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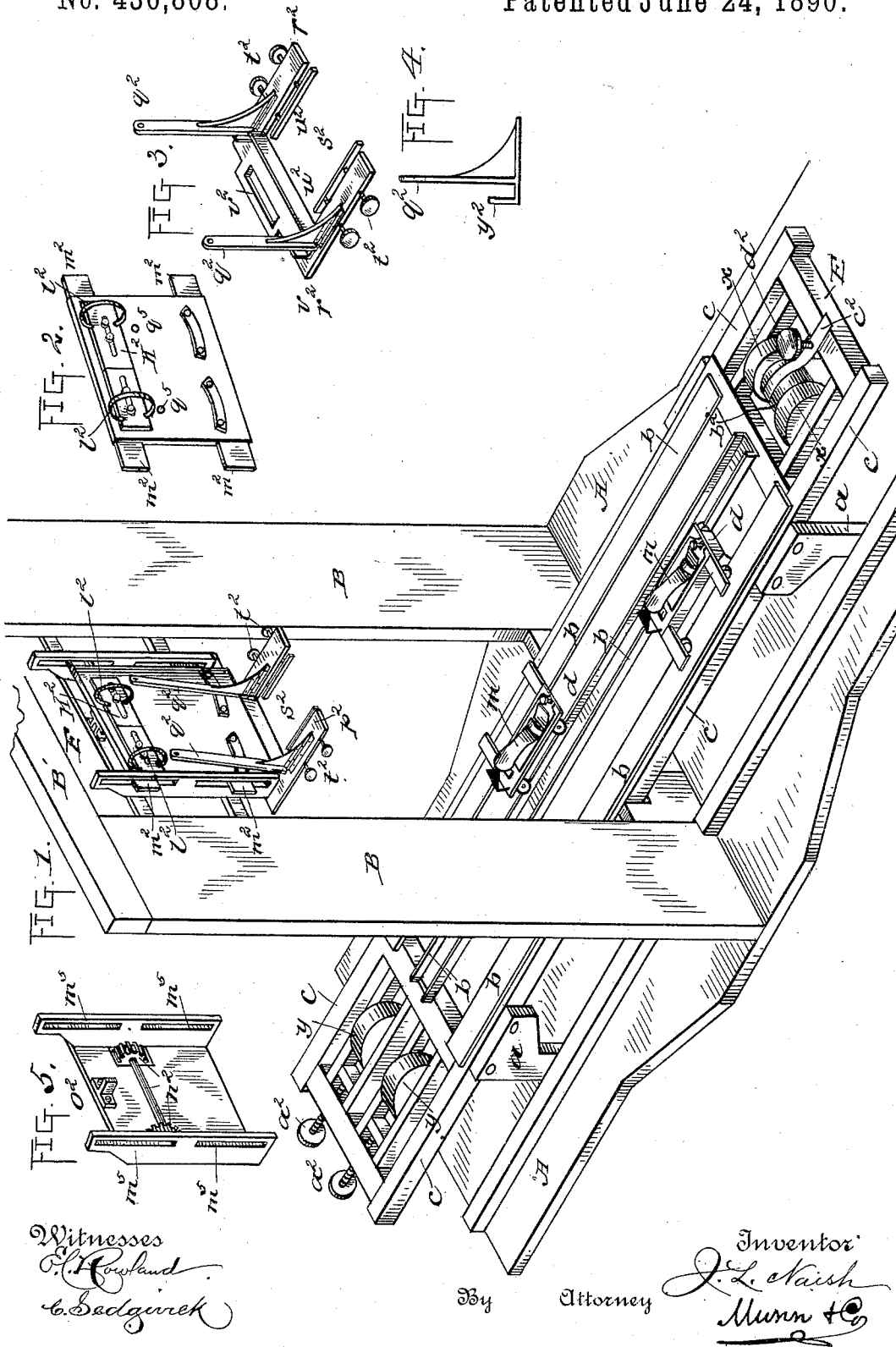
5 Sheets—Sheet 1.

J. L. NAISH.

ORTHOPEDIC MARCHING MACHINE.

No. 430,808.

Patented June 24, 1890.



Witnesses
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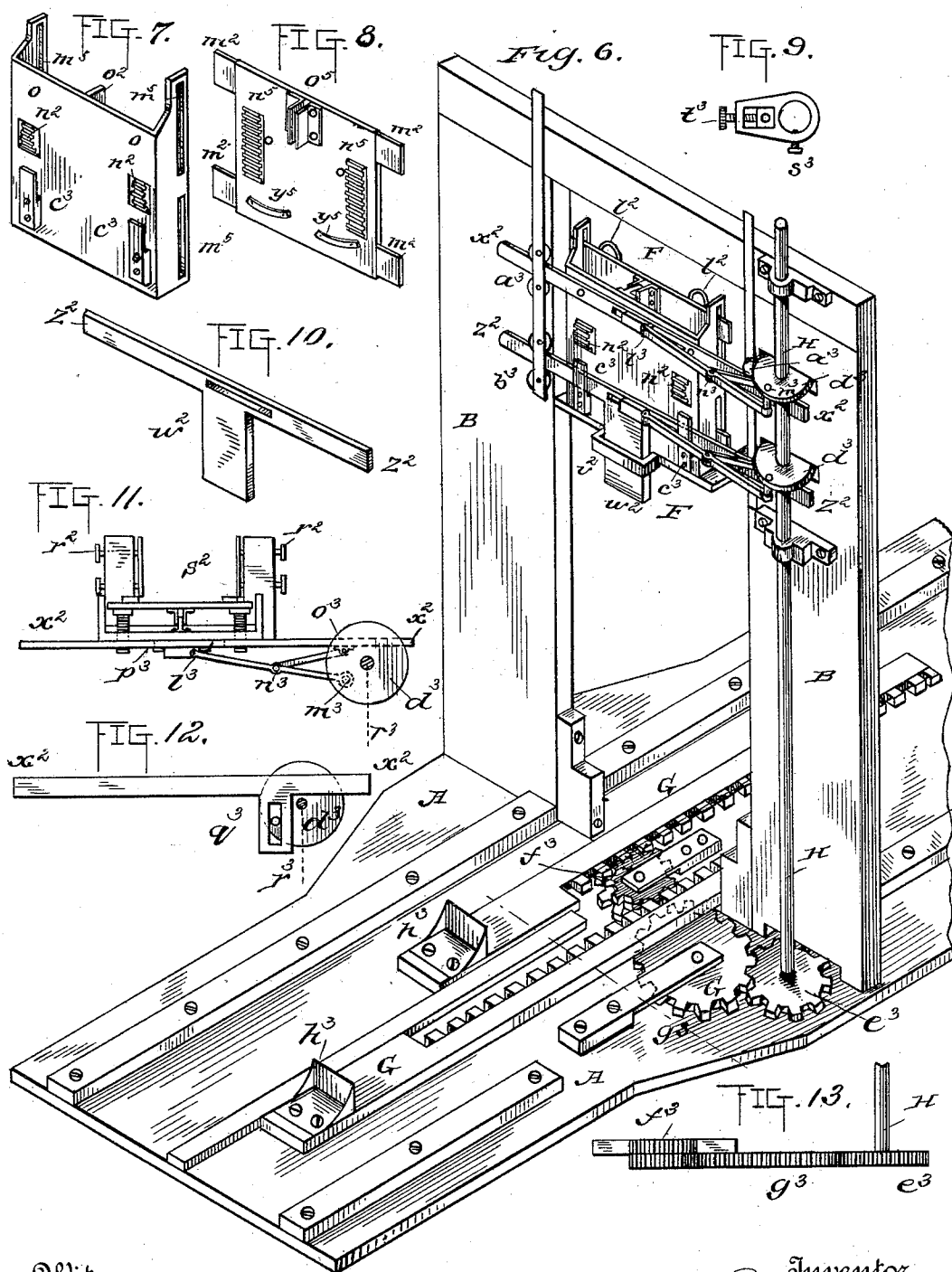
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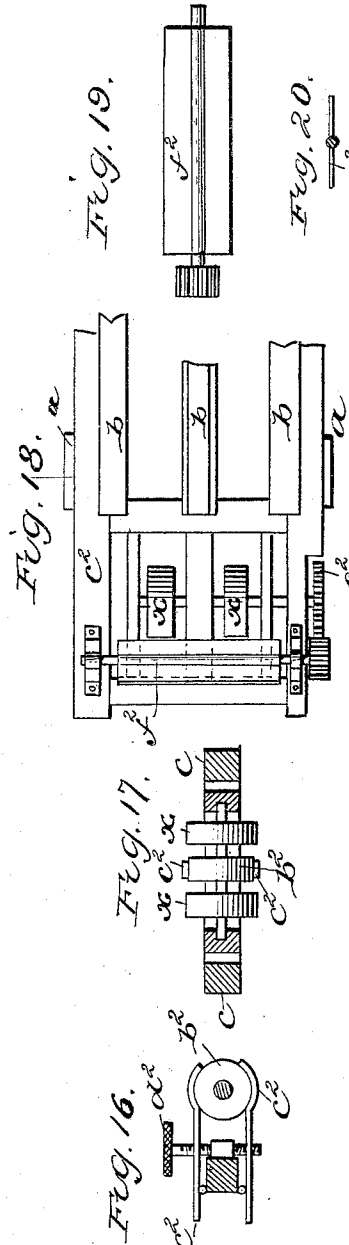
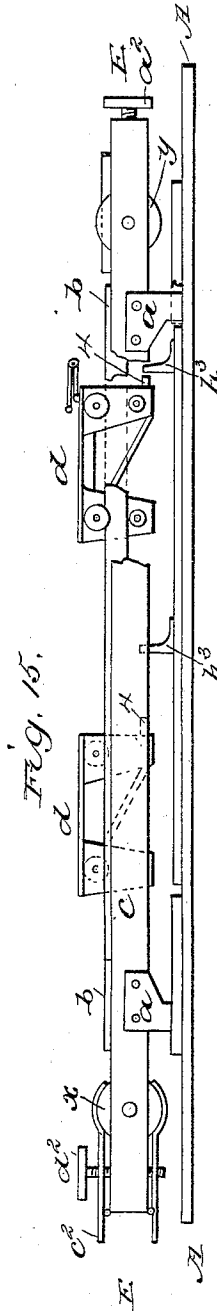
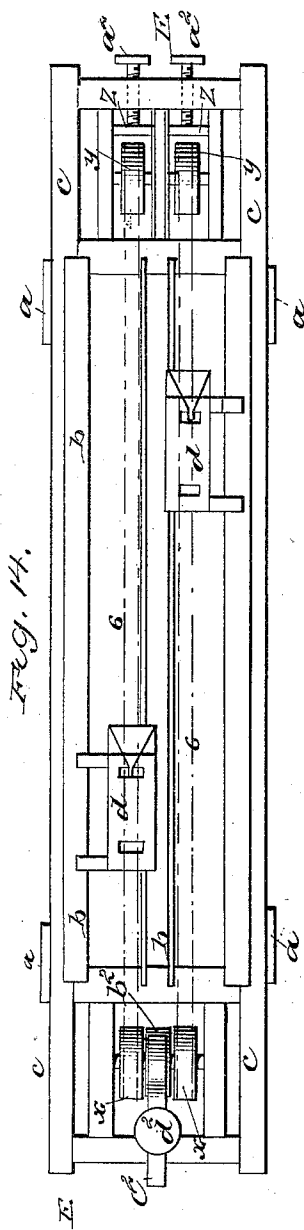
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5 Sheets—Sheet 3.

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No. 430,808.

Patented June 24, 1890.



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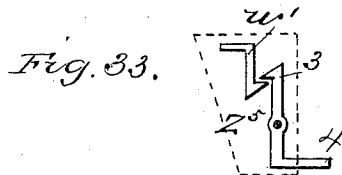
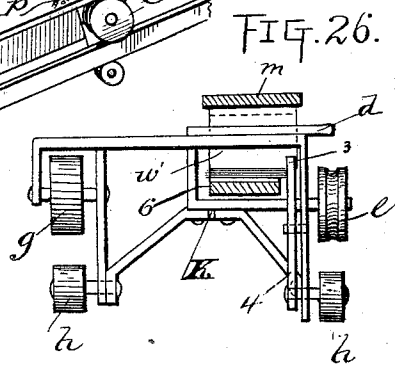
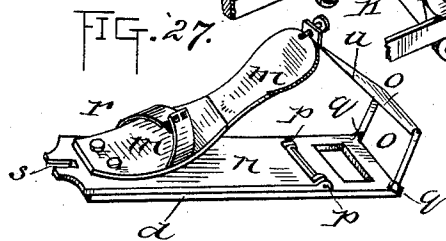
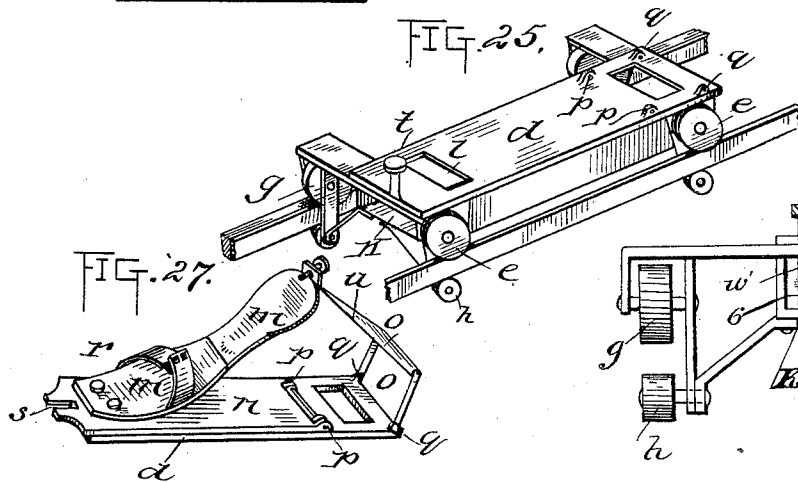
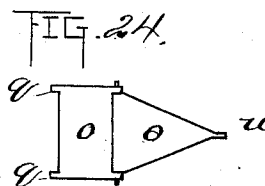
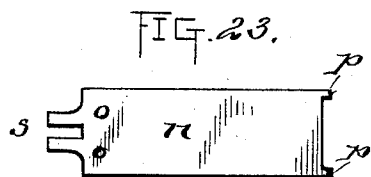
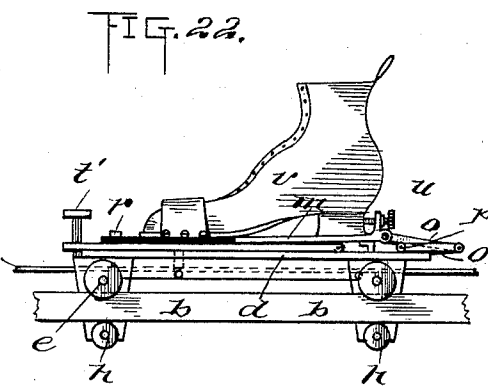
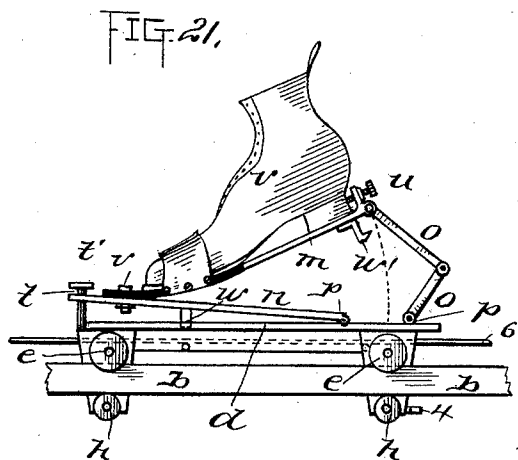
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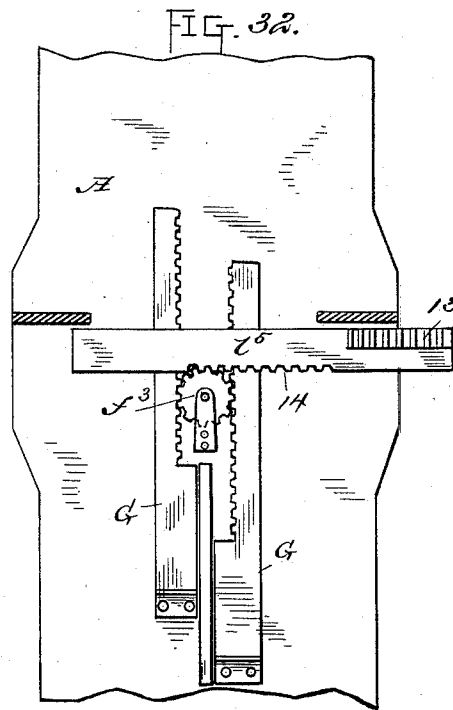
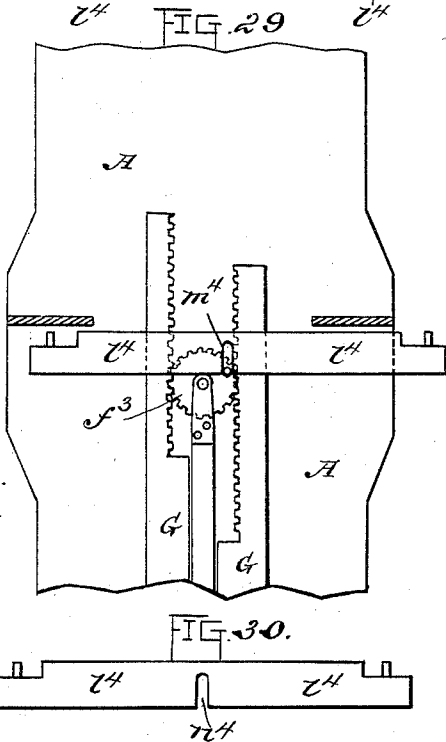
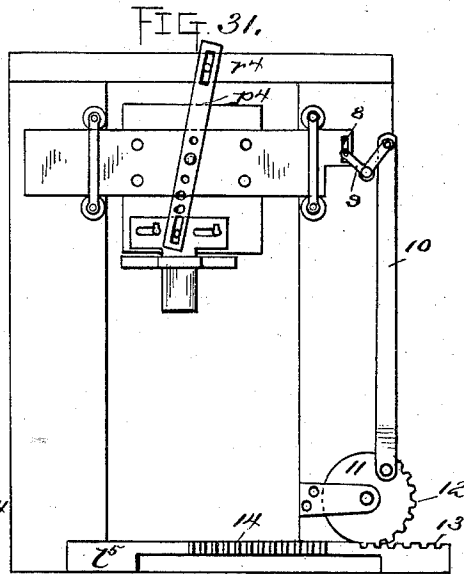
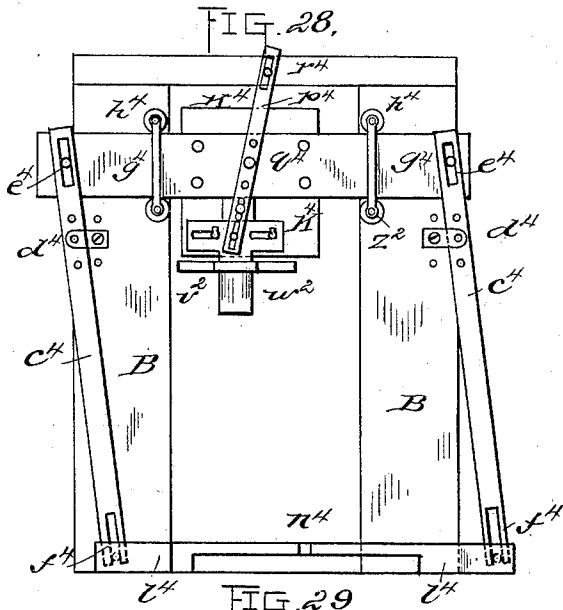
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UNITED STATES PATENT OFFICE.

JOSEPH L. NAISH, OF NEW YORK, N. Y.

ORTHOPEDIC MARCHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 430,808, dated June 24, 1890.

Application filed December 21, 1889. Serial No. 334,563. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH L. NAISH, of New York city, in the county and State of New York, have invented an Orthopedic Marching-Machine, of which the following is a full, clear, and exact description.

The physical training of a soldier, as distinguished from that which is strictly technical or military, may be regarded as having two distinct branches, one consisting of exercises for the limbs and trunk, and which are performed in a stationary position, the other consisting of exercises for teaching him to march, and of course involving locomotion. The former is commonly called "setting-up" drill, being designed to develop the muscular system and give to the soldier a good military shape. To attain this object various kinds of muscular movements are prescribed in the drill-book, others being sometimes used in addition, yet all methods duly employed lead to success; but the marching-drill is a widely-different matter, its essential object being to give the body perfect equilibrium, not merely when stationary on one leg, but when in motion thereon between successive paces, and, further, to transfer it smoothly and without shock to the other leg, at the same time preserving an unimpaired equilibrium; and it is plain that in this case there can be but little scope for variety—in fact, without the practice of balancing no perfect balance can be acquired; hence it is that for imparting to the march an elegant and symmetrical equipoise in all positions of the pace, whether quick or slow, one method and only one is ever employed. This is known as the "balance-step;" but it must be practiced persistently until proficiency is attained. The following quotation from the British infantry-drill book will indicate the importance of this exercise: "The object of the balance-step is to teach the soldier the free use of his legs, preserving at the same time perfect squareness of the shoulders and steadiness of body. No labor must be spared to attain this object, which forms the very foundation of correct marching." And to insure extra care with recruits in this exercise it is specially enjoined to instructors in the army of the United States that not more than four men shall be drilled together in the balance-

step at one time. (See *Upton's Tactics*.) Yet with all its usefulness this exercise has one serious drawback. It is usually regarded by recruits as the most tedious task in their drill. Consequently the "goose-step," as it is vulgarly called, is very unpopular.

Marching, or, as it might be called, "good deportment," is widely appreciated. Even outside of the army, not to mention the National Guard, the military marching-drill is much in request and has been so for generations, not only for the benefit of the youth in schools, but often even by their civilian elders individually; but in most cases of private drill the tendency is to commence "marching" without sufficient training in the balance-step, or it is omitted altogether. There are, indeed, some to whom this omission may be less important; but to the majority, who mostly need the training in question, this sort of instruction practically teaches nothing more than the power to "keep step," which alone does not constitute marching; nor does it remove any of the abnormal peculiarities of a bad walk. The cause of this neglect of so important a preparation is of course the large expenditure of time and patience required to make it really effective. The orthopedic marching-machine has been designed as a solution of this difficulty, for when this is used the balance-step is unnecessary, and in a very short time a well-balanced and correct military march may be acquired without any unpleasantness whatever and with absolute certainty.

In constructing the machine the directions of the drill-book have been necessarily observed in reference to the "position of the soldier at the halt" and "position of the soldier in marching." The machine is stationary, and the person using it having placed himself therein his shoulders are held back firmly to a back-board and "square to the front," or at right angles to the track in which his feet move. The feet are placed upon two small cars and fastened thereon. The cars move in tracks, allowing motion back and forth to a distance limited to the extent of the prescribed pace, which motion is communicated by the feet alternately in the ordinary manner of walking. The operator's hips are also held in a guide which controls their mo-

tions, and his body is made to incline forward at the angles suited to the quickness and length of the pace. The action of the feet causes the shoulders and hips to move alternately right and left to certain small distances which are prescribed for each person. The small cars to which the feet are attached also communicate to the latter at the toe and heel an orthopedic action, which restrains those parts of the foot from incorrect movements. Thus the body, though not advancing, but, for convenience, occupying a fixed position, except laterally, is by the action of the feet made to perform virtually all the movements which it would execute in the actual march, but with this difference, that its movements in alternate (or the right and left) paces are absolutely symmetrical—that is, accurately equal and similar in direction for any two corresponding points on opposite sides of the body. When the machine is used in very slow time, with shoulders and hips thus under constraint, the balance-step becomes a continuous slow march, in which the muscles of the trunk, hips, legs, and feet are all subjected to their appropriate training and speedily attain a power of mutual adaptation to one another. Again, for the purpose of testing progress the trunk can be at any time released from its compulsory movements and permitted to move freely, but, of course, in lateral direction only. Under such circumstances the march can be practiced as an ordinary exercise in walking or for recreation, while at the same time all inaccurate movements of the shoulders and hips will be detected and pointed out by the resulting converse motions imparted by shoulders and hips to the corresponding parts of the machine. The machine regulates the movements of the feet with similar precision, accurately guiding the heel and toe throughout the action of the pace until by frequent repetition the legitimate motion of each becomes familiar to the individual and can be imitated without hesitation in his ordinary walk or march. In the common marching-drill in the army a frequent use of the pace-stick is necessary in order to test not only the length of the pace, but, what is even more important, the equality of the right and left paces. Even when these are equal it often happens that one foot is carried farther to the front than the other in commencing a pace or thrust farther back at its completion. This symmetrical habit either tends to produce or is the result of obliquity of the pelvis. In using the machine these defective movements are prevented, and a short period of practice will entirely eliminate them from the person's walk or march. Though the military march is in many respects widely different from that which is called the natural walk, (of which, in fact, there exists no uniform standard,) yet it is, of course, equally subject to the laws of human locomotion.

Reference is to be had to the accompanying

drawings, forming a part of this specification, in which similar letters and figures of reference indicate corresponding parts in all the views.

Figure 1 is an isometrical view of my orthopedic marching-machine, parts being removed therefrom. Fig. 2 is a similar detail view of the shoulder-supporting plate and back-board. Fig. 3 is a detail view of the hip-moving attachment. Fig. 4 is a side view of the hip-moving attachment. Fig. 5 is a detail view of the front of the case in which the back-board rides. Fig. 6 is an isometrical view taken from a point to the rear of the machine. Fig. 7 is a detail view of the back of the case in which the back-board rides. Fig. 8 is a detail view of the back of the back-plate. Fig. 9 is a detail view of one of the main-shaft attachments. Fig. 10 is a detail view of the lower cross-bar. Fig. 11 is a plan view of the body-supporting apparatus and its connections. Fig. 12 is a plan view illustrating a modified arrangement for imparting a reciprocating motion to the cross-bars. Fig. 13 is a detail view illustrating the gearing employed in connection with the main shaft and the racks. Fig. 14 is a plan view of the carriages and their connections. Fig. 15 is a side view of the parts shown in Fig. 14. Fig. 16 is a detail view of the tension device. Fig. 17 is a detail view illustrating the arrangement of the anterior set of pulleys and the friction-wheel arranged in connection therewith. Fig. 18 is a detail view of a modified controlling mechanism. Fig. 19 is a view of the fan employed in connection with the arrangement shown in Fig. 18. Fig. 20 is an edge view of the fan. Fig. 21 is a side view of the foot car or carriage, the parts being represented as they appear when the grips are freed from the belt. Fig. 22 is a similar view, the parts, however, being represented as they appear when the grips are forced down upon the belt. Fig. 23 is a detail view of the hinged plate to which the foot-sandal is secured. Fig. 24 is a view of the heel-guide. Fig. 25 is an isometrical view of the foot car or carriage, the sandal, hinged plate, and the heel-guide being removed. Fig. 26 is an end view of the carriage. Fig. 27 is a view of the carriage or car platform, the sandal, hinged plate, and the heel-guide, the parts being represented as they appear when the heel is raised. Fig. 28 is a rear view of the machine-standards and parts carried thereby, this view being given to illustrate a modified arrangement for imparting a reciprocating motion to the body-support. Fig. 29 is a plan view of the racks when arranged to operate in connection with the construction shown in Fig. 28. Fig. 30 is a detail view of the main slide employed in the construction illustrated in Figs. 28 and 29. Fig. 31 is a view of the standard and parts carried thereby, illustrating a still further modification. Fig. 32 is a view of the operating mechanism employed in connection with the construction

shown in Fig. 31, and Fig. 33 is a view of the heel-grip and its keeper.

Referring now to the drawings, and more particularly to Fig. 1, A A represent a platform upon which the entire machine rests, and B B two standards between which the body-supporting attachment F F is held. The standards are in the same plane and about thirty inches (more or less) apart, the inner edges being parallel, and the standards being firmly bound together and held by a strong cross-piece B'. In practice the standards should be braced so that they will be held in a rigid vertical position. They may be also affixed directly to the floor.

In the oblong frame E E, Figs. 14 and 15, c c c c are the sides, consisting of strong bars placed parallel, united by cross-pieces near each end, and supported by four or more bearings a a a a, two only of which are visible in the figure. These are sufficiently high to prevent all contact between the belts and objects beneath when in normal position, Fig. 1. The frame is rectangular, and when in position must be placed centrally between the standards B B, its sides being strictly at right angles to the plane of said standards.

b b b b b are three flat bars or rails fastened longitudinally upon the upper side of the frame and serving as tracks on which the two foot-cars d d travel back and forth as well as for guides to the same. One of these tracks extends along the frame centrally, each of the others lying equally distant and parallel to it. I prefer that the central rail have on each of its sides a flange upon which may run the inside wheels of the respective foot-cars, which are flanged or grooved. (See Fig. 26.) The length of the tracks is not less than one pace and a half added to the length of one foot-car. For an ordinary adult this will be found to be from forty to forty-five inches in addition to twelve inches for the foot-car. For ladies and the young of either sex of course less than this would be sufficient; but a full-sized machine can be utilized by persons of less stature. If the oblong frame be made to shift in direction of its length, it may be constructed of less extent than if fixed. The oblong frame is so placed between the vertical standards B B that the common plane in which the latter stand shall divide the tracks b b b b b into two parts, of which the part behind said plane shall be the greater by six inches, more or less, the platform A A being of course apportioned in accordance therewith. This presumes that the standards are not attached to the floor of a room, (which in many cases would be preferable.) The width of the central track regulates the distance at which the foot-cars, and therefore the feet, pass one another; but the central track may, if desired, be replaced by two single tracks, thereby permitting this distance to be varied.

d d are the foot-cars, one of which is seen enlarged in an isometrical view, Fig. 25.

This car is for the right foot, and Fig. 26 is a front view of the same.

e e are the grooved wheels, which run on the central or flanged rail, g g being the ungrooved wheels to run on the flat or outer rail, while h h are guide-wheels to run below the tracks, so as to keep the upper wheels close down on the tracks. Moreover, the outer wheels g g are carried by a species of outriggers beyond the outer edge of the car, in order to give the car greater stability against the side-thrust of the foot. It will be seen that the foot-car in shape resembles an oblong and very shallow box, but with the ends uninclosed, as at K, (see also K, Fig. 26,) the upper surface being pierced with a broad aperture near each end for the passage of two grips. The breadth of the foot-car proper is about that of a full-sized boot-sole, in length about twelve inches, as before seen.

Fig. 27 shows, in combination, the working-connections which unite the boot of the operator to the foot-car, and consist of the sandal m m, the hinged plate n, (see also Fig. 23,) the heel-guide O O, (see also Fig. 24,) and the upper surface of the foot-car d, (supposed to be removed from the car.) The sandal is a sole of any suitable material shaped like a boot-sole, but longer than the boot of the person by about an inch or more, said extra length lying beyond the toe. It is rigid in all its length, except the part beneath the fore part of the foot, where it is pliant.

The sandal may be applied to the boot in the manner usual with skates—viz., by a strap buckled across the instep and a flange on the heel pinned to the boot-heel. (See Figs. 21 and 22.) The hinged plate n, Fig. 23, is of hard material, in breadth equal to the upper surface of the foot-car, but shorter. It is hinged to the upper surface of the foot-car in the points p p (see Fig. 27) and is jointed to the toe of the sandal at r. The slot S at its anterior end plays vertically upon the vertical guide-rod t at the front of the foot-car, Fig. 25 (See also Figs 21 and 22.)

The heel-guide O O, Fig. 24, is formed from two sections q and u, that are united by a hinge-joint. The section q is hinged to the foot-car, and is preferably of the form shown in Fig. 24, and the section u, which is preferably triangular, is hinged to the sandal.

Fig. 21 is a side view of the boot and foot car united by the above working-connections, V being the boot; m, the sandal; n, the hinged plate; O O, the heel-guide, and d the foot-car as when mounted on the track b b, the dotted curve showing the path of the heel in rising. The anterior end of the hinged plate is raised by the lifting of the foot, guided in a vertical direction by the rod t, working in the slot S, and limited in said rise by the knob t'.

w w' are two grips for binding by pressure the foot-car to the belt, which passes longitudinally through it. The anterior grip w is attached to and vertically beneath the hinged plate n, and the posterior grip w' is fixed to

and beneath the heel of the sandal, so that when the foot is raised both grips run clear of the belt. This condition is shown in Fig. 21; but when the foot is resting on the car both grips are pressed down on the belt and bind it, with all the weight of the body, against the upper surface of the bottom of the foot-car or against small friction-rollers over which it runs, as in Fig. 22. The grip w' is formed with a catch z^3 , Fig. 33, that is engaged by a keeper 3 when the operator's heel is depressed, and the heel will be held so depressed until the lower end of the lever 4, upon which the keeper 3 is formed, strikes against the rack projection h^3 , Figs. 6 and 15.

By the mechanism of the heel-guide O O the heel of the person is constrained to rise in a plane which is vertical and also parallel to the central track. Moreover, by means of the slot S and vertical rod t the toe is retained at such angle from the front as the drill-book directs, and, as before seen, hindered from rising too high by the knob t' ; but by means of a set-screw the heel-guide can be so fixed as to guide the heel in a plane divergent from the front, if so desired.

Returning to Fig. 14, the oblong frame $c c c c$ extends longitudinally beyond the ends of the tracks $b b b b b b$ in both directions. Near its anterior end are two belt-wheels $x x$, running in bearings, and near its posterior end two similar and equal wheels $y y$, also running in bearings. The former pair are fixed on a common axle and therefore run together. The latter pair are on separate axles, each of which is mounted in a separate sliding frame Z Z, said sliding frame being moved longitudinally by its appropriate hand-screw $a^2 a^2$. The four belt-wheels have a diameter of about six or seven inches; but this can of course vary. From each anterior belt-wheel $x x$ to the corresponding posterior belt-wheel $y y$ an endless belt 6 is stretched parallel to the sides of the oblong frame and passing above and beneath them. Each belt can be kept at the proper degree of tension independently of the other by means of the hand-screws $a^2 a^2$. The upper half of each belt passes through the corresponding foot-car from end to end, as before mentioned, between the upper and lower inclosures of the same. To insure this arrangement with accuracy, each pair of belt-wheels is so mounted in the bearings that the highest point in the circumference of each shall be in the same horizontal plane with the upper surface of the bottom of the foot-car.

Fig. 21 shows in what manner the belt passes through the car when left free to do so by the lifting of the grips $w w'$. How it is prevented from passing through when said grips are pressed down by the superincumbent weight of the body is shown by Fig. 22. The former case happens when the foot is being carried to the front during the swing of the leg, the latter when it is being thrust backward, bearing the weight of the body.

In natural walking or marching the pressure of the foot on the ground both supports the body and propels it forward. The propulsion is rendered possible only by the friction engendered between the foot and the ground, due to the weight of the body. If the entire pressure at any moment be supposed to be resolved into two forces—one upon the plane of the ground and the other perpendicular to it—the latter may be disregarded, and the former alone will represent the force of propulsion which carries the body forward and will vary with the quickness of the pace. Among a given number of persons it will also vary with their weight severally. In this machine the reactive force of propulsion is represented by a retarding force against which the feet act in a backward direction. The retarding force must be capable of being varied for the respective weights of light and heavy persons and according to the quickness of the pace. I will first describe a method for obtaining a suitable force from friction.

Returning to Fig. 14, between the belt-wheels $x x$ and on the same axle with them is fixed a friction-wheel b^2 . It therefore revolves at the same rate as the belt-wheels. Fig. 16 is a side view of said friction-wheel separate from the belt-wheels $x x$. Above and below it is a friction-brake $c^2 c^2$, which by a single turn of the hand-screw d^2 , whose threads run in opposite directions, is made to press with greater or less force upon the friction-wheel, and thus either retard or render more free the rotation of the belt-wheels, and consequently the motion of the belts. The brakes are affixed to the cross-piece at the end of the frame $c c c c$. It has been seen that when the foot is pressed down on the car, Fig. 22, the belt is held firmly by the grips, and when lifted, Fig. 21, the belt runs free of said grips. The former case happens when the foot is urged backward, (corresponding to the forward movement of the body in natural walking.) Thus when the backward motion of the foot-car is too free an increase of the friction will restrain and retard it. Another retarding force can be obtained by atmospheric pressure acting against a revolving fan.

Fig. 18 is an anterior portion of the oblong frame $c c c c$, Fig. 14, containing the belt-wheels $x x$, but with the friction-wheel left out, instead of which on the end of the same axle with $x x$ is a toothed wheel e^2 , which is geared with the pinion of the fan f^2 , Fig. 19, such fan being suitably mounted in bearings upon the cross-piece at the anterior end of the oblong frame.

Fig. 20 is a section of the fan at right angles to the axle. The fan and friction-wheel, Figs. 19 and 16, may both be attached to the end of the oblong frame, provision being made for disconnecting one while the other is in use.

In Fig. 1, F is the mechanism for controlling and guiding the hips and shoulders correctly in their appropriate and respective lateral

motions during the march. It is affixed to the standards B B at such altitude above the level of the foot-cars as shall permit the shoulders of the operator when standing on said cars to be placed in the shoulder-rings l^2 l^2 , allowance being made for the natural sinking and rising of the trunk of the body during the march. The parts of this mechanism are shown separately in Figs. 2, 3, 4, 5, 7, and 8.

Fig. 2 is the front of the back-board, and Fig. 8 the back surface of the same. It is rectangular, about as long vertically as the human back of an adult of ordinary stature, but of width sufficient to allow of the lateral alternate play of the pelvis-guide or hip-moving attachment, to be hereinafter described. It should be strong and rigid, but of light substance.

Figs. 5 and 7 are the front and back views, respectively, of the back-board holder or case in which the back-board slides vertically to the extent of two inches or more.

In Fig. 2, m^2 m^2 are strong thin bars passing horizontally across the back-board and projecting beyond its vertical edges. When the back-board is in normal position, these projecting ends m^2 m^2 pass through the vertical slots m^5 m^5 in the flanges of the back-board holder, Fig. 5. While sliding in said slots the back-board is held in horizontal position by the pinions n^2 , Fig. 5, which gear with the racks n^5 n^5 , Fig. 8, on the back surface of the back-board, the pinions being fixed on a common axle. Moreover, to prevent all lateral play between the back-board and back-board holder during the vertical slide of the former, the projecting tongue of metal O^2 , Fig. 5, slides between flanges O^5 , that are secured to the back-board. (See Fig. 8.)

In Fig. 2, l^2 l^2 are the shoulder-rings by which the shoulders of the operator are encompassed when standing on the foot-cars. They are curved to the ordinary contour of the human shoulder and padded. The yoke K^2 in which they are fixed permits them to be moved to equal distances from a vertical line through its center, and is itself attached to the back-board horizontally. The shoulders are thus held continually on a horizontal level with each other and kept back "square to the front" during the march.

Fig. 3 shows the mechanism for controlling and guiding the pelvis and hips, and consists of three chief pieces. Fig. 4 shows the form of two of these, which I call "pendants." They resemble two ordinary rectangular brackets, but with the horizontal arm below instead of above the vertical arm, and they should be as light as possible consistent with firmness. The rectangular flat plate r^2 r^2 , Fig. 3, is the pelvis-guide, and may be of wood or any light and firm material, the vacant rectangular space S^2 being intended to span the pelvis from side to side. The horizontal arms of the pendants q^2 q^2 are jointed to the pelvis-

guide by hinge-joints along lines which are parallel to its opposite sides, and the parallel bars w^2 w^2 within the rectangular space S^2 are designed to gage the pelvis with greater accuracy by suitably adjusting them with the hand-screws t^2 t^2 . The slot v^2 at the back of the pelvis-guide is designed to receive and serve as a guide for the tongue w^3 , Fig. 10, that is attached to the cross-bar z^2 z^2 , which, when in normal position, gives the pelvis-guide alternating lateral motion. The upper ends of the vertical arms of the pendants are loosely pivoted to the back-board, Fig. 2, at the round apertures q^5 q^5 , which are in a horizontal line and at the same distance apart as the hinges of the pendants, while the hooks y^2 , Fig. 4, pass up behind the back-board. The vertical arms are therefore always retained close to the back-board and remain parallel because they are equal. Hence the lateral oscillation of the pendants is always accompanied by a horizontal position of the pelvis-guide r^2 r^2 . The hooks y^2 y^2 slide upon the curved bearings y^5 y^5 , Fig. 8, at the back of the back-board.

Fig. 6, being a back view of the machine, as before mentioned, shows a back view of the back-board holder with its attachments. Fig. 7 is the back of the same apart from the machine. The cross-bar x^2 x^2 is firmly attached to the back of the holder near the upper edge and passes between the guide-pulleys a^3 , which are fixed to the standards B B on either side and at the same horizontal level. As the cross-bar is made to travel alternately to either side, the whole mechanism F is carried with it. The cross-bar z^2 z^2 also passes horizontally between guide-pulleys b^3 , attached to the standards B B; but it is not fastened to the back-board holder, instead of which it is held loosely against it by the cleats c^3 c^3 , Fig. 7, which allow it to slide below them and in contact with said holder. The mechanism F is thus retained upright and continually in the same position relative to the standards B B, except in regard to its alternate lateral motion between them. This lateral motion is imparted by the upper cross-bar exclusively, as before mentioned, the lower cross-bar having the special objects of keeping the mechanism F vertical and moving the pelvis-holder, which moves simultaneously in the same direction, but generally at a slightly different rate. This result is effected as follows: The lower cross-bar z^2 z^2 is shown separate in Fig. 10, from which descends the tongue w^3 , of metal, which again, when in normal position, passes through the slot v^2 at the back of the pelvis-guide. (See Fig. 3.) As the body of the operator rises in marching, the pelvis-guide (being attached to the back-board and in close contact with the pelvis) rises also; but the cross-bar z^2 z^2 does not rise, so that the pelvis-guide slides vertically upon the descending tongue w^3 and is effectually controlled by it as to lateral motion. The cross-bars are actuated by the disks d^3 d^3 , which

are fixed on the vertical shaft H H. The lower end of said shaft carries a toothed wheel e^3 , which receives its reciprocating motion from the wheel and pinion f^3 , situated between and below the racks G G. The communication of motion from f^3 to e^3 , and therefore to the cross-bars, is made by the intervening wheel g^3 , which may be of any convenient diameter, its object being to span the space between the pinions f^3 and e^3 , the diameters of which are in a given ratio to one another.

Fig. 13 is a side view of the last-mentioned gear-wheels with section of racks. These gears are rotated by the racks G G, which gear with the upper wheel of the pair f^3 , Fig. 13. The racks again are forced backward alternately by the pressure of the foot-cars against the vertical flanges h^3 h^3 , which are attached to the posterior extremities of said racks. This is not effected by the direct contact of the foot-cars with the said flanges, but by the interposition of an appendage to the hind extremity of each. Fig. 33 shows this arrangement.

The lever 4, Fig. 33, is such a foot-car appendage as that above mentioned, and when used in connection with the grip w' the required contact against the flange h^3 is effected by the lower end of said lever or by some other obstacle suitably placed in its path; but when at any time the grip w' is not required to be held down the lever 4 can be fastened back to the car and still perform its other office of impinging against the flange h^3 of the rack, Fig. 6. It will be seen that the racks G G move forward a much less distance than the foot-cars, and hence the said racks will not be acted on by the cars during the first part of the backward movement of the latter. Consequently the keepers will engage the grips w' from the moment the foot is brought to a horizontal position until the keepers strike the flanges h^3 , the position of the keepers normally being such as to engage the grips w' when the foot is brought to the horizontal position. As seen in Fig. 26, the grip w' and the horizontal member or catch z^5 , that is formed on its lower end, extend over the side of the belt 6, and the said catch will thus be engaged by the hook 3 of the keeper 4.

The disks d^3 d^3 and respective cross-bars are connected by means of links, which are arranged according to the following plan: Fig. 11 is a view of the mechanism F from a point vertically above it. l^3 m^3 is a link fixed at one end in the disk d^3 and at the other end in a block p^3 , which is permitted a longitudinal motion in the back of the cross-bar x^2 x^2 . At n^3 , the middle point of said link, is loosely pivoted one end of a shorter link half the length of the other, its opposite end being loosely pivoted in the cross-bar at O^3 . The result of this combination of links is that if O^3 were a fixed point the only direction in which the point m^3 could move would be a straight line passing through the point O^3 perpendicular to the cross-bar. The other end of the

link l^3 would have a slight motion along the cross-bar. The point m^3 lies in this perpendicular, and the link mechanism forms a parallel motion, illustrating the theorem that the angle in a semicircle is a right angle; but since the point m^3 is fixed in the disk d^3 , which has a reciprocal rotation, and the point O^3 is free to move laterally, together with the cross-bar to which it is pivoted, the straight line passing through the respective ends O^3 m^3 of the said links will move in the same manner as a slot perpendicular to the cross-bar, and which should be moved by a pin projecting from the disk. In Fig. 12, q^3 is such a slotted projection connected with a similar bar to that of Fig. 11, and which is moved alternately right and left by the peg or crank within the slot. If the rotation of the disk be at a uniform rate, the corresponding lateral motion of the bar will be variable, being quickest at the straight line r^3 , which is perpendicular to the cross-bar, slowest at the angular distance of ninety degrees therefrom on either side, (which are dead-points,) and precisely equal at other equal distances. The motion produced on the cross-bar, Fig. 11, by the links being variable at the same rate as that from the slot and pin, Fig. 12, is symmetrical, and I prefer to use the former. The extent to which the cross-bar is moved right and left evidently depends on the distance from the center of the disk at which the end m^3 of the link is pivoted, and to allow for changes of this kind I make additional pivot-holes in the disk, all lying in a radial line from the center; but instead of disks and separate holes the following contrivance can be substituted:

Fig. 9 is an appendage to be fixed on the vertical shaft H H in place of each disk by means of the collar and set-screw S^3 . The wide slot in the body of the appendage incloses a perforated block adjustable by the set-screw t^3 , so that when in normal position the perforation may be brought to any desirable distance from the center of the shaft. Thus the end m^3 of the longer link, Fig. 11, may be shifted to or from the center of the shaft without breaking its connections. I prefer that the rotation of the shaft should be limited to the angular measure of about one hundred and sixty degrees—eighty on each side of the perpendicular line r^3 —in order to avoid the dead-points at ninety degrees distance therefrom.

Figs. 28, 29, and 30 show another method of communicating the action of the feet to the shoulders and pelvis, all other parts of the machine remaining unchanged. Instead of the vertical shaft H H and disks d^3 d^3 , Fig. 6, I use here either one or two upright levers c^4 c^4 , pivoted to the standards B B at points d^4 d^4 near the upper ends of said levers, at the extreme ends of which are slots e^4 e^4 above and f^4 f^4 below. The upper slots play upon pins (with friction-slides, if necessary) in the wide cross-bar g^4 g^4 , and the lower upon

pins (equally distant apart with the two above) in the slotted cross-bar $l^4 l^4$, lying on the platform A A, so that the levers with the upper and lower cross-bars, respectively form a parallelogram when two levers are used, which is not necessary. The upper cross-bar passes between friction guiding-pulleys $h^4 h^4$, affixed to the standards B B of the framework, and is attached to the back-board holder $K^4 K^4$. The lower cross-bar, properly kept in place by guiding-bands, is moved alternately right and left by means of the toothed wheel and crank-pin m^4 , the latter of which works in the slot n^4 . The toothed wheel m^4 is rotated reciprocally by the racks G G, precisely in the same manner as in Fig. 6; but in this case rotation is limited to one hundred and seventy degrees, or thereabout, and the lower cross-bar being thus moved the upper cross-bar, with the back-board attached, is simultaneously put in lateral motion, the extent of which can be varied either by shifting in a vertical direction the pivot-pins $d^4 d^4$ or the crank-pin in the toothed wheel m^4 . Instead of slots in the levers and corresponding pins, I prefer to use the combined link-motion shown in Fig. 11. In this method of giving lateral motion to the trunk the pelvis-guide is moved by the small lever p^4 , which is pivoted to the back of the back-board holder at a point q^4 , the position of which can be varied. At the upper and lower ends, respectively, is a slot, the former playing upon a pin r^4 , fixed in the cross-beam of the framework and above the symmetrical center of the machine, the latter slot playing upon a pin in the tongue w^2 , (see Fig. 10,) which moves the pelvis-guide. Thus the pelvis-guide moves in the same direction as the cross-bar and back-board, and the extent of its motion is also dependent upon that of the latter, being increased by fixing the pin q^4 at a higher point and diminished by placing it lower.

In Figs. 31 and 32 I illustrate a still further modification, wherein the bars $C^4 C^4$, Fig. 28, are dispensed with, the upper cross-bar of the body-support in this case being formed with a slot 8, in which there rides a stud or pin that is carried by one arm of a bell-crank lever 9. To the other arm of the lever 9, I pivotally secure a connecting-rod 10, that is in turn connected to a crank-disk 11, which said disk is formed with teeth 12, that engage teeth 13, formed at the end of the cross-bar l^5 , such cross-bar having a central series of teeth 14, that engage the gear f^3 , the arrangement being such that as the racks G G are reciprocated the bar l^5 will also be reciprocated, and the motion of such bar will be imparted to the body-supporting devices. Independent motion of the pelvis-supports is imparted in this construction in the same manner as in the construction illustrated in Fig. 28.

Although I have described the wheels $x x$ and $y y$ as being mounted on horizontal shafts,

I desire it to be understood that with slight modifications the said wheels might be mounted upon vertical shafts, and I also desire it to be understood that, although I have hereinbefore described specific constructions, any equivalents of such constructions might be employed.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In an orthopedic marching-machine, the combination, with a pair of foot cars or carriages that are mounted to run on ways, of a body-support and connections between the foot-cars and such support, whereby when the foot-cars are reciprocated a corresponding motion will be imparted to the body-support.

2. In an orthopedic marching-machine, the combination, with a pair of foot-cars mounted to run on ways, of a body-support, a pelvis-support carried thereby, a means for reciprocating the body-support, and a means for imparting an independent motion to the pelvis-support, substantially as described.

3. In an orthopedic marching-machine, the combination, with a pair of foot cars or carriages mounted to run on ways, of a vertically-adjustable body-support and connections between the foot-cars and the body-support, whereby when the foot-cars are reciprocated a corresponding motion will be imparted to the body-support, substantially as described.

4. In an orthopedic marching-machine, the combination, with a pair of foot cars or carriages mounted to run on ways, of a vertically-adjustable body-support, a hip or pelvis support, and connections, substantially as described, between the foot-cars and the body and pelvis supports, whereby when the foot-cars are reciprocated a corresponding motion will be imparted to the body-support and to the pelvis-support, substantially as described.

5. In an orthopedic marching-machine, the combination, with a pair of foot cars or carriages mounted to run on ways, of a body-support, racks and pinions arranged in connection with such support, whereby both ends of the support will be raised or lowered in using, and connections between the foot-cars and body-support, whereby when the foot-cars are reciprocated a corresponding motion will be imparted to the body-support, substantially as described.

6. In an orthopedic marching-machine, the combination, with a pair of foot-cars mounted to run on ways and formed with downwardly-extending projections, of racks formed with upwardly-extending projections, a gear that is engaged by the racks, a vertical shaft, gearing arranged in connection with such shaft and the gear that is driven by the racks, a body-support, a cross-bar carried thereby, a crank-disk carried by the shaft, and a connection between the disk and cross-bar, substantially as described.

7. In an orthopedic marching-machine, the

- combination, with a pair of foot-cars mounted to run on ways and formed with downwardly-extending projections, of racks formed with upwardly-extending projections, a gear that
 5 is engaged by the racks, a vertical shaft, gearing arranged in connection with such shaft and the gear that is driven by the racks, a body-support, a pelvis-support arranged in connection therewith, a cross-bar connected
 10 to the body-support, a second cross-bar arranged in connection with the pelvis-support, crank-disks carried by the shaft, and connections between the cross-bars and said disks, substantially as described.
- 15 8. In a machine of the character described, the combination, with a bar, of a block mounted to slide in a groove formed therein, a link pivotally connected to the block and to a crank-disk, and a second link pivotally
 20 connected to the center of the first link and also pivotally connected to the bar, and means for operating the crank-disk, substantially as described.
9. In a machine of the character described,
 25 the combination, with a bar formed with a slot, of a block mounted to slide within said slot, a link pivotally connected to the block and adjustably connected to a crank-disk, and a second link pivotally connected to the
 30 center of the first link and to the bar, the second link being one-half the length of the first link, and means for operating the crank-disk, substantially as described.
10. In an orthopedic marching-machine,
 35 the combination, with a foot car or carriage, of a plate n , hinged thereto, a sandal connected to the plate by a flexible section, and a heel-guide hinged to the sandal and to the foot-car, substantially as described.
- 40 11. In an orthopedic marching-machine, the combination, with a foot car or carriage arranged to receive a belt, of a plate hinged thereto and formed with a slotted end, a
 headed stud that rides within said slot, a sandal connected to the plate and capable of
 45 flexing, a heel-guide hinged to the sandal and to the car, a grip carried by the plate, and a second grip carried by the sandal, substantially as described.
12. In a machine of the character described,
 50 the combination, with a foot car or carriage arranged to receive a belt, of a grip for engaging the belt and a keeper for engaging the grip, substantially as described.
13. In an orthopedic marching-machine,
 55 the combination, with belts and belt-supporting devices, of a friction-regulating attachment arranged in connection with the belts, foot-cars mounted to slide on ways, and a means, substantially as described, for bind-
 60 ing said cars to the belts, as and for the purpose stated.
14. In an orthopedic marching-machine, the combination, with belts and belt-support-
 65 ing wheels, of a friction-disk arranged in connection with one set of the belt-supporting wheels, spring friction-arms C^2 , which bear upon the friction-disk, and a means for adjusting said arms, substantially as described.
15. In an orthopedic marching-machine,
 70 the combination, with a pair of belts, of belt-supporting wheels mounted at one end of the machine upon a single shaft, a second set of belt-supporting wheels independently mount-
 75 ed at the opposite end of the machine, and a means for adjusting the independently-mounted wheels, substantially as described.
16. In an orthopedic marching-machine, the combination, with a hip or pelvis sup-
 80 port, of strips or bars u^2 , carried thereby, and a means for adjusting said strips or bars, substantially as described.

JOSEPH L. NAISH.

Witnesses:

EDWARD KENT, Jr.,
 EDGAR TATE.

It is hereby certified that in Letters Patent No. 430,808, granted June 24, 1890, upon the application of Joseph L. Naish, of New York, N. Y., for an improvement in "Orthopedic Marching-Machines," an error appears in the printed specification requiring correction, as follows: In line 55, page 2, the word "symmetrical" should read *asymmetrical*; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 1st day of July, A. D. 1890.

[SEAL.]

CYRUS BUSSEY,
Assistant Secretary of the Interior.

Countersigned:

C. E. MITCHELL,
Commissioner of Patents.