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SELF-PROPELLED APPARATUS

Filed June 8, 1936 4 Sheets-Sheet 1

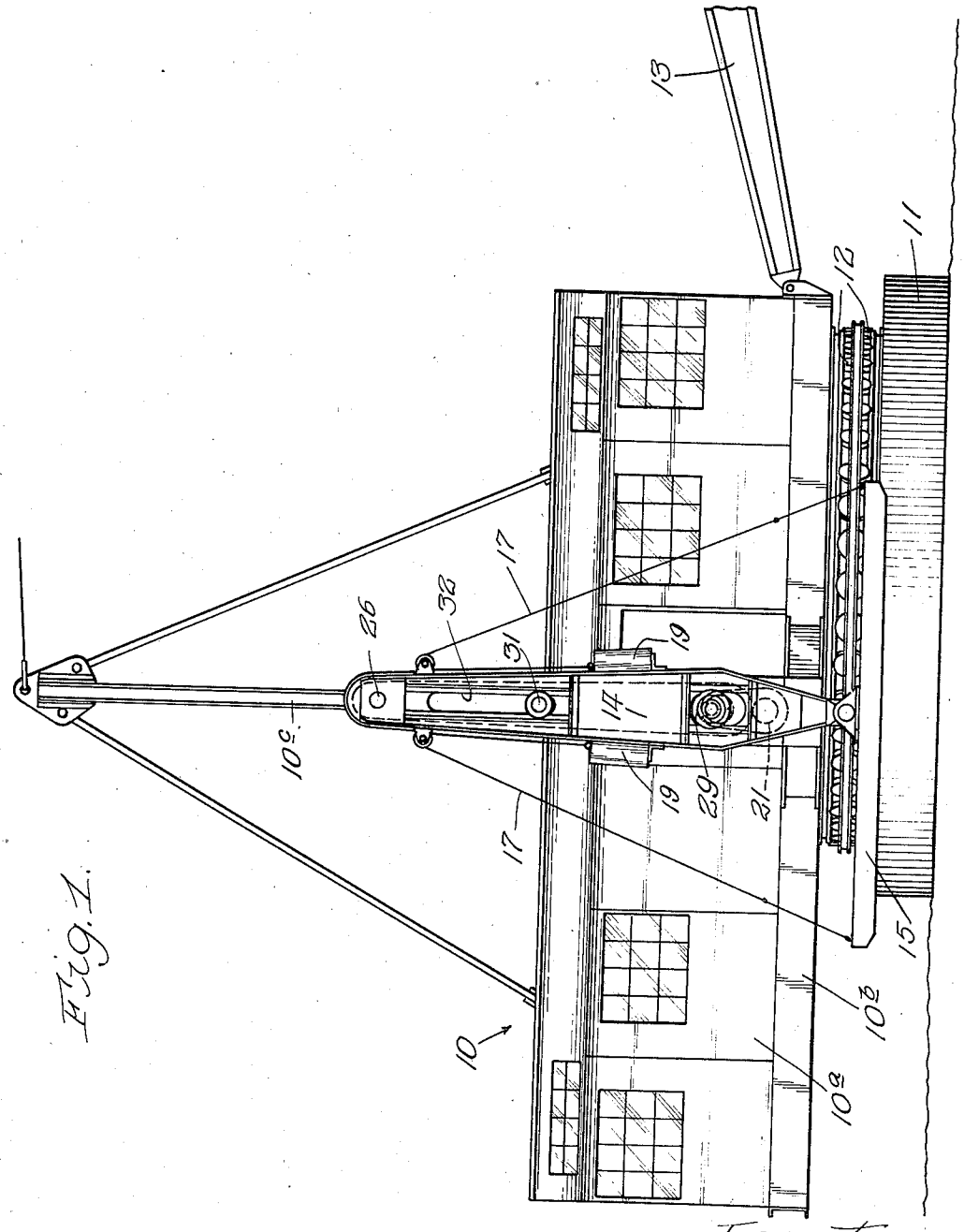


Fig. 1.

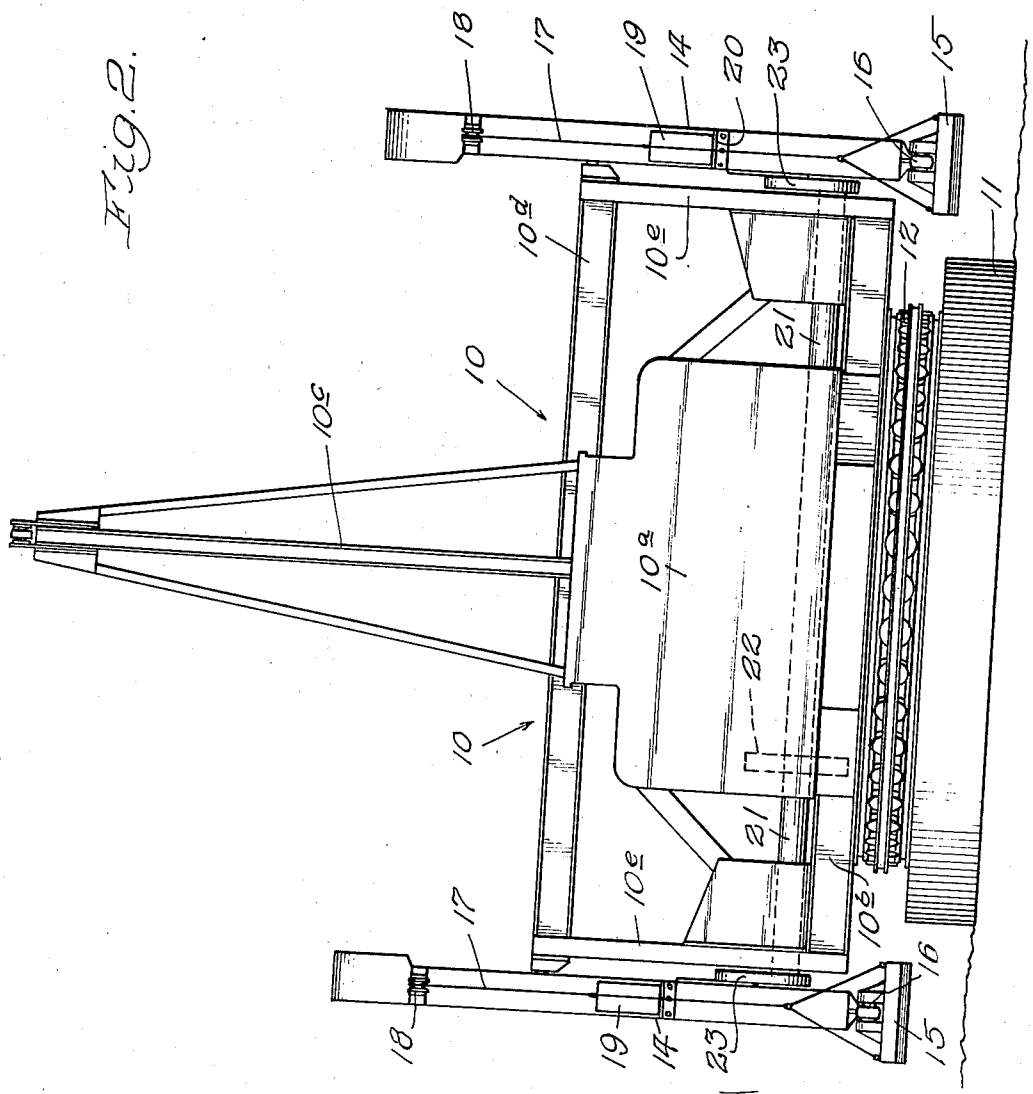
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Fig. 2.



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Fig. 3.

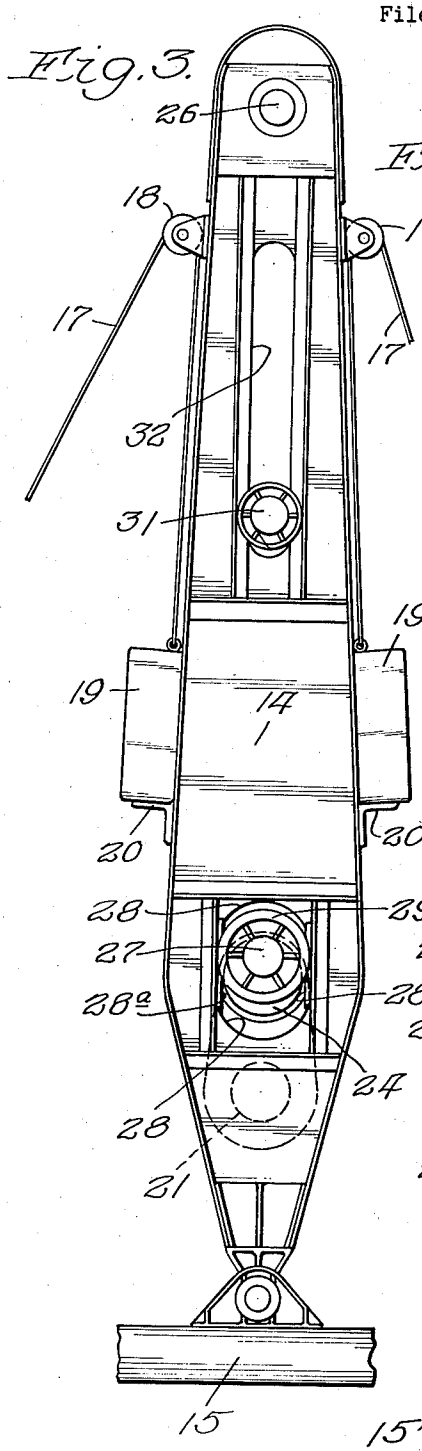


Fig. 4.

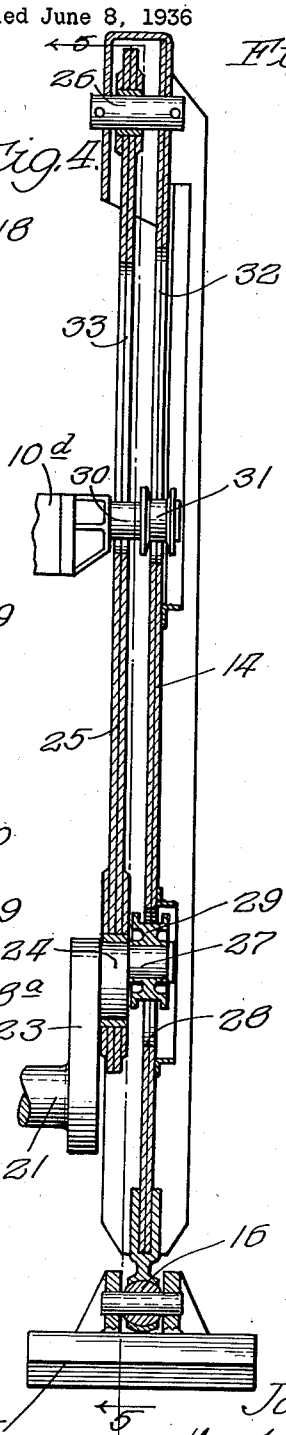
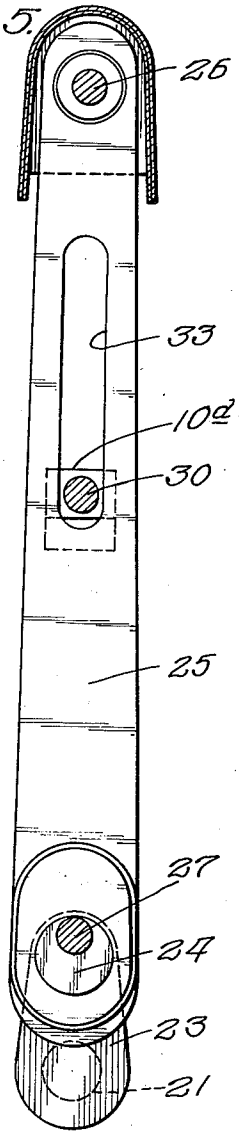


Fig. 5.



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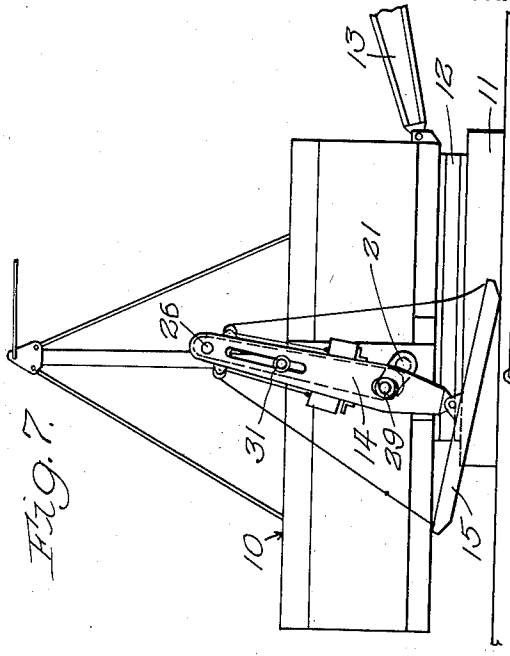


Fig. 7.

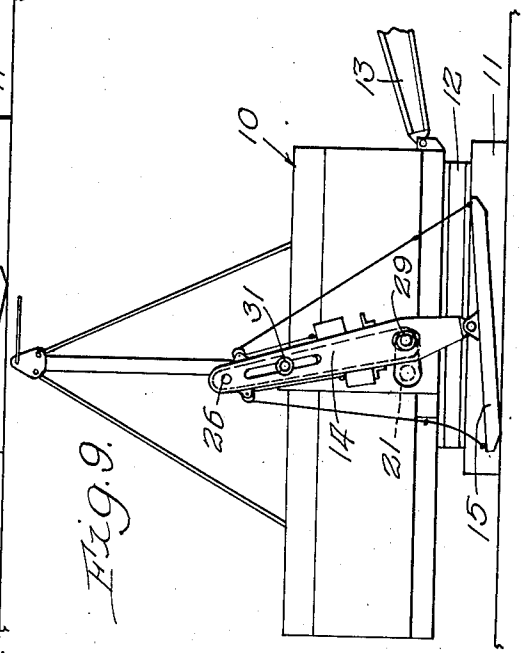


Fig. 9.

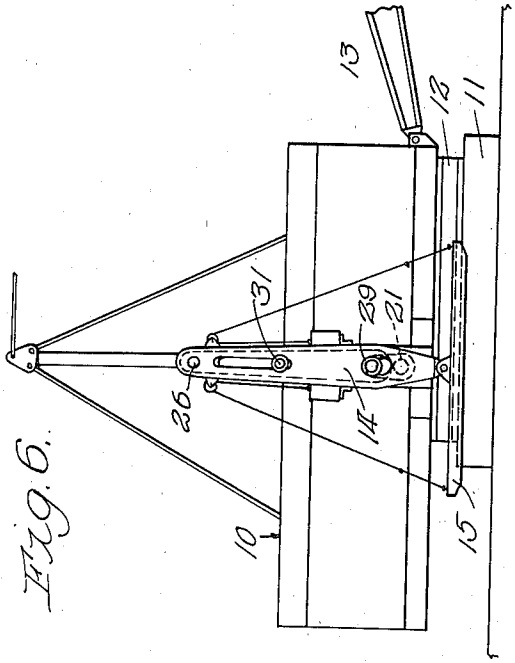


Fig. 6.

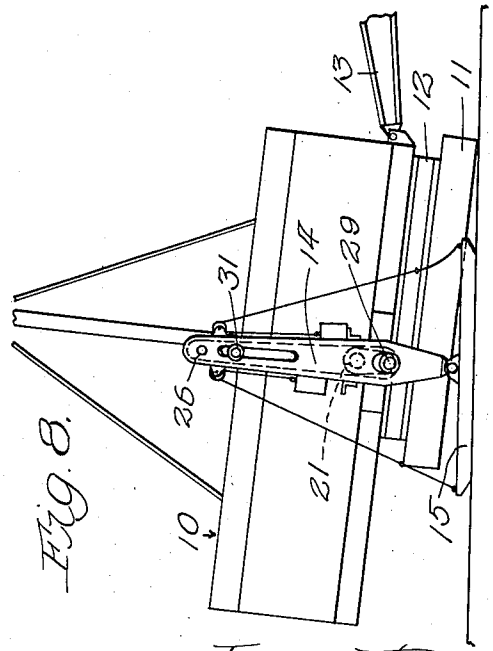


Fig. 8.

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Patented Feb. 4, 1941 2,230,759

UNITED STATES PATENT OFFICE

2,230,759

SELF-PROPELLED APPARATUS

John W. Page, Chicago, Ill., assignor to Page Engineering Company, Chicago, Ill., a corporation of Illinois

Application June 8, 1936, Serial No. 84,205

17 Claims. (Cl. 180—8)

This invention relates to improvements in self-propelled apparatus and, more especially, such apparatus adapted to propel itself by a step-by-step or walking motion.

My invention is applicable for many uses. It may be used, for example, in connection with dredging, digging, excavating apparatus, and the like. It may also be used for pile-drivers, cranes, derricks, and similar devices; and, in fact, in connection with any apparatus which is to be self-propelled. It is particularly adapted for heavy apparatus designated to move over rough, uneven, or soft ground and not requiring a high rate of speed. For the purpose of illustrating my invention, I have here shown it embodied in a self-propelled drag line bucket excavator.

Among the features of my invention is the provision of such apparatus that is simple in construction and operation and rugged and strong.

In general, my improved apparatus includes the body that is to be propelled, which may be for example a platform with suitable housing and the like for containing the power means for driving the propelling mechanism and for operating the drag line bucket, crane, derrick, or other apparatus.

The propelling mechanism includes, in general, a pair of legs connected to crank-pins on cranks mounted on a shaft carried by the body. The legs are provided with suitable feet. Rotation of the shaft alternately lifts the legs and the body to propel the latter. It is to be understood that the legs operate in unison and not alternately. That is, both legs are lifted at the same time, advanced, lowered, and the body is then raised and advanced. This cycle of operations is repeated to move the body any distance desired.

Among the features of my invention is improved means for advancing the legs somewhat farther than they would be advanced if the same crank-pin connecting them to the body for lifting purposes were also used to advance the legs. Accordingly, I provide additional crank-pins on greater radii for advancing the legs so that when they are raised, they will be advanced a greater distance than otherwise would be the case.

Another feature of the invention is the extension of the legs some distance above the crank-pins with the connection between the crank-pins and the upper ends of the legs by means of links, the upper ends of which are pivotally pinned to the upper ends of the legs.

Another feature of the invention is the provision of a member on the body above the crank-shaft extending outwardly and provided with a pulley operating in a slot in the leg.

Other features and advantages of my invention will appear more fully as I proceed with my specification.

In that form of device embodying the features of my invention shown in the accompanying drawings—

Figure 1 is a view in side elevation; Fig. 2 is a view in front elevation; Fig. 3 is an enlarged view in side elevation of one of the legs; Fig. 4 is a vertical sectional view of one of the legs; Fig. 5 is a view taken as indicated by the line 5 of Fig. 4; and Figs. 6, 7, 8 and 9 are views showing the parts in different positions to illustrate the walking motion.

As shown in the drawings, 10 may indicate any suitable body which is to be self-propelled. As here shown, this body includes a house 10a mounted on a platform 10b. It also includes suitable framework 10c and the cross-member 10d. The house 10a may contain suitable power means for driving the propelling mechanism and also any excavating or other apparatus which it is desired to operate.

11 indicates a base rotatably connected to the body 10 and so designed that it will be lifted with the body and carried thereby. When the base is resting on the ground and the body is resting on the base, it is rotatably supported on the base by means of the rollers 12 in the well-known manner.

13 may indicate a boom, arm, or the like, which may carry a drag line bucket (not shown), or any other suitable excavating, lifting apparatus, or the like. Suitable means (not shown), of course, may be provided for elevating and supporting the boom. The details of any excavating apparatus, or the like, need not be described herein, since this invention relates primarily to the propelling means for the body 10.

The propelling means includes two legs 14, 14 on opposite sides of the body, each provided with a foot 15 universally connected thereto by the ball and socket joint 16. 17, 17 indicate cables extending from the ends of the foot around pulleys 18 near the upper end of the leg and thence to counterweights 19 slidably mounted on the sides of the leg to tend to maintain the foot at right angles to the leg. Shelves 20 are provided for the counterweights 19 when they are at the bottom of their travel and the foot is at right angles to the leg. If the right angle on either side increases substantially, the weight 19 on that side is lifted from the shelf to place tension on

the cable 17 to tend to lift that end of the foot to restore the right angle.

21 indicates a shaft carried by the body 10 a short distance above the platform 10b. Suitable means (not shown) are provided on the platform for rotating the shaft 21. For example, 22 may indicate a gear wheel on the shaft through which the drive is transmitted from suitable power means (not shown). The shaft 21 carries a crank 23 at each end, the cranks having identical angular positions on the shaft. Since the crank positions on each side of the body and the leg construction are the same, it will be sufficient to describe in detail the construction on one side of the body, it being understood that the other side is the same and that both legs operate simultaneously in the walking operation.

The crank 23 carries a crank-pin 24 connected to the upper end of the leg 14 by means of a link 25 pivotally pinned at its upper end to the upper end of the leg by the pin 26. That is, the crank-pin 24 hangs from the upper end of the leg by the link 25.

The crank 23 also carries another crank-pin 27, here shown as mounted on the crank-pin 24, by having a different radius. In speaking of the radius of either crank-pin, it is understood, of course, that the same is measured from the center of the crank-pin to the center of the shaft. That is, the radius of the pin 27 is greater than the radius of the pin 24. The leg 14 is provided with a slot 28 through which the crank-pin 27 extends and the latter carries a flange roller 29 operating in such slot. The slot 28 is long enough so that in the walking movement, the roller 29 does not engage either the upper or the lower end. That is, none of the weight is taken by the roller 29 or crank-pin 27. The sides of the slot 28 are provided with rails 28a, however, having a reasonably close fit with the sides of the roller 29 so that as the shaft 21 rotates, the roller 29 on the crank-pin 27 will swing the leg.

The member 10d is rigidly mounted on the body 10 and the ends may be supported, for example, by side braces 10e. The outer ends of the cross-member 10d are provided with pins 30 carrying grooved rollers 31 operating in slots 32 in the upper ends of the legs. Here again the slot 32 is long enough so that the roller does not engage either the upper or the lower end; but the slot is narrow enough so as to give a reasonably close fit for the roller 31. Movement of the pin 27, therefore, will cause the leg 14 to swing about the roller 31 as a center. The link 25 is provided with a slot 33 through which the pin 30 extends and the slot is wide enough so that free movement of all the parts is permitted without the pin 30 engaging the sides of the slot 33.

In the walking operation, the shaft 21 is rotated and this causes the body and the legs to be alternately raised, advanced and lowered. The legs are long enough so that when the cranks are turned upwardly the body will rest on the ground and the feet will be raised from the ground. When the cranks are turned downwardly, on the other hand, the feet will rest on the ground and the body will be substantially raised from the ground as indicated in Fig. 8. As here shown, the body is not exactly balanced and consequently when it is substantially lifted or raised from the ground one end may rest or drag on the ground. When the body is raised, the weight is carried through the links 25 connecting the upper ends of the legs to the crank-pins 24. When the cranks 23 are turned upwardly, the links 25 act as thrust members to lift the legs. That is, when the legs are raised, they are supported by their upper ends through the links 25 from the crank-pins 24. When the legs are raised, however, their lower ends will be swung forwardly by the rollers 29 mounted on the crank-pins 27 and operating against the sides of the slots 28. Since the pins 27 are on longer radii than the pins 24, the legs will be advanced or swung forwardly a greater distance than would be the case if the crank-pins 24 which lift the legs also advanced them or swung them forwardly.

In actual construction, since the center of gravity of the body may be somewhat above the shaft 21, the body when lifted from the ground may tilt somewhat so that one end may drag on the ground as it is moved.

The walking motion is illustrated diagrammatically in Figs. 6 to 9, inclusive. In Fig. 6, the legs are in their uppermost position, the shaft 21 is rotating counterclockwise and the entire device is to move to the left. In Fig. 7, the legs have been swung forwardly, that is, to the left, and are being lowered. In Fig. 8, the legs are in their lowest position and the body has been raised. In Fig. 9, the body has been moved forwardly, that is, to the left, and lowered, and the legs are again beginning to be raised.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims, in which it is my intention to claim all novelty inherent in my invention as broadly as permissible, in view of the prior art.

What I claim as new, and desire to secure by Letters Patent, is:

1. Apparatus of the character described, including: a body; a horizontal transversely arranged shaft carried by the body; a crank on each end of the shaft; a crank-pin on each crank; a rigid leg at each side of the body; a foot on each leg; a connection between each crank-pin and its corresponding leg through a link with its upper end pivotally connected to the upper end of the leg and its lower end pivotally mounted on the crank-pin, whereby rotation of the shaft will raise and lower the leg, each leg being of such length below said connection that when the crank-pin is up the body will rest on the ground and the foot will be substantially raised therefrom and when the crank-pin is down the foot will rest on the ground and the body will be substantially raised therefrom; and means for rotating the shaft, whereby the body and legs alternately will be raised, advanced, and lowered.

2. Apparatus as claimed in claim 1 in which the leg extends a substantial distance above the shaft.

3. Apparatus of the character described, including: a body; a horizontal transversely arranged shaft carried by the body; a crank on each end of the shaft; a crank-pin on each crank; a rigid leg at each side of the body extending a substantial distance above the shaft; a part carried by the body above the shaft connected to the leg to permit substantially vertical and rotary movement of said leg with respect to said part; a foot on each leg; a connection between each crank-pin and its corresponding leg whereby rotation of the shaft will raise and lower the leg, each leg being of such length below

said connection that when the crank-pin is up the body will rest on the ground and the foot will be substantially raised therefrom and when the crank pin is down the foot will rest on the ground and the body will be substantially raised therefrom; and means for rotating the shaft, whereby the body and legs alternately will be raised, advanced, and lowered.

4. Apparatus of the character described, including: a body; a shaft carried by the body; a crank on each end of the shaft; first crank-pins on the cranks; a pair of legs extending a substantial distance above the shaft; feet on the legs; a connection between each crank-pin and its corresponding leg whereby upon rotation of the shaft the body and legs will be alternately raised and lowered, each leg being of such length below said connection that when the crank-pin is up the body will rest on the ground and the foot will be substantially raised therefrom and when the crank-pin is down the foot will rest on the ground and the body will be substantially raised therefrom; means for rotating the shaft; pivotal connections above the shaft between the body and legs permitting substantially vertical movement of the legs with respect to the body and swinging movement of the legs on said connections; second crank-pins on said cranks set on longer radii than the first crank-pins; and connections between said second crank-pins and said legs for swinging said legs on the pivotal connections between the legs and body above the shaft.

5. Apparatus of the character described, including: a body; a shaft carried by the body; a crank on each end of the shaft; crank-pins on the cranks; a pair of legs extending a substantial distance above the shaft; feet on the legs; a connection between each crank-pin and its corresponding legs whereby upon rotation of the shaft the body and legs will be alternately raised and lowered each leg being of such length below said connection that when the crank-pin is up the body will rest on the ground and the foot will be substantially raised therefrom and when the crank-pin is down the foot will rest on the ground and the body will be substantially raised therefrom; means for rotating the shaft; pivotal connections above the shaft between the body and legs, said connections permitting substantially vertical movement of the legs with respect to the body; and means for swinging said legs on said pivotal connections.

6. Apparatus as claimed in claim 5, in which the means for swinging the legs includes second crank-pins on the cranks.

7. Apparatus of the character described, including: a body; a shaft carried by the body; a crank on each end of the shaft; first crank-pins on the cranks; a pair of legs extending a substantial distance above the shaft, said legs having upper and lower vertical slots; feet on the legs; links with their upper ends pivotally connected to the upper ends of the legs and their lower ends pivoted on the first crank-pins; members on the body above the shaft having pivotal engagement with the upper slots in the legs; and second crank-pins on the cranks having pivotal engagement with the lower slots in the legs.

8. Apparatus as claimed in claim 7, in which the second crank-pins have longer radii than the first crank-pins.

9. Apparatus as claimed in claim 7, in which the links are provided with slots and in which the members carried by the body having pivotal engagement with the upper slots in the legs are carried by members extending through said slots in said links.

10. Apparatus as claimed in claim 4, in which the feet are mounted on the legs by universal connections and in which means are provided for yieldingly maintaining said feet substantially at right angles to said legs.

11. Apparatus as claimed in claim 5, in which the feet are mounted on the legs by universal connections and in which means are provided for yieldingly maintaining said feet substantially at right angles to said legs.

12. Apparatus as claimed in claim 7, in which the feet are mounted on the legs by universal connections and in which means are provided for yieldingly maintaining said feet substantially at right angles to said legs.

13. Apparatus of the character described, including: a body; a shaft carried by the body; means for rotating said shaft; a pair of legs; feet on the legs; pivotal connections between the body and legs above the shaft, said connections permitting substantially vertical movement of the legs; and means whereby rotation of the shaft alternately raises and lowers the legs and swings the legs on said pivotal connections, the legs being of such length below the shaft that when they are lowered the feet will rest on the ground and the body will be substantially raised therefrom and when they are raised the body will rest on the ground and the feet will be substantially raised therefrom, the means for raising and lowering the legs including cranks and crank-pins on the shaft.

14. Apparatus of the character described, including: a body; a shaft carried by the body; means for rotating said shaft; a pair of legs; feet on the legs; pivotal connections between the body and legs above the shaft, said connections permitting substantially vertical movement of the legs; and means whereby rotation of the shaft alternately raises and lowers the legs and swings the legs on said pivotal connections, the legs being of such length below the shaft that when they are lowered the feet will rest on the ground and the body will be substantially raised therefrom and when they are raised the body will rest on the ground and the feet will be substantially raised therefrom, and means for raising and lowering the legs and swinging the latter including cranks and crank-pins on the shaft.

15. Apparatus of the character described, including: a body; a shaft carried by the body; means for rotating said shaft; a pair of legs; feet on the legs; pivotal connections between the body and legs above the shaft, said connections permitting substantially vertical movement of the legs; and means whereby rotation of the shaft alternately raises and lowers the legs and swings the legs on said pivotal connections, the legs being of such length below the shaft that when they are lowered the feet will rest on the ground and the body will be substantially raised therefrom and when they are raised the body will rest on the ground and the feet will be substantially raised therefrom, the means for raising and lowering the legs including cranks and first crank-pins on the shaft and the means for swinging the legs including second crank-pins on longer radii than the first crank-pins.

16. A walking mechanism, comprising a main base and an associated machine supporting structure, auxiliary bases at the sides of the main

base, vertically disposed arms fulcrumed at their lower ends to the auxiliary bases and fulcrumed at two other spaced points to the machine supporting structure, one of said fulcrums on the machine supporting structure being an eccentric driving element, and means for driving said eccentric driving element.

17. A walking mechanism, comprising a main base and an associated machine supporting structure, auxiliary bases at the sides of the main base, means for carrying the auxiliary bases, said means fulcrumed at their lower ends to the auxiliary bases and fulcrumed at two other spaced points to the machine supporting structure, one of said fulcrums on the machine supporting structure being an eccentric driving element, and means for driving said eccentric driving element.

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