

July 25, 1961

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2,993,550

PRIME MOVER FOR WHEEL CHAIRS

Filed May 9, 1958

5 Sheets-Sheet 1

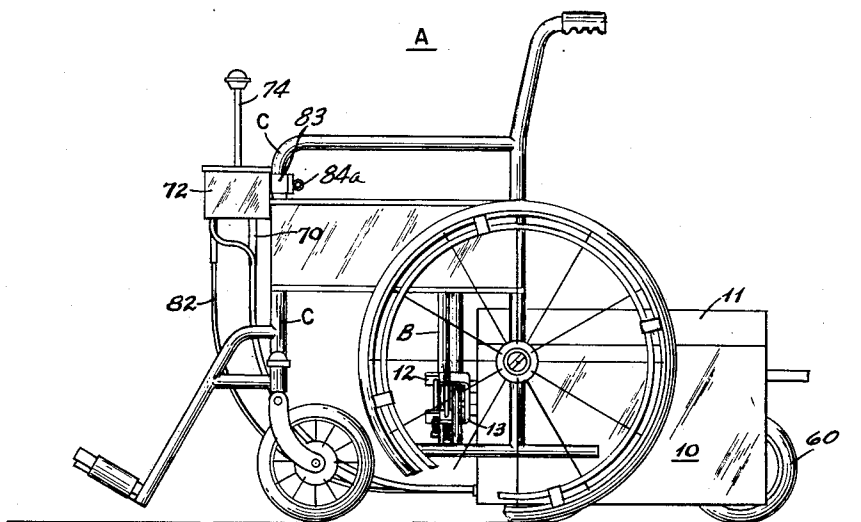


Fig. 1.

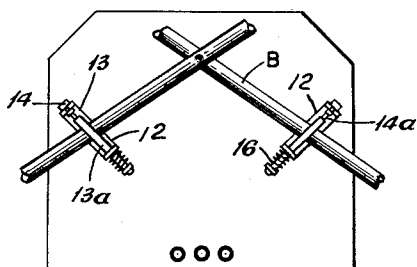


Fig. 7.

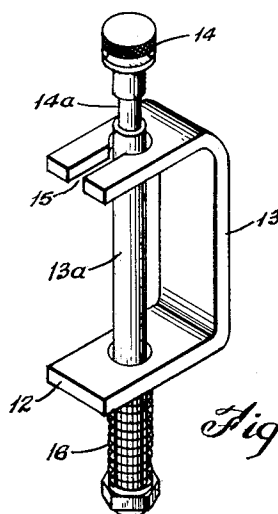


Fig. 8.

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5 Sheets-Sheet 2

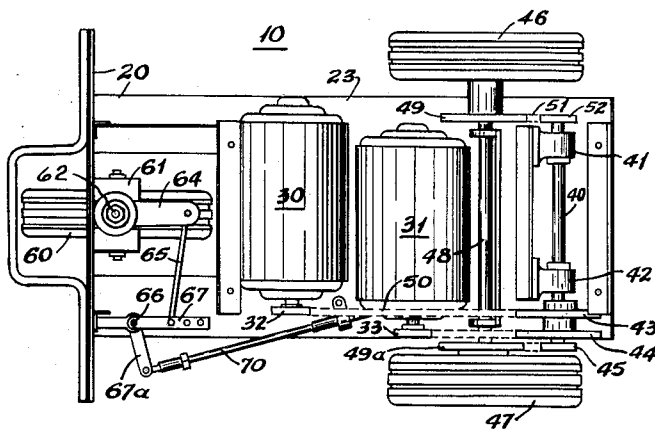


Fig. 2.

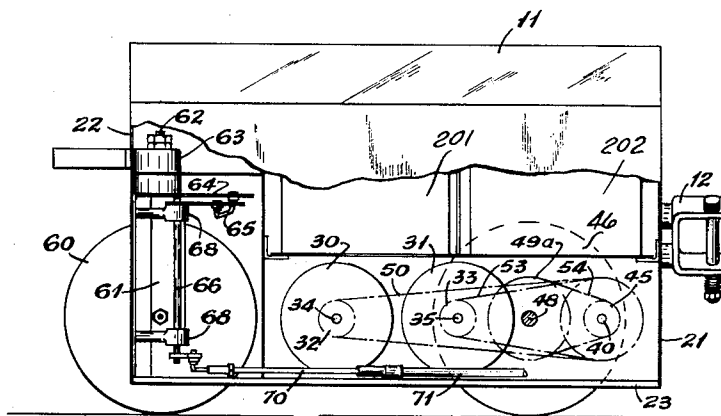


Fig. 3.

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5 Sheets-Sheet 3



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5 Sheets-Sheet 4

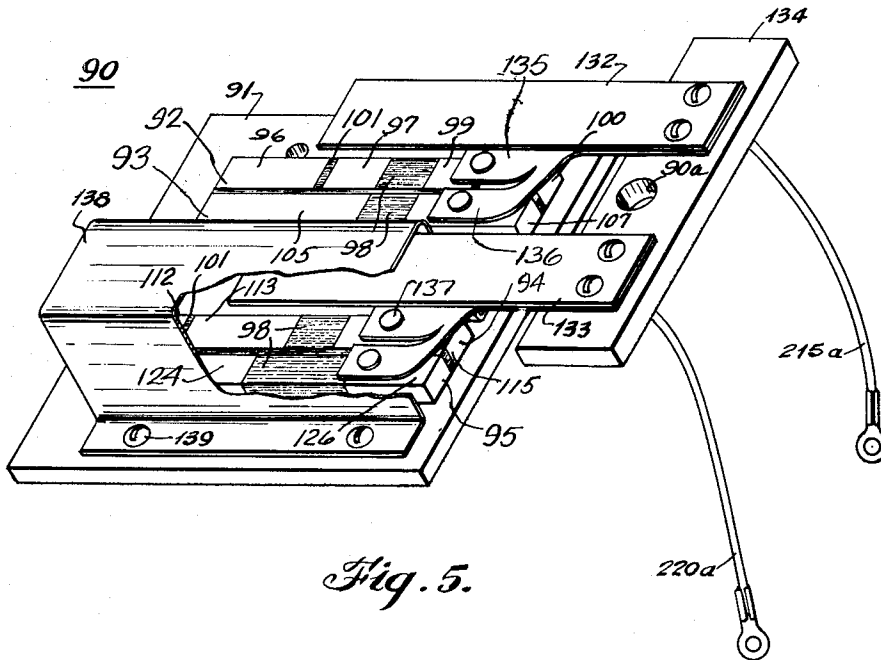


Fig. 5.

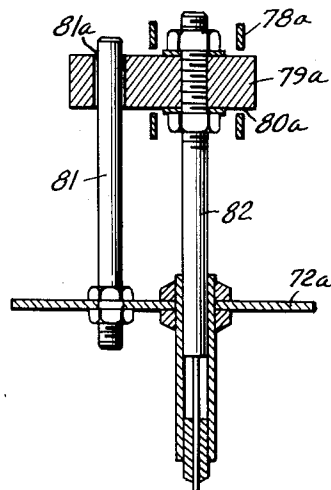


Fig. 9

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5 Sheets-Sheet 5

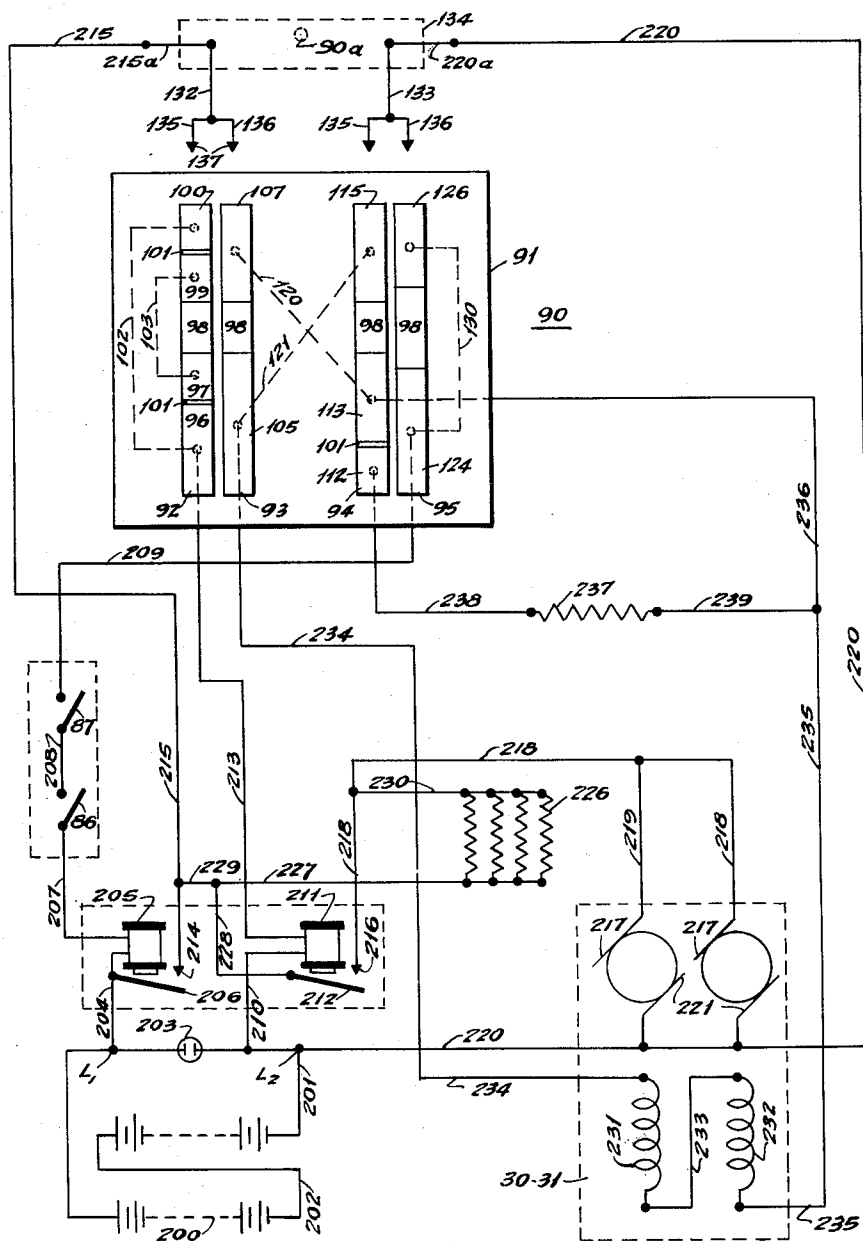


Fig. 6.

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PRIME MOVER FOR WHEEL CHAIRS

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3 Claims. (Cl. 180-15)

This invention relates to electrically operated prime movers and especially to prime movers adapted to be readily attached to wheel chairs and the like.

It is an object of the invention to provide improved electrically operated means for propelling a wheel chair which may be quickly and easily connected to, and removed from standard, folding type wheel chairs.

Another object of the invention is to provide means of the type described wherein the occupant of a wheel chair can control a plurality of forward and reverse speeds and turning movements of the chair with a single control rod.

Another object of the invention is to provide a prime mover for wheel chairs and the like having a simple and novel means for imparting differential speeds to the driving wheels of the prime mover on the one hand, while utilizing a single axle on the other hand.

A further object of the invention is to provide a prime mover of the type described including a wheeled frame, a guide wheel for the frame, and unitary control means adapted to be connected to a wheel chair for controlling forward, reverse and turning movements of the wheel chair.

A further object of the invention is to provide a prime mover for wheel chairs and the like that is simple and practical in construction, has a low center of gravity, is strong and reliable in use, is neat and attractive in appearance, is relatively inexpensive to manufacture, and otherwise well adapted to the purposes for which the same is intended.

Another object of the invention is to provide novel means for attaching a prime mover to a wheel chair whereby vibrations and vertical impacts imparted to said prime mover will not be transmitted to said chair.

Another object of the invention is to provide a simple and inexpensive means for controlling the operation of a prime mover with a single control lever.

A further object of the invention is to provide a novel switch for controlling the electrical circuit of a prime mover.

Other objects and advantages of the invention reside in the details of construction and operation as more fully hereinafter described and claimed.

While motorized wheel chairs are known and are generally satisfactory, they do have some drawbacks. The major drawback resides in the fact that the motorized units are incorporated into the chair as a more or less permanent part thereof which makes it difficult, and quite often impossible, to fold the chair for easy storage and transportation thereof. Also, the motorized units are sometimes adapted to drive the large wheels of the chair by frictional contact therewith which results in slippage and inability to impart positive hill climbing ability to the chair. If the motorized units are not adapted to frictionally drive each wheel of the chair, expensive differential means or separate axles for each wheel must be provided.

My invention overcomes these and other drawbacks as will be apparent from the description and claims which follow.

The invention will be readily understood by reference to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which;

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FIG. 1 is a side elevational view showing a prime mover of my invention attached to a wheel chair;

FIG. 2 is a plan view of the prime mover of my invention with its cover removed;

FIG. 3 is a side elevational view of the prime mover of my invention with its cover partially broken away;

FIG. 4 is a plan view partly in section, of a control lever for controlling the operation of the prime mover;

FIG. 5 is a perspective view of the electrical switch for controlling the electrical system shown in FIGURE 6;

FIG. 6 is a schematic diagram illustrating the electrical system for the prime mover shown in FIGURES 2 and 3;

FIG. 7 is a front elevational view of a portion of the apparatus shown in FIGURE 1;

FIG. 8 is a perspective view of a portion of the apparatus shown in FIG. 7; and

FIG. 9 is a cross-sectional view, partly in elevation, of details of the control lever taken on the line 9-9 in FIGURE 4.

Referring now to FIGS. 1 and 7 of the drawings, a wheel chair A, of the well known folding type, includes an X-brace B and an upstanding post C. A prime mover 10, having a hood or cover 11, is held in driving engagement with the chair A by means of U-shaped brackets 12, each of which has a back plate 13 and a pin 13a. The back plates 13 push against the X-brace B to move the chair A forward and the pins 13a pull against the X-brace B to pull the chair A in a reverse direction. Sufficient space is maintained between back plate 13 and pins 13a to permit the brackets 12 to move freely along the longitudinal axes of the X-brace B so that vibrations and impacts imparted to prime mover 10 will not be transmitted to the chair A. This feature also permits the prime mover 10 to rise and fall with rough spots in the ground over which it travels without jarring or tipping chair A.

Each pin 13a has a head 14 and a cut-out portion 14a adapted to pass through the slotted portion of a slotted-hole 15 (FIG. 8). Each pin 13a also has a spring 16 which biases the pin 13a against being dislodged from slotted-hole 15. The operator of the wheel chair A can readily attach the prime mover 10 thereto while remaining in the chair A by backing it over the prime mover 10 so that the X-brace B is in engagement with the brackets 12. The pins 13a are then pulled up so that the cut-out portions 14a of the pins 13a pass through the slotted portions of slotted-holes 15. The pins 13a are then released and the portions of the pins 13a which are above the cut-out portions 14a engage the circular portions of the slotted-holes 15.

The prime mover 10 is controlled through a control box 72 which is attached to the upstanding post C on the chair A and which will be hereinafter described.

Referring to FIGS. 2 and 3, the prime mover 10 includes a main frame 20 having an upstanding front wall 21, an upstanding rear wall 22 and a bottom portion 23. Two D.C. (direct current) motors 30 and 31 are rigidly secured to the bottom 23 of the frame 20 by any suitable means, not shown. Although any suitable motors may be used, I prefer to use standard 6 volt automobile generators having their fields in series and their armatures in parallel. Sprockets or pulleys 32 and 33 are affixed to the shafts 34 and 35 of the motors 30 and 31, respectively. The motors 30 and 31 are controlled in a manner and by means to be hereinafter explained.

A shaft 40 is rotatably mounted on frame 20 in pillow blocks 41 and 42. A sprocket or pulley 43 is rigidly affixed to shaft 40 and a sprocket 44 is rotatably mounted thereon. A sprocket 45 is rigidly affixed to rotatable sprocket 44 by any suitable means, such as welding.

Wheels 46 and 47 rotatably mounted on opposed ends

of a fixed shaft or axle 48 and sprockets or pulleys 49 and 49a are affixed to the wheels 46 and 47, respectively.

A first chain or belt 50 is trained about the sprocket or pulley 32 of the motor 30 and the sprocket or pulley 43 which is affixed to rotatable shaft 40. A second chain 51 is trained about the sprocket or pulley 49 which is affixed to the wheel 46 and a sprocket or pulley 52 which is affixed to one end of rotatable shaft 40. The motor 30 drives the wheel 46 by rotation of sprocket or pulley 32 which drives sprocket 43 and the shaft 40 through chain or belt 50. Rotation of shaft 40 causes chain 51 to drive the wheel 46.

A third chain or belt 53 is trained about the sprocket 33 of the motor 31 and the sprocket 44 which is rotatably mounted on the shaft 40. A fourth chain or belt 54 is trained about the sprocket pulley 45 which is rigidly affixed to rotatable sprocket 44 and the sprocket or pulley 49a which is affixed to the wheel 47.

The motor 31 drives the wheel 47 through the rotation of sprockets 44 and 45 as a unit on shaft 40 which, in turn, rotates the wheel 47 through sprocket 49a by means of chain 54.

The sprocket 43 has been rigidly affixed to the rotatable shaft 40 while the sprockets 44 and 45 rotate thereon as a unit to provide a universal or differential effect when the prime mover 10 turns corners. The differential action permits one wheel 46 or 47 to turn faster than the other wheel 46 or 47.

While other means for transmitting power to the wheels 46 will manifest themselves, I prefer to use the drive arrangements shown because of its simplicity, inherent low friction and "free-wheeling" ability. Worm gear drives could be used, but have the drawback that an extra large current is required to overcome their frictional resistance and also because it is extremely difficult to push the chair by hand with such a unit attached thereto.

The motors 30 and 31 and also the batteries 201 and 202 (FIG. 6) are mounted between the wheels 46 and 47 so that the frame 20 can be very close to the ground, thereby giving the prime mover 10 a very low center of gravity. When the prime mover 10 is used for propelling wheel chairs, the low center of gravity of the prime mover 10 minimizes any tendency of the wheel chair to upset and gives the user of the chair a better sense of security against tipping over than would be the case if the prime mover 10 had a high center of gravity.

A tiller wheel 60 is mounted in a bifurcated portion 61 which has a shaft 62 rotatably mounted in a bearing 63. The tiller wheel 60 is pivoted by means of a first link 64 rigidly affixed to the bifurcated portion 61; a second link 65 which has one end pivotally connected to the first link 64, and its other end pivotally connected to a third link 67 which is rigidly connected to an upstanding rod 66; and a fourth link 67a which has one end rigidly connected to the lower end of rod 66 and its other end pivotally connected to a cable 70. The upstanding rod 66 is pivotally mounted in knuckles 68 which are affixed to the front wall 21 of frame 20. The tiller wheel 60 is controlled through the cable 70 which is encased in a flexible housing 71 and is controlled through the control box 72 shown in FIGURE 1.

Referring now to FIG. 4 the control box 72 includes a bottom wall 72a, ball and socket joint 73 is mounted in said box 72 by any suitable means, not shown. A handle or rod 74 is attached to a bracket 75 by any suitable means, not shown. The bracket 75 includes legs 75a and 75b which lie at right angles to each other in a horizontal plane. The bracket 75 is attached to the ball-and-socket joint 73 by means of a first pin 77, nuts 77a and ferrules 77b. A second pin 76 is rigidly secured to the bracket 75, as shown in FIG. 4. Clevises 78 and 78a are rotatably mounted on the pins 76 and 77. The clevis 78 has a shaft 79 slidably engaging elongated holes 80 in the end thereof, and the clevis 78a has a shaft 79a

loosely mounted in elongated holes 80a in the end thereof. An upstanding rod 81 prevents longitudinal movement of shaft 79a, but permits vertical movement thereof through hole 81a in shaft 79a. The tiller cable 70 is rigidly affixed to the shaft 79 and a control cable 82 is rigidly affixed to the shaft 79a. The sliding shafts 79 and 79a and the mounting of the handle 74 on the ball and socket joint 73 makes it possible to simultaneously move both cables 70 and 82 by moving the lever 74 both sidewise and forward (or backward as the case may be) on a sort of arc. The control box 72 may be attached to the wheel chair A by any suitable means such as a clamp 83 which includes a U-shaped portion 83a having a bar or strap 84 hingedly mounted on one leg thereof. The strap 84 carries a threaded bolt 84a. The U-shaped portion 83a of the clamp 83 engages the upstanding post C of wheel chair A and the strap 84 is then swung shut and retained in contact with the post C adjacent the U-shaped portion 83a by threading the bolt 84a into a nut 85. Resilient pads 88 are provided as shown, to assure a firm grip of the clamp 83a to the post C.

The control box 72 also carries an interlock switch 86 which is depressed when the control box 72 is attached to the chair A. The interlock switch 86 must be depressed before a circuit can be completed to the motors 30 and 31. In addition, the control box carries a toggle switch 87 which must be thrown to its "on" position before a circuit can be completed to the motors 30 and 31. Thus, the control lever 74 will not activate the motors 30 and 31 unless both the interlock 86 and the toggle switch 87 are in their "on" positions.

Electrical current to the motors 30 and 31 is controlled through a switch 90 (FIGS. 5 and 6) which may be located in any suitable place, such as on wall 22 within the prime mover 10 superjacent the bottom portion 23, not shown. The switch 90 is a six position, four pole, sliding contact type switch having a base 91 on which is mounted four bus bars 92, 93, 94, and 95. The bus bar 92 is divided into segments 96, 97, 99 and 100. The segments are separated by suitable insulators 98 and 101. A conductor 102 connects segment 96 to segment 100 and a conductor 103 connects segments 97 and 99 together. The bus bar 93 is divided into segments 105, and 107 which are separated by insulator 98. The bus bar 94 is divided into segments 112, 113, and 115 which are separated by insulators 98 and 101. A conductor 120 connects segment 107 of bus bar 93 with segment 113 of bus bar 94 and a conductor 121 connects segment 105 of bus bar 93 with segment 115 of bus bar 94. The bus bar 95 is divided into segments 124 and 126 which are separated by insulator 98. Segments 124 and 126 of bus bar 95 are connected together by a conductor 130. Contact carriers 132 and 133 are made of electrical conducting material and are attached to an insulated bar 134. Each contact carrier is split into prongs 135 and 136 near the end remote from the bar, 134. Each prong has a self-cleaning type contact 137 affixed thereto. The contacts 137 slidably engage the bus bars and are maintained in position thereon by covers 138, only one of which is shown, which are affixed to the base plate 91 by any suitable means, such as screws 139. The switch 90 is positioned by cable 82 which engages hole 90a and provides a neutral position where no current will flow therethrough when the contacts 137 are riding on the insulators 98, and five "current-flowing" positions when the contacts selectively engage segment groups 100-107-115-126, 99-107-115-126, 97-105-113-124, 96-105-113-124 and 96-105-112-124, respectively.

Twelve volt, D.C. electrical power is supplied to the motors 30 and 31 through the electrical system shown in FIG. 6, wherein the numeral 200 represents a 12-volt source of power which in my preferred embodiment comprises two six volt batteries 201 and 202 connected in

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series. A polarized charging receptacle 203 is connected across the batteries 201 and 202. The positive side L1 of the power source 200 is connected through conductor 204 to one end of the coil of a solenoid or relay 205 having a normally open pole 206. The other end of the coil of the relay 205 is connected through conductor 207 to the interlock 86 which, in turn, is connected in series through conductors 208 and 209 with the toggle switch 87 and segment 124 of bus bar 95. The negative side L2 of the power source 200 is connected through conductor 210 to one end of the coil of a second solenoid or relay 211 which has the normally open pole 212. The other end of the coil of relay 211 is connected through conductor 213 to the segment 96 of bus bar 92.

The relay 205 has a contact 214 which is superjacent the pole 206 and which is connected through conductors 215 and 215a to the contact carrier 132 of switch 90. The relay 211 has a contact 216 which is superjacent the pole 212 and which is connected to one brush 217 of each motor 30 and 31 through conductors 218 and 219, respectively. The negative side L2 of the power source 200 is connected through conductors 220 and 220a to the contact carrier 133 of switch 90.

The other brushes 221 of the motors 30 and 31 are connected to the negative side L2 of the power source 200 through conductor 220. One side of a resistance grid 226 is connected through conductors 227 and 228 to the pole 212 of the relay 211 and to the contact 214 of relay 205 through conductors 227, 229 and 215. The other side of the resistance grid 226 is connected through conductors 230 and 218 to the contact 216 of relay 211 and through conductors 230, 218 and 219 to the brushes 217 of motors 30 and 31.

The field coils 231 and 232 of the motors 30 and 31 are connected together in series through conductor 233, to segment 105 of bus bar 93 through conductor 234, and to segment 113 of bus bar 94 through conductors 235 and 236. A resistance 237 of approximately 8 ohms is connected between segment 112 of bus bar 94 and the field coils 231 and 232 through conductors 238, 239 and 235.

Operation of the device will be readily understood.

Three forward speeds, two reverse speeds and turning movements are controlled as follows:

With the control lever 74 in a vertical position, tiller cable 70 is in such a position that tiller wheel 60 will be set so that the prime mover 10 will follow a straight course. The control cable 82 will be in such a position that contacts 137 will be riding on insulators 98 and current will not flow in the electrical circuit.

When switches 86 and 87 are closed and control lever 74 is pushed forwardly so that cable 82 moves insulated bar 134 to place contacts 137 into contact with segment 97, 105, 113 and 124 a circuit is completed from L1 to L2 through conductor 204, relay 205, conductor 207, switch 86, conductor 208, switch 87, conductor 209, segment 124, contact 136, contact carrier 133 and conductors 220a and 220 to L2. The current flowing in relay 205 closes pole 206 and permits current to flow from L1 through conductor 204, pole 206, contact 214, conductors 215, 227 and 229, grid 226, conductors 230, 218 and 219, brushes 217 and 221, and conductor 220. This places the resistance of grid 226 in series with the armatures of motors 30 and 31.

The resistance in grid 226 reduces the voltage to the armatures of motors 30 and 31 causing them to revolve at a speed forward which is slow enough for a person accompanying the wheel chair occupant to walk beside the chair.

When the control lever 74 is pushed forwardly to position contacts 137 on segments 96, 105, 113 and 124, an additional circuit is completed to L2 through relay 211. This closes pole 212 and takes the resistance grid 226 out of the circuit and causes the motors 30 and 31 to speed up to their second forward speed.

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Since segments 96, 97 and 124 are connected to segments 100, 99 and 126 respectively, it will be obvious that the two aforementioned speeds will be imparted to the prime mover in a reverse direction of moving control lever 74 so that contacts 137 engage the sets of segments 99, 107, 115, and 126 and 100, 107, 115 and 126, respectively.

A third forward speed is imparted to the device by moving the control lever 74 forwardly until contacts 137 engage segments 96, 105, 112 and 124. This not only takes grid 226 out of the circuit in the manner above stated, but also places resistance 237 in series with field coils 232 and 231, thereby speeding up the motors 30 and 31.

When control lever 74 is tilted sidewise to the right, the tiller wheel 60 turns the wheel chair A to the right. Conversely, when the control lever 74 is tilted to the left, the tiller wheel 60 turns the wheel chair A to the left.

It will be seen that the invention provides an improved prime mover for wheel chairs.

Many modifications and variations of the invention, as set forth herein, may be made without departing from the spirit and scope of the invention. Accordingly, the drawings and specification herein are to be considered for purposes of illustration rather than of limitation.

I claim:

1. In a detachable prime mover attachment for a wheel chair of tubular construction, said prime mover including a frame, a driving wheel rotatably mounted on said frame, and an electric motor in driving engagement with said driving wheel, the improvement comprising a tiller wheel mounted on said frame, means for controlling flow of electrical current to said motor and turning of said tiller wheel, said last mentioned means including a control box, an articulated control lever mounted in said box, a clamp on said box for clamping said box to said wheel chair, a multi-pole electric switch mounted on said prime mover, said electric switch including segmental bus bars and electrical contacts slidably engaging said bus bars, a first flexible cable having one end connected to said switch for sliding said contacts over said bus bars, and another end connected to said lever, and a second flexible cable having one end connected to said tiller wheel and another end connected to said lever.

2. A free-standing, detachable prime mover attachment for a wheel chair of tubular construction, said prime mover comprising a frame, wheels rotatably mounted on said frame, a sprocket rigidly affixed to each of said wheels, an electric motor affixed to said frame for each of said wheels, each of said motors including a shaft, a sprocket fixed to and rotatable with each of said motor shafts, chain means connecting each motor shaft sprocket in driving engagement with each wheel, and means for controlling flow of electrical current to said motors and turning movements of said tiller wheel, said last mentioned means including a control box, an articulated control lever mounted in said box, a clamp on said box for clamping said box to said wheel chair, a multi-pole electric switch mounted on said prime mover attachment, said electric switch including segmental bus bars and electrical contacts slidably engaging said bus bars, a first flexible cable having one end connected to said switch for sliding said contacts over said bus bars and another end connected to said lever, and a second flexible cable having one end connected to said tiller wheel and another end connected to said lever.

3. The prime mover of claim 2 including also a clamp mounted on said prime mover, said last mentioned clamp including a U-shaped frame, an aperture in each leg of said U-shaped frame, a slot connecting one of said apertures to the exposed edge of one of said legs, a pin mounted in said apertures, said pin having a reduced cross-section intermediate its ends, and a compression spring biasing said pin in such a manner that said re-

duced cross-section is normally maintained out of engagement with said slot.

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