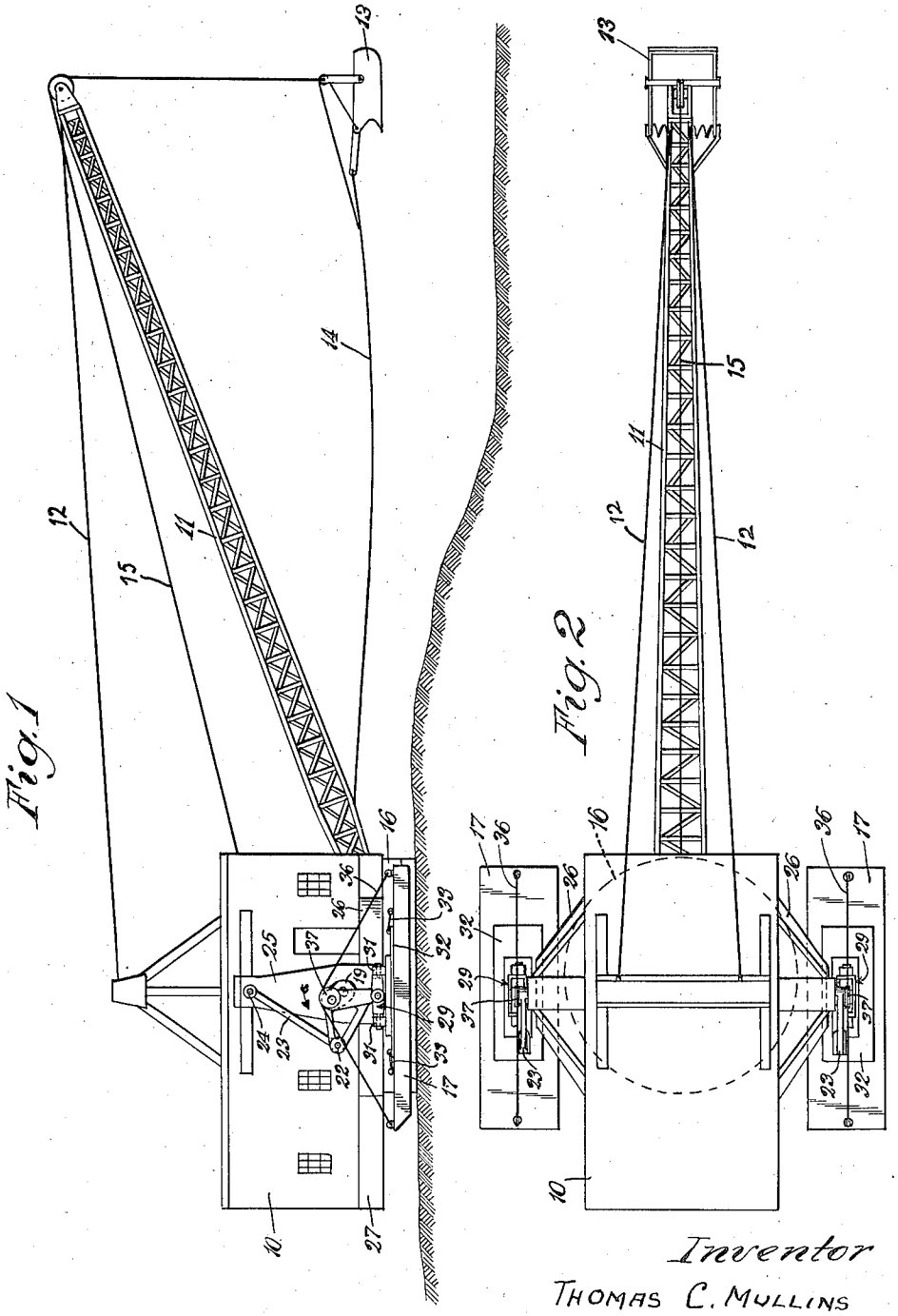
April 30, 1946. T. C. MULLINS 2,399,375

WALKING APPARATUS FOR EXCAVATORS

Filed Oct. 20, 1943 2 Sheets-Sheet 1



Inventor
THOMAS C. MULLINS
by Sheridan, Davis & Cargill
Attorneys

April 30, 1946. T. C. MULLINS 2,399,375

WALKING APPARATUS FOR EXCAVATORS

Filed Oct. 20, 1943 2 Sheets-Sheet 2

Fig. 3

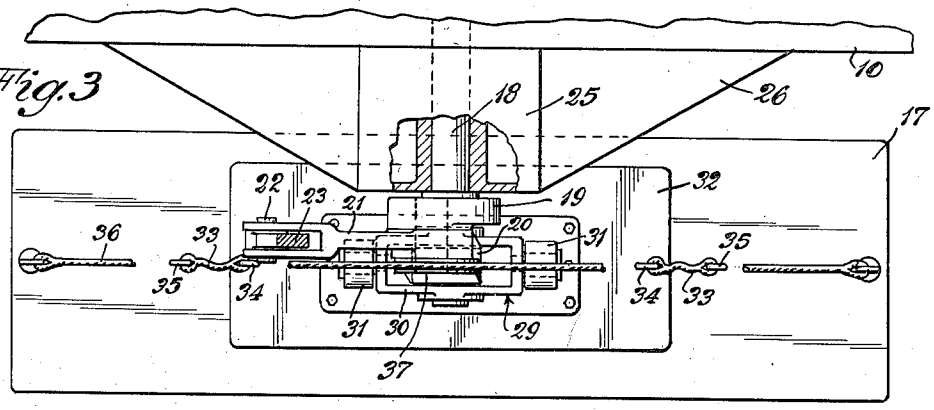


Fig. 4

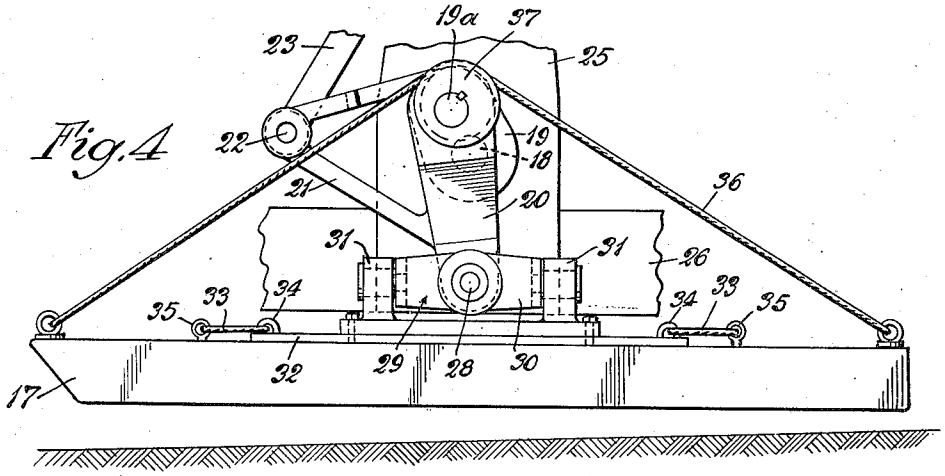


Fig. 5

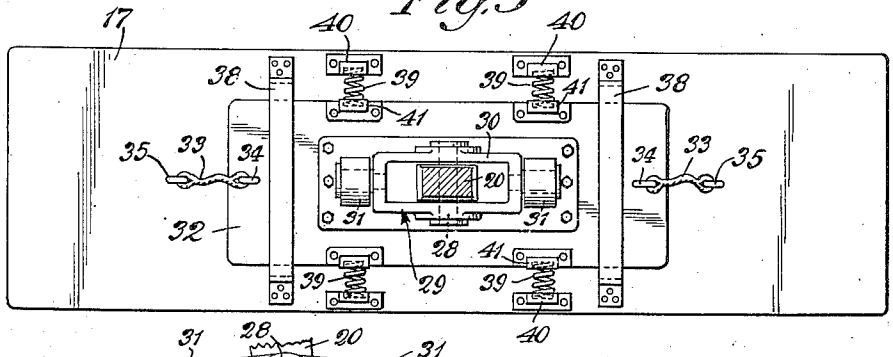
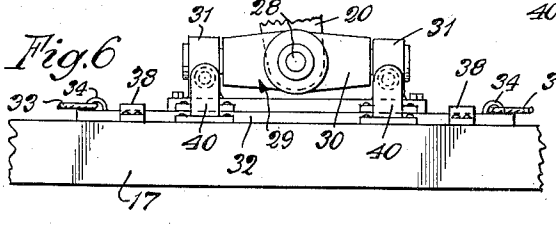


Fig. 6



Inventor
THOMAS C. MULLINS
by Sheridan, Davis & Cargill
Attorneys.

Patented Apr. 30, 1946 2,399,375

UNITED STATES PATENT OFFICE

2,399,375

WALKING APPARATUS FOR EXCAVATORS

Thomas C. Mullins, Chicago, Ill., assignor to The Marion Steam Shovel Company, Marion, Ohio, a corporation of Ohio

Application October 20, 1943, Serial No. 506,943

7 Claims. (Cl. 180—8)

This invention relates to improvements in walking apparatus of the type employed in mobile excavating machines of the dip bucket or drag line type.

One form of such walking apparatus for excavators of the mobile type comprises a central base or so-called tub which normally supports the machine during digging or excavating operations and upon which the apparatus can be turned for swinging the boom and bucket, if of the drag line type, or the stick and dipper, if of the shovel type, into the desired positions for loading and dumping. In moving such apparatus a pair of shoes of pontoon-like form cooperate with the tub and are operated by crank arm mechanism for lifting the tub and machine from the ground and moving the same forwardly a short distance and then lowering them, whereupon, by continued rotation of the crank arms the shoes are elevated and moved forwardly and then into contact with the ground to again lift the machine and tub and advancing the same another step.

Such walking mechanism generally has been satisfactory especially for use with excavating machines of moderate weight, but it was found that when embodied in a machine of substantially larger capacity and greater weight, for instance a machine having a drag bucket of twenty-five cubic yards capacity, the conventional walking mechanism failed several times under conditions that could be expected to be encountered frequently in the use of the machine. Such failures occurred notwithstanding that the walking mechanism of the machine was carefully designed originally to withstand the expected stresses and, after failure, was further strengthened, but without correcting the cause of the breakage and avoiding the resultant shut-down of the machine and reduced coal production.

The principal object of the present invention, therefore, is to provide improvements in walking apparatus of excavating or like machines which without inordinately increasing the size of the parts of the crank arm mechanisms to prevent breakage thereof, affords relative lateral movement of the crank arm mechanisms with respect to the shoes to reduce or avoid imposition on the arm mechanism of destructive stresses resulting from the tendency of the machine to shift laterally under certain conditions during walking operations, as where the shoes contact soil affording unequal support at opposite sides of the machine.

An additional object of the invention is to provide a structure accommodating relative movement between crank arm mechanisms and the respective shoes of walking apparatus, and to provide relatively large surfaces of bearing contact between such relatively moving parts for reducing excessive wear under the large loads imposed on such parts.

Other objects of the invention relate to various features of construction and arrangement of parts which will be apparent from a consideration of the following specification and accompanying drawings wherein:

Figure 1 is a side elevational view of an excavating machine of the drag line type embodying improvements which are illustrative of the present invention.

Fig. 2 is a top plan view of the machine shown in Fig. 1;

Fig. 3 is an enlarged broken plan view illustrating one of the two shoes and associated operating means therefor;

Fig. 4 is a side elevation of the apparatus shown in Fig. 3;

Fig. 5 is a top plan view of a modification of the improvements; and

Fig. 6 is a side elevation of the modification shown in Fig. 5.

In Figs. 1 and 2 of the drawings a drag line machine is shown which comprises a house or housing 10 within which is positioned the major portion of the operating mechanism (not shown) including a control cab or compartment for the operator and power units by means of which the power operated boom 11 can be raised and lowered by cables 12 and whereby a bucket 13, provided with haul and hoist lines 14 and 15, respectively, can be loaded, elevated and supported by the boom as the machine is swung upon its turntable from loading to load-discharging positions and vice-versa. The details of such parts being well-known are not shown in the drawings nor are the conventional power means, such as the electric motors that supply the control and operating power and which are positioned within the housing 10. Whether the apparatus is electrically operated, as may be assumed in the present instance, or is operated by steam or Diesel power is not important insofar as the present invention is concerned.

The conventional apparatus shown also comprises a tub 16 which normally supports the machine during excavating operations and upon which the machine may be rotated or oscillated in swinging the housing and boom arcuately for carrying a loaded elevated bucket to and from load and discharging positions.

At opposite sides of the machine are shown shoes 17 which cooperate with the tub 16 during walking operations. The conventional means shown for operating the shoes comprise a power operated shaft 18 extending from each side of the housing and provided with crank arms 19 at each side of the machine but inasmuch as the parts of the walking mechanism at each side of the machine are similar and are operated in unison, only the parts at one side of the machine as shown in Figs. 3 and 4 will be described.

Pivotally secured to a crank pin 19a at the end of the crank arm 19 is a leg or link 20 which, in the form shown constitutes one side of a triangular member 21 and to the forward apex of which is pivotally attached at 22 the lower end of a link 23 which at its upper end (see Fig. 1) is pivotally attached at 24 to the exterior supporting structure 25, which in turn is secured at its upper portion to the framework of the super-structure of the machine and at its lower end is secured to a laterally extended portion 26 of the base 27 of the machine.

In such types of walking mechanisms heretofore employed, the lower ends of the links or legs 20 have been attached pivotally by suitable bearing means directly to the respective shoes without interposed means for accommodating relative lateral movement of the crank arm mechanisms with respect to the shoes while the arms are elevating the machine. In large capacity machines in particular, such as are herein under consideration, it was found that breakage of the crank arm mechanism at one side of the machine or the other occurred notwithstanding that those parts were originally so designed and subsequently strengthened to provide what appeared to be adequate strength to withstand the stresses normally imposed thereon. However, it has been found that due to the tendency of a machine to shift laterally during walking operations when one shoe is less firmly supported by the ground than the other, lateral stresses were set up which caused failures even of the strengthened crank arm mechanisms.

During the walking operations, the shaft 18 is rotated in one direction (counter-clockwise as viewed in Figs. 1 and 4) which, by reason of the controlling action of the members 21 and 23 causes the legs 20 to move downwardly during the first portion of the walking operation and press the shoes 17 into contact with the ground and, as the rotation of the shaft 18 continues to lift the tub and machine and move it to the left, (as viewed in said figures) and thereafter to lower the tub and machine and then lift the shoes and move the latter arcuately to the left (counter-clockwise) in preparation for the next downward movement constituting the beginning of the next walking step or cycle. Since the machine can be swung arcuately in either direction when the tub supports the machine and the shoes are elevated, the machine can be caused to walk in any angular direction from a given position. Such walking operations, as stated, have resulted in breakage of the crank arm mechanism at one side of the machine or the other under conditions wherein one shoe failed to provide adequate support for the load due to the character of the supporting earth. Under such conditions apparently a greater portion of the work in elevating the machine was imposed on the crank arm mechanism on the other side of the machine which apparently set up laterally directed stresses which, with the shoes unable to shift laterally by reason of their contact with the ground, caused breakage of one or the other of the crank arm mechanisms.

For the purpose of compensating for the inability of the shoes to shift laterally while in contact with the ground and while offering unequal support for the machine during the walking operation and to prevent the setting up of destructive lateral stresses in the crank arm mechanism, means have been provided to permit limited relative movement between the crank arm structure and the respective shoes. Such lateral shifting can be accommodated by various structures, two of which are shown for illustrative purposes in the drawings.

As shown in the drawings the lower end of each crank arm 20 is pivotally secured at 28 to a saddle bearing indicated generally by numeral 29 and comprising a member 30 which itself is pivotally mounted at its ends in brackets or supports 31. Such saddle bearings 29 accommodate movement of the arms 20 to slightly different angular positions of the shoes when pressed against the ground, but instead of being secured directly to the shoes 17 as heretofore, said bearings are secured to plates 32 which are so mounted on the respective shoes that they can shift laterally relative to the same though limited distances when excessive lateral stresses are imposed on the crank arm mechanisms. The plates 32 while movable upon the shoes are attached thereto by suitable means so that during elevation of the plates during walking operations the shoes will be lifted and moved forwardly as heretofore.

The means shown in Figs. 1 to 4 for securing each plate 32 to a shoe 17 comprises a pair of cables 33 each attached to the respective end of the plate as by eye members 34 and to the shoe by eye members 35. Sufficient slack is provided in the cables to enable the plate to slide laterally on the shoes to a limited extent, a few inches to a foot generally being adequate for adjustment of the plate with respect to a shoe in response to imposed lateral stresses and hence to prevent breakage of the crank arm mechanisms from that cause. The plates 32 contact relatively large portions of the surface area of the respective shoes and hence wear of the contacting surfaces is kept at a minimum.

Upon elevation of the plates during a walking operation, the cables 33 will elevate the shoes and permit the latter to reassume normal positions with respect to the plates but due to the slack provided in the cables as mentioned, a slight vertical separation of the plates from the shoes will occur during that portion of the walking cycle. Where such separation is objectionable, substantial contact between the plates and respective shoes can be maintained by any suitable means such, for example, as shown in Fig. 4 or by the modification of the structure illustrated in Figs. 5 and 6.

In Fig. 4 there is shown a cable 36 which is attached at its ends to end portions of the shoe 17 and passes tautly over a grooved cam or eccentric 37 mounted on the crank pin 19a and secured to the leg 20 against relative rotation with respect to the latter.

When the crank arm mechanism is in the shoe elevating position shown in Fig. 4, the eccentric 37 retains the shoe in suitably close contact with the plate whereby the shoe is elevated to the greatest extent for reducing drag on the shoe by loose earth during the forward movement of the shoe within a walking cycle. Such arrange-

ment permits relative lateral movement of the shoes 17 with respect to the plates 32 as stated and during elevation of the shoes to the position shown in Fig. 4, when the load is removed from them, the shoes by gravity readjust or realign themselves from a laterally or longitudinally displaced position with reference to the plates.

The modified structure shown in Figs. 5 and 6 eliminates the use of the cable 36 and eccentric 37 by providing a pair of transverse bars 38 which extend across the upper surface of the plate 32 and are attached at the ends to the upper surface of the shoe 17. The length of the bars and vertical spacing between the intermediate portions of the bars and shoes is such as to accommodate sliding movement of the plate without permitting appreciable relative vertical movement between the shoes and plates whereby the latter, during the elevating portion of a walking cycle will pick up the shoes without lost motion.

In Figs. 5 and 6 the ends of the plate 32 are shown attached to the shoes also by short cables 33 as in the structure shown in Fig. 4 and in addition means are provided for restoring the shoes to normal relation following lateral displacement thereof.

The last mentioned means shown for illustration are in the form of coil springs 39 under compression between pairs of seat members 40 to 41 secured respectively to the shoe and plate. Upon elevation of the shoes, the springs 39 will restore the shoes to original position with respect to the respective plates following lateral displacement, should such occur, during the portion of the walking cycle within which the load of the machine is imposed upon the shoes.

While I have shown and described structures for permitting relative movement between the crank arm mechanisms and the respective shoes while the latter are in contact with the earth and are supporting the weight of the machine, and have provided relatively large bearing surfaces between the plates and shoes for distributing the imposed loads and reducing wear of the parts between which such relative movement occurs, it will be apparent that other modification of the disclosed structure may be utilized within the spirit of the invention.

I claim:

1. Walking apparatus for an excavating machine comprising a crank arm mechanism and an associated shoe at each side of the machine, plates each secured to one of said mechanisms and arranged to bear on the upper surface of the respective shoes for transmitting to the latter the weight of the machine during the machine elevating and advancing portion of the walking cycle, and means comprising flexible members operatively attaching the shoes to the respective plates whereby the latter can slide laterally of the shoes during said portion of the walking cycle and said shoes will be suspended from said plates during a succeeding portion of the walking cycle and will be free to return to their original positions with relation to the respective plates.

2. Walking apparatus for an excavating machine comprising a crank arm mechanism and associated shoe at each side of the machine, a plate secured to each mechanism and arranged to make load-supporting contact with the respective shoe during the machine elevating and advancing portion of a walking cycle, and flexible means attaching said shoes to the plate to accommodate limited relative movement between the respective shoes and plates during said portion of the walking cycle.

3. Walking apparatus for an excavating machine comprising a crank arm mechanism and associated shoe at each side of the machine, a plate secured to each mechanism and arranged to make load supporting contact with the respective shoe during the machine elevating and advancing portion of a walking cycle, and means comprising flexible members attaching the shoes to the respective mechanisms for affording relative sliding movement therebetween and for effecting elevation and advancing movements of the shoes during the remaining portion of a walking cycle.

4. Walking apparatus for an excavating machine comprising a crank arm mechanism and an associated shoe at each side of the machine, a plate on the upper surface of each shoe providing a relatively large area of contact therewith, means attaching each plate to the respective mechanism, and flexible means at opposed portions of each plate securing the same to the respective shoe to enable limited relative sliding movement of the plate upon the shoe during the machine elevating and advancing portions of a walking cycle.

5. Walking apparatus for an excavating machine comprising a crank arm mechanism and an associated shoe at each side of the machine, a slidable load distributing plate on the upper surface of each shoe, means operatively securing each mechanism to the respective plate, and means comprising flexible members securing each plate to the associated shoe for limiting the sliding movement of the former with respect to the latter and for supporting the shoes during the shoe elevating and advancing portion of a walking cycle.

6. Walking apparatus for an excavating machine comprising a rotary crank arm mechanism and a ground engaging shoe at each side of said machine, load supporting and distributing plates, connected with the respective crank arm mechanisms for movement thereby and arranged to bear upon the upper surfaces of the respective shoes during the machine advancing portion of a walking cycle, and means for connecting each plate with its associated shoe for movement as a whole on and transversely to said shoe during said machine advancing portion of said walking cycle, for preventing substantial movement of said plate lengthwise of and with relation to said shoe and for causing said shoe to move with said plate during a succeeding portion of said walking cycle.

7. Walking apparatus for an excavating machine comprising a rotary crank arm mechanism and a ground engaging shoe at each side of said machine, load supporting and distributing plates, connected wth the respective crank arm mechanisms for movement thereby and arranged to bear upon the upper surfaces of the respective shoes during the machine advancing portion of a walking cycle, and means for connecting each plate with its associated shoe for movement as a whole on and transversely to said shoe during said machine advancing portion of said walking cycle, for preventing substantial movement of said plate lengthwise of and with relation to said shoe and for supporting said shoe for movement with relation to said plate to its original position during the shoe advancing portion of said walking cycle.

THOMAS C. MULLINS.