(No Model.) 5 Sheets—Sheet 1.

G. R. MOORE.

WALKING AUTOMATON.

No. 454,570. Patented June 23, 1891.

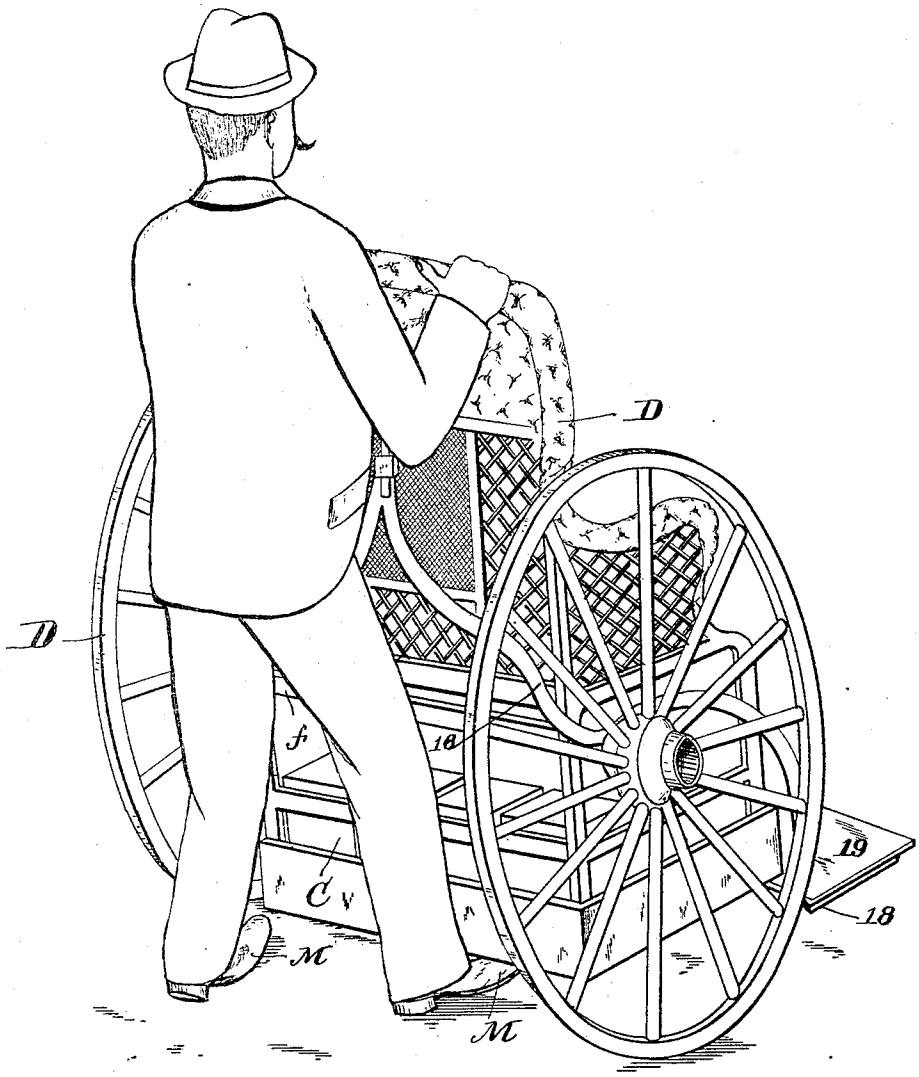

Fig. 1.

WITNESSES

Harry W. Atkeson

J. S. F. Huddleston

INVENTOR

George R. Moore

By J. D. Teschemacher

ATTORNEY

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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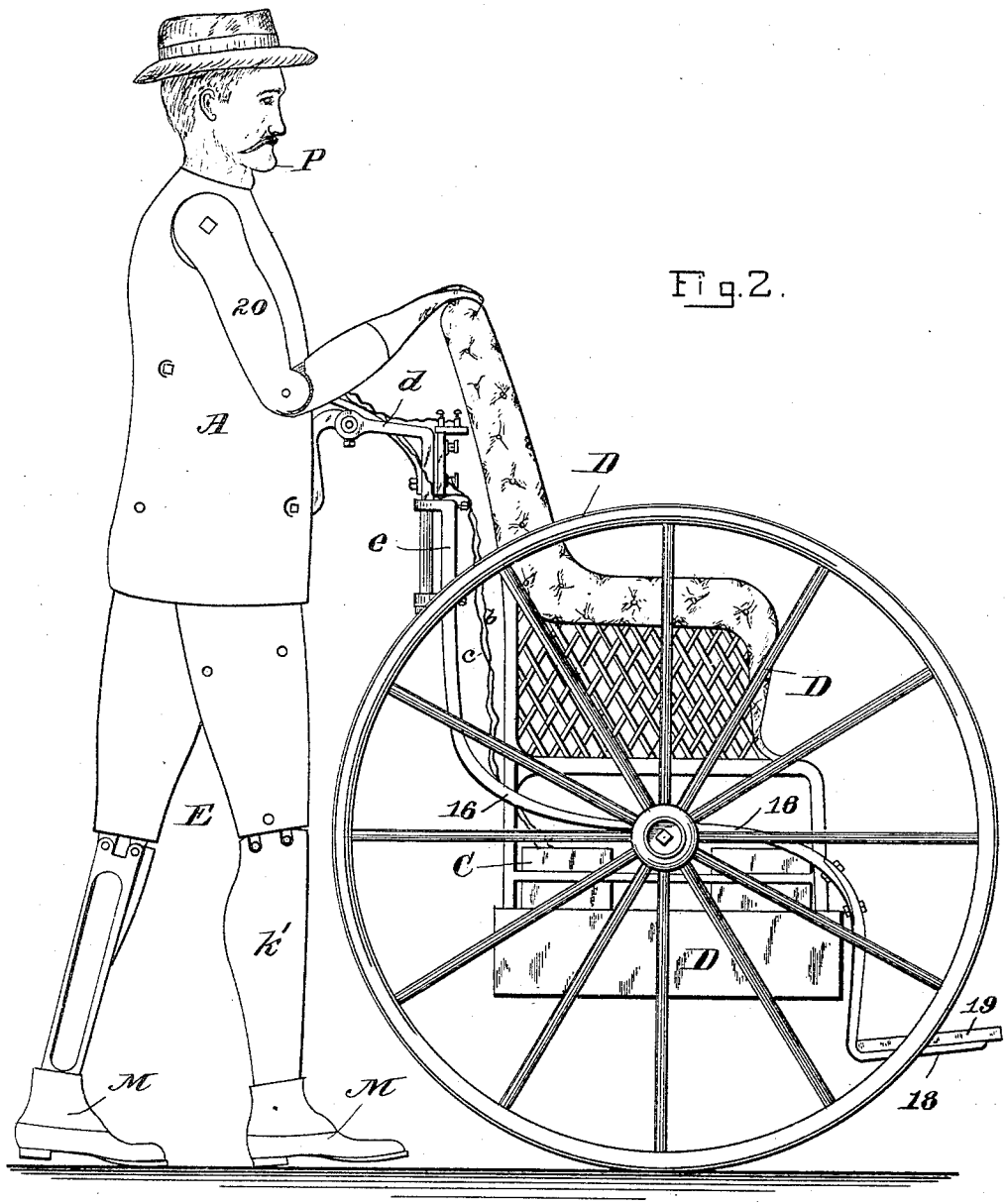
Fig. 2.



WITNESSES

Harry E. Atkinson

J. L. L. Headleston

INVENTOR

George R. Moore

By F. O. Lieschenmacher

ATTORNEY.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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G. R. MOORE.

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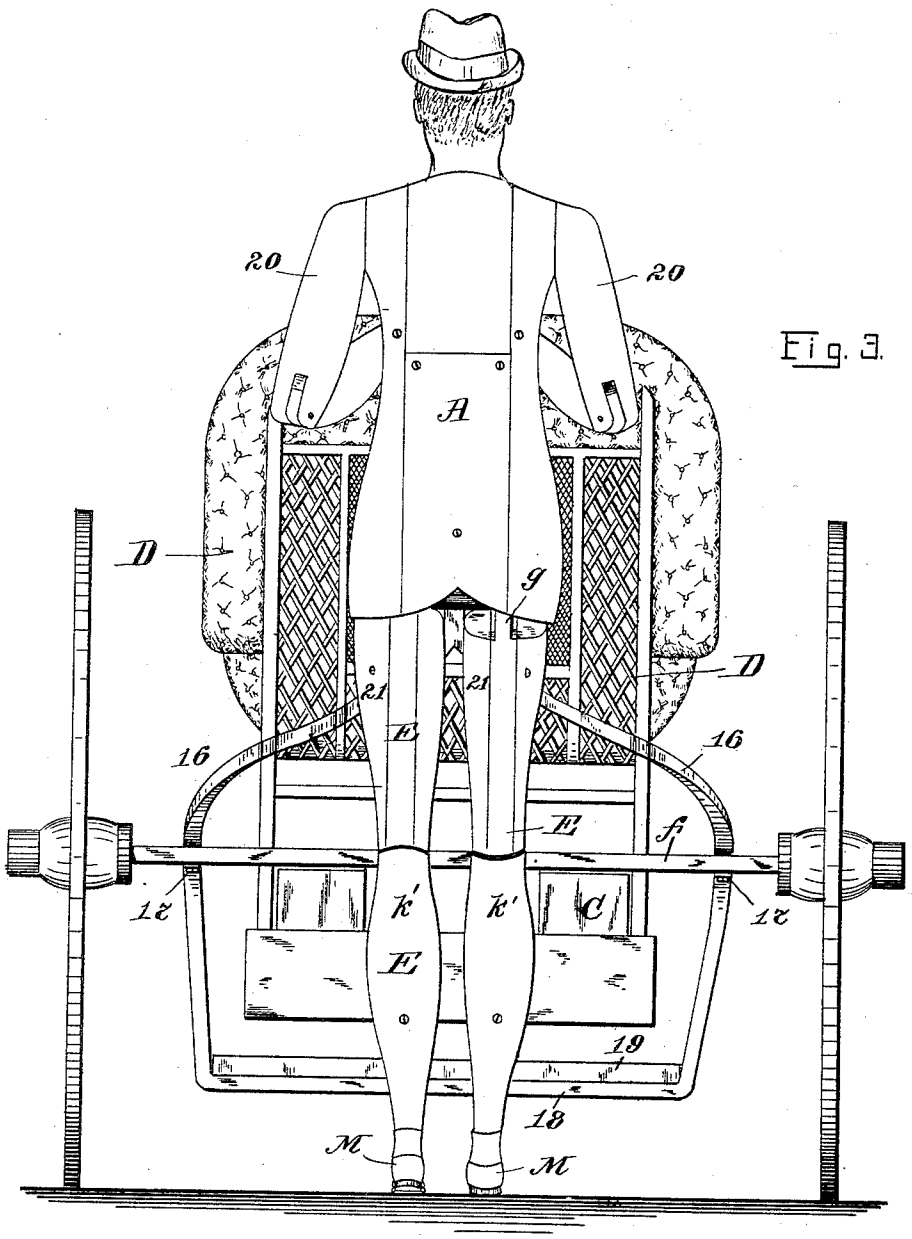

Fig. 3.

WITNESSES

Harry A. Acker

J. L. F. Maddison

INVENTOR

George R. Moore

By P. E. Teschemacher

ATTORNEY

THE HORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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G. R. MOORE.

WALKING AUTOMATON.

No. 454,570. Patented June 23, 1891.

Fig. 4.

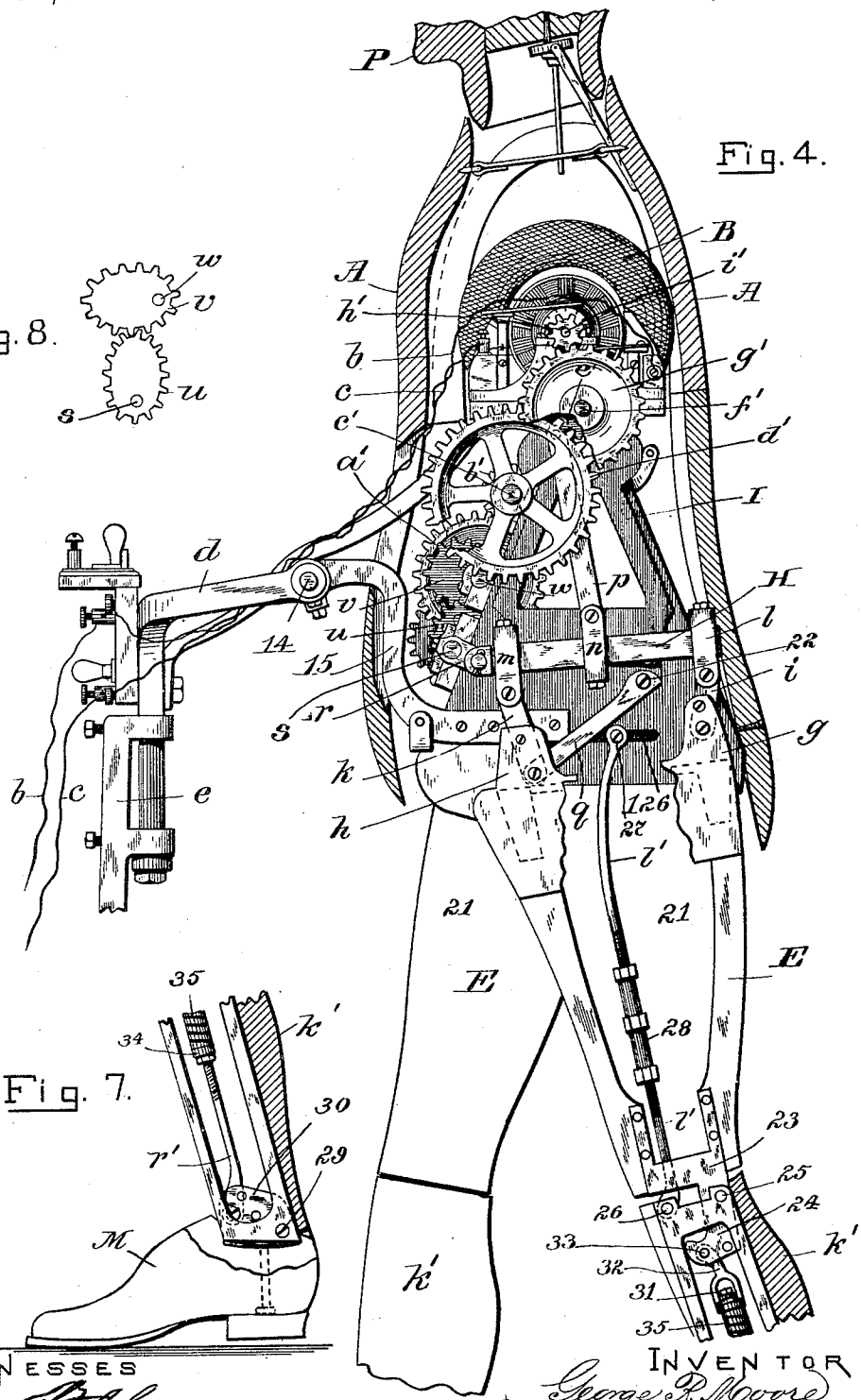

Fig. 8.

Fig. 7.

WITNESSES

Ramo. H. Robbins

J. L. Middleton

INVENTOR

George R. Moore

By R. E. Teschemacher

ATTORNEY

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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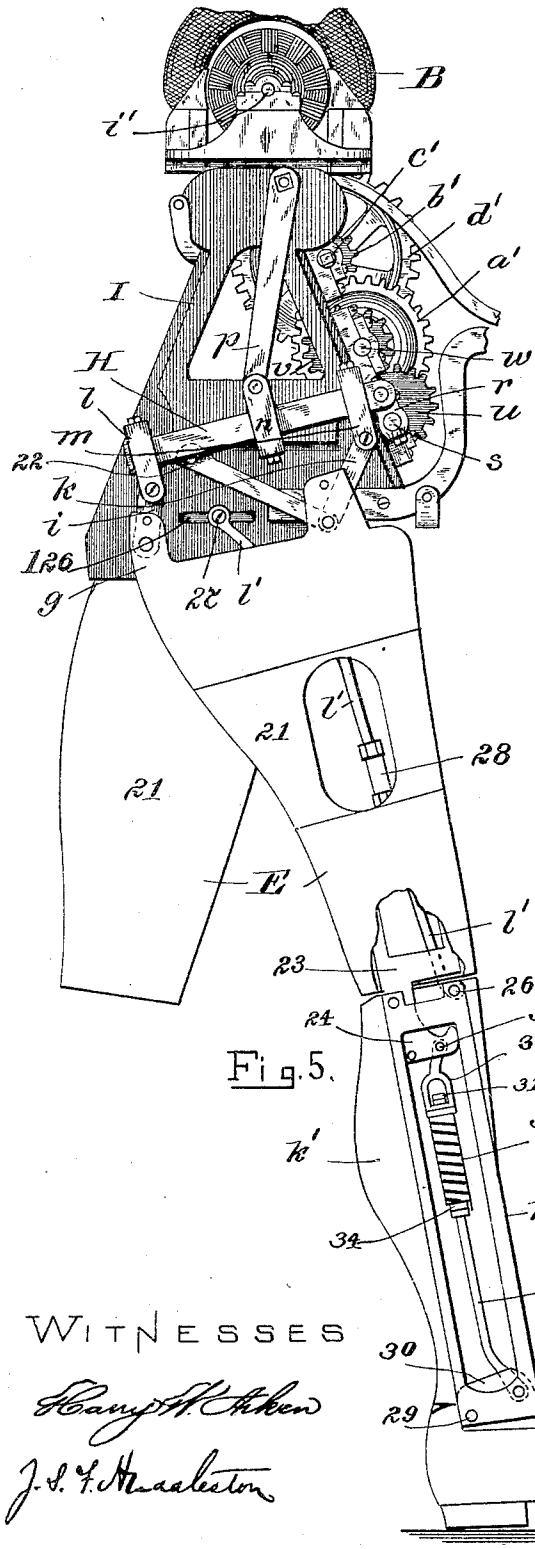

Fig. 5.

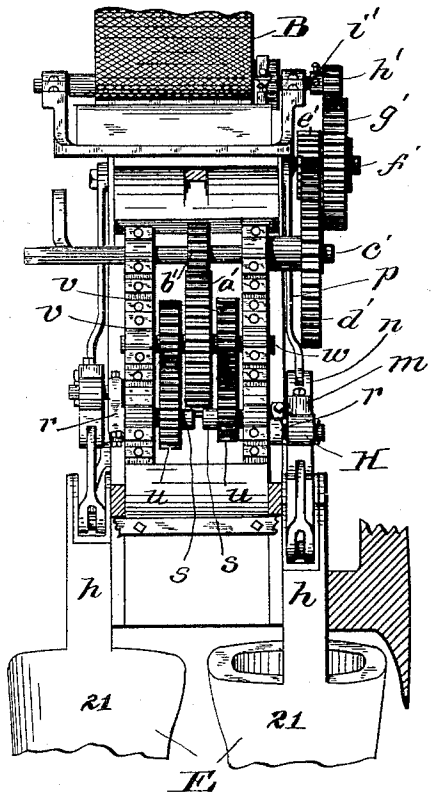

Fig. 6.

WITNESSES

Harry H. Aiken

J. L. J. Maddeston

INVENTOR

George R. Moore

By P. C. Teschemacher

ATT'Y.

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UNITED STATES PATENT OFFICE.

GEORGE R. MOORE, OF WESTFORD, MASSACHUSETTS, ASSIGNOR OF ONE-HALF TO EDWARD A. MOORE, OF SAME PLACE.

WALKING AUTOMATON.

SPECIFICATION forming part of Letters Patent No. 454,570, dated June 23, 1891.

Application filed January 30, 1891. Serial No. 379,693. (No model.)

To all whom it may concern:

Be it known that I, GEORGE R. MOORE, a citizen of the United States, residing at Westford, in the county of Middlesex and State of Massachusetts, have invented certain Improvements in Walking Automatons, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a perspective view of my walking automaton attached to a wheel chair or carriage. Fig. 2 is a side elevation of the same. Fig. 3 is a rear elevation of the same. Fig. 4 is a sectional elevation of the automaton without the carriage. Fig. 5 is an elevation of a portion of the automaton, showing the side of the mechanism opposite to that shown in Fig. 4. Fig. 6 is an end elevation of the operative mechanism contained in the body of the automaton. Fig. 7 is a sectional elevation of the lower portion of the leg and the foot. Fig. 8 is a detail of the elliptical gearing.

My invention relates to a walking automaton adapted to be actuated by an electric or other suitable motor, and has for its object to impart life-like movements to the lower limbs of the figure, causing it to walk in a natural manner.

To this end my invention consists in a novel mechanism for actuating the lower limbs of a walking automaton and in certain combinations of parts and details of construction, as hereinafter fully described, and specifically pointed out in the claims.

In the said drawings, A represents the body or shell of an automaton representing a man, said body or shell being composed of a suitable number of plates or pieces secured together by screws, rivets, or otherwise and forming a hollow casing for the reception of an electric motor B and the operative mechanism connected therewith. This motor is connected by wires *b c* with a storage or other battery C, preferably located in the body of a wheel-carriage D, to which the automaton is attached by means of a yoke *d*, jointed at 14 to a bar or lug 15, projecting from the body A, to permit of the natural movement of the latter in the act of walking. The vertical portion of the yoke swivels in lugs projecting from a bar *e* at the back of the carriage, said bar having two curved branches 16, which extend around over the axle *f*, to which they are fastened by bolts 17, Fig. 3, the two branches 16 being united by a transverse piece 18, to which is secured a foot-rest 19 for supporting the feet of a person who may be seated in the carriage D, it being intended to construct the automaton of life size for exhibition purposes. The arms 20 of the automaton are jointed and rest on the back of the carriage D, but do not receive any motion from the actuating mechanism.

E E are the lower limbs of the figure, which are hollow and adapted to be vibrated alternately by mechanism to be hereinafter described. At the upper end of the thigh portion 21 of each limb are two lugs or projections *g h*, one at the rear and the other near the front. To these lugs are pivoted links *i k*, the upper ends of which are pivoted to adjustable lugs *l m*, secured to a rocker-bar H, at or near the center of which is an adjustable lug *n*, to which is pivoted the lower end of a connecting rod or bar *p*, the upper end of which is pivoted to the frame-work I of the clock-work mechanism to be hereinafter described. To the front lug *h* is also pivoted a connecting rod or bar *q*, the upper end of which is pivoted to the frame I at 22. There are two rocker-bars H—one on each side of the frame-work I—and to the front end of each rocker-bar H is pivoted a crank *r*, keyed to the end of a short shaft *s*, Figs. 4, 5, and 6, having its bearings in the frame I, said shaft carrying an eccentric elliptical gear *u*, which meshes with a corresponding eccentric elliptical gear *v* on a shaft *w*, as seen in Figs. 4, 6, and 8, said shaft carrying a large gear *a'*, which is driven by a pinion *b'* on a shaft *c'*, the latter having keyed to it outside the frame-work a large gear *d'*, which is driven by a smaller gear *e'* on a shaft *f'*, the latter carrying a gear *g'*, which is driven by a pinion *h'* on the main shaft *i'* of the electric motor B.

It will be seen that both of the upper eccentric gears *v* are keyed to the same shaft, while the lower eccentric gears *u*, which mesh therewith, are each fixed upon a short independent shaft *s*, provided with a crank *r*,

jointed to the rocker-bar H on that side, as is necessary to enable the limbs E E to be vibrated alternately in opposite directions, and as the crank-shafts with their cranks are rotated a peculiar rocking motion having a variable speed due to the arrangement of the eccentric gears is imparted to the two bars H H, which by reason of the jointed connections with the limbs E E, above described, and the connecting-rods *p q* will cause the said limbs to be swung forward and back, and at the same time lifted with a motion closely resembling that of the legs of a human being in the act of walking, the motion being at first slow, and being subsequently accelerated as the limb is swung forward.

To the lower end of the thigh portion 21 of each of the lower limbs is secured a plate 23, having a downwardly-extending lug or projection 24, to which is articulated at 25 a hollow leg portion *k'*. To the front upper corner of the portion *k'* at the knee-joint is pivoted at 26 a connecting-rod *l'*, which extends up through the hollow thigh portion 21 and is adjustably secured at its upper end by means of a slot 126 and screw 27 to the frame-work I, forming a portion of the body A, the arrangement being such that as the limb is swung forward and lifted in taking the step, as above described, the rod *l'* will act upon the front upper corner of the leg *k'* and swing it to the rear on the knee-joint 25, and subsequently swing it forward to straighten out the limb just before the completion of its forward movement, the leg being thus caused to bend at the knee in walking in a natural and life-like manner. The rod *l'* is made in two parts, one having a right-hand and the other a left-hand screw-thread, said parts being united by a screw-sleeve 28, by turning which the length of the rod *l'* can be adjusted as required.

To the lower end of each leg *k'* is pivoted at 29 a foot portion M, an ankle-joint being thus formed, and to the foot portion near the heel is secured by means of a bolt (seen dotted in Fig. 7) a plate 30, which extends up into the leg portion and has pivoted to it at its front end a connecting-rod *r'*, the upper end of which is provided with a head 31, Fig. 4, and is adapted to slide longitudinally through a swivel-link or connecting-piece 32, which is pivoted at 33 to the front end of a hook-shaped projection at the lower end of the projection 24 of the plate 23, which is secured to the thigh portion 21, as before described, and thus as the limb is bent at the knee-joint the foot portion will be drawn upward at the toe, while when the limb is straightened at the knee-joint the foot portion will be carried downward at the toe, so that it will rest squarely on the ground.

Between the connecting-piece 32 and a collar 34, Figs. 5 and 7, on the rod *r'* is a spring 35, which permits the rod *r'* to yield slightly in the direction of its length, as is necessary to produce a natural and elastic step.

The head P of the automaton is supported and balanced in such manner that it will be free to oscillate slightly as the body moves in the act of walking, thus giving it a natural appearance.

The shaft *c'* is elongated, as seen in Fig. 6, and extends through an aperture (not shown) in the shell or body A, being squared at one end to receive a crank-handle, (not shown,) by turning which the mechanism can be operated without employing the motor B, if it should be desired to do so.

I do not confine myself to the employment of my mechanism in automatons representing human beings, as it is obvious that said mechanism can be applied to walking automatons representing animals without departing from the spirit of my invention.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a walking automaton, the combination, with the body, of the lower limbs, each connected at the front and rear of the upper end with a rocker-bar actuated by a crank, and crank-shaft rotated with varying speed by means of elliptical gearing forming a part of the operating mechanism, whereby the lower limbs are lifted and swung backward and forward to cause the automaton to walk in a natural and life-like manner, substantially as set forth.

2. In a walking automaton, the combination of the cranks rotated at varying speed by means of elliptical gearing, the rocker-bars connected with said cranks, jointed connections between the opposite ends of said rocker-bars and the upper ends of the lower limbs at the front and rear of the same, the connecting-rods *p*, pivoted at their upper ends to stationary supports and pivotally connected at their lower ends to said rocker-bars, and the connecting-rods *q*, pivoted to the body and to the lower limbs at or near the front upper corners of the same, whereby the said lower limbs are lifted and swung backward and forward in imitation of a natural step, substantially as set forth.

3. In a walking automaton, the combination, with the body and the lower limbs, of an actuating-motor, a train of gearing connected therewith and having on one of its shafts a pair of eccentric gears *v v*, two separate shafts *s s*, provided with eccentric gears *u u*, meshing with said eccentric gears *v v*, said shafts *s s* being provided with cranks *r r*, the rocker-bars H H, connected with the cranks *r r*, and jointed connections between the said rocker-bars and the lower limbs at the front and rear of the upper ends of the same, all operating substantially in the manner and for the purpose set forth.

4. In a walking automaton, the combination, with the body, the lower limbs, a motor, and an actuating mechanism operated thereby and provided with crank-shafts and cranks rotated with varying speed through the medium of elliptical gearing, substantially as de-

scribed, of the rocker-bars H H, each connected at one end with one of said cranks, jointed connections between the opposite ends of the rocker-bars and the front and rear portions of the upper ends of the lower limbs, the connecting-rods *p p*, pivoted at their upper ends to the body or frame-work and jointed to the rocker-bars at points at or near the center of their length, and the connecting-rods *q q*, pivoted to the body and to the lower limbs near the front of the same, whereby the said lower limbs will be swung forward and back and simultaneously lifted, substantially as described.

Witness my hand this 28th day of January, A. D. 1891.

GEORGE R. MOORE.

In presence of—
P. E. TESCHEMACHER,
HARRY W. AIKEN.