Feb. 3, 1970 E. C. WILSON 3,493,064

WALKING MECHANISM FOR DRAGLINE EXCAVATORS AND THE LIKE

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Fig. 1

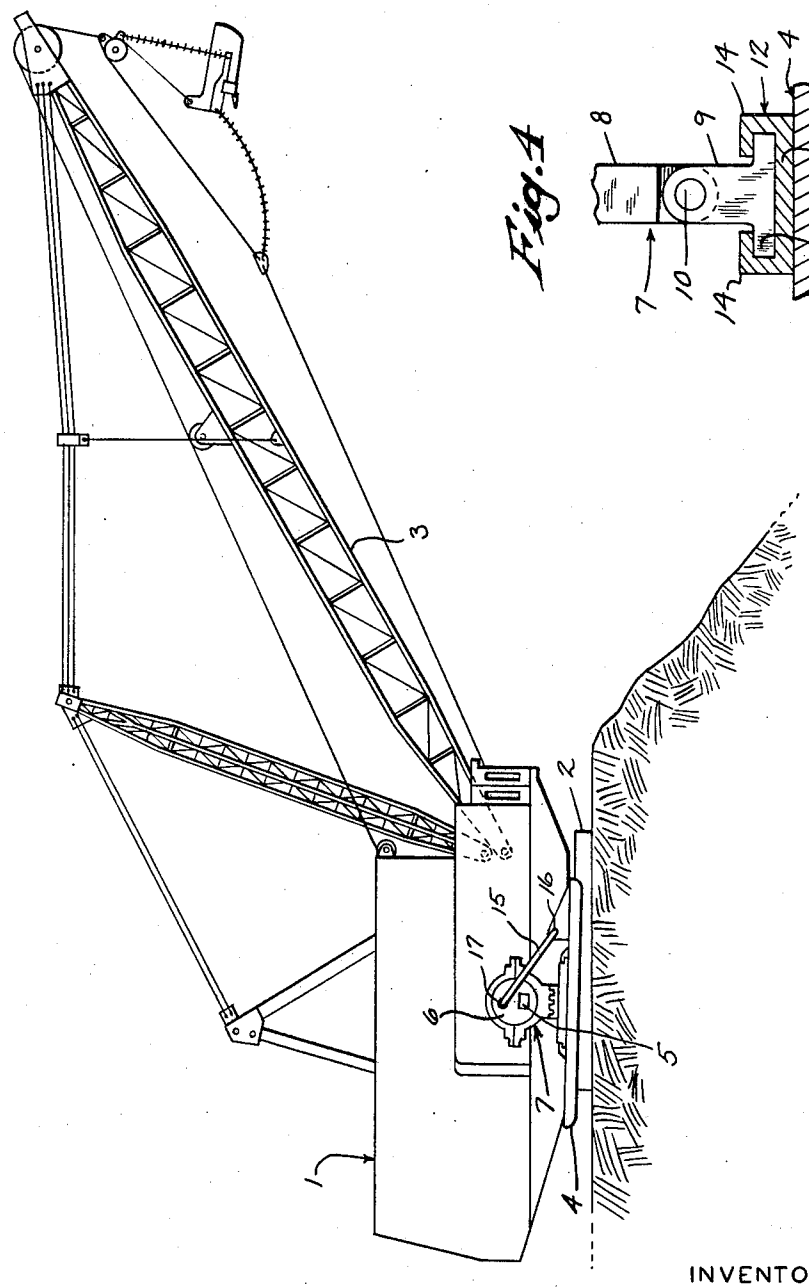

Fig. 4

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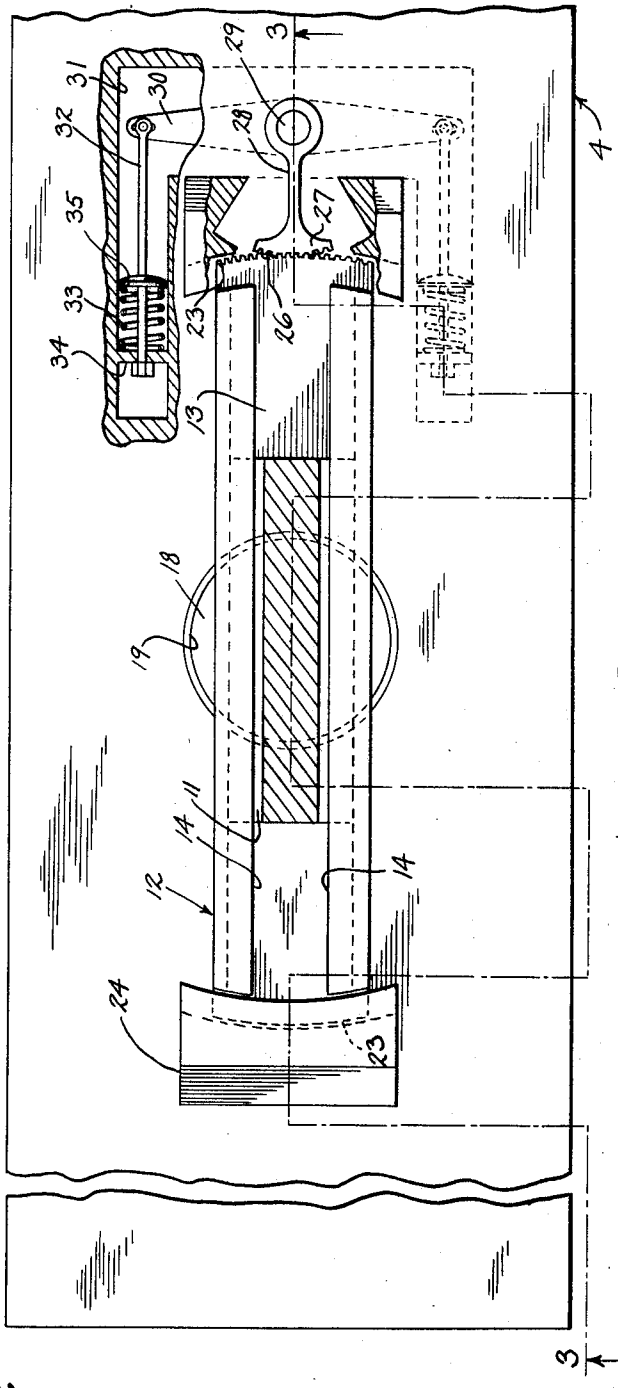

Fig. 2

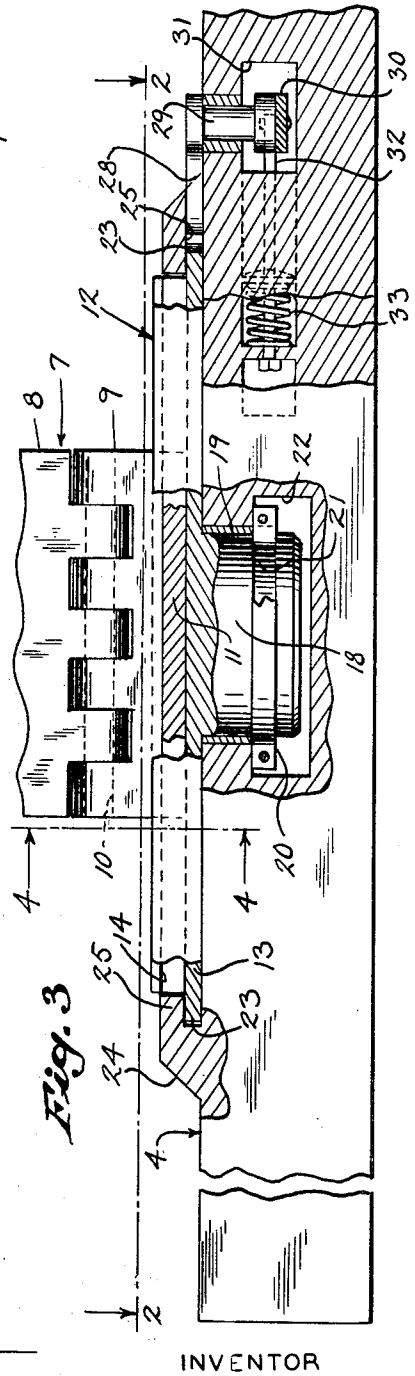

Fig. 3

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WALKING MECHANISM FOR DRAGLINE EXCAVATORS AND THE LIKE

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Int. Cl. B62d 57/02, 51/06
U.S. Cl. 180—8 6 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to a walking dragline of the type having walking shoes on opposite sides of the machine which have a slide and slideway connection with the machine to allow for relative longitudinal movement during a stepping action. According to the invention, the slideways on the walking shoes are pivotally mounted to allow for rotation of the machine relative to the walking shoes to compensate for uneven ground conditions; and spring biased equalizer bars are provided on the shoes and engage the slideways to urge the shoes toward aligned positions parallel to the machine.

This invention relates to a walking mechanism for dragline excavators and the like. More particularly, it resides in an improved walking mechanism of the type where there is a slide and slideway connection between a walking shoe and the machine, the primary improvement residing in mounting the slideway pivotally on the shoe to compensate for uneven ground conditions.

A walking dragline usually has two shoes or sets of shoes on opposite sides of the main frame of the machine. When the machine is walking over uneven terrain, one shoe may contact the ground before the other. Even on flat surfaces, one shoe may be on firmer ground than the other shoe. Whenever the machine encounters such uneven conditions, there is a tendency for the machine to rotate relative to one or both shoes. If the mechanical connection between the machine and shoes does not allow for at least some relative rotation, the walking mechanism or the entire machine will be subjected to severe torsional and bending forces and stresses which can result in serious damage or destruction. This problem exists in all machines of this general type, but is particularly serious in extremely large and heavy machines. The machine disclosed therein, for example, has a working weight of approximately 25 million pounds, and is equipped with a 220 yard bucket and a boom in excess of 300 feet in length. The stresses which might be encountered in moving a machine of such proportions are enormous. Further, with a machine of this size the shoes are spaced so far apart that the likelihood of encountering uneven ground conditions is quite great.

The walking mechanism described in U.S. Patent No. 3,265,145 to Beitzel provides one workable solution to the problem of relative rotation. The machine therein described is provided with walking shoes having slideways rigidly mounted thereon, and slides on the machine proper which are slidably received in the slideways. To compensate for ground irregularities, the slideways are constructed so as to provide a loose fit for the slides and this allows for lateral, angular rotation of the shoes with respect to the machine. It is also important to provide a means for aligning the shoes prior to the beginning of a walking step, however, and to accomplish this, the Beitzel patent calls for slideways which are tapered at one end, the slides being intended to be in the narrowest part of the slideway just prior to the beginning of a step when the shoes are still off the ground. Although the

Beitzel structure is quite satisfactory, for various reasons it has been found that as a practical matter the lateral, angular rotation of the shoes in either direction is limited to about 2°. There are times when this degree of rotation is not enough, and it becomes necessary to provide for considerably greater rotation of the shoes. Further, where there are uneven ground conditions, it is possible with the tapered slideway for the slide to still be in the narrowed part of the slideway after the beginning of a walking step when the shoes are on the ground and weight is being put on them. In this case there is no room for relative rotation when it is most needed.

SUMMARY OF THE INVENTION

In accordance with this invention, an improved walking mechanism for a dragline excavator is provided which includes a walking shoe capable of greatly increased lateral, angular rotation in either direction with respect to the machine proper. This is accomplished primarily by providing a pivotally mounted slideway on the walking shoe.

It is the general object of this invention to provide an improved walking mechanism which includes such a pivotal slideway to provide for increased rotatability. In the particular embodiment shown, for example, the walking shoe is capable of up to as much as 6° to 8° lateral, angular rotation in either direction.

It is another object of this invention to provide an improved walking mechanism which includes means for aligning the walking shoe with respect to the machine at the beginning of a walking step.

It is still another object of the invention to provide a walking mechanism having the foregoing advantages which is adaptable for use in various types of walking machines.

It is still another object of the invention to provide an improved mechanism which has the several cited features and advantages which is quite strong and readily adaptable to very large machines while still being relatively simple and inexpensive to manufacture and maintain.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a somewhat schematic side view in elevation showing a walking dragline excavator provided with a walking mechanism constituting a preferred embodiment of the invention,

FIG. 2 is an enlarged fragmentary top view through the plane 2—2 shown in FIG. 3, with parts shown broken away and in cross-section, further illustrating the walking mechanism of FIG. 1,

FIG. 3 is an enlarged fragmentary side view, with parts shown broken away and in cross-section, taken in the plane 3—3 shown in FIG. 2, and

FIG. 4 is an enlarged fragmentary end view taken in the plane 4—4 shown in FIG. 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The dragline excavator shown in FIG. 1 is generally conventional and, for this reason and since the walking mechanism of this invention is equally useful for other types of machines, is shown somewhat schematically and will be described only briefly. It includes, in general, a main or revolving frame 1 which is revolvably mounted on a central supporting base or tub 2 and which supports a main boom 3 and usual appurtenant elements. A pair of identical walking shoes 4, only one of which can be seen, are disposed alongside the frame 1 and base 2 on opposite sides and are connected to the frame 1 as will be described to be revolvable with it.

The connections between the frame 1 and shoes 4 constitute the walking mechanisms, which are generally as shown and described in the said U.S. Patent No. 3,265,-

145. Again, however, only one set of connections or mechanism can be seen and will be described, but the mechanism on the other side of the machine is the same.

The walking mechanisms are driven by means of a shaft **5** which extends outwardly on both sides of the frame **1** and is driven by suitable motors (not shown). Each walking mechanism includes a circular driving disc **6** eccentrically mounted on the shaft **5** and a walking frame designated generally by the reference numeral **7** which is rotatably mounted on the disc **6**. The walking frame **7** includes an upper part **8**, which actually receives the disc **6**, and a lower part **9**, with a hinge connection **10** therebetween. The lower part **9** is provided with laterally extending flanges **11** to have an inverted T-configuration, and serves as a slide as will be described.

A longitudinally extending slideway designated generally by the reference numeral **12** is provided on the flat upper surface of the shoe **4**, and slidably receives the slide part **9** of the walking frame **7**. In the embodiment shown, the slideway **12** is of unitary construction and includes a flat base portion **13** against the shoe **4** and opposite, facing angle portions **14** which overhang the slide flanges **11**. The slideway, could, of course, also be made up of separate parts bolted or otherwise connected together.

A rigid link **15** has one end pivotally connected to the shoe **4** at a point **16**. The other end of the link **15** is pivotally connected to the disc **6** at a point **17** that is generally diametrically opposite from the shaft **5**.

The operation of the walking mechanisms is as described in the aforesaid Beitzel patent. Rotation of the shaft **5** causes the frame **7** to be moved in what would be a circular path were the shoe **4** suspended in space. At the same time, the link **15** causes the shoe **4** to slide forwardly and rearwardly with respect to the frame **7**, this motion being additive to give a resultant thoretical elliptical path to the shoe **4**. In actual operation, the shoe **4** is moved forwardly and downwardly until it contacts the ground, and further rotation of the shaft **5** causes the leading edge of the tub **2** to be lifted and the machine proper to be moved in the same direction as the shoe. The tub **2** is then lowered and the shoe **4** picked upwardly and moved forwardly again. The net result of repeated rotations is a stepping type of action in which the machine moves in a direction away from the boom **3**, or to the left as seen in FIG. 1.

A large circular pivot pin **18**, seen most clearly in FIG. 3, is fixed to the underside of the slideway base portion **13**, at a suitable point as will be described, and is received in a circular opening **19**, which is provided with a suitable bearing surface, in the top of the shoe **4**, so that the entire slideway **12** is pivotally mounted on the shoe **4** to be movable in a horizontal plane. A split retaining collar **20** received in an annular recess **21** near the outer end of the pin **18** and disposed in an enlarged chamber **22** below the opening **19** holds the slideway **12** against vertical movement.

The ends of the slideway base portion **13** extend beyond the angle portions **14** to define toe portions **23** which are generally arcuate. A spaced set of retaining blocks **24** are rigidly mounted on the top of the shoe **4** at either end of the slideway **12** and include lip portions **25** which overhang the toe portions **23** to further hold the slideway **12** against vertical movement off the shoe **4**.

It will be appreciated that the pivotal mounting of the slideway **12** allows, in effect, for relative rotation between the machine proper and the shoes **4** in the event of uneven ground conditions. In the embodiment shown, up to 6° to 8° of rotation is possible, which represents a substantial improvement over known prior arrangements. The hinge connection **10** is also helpful in the event of uneven ground conditions since it provides for movement of the shoes in a vertical plane transverse to the line of movement of the machine.

In the embodiment shown, the pin **18** is approximately at the longitudinal center of the slideway base **13**. The location of the pivot pin **18** with respect to the slide **9** and disc **6** constantly changes during walking since the shoe **4** is constantly moving with respect to the frame **7**. To insure maximum effectiveness, the pin **18** should be located so that it is approximately directly under the center line of the disc **6** when the shoe **4** is placed on the ground at the beginning of a step, or in other words at about the time when the tub **2** begins to be raised.

As can be seen in FIGS. 2 and 3, the right-hand toe portion **23** of each slideway **12** is provided with cast teeth **26**. The teeth **26** mesh with a rack segment **27** at one end of a lever arm **28** which has its other end fixedly connected by means of a vertical pin **29** to an equalizer bar **30** disposed in a cavity **31** in the shoe **4**. Rods **32** are fastened to each end of the bar **30**, and constant biasing forces of equal magnitude are applied to the rods **32** by means of springs **33** which operate between brackets **34** in the shoe **4** and retainers **35** fixed to the rods **32**. These elements constitute an aligning means which exerts a constant force resisting the relative pivotal movement between the shoe **4** and slideway **12** in either direction. Thus, the shoe **4** is urged toward a parallel relationship with the slideway **12**, the slide **9**, the frame **7** and the main frame **1**, the two shoes **4** also being urged toward a parallel relationship with one another.

The alignment provided by the arm **28** and bar **30** and their associated elements insures that the shoes **4** will be properly positioned at the beginning of each step. The aligning elements are effective only when the shoe **4** is raised off the ground, however, and are overridden when the machine proper is being lifted or moved. They do not, therefore, interfere with the desired compensating pivotal movement of the slideway **12**.

Thus, the embodiment of the invention shown and described herein provides an improved walking mechanism which provides for substantially increased rotatability of the shoes **4**. It will be obvious that the arrangement shown is relatively simple and easily adaptable to even very large machines.

Although a preferred embodiment of the invention has been shown, it will be obvious that various modifications are possible without departure from the spirit of the invention. The invention is of course not necessarily limited to dragline excavators, and may be useful in other types of walking machines. Nor is the invention limited to the particular basic type of walking mechanism shown. the copending application of Kraschnewski et al. Ser. No. 506,207, filed Nov. 3, 1965, and now Patent No. 3,375,892 for example, shows a walking arrangement involving vertical and horizontal hydraulic cylinders to effect the desired motion. The Kraschnewski et al, arrangement also includes a slide and slideway connection between walking shoes and a machine and the pivotal slideway herein could be advantageously incorporated therein.

Further, changes could be made in the specfic embodiment shown. The particular slide and slideway arrangement in which the slide **9** has an inverted T-configuration and the slideway **12** has the overhanging angle portions **14** is not critical; and a reverse arrangement could be used with the slideway having an upright T-configuration and the slide having inwardly extending flanges under the crossbar portion thereof. Other aligning arrangements for the shoes **4** could also be provided, or the particular arrangement shown could be provided at both ends of each slideway **12**.

What is claimed is:

1. In a walking mechanism for a dragline excavator and the like having a revolving frame, a slide operatively connected to the revolving frame, a shoe alongside the revolving frame, and a slideway on the shoe that slidably receives the slide to allow for relative longitudinal movement between the shoe and the revolving frame,

the improvement wherein

the slideway is pivotally mounted on the shoe to be movable in a horizontal plane.

2. The walking mechanism of claim 1 wherein the slideway comprises a base portion and there is a pivot pin attached to the underside of the base portion which is received in the shoe to pivotally mount the slideway thereon.

3. The walking mechanism of claim 1 wherein the slideway has a toe portion at each end thereof; and there is a spaced set of facing retaining blocks mounted on the shoe, said blocks overhanging respective toe portions of the slideway.

4. The walking mechanism of claim 1 which includes means for aligning the shoe with respect to the slideway prior to the beginning of a walking step.

5. The walking mechanism of claim 4 wherein the aligning means comprises bias means operative between the shoe and slideway to exert a constant force resisting relative pivotal movement in either direction.

6. The walking mechanism of claim 5 wherein there are teeth provided on at least a portion of at least one of the toe portions; and there is a lever arm having a rack segment at one end which meshes with said teeth; and there is an equalizer bar, the other end of the lever arm being fixedly connected to the equalizer bar intermediate the ends of the bar; and the bias means acts against the ends of the bar.

References Cited

UNITED STATES PATENTS

2,399,375	4/1946	Mullins.
2,399,417	4/1946	Wilson et al.
3,265,145	8/1966	Beitzel.
3,375,892	4/1968	Kraschnewski.

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