Dec. 1, 1964 R. L. BRASS ETAL 3,159,400

GAME APPARATUS FOR SIMULATING SKIING

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FIG. 1

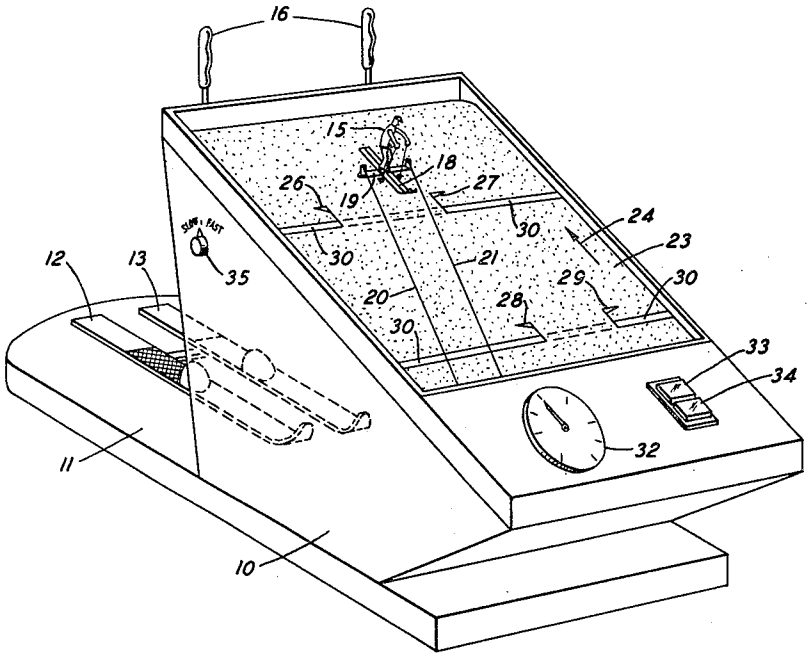


FIG. 3

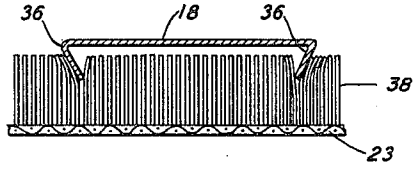
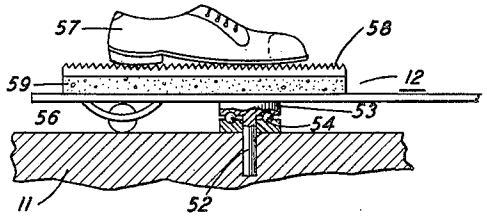


FIG. 4



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GAME APPARATUS FOR SIMULATING SKIING

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FIG. 2C

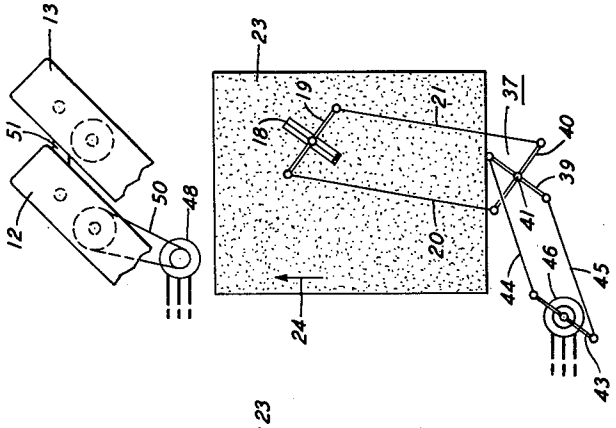


FIG. 2B

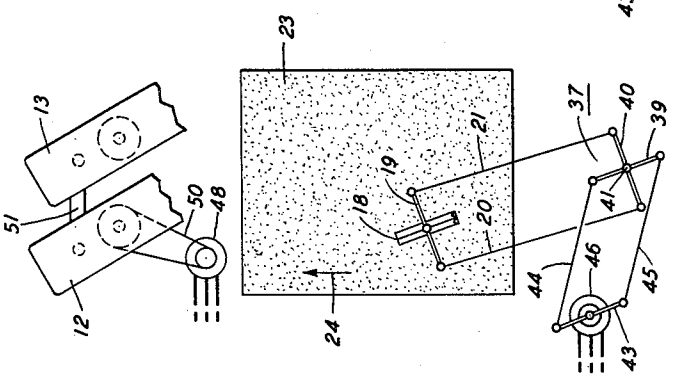
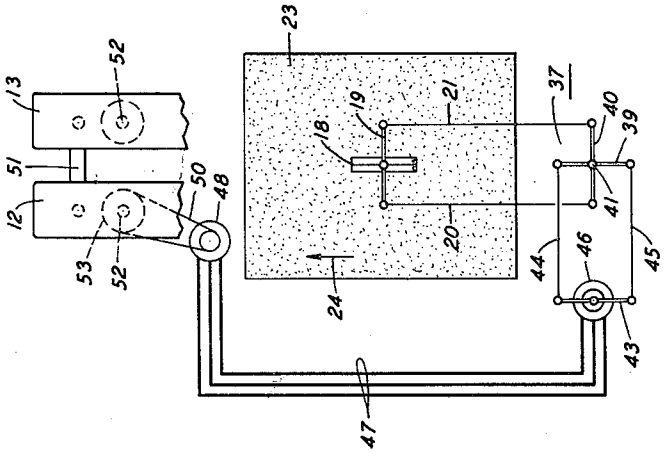


FIG. 2A



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GAME APPARATUS FOR SIMULATING SKIING

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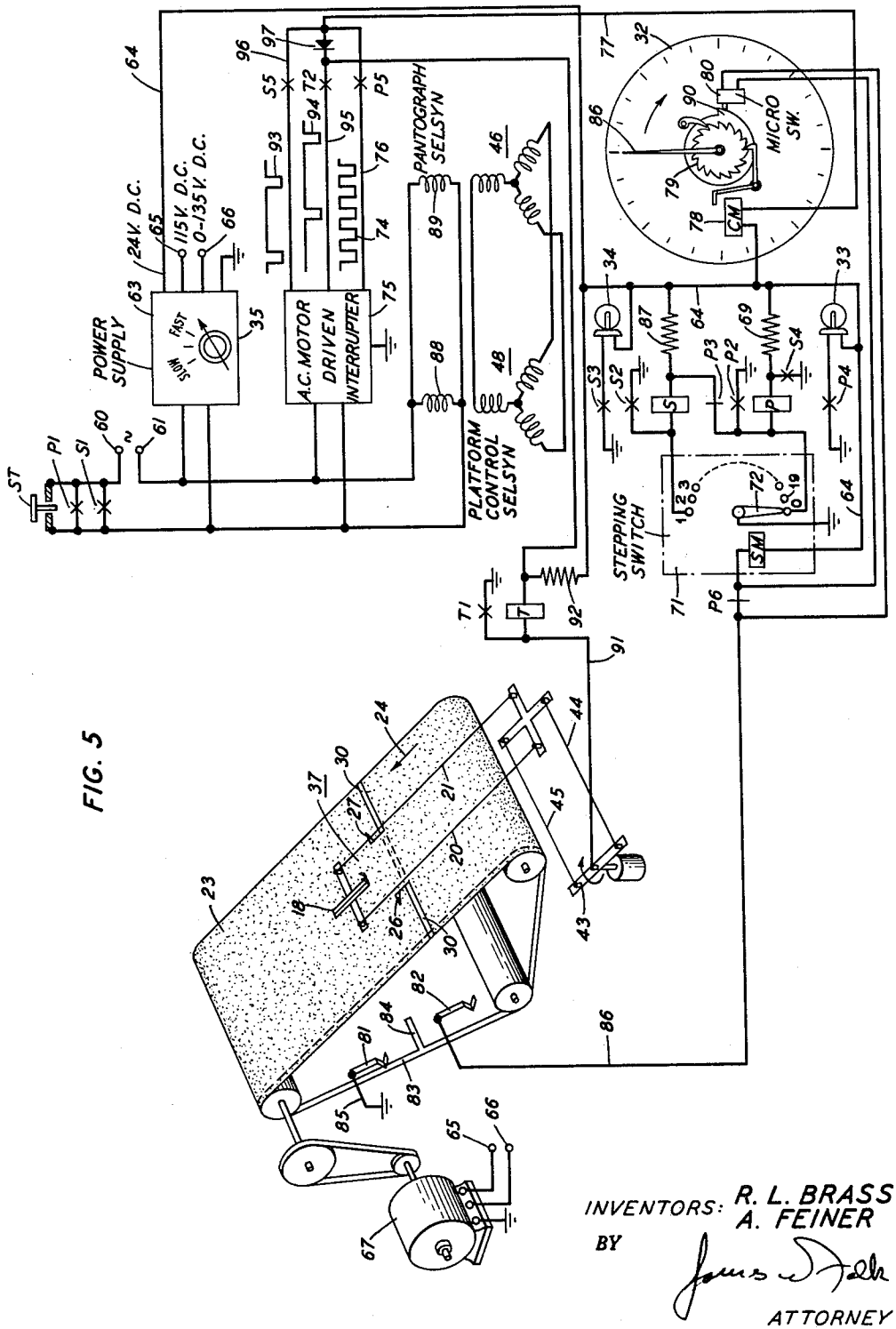

FIG. 5

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GAME APPARATUS FOR SIMULATING SKIING

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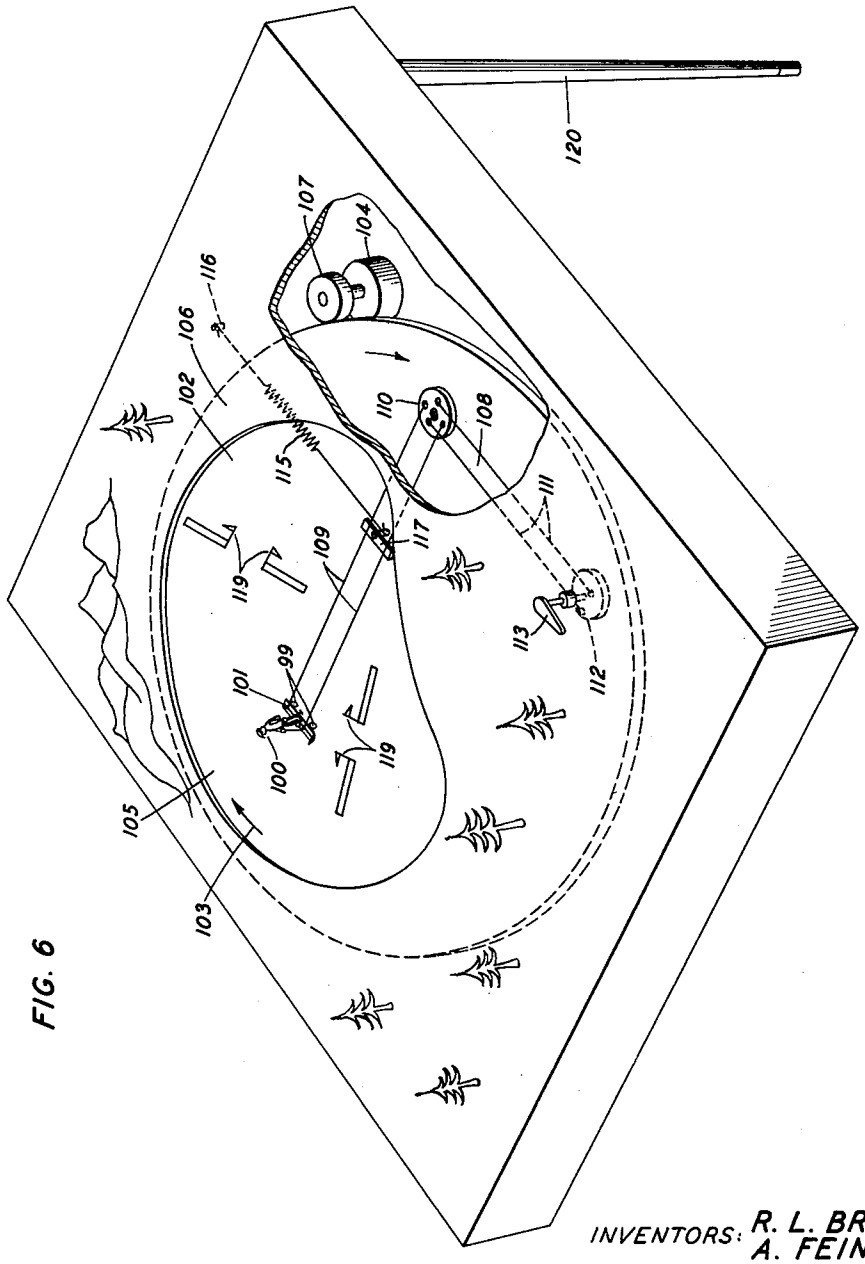

FIG. 6

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GAME APPARATUS FOR SIMULATING SKIING

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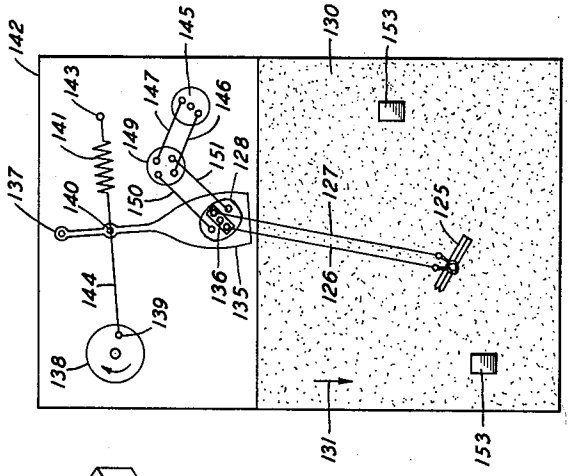

FIG. 8

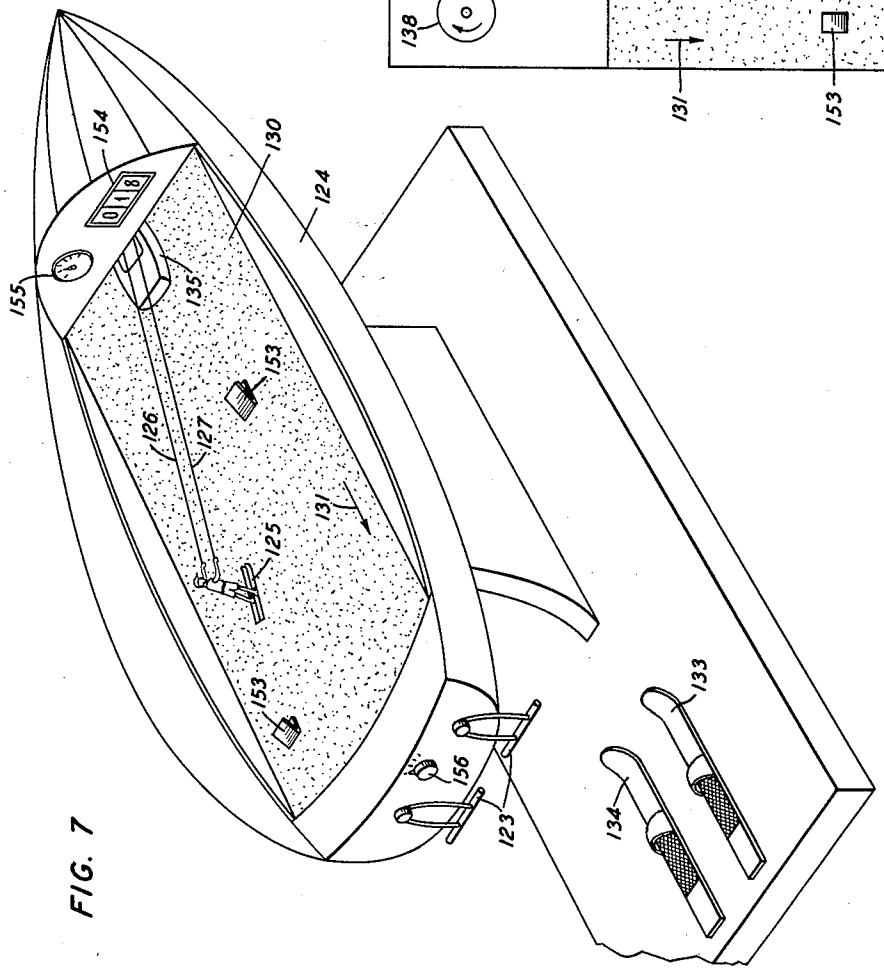

FIG. 7

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GAME APPARATUS FOR SIMULATING SKIING

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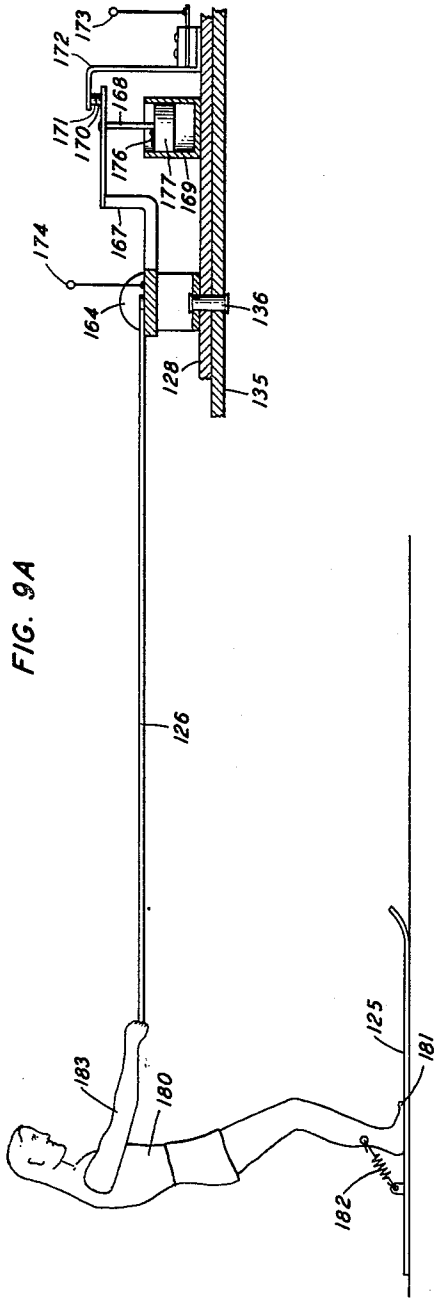

FIG. 9A

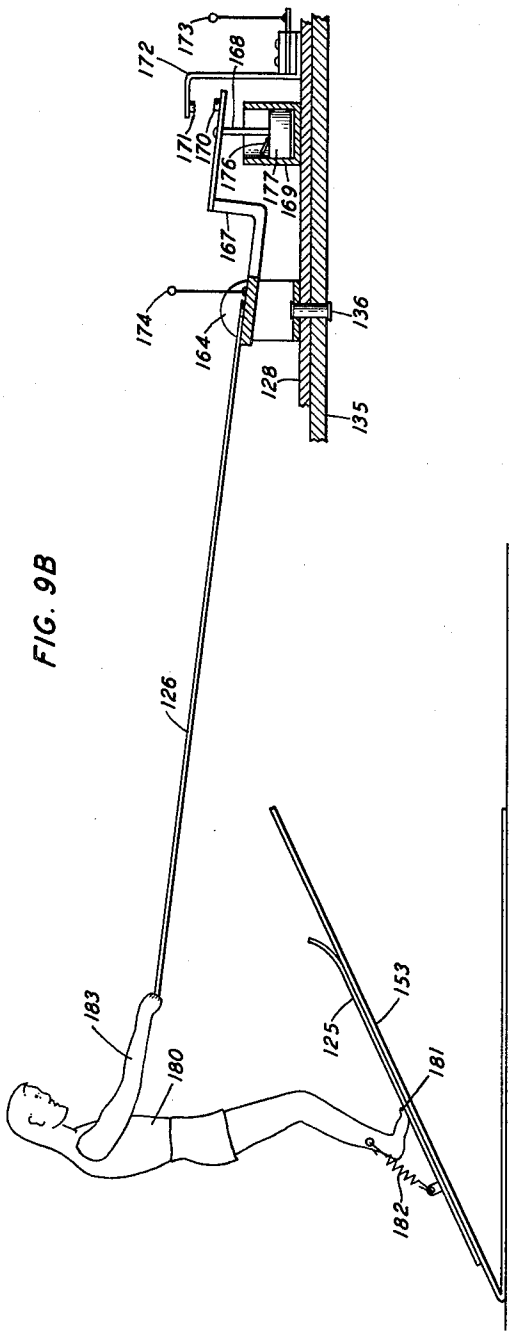

FIG. 9B

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GAME APPARATUS FOR SIMULATING SKIING

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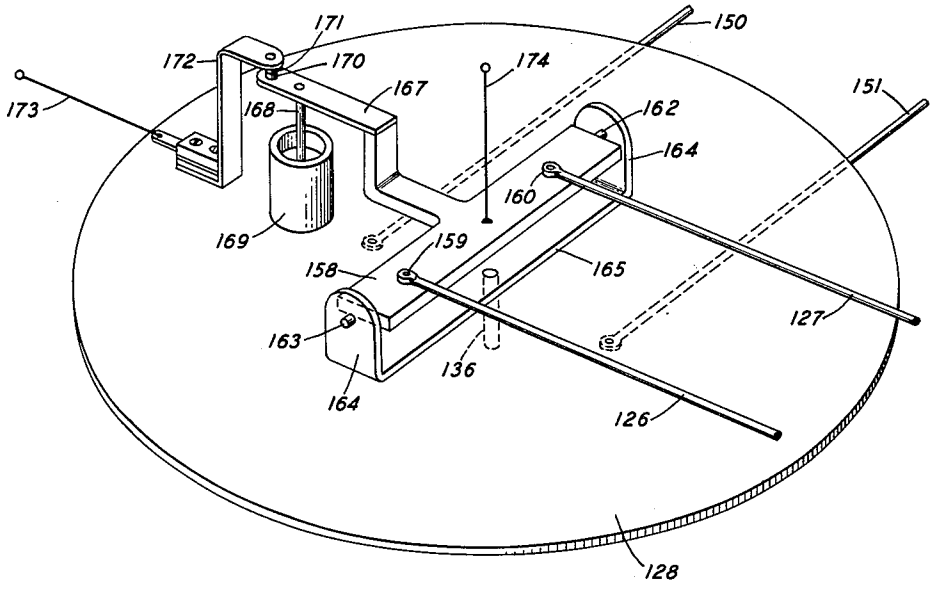
FIG. 10



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United States Patent Office

3,159,400

Patented Dec. 1, 1964

3,159,400

GAME APPARATUS FOR SIMULATING SKIING

Robert L. Brass, Morristown, and Alexander Feiner, Morris Plains, N.J., assignors to Orbicon, Ltd., New York, N.Y., a corporation of New York

Filed Dec. 6, 1961, Ser. No. 157,354

15 Claims. (Cl. 273—1)

This invention relates to amusement apparatus, games, or training devices and more particularly to such in which the player or participant tests his skill at skiing.

In many types of games or simulated testing or training equipments, there is an attempt to provide, under hand control, a rough approximation of some of the conditions of the actual event. In certain driving and steering games there is a somewhat greater degree of simulation. However, in each of these types of games or training devices there is a direct control or coupling between the player or operator and some element being controlled; almost invariably this control is manual, as by manipulation of a wheel, knob, or lever.

Skiing, which has recently been undergoing a great surge of new interest in this country, can not be simulated by a game along the lines of these prior devices. This is particularly true because the actual control of the skis is due to movement of the skier's body and rotation of his legs so that a manual control would be only a poor simulation of actual skiing and a direct manipulative control would not be at all representative of actual skiing conditions.

In this country two types of skiing have become quite popular. The more traditional skiing is, of course, done on snow covered slopes and generally involves a downhill run. One of the more popular tests of skill is slaloming, which tests both the skier's speed and dexterity. A newer type of skiing is water skiing in which the skier, standing on water skis, is pulled behind a motor boat. One test of skill in water skiing is to direct oneself to an inclined jump over which the skier is pulled, then landing again on the water. In both types of skiing the control of the direction of the skis is obtained by leg and body rotation and this control is effected indirectly. By rotating his legs the skier changes the angle of the skis with respect to his direction of motion, whether that motion be due to his sliding downhill or due to the boat, behind which he is being pulled.

It is, therefore, an object of our invention to provide a skiing game or training device in which there is an accurate simulation of skiing. Further objects of specific illustrative embodiments of our invention include simulations of actual downhill skiing and water skiing.

It is another object of our invention to provide such a device wherein the control exercised by the player or trainee is of the same nature as that exercised by one in actual skiing. Accordingly, other objects of our invention include providing an indirect control of the simulated skiing, the control being of the same type as actually exercised in skiing. Additionally in specific embodiments of our invention an object is to control a ski game by leg movements as in actual skiing, whether of the downhill or water type.

Other objects of our invention include a ski game wherein a player can determine by an appropriate score his relative skill, wherein as his skill changes he can render the game more, or less difficult, as by effectively changing the speed of motion of the simulated skiing, and wherein the nature of the problem presented to him by the game closely approximates one of the forms of skiing competition or one of the tests of skiing ability.

These and other objects of our invention are achieved in various specific illustrative embodiments of our invention wherein an endless surface, such as a belt, is continuously moving. Positioned on this surface is a model of a skier mounted on an elongated flat support shaped in the form of two skis held adjacent each other. Because this support is elongated, a varying relative motion occurs between the support, i.e., the model of the skier, and the surface; this relative motion is dependent on several factors, but particularly on the difference between the ease of motion in the direction of the support and in the direction of the motion of the surface. In various embodiments this can be stated as the degree of friction presented to the support by the surface. This will in turn particularly depend on the momentary angle between the position of the elongated support on the surface and the direction of the motion of the surface. Other factors involved in determining this relative motion include the speed of the surface, which is advantageously variable and under the control of the user dependent on his skill and skiing dexterity; the inclination, if any, of the surface to the horizontal plane; and the relative natures of the bottom of the elongated ski model support and the surface.

In order to vary the motion of the ski model relative to the moving surface, we provide an attachment to the skier model support such that the angular position of the elongated support relative to the direction of motion of the surface may be controlled without, at the same time, restricting the location of the skier support on the surface. Specifically in these embodiments illustrating various forms of our invention a mechanical control linkage is interposed between the skier support and the control elements varied by the player so that the player has an indirect control which, however, allows him to control the angular position of the elongated member on the moving surface. This indirect control is obtained by at least a pair of parallel bar control linkages which are interconnected by an intermediate coupling element. This intermediate coupling element and the provision of more than one parallel bar linkage assures that the elongated ski support member has more than one degree of freedom of motion on the moving surface. Accordingly, the support member may assume various angular positions on the surface.

One specific linkage that may be advantageously utilized in accordance with our invention, comprises a pair of four-bar linkages consisting primarily of a pair of parallelograms. The bar at one end of the first parallelogram is under the immediate control of the user while the bar at the other end of the first parallelogram is rigidly coupled to the first bar of the second parallelogram. The bar at the other end of this second parallelogram is attached to the elongated ski support which is advantageously perpendicular to it. The other sides of the two parallelograms may advantageously be rigid wires through which the motion of the end bars is transmitted. This combination shall be referred to herein as a double parallel linkage with an inner cross-coupling member and the side arms of the parallelograms shall be referred to as the parallel arms.

Other specific types of indirect control linkages utilizing an internal rigid coupling member may also be employed, such linkages comprising various pulley or other arrangements whereby the motion of first control wires can be transmitted through the internal coupling member to second control wires which determine the position of a member or bar around an axis which may be considered to be at some point along the member or bar. If a pulley arrangement is utilized then this axis may be the axis about which the control wires rotate the pulley shaft, the axis itself being rigidly connected to an axis of the internal coupling member in turn rigidly connected to an axis on

the first member or bar directly responsive to the user's control.

Accordingly, we provide an indirect control of the ski support through at least a pair of control linkage components including a rigid coupling member common to both of the linkage components.

In one specific illustrative embodiment of our invention, an endless belt is supported upon two or more rollers, to at least one of which a motor is attached for continuously driving the belt. This moving belt has its upper surface substantially in a single plane at an angle to the horizontal, although, if desired, various uneven humps may be introduced into the surface of the belt. Further, in accordance with an aspect of this embodiment of our invention, the surface of the moving belt preferably has a deep pile, such as may be provided by carpeting or other material of a rug-like consistency, so as to provide a frictional surface.

In this specific embodiment it is therefore apparent that the inclined surface corresponds to the hill down which the skier will ski while the skier himself is represented by the ski model on the elongated ski support. Further in this game or training device it is the hill, i.e., the belt, which moves in the direction of the incline and moves, obviously, opposite to the direction apparently taken by the skier model. However, while the hill provides this one degree of motion, the skier model itself, in accordance with our invention, has all degrees of motion. Thus dependent on the angular position of the elongated ski support on the moving belt, and thus of the degree of friction between the moving belt and the ski support, the ski support will move across the belt and will also move with or against the motion of the belt, i.e., will appear to travel "downhill" at different rates of speed.

The participant in the game exercises control over the model skier in accordance with these principles as remote control of the angular position of the skier thus permits accurate control of the skier model on the moving surface. This control is exercised by controlling the double parallel linkage attached to the elongated ski model support. While the player may control the double parallel linkage by his hands, in this embodiment we prefer that such control be by conveniently placed foot controls, such as a platform approximating the mount or boot portion of a pair of skis and on which the player's feet would rest, the platform being rotatable and the rotary position being transmitted to the double parallel linkage as by another direct mechanical linkage, by synchronous torque transmitters, such as selsyn motors, or by a combination of both; in this manner the control of the ski model on the belt permits, to a considerable degree, the player to simulate actual skiing sensations.

It may be pointed out at this point that, unlike prior devices and games wherein the participant exercised control over an element on a moving surface or belt, such as in those games where the participant was, by steering, to guide a model car on a moving belt which simulated a highway, there is, in accordance with our invention, no direct control exercised by the participant over the model's position in order to guide the model to the proper location on the belt. This control is entirely indirect and is determined, through the double parallel linkage, by the angular position of the skier model support on the moving belt. The participant must therefore exercise his skill and judgment in a manner not unlike that required for actual skiing.

In this one specific illustrative embodiment of our invention we provide a scoring mechanism based upon slalom skiing, in order to increase the entertainment value of the game and to provide an objective assessment of the player's skill. In skiing, the slalom competition is based on a race against time over a prescribed course marked by pairs of poles indicating the slalom gates through which the skier must pass. In accordance with this specific embodiment of our invention, we provide

conductive strips on the moving belt to indicate the slalom position poles. Appropriate electrical connection is made through the underside of the moving belt to these strips. The bottom or a portion of the ski model elongated support is also of a conductive material.

The object of this specific embodiment of our game is to achieve the shortest time for an allotted fixed number of total revolutions of the belt while properly passing through all marked slalom gates. Improper passage through a gate is, in accordance with this aspect of our invention, sensed by the electrical contact effected between the skis and the conductive strips on the moving belt. The scoring may comprise either a direct counting of these improper passages or the adding of an increment of time to the actual elapsed time. Specifically in this embodiment, we provide a clock mechanism which measures the elapsed time for the number of revolutions of the belt allotted and which also adds a specified increment of time for each contacting of a slalom position pole.

In order to better his score, the player has to achieve a sufficient amount of skill to pass through all the gates without touching the metallic spots representing slalom poles. Players of different and various skills are accommodated by controlling the speed of the moving belt, several speed settings advantageously being available. The best possible score can only be achieved at the highest speed setting of the machine, indicating the shortest elapsed time to complete the prescribed slalom course, with, of course, no advancements of the clock mechanism due to improper passage through the slalom gates.

In another specific illustrative embodiment of our invention intended as an inexpensive toy, the moving belt may be replaced by a rotating disc driven by a small battery operated motor. The surface of the disc may be smooth and the desired degree of preference for motion in the direction of the ski supports provided by mounting the ski on small rollers. Again a double parallel linkage is provided to the ski support, which is linkage is, however, manually controlled from a knob appropriately located on the top of the toy. A lightly loaded spring is attached to the parallel linkage arms and serves to restrain the motion of the skier. No scoring is provided, the player merely observing his successful passages through the slalom gates.

In still another specific illustrative embodiment of our invention, the participant's skill at water skiing, rather than downhill skiing, is tested. In this embodiment the ski model again is positioned on an endless moving surface and the control of the position of the ski model is determined by a triple parallel linkage controlled by the rotation of the player's feet, as in actual water skiing. In this embodiment, however, the cross arm of the parallel linkage to which the skier is attached is itself subject to an oscillatory motion, representing the somewhat unpredictable motion of the boat behind which the water skier is being pulled.

Further the test of the water skier's skill in this game is his ability to position the skier model so as to pass over a number of unevenly positioned jumps or raised portions of the endless surface. By an electrical switch actuated by the parallel arms attached to the ski model's arms, the change in angle of these parallel arms relative to the cross arms of the linkage on a change of angle of the skis, due to the ski model going over the jump, is sensed and counted on a register. The total number of successful jumps is then a measure of the skier's skill. Again the speed of motion of the moving belt may be changed to accommodate different degrees of skill. Obviously, the faster the belt for the timed interval of play the more successful jumps will be possible and the higher the score, assuming a player is allowed a predetermined time of play.

Various embodiments of our invention may advantageously be coin operated, as is known in the art.

It is a feature of our invention that a ski game or training apparatus include a movable endless surface on which

an elongated strip support member is positioned and controlled as to its angular position with respect to the direction of motion of the movable surface.

It is another feature of our invention that the surface of the endless surface and the under surface of the elongated strip be such as to provide an easier degree of motion in the direction of the elongated strip than perpendicular thereto. Specifically in certain embodiments of our invention the surface of the moving belt is such as to provide different degrees of friction or resistance to motion of the elongated strip dependent on the angular position of the strip on the surface relative to the motion of the surface. More specifically in accordance with this feature of our invention and in certain embodiments thereof the surface of the endless belt or movable surface may be provided by a deep-pile like member, such as carpeting or a rug-like body.

It is another feature of our invention that the elongated strip member be connected to a mechanical linkage affording an indirect control of the position of the elongated strip member and enabling more than one degree of freedom of motion of the elongated strip member so as to enable control of the angular position of the strip member on the moving surface.

It is still another feature of this invention that the mechanical linkage include an intermediate coupling member, interconnecting a first linkage to which the elongated strip member is connected and a second linkage to which the player's control is applied. More specifically in one specific embodiment of our invention it is a feature that the mechanical linkage comprise a double parallel linkage including two cross-coupled parallelograms or four-bar linkages.

It is still another feature of this invention that the mechanical linkage be controlled remotely and specifically in certain embodiments by the rotation of ski-like elements on which the player's feet are positioned, the control thus being by the skier's feet in a manner similar to that of controlling actual skis.

Further features of one specific illustrative embodiment include utilizing an endies belt as the movable surface; positioning that surface at an incline to the horizontal; providing conductive strips or spots on the moving belt to simulate slalom gates; providing a mechanism for detecting and registering, in the score, the contactings of these conductive strips by the elongated ski support; providing a clock mechanism for measuring the speed with which the skier completes the prescribed course, i.e., the prescribed number of revolutions of the endless belt; providing circuitry for advancing the clock for each registration of a contacting of the slalom gates; and electrical control circuitry for assuring that none of these registrations is lost.

It is a further feature of various embodiments of our invention, wherein the endless belt has a pile-like surface and downhill skiing is to be simulated, that the elongated support member for the model skier have side portions depending therefrom and biting into the pile under the support member, the side portions being bent in under the support member for best effect.

It is a further feature of various embodiments of our invention that the parallel arms of the inner four-bar or parallel linkage be spring loaded to limit the degree of motion of the elongated support member.

Further features of another specific embodiment wherein water skiing is simulated include providing the inner cross member or coupling member of the parallel linkage with a degree of motion of its own; providing that such motion be oscillatory; providing that the surface of the endless belt have periodic raised narrow sloping portions defining jumps over which the skier model is to go; providing a switch actuated by the parallel arms of the inner linkage for detecting the angular variation in the position of the parallel arms when the skier model ascents the jump; registering such closure of the switch; and providing the skier model's arms and feet with sufficient freedom of motion to allow for both the jumps and the sidewise movement of the skier model across the endless belt.

A complete understanding of these and other advantageous objects and features of our invention may be gained from consideration of the following detailed description, together with the accompanying drawing, in which:

FIG. 1 is a perspective view of one specific illustrative embodiment of our invention wherein the skill of the participant in downhill, slalom skiing is tested;

FIGS. 2A, 2B, and 2C are diagrammatic representations depicting the control of the position of the skier model support on the endless surface in the embodiment of FIG. 1 by the double parallel linkage and the control, in turn, of the double parallel linkage by the position of the user's feet;

FIG. 3 is a sectional view across the skier model elongated support member depicting particularly the shape of the member and its cooperation with the pile of the endless surface of the embodiment of FIG. 1 to obtain an effect analogous to the edge effect obtained by skiers in snow;

FIG. 4 is a view of the foot support showing details thereof;

FIG. 5 is a schematic representation of the control and scoring circuitries and devices of the embodiment of FIG. 1;

FIG. 6 is a perspective view of another specific illustrative embodiment of our invention comprising an inexpensive toy for simulating downhill slalom skiing;

FIG. 7 is a perspective view of a third specific embodiment of our invention comprising a device for simulating water skiing;

FIG. 8 is a diagrammatic representation of the control mechanism, including particularly a triple parallel linkage for the embodiment of FIG. 7;

FIGS. 9A and 9B depict details of the ski model and the parallel arms for allowing the model to ascend the jumps and for detecting such ascension of the jumps; and

FIG. 10 is an enlarged view of the linkage cross-coupling member of the embodiment of FIG. 7.

Turning now to the drawing, one specific illustrative embodiment of our invention as a slalom downhill skiing game is depicted in FIG. 1. As there seen, the various elements of the game are mounted in a housing 10 positioned on a base plate 11. To one side of the housing 10 and mounted on the base platform 11, as seen in FIG. 4 and described further below, are two control platforms 12, 13 on which the player stands and by means of which he controls the movement of a ski model 14. Two handle supports 16, representing ski poles, are also mounted from the housing 10.

The ski model 15 stands on an elongated support member 18. The support member 18 is attached to a cross arm or bar 19 controlled by two wires 20, 21 which are arms of a four-bar linkage or a double parallel linkage, as discussed further below particularly with reference to FIG. 2. The support 18 rests on a continuously moving belt 23, moving in the direction of the arrow 24. In accordance with this embodiment of our invention, the player attempts to control the path of the skier 15 on the ski support member 18 "downhill," i.e., against the motion of the belt 23 as indicated by the arrow 24 so that the skier passes through slalom gates indicated by the flag poles 26, 27 and 28, 29 painted on the top of the surface of the belt 23. The poles 26, 27 and 28, 29 may be painted on by an electrically conductive paint or may comprise small flexible elements placed on the surface and short enough so as not to interfere with or impede the parallel arms 20, 21. The slalom gates are electrically defined by the conductive wires 30 on the upper side of the moving belt 23, as discussed further below.

Also depicted in FIG. 1 are a scoring clock 32, a pair of signal lights 33 and 34, and a knob 35 for regulating the speed of the belt 23. Light 33 may advantageously be a yellow light to alert the player to get ready to play after he starts the game mechanism, as by deposit of a suitable coin, while light 34 may be a green light to tell him that he should properly control the skier 15 and that the clock 32 is then measuring both the elapsed time of play and also penalty time intervals on improper passage of the skier 15 through a gate. As the conductive strips 30 are on top of the surface of the belt 23 the passageway between the poles, such as 26, 27, is the only path that does not cross an electrically conductive member which, when contacted by the support member 18, causes a penalty interval to be added to the player's time, as described further below with reference to FIG. 5.

In accordance with an important aspect of our invention, the player's control of the motion of the ski model 15 is entirely indirect and specifically is by means of a double parallel linkage as depicted in FIGS. 2A, 2B, and 2C. Further in accordance with an important aspect of our invention the contiguous surfaces of the endless belt 23 and the elongated ski support 18 are such that the ski support has a preferential direction of motion in the direction of the axis of the ski support itself as the belt moves. This may be expressed by saying that the surfaces are preferentially frictional, there being a larger degree of friction between the two surfaces for certain angular positions of the elongated support 18 than for others. Thus the angular position of the support 18 determines whether the support moves "downhill" against the motion of the belt or moves up with the belt; it also determines the sidewise motion of the skier. This control closely approximates that which a skier actually has on downhill skiing.

In this specific embodiment of our invention the ski support 18, as best seen in FIG. 1, is shaped in the form of a pair of skis held adjacent each other. While this lends a degree of pictorial verisimilitude to the game, it also has an important bearing on the proper motion of the ski support across and along the moving belt. This is because the front end of the elongated ski support 18 is curved upwards, as actual skis are, and, just as actual with skis, this turned up portion prevents the ski support from digging into the surface of the moving belt 23.

The varying degree of friction between the skis and the snow on a hill is enhanced by a skier's use of what is known as edge control. This is simulated in this embodiment of our invention by providing the ski support member 18, as seen in cross section in FIG. 3, with side flanges 36 which depend from the ski support 18 and are bent in under it so as to "bite" into the deep pile 38 of the carpet-like surface of the moving belt 23. We have found that providing the moving belt 23 with a carpet-like surface in conjunction with an elongated metallic ski support 18, advantageously with bent under depending flanges 36 to provide the desired edge effect by biting into the pile 38 of the belt surface 23, gives the desired degree of preferential motion in the direction of the axis of the elongated member 18 and provides a good approximation of the actual control exercised by a skier in downhill skiing.

Turning again to FIG. 2A, the ski model support member 18 is depicted in a position parallel to the motion of the endless belt 23 and substantially centrally located. In this angular position of the ski support the double parallel linkage 37 and the control platforms 12, 13 are as depicted. The double parallel linkage 37 includes an inner four-bar or parallel linkage including bars 19 and 40 and side parallel arms 20, 21, advantageously of a thin, rigid wire, and an outer four-bar or parallel linkage including bars 39 and 43 and parallel arms 44 and 45 similar to arms 20 and 21. The cross bars 39 and 40 are rigidly secured to each other, as by a bolt or other riveting member 41; they are thus prevented from having any motion relative to each other and define an inner coupling member. The coupling member is, however, free to move as a unit with respect both to the cross arm 19 and to the energizing cross arm 43. It is apparent that the cross arms 39 and 40 of this rigid coupling member could be replaced by a coupling ring provided that the ends of the parallel arms 20, 21 and 44, 45 are connected to the ring in the positions shown; such an arrangement is, in fact, depicted with respect to the embodiment of FIG. 6.

The energizing bar 43 and thus the first parallel linkage is driven by a selsyn motor 46 responsive, over three wires 47, to the movement of the associated foot control selsyn 48. This latter selsyn is directly driven, as by a belt 50 or other suitable mechanical drive elements with an appropriate drive ratio, from the rotation of the control platform 12 determined by the rotation of the player's feet. Platforms 12 and 13 are advantageously coupled together, as by a bar 51. Each, however, pivots about its own axis and shaft 52 to one of which is attached a pulley 53 for the drive belt 50. As seen in FIG. 4 the shaft 52 may be placed in an aperture and a thrust bearing 54 is provided around the shaft 52 and between the pulley 53 and the base platform 11, while the rear of the platform 12 rests on a steel ball support 56 which rolls over the upper surface of the base platform 11. The upper surface 58 of the platform 12 is advantageously of a material, geometry, or both to prevent slippage of the user's shoe 57, while the middle 59 of the platforms is of foam rubber. This allows for a slight tipping of the control platforms as the player bends his ankles and shifts his weight, as in skiing.

While a selsyn linkage has been depicted between the platforms 12, 13 and the double parallel linkage 37, a direct mechanical coupling could also be utilized. A selsyn arrangement however has the advantage that, when power to the machine is off, attempting to force a change in the position of the platforms 12, 13 will have no effect on the double parallel linkage 37 and therefore such an arrangement is considerably safer for use in a game apparatus left in a public place.

As the player changes the direction of his feet on the platforms 12, 13, the platforms rotate around their axes indicated by the shafts 52 and this rotation is transmitted through the pulley 53 and belt 50 to the first or foot control selsyn 48. By selsyn operation, as is well known in the art, this rotation is repeated exactly at the remote or second selsyn 46. Thus, as shown in FIG. 2B, a rotation of the player's feet so that his heels, i.e., the rear of the platforms 12, 13, moves to the right or counterclockwise, causes through the selsyns and double parallel linkage 37 a corresponding shifting of the position of the support member 18. In this angular position the support 18 will offer more resistance to the motion of the belt 23 and will also tend to move across the belt in the direction shown. Thus the ski model will seem to "ride" slightly "uphill" with the belt and will move across the belt, as opposed to the model's prior motion simply straight downhill relative not only to the belt, but because of the preferred axis of motion, even relative to the stationary housing.

It should be pointed out at this time that while FIGS. 2A and 2B depict possible angular positions and motions at various stages of double parallel linkage control, they are not to be considered as occurring necessarily sequentially. Thus from FIG. 2A a change to the linkage control conditions of FIG. 2B would cause the ski support to actually be further to the right of the belt 23, as viewed by the reader, or further to the left from the standpoint of the ski model.

FIG. 2C similarly depicts the linkage conditions for control when the control platforms 12, 13 are rotated in the opposite or clockwise direction.

From the above discussion it is apparent that the double parallel linkage 37 includes a pair of four-bar linkages in which the links form parallelograms, with a coupling

member rigidly connecting the adjacent inner bars or cross members of the parallelograms. This inner coupling member is an important aspect of the linkage and enables the linkage to afford the type of and degree of control desired for our invention. However, while only a double parallel linkage has been depicted in this embodiment, additional four-bar parallelogram linkages could be inserted in the drive or control chain, each parallelogram being similarly rigidly coupled by a cross-coupling member to the adjacent parallelogram. Such an arrangement is depicted in the embodiment of FIG. 8 wherein a triple parallel linkage is employed.

Having described the main control elements and the general principles of our invention, we shall now set forth one specific embodiment in detail and specifically with respect to the scoring mechanism utilized. FIG. 5 depicts a schematic diagram of the electrical control circuitry for the embodiment of FIG. 1 described above. As seen in the figure, A.C. power, from a usual house supply, is applied, as by a normal house plug, to the input terminals 60, 61. When the apparatus is not in use, no power is applied to it from terminals 60, 61 as connection to terminal 60 is prevented by the open contacts P1 of the P relay, open contacts S1 of the S relay, and open start button ST, all in parallel. To start the game the user depresses the start button ST; it is to be understood that this may advantageously comprise inserting a coin into a coin receptable which in turn effects closure of the start button ST.

The momentary closure of the start button ST closes the circuit to the power supply 63 for the equipment. Power supply 63 advantageously comprises a rectifier, voltage dividers, and rheostat for providing a variety of direct current output voltages: specifically a 24 volt output appears on lead 64 for operating certain relays, as set forth below; a 115 volt output appears on lead 65 and is connected to the field supply of the motor 67 which drives the belt 23; and a 0–135 volt output appears on lead 66 and is connected to the motor armature supply. This output is controlled by a variac or rheostat under control of the knob 35 on the side of the housing 10, as described above, and thus determines the speed of the belt 23.

Accordingly, when the start button ST is closed, 24 volts D.C. appears on lead 64; this causes operation of relay P over a path from lead 64, resistance 69, winding of relay P, the 0 terminal of stepping switch 71, and wiper 72 of the stepping switch 71 to ground. Energization of relay P closes normally open contacts P1 connected to terminal 60 and in shunt of button ST thereby assuring continuity of power on release of the manually or coin operated button ST.

Relay P also closes a locking path for itself through normally open contacts P2; releases a shunt down path for relay S by opening normally closed contacts P3, thereby preparing for subsequent operation of relay S as described further below; causes lighting of the yellow or preparatory lamp 33 by closing contacts P4; allows a train of pulses 74 to be applied from an alternating current motor-driven interrupter 75 over lead 76 to conductor 77 to operate clock magnet 78 which in turn controls the ratchet mechanism 79 which advances the clock 32 by closing contacts P5; and by opening normally closed contacts P6 places the ground applied over lead 86 to the stepping magnet SM under control of normally open microswitch 80. When the game is first started, it is to be expected that the clock 32 will have its arm 86 in some position other than the initial zero or vertical position. Accordingly, before any stepping pulses can be applied to the stepping switch 71 to initiate the timed play of the game, a rapid train of pulses 74 is applied to the clock magnet 78 to advance the clock to its zero position. This position is recognized by cam 90 causing closure of microswitch 80. The next ground pulse on lead 86, as discussed below, then steps the wiper 72 to the first terminal to operate the S relay.

When start button ST is closed the motor 67 starts due to the appropriate D.C potentials appearing on output leads 65 and 66 of the power supply 63. A pair of sliding contacts 81 and 82 ride on the inner surface of the belt 23. Contact 81 is continuously in contact with a metallic strip 83 along the edge of belt 23; ground is applied over a lead 85 to contact 81 and thence to this strip 83. Extending inwardly from this strip 83 is a conducting stub 84 which, once each revolution of the belt, makes contact with the sliding contact 82. Accordingly, once each revolution ground is extended from lead 85, contact 81, strip 83, stub 84, contact 82 and lead 86 through normally closed contacts P6 to the stepping magnet SM of the stepping switch 71. Initially, however, relay P is energized so that contacts P6 are opened and the ground can only be applied to the stepping magnet through microswitch 80 when the clock has been returned to its zero position, as discussed above. However, when the microswitch contacts 80 have been closed by the cam 90, the next ground appearing on lead 86 is applied to the stepping magnet SM and causes the wiper 72 to advance from the 0 terminal to the 1 terminal of the switch 71 thereby connecting ground to the S relay winding.

The S relay now operates over a path from power supply 63 by means of lead 64, resistance 87, relay winding S, terminal 1 of the stepping switch 71 and wiper 72 to ground. Relay S in operation: closes contacts S1 assuring power being applied from terminals 60, 61; closes contacts S2 to provide its own locking path; closes contacts S3 to light the start or green light 34 to advise the player that his time and movements are now being registered; closes contacts S4 to shunt down the P relay, thereby releasing it; and closes the contacts S5 thereby applying the timed drive pulses 93 over lead 96 to the clock magnet 78 to advance the clock 32, thereby timing the play of the game.

During the time the wiper 72 is moving from the 0 to the 1 terminal of the stepping switch, the P relay is maintained operated by its locking path over the P2 contacts to assure continuity of power to the equipment from terminals 60, 61. In effect the P relay operation gives the player at least one preliminary rotation of the belt 23 to practice or get in position before the clock mechanism is returned to its initial position by the pulses 74.

The sequential closure of the start button ST, relay contacts P1, and relay contacts S1 applies A.C. power to the input windings 88 and 89 of the selsyns 43 and 46, respectively. With power applied to the selsyns the double parallel linkage 37 can be controlled by the user's feet on the control platform 12, 13, as described above.

On each rotation of the belt 23, ground is applied over lead 86 from sliding contact 82, as described above, to operate the stepping magnet SM. Specifically we have depicted a twenty terminal stepping switch, of which output terminals 2 through 19 are unconnected. When wiper 72, however, again contacts the 0 terminal, ground is applied by the wiper 72, the 0 terminal, and closed contacts P3 to shunt down the relay S causing its release, thereby removing power from the apparatus on the opening of the S1 contacts.

As described above the clock 32 is operated to time the duration of the game, which in turn depends on the setting of the variac control 35 to determine the time required for twenty revolutions of the belt 23. However, in accordance with an aspect of our invention, a player's ability is measured and scored also by the clock 32. As discussed above with reference to FIG. 1, it is desired to register each time the ski model does not properly pass through a slalom gate, such as indicated by the poles 26, 27. Ground is applied to the poles 26, 27 through the conductive strips 30 above the belt 23 except between the poles themselves, the strips

30 in turn receiving ground from strips 83, sliding contact 81, and lead 85. Accordingly, when the metallic ski support member 18 touches a strip 30 or pole 26, 27, this ground is extended through the support member 18, the pantograph arms 20, 21 and 44, 45 to the lead 91 to operate relay T from the 24 volts D.C. appearing on lead 64 via resistance 92. Relay T locks operated over its T1 contacts and also closes contacts T2 allowing an additional pulse 94 from interrupter 75 to be applied over a distinct lead 95 through a diode 97 to operate the clock magnet 78 and advance it one step as if a normal advance pulse had been received through contacts S5 over lead 96. Pulse 94, in addition to advancing the clock 32, also shunts down the T relay, causing it to release. The diode 97 assures that a pulse 93 on lead 96 which may occur after operation of the T relay and before the occurrence of the next pulse 94 does not de-energize the T relay and thereby lose the registration of a penalty before the penalty time has been scored on the clock 32.

When the stepping magnet has counted twenty revolutions of the belt 23, by having ground applied thereto by twenty passes of stub 84 under contact 82, the wiper 72 is returned to the initial of zero terminal of the switch 71. At this terminal ground is applied through closed contacts P3 to shunt down the S relay thereby releasing it. The closed contacts S5 prevent the ground at terminal zero applied to the P relay from cooperating with the D.C. potential on lead 64, thus preventing the P relay from reoperating. Accordingly with both relays P and S released, the connection to terminals 60, 61 is broken and power is removed from the machine.

The clock arm 86 will now indicate the player's score, which has been determined by two factors, the first being the speed of the belt, as set by the player's setting of variac control 35 and which obviously determines the total number of normal advancing pulses 93 applied to the clock, and the second being the number of penalty pulses 93 applied to the clock, these penalty pulses being determined by the contacting of the ski support 18 with pole 26, 27 or conductive strip 27.

FIG. 6 depicts another embodiment of our invention which is similar in certain aspects to the just described embodiment but which is arranged as an inexpensive child's toy. In this embodiment the ski model 100 is again supported by an elongated ski support 101 which rests on a rotating surface 102, rotating in the clockwise direction as indicated by the arrow 103. The surface 102 in rim driven by a small motor, indicated at 104, which may be battery operated as is known in the art through a friction wheel 107.

In this embodiment of our invention we insure that the ski support member 101 has the preferred direction of motion along its own axis by providing four small rollers 99 rigidly affixed beneath the ski support member 100, two at the front and two at the back. The surface of the rotating plate 102 may now be relatively smooth. Only a portion of this surface is visible through an arcuate aperture 105 in a cover plate 106. The cover plate 106 may be formed to represent a hill with trees mounted or painted thereon.

A double parallel linkage 108 extends from the ski support 101, which in this instance is a bar of the parallelogram, and includes parallel arms 109, rigid cross-coupling member 110, and parallel arms 111, and rotating member 112 to which a control handle 113 is attached. Rotating member 112 is attached to the under side of the cover plate 106 and the cover plate also serves to hide the double parallel linkage from view. Advantageously a lightly biased spring 115 is also attached to the cover plate 106, as at 116, and to a cross piece 117 slidably positioned on parallel arms 109, so as not to interfere with their relative motion, to provide a spring bias on the parallel linkage always tending to return the ski model to a centrally located position.

In this embodiment slalom skiing is also simulated, poles 119 being painted on the rotating plate 102. However no score is kept, the player merely observing visually his ability to control the skier in passing through the slalom gates. However, if desired a light positioned on the surface of the cover plate 106 could be arranged to be in series with electrical strips defining the gates so that the light is energized either on successful or unsuccessful passage through the gate.

While we visualize this embodiment as a small toy to be placed on a table or on the floor, advantageously short back legs 120 are provided so that the ski model has a tendency under the pull of gravity to travel down the rotating plate 102 and against the direction of rotation, which tendency is restrained by the spring 115.

Turning now to FIG. 7 there is depicted another specific embodiment of our invention wherein a game or training apparatus simulates water skiing. As various of the elements are the same or similar to those described above with reference to the other embodiments, we shall mainly discuss for this embodiment those elements and aspects unique to it. Similarly a control circuit of the type described above with respect to FIG. 5 may be employed except that the manner of scoring used is different, as set forth hereinafter.

In this embodiment a ski model positioned on an elongated ski support member 125 is attached by the parallel arms 126 and 127 of a four-bar parallelogram linkage to a first cross-coupling member 128. As in the embodiment of FIG. 1 the elongated support member 125 is positioned on an endless belt 130 advantageously having a deep rug-like pile so that the surface of the belt 130 and the support member 125 provide the desired preferred degree of motion in the direction of motion of the belt 130, indicated by the arrow 131, rather than across the belt. In water skiing the skier does not have the same degree of edge control described above as in downhill snow skiing. We have found, however, that the desired frictional differences depending on the angle of the ski support member 128 to the belt's motion can be obtained by providing that the undersurface of the elongated support member 128 is of Teflon.

The player stands on the control platforms 133, 134 and as in the embodiment of FIG. 1, has an indirect control, by movement of his body, over the angular position of the elongated ski support member 125. Handles 123 are mounted on the frame 124, which may be in the form of a boat. The handles 123 merely help the player feel that he is being pulled behind the boat and serve no control purpose. In water skiing, however, the skier has to accommodate himself to the occasional erratic movement of the boat behind which he is being pulled. In accordance with an aspect of our invention in this embodiment thereof this is also simulated, as best seen in FIG. 8. The parallel arms 126, 127, which represent the ropes to which a water skier holds, appear to come from the stern of a boat 135. Boat element 135 has mounted on it the cross-coupling member 128 which is, however, free to rotate about a pivot 136 affixed to the boat element 135. Considering only the boat element 135 for the moment and apart from the indirect control exercised by the player through the multiple parallel-bar linkage including the cross-coupling member 128, it can be seen that the boat element 135 is itself pivoted about an axis defined by pin 137. About this axis the stern of the boat element 135 is given an oscillatory motion by rotation of the cam or wheel 138 to which is eccentrically connected, as as point 139, a wire 144 connected to the boat element 135 at point 140 and, by means of a spring 141, to the supporting frame 142 at point 143; the cam 138 is driven by the motor driving the belt 130. It is, therefore, apparent that the eccentric path of the point 139 and the action of the spring 141 cause the stern of the boat element 128 to move across the end of the belt 130.

The rotation of the control platforms 133, 134 is transmitted, as by selsyn motors are priorly explained, to the bar 145, which is rotatably mounted on the supporting frame 142. While bar 145 is depicted as a circular member it is to be understood that the effective bar in the four-bar linkage is defined by the line between the points of attachment of the parallel arms or rods 146, 147 to the circular member 145. As this linkage is generally referred to as a four-bar or parallelogram linkage, the member 145 and the various other cross-coupling elements will be referred to herein in terms of the effective bars they define.

The other ends of the arms or rods 146, 147 are attached to an effective bar of a freely-moving cross-coupling member 149. Also attached to member 149 are ends of arms or rods 150, 151 so positioned that the effective bar between them is perpendicular to the effective bar between arms 146, 147. The other ends of the arms 150, 151 are attached to the rotatable cross-coupling member 128, described above.

It is, therefore, apparent that the indirect control linkage of this embodiment includes three parallelogram linkages interconnected by a pair of cross-coupling members. Further, the cross-coupling member 128 which is part of the linkage including the ski support member 125 as a bar thereof has a further motion imposed upon it by the oscillatory motion imparted to it by the wheel 138. As the manner of control is analogous to that described above with respect to FIG. 2, the various positions of the control linkage will not be described at this time. However, as the ski support member 125 is itself a bar of the four-bar linkage, which was not the case in the embodiment of FIG. 1, the arms of the skier must be free to pivot or rotate in a horizontal plane, as described further below with reference to FIG. 9.

In water skiing one measure of a skier's skill is his ability to direct himself over jumps. This is also utilized in this embodiment of our invention as a test of a player's skiing skill. To that purpose small inclined "jumps" 153, which may be defined by V-shaped spring metal elements, are positioned on the moving belt 130; the rollers around which the belt 130 moves may provide sufficient clearance for the jumps 153 or the spring metal may be depressed when the belt carries them away from the playing area. By shifting his weight, through the indirect mechanical linkage described above, the player has to control the angle of the ski support 125 so that the varying friction between the belt 130 and the ski support 125 directs the ski support 125 over the jumps 153 in succession.

Scoring is determined, in this embodiment, by counting the number of successful jumps, as indicated on a register 154, within the allotted time, which may be shown on a timer 155. The player, depending on his skill, may also set the speed of the belt 130, thereby effectively controlling the speed of the boat behind which he is being pulled, by a speed control knob 156. The circuitry involved in these elements may be similar to that described above. However, the manner of registering the successful passage of the skier over a jump 153 in accordance with another aspect of our invention can be best understood with reference to FIGS. 9 and 10.

In FIG. 10 there is depicted an enlarged view of the cross-coupling element 128 which is mounted, as by pivot 136, on the boat element 135. The parallel arms 126, 127 are connected to a cross member 158 by pivots 159, 160 so that the arms 126, 127 can move horizontally during the normal operation of the four-bar parallelogram linkage defined by member 158, arms 126, 127 and the elongated ski support member 125. At the same time the member 158 is itself mounted by pins 162, 163 for rotation; the pins 162, 163 extend through or into side pieces 164 mounted, as from an integral plate 165, on the cross-coupling element 128. A finger 167 extends from the member 158; this finger serves two purposes: (1) it carries the plunger 168 of a dashpot 169 for damping the motion of the ski support 125 during jumps, as described below, and (2) it carries a contact 170 which mates with a contact 171 on a finger 172 extending up from the member 128. Each closure of the contacts 170, 171 closes an electrical circuit between leads 173, 174 which in turn effects the registration, by register 154, of a successful jump. It may be noted that this registering circuit, which is not depicted but may take any of a number of forms known in the art, is energized after each jump, that is, on the return of the ski support member 125 to its normal position on the belt 131. The fingers 167, 172 are, of course, suitably insulated from each other.

The dashpot 169 advantageously includes a one-way valve 176, seen in FIG. 9, in the plunger seat 177 so that the seat may be rapidly depressed into the dashpot cylinder, with the valve open, but returns more slowly, with the valve closed.

The operation of the dashpot and contacts can be also seen in FIG. 9. FIG. 9A depicts the ski model 180 positioned on the skis 125 and pivoted at his toes 181 with a spring 182 connected between his legs and the skis 125 to tend to keep the skier in an upright position. The parallel arms 126, 127 are connected to the skier arms 183 which, as described above, are free to pivot horizontally but which cannot move in a vertical direction. As seen in FIG. 9A when the skier is on the flat portion of the belt 130, the contacts 170, 171 are closed. However, as seen in FIG. 9B, when the skier goes up one of the jumps or ramps 153 the skier must lean forward, against the pull of the spring 182, as the angle between the parallel arms 126, 127 (or his arms 183) and his body must remain constant. At the same time the rods are lifted up, rotating the member 158, FIG. 10, thereby opening the contacts 170, 171 and depressing the plunger 168 and seat 177 into the dashpot 169.

While specific illustrative embodiments of our invention have been depicted and described, it is to be understood that they are merely illustrative of the application of the principles of our invention and that various modifications and other improvements may be devised without departing from the spirit and the scope of the invention.

What is claimed is:

1. A game for simulating skiing comprising an endless moving surface, an elongated member positioned on said surface, means including at least one of said surface and said elongated member for causing said member to be subjected to less frictional resistance as it moves on said surface in the direction of the elongated axis of said member than across said axis, a control member, and control means coupling said control member to said elongated member for providing said elongated member more than one degree of motion in response to said control member and the movement of said surface, said control means comprising indirect mechanical linkage means including two distinct linkage components and a rigid coupling means therebetween, said rigid coupling means itself being free to move both in and against the direction of motion of said moving surface and in the direction transverse to the direction of motion of said moving surface.

2. A game in accordance with claim 1, wherein said means for causing said different frictional resistances includes a rug-like pile on said moving surface.

3. A game in accordance with claim 1 wherein said distinct linkage components are four-bar linkages.

4. A game in accordance with claim 3 further comprising spring biasing means connected to the bars coupled to said elongated member.

5. A game for simulating the experience of skiing comprising an endless moving surface, means for moving said surface, an elongated member positioned on said surface, and means for determining the angular position of said member on said surface relative to the direction of motion of said surface and for varying said angular position

to determine the actual position of said member on said surface, said determining means including a control element and an indirect mechanical linkage coupling said control element to said elongated member, said indirect mechanical linkage including a first and a second four bar linkage, said control element being coupled to one bar of said first linkage, said elongated member being coupled to one bar of said second linkage, and the bars parallel to said one bar being rigidly connected together, said first linkage extending substantially across the direction of motion of said surface at one end thereof and said second linkage extending substantially in the direction of motion of said surface from said one end thereof.

6. A game for simulating the experience of skiing to a player comprising an endless moving surface positioned at an incline to the horizontal, means for causing said surface to move in a direction upward against said incline, a flat elongated member positioned on said moving surface and having its lower surface resting on said moving surface, and means for determining the angular position of said member on said surface relative to the motion of said surface, said surface and said elongated member coacting so as to provide a varying amount of friction therebetween depending on the direction of motion of said member relative to the direction of motion of said surface, and said determining means including a pair of rotatable ski-members on which the player stands, said ski-members being positioned behind the upper end of said inclined moving surface so that the player standing on said ski-members is positioned to look down the slope of said inclined moving surface, and said determining means further including an indirect mechanical linkage connected to said elongated member, and means for transmitting the rotation of said rotatable ski-members as the player rotates his legs, as in skiing, to said indirect mechanical linkage.

7. A ski-game comprising an endless moving surface of a material having a deep pile, means for moving said surface, a flat elongated member positioned on said surface and having depending side flanges extending into said pile, an indirect mechanical linkage connected to said member, and means for controlling said mechanical linkage to determine the angular position of said member on said surface.

8. A ski-game in accordance with claim 7 wherein said indirect mechanical linkage includes a first four-bar parallel linkage, a second four-bar parallel linkage, means for rigidly connecting one bar of each linkage together and at right angles to each other, and means for connecting said elongated member to one bar of a linkage, and wherein said controlling means comprises means for controlling the position of one bar of a different linkage under control of the player of the game.

9. A ski-game in accordance with claim 8 wherein said means for controlling the position of said one bar under control of the player includes means connected to said one bar of said different linkage and responsive to the position of the player's feet.

10. A ski-game comprising an endless belt positioned at an incline to the horizontal and having a rug-like pile, means for moving said belt, means for varying the speed of said belt, a flat elongated member positioned on said belt, said elongated member having edge portions depending therefrom and bent under said member to bite into said pile, said edge portions causing said members to be subject to less frictional resistance to motion in the direction of the axis of said members than perpendicular to said axis, and means including a double parallel linkage for determining the angular position of said member on said belt for varying said angular position to move said member across said belt.

11. A ski-game comprising an endless moving surface, means for moving said surface, a flat elongated member on said surface, said member and said surface in combination causing said member to be subject to different frictional resistance depending on the direction of motion of said member relative to the direction of motion of said surface, means for determining the angular position of said member on said surface, conductive members positioned on said surface and between which said elongated member is to be directed, clock means for registering the contactings of said conductive members by said elongated member, and control circuitry including means for advancing said clock at a constant rate, means for advancing said clock further in response to each of said contactings of said conductive members by said elongated member, means responsive to each rotation of said surface for determining the amount of play of the game allowed the player, means for applying rapid control pulses to said clock to reset said clock on commencement of play, and means for preventing said means for determining the amount of play being responsive to said surface rotation until said clock is reset.

12. A ski-game comprising an endless moving surface, means for moving said surface, a flat elongated member on said surface, at least one of said member and said surface causing said member to be subject to less frictional resistance to motion in the direction of the axis of said elongated member than across said axis, means including a double mechanical linkage for determining the angular position of said member on said surface, control means responsive to the position of the player's feet, means interconnecting said control means and said double mechanical linkage, conductive elements on said surface and between which said elongated member is to be directed, a clock, means including a first relay and first contacts thereon for applying resetting pulses to said clock on initiation of play of the game, stepping means for determining the number of revolutions of said endless moving surface allowed the player, means including second contacts on said first relay for preventing operation of said stepping means until said clock is reset, a second relay operated on initial operation of said stepping means, means including contacts on said second relay for applying timed pulses to advance said clock, a third relay, means for operating said third relay on each contacting of a conductive element by said elongated member, means including contacts of said third relay for applying a single advance pulse to said clock for each said contacting, and means for de-energizing said third relay on registration of each additional single advance pulse only.

13. A game in accordance with claim 6 wherein said indirect mechanical linkage includes a first distinct linkage portion extending substantially perpendicular to the direction of said inclined moving surface and adjacent the lower end thereof, a second distinct linkage portion extending from said lower end up said inclined surface, and a rigid cross-coupling member interconnecting said first and second linkage portions.

14. A game in accordance with claim 6 further comprising independent pivot means for each of said rotatable ski-members and means coupling said ski-members together whereby said ski-members are always parallel to each other.

15. A game for simplating the experience of skiing to a player comprising an endless moving surface having a deep pile, a flat elongated member positioned on said moving surface and having its lower surface resting on said moving surface, a pair of control platforms on which the player stands, and means for transmitting the movements of the player's legs from the platforms to the flat elongated member, said control transmitting means including an indirect mechanical linkage including a first and a second linkage component and a rigid member interconnecting said linkage components, said rigid member having degrees of freedom relative to both the direction of motion of said moving surface and the direction perpendicular to said first mentioned direction whereby said flat elongated member can both traverse said moving

surface and also move with and against the motion of said surface.

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