinbefore described, the body members forming the ski proper have consisted of the fore and aft segments together with the binding plate pivotally mounted intermediate the ends of the segments but many, if not all, of the features and advantages of the forms of the invention hereinbefore described can be had by attaching a driving unit to a conventional ski with but few alterations. Such an installation is shown in Figure 20 of the drawing in which a conventional ski 201 is shown with a driving unit similar to the driving unit shown in Figure 3 mounted thereto. The driving unit can be either powered by a motor, such as that shown at 31, or by a power unit actually carried by the driving unit and which has been previously described in connection with the embodiment of the invention shown in Figure 21.

The driving unit of the embodiment of the invention shown in Figure 20 can be identical to the driving units previously described for it should be seen that as the brackets are all detachably mounted to the body of the ski, the entire driving unit could be bodily removed from either the ski of the embodiment shown in Figure 2 or Figure 21 and mounted to a conventional ski, such as illustrated at 201. In fact the only modifications to the ski would be the provision of the spring mounted pins 42 for mounting the flanges 41 to the ski body and the addition of the pins 17 for mounting the toe iron 12 to either face of the ski 201. To simplify the disclosure of this form of the present invention, all elements thereof identical to elements previously described have been given the same reference characters.

A conventional ski, modified as above mentioned and carrying the driving unit, could be used in exactly the same manner as are the other embodiments of the ski herein shown. With the ski in use as shown in Figure 20, the driving belts 37 and 92 would propel the skier forwardly in exactly the same manner as hereinbefore described. In such a use of this form of the invention, the toe iron 12 would be mounted in such a position as to hold the boot 11 of the skier to the gliding surface of the ski and the boot would be held in substantially the same attitude as is the boot in the embodiment of the invention illustrated in Figure 19. When it was desired to use the ski with the gliding surfaces engaging the terrain, the toe iron 12 could be easily removed from the ski 201 and the entire ski inverted after which the toe iron would be again placed in its conventional position and the skis would be then ready for use to glide downwardly as a conventional ski.

In all forms of the invention hereinbefore described, the driving belts have comprised elastically deformable loops in which the bristles were embedded or to which sealskin or other similar animal hide was secured. The belts must be slightly deformable because of the particular manner in which the sprocket chains were secured to their undersurface. It will be seen, referring now to Figure 8, that the sprocket chain there shown is actually displaced inwardly from the traction belt so that as the belt and the sprocket chain fixed thereto travels about either of the pulleys over which the belt is running, there will be a difference in the peripheral speeds of the belt and the sprocket chain. This is so for the radius of curvature of the path of movement of the belt and chain about the pulley will differ. If the body of the belt is elastically deformable, the difference in peripheral speed can easily be accommodated but if it is desired to form the belt of a material which is not elastically deformable, the sprocket chain must be fixed to the belt so that the belt and the chain move about the pulley at the same peripheral speed.

Such a belt is shown in Figures 27 and 28 in which the belt is formed of a pair of belt sections 202 of some suitable material carrying bristles 203. The sprocket chain 204 is mounted between the adjacent edges of the belt sections 202 through angle brackets 205 attached to the ad-

jacent edges of the belt sections 202. The legs of the brackets 205 attached to the belt sections 202 are held spaced therefrom by small bushings 206 or the like sleeving the rivets 207 used to fix the bracket 205 to the belt sections 202.

It will be seen, referring specifically to Figure 28, that the angle brackets 205 so mount the sprocket chain 204 that the pivot pins 208 thereof are disposed in a plane which contains the transverse axes of the belt sections 202. Thus the belt formed by the sections 202 and the sprocket chain 204 will move at substantially the same peripheral speed as the belt moves about either of the pulleys supporting the belt for rotation. The belt formed by the sections 202 also carries on its inner face V-belts 209 which perform the same function as the V-belts of the embodiments of the driving belt previously described.

There is shown in Figures 29 to 31, inclusive, a further modified form of the driving belts and the belt there shown, like the belt of Figure 27, is formed with the sprocket chain 210 lying in substantially the same plane as that of the transversely arranged, spaced lugs 211 interconnected through the angle brackets 212, including spacer bushings similar to those used in the embodiment of the belt sohwn in Figure 28, which mount the sprocket chain 210 and the V-belts 213 to form an endless driving belt. The lugs 211 are T-shaped in cross-section as is clearly shown in Figure 31. The shanks 214 of the lugs 211 form spaced cleats extending transversely of the belt for improving the traction between the belt and the snow covered terrain engaged thereby.

Although the now preferred embodiments of the present invention have been shown and described herein, it is to be understood that the invention is not to be limited thereto, for it is susceptible to changes in form and detail within the scope of the appended claims.

I claim:

1. A power driven ski, comprising: a ski body member formed with a gliding surface; at least one endless belt having a traction surface; means for rotatably supporting said endless belt on said body member in superposed relationship to the surface thereof opposite to said gliding surface; means for mounting a skier's boot to said body member; said body member being invertible to move said gliding surface from a downwardly facing position engaging a snow covered surface to an upwardly facing position as said traction surface is moved into a downwardly facing position in which it is adapted to engage said snow covered surface; and power means for driving said belt for propelling the ski forwardly when the traction surface of said belt is engaging the snow covered surface.

2. A power driven ski, comprising: a ski body member having one face thereof formed with a gliding surface; at least one endless belt having a traction surface; means for rotatably supporting said endless belt on said body member adjacent the face thereof opposite to said gliding surface; means for mounting a skier's boot to said body member; said mounting means being so arranged relative to said body member that said gliding surface is movable from an operative position engaging a snow covered surface as said traction surface is moved into an operative position to engage said snow covered surface; and power means for driving said belt for propelling the ski forwardly when the traction surface of said belt is in an operative position in engagement with the snow covered surface.

3. A ski of the type described, comprising: a body member having a gliding surface coextensive with one surface thereof for supporting the ski on a snow covered terrain; a pair of endless belts; a pair of pulleys over which each belt runs; bracket means for removably mounting each pulley to said body member in superposed relation to the surface of said body member opposite to said gliding surface and in spaced relationship therealong to mount said belts in superposed relationship to said body member and in longitudinally aligned relationship therewith; rigid means interconnecting each pair of pulleys, whereby the distance between the axes of rotation of adjacent pulleys remains constant; said bracket means including means for permitting at least one of each pair of said pulleys to move relative to said body member as the latter flexes in traveling over irregular terrain with the gliding surface of the body member in engagement therewith; and means for driving said belts, whereby said belts, when the latter are disposed in engagement with the snow covered terrain, will propel said ski forwardly thereover.

4. A ski of the type described, comprising: a body member including a pair of ski segments each formed with a gliding surface; a rigid member holding said segments apart in a longitudinally aligned relationship; a plate to which the boot of the skier is to be mounted adapted to be mounted between said segments; a pair of endless belts; means for mounting a belt to each segment in superposed relation to the surface of the segment opposite to the gliding surface thereof; means for driving one of said belts; and means for transmitting power from said driven belt to the other of said belts, said transmitting means mounting said plate for pivotal movement relative to said segments whereby said segments are movable from a position in which the gliding surfaces thereof are engaging the snow covered terrain to an inverted position relative thereto in which said belts are engaging the terrain.

5. A ski of the type described, comprising: a body member including a pair of aligned ski segments each formed with a gliding surface and pivotally interconnected by a plate to which the boot of the skier is to be mounted, said segments being invertable relative to said plate; a pair of endless belts; means for mounting a belt to each segment in superposed relation to the surface of the segment opposite to the gliding surface thereof; an endless drive chain fixed to the inner surface of each of said belts; means, including means engaging one of said chains, for driving the belt to which said chain is fixed; and means for transmitting power from said driving means to the chain fixed to the other of said belts, said segments being movable from a position in which the gliding surfaces thereof are engaging the snow covered terrain to an inverted position relative thereto in which said belts are engaging the terrain and operative, when driven, to drive the ski forwardly thereover.

6. A power driven ski, comprising: a binding plate to which the boot of the skier is adapted to be detachably clamped; a ski segment extending rearwardly of said plate, a ski segment extending forwardly of said plate; said segments being longitudinally aligned and each segment being formed with a polished surface for gliding over snow covered terrain; means for mounting said plate intermediate said ski segments for rotational movement about an axis coincident

with the longitudinal axes of said segments whereby the latter may be inverted relative to said plate; a rotatably supported endless belt longitudinally mounted to each segment above the face thereof opposite to said gliding surface; traction means carried by the outer surface of said belts; power means carried by one of said segments for driving the belt mounted thereto; and power transmitting means interconnecting said driven belt and the other of said belts, the traction means carried by said belts being moved into a position to engage the snow surface as said segments are inverted relative to said binding plate.

7. A power driven ski, comprising: a binding plate for supporting the boot of the skier; means adapted to clamp said boot to either face of said plate; a ski segment extending rearwardly of said plate, a ski segment extending forwardly of said plate, said segments being longitudinally aligned, and each having one face formed with a polished surface for gliding over snow covered terrain; means for mounting said plate intermediate said ski segments for rotational movement about an axis substantially coincident with the longitudinal axes of said segments whereby the latter may be inverted relative to said plate; a rotatably supported endless belt mounted to each segment and drivingly engageable with said terrain upon inversion of said segments; power means for driving one of said belts; and power transmitting means interconnecting said driven belt and the other of said belts.

8. A power driven ski, comprising: a binding plate to which the boot of the skier is adapted to be detachably clamped; a ski segment extending rearwardly from said plate; a ski segment extending forwardly of said plate, each segment being formed with a polished surface for gliding over snow covered terrain; means rigidly interconnecting said segments for conjoint movement; means for mounting said plate intermediate said ski segments for rotational movement about an axis coincident with the longitudinal axes of said segments whereby the latter may be inverted relative to said plate; a pair of endless belts; means for supporting a belt on each segment for rotational movement; traction means carried by the outer surface of each belt; power means for driving one of said belts; and power transmitting means interconnecting said driven belt and the other of said belts, the traction means carried by said belts being moved into a position to engage the snow surface as said segments are inverted relative to said binding plate.

9. A power driven ski, comprising: a binding plate to which the boot of the skier is adapted to be detachably clamped; a ski segment extending rearwardly of said plate; a ski segment extending forwardly of said plate, each segment being formed with a polished surface for gliding over snow covered terrain; means for mounting said plate intermediate said ski segments for rotational movement about an axis coincident with the longitudinal axes of said segments whereby the latter may be inverted relative to said plate; an endless belt mounted to each segment for rotational movement; traction means carried by the outer surface of said belts; power means for driving one of said belts; and power transmitting means interconnecting said driven belt and the other of said belts, the traction means carried by said belts being moved into a position to engage the snow surface as said segments are inverted relative to said binding plate.

10. A ski of the type described, comprising: a body member including a pair of aligned ski segments each formed with a gliding surface and pivotally interconnected by a plate to which the boot of the skier is to be mounted, said segments being invertable relative to said plate; a pair of endless belts; means for mounting a belt to each segment in superposed relation to the surface of the segment opposite to the gliding surface thereof; means for driving one of said belts; means for transmitting power from said driven belt to the other of said belts, said segments being movable from a position in which the gliding surfaces thereof are engaging the snow covered terrain to an inverted position relative thereto in which said belts are engaging the terrain; a tip member having a smoothly curved surface; and means for detachably mounting said tip member to the leading edge of said anterior segment with the smoothly curved surface thereof forming a continuation of either surface of said anterior segment whereby said tip member projects upwardly in either position of said segments relative to said plate.

11. A ski of the type described, comprising: a body member including a pair of ski segments each formed with a gliding surface; a yoke rigidly interconnecting said segments in an aligned, spaced apart relationship; a plate to which the boot of the skier is to be mounted; means for pivotally mounting said plate intermediate said segments whereby said segments are invertable relative to said plate; a pair of endless belts; means for mounting a belt to each segment in superposed relation to the surface of the segment opposite to the gliding surface thereof; means for driving one of said belts; and means for transmitting power from said driven belt to the other of said belts, said segments being movable from a position in which the gliding surfaces thereof are engaging the snow covered terrain to an inverted position relative thereto in which said belts are engaging the terrain, said power transmitting means including a shaft carried by said plate and forming a pivotal axis about which said segments may individually move.

12. A ski of the type described, comprising: a body member including a pair of ski segments arranged in an aligned spaced apart relationship and a booth-binding plate pivotally mounting intermediate the adjacent ends of said segments; means holding said plate in a selected one of alternate positions relative to said segments; each of said segments and plate being formed with a gliding surface, which surfaces in one of said alternate positions of said plate are substantially coplanar; a pair of endless belts; means, including a pair of pulleys longitudinally spaced apart on each segment for mounting a belt thereto superposed relative to the surface thereof opposite to the gliding surface thereon; the pulleys mounting the belt to the forward segment of said body member being movable relative thereto; a rigid member tying said movable pulleys together and holding the same against relative movement; power transmitting means interconnecting adjacent pulleys of said sets of pairs of pulleys; and power means for driving one of said interconnected pulleys whereby said belts are simultaneously driven, the movable pulleys permitting said forward segment to flex as the gliding surface thereof moves over irregular snow covered

terrain; said segments being invertable to dispose said plate in the other of said alternate positions relative to said segments, said belts in said other position being disposed beneath said segments and engageable with the terrain for propelling said ski forwardly thereover.

13. A ski of the type described, comprising: a pair of ski segments; a boot-binding plate; power transmitting means pivotally mounting said plate intermediate said segments and holding the latter in a longitudinally aligned spaced apart relationship; means holding said plate in a selected one of alternate positions relative to said segments; each of said segments and plate being formed with a gliding surface, which surfaces in one of said alternate positions of said plate are substantially coplanar; a pair of endless belts; means, including a pair of pulleys for mounting a belt to each segment superposed relative to the surface thereof opposite to the gliding surface thereon; and power means for driving one of said interconnected pulleys whereby said belts are simultaneously driven, said segments being invertable to dispose said plate in the other of said alternate positions relative to said segments, said belts in said other position being disposed beneath said segments and engageable with the terrain for propelling said ski forwardly thereover.

14. A ski of the type described, comprising: a pair of ski segments; a rigid yoke interconnecting said segments in an aligned spaced apart relationship; a boot-binding plate; means for pivotally mounting said plate intermediate the adjacent ends of said segments; means holding said plate in a selected one of alternate positions relative to said segments; each of said segments and plate being formed with a gliding surface, which surfaces in one of said alternate positions of said plate are substantially coplanar; a pair of endless belts; means, including a pair of pulleys for mounting a belt to each segment superposed relative to the surface thereof opposite to the gliding surface thereon; power transmitting means interconnecting adjacent pulleys of said sets of pairs of pulleys; and power means for driving one of said interconnected pulleys whereby said belts are simultaneously driven, said segments being invertable to dispose said plate in the other of said alternate positions relative to said segments, said belts in said other position being disposed beneath said segments and engageable with the terrain for propelling said ski forwardly thereover.

15. A foot-worn conveyance alternatively propellable over snow covered terrain by gravity or manual-thrust reaction and as an automotive vehicle, comprising: an elongate segmental member having a substantially planar face adapted to glide in contact with and over a snow covered terrain and including a foot-supporting segment, a relatively longer anterior weight distributing and area increasing segment and a relatively less longer posterior weight-distributing and area increasing segment, all longitudinally aligned and mutually interconnected for mutual pivoting in the vertical plane; prime-mover means carried by the face of said posterior segment opposite to said planar face; an endless track mounted on the said last named face of the posterior segment in longitudinally extending attitude with its one face lying normally above the prime-mover means; a similar track similarly mounted on the corresponding face of the anterior segment; a driving connection between the prime-mover means and the rearward endless track; and a driving connection between the rearward endless track driving means and the forward endless track, whereby when the conveyance is inverted from its normal gliding position resting on said substantially planar face, it rests on said driven endless tracks for automotive propulsion.

16. A ski of the type described, comprising: an elongate segmental member having the one face substantially planar and adapted to glide forwardly in contact with and over a snow covered terrain, one of the segments constituting a relatively fixed fulcrum adapted to support a pedal extremity of the skier and the other segments being aligned therewith anteriorly and posteriorly thereto; prime mover means carried on the opposite face of another one of the segments; endless track means mounted in longitudinally extending attitude on the same face of said last mentioned segment and drivenly connected to the prime mover means; and endless track means mounted in longitudinally extending attitude on the corresponding face of still another segment and drivenly connected to the driving connection of the first-said endless track means, whereby to constitute said member a ski and alternatively a tractor.

17. A ski of the type described, comprising: a main load supporting segment; a longer segment anteriorly aligned therewith; a less longer aft segment posteriorly aligned with the first named segment; rigid laterally extending means flexurally uniting the aft and forward segments to permit vertical relative displacement thereof; means articulatedly uniting the load-supporting segment in alignment with the other segments; prime-mover means fixed to the one face of the aft segment; an endless track mounted in fore-and-aft attitude on said one face on said aft segment; an endless track mounted in fore-and-aft attitude on the corresponding face of the forward segment; and driving connections between said prime mover means and the endless track segments, whereby when the ski is inverted from its normal attitude it can be propelled by said driven endless track segments, thereby to constitute it a tractor-vehicle.

18. A ski of the type described, comprising: a body member having a gliding surface coextensive with one surface thereof; a pair of endless belts; a pair of pulleys over which each belt runs; bracket means for mounting each pulley to said body member in spaced relationship therealong to mount said belts in superposed relationship to the surface of said body member opposite to said gliding surface and in longitudinally aligned relationship therewith; rigid means interconnecting each pair of pulleys, whereby the distance between the axes of rotation of adjacent pulleys remains constant; means carried by said rigid means for closing the space between the stretches of each belt to prevent the entry of snow between the stretches of each belt; said bracket means including means for permitting at least some of said pulleys to move relative to said body member as the latter flexes in traveling over irregular terrain; means for driving said belts, whereby said belts, when engaging the snow covered terrain, will propel said ski forwardly thereover; and means carried by each of said rigid means for yieldably holding each belt in good driving engagement with the snow covered terrain.

19. A ski of the type described, comprising: a

flexible body member having a gliding surface coextensive with one face thereof; an endless belt to be superimposedly mounted to the aft portion of said body member; an endless belt to be superimposedly mounted to the forward portion of said body member; a pair of pulleys over which each belt is to run; a first bracket; means for mounting said bracket to the forward end of the aft portion of said body member; an axle rotatably supported on said bracket; means for fixing a pulley to said axle for rotation therewith; a U-shaped bracket mounted to the trailing end of the aft portion of said body member; an axle having the opposite ends thereof projecting through elongate openings formed in the opposing arms of said U-shaped bracket and mounting said axle for limited movement longitudinally of said body member; means for rotatably mounting a pulley to said last named axle; an elongate rigid member extending between said axles; bearing means carried by the forward end of said rigid member and rotatably engaging the opposite ends of said first named axle; means carried by the trailing portion of said rigid member for holding said last named axle against rotation; a pair of U-shaped brackets spacedly mounted to the fore and aft sections of the forward portion of said body member; a transversely extending axle mounted to each bracket for limited movement longitudinally of said body member; a rigid frame member extending between said transversely extending axles; bearing means carried by the trailing portion of said frame member for rotatably supporting the axle carried by the bracket mounted to the aft section; means for fixing a pulley to said rotatably supported axle; means carried by the opposite end of said frame member for holding the other of said axles against rotation; means for rotatably mounting a pulley to said fixed axle, the pulleys mounted on said U-shaped brackets movable relative to said body member whereby the latter may flex as the gliding surfaces thereof moves over irregular snow covered terrain; means for rotatably driving said first named axle, whereby the belt passed around the pulley fixed thereto will be driven; and drive transmitting means interconnecting said first named axle and the axle rotatably supported by the bracket mounted to the aft section of the forward portion, whereby the belt mounted to the forward portion of said body member will also be driven so that when said ski is positioned with the belts engaging a snow covered terrain the ski will be driven thereover by said belts.

20. A ski of the type described, comprising: a body member having a gliding surface coextensive with one face thereof; an endless belt to be mounted to the forward portion of said body member superposed relative to the surface thereof opposite to the gliding surface; a pair of pulleys over which each belt is to drivingly run; bracket means for rotatably mounting each pair of pulleys in spaced apart relationship to the forward portion of said body member for limited movement longitudinally of the same; a rigid frame member interconnecting said pulleys for conjoint movement; a U-shaped bracket mounted to the posterior section of the aft portion of said body member; an axle having the opposite ends thereof projecting through elongate openings formed in the opposing arms of said U-shaped bracket; means for rotatably mounting a pulley to said axle; a second U-shaped bracket mounted to the anterior section of the aft portion of said body member; an axle having the opposite ends thereof rotatably mounted in the opposing arms of said second bracket; a pulley fixed to said rotatably mounted axle; an endless belt passed around said last named pulleys; an elongate rigid member extending between said axles; bearing means carried by the forward end of said rigid member through which said last named axle projects; means carried by the trailing portion of said rigid member for holding said first named axle against rotation; means for rotatably driving said rotatably mounted axle, whereby the belt passed around the pulley fixed thereto will be driven; and drive transmitting means interconnecting said axle and one of the pulleys rotatably mounted to the forward portion of said body member, whereby the belt mounted to the forward portion of said body member will simultaneously be driven.

21. A ski of the type described, comprising: a body member having a gliding surface coextensive with one face thereof; an endless belt to be mounted to the aft portion of said body member; an endless belt to be mounted to the forward portion of said body member; a pair of pulleys over which each belt is to run; a first bracket; means for mounting said bracket to the forward end of the aft portion of said body member; an axle rotatably supported on said bracket; means for fixing a pulley to said axle for rotation therewith; a U-shaped bracket mounted to the trailing end of the aft portion of said body member; an axle having the opposite ends thereof projecting through elongate openings formed in the opposing arms of said U-shaped bracket and mounting said axle for limited movement longitudinally of said body member; means for rotatably mounting a pulley to said last named axle; an elongate rigid member extending between said axles; bearing means carried by the forward end of said rigid member for rotatably engaging the opposite ends of said first named axle; means carried by the trailing portion of said rigid member for holding said last named axle against rotation; resilient means carried by said rigid member and engaging the belt mounted to said aft portion for yieldably resisting movement of the belt toward said body member; a pair of U-shaped brackets spacedly mounted to the fore and aft sections of the forward portion of said body member; an axle transversely extending of said body member mounted to each bracket for limited movement longitudinally of said body member; a rigid frame member extending between said transversely extending axles; bearing means carried by the trailing portion of said frame member rotatably engaging the axle carried by the bracket mounted to the aft section; means for fixing a pulley to said rotatably supported axle; means carried by the opposite end of said frame member for holding the other of said axles against rotation; means for rotatably mounting a pulley to said fixed axle; resilient means carried by said frame member and engaging the belt mounted to said forward portion for yieldably resisting movement of said belt toward said body member; means for rotatably driving said first named axle, whereby the belt passed around the pulley fixed thereto will be driven; and drive transmitting means interconnecting said first named axle and the axle rotatably supported by the bracket mounted to the aft section, whereby the belt mounted to the forward portion of said body member will be simultaneously driven, whereby said belts, when said ski is disposed with the

belts engaging the snow covered terrain, will drive said ski forwardly thereover.

22. A ski of the type described, comprising: a pair of ski segments; means interconnecting said segments in an aligned spaced apart relationship; a boot-binding plate pivotally mounted intermediate said segments; means holding said plate in a selected one of alternate positions relative to said segments; each of said segments and plate being formed with a gliding surface, which surfaces in one of said alternate positions of said plate are substantially coplanar, whereby said ski may glide over a snow covered terrain; a pair of endless belts; means, including a pair of pulleys for mounting a belt to each segment superposed relative to the surface thereof opposite to the gliding surface thereon; power transmitting means interconnecting adjacent pulleys of said sets of pairs of pulleys; power means for driving one of said interconnected pulleys whereby said belts are simultaneously driven, said segments being invertable to dispose said plate in the other of said alternate positions relative to said segments, said belts in said other position being disposed beneath said segments and engageable with the terrain for propelling said ski forwardly thereover; and means carried by each segment for removing snow from the belt mounted thereto as the same moves over the one pulley and out of driving engagement with the snow covered terrain.

23. A ski of the type described, comprising: a body member having a gliding surface coextensive with one face thereof; an endless traction belt to be mounted to the aft portion of said body member; an endless traction belt to be mounted to the forward portion of said body member; a pair of pulleys over which each belt is to run; a bracket; means for mounting said bracket to the forward end of the aft portion of said body member; an axle rotatably supported on said bracket; means for fixing a pulley to said axle for rotation therewith; a U-shaped bracket mounted to the trailing end of the aft portion of said body member; an axle having the opposite ends thereof projecting through elongate openings formed in the opposing arms of said U-shaped bracket; means for rotatably mounting a pulley to said last named axle; an elongate rigid member extending between said axles; bearing means carried by the forward end of said rigid member through which said first named axle projects; means carried by the trailing portion of said rigid member for holding said last named axle against rotation; a pair of spaced U-shaped brackets mounted to the fore and aft sections of the forward portion of said body member; a transversely extending axle mounted to each bracket for limited movement longitudinally of said body member; a rigid frame member extending between said transversely extending axles; bearing means carried by the trailing portion of said frame member for rotatably supporting the axle carried by the bracket mounted to the aft section; means for fixing a pulley to said rotatably supported axle; means carried by the opposite end of said frame member for holding the other of said axles against rotation; means for rotatably mounting a pulley to said fixed axle; means for rotatably driving said first named axle, whereby the belt passed around the pulley fixed thereto will be driven; drive transmitting means interconnecting said first named axle and the axle rotatably supported by the bracket mounted to the aft section, whereby the belt mounted to the forward portion of said body member will also be driven; a pair of V-belts fixed in spaced relationship to the inner surface of each traction belt, each pulley being formed with a pair of spaced circumferentially extending grooves for receiving said V-belts; and a plurality of resiliently mounted idler pulleys carried by said rigid member and said frame member for engaging respectively the traction belts mounted to the aft and forward portions of said body member.

24. A ski of the type described, comprising: a body member having a gliding surface coextensive with one surface thereof for supporting the ski on a snow covered terrain; a pair of endless belts; a pair of pulleys over which each belt runs; bracket means for removably mounting each pulley to said body member in superposed relation to the surface of said body member opposite to said gliding surface and in spaced relationship therealong to mount said belts in superposed relationship to said body member and in longitudinally aligned relationship therewith; rigid means interconnecting each pair of pulleys, whereby the distance between the axes of rotation of adjacent pulleys remains constant; said bracket means including means for permitting at least one of each pair of said pulleys to move relative to said body member as the latter flexes in traveling over irregular terrain with the gliding surface of the body member in engagement therewith; said body member being invertible to move said gliding surface from a position engaging the snow covered terrain to an upwardly facing position thereby to move said belts into engagement with said snow covered terrain; means for driving said belts, whereby said belts, when the latter are disposed in engagement with the snow covered terrain, will propel said ski forwardly thereover; and means for mounting a skier's boot to said body member in either position of said body member.

STANLEY VAN VOORHEES.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,063,627	Ruf	Dec. 8, 1936

FOREIGN PATENTS

Number	Country	Date
118,365	Germany	July 21, 1926
300,837	Germany	Sept. 22, 1917
329,582	Italy	Sept. 16, 1935
513,031	Great Britain	1939