June 12, 1962 A. CURCI 3,038,275

SELF-WALKING DEVICE

Filed May 24, 1960

3 Sheets-Sheet 1

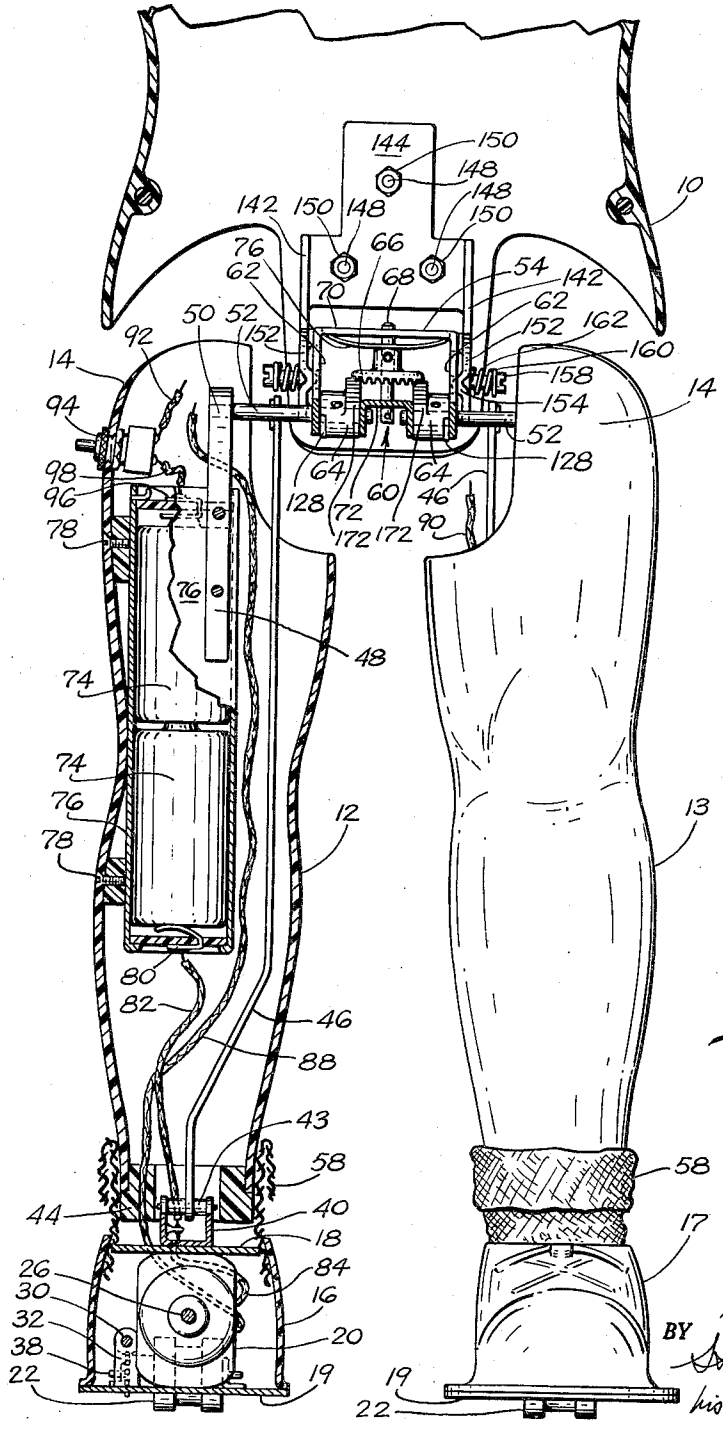


Fig. 1

INVENTOR.
ALFRED CURCI
BY Steward & Steward
his attorneys

June 12, 1962

A. CURCI

3,038,275

SELF-WALKING DEVICE

Filed May 24, 1960

3 Sheets-Sheet 2

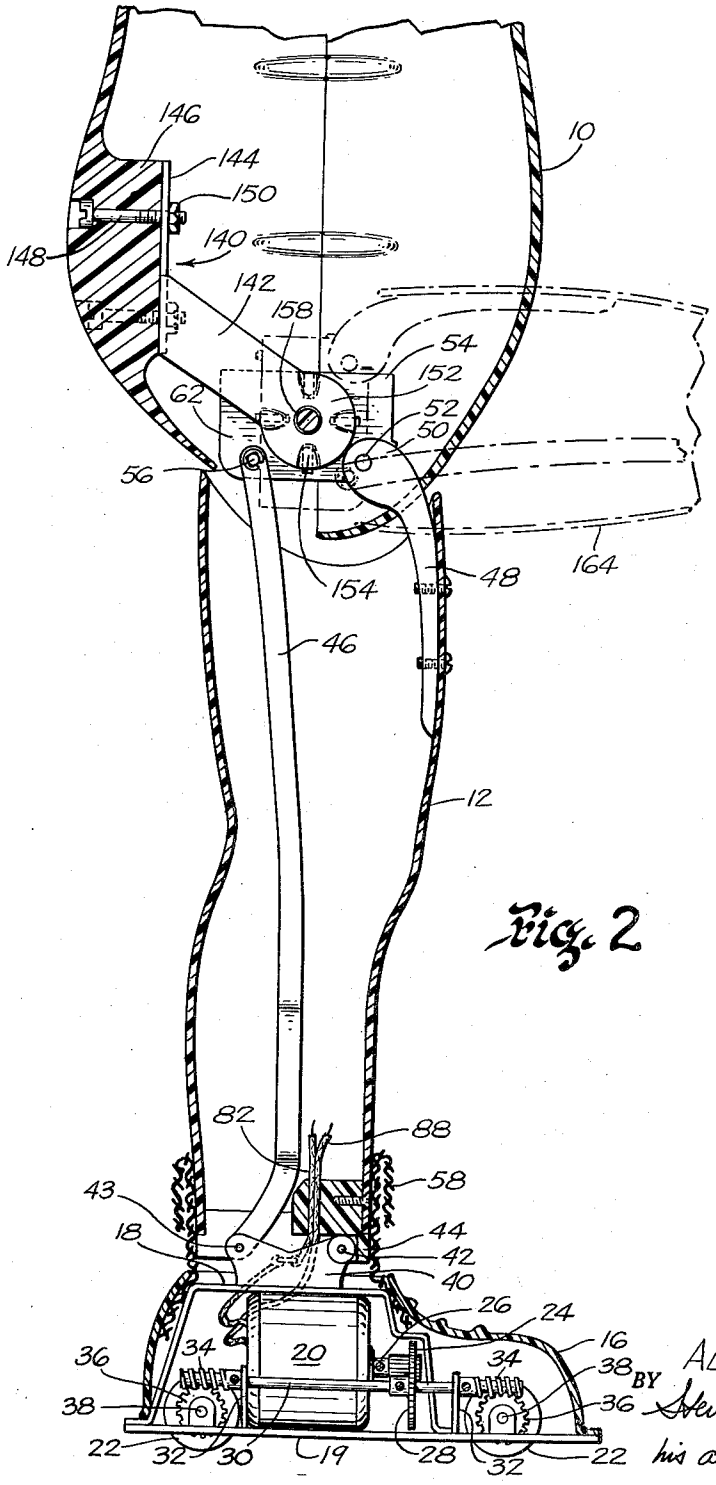


Fig. 2

INVENTOR.
ALFRED CURCI
BY Steward & Steward
his attorneys

June 12, 1962 A. CURCI 3,038,275

SELF-WALKING DEVICE

Filed May 24, 1960 3 Sheets-Sheet 3

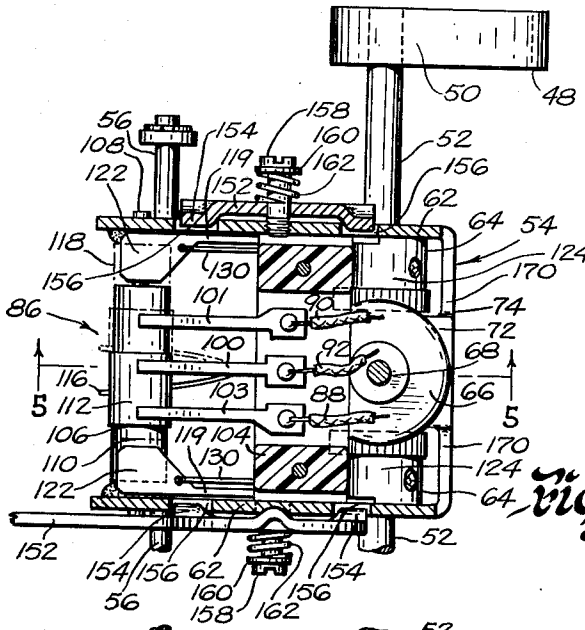


Fig. 3

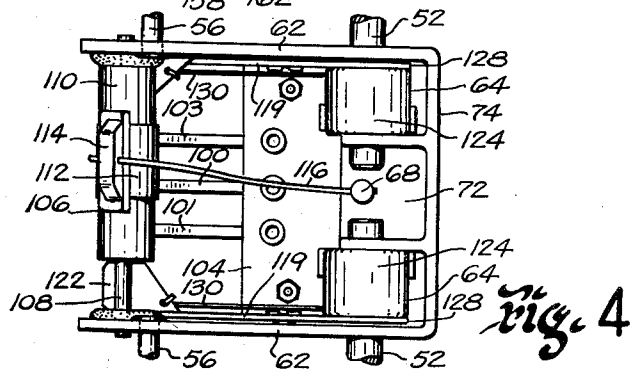


Fig. 4

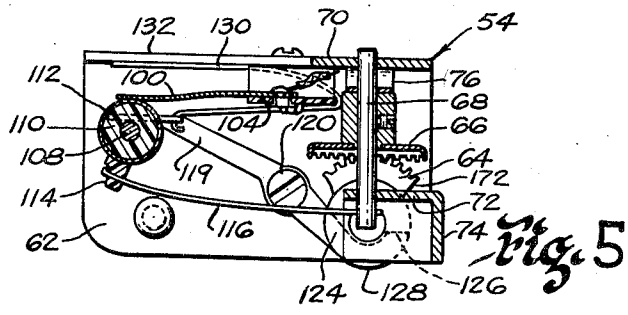


Fig. 5

INVENTOR.
ALFRED CURCI
BY
Steward & Steward
his attorneys

United States Patent Office 3,038,275 Patented June 12, 1962

3,038,275

SELF-WALKING DEVICE

Alfred Curci, 183 London Drive, Hamden, Conn.

Filed May 24, 1960, Ser. No. 31,409
18 Claims. (Cl. 46—247)

This invention relates generally to self-walking devices and more particularly to self-walking devices intended to simulate a walking human being such as dolls, toy soldiers and the like. The invention, however, is not limited to two-legged devices but is applicable to devices having more than two legs.

This application is a continuation-in-part of my co-pending application Serial No. 685,126 filed September 20, 1957, now abandoned.

Heretofore, in such devices, it has been common practice to locate the driving means, and a source of power therefor, in the body portion of the device and to connect the driving means to the legs through a system of mechanical linkages. In practice such devices have proven to be generally unsatisfactory.

The unsatisfactory performance of prior self-walking devices has stemmed from the fact that the positioning of the power source and the driving means in the body portion has, of necessity, resulted in a mechanically complicated arrangement of parts. Because such devices have been mechanically complex they have been difficult to assemble and subject to frequent injury from the type of handling that children's toys usually receive. Such devices have had the further disadvantage of being easily tipped over because of the placement of the heavier driving parts in the body portion. In addition, the complexity of the system of mechanical linkages has heretofore precluded rotation of the legs to a sitting position with respect to the body portion because the legs have not been structurally independent of the body portion. This latter disadvantage is a very serious drawback in the case of dolls which constitute the most commercially important type of self-walking devices.

The present invention, accordingly, has for its object the provision of a self-walking device in which the above-discussed disadvantages are overcome or diminished. Specifically, the invention has for its objective a self-walking device having an inexpensive and mechanically uncomplicated walking mechanism incorporated entirely in the leg portions of the device without any rigid structural connections with the body portion.

Briefly, and in general, the present invention comprises a walking device which is provided with a pair of legs pivotally connected adjacent their upper ends and, at their lower ends, with foot-portions adapted to rest on a walking surface. Power-driven means are mounted on each of the foot-portions and engage the walking surface to propel the respective foot-portions across the surface. A source of power is located on the device, either in the body portion or on the legs, preferably the latter, and is connected to each of the power-driven means in the foot-portions. Although any suitable source of power may be used, an electrical source of power is preferred since mechanical connections from the power source to the power-driven means can be omitted in favor of the usual simple and flexible electrical wires. Also, an electrical power source may be located within the body portion, if desired, without destroying the structural independence of the leg portions from the body portion.

Walking movement of the device is obtained by first actuating the power-driven means in one foot-portion and then the power-driven means in the other foot-portion. This alternate driving of the foot-portions may be automatically effected by pivotal movement of the legs relative to each other. Any suitable means, such as switching

means, may be employed to alternately connect the power source with the power-driven means in one foot-portion and then, after that leg has moved through the desired amount of pivotal movement relative to the other leg, to the power-driven means in the other foot-portion. In this manner each foot is alternately moved forwardly to impart a walking action to the legs. Where a preferred electrical power source is used the power-driven means in each foot-portion preferably includes a miniature electric motor for driving the locomotion means on the foot-portion by which the foot-portion is advanced.

The legs of the device are interconnected adjacent their upper ends in such a manner that pivotal movement of one leg in one direction drives the other leg through an equal pivotal movement relative to the first leg in the opposite direction. Preferably the legs are interconnected through a suitable gear mechanism that converts the pivotal movement of one leg into opposite pivotal movement of the other leg. As the gear mechanism is housed in a bracket fixed to the body portion of the device the opposite pivotal driving movement of the legs always places the downward weight component of the body between the points of support of the front and rear foot-portions. Toppling of the device is thereby prevented.

The present invention produces a self-walking device in which the driving mechanism and power source may be located entirely within the legs and outside the body portion or with only the power source located within the body portion. The legs may be structurally independent of the body portion so that they may be rotated to a sitting position with respect thereto. Preferably the legs are pivotally joined to the body portion. Location of the power source and driving parts in the legs lowers the center of gravity of the device and thus, improves its stability. The use of an electrical power source and miniature driving motors results in an easily assembled, mechanically uncomplicated mechanism.

For the purpose of illustrating the invention, a preferred embodiment thereof is shown in the drawings and this perferred embodiment will now be described in detail. However, it is to be understood that the foregoing general description and the following detailed description, as well as the drawings, are by way of example only and do not define or restrict the scope of the invention, the claims appended hereto being relied upon for that purpose.

In the drawings:

FIG. 1 is a partial front elevational view, partly in section, of a self-walking device embodying a preferred form of the invention;

FIG. 2 is a partial side sectional view of the device shown in FIG. 1 with some of the parts removed;

FIG. 3 is a top plan view, partly in section, of one form of switching mechanism suitable for use in the invention;

FIG. 4 is a bottom plan view of the switching mechanism shown in FIG. 3; and

FIG. 5 is a vertical sectional view taken along the line 5—5 in FIG. 3 looking in the direction of the arrows.

Referring first to FIG. 1 there is shown a self-walking device in the form of a doll. The doll comprises a body portion 10 and a pair of legs 12, 13 that are pivotally connected adjacent their upper ends 14, 14. At their lower ends, the legs 12, 13 are provided with foot-portions 16, 17 adapted for walking engagement with a suitable surface (not shown).

Each foot-portion 16, 17 is provided with power-driven means comprising suitable locomotion means and a driving mechanism therefor. The power-driven means may, as shown, be formed as a single unit so as to facilitate assembly and repair. In the embodiment of the invention shown each power-driven unit is mounted between a pair

of sheet-like members 18, 19, the bottom member of which serves to close off the lower end of the foot-portion when the unit has been removably secured thereto. As is best shown in FIG. 2, the power-driven means preferably includes a miniature electric motor 20 which serves to drive the locomotion means. The locomotion means comprise two sets of wheels 22, 22 that are connected to the motor 20 through a suitable gear mechanism. A gear 24 is provided at the outer end of the armature shaft 26 of the motor 20 and meshes with a larger gear 28 mounted on a drive shaft 30 journaled in the brackets 32, 32 and extending longitudinally of the foot-portion at one side of the motor. The terminal portions of the drive shaft 30 are provided with worm gears 34, 34 that engage spur gears 36, 36 fixedly mounted to the axle shafts 38, 38 for the wheels 22, 22. When energized the motor, thus, serves to drive the wheels and to move the foot-portion forwardly with respect to the device.

As the foot-portion moves forwardly the angle between the foot-portion and the leg changes continuously. The foot-portion is therefore articulately connected to the leg so as to permit the foot-portion to assume varying attitudes with respect to the leg. To this end, a longitudinally extending U-shaped bracket 40 is fixed to the top sheet-like member 18. The bracket 40 is provided with connecting pins 42, 43 extending transversely between the sides of the bracket at its upper forward and rearward ends. The connecting pin 42 at the front end of the bracket 40 is pivotally journaled in a boss 44 formed at the lower front end of the leg 12 while the rear connecting pin 43 is pivotally journaled in the lower end of a long link arm 46. At its upper forward end the leg 12 is fixedly secured to a rigid arm 48 having an enlarged head portion 50 that is fixed to a rocker shaft 52 pivotally journaled in the lower front end of a generally box-like bracket member 54. At its upper end the link arm 46 is pivotally journaled on a short stub shaft 56 mounted at the rearward end of the box-shaped bracket member 54. Sufficient clearance is provided between the top of the foot-portion 16 and the bottom of the leg 12 so that the leg and foot-portion may move relative to each other without interference. For appearance sake the gap formed by such clearance may be covered by a sock 58, the lower portion of which is tucked inside the foot-portion and the upper portion of which extends above the bottom of the leg.

The legs are interconnected so that pivotal movement of one results in equal and opposite pivotal movement of the other. In the preferred embodiment of the invention a suitable gear mechanism 60 is provided for this purpose. The gear mechanism 60 is housed within the generally box-like bracket member 54 located between the upper ends of the legs 12, 13. Bracket 54 has two parallel side members 62, 62 adapted at their lower front portions to pivotally receive the rocker shafts 52, 52 of the legs 12, 13. The rocker shafts 52, 52 extend substantially inwardly of the sides 62, 62 of the bracket 54 and terminate adjacent the center thereof and each shaft has a segmental spur gear 64, 64 fixedly mounted at its end. The two segmental gears 64, 64 mesh with a horizontally disposed gear 66 fixed to a shaft 68 vertically mounted in the bracket 54. The shaft 68, at its upper end, is pivotally journaled in the top 70 of the bracket and, adjacent its lower end, is pivotally journaled in a horizontal tab 72 of the front side 74 of the bracket 54. A leaf spring 76 is interposed between the gear 66 and the top 70 of the bracket so as to constantly urge the gear into engagement with the segmental gears 64, 64 to eliminate any backlash in the gear mechanism. Pivotal movement of either leg 12, 13 with respect to the other causes the corresponding segmental gear 64 to rotate the horizontally disposed gear 66 in one direction or the other. This rotation results in an equal and opposite pivotal movement of the other segmental gear and in pivotal movement of the corresponding leg. In this manner the two legs are always moved in opposite directions with respect to each other.

While any suitable power source may be utilized to actuate the power-driven means in the foot-portions, an electrical source of power is preferred. Accordingly, provision is made to carry a pair of electric batteries 74, 74 somewhere on the device. Since the connections between the batteries 74, 74 and the electric motors 20, 20 in the foot-portions need only be the usual simple and flexible electric wires, such a power source may be located either on the body portion or in the legs without impairing the structural independence of the legs from the body portion. However, it is preferred that the batteries be located in one or the other of the legs and to this end a casing 76 for the batteries is fixed to one leg 12 by any suitable fastening means such as the screws 78, 78 shown in FIG. 1. The casing 76 is provided with the usual spring contact 83 at the bottom thereof and a connector 82 is connected between this contact and the bracket 40 at the top of the foot-portion 16. A connector 84 extends from the bracket 40 to the input side of the electric motor 20 in the foot-portion 16. The electric motor 20 is connected to suitable switching means 86 (described hereinafter) by a connector 88 and the electric motor (not shown) in the foot-portion 17 is connected to the same switching means 86 by the connector 90. Because of the connection with the connector 82 from the batteries 74 the link arms 46, 46 and gear mechanism 60 serve as the connector with the batteries for the other motor. A connector 92 connects one side of a start-stop switch 94 mounted on the outer surface of one leg 12 with the switching means 86 while the opposite side of the start-stop switch 94 is connected to a contact 96 at the top of the battery casing 76 by the connector 98.

Alternate movement of the legs is effected by providing means on the device for automatically and alternately connecting the power source first with one of the power-driven means in one foot-portion 16 and then with the power-driven means in the other foot-portion 17. While this may be accomplished in any number of ways in which a time delay is obtained, it is preferred to effect alternate connection of the power source with the power-driven means in the foot-portions 16, 17 by pivotal movement of the legs 12, 13 relative to each other. Suitable switching means 86, adapted for actuation by the pivotal action of the legs 12, 13, are, therefore, provided, and, as incorporated in the preferred embodiment of the invention shown in the drawings, comprise three elongated, flexible contacts 100, 101, 103 that are mounted at their ends to an electrically nonconductive plate 104 extending transversely between the sides 62 of the bracket member 54. The elongated contacts 100, 101, 103 are parallely disposed with respect to each other and extend rearwardly of the plate 104 to bear against a transversely slidable circuit-closing member 106. The circuit-closing member 106 is mounted on a rod 108 extending transversely between the rearward portions of the sides 62, 62 of the bracket 54 and comprises a cylindrical body 110 of electrically nonconducting material, such as plastic, with a centrally located circumferential band 112 of electrically conducting material, such as metal. The length of the cylindrical body 110 is substantially less than the distance between the sides 62, 62 of the bracket 54 so as to permit the body to be moved back and forth on the rod 108. A flange 114, made from electrically nonconducting material, is fixed to the underside of the body and has a small opening therein to receive the end of a thin spring rod 116, the opposite end of which, is fixed in the lower end of the shaft 68. Rotation of the shaft 68 serves to swing the spring rod 116 back and forth in a sweeping manner to move the body 110 back and forth between the sides 62, 62 of the bracket 54.

In bearing against the circuit-closing member 106 the elongated contact 100, 101, 103 are bent slightly upwardly thereby placing the contacts under a degree of tension which insure firm contact between the contacts and the member 106. The location of the contacts with respect

to the sides of the bracket is such that the inner contact 100 always bears against the circumferential, electrically conducting band 112 regardless of the position assumed by the cylindrical body 110. It is this contact to which the connector 92 to the start-stop switch 94 is connected. The outer contacts 101, 103 are so spaced from the center contact 100 that each alternately engages the circumferential band 112 when the body 110 is in one position and does not engage the band 112 when the body 110 is in its alternate position, the two positions of the body being shown in FIG. 3 of the drawings in which the alternate position of the body and band are shown in dot, dash lines 118. Each of the connectors 88, 90 from the output side of the electric motors 20, 20 is connected to an outer contact, the connector 88 to contact 103 and connector 90 to contact 101. When the conducting band 112 electrically connects the center contact 100 with either of the outer contacts 101, 103 a complete circuit between the batteries 74, 74 and one or the other motors 20, 20 is made through the start-stop switch 94. In order to obtain a "snap" action from the switch means are provided for holding the cylindrical body 110 against movement for a limited time period in each of its operating positions thereby stressing the spring rod 116. To this end a pair of pivotal stop members 119, 119 are provided immediately adjacent the sides 62, 62 of the bracket 54. Each of the stop members 119, 119 is loosely mounted on a screw 120 in a side 62 of the bracket 54 so as to be pivotable about the axis of the screw. The stop member 119 extends rearwardly of the screw 120 and is formed with a flange 122 at its rearward end so positioned above the rod 108 as to interpose between the end of the body 110 and the adjacent side 62 of the bracket 54 whenever the stop 119 is pivoted downwardly toward the rod 108. Until it is withdrawn from this position the flange 122 prevents the body 110 from moving under the urging of the spring rod 116 and the spring rod is forced to bend to accommodate itself to the resistance of the body. As a result of this resistance spring rod 116 imparts a "snap" action to body 110 when released by the pivotal stop member 119.

Upward pivotal movement of the stops 119, 119 is effected by the segmental gears 64, 64. Each end face of the gear bodies 124, 124 is cut away to provide a shoulder 126 at the underside of the gear body 124 against which the forward end 128 of the stop member 119 abuts. As the pivotal movement of its opposite leg rotates a gear 64 forwardly and downwardly, the shoulder 126 on the gear body 124 pushes the forward end 128 of the stop member 119 downwardly and pivots the flange 122 at the rearward end upwardly out of engagement with the end of the cylindrical body 110 which is then free to "snap" to its other operating position under the urging of the spring rod 116. At the same time, the opposite stop member 119 is pivoted downwardly between the opposite end of the body 110 and the other side 62 of the bracket 54 under the urging of a spring 130 hooked onto the flange 122 at one end and held under a narrow flange 132 at the top 70 of the bracket 54 at the other end. Both stop members 119, 119 are provided with these springs 130 so as to be constantly urged in a downwardly direction thereby. Variations in the length of the stride of the device can be easily effected simply by bending the flanges 122, 122 at different angles with respect to the rest of the pivotal members 119, 119.

Since the legs 12, 13 are structurally independent from the body portion 10 of the device, that is, have no mechanical connections preventing simultaneous movement of both legs with respect to the body portion, it is possible to arrange the device in a sitting position without injuring any of the driving parts. By reason of this structural independence the legs 12, 13 need only be pivotally or flexibly connected to the body portion 10 in any suitable manner. In the preferred embodiment of the invention shown in the drawings, the bracket 54 is pivotally mounted in a frame 140 fixed to the body portion.

The frame 140 comprises a pair of arms 142, 142 formed at the sides of a plate 144 that is secured to a suitably contoured boss 146 on the body portion 10 by the screws 148, 148 and nuts 150, 150. The arms 142, 142 angle downwardly from the plate 144, as is best shown in FIG. 2, and are provided with enlarged, generally circular head portions 152, 152.

A series of inwardly extending bumps 154, 154 are formed at the quadrants of the circular head portions 152, 152 to serve as detents which are engageable with rectangular openings 156, 156 formed in the sides 62, 62 of the bracket 54 at the same quadrants. As will be seen from FIG. 3 the sides 62, 62 of the bracket 54 are each provided with a screw 158, 158 that serves to connect the head portions 152, 152 to the bracket 54. The screw 158 extends through the head portion 152 to a substantial distance and in the space thus formed between the washer 160 for the screw 158 and the outer surface of the head portion 152 a relatively strong spring 162 is mounted. The spring 162 acts to strongly urge the head portion 152 into engagement with the bracket 54 and forces the detents 154, 154 on the head portions into the corresponding openings 156, 156 in the sides 62, 62 of the bracket 54. In this manner sufficient resistance to relative rotation of the bracket 54 with respect to the frame 140 is provided to normally maintain the parts in their respective positions. However, the resistance is not so great as to prevent relative rotation of the bracket 54 with respect to the frame when it is desired to manually move the legs to the sitting position shown by the dot, dash lines 164 in FIG. 2.

In order to safeguard the device from damage resulting from the legs being moved too far apart, the top edge 170 of the front wall 74 of the bracket 54 is positioned so as to limit the extent to which the segmental gears 64, 64 may be rotated. If the legs are moved beyond their normal pivotal movement, the front edge 172 of one or the other gears 64 will abut against the top edge 170 of the front wall 72 of the bracket 54 and prevent any farther movement of the legs 12, 13.

What is claimed is:

1. In a self-walking device, the combination comprising a pair of pivotable legs having foot-portions at their lower ends adapted to rest on a walking surface, power-driven means mounted on each of said foot-portions and engageable with said walking surface for moving said foot-portions forwardly along said walking surface, power means mounted on the device, and means for automatically and alternately connecting said power means first with the power-driven means in one foot-portion and then with the power-driven means in the other foot-portion so as to alternately move said legs.

2. In a self-walking device, the combination comprising a pair of legs pivotally connected adjacent their upper ends and having foot-portions at their lower ends adapted to rest on a walking surface, power-driven means mounted on each of said foot-portions and engageable with said walking surface for moving said foot-portions forwardly along said walking surface, power means mounted on the device, and means actuated by the movement of said legs for automatically and alternately connecting said power means first with the power-driven means in one foot-portion and then with the power-driven means in the other foot-portion so as to alternately move said legs.

3. The combination set forth in claim 2 wherein said power means are positioned on the legs of the device.

4. The combination set forth in claim 2 wherein said power-driven means in each foot-portion includes an electric motor and said power means on said device comprises a source of electrical power operatively connected to each of said electric motors.

5. In a self-walking device, the combination comprising a pair of legs having foot-portions at their lower

ends adapted to rest on a walking surface, power-driven means mounted on each of said foot-portions and engageable with said walking surface for moving said foot-portions forwardly along said walking surface, means interposed between said legs at the upper ends thereof and pivotally interconnected thereto whereby pivotal movement of one of said legs in one direction pivotally moves the other of said legs in an opposite direction, power means mounted on said legs, and means actuated by the pivotal movement of said legs for automatically and alternately connecting said power means first with the power-driven means in one foot-portion and then with the power-driven means in the other foot-portion so as to alternately move said legs.

6. The combination set forth in claim 5 wherein said means interposed between the upper ends of the legs comprise a gear mechanism adapted to convert pivotal motion of one leg into opposite pivotal motion of the other of said legs.

7. The combination set forth in claim 6 wherein said power-driven means includes a drive wheel journaled in each of said foot-portions for engagement with said walking surface.

8. The combination set forth in claim 7 wherein said power means is an electrical power source, said power-driven means includes an electric motor and said alternately connecting means comprises a switch having two operating positions, in one of which one of said motors is energized and the other is de-energized, while in the other operating position of said switch the other of said motors is energized and the said one motor is de-energized.

9. The combination defined in claim 8, which further includes means associated with and interconnecting said gear mechanism and said switch, whereby said switch is moved from one operating position to the other by oscillation of said gears.

10. The combination set forth in claim 9 having a body portion terminating adjacent the legs and wherein said gear mechanism is mounted in a bracket pivotally connected to said body portion.

11. The combination defined in claim 10 wherein said legs are pivoted with respect to each other on separate shafts journaled in said gear mechanism, said gear mechanism having a pair of gears mounted on said shafts, a third gear meshing with said pair of gears and spring means resiliently urging said gears into engagement.

12. The combination defined in claim 11 wherein said gears are provided with positive stop-means in order to limit the distance which said legs can be moved forwardly and rearwardly.

13. The combination defined in claim 12 wherein said body portion includes a frame having a pair of arms embracing said bracket and pivoted thereto, and means for releasably resisting pivotal movement between said body portion and said bracket, said means comprising a plurality of detents formed on the portions of said arms which are in juxtaposition with the walls of said bracket, said detents being spaced from the pivot point of said body and bracket, and corresponding detent openings formed on the sides of said bracket with which said detents engage at predetermined positions upon relative rotation between said body portion and bracket.

14. In a self-walking device, the combination comprising a pair of legs pivotally connected adjacent their upper ends and having foot-portions at their lower ends adapted to rest upon a walking surface, power-driven means mounted on each of said foot-portions and engageable with said walking surface for moving said foot-portions forwardly along said walking surface, electrical power means mounted on the device, and switching means for automatically and alternately connecting said power means first with the power-driven means in one foot-portion and then with the power-driven means in the other foot-portion so as to alternately move said legs, said switching means comprising an electrical contact connected with said electrical source of power and an additional contact for each of said power-driven means located at either side of said first-mentioned contact, means slidable transversely with respect to said contacts adapted to connect the first-mentioned contact with one of said second-mentioned contacts, and means for moving said slidable means transversely with respect to said contacts to alternately connect the first-mentioned contact with said second-mentioned contacts.

15. The combination set forth in claim 14 wherein said legs are pivotally interconnected adjacent their upper ends through a gear mechanism oscillated by pivotal movement of said legs and said slidable means is actuated by the oscillations of said gear mechanism.

16. The combination set forth in claim 15 wherein said gear mechanism comprises a pair of gears, each of which is fixedly secured to one of said legs, and a third gear meshing with said pair of gears, said third gear being oscillated by pivotal movement of said legs, said third gear having a flexible shaft connected to said slidable means whereby oscillation of the gear and the shaft serves to oscillate said slidable means.

17. The combination set forth in claim 16 wherein said contacts comprise three parallel spaced-apart members and said slidable means comprise a reciprocable body formed of nonconducting material and having a centrally positioned circumferential band formed of electrically conducting material, said band being adapted to constantly engage said central contact member and to alternately engage each of said outer contact members.

18. The combination set forth in claim 17 having a gear mechanism interconnecting said legs whereby pivotal movement of one leg results in opposite pivotal movement of the other leg, and stop means for said slidable means to prevent movement thereof and to stress said flexible shaft, said stop means being movable by the gear mechanism to release said slidable means after said flexible shaft becomes stressed.

References Cited in the file of this patent

UNITED STATES PATENTS

1,880,138	Hubl	Sept. 27, 1932
2,502,583	Murphy	Apr. 4, 1950
2,695,472	Adrolino	Nov. 30, 1954
2,881,559	Glass	Apr. 14, 1959

FOREIGN PATENTS

528,749	Italy	June 15, 1954
1,171,400	France	Oct. 6, 1958