Jan. 1, 1935. B. D. POWLESON 1,986,446

WALKING FIGURE

Filed July 9, 1932 3 Sheets-Sheet 1

Fig. 1

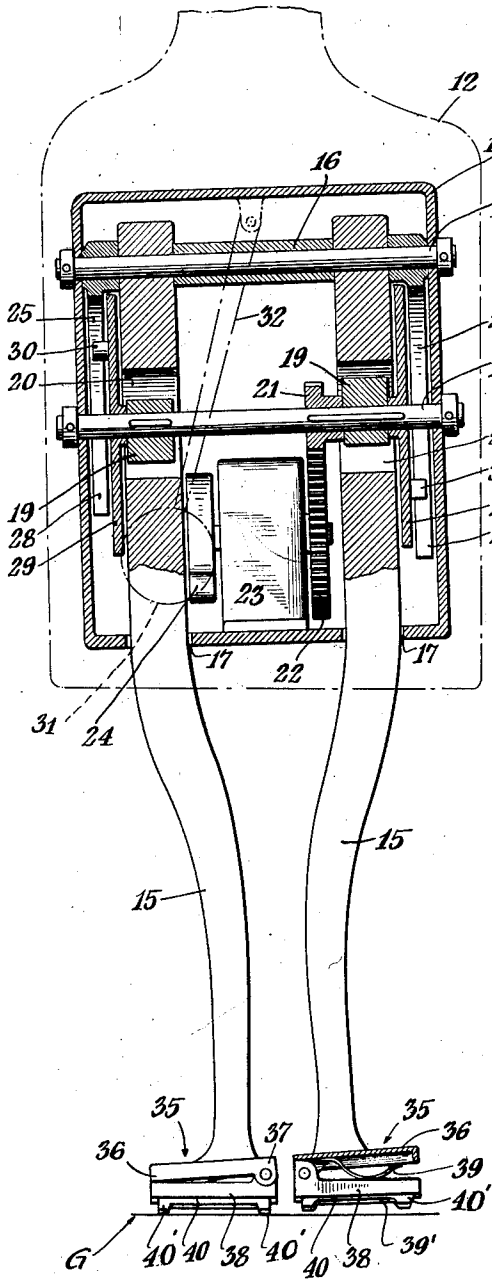


Fig. 3

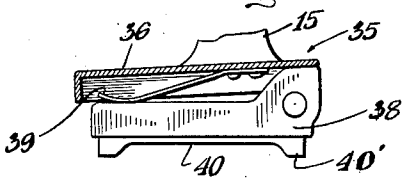
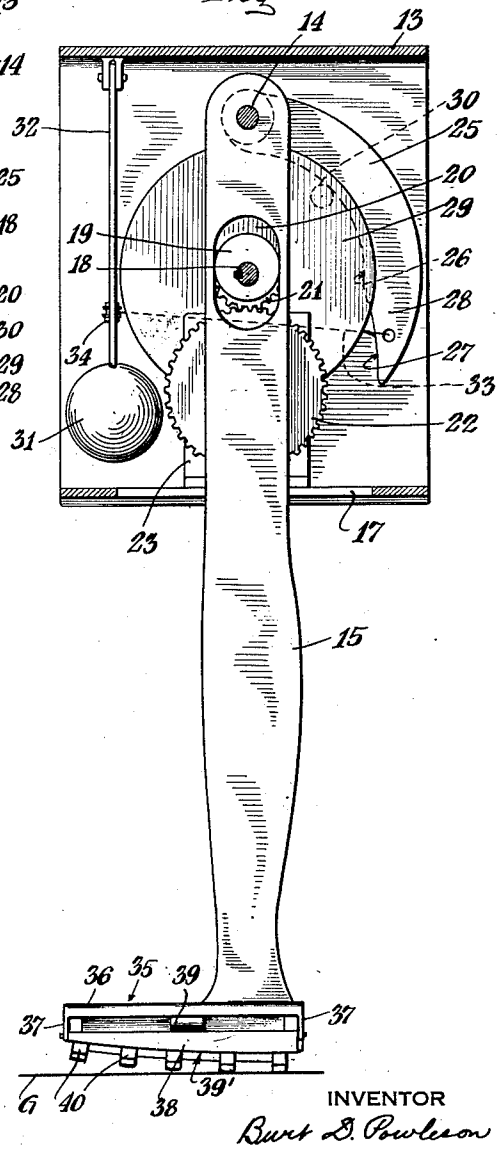


Fig. 2

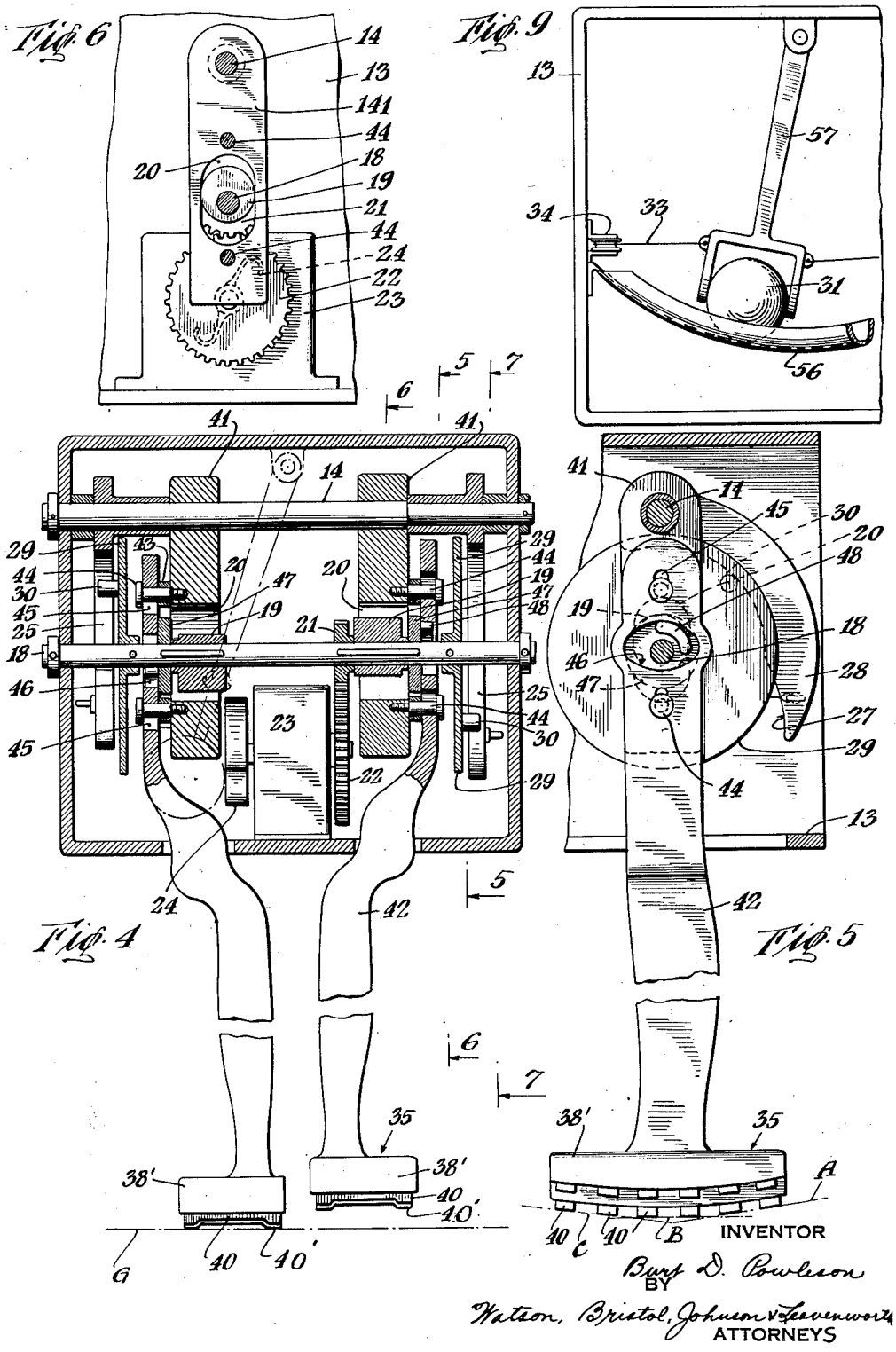


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WALKING FIGURE

Filed July 9, 1932 3 Sheets-Sheet 2



Jan. 1, 1935. B. D. POWLESON 1,986,446

WALKING FIGURE

Filed July 9, 1932 3 Sheets-Sheet 3

Fig. 7

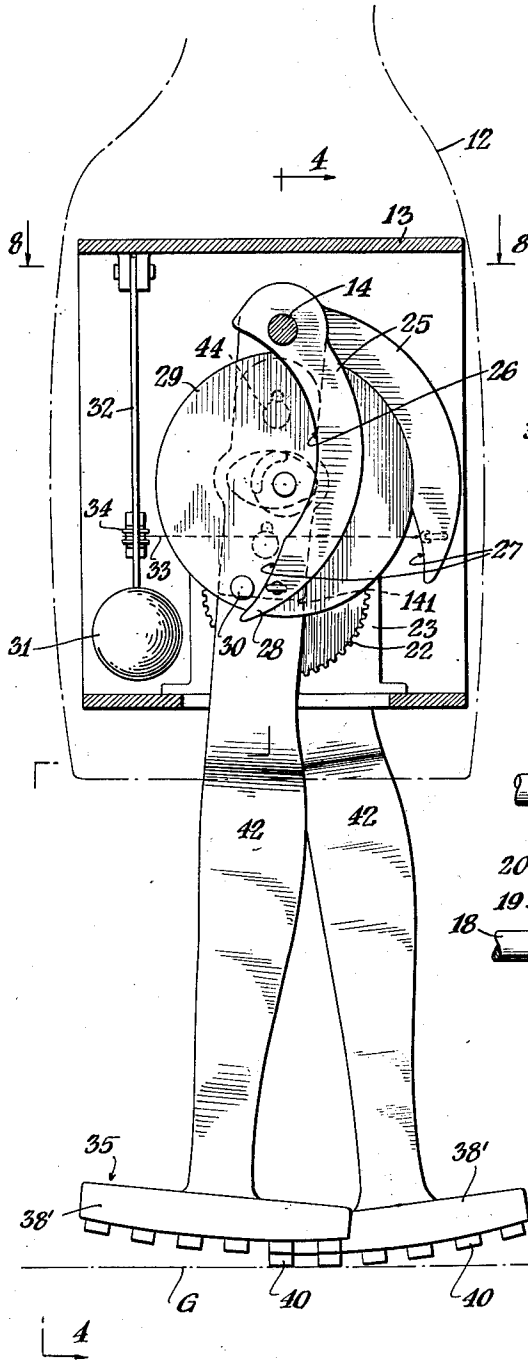


Fig. 8

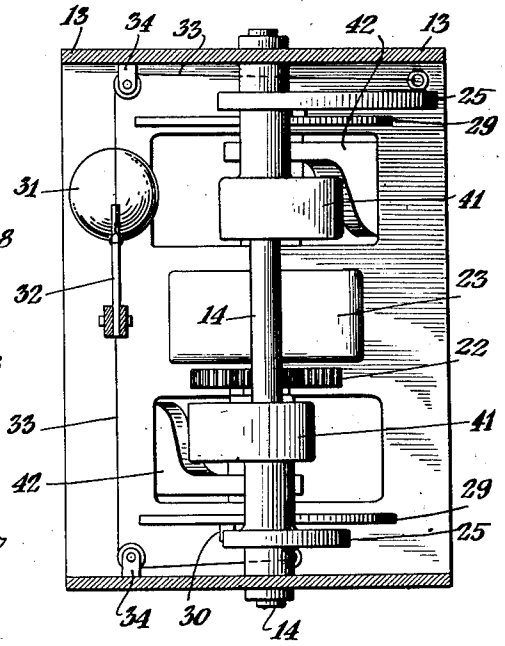


Fig. 10

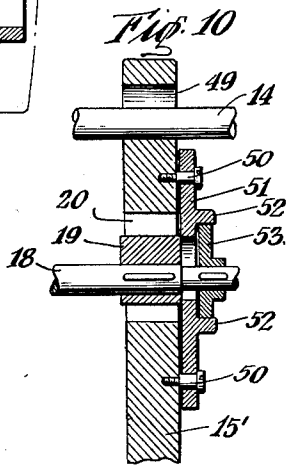
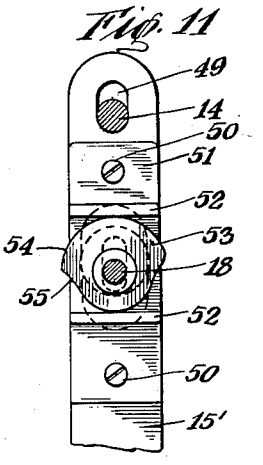


Fig. 11



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1,986,446

WALKING FIGURE

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Application July 9, 1932, Serial No. 621,551

12 Claims. (Cl. 46—40)

This invention relates to walking figures and, more particularly, to the type in which a body member is supported by one or more pairs of legs motor actuated to simulate walking.

A general object of the invention is the provision of novel and efficient means for causing a figure to move forward by motions closely simulating the natural motions of walking.

A more specific object of the invention is the provision in such a device of foot devices each comprising a tread member having a plurality of tread planes each of which is substantially tangent to a circle described about the swinging axis of the leg member, the tread planes cooperating to efficiently prevent undesirable rocking action when the figure is walking.

Another object of the invention is the provision of such a device wherein a movable weight mass is used to periodically shift the center of gravity from one side to the other whereby the body may be supported on one foot while the other is being moved forward by motor actuated mechanism which raises the forwardly moving foot clear of the surface over which the figure is moving, the raising action being accomplished by a side-swaying motion of the body or a lifting of the forwardly moving leg, or by a cooperation of these two features as desired.

Additional objects of the invention are the provision of a foot device comprising a base member and a tread member longitudinally pivoted thereto which allows such side-swaying motion of the body, and the provision of simple and efficient mechanism for raising a leg member during its motion forward.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction combination of elements, and arrangement of parts, which will be exemplified in the construction hereinafter set forth and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a front elevational view with parts in section of a device made in accordance with the present invention;

Fig. 2 is a side elevational view of the device depicted in Fig. 1 with parts in section;

Fig. 3 is an enlarged end view with parts in section of the foot device depicted in Fig. 1;

Fig. 4 is a front elevational view with parts in section and parts broken away of a modification of the device depicted in Fig. 1;

Fig. 5 is a view with parts broken away of the device depicted in Fig. 4 taken on lines 5—5 thereof;

Fig. 6 is a sectional view with parts broken away taken on lines 6—6 of Fig. 4;

Fig. 7 is a sectional view taken on lines 7—7 of Fig. 4;

Fig. 8 is a sectional view taken on lines 8—8 of Fig. 7;

Fig. 9 is a view of a modified form of the weight mass shifting means depicted in Figs. 1 to 8 inclusive;

Fig. 10 is a modified form, with parts in section and parts broken away, of the leg lifting mechanism depicted in Figs. 4 to 7 inclusive; and

Fig. 11 is a side elevational view of the structure depicted in Fig. 10.

Referring to the drawings and, more particularly, to Figs. 1 and 2, a body 12 of a walking figure shown in dot-dash lines is provided with a body member 13 on which is mounted a transverse leg-supporting shaft 14. A pair of legs 15—15 are pivotally mounted on the shaft 14 and spaced apart by the collar 16. These legs extend through elongated slots 17—17 in the bottom of the body member 13, the slots being of sufficient length to allow a swinging action of the leg members 15—15. A driven shaft 18 is mounted upon the body member preferably below the leg-supporting shaft 14, and is provided with a pair of eccentrics 19—19, each of which is disposed in an elongated slot 20 in each of the leg members 15. The driven shaft 18 is additionally provided with a pinion 21 fixed to the shaft and in mesh with a gear wheel 22 fixed to the shaft of a spring motor 23 mounted upon the bottom of the body member 13. The eccentrics 19—19 being reversely mounted on the shaft 18 the mechanism just described will periodically move the leg members 15—15 in opposite directions. If desired the spring motor 23 may be provided with a fan regulator 24 which may be adjusted to vary the speed of the motor.

Pivoted upon the transverse shaft 14, preferably outside the leg members 15—15 and within the body member 13 are a pair of following arms 25—25. Each of these following arms 25 comprises an arcuate-shaped member having an arcuate inner surface 26 which lies upon the circumference of a circle described about the axis of the shaft 18 when the arm 25 is in one position and with an additional face 27 forming a tapered nose 28 thereon. A plate 29 fixed to the shaft 18 carries an eccentric pin 30 which is adapted to engage successively the faces 27 and 26 of the following arm 25 when the shaft 18 is rotated in a counter-clockwise direction.

A weight mass 31 is supported by a pivoted arm 32 on the body member 13 for swinging motion. Each of a pair of cables 33 is secured to one of the following arms 25—25 in any suitable man-

ner and is led through a pulley device 34 fixed to the body member 13 and then attached to one side of the arm 32.

A foot device 35 is mounted upon each leg member 15 and preferably comprises a base member 36 preferably provided with a pair of downwardly extending ears 37—37 preferably positioned on the inner side thereof. To the ears 37—37 is pivoted for rocking motion a tread member 38. A spring 39 of any suitable type is disposed between the base member 36 and tread member 38 and is adapted to normally urge the outer sides of those members away from each other.

The tread member 38 having an arcuate bottom surface 39' substantially lying on the circumference of a circle described about the swinging axis of the leg member 15, is provided with a plurality of transversely extending members 40 to engage the surface G over which the figure travels. Each transverse member 40 is preferably provided adjacent each end thereof with an extending portion 40' adapted to contact with the surface G. Obviously, however, these transverse members may be either flat on the bottom or provided with any desired number of extending portions to form contact points in accordance with the present invention.

Adjacent pairs of the transverse members 40 cooperate to form "tread planes" each of which is substantially perpendicular to a normal of the arcuate bottom surface 39' of the tread member 38. The term "tread plane" as used may be defined as a plane in which lie lines and/or points of adjacent members 40 of which simultaneously contact with a flat surface over which the figure is walking. Three of these tread planes are depicted by dot-dash lines in Fig. 5 and indicated by the letters A, B, and C respectively. It will be apparent that in accordance with the present invention the tread member 38 may be directly provided with a plurality of flat surfaces, each being normally tangent to a circle described about the swinging axis of the leg member 15 in lieu of the tread planes A, B and C provided by the adjacent pairs of transverse members 40.

In operation the center of gravity of the walking figure is shifted to one leg member by disposing the weight mass 31 to one side of the body member 13. This will cause the spring member 39 between the tread member 38 and the base member 36 of the foot device on that side of the walking figure to be compressed allowing the body of the figure to sway to that side. Such action will lift the other foot device 35 free from the surface G over which the walking figure is moving. When the foot device is so lifted the spring member 39 urges the outer sides of the base member 36 and the tread member 38 apart so that the space between the bottom of the tread member and the surface G will be substantially equal at the inner and outer sides of the foot device. This rocking motion of the tread member is suitably controlled by the proper positioning of the pivot axis so that the upper surface of the tread member 38 and a portion of the base member 36 contact at the inner sides thereof when they are in the relative positions depicted in Fig. 1. This function, however, if desired may be provided by a suitable stop mounted either on the base member 36 or on the tread member 38, or both, the stop on one member being spaced from a portion of the other member, or when stops on both members are used these stops being spaced from each other, a suitable distance to limit the transverse pivoting of the foot members and the consequent rocking action of the figure.

The eccentrics 19—19 rotated by the shaft 18 swing the legs 15—15 in opposite directions so that the foot device 35 free from the surface G will be moved forward. During this action the eccentric pin 30 moves in contact with the surface 26 of the following arm 25, maintaining the weight mass 31 in the above mentioned position at one side of the body for about 135° of one complete rotation of the shaft 18. As the forwardly moving foot device 35 approaches its extreme forward position the other eccentric pin 30 engages the surface 27 of the other following arm 25 and moves this arm to the rear to the position depicted in Fig. 2 shifting the weight mass 31 to the other side of the body member 13 to sway the figure to the other side, thereby bringing the other foot device 35 down into contact with the surface G and freeing the first mentioned foot device from contact with the surface G. This last described action is carried out during the rotation of the shaft 18 through an angle of about 45°.

During this pacing and walking action the plurality of tread planes referred to above, such as A, B and C, perform an important function in that when the foot device is in the extreme forward position and the weight is shifted to that foot device the plane to the rear of the tread member thereof efficiently supports the walking figure, and as that leg member 15 is moved to the rear by one eccentric 19 while the other leg member 15 is being moved forward by the other eccentric 19 the contact between the tread member and the surface G shifts from one tread plane to the successive tread plane nearer the front of the tread member. This action prevents any undesirable teetering or rocking of the walking figure which would reduce the efficiency of the action.

In the modification depicted in Figs. 4, 5, 6, 7 and 8 each of the legs consists of a pair of telescoping members which allow the foot devices 35—35 alternately to be picked up substantially vertically from the surface G to permit them to be swung forward. Each leg includes an upper leg member 41 pivoted to the shaft 14 as in the first modification and provided with the eccentric slot 20 adapted to cooperate with the eccentric 19 on the driven shaft 18 so that it may be swung forward and backward periodically. A lower leg member 42 is spaced from the upper leg member 41 by suitable spacing rings 43 mounted on bolts or pins 44 disposed in longitudinally extending slots 45 in the lower leg member 42. A cam slot 46 is provided in the lower leg member 42 and a cam plate 47 is fixed to the shaft 18 between the leg members 41 and 42. This cam plate 47 carries a cam 48 adapted to cooperate with the cam slot 46 so that when the foot is in its rearmost position the leg members 41 and 42 will be telescoped, that is the lower leg member 42 will be picked up by the action of the cam 48 riding against the upper portion of the cam slot 46. When the leg member 41 is then swung forward carrying with it leg member 42 to its foremost position, the leg member 42 will be extended by the action of the cam 48 on the lower surface of the cam slot 46 so that the tread member 38' of that leg will be placed in contact with the surface G and will be held in such extended position to support the weight of the walking figure while the other leg is being moved forward.

In this modification the center of gravity of the weight of the walking figure is periodically shifted from one foot to the other by a periodical shifting of the weight mass 31 as in the first modification. In this modification it is not essential to have each foot device consist of a base member and a rocking tread member since the lifting action of the leg will allow the forwardly moving foot to free the surface G over which the figure is walking. The foot devices 35—35 may thus consist of a single tread member 38' similar to the tread member 38 of the first modification. If desired, however, foot devices similar to those depicted in the first modification may be used in the present modification to insure greater efficiency of action and to give to the figure a life-like swaying motion.

A modified form of leg structure is shown in Figs. 10 and 11 which will provide a lifting action similar to that obtained by the modification depicted in Figs. 4 to 8 inclusive. A leg member 15' similar to the leg member 15 of the first modification is provided with a longitudinally extending slot 49 to receive the transverse shaft 14. As in the first modification the legs are swung by eccentrics mounted on the driven shaft 18. A cam plate 51 is fixed to one side of the leg member 15' by suitable pins 50 and is provided with a pair of spaced apart substantially parallel projecting portions 52—52 adapted to cooperate with a cam 53 fixed to the driven shaft 18. The cam plate 53 has a major arcuated surface 54 and a surface 55 adapted to cooperate with the projecting portions 52—52 to shift the leg member 15' longitudinally. The surface 54 by cooperation with the upper projecting portion 52 is adapted to hold the leg member 15' in a lifted position while it is being swung forward. When the weight of the body member is shifted from the other foot to the foot of the leg member now under discussion the cam surface 55 cooperates with the lower projecting portion 52 to extend the leg 15' so that the tread member contacts with the surface G. The cam surface 54 then cooperates with the lower projecting portion 52 to hold the leg in the extended position while the other leg is being moved forward.

In Fig. 9 is depicted a modification of the means for shifting the weight mass from one side of the body member to the other. In this modification the weight mass 31 is suitably supported in an arcuate-shaped way 56 and is moved therein by a forked arm 57 as depicted. It is to be understood that the present invention is not limited to the particular means shown for shifting a movable weight mass from one side of the body to the other since various other means will readily suggest themselves to those skilled in the art, it being possible to use a confined liquid body or other weight mass which may be shifted transversely of the body by any suitable mechanical means.

It is readily apparent that the function provided by the two part foot members is not limited in its practice to the particular structure shown since the transverse pivot axis thereof may obviously be placed in a position other than that adjacent the inner side of the foot member and since other structure may be utilized to obtain the operation set forth above. It is possible to use more than two vertically stacked members longitudinally pivoted together for transverse rocking motion. It is also possible to use a longitudinally articulated or a flexing tread member in lieu of the present tread member so long as such structure is designed to provide a plurality of transverse tread planes each of which is disposed substantially tangent to the circumference of a circle described about the swinging axis of the leg member as set forth above. The structure shown is, however, preferred because of its simplicity and since it may be economically manufactured and efficiently used.

It will thus be seen that the objects set forth above are attained in an efficient manner in accordance with the present invention, the actions of the walking figure being very similar to those of a person.

Since certain changes may be made in the above construction and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings, shall be interpreted as illustrative and not in a limiting sense.

Having described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In a walking figure, the combination with a body member, body-supporting leg members jointed to said body member for at least swinging motion, and a movable weight mass periodically to shift the weight from one of said leg members to the other, of a foot device on each leg member comprising a tread member having a plurality of groups of tread surface contacting points arranged successively from the toe to the heel of said foot device with the contact points of each group lying in a plane which is substantially tangent to a circle described about the axis about which said leg member swings.

2. In a walking figure, the combination with a body member, body-supporting leg members jointed to said body member for at least swinging motion, and a movable weight mass periodically to shift the weight from one of said leg members to the other, of a foot device on each leg member comprising a tread member having an arcuate bottom surface lying on the circumference of a circle described about the axis about which said leg member swings, and a plurality of tread surface contacting members mounted on said surface each having a plurality of tread surface contacting points with the contact points of each of said tread surface contacting members and those of an adjacent tread surface contacting member lying in a plane which is perpendicular to a normal of said surface.

3. In a walking figure, the combination with a body member, body-supporting leg members jointed to said body member for at least swinging motion, and a movable weight mass periodically to shift the weight from one of said leg members to the other, of a foot device on each leg member comprising a tread member having an arcuate bottom surface lying on the circumference of a circle described about the axis about which said leg member swings, and a plurality of transverse members mounted on said surface each having at least two tread surface contacting points with the contact points of each transverse member and those of an adjacent transverse member lying in a plane which is perpendicular to a normal of said surface.

4. In a walking figure, a foot device comprising a base member and a tread member pivoted thereto for transverse rocking motion, said tread member having a plurality of groups of tread surface contacting points arranged successively from the toe to the heel of said foot device with the contact points of each group lying in a plane which is substantially tangent to a circle de-

scribed about the axis about which said foot device is adapted to swing.

5. In a walking figure, a foot device comprising a base member, a tread member having an arcuate bottom surface, means at the ends of said members located adjacent the inner sides thereof to pivot said members together for relative rocking motion, a spring disposed between said members to normally urge their outer sides away from each other, at least one of said members having a portion serving as a stop located adjacent the inner sides of said members to cooperate with a portion of the other member to limit the rocking motion, and a plurality of spaced apart transverse rows of contact points on said arcuate surface with each of said rows and an adjacent row lying in a plane which is substantially perpendicular to a normal of said arcuate surface.

6. In a walking figure, the combination comprising a body member, a pair of legs pivoted thereto for swinging action, a movable weight mass mounted on said body member, a foot base member on each leg member, a tread member pivoted to said base member for transverse rocking action with the pivot axis located adjacent the inner side of said tread member and extending substantially longitudinally thereof, said tread member having a plurality of groups of tread surface contacting points arranged successively from the toe to the heel of said tread member with the contact points of each group lying in a plane which is substantially tangent to a circle described about the axis about which said leg member swings, motor driven means connected with said leg members to swing them positively in opposite directions, and motor driven means adapted to shift said weight mass transversely of said body member periodically to shift the weight from one foot to the other while walking.

7. In a walking figure, the combination comprising a body member, a pair of leg members pivoted thereto for swinging action, motor operated eccentric means for swinging said leg members positively in opposite directions, a movable weight mass mounted on said body member, motor operated cam means periodically to shift said weight mass transversely of said body member timed with the swinging action of said leg members, a foot base member mounted on each leg member, a tread member pivoted to said base member with the pivot axis located adjacent the inner side of said tread member and extending substantially longitudinally thereof, said tread member having an arcuate bottom surface lying on the circumference of a circle described about the axis about which said leg member swings, a spring mounted between said base member and said tread member, and a plurality of spaced apart transverse rows of contact points on said arcuate surface with each of said rows and an adjacent row lying in a plane which is substantially perpendicular to a normal of said arcuate surface.

8. In a walking figure, the combination with a body member, transverse leg member supports on said body member each located on the axis about which a leg member swings, a movable weight mass periodically to shift the center of gravity from one side of said body member to the other, leg member actuating means, and a pair of foot devices each comprising a tread member having a plurality of groups of tread surface contacting points arranged successively from the toe to the heel of said foot device with the contact points of each group lying in a plane which is substantially tangent to a circle described about the above mentioned axis, of a pair of leg members each comprising a pair of longitudinally telescoping members one of which is pivoted to one of said transverse supports for swinging action and the other of which is slidably mounted on said swinging member to allow said foot member to be picked up when said leg member is swung forward.

9. In a walking figure the combination in accordance with claim 8 in which the leg members and actuating means comprise the combination of two upper leg members pivoted to the body member, means to swing said leg members in opposite directions, lower leg members each of which is mounted for longitudinally telescoping motion on one of said upper members, and cam means mounted on said body member to telescope each of said lower leg members on its respective upper leg member when the latter is swung forward and to return the former to its initial position and hold it in such position to support the weight of said figure when said upper leg member is swung backward.

10. In a walking figure, the combination in accordance with claim 8 in which the leg members and actuating means comprise the combination of two upper leg members pivoted to the body member each having a longitudinally extending slot therein, a transverse driven shaft, a pair of eccentrics mounted on said shaft each of which is disposed in one of said slots to swing said leg members in opposite directions, a pair of pins mounted on each of said leg members, lower leg members each of which has a cam slot and a pair of longitudinally extending slots to receive said pins, and a pair of cams each of which is disposed in one of said cam slots to telescope said lower leg member upon said upper leg member when the latter is swung forward and to extend said lower leg member when said upper leg member is swung backward.

11. In a walking figure, the combination in accordance with claim 1 in which the leg supporting and actuating means comprise transversely extending pivoting means mounted on the body member, the leg members having elongated slots to receive said pivoting means, means to swing said leg members in opposite directions, a cam plate secured to each leg member, and a cam to cooperate with said cam plate to lift said leg member and hold it in such position while it is being swung forward and to extend said leg member to its initial length and cause it to carry the weight of said body member when said leg member is swung backward.

12. In a walking figure the combination in accordance with claim 1 in which the leg actuating means comprises a driven shaft, eccentrics mounted on said shaft and cooperating with longitudinally extending slots in the leg members to swing them in opposite directions, a cam plate fixed to each leg member, a pair of spaced apart substantially parallel projecting portions carried by said cam plate, and a cam fixed to said driven shaft and disposed between said projecting portions to lift said leg member and hold it in such position when said leg member is swung forward and to extend said leg member to its initial length and cause it to carry the weight of said body member when said leg member is swung backward.

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