Jan. 25, 1955 H. R. BRAND 2,700,382

THERAPEUTIC APPARATUS

Filed Oct. 11, 1950 5 Sheets-Sheet 1

FIG. 1

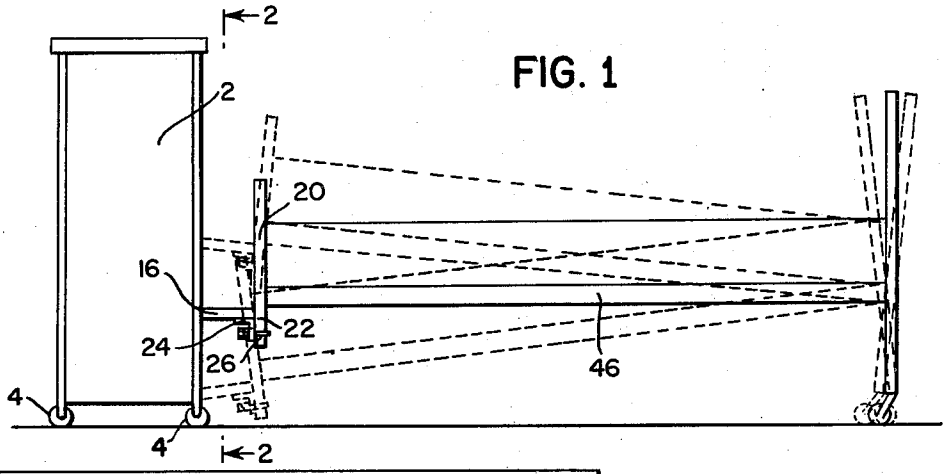



FIG. 2

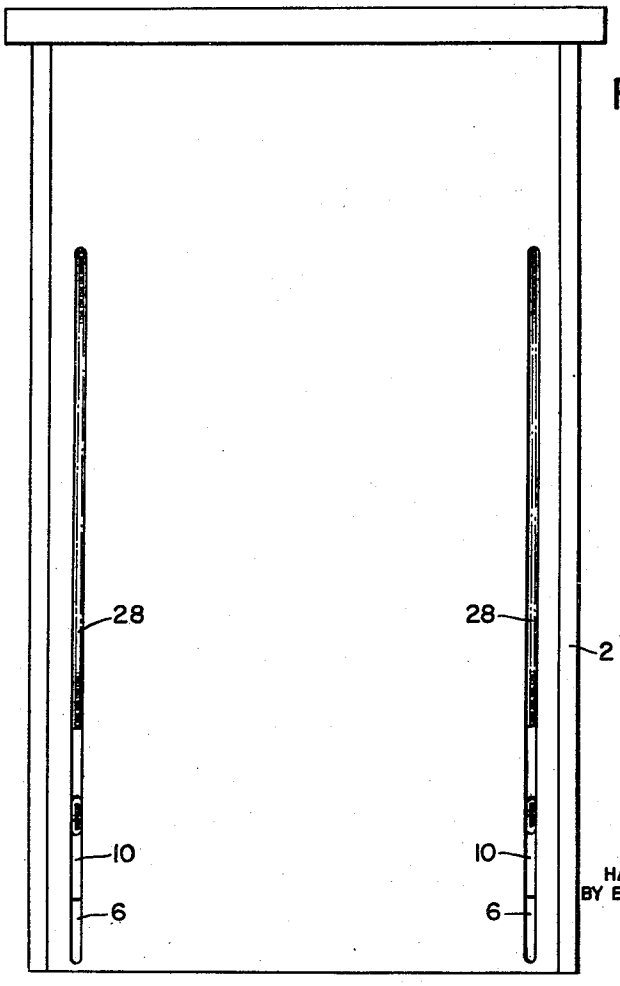
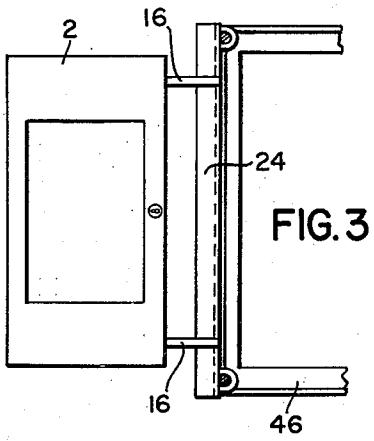



FIG. 3




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THERAPEUTIC APPARATUS

Filed Oct. 11, 1950 5 Sheets-Sheet 2

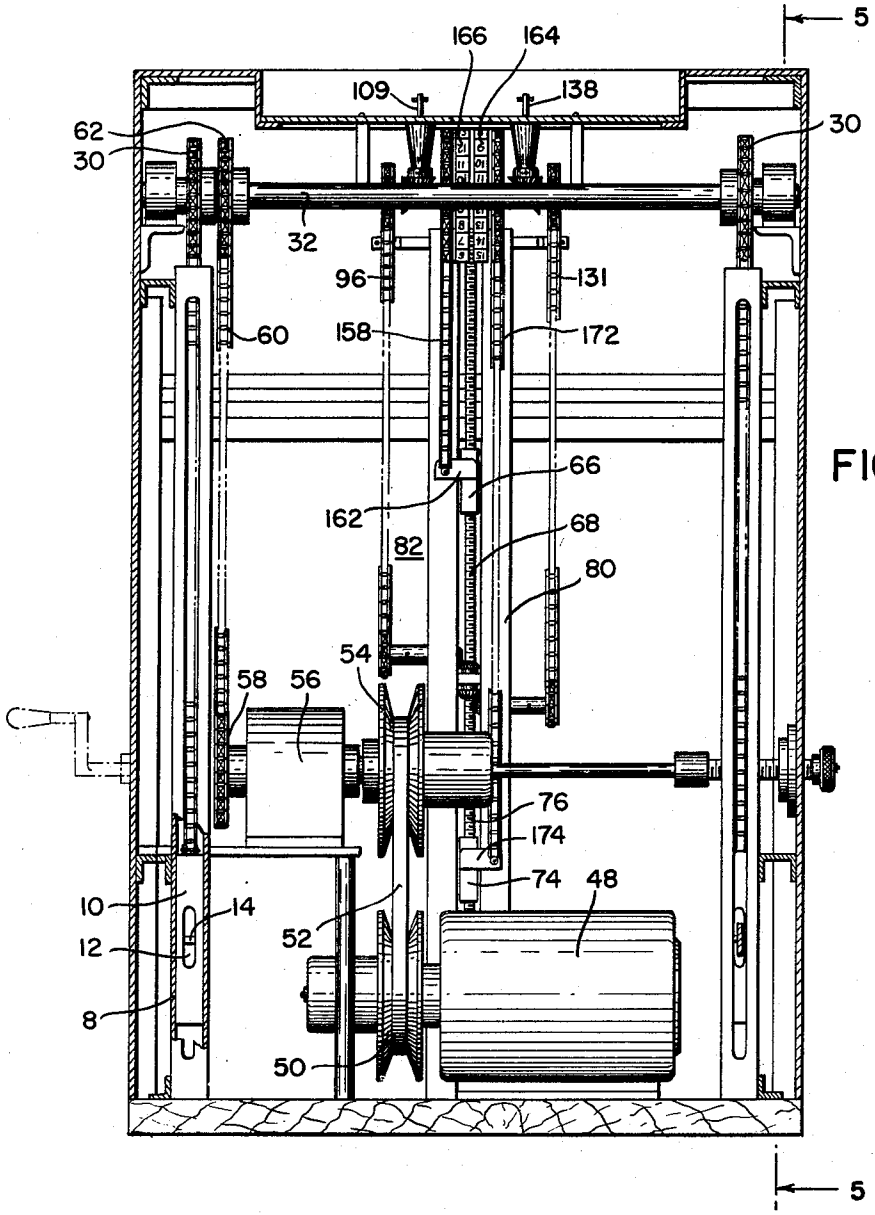



FIG. 4

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THERAPEUTIC APPARATUS

Filed Oct. 11, 1950 5 Sheets-Sheet 3

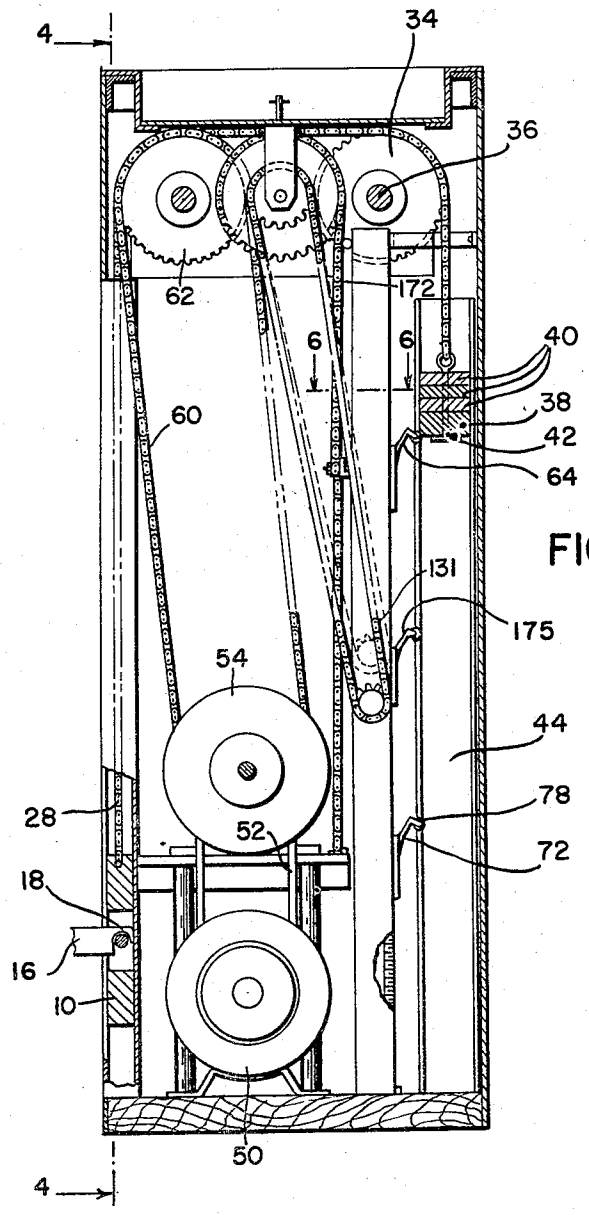



FIG. 5

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THERAPEUTIC APPARATUS

Filed Oct. 11, 1950 5 Sheets-Sheet 4

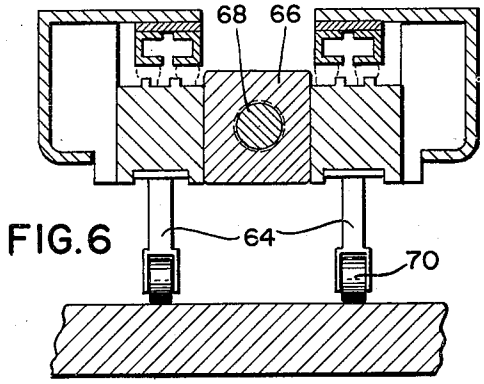



FIG. 6

FIG. 7

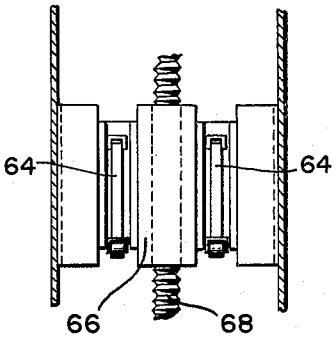



FIG. 9

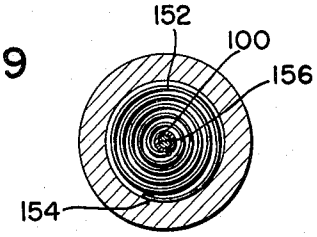



FIG. 8

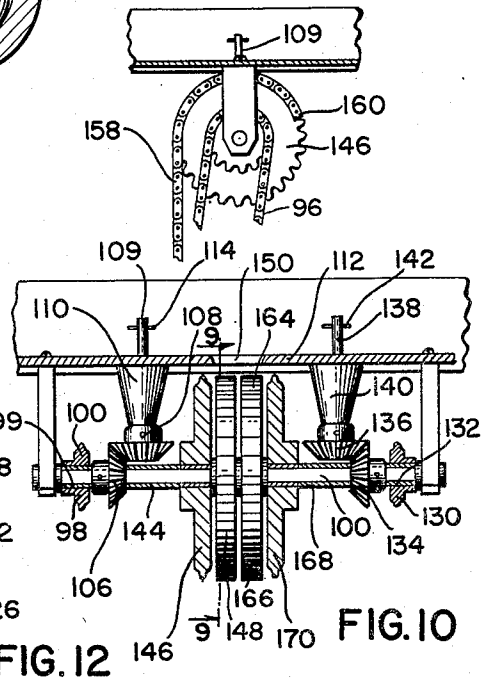
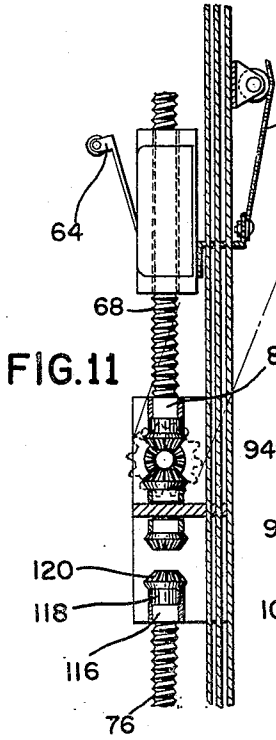



FIG. 10

FIG. 11



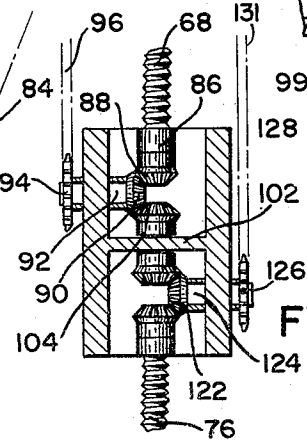




FIG. 12

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THERAPEUTIC APPARATUS

Filed Oct. 11, 1950 5 Sheets-Sheet 5

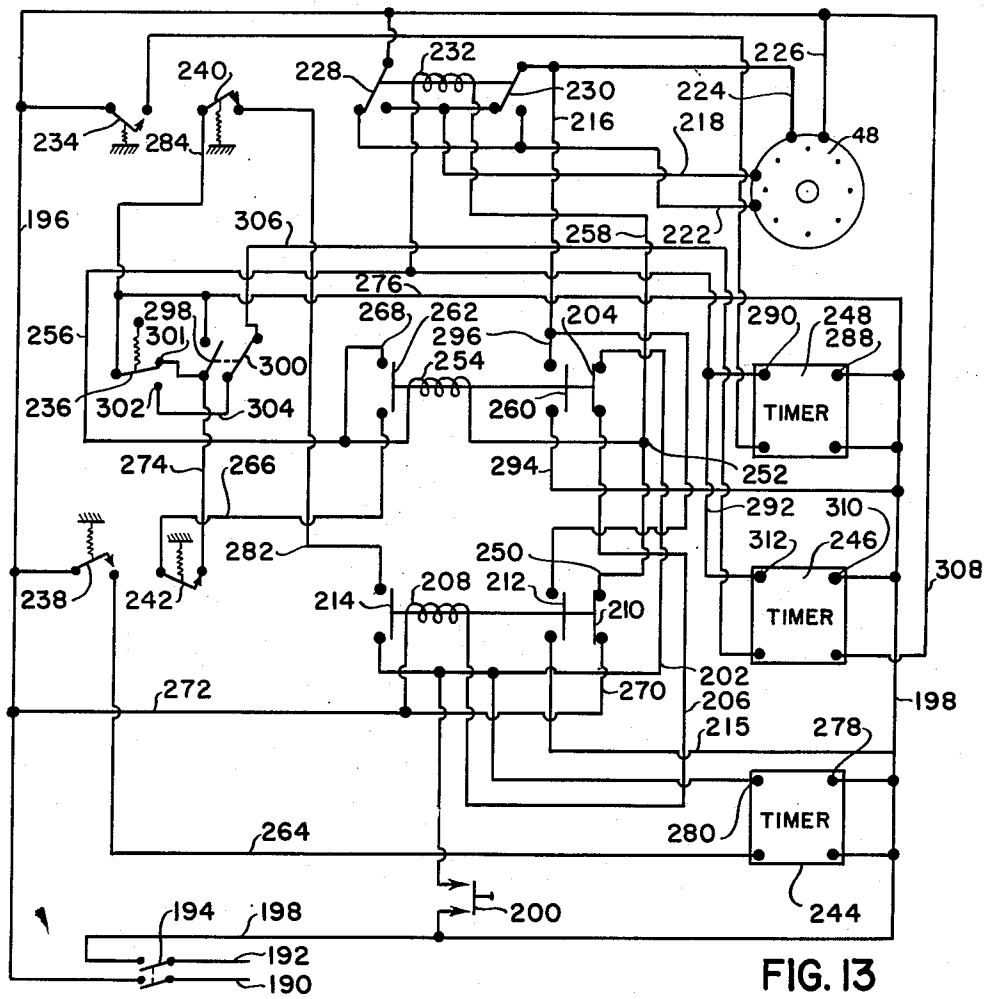



FIG. 13

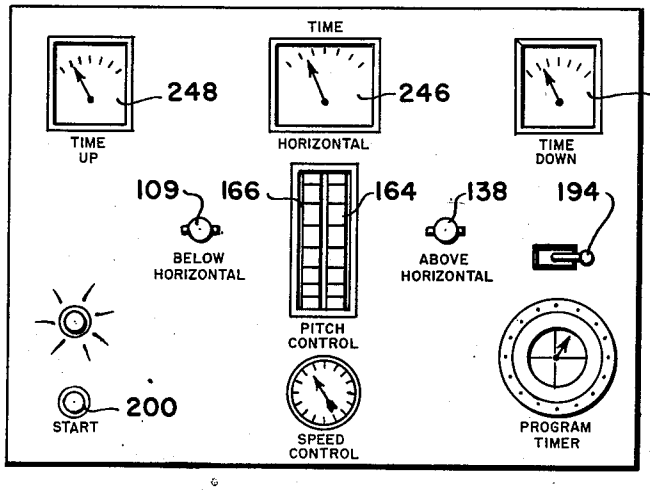



FIG. 14

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United States Patent Office 2,700,382 Patented Jan. 25, 1955



2,700,382

# THERAPEUTIC APPARATUS

Harry Russell Brand, deceased, late of New York, N. Y., by Emily Mary Ann Brand, executrix, New York, N. Y.

Application October 11, 1950, Serial No. 189,507

18 Claims. (Cl. 128—33)

This invention relates to therapeutic apparatus for use in the treatment of patients suffering from ailments or diseases which may advantageously be treated or relieved by insuring a thorough and complete circulation of the blood. More particularly the invention relates to therapeutic apparatus which operates in such manner that gravity is utilized to aid the heart action in effecting the circulation of the blood.

Therapeutic apparatus designed to utilize gravity in assisting the heart to effect a proper circulation of the blood is usually provided with a support or bed upon which the patient reclines and with means for oscillating this support or bed so that the support or bed, with the patient thereon, may be brought into different inclinations to the horizontal, whereby the blood may first be aided in its flow to the extremities and then aided in its return from the extremities, the necessary rapidity of this oscillating movement and its continuity varying considerably for different ailments. For example, among the many different treatments now prescribed in vascular diseases is the Berger treatment which consists in a cycle of alternating movements and periods of rest; first with the bottom of the feet on the floor for a period of approximately 1½ minutes, next with the feet level with the body for approximately 2½ minutes, and third with the feet far above the head for a period of approximately 2 minutes. In other treatments prescribed for vascular ailments the support, on which the patient lies prone, is oscillated between a position in which the feet are lower than the head and a position in which the feet are higher than the head and in such cases it is sometimes desirable that there be a period of rest at the end of each movement of the patient's support or bed in either direction. The treatment may also vary with different patients in respect to the amplitude of the oscillating movement, the rapidity thereof, the distance of the movement above and below the horizontal and the relationship between the speed of movement between the extreme positions and the rest period at each extreme position.

A general object of the present invention is to provide therapeutic apparatus of the class described which can easily be adjusted to the particular requirements of any patient and which has a comparatively wide range of possible adjustments.

Among the advantages of the comparatively wide range of adjustments provided for in the therapeutic apparatus of the present invention is the possibility of saving time in giving a treatment by reducing the time of travel between the starting and stopping points of a movement from one position of the support or bed to another and increasing the time of rest at each of the extreme positions or at either of them.

With the foregoing and other objects in view the invention aims to provide means for effecting the raising and lowering of one end of an ordinary hospital or other bed which is adaptable to substantially any type of hospital or other bed and which, therefore, does not require the support for the patient to be a permanent part of the therapeutic apparatus. The invention further aims so to connect the raising and lowering mechanism to the patient's bed that the bed itself will be insulated from any vibrations from the mechanism of the apparatus and so to construct the raising and lowering apparatus itself that substantially all noises and vibrations which would be objectionable in a hospital are eliminated from its operation.



An important feature of the invention is the provision of means in the raising and lowering apparatus for counterbalancing not only the weight of that part of the bed which is supported by the apparatus during the raising and lowering movements but also that part of the weight of the patient which must be raised and lowered. By thus counterbalancing the weight to be moved the power required for effecting the movements between the various circulating aiding positions is reduced to a minimum. This is an important consideration in therapeutic apparatus of this type since frequently it is called upon to operate 24 hours per day.

Another important feature of the invention is the arrangement of the lifting and lowering mechanism so that it operates on one end only of the bed, thus disturbing as little as possible a patient's comfort, the apparatus being usually connected to the foot end of the bed so that the head of the patient is not raised and lowered to any extent. It will be understood, however, that if the doctor wishes to prescribe a treatment in which the patient's head is to be raised and lowered it will only be necessary to place the head of the patient at the foot of the bed.

Other objects, advantages and important features of the invention to which reference has not hereinabove specifically been directed will appear hereinafter when the following description and claims are considered in connection with the accompanying drawings, in which—

Figure 1 is a side elevation on a considerably reduced scale of the apparatus of the present invention connected to an ordinary hospital bed in which a short-legged footboard end has been substituted for the regular footboard to permit tilting of the foot end of the bed below horizontal position, this view showing only the outer casing of the raising and lowering mechanism;

Figure 2 is a rear elevation on a considerably larger scale of the raising and lowering mechanism in its enclosing casing, that is, a view from the bed side of the casing;

Figure 3 is a plan view on the same scale as Fig. 1 of the mechanism housing of the foot end of the bed and of the connections between the mechanism and the bed;

Figure 4 is a vertical section through the raising and lowering mechanism on the line 4—4 of Figure 5;

Figure 5 is a vertical section through the raising and lowering mechanism substantially on the line 5—5 of Figure 4;

Figure 6 is a transverse section on a somewhat larger scale through the switch operating mechanism on the line 6—6 of Figure 5;

Figure 7 is a detail view, partly broken away and partly in section, of one of the switch-carrying slides and a part of the lead screw by which vertical adjustment of the slide is effected, this view being on a scale corresponding to Fig. 6;

Figure 8 is a detail view on a scale substantially that of Fig. 5 of one of the indicator mechanisms for showing the stroke length of the oscillating movement above or below the horizontal, there being one of these mechanisms for the movement above the horizontal and another for the movement below the horizontal;

Figure 9 is a vertical section on the line 9—9 of Figure 10 showing one of the coil springs used in urging the indicator wheel in one direction;

Figure 10 is a rear elevation of the indicator mechanisms for the two stroke adjustments, this view also showing a part of the stroke adjusting mechanism;

Figure 11 is a side elevation, with parts shown in section, of the upper switch adjusting mechanism for adjusting the upper limit of that part of the oscillating movement which is above the horizontal, this view also showing the upper end of the lower switch adjusting mechanism;

Figure 12 is a vertical sectional detail, looking from the left in Fig. 11, through the mechanism for effecting the turning of the switch adjusting screws;

Figure 13 is a wiring diagram, and

Figure 14 is a plan view of the control board or panel.

In the illustrative embodiment of the invention the therapeutic apparatus is shown as comprising essentially

a device that may be attached to any bed, and particularly any hospital bed, on which the patient to be treated reclines, this mechanism being enclosed in a housing 2 mounted upon casters 4 so that the apparatus may be easily moved into operative relation to the bed to be oscillated and when connected thereto can be moved with the bed into different positions in the hospital room or ward. In Figure 2 it will be seen that the housing 2 is provided with vertical slots 6 which communicate inside the casing with vertical tubes 8 in each of which a slide 10 is arranged to slide vertically, the slide 10 being provided with a slot 12 having therein a transverse pin 14 to be engaged by a link 16 having a hooked end 18 adapted to hook over the pin 14 to connect the bed to the slide 10 so that the bed will partake of the vertical movements of the slide 10.

As hereinabove suggested, there is preferably substituted for the usual footboard of the hospital bed, having legs of the same length as the headboard, a footboard 20 having short legs so that the foot end of the bed may swing below its normal horizontal position. Extending across the short legs 22 of the footboard 20 is an angle bar 24 having at its ends sockets 26 which receive the ends of the legs 20, these sockets 26 preferably having therein rubber cushions, not shown, to insulate the legs 20 from vibrations that might be imparted thereto by the operations of the mechanism in the housing 2. It will be seen that there are two links 16, one for each slot 6, connected in any suitable manner to the angle bar 24, as, for example, by welding, so that when these links 16 are hooked over the pins 14 a positive and firm connection is made to the raising and lowering mechanism of the therapeutic bed oscillating attachment.

As shown in Figures 4 and 5, each of the slides 10 is connected by a sprocket chain 28, passing over a sprocket wheel 30 on a shaft 32 and over an idler sprocket wheel 34 on a shaft 36, to a counterweight 38, the counterweight extending across the entire front of the machine and being connected to both sprocket chains 28. It will be seen that the counterweight is made up of bars 40 strung on a hanger 42 so that different bed and patient weights may be counterbalanced thereby. The counterweight is preferably guided at its ends in guideways 44, preferably of plastic material for sound deadening purposes.

Movement of the slides 10 up and down in the guide tubes 8, such movement being transmitted through the links 16 to the bed 46, is effected by turning the shaft 32 to which the sprocket wheels 30 are connected in one direction or the other according as the foot end of the bed is to be lowered or lifted. Turning movement is imparted to the shaft 32 through connections to an electric motor 48, such connections including a V-belt pulley 50 on the driving shaft of the motor 48 which, through a V-belt 52, drives a second V-belt pulley 54 attached to the shaft of a reduction gear mechanism, not shown in detail but enclosed within a housing 56, the reduction ratio being comparatively large, for example 900 to 1 for a motor running at a speed of 1800 R. P. M. The slow speed shaft of the reduction gearing carries a sprocket wheel 58 through which turning movement is transmitted from the motor 48 through chain 60 and sprocket wheel 62 to the shaft 32 and through said shaft to the sprockets 30 which effect the lifting and lowering movements of the slides 10.

From the connections between the motor 48 and the slides 10 just described it will be seen that movement of the slides in one direction requires rotation of the motor in a certain direction and that a reverse movement of the slides requires reversal of the direction of rotation of the motor. To effect the stopping of the motor after the slides 10 have carried the foot end of the bed 46 to the desired inclination to the horizontal in one direction, a switch is provided which is so located that it operates to break the motor driving circuit, either directly or through a relay, preferably the latter, when the slides 10 have reached the position for which the apparatus has been set.

In the illustrative embodiment of the invention two of these switches are preferably provided at each end of the path of travel of the slides 10, these switches being connected in parallel and the extra switch being in the nature of safety mechanism to insure energization of the motor circuit breaking relay switch in the event that one of the switches fails to act. The upper pair of switches designated generally by the reference numeral 64 attached to the switch operating arms (Figs. 6 and 11) are mounted on a slide 66 which is adjustable by means of a lead screw 68 to different operating positions. The switch arms 64 carry rollers 70 projecting into the path of movement of the counterweight 38 so that the counterweight, when it engages the rollers 70, rocks these switches into closed position. It will be seen, therefore, that by adjusting the switch carrying slide 66 to different vertical heights the amount of movement imparted to the slides 10 by the motor 48 before the motor circuit operating circuit is broken can be fixed.

It will be seen that the upper switches 64 control the extent of movement of the slides 10 downwardly, that is their movement to carry the foot end of the bed below its normal horizontal position, the switches 64 being engaged by the counterweight on its upward movement. It will be seen, therefore, that the higher the adjusted position of the slide 66 the greater will be the downward inclination of the bed, connected to the slides 10 through the links 16, at the end of the downward movement of the slides 10.

The lower switches likewise designated generally by the reference numeral 72 attached to the switch operating arms (Fig. 5), like the upper ones, are carried on a slide 74 (Fig. 4) which may be adjusted vertically by a lead screw 76. These switch arms 72 carry rollers 78 projecting into the path of movement of the counterweight 38 so that when engaged thereby these switches are closed and serve to break the motor operating circuit, preferably through a relay-operated switch. These switches 72 control the extent of the upward stroke of the bed-oscillating mechanism, that is the extent of the upward movement of the slides 10, connected through the links 16 to the foot of the patient supporting bed. From this it will be seen that the lower the adjustment of the slides 74 the greater will be the length of the upward movement of the slides 10 and therefore the greater the upward inclination of the foot of the bed to the horizontal at the end of the upward movement of the slides 10.

The mechanism for turning the lead screws 68 and 76 to effect the adjustment of the switch carrying slides 66 and 74 is shown particularly in Figures 4, 10, 11 and 12. The lead screw 68 is located between upright frame members 80 and 82, and, as shown in greater detail in Figures 11 and 12, the lead screw 68 has a smooth cylindrical end 84 extending through a bearing 86 and having at its lower end a bevel pinion 88 engaging a bevel pinion 90 on a short shaft 92 extending through the upright frame member 82. At the other end of the short shaft 92 is a sprocket wheel 94 connected by a sprocket chain 96 to a sprocket wheel 98 on a sleeve 99 on the stationary shaft 100. A crosspiece 102 between the uprights 80 and 82 has mounted thereon a freely turning bevel gear 104 which serves merely to take up any lateral thrust on the horizontal shaft 92. Also mounted on the sleeve 99 and attached thereto to turn with the sleeve and sprocket 98 is a bevel pinion 106 engaging a bevel pinion 108 on a shaft 109 extending through a bearing 110 on the under face of the dial plate 112, the shaft 109 at its upper end being provided with a key pin 114 for receiving a key by which the shaft 109 may be turned to effect the vertical adjustment of the slide 66 through the connections just described.

Mounted on the sleeve 99 on the shaft 100 is a sprocket wheel 146 and an indicator wheel 148, the indications on which can be read through an opening 150 in the dial plate 112. The indicator wheel 148 and sprocket wheel 146 are connected together to turn synchronously and inside the indicator wheel is a coil spring 152 connected at one end at 154 to the indicator wheel and at its inner end at 156 to the shaft 100, which is a fixed shaft held against turning. A ladder or sprocket chain 158, partly wrapped about and fixed at its upper end at 160 to the sprocket wheel 146 and connected at its lower end to an arm 162 attached to the slide 66, serves to transmit the adjustments of the slide 66 to the indicator wheel 148 through the sprocket wheel 146, the coil spring 152 tending to rotate the sprocket wheel 146 in the clockwise direction in Figure 8 so that the chain 158 is maintained taut between the sprocket wheel and the slide 66, whereby the indicator wheel 148 indicates accurately the position of the slide. The indications 164 on the indicator wheel 148 may be of any suitable character such, for example, as figures showing the extent of the movement in inches of the slide

10 below the position in which it holds the foot of the bed horizontal.

There is a similar indicator wheel 166 for the position of the slide 74, this indicator wheel being mounted upon a sleeve 168 on the shaft 100 to which is also attached a sprocket wheel 170 of like construction to the sprocket wheel 146. A coil spring similar to the coil spring 152 is located in the indicator wheel 166 and tends to urge said wheel to turn in the direction to maintain the chain 172, Fig. 4, connected to the arm 174 on the slide 74, in taut condition so that the indications 164 on the wheel 166 will show accurately the extent of the movement of the slides 10 above the position in which they would hold the bed in horizontal position.

In this connection it will be noted that the sprocket wheel 130 fixed upon the sleeve 168 is connected by a sprocket chain 131 to the sprocket 126 which through shaft 124 and bevel pinion 122 turns the lower switch slide adjusting screw 76. Turning of the sleeve 168 to effect the turning of the sprocket 130 is effected through a bevel pinion 134 attached to the sleeve 168 and engaging a bevel pinion 136 on the vertical adjusting shaft 138 mounted in bearings 140 on the under side of the dial plate 112. The key pin 142 on shaft 138 corresponds to and has the same function as the key pin 114 on shaft 109.

When the apparatus is to be used to treat the patient in accordance with the so-called Berger treatment, hereinabove defined, an intermediate switch having an operating arm 175 (Fig. 5) is brought into operation, as more fully hereinafter set forth. The arm 175 operates in the same manner as the actuating arms 64 and 72 of the other two switches, being engaged by the counterweight 38 for operation both on the upward movement of the counterweight and on its downward movement.

Referring to the wiring diagram of Figure 13, the current is introduced from mains 190 and 192 through a main switch 194 and the main 190 is thus connected to one side 196 of the local therapeutic apparatus circuit and the main 192 is connected to the other side 198 of the local therapeutic apparatus circuit. When the main switch 194 has been closed it is still necessary temporarily to close the local circuit through a starting button 200 in order to start the motor which moves the patient's bed up and down through the movement of the slides 10.

Movement of the starting button 200 into the closed position makes a connection between the side 198 of the local circuit and a wire 202 that is connected to one member 204 of a normally closed switch, the other member of which is connected by a wire 206 with a solenoid coil 208 which operates to swing simultaneously three switch members 210, 212, 214 to the left in Figure 13, these switch members being interconnected mechanically, but not electrically, and being normally urged into the position shown in Figure 13 and only moved toward the left when the coil 208 is energized. It will be seen that this energization of the coil 208 moves the switch member 212 into contact with its cooperating switch member which establishes a connection through wires 198, 215 and 216 and one side of the reversing switch to the wire 218 of the starting winding of the motor 48, thus completing a circuit for starting the motor 48, the other side 196 of the local main circuit being connected through one side 228 of the reversing switch by wire 222 to the other side of the starting winding of the motor 48. The running winding of the motor 48 is connected by wires 224 and 226 to the two sides of the local circuit, these connections being in parallel with those to the starting winding. The reversing switch is made up of switch members 228 and 230 mechanically interconnected and normally urged into the position shown in Figure 13 and is only moved into its reversing position when the solenoid 232 is energized, as hereinafter more fully set forth. The starting button 200 is engaged only temporarily, after which the holding circuits and timers, hereinafter described, take over.

Starting of the motor 48 will cause the counterweight 38 to move successively into circuit closing relation to the micro switches 234, 236 and 238, assuming that the apparatus is set for the Berger system, or only in succession into circuit closing relation to the top micro switch 234 and to the bottom micro switch 238, these two switches defining the extreme limits of movement of the slide 10 down and up, respectively, if the ordinary use of the apparatus is being made. In this connection it may be pointed out that the position controlling switches, which have been designated generally by the reference numerals 64, 72 and 175 attached to their operating arms in Fig. 5, consist essentially of two switches each, as shown in the wiring diagram in Fig. 13. For example, the operating arm 64 which through its roller 70 is engaged by the counterweight near the end of its upward movement, which corresponds to the downward movement of the bed, operates to close the micro-switch 234, which is normally spring urged to open position, and at the same time to open the micro-switch 240, which is normally spring urged to closed position. In a smiliar manner, when the counterweight approaches its lower position it engages the roller 78 on the switch arm 72 and this serves to close the micro-switch 238, which is normally spring urged to open position, and to open the micro switch 242, which is normally spring urged to closed position. When the machine is being operated to give the Berger treatment, hereinabove defined, the roller on the switch arm 175 is engaged by the counterweight as it moves in either direction past this switch arm and, as it does so, it swings the micro-switch arm 236, which is normally spring urged into closed circuit relation to the contact 301, to break this circuit and to move into circuit-closing relation to the other contact 302. The specific switch constructions producing the aforementioned results are not herein shown, being well known in the art and commercially available. Leaving out of consideration for the present any use of the apparatus for giving the Berger treatment, at the same time that the counterweight 38 closes the switch 234, the adjusted position of which determines the lower limit of movement of the slide 10, it opens the switch 240, associated with the switch 234, and, likewise, when it closes the switch 238, the adjusted position of which defines the upper limit of movement of the slide 10, it opens the switch 242 associated therewith.

There are located in the circuits for controlling the operation of the slides 10, three timers 244, 246 and 248 of the type which, when energized, hold open the motor starting circuit for a predetermined time and then close a relay actuating switch therein that permits the motor to resume operation after a predetermined time. The operation of the timers 244, 246 and 248 will be more clearly understood if it is borne in mind that, in a sense, they take the place of the starting button 200 for starts taking place after functional stops of predetermined lengths, that they are actuated by the closing of the respective position switches 234, 236—302 and 238 and that the stopping of the motor 46 in each instance is brought about by opening one of the associated position switches 240, 236—301 and 242 of the relay holding circuits, as more fully hereinafter set forth. The timer 244 is the one that controls the pause in the movement of the slides at the upper end of their path of travel before the slides 10 start downward. The timer 248 controls the pause in the movement of the slides after they have reached their lowermost limit of movement before they start back upward and the timer 246 determines the pause in mid position when the Berger treatment hereinabove defined is being administered by the apparatus. Three relays are also shown, the relay solenoid 208 operating, as hereinabove set forth, to swing to the left, in Figure 13, three mechanically interconnected switch arms 210, 212 and 214, normally urged by spring or other suitable means not shown into the position shown in Figure 13, in which the switch arm 210 closes a circuit that includes the wire 250 branching at 252 so that one branch goes through the solenoid 254 and wire 256 to the switch constituting an element of the timer 246 as hereinabove set forth and the other branch goes through wire 258 and solenoid 232 both to the switch controlled by the timer 246 and to the switch controlled by the timer 248. The relay solenoid 254 acts upon three mechanically interconnected switch arms 204, 260 and 262 normally urged into the position shown in Figure 13 but movable to the left when solenoid 254 is energized so that the switch arms 260 and 262 cooperate with their stationary contacts to close circuits to be described and the switch arm 204 breaks the normally closed circuit through the solenoid 208 hereinabove described.

As hereinabove pointed out, the solenoid 232, when energized, moves the reversing switch, comprising the mechanically interconnected switch arms 228 and 230, to the right to reverse the current flow through the field of

the motor 48 and thus reverse the direction of turning of the motor 48. It will be seen that this reversal of the motor by action of the solenoid 232 only takes place when the timer 248 has closed the switch therein after the slides 10 have reached their lowermost position and are ready to return to their uppermost position. When the slides have reached their uppermost position and the circuit through the relay 232 has been broken it will be seen that the reversing switch, made up of the members 228 and 230 normally urged into the position shown in Figure 13, will return to that position and the direction of turning of the motor 48 will again be reversed preparatory to the up movement of the slides 10.

Let us assume that the machine has been stopped with the slides 10 moving in the upward direction so that the counterweight 13 is moving downward. The switch 194 having been closed to supply energy from the mains 190 and 192 to the local circuit comprising the lines 196 and 198, this will not in itself close the circuit through the motor 48 if the parts are in the position shown in Figure 13. If now the push button 200 be depressed to close the circuit hereinabove described that includes the relay solenoid 208, the energized solenoid 208 will move the switch arms 210, 212 and 214 to the left in Figure 13 and close a motor circuit including the wires 198, 215, switch member 212, wire 216, reversing switch member 230, wire 218, starting winding of the motor 220, wire 222, reversing switch member 228 and wire 196. The starting of the motor, if the apparatus was stopped with the switch in the up timer 248 closed and the relay 232 therefore in position to be energized, will cause the motor to turn in the direction to continue the up movement of the slides 10 until the counterweight 38 engages and closes the micro-switch 238 and engages and opens the micro-switch 242. The closing of the micro-switch 238 energizes the wire 264 and thus energizes the coil of the timer 244 preparatory to closing the switch therethrough. The opening of the micro-switch 242 opens a circuit which includes a wire 266, the switch arm 262, short wire 268 and wire 256, relay solenoid 232, wire 258, switch member 210, wire 270 and wire 272 to the local main wire 196 on one side of the micro-switch 242 and through wire 274, micro-switch 236 and wire 276 to local main wire 198 on the other side. The breaking of this circuit through which the relay solenoid 232 was energized automatically permits the reversing switch to return to the position shown in Figure 13 preparatory to the closing of the circuit through the motor for the downward movement when the timer 244 has operated to this end. When the timer 244 closes the circuit between its two contacts 278 and 280, one of which is connected with the local main 198 and the other of which is connected with the wire 202 leading to the switch arm 204, which is normally in the position shown in Figure 13 when the relay solenoid 254 is not energized, then through wire 206, solenoid relay coil 208 and wire 272, back to the other side of the local main circuit, namely wire 196. This energization of the coil 208 will move the interconnected switch arms 210, 212 and 214 to the left in Figure 13 and close the running circuit from wire 198 through wire 215, switch arm 212, wire 216 to the motor and cause it to start the downward movement of the slides 10.

As the slides 10 move downwardly the counterweight 38 moves upwardly and as it moves out of engagement with the micro-switches 238 and 242 the micro-switch 238 is again opened to break the circuit through the actuating coil of the timer 244 and the micro-switch 242 is closed to help complete a relay holding circuit. The moving of the switch 214 into contact with its cooperating switch member closes a relay holding circuit which includes the wire 282, the micro-switch 240, the wire 284 and the wire 276 running to the local main 198, wire 202, switch arm 204, wire 206, relay coil 208 and wire 272 to the other local main 196.

Assuming that the Berger micro-switch 236 is not operating and that the timer switch connecting the terminals 280 and 278 has opened after it has been closed to energize the relay 208 the motor will continue to move the slides 10 and the connected bed downward and the counterweight 38 upward, the motor circuit having been closed by the energization of the relay 208 and the relay holding circuit having been closed through switch arm 214, wire 282, micro-switch 240, wire 284 and wire 276 to main 198 on one side and wire 202, switch arm 204, wire 206, relay coil 208 and wire 272 to main 196 on the other side. The upward movement of the counterweight will continue until the counterweight engages the micro-switches 234 and 240 and closes the switch 234 and opens the switch 240. The closing of the switch 234 will close a circuit through the actuating coil of the timer 248 and start this timer to operating. The breaking of the switch 240 will break the relay holding circuit that includes the relay 208 and the switch member 214.

When the timer 248 operates to close the switch connecting its terminals 288 and 290, the closing of this switch in the timer 248 completes a circuit from the local main 198 through the timer switch, wire 292, relay 232, wire 258, wire 250, switch arm 210, which has now been returned to its closed circuit position, wire 270 and wire 272 to the other local main 196. The closed circuit just referred to energizes the relay 232 and through this relay operates the reversing switch 228, 230.

Closing of the switch in the timer 248 also closes a circuit which includes the relay 254, this circuit comprising a branch 256 from the wire 292 that runs through relay 254, wire 250, switch arm 210 in closed position, wire 270 and wire 272 to the local main 196. Energization of relay solenoid 254 operates to move to the left the interconnected switch arms 204, 260 and 262, the switch arm 260 closing a motor operating circuit including wire 294, wire 296 and wire 216 running to the reversing switch arm 230, the return circuit being the same as for the other relay. Movement of the switch arm 262 into closed circuit position closed the relay holding circuit which includes wire 268, wire 256, relay 254, wire 250, switch arm 210, wire 270 and wire 272 to the local main 196 on one side and wire 266, micro-switch 242, wire 274, micro-switch 236 and wire 276 to local main 198 on the other side. This is the relay holding circuit that is broken when the slides 10 reach the upper limit of their movement and the counterweight opens the normally closed micro-switch 242.

As hereinabove pointed out, the timer 246 is used when the Berger treatment is to be administered. In the Berger treatment there is a movement from the lowest position up to an intermediate or horizontal position, a rest in this position determined by the setting of the timer 246 and then a movement into the uppermost position. On the return movement there is also a period of rest.

The connections to the micro-switch 236 for causing the mid pause when giving the Berger treatment are shown in Figure 13 of the drawings, that is with the switch arm 298 in its open position and the switch arm 300 in its closed position. With the connections shown, when the micro-switch 236 is moved away from its normally closed contact 301 to the contact 302 it establishes a circuit through the actuating coil of the timer 246 and breaks the holding circuit that kept the relays 232 and 254 energized, thereby interrupting the current to the motor 220 and stopping the movement of the slides 10. The circuit through the timer 246 includes the wire 276 from the local main 198, the micro-switch arm 236, the wire 304, the switch arm 300, the wire 306, the timer coil and the wire 308 back to the local main 196. The holding circuit that is broken by the movement of the micro-switch arm 236 away from its contact 301 includes the wire 276, the wire 274, the micro-switch 242, the wire 266, the switch arm 262, wire 268, wire 256, solenoid relay coil 254, wire 250, switch arm 210, wire 270 and wire 272. A shunt in this circuit in parallel with the coil 254 also kept the relay solenoid coil 232 energized.

Closing of the timer switch connecting the timer contacts 310 and 312 again starts the motor 48 and permits the return of the micro-switch arm 236 to the contact 301, thus reestablishing the holding circuit at the same time that the relay coils 254 and 232 are re-energized.

When the slides 10 are moving in the other direction, that is down, and the weight is moving up, the holding circuit, which has been established by the energization of the coil 208 and which is broken by the movement of the micro-switch arm 236 away from its contact 301, is the following: Wire 276 from local main 198, wire 284, micro-switch 240, wire 282, switch arm 214, wire 202, switch arm 204, wire 206, relay coil 208 and wire 272, back to the other local main 196.

When the intermediate micro-switch 236 is not to

operate, that is when the Berger treatment is not to be given, the switch arm 298 is moved to closed position and the switch arm 300 is moved to open position. The holding circuit for the relay 254 is then as follows: Wire 272 from local main 196, wire 270, switch 210, wire 250, coil 254, wire 268, switch 262, wire 266, switch 242, wire 274, switch 298 and wire 276 back to local main 198.

The motor 48 may be either an alternating current motor or a direct current motor but there are some advantages, so far as noise of operation of the apparatus is concerned, in the use of a direct current motor. There is also the further advantage that the speed of operation of the apparatus may be more readily changed by changing the speed of operation of the motor through a rheostat or other suitable means.

When the building current, as is now usual, is alternating current a suitable converter can be interposed between the current supply and the apparatus or may be made a part of the apparatus, thus making possible the use of a direct current motor.

It will be seen also that, where V-belt pulleys such as 52 and 54 are employed, these may be of the speed varying type, thus making possible variation of speed by varying the relative belt engaging diameters of the V-belt pulleys.

It will also be seen that the apparatus lends itself to the addition of other control means such, for example, as a program timer enabling the doctor to set the apparatus for operation at certain periods of time during the day or night. Timers that may be connected to the main starting and stopping mechanism of the machine for this purpose are already on the market and, in themselves, do not constitute a part of the present invention.

What is claimed as new is:

1. A therapeutic appliance comprising, in combination, a supporting frame, a member vertically reciprocable on said frame, means for reciprocating said member, and means for connecting said reciprocable member to one end of a patient's bed to impart oscillating movement to the entire bed about the floor-supported other end thereof, the means for reciprocating the reciprocable member comprising an electric motor having a positive driving connection to said member and means, operating at the predetermined end of each stroke of the reciprocating member, to effect the reversal of the direction of rotation of said motor.

2. A therapeutic appliance comprising, in combination, a supporting frame, a member vertically reciprocable on said frame, means for reciprocating said member, and means for connecting said reciprocable member to one end of a patient's bed to impart oscillating movement to the entire bed about the floor-supported other end thereof, the means for effecting the reciprocation of the reciprocable member comprising an electric motor having positive driving connections to said reciprocable member and means for effecting a reversal of the direction of rotation of said motor at the end of the movement of said member in either direction, said means including a switch in a relay circuit arranged to be closed by engagement with a part movably connected to said reciprocable member.

3. A therapeutic appliance according to claim 2 in which the switch is adjustable along the path of movement of the movable switch-actuating part to vary the amplitude of the reciprocating movement.

4. A therapeutic appliance according to claim 2 in which a switch operable at each end of the reciprocating movement of the reciprocating member effects the reversal of the motor, whereby the amplitude of the reciprocating movement is determined, and in which the position of each switch is adjustable independently of the other to vary independently that part of the total oscillating movement imparted to the patient's bed which is above or below the horizontal position of said bed.

5. A therapeutic appliance comprising, in combination, a supporting frame, a member vertically reciprocable on said frame and adapted to carry with it one end of the patient's bed, an electric motor for effecting the reciprocation of said member and reversing means, including switches in the path of a part connected to said reciprocating member to be operated thereby, and relays controlled by said switches for stopping the movement of said reciprocating member by said motor in one direction and causing it to move in the reverse direction.

6. A therapeutic appliance according to claim 5 in which the switch operating part connected to said reciprocating member comprises a counterweight for counterbalancing the weight imposed upon said member by the connected bed end and the patient upon the bed.

7. A therapeutic appliance according to claim 5 in which timer operated switches are interposed between the terminal determining switches and the associated relays for providing a predetermined period of rest before each return movement of the reciprocating member.

8. A therapeutic appliance according to claim 5 in which a switch, located between the terminal determining switches and operated by the same switch operating part at an intermediate point in its movement, has connections for stopping the movement of said reciprocating member by said motor, and a timer operated movement restoring switch actuated by said intermediate switch for providing a predetermined period of rest when said reciprocating member is at an intermediate point in its movement in either direction.

9. A therapeutic appliance comprising, in combination, a supporting frame, a member vertically reciprocable on said frame and adapted to carry with it one end of the patient's bed, an electric motor for effecting the reciprocation of said member, means for reversing the operation of said motor at the end of the movement of said reciprocating member in each direction, said means including a reversing switch normally urged into position to control the operation of the motor in one direction, electromagnetic switch operating means for moving said switch into current reversing position, relay operated switches for controlling the energization of said motor and the energization of said electromagnetic switch-operating means, and micro-switches in the path of movement of a part connected to said reciprocating member for controlling the energization of said relays, said micro-switches being vertically adjustable to provide for different lengths of stroke of said reciprocating member.

10. A therapeutic appliance comprising, in combination, a supporting frame, a slide vertically reciprocable on said frame and adapted to be connected to one end of a patient's bed to effect an oscillation thereof about the floor-supported other bed end, means for effecting the reciprocation of said slide including an electric motor having driving connections to said slide, means for reversing the direction of rotation of the motor at the end of each stroke of said reciprocable slide, and means for controlling the operation of said reversing means, including switches operable from a part connected to said slide when said slide reaches a predetermined position in each direction, the position of said switches being adjustable to vary the amplitude of reciprocation of said slide.

11. A therapeutic appliance according to claim 10 in which each switch is adjustable independently of the other and has a position indicator connected thereto.

12. A therapeutic appliance comprising, in combination, a supporting frame, a slide vertically reciprocable on said frame and adapted to be connected to one end of the patient's bed to effect oscillation of said bed about the floor-supported other bed end, a counterweight connected to said slide for counterbalancing the weight imposed thereon by the attachment of the patient carrying bed thereto, means, including an electric motor having driving connections to said counterweighted slide, for effecting a positive reciprocation of said parts, a switch operable by one of said reciprocating parts when the slide has reached a predetermined height for causing the stopping of said motor, a switch operable by one of said reciprocating parts when said slide has reached a predetermined low position for effecting the stopping of said motor, and means for effecting the starting of said motor after each stopping operation, including a timer controlled switch actuated by one of said aforementioned limit switches, and a reversing switch and a relay controlling the operation thereof associated with each limit switch.

13. A therapeutic appliance according to claim 12 in which a holding circuit including the relay is arranged to be closed when the relay is energized by the operation of the timer controlled switch associated with either relay.

14. A therapeutic appliance according to claim 13 in which each relay holding circuit includes a normally closed switch so located as to be opened to break the re-

lay holding circuit when the associated limit switch is closed.

15. A therapeutic appliance comprising, in combination, a supporting frame, a member vertically reciprocable on said frame and adapted to carry with it one end of the patient's bed, an electric motor having connections to said reciprocable member to effect a positive reciprocation thereof, and means for stopping said motor and reversing the operation thereof at the end of the movement of said reciprocable member in each direction, said means including a normally open switch in the path of movement of a part connected to said reciprocable member, a normally closed switch also in said path, a timer controlled relay energizing switch, a motor energizing circuit closed by said energized relay, and a relay holding circuit also closed by said energized relay, the first mentioned switch when closed serving to actuate said timer and the second mentioned switch when opened serving to break the holding circuit for the relay controlling the movement of the reciprocable member up to the point of operation of said switches.

16. A therapeutic appliance according to claim 15 in which an intermediate switch and a timer actuated relay



controlling switch operate to break said motor circuit and said relay holding circuit and to actuate said timer to effect a predetermined period of rest at an intermediate point in the movement of the reciprocable member.

17. A therapeutic appliance according to claim 15 in which the reciprocable member is made up of laterally spaced slides driven by connections to a common motor driven shaft.

18. A therapeutic appliance according to claim 15 in which the timer actuating normally open switch and the relay holding circuit normally closed switch are simultaneously adjustable vertically to vary the amplitude of movement of the reciprocable member.

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