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3,531,088

HOIST MECHANISM FOR BUCKET

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2 Sheets-Sheet 1

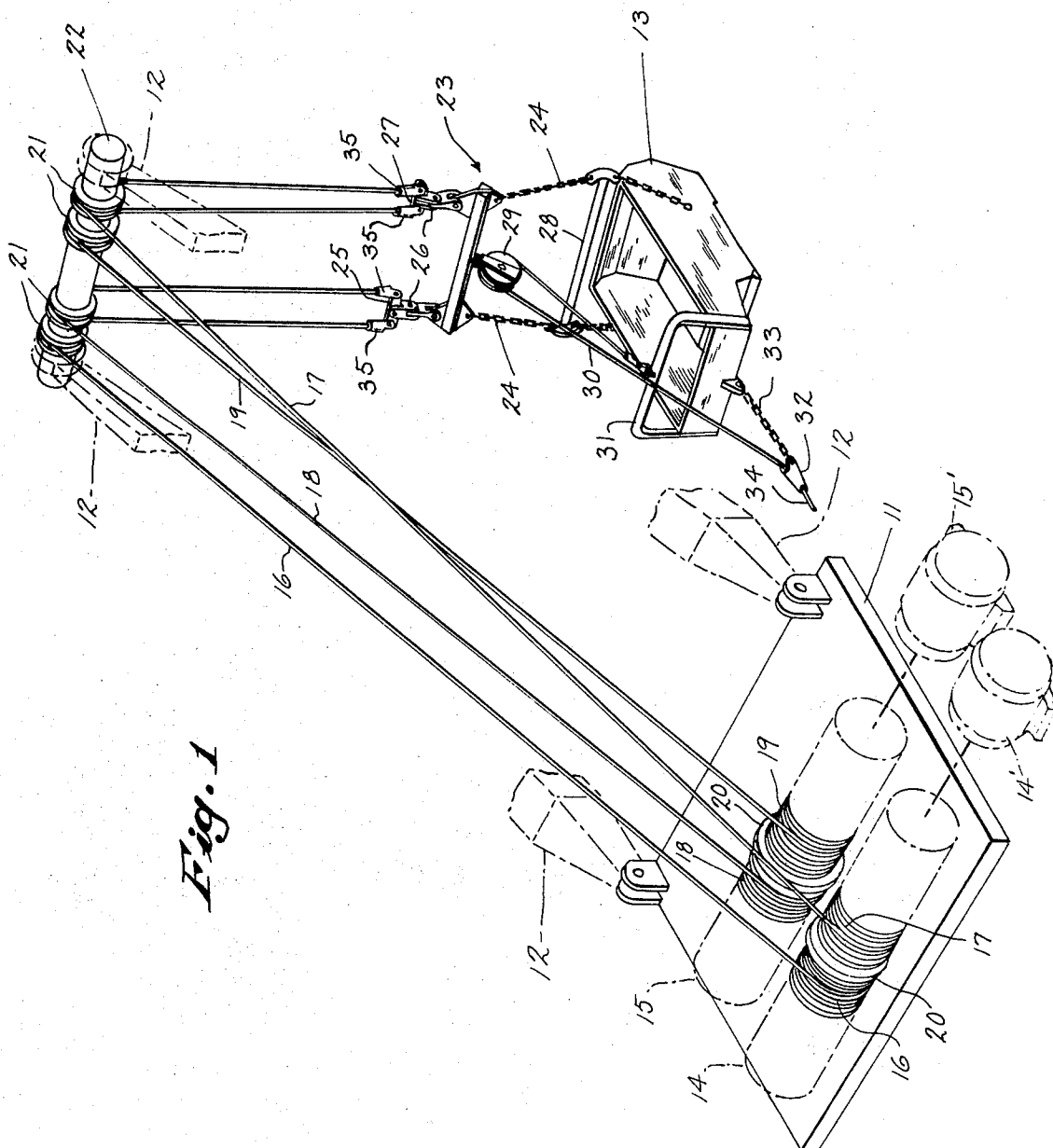


Fig. 1

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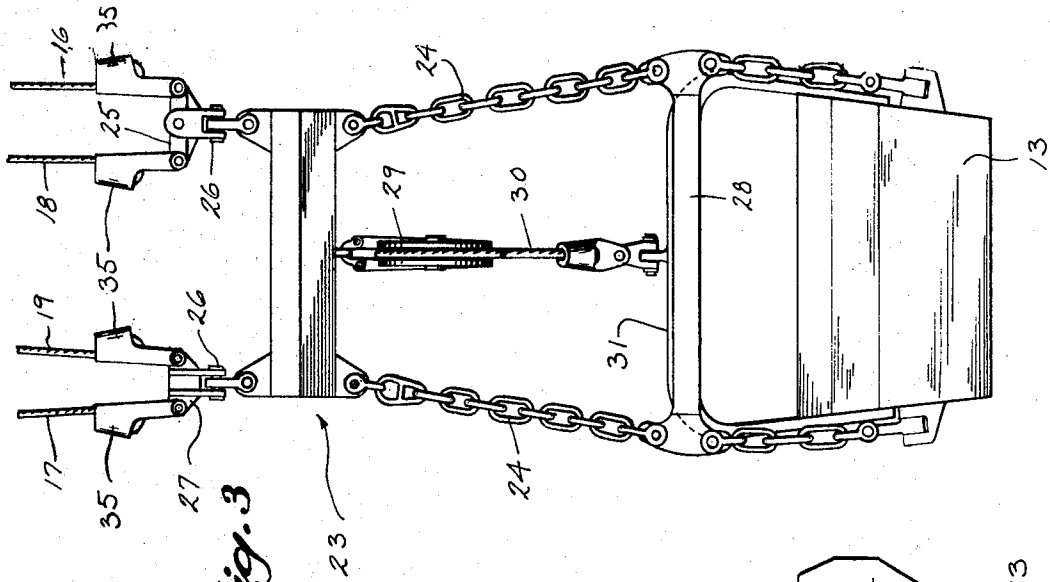


Fig. 3

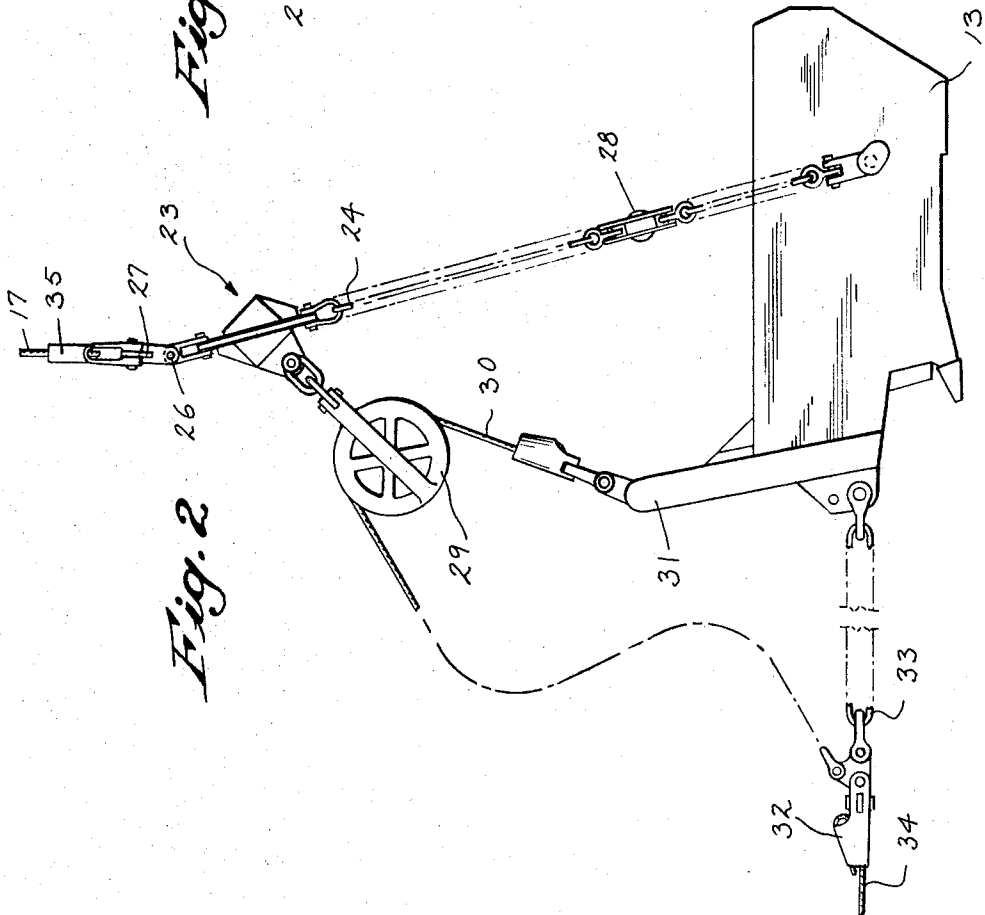


Fig. 2

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1

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HOIST MECHANISM FOR BUCKET

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1 Claim

ABSTRACT OF THE DISCLOSURE

A bucket hoist mechanism for a dragline excavator includes two independently driven hoist drums and two pairs of hoist cables. The drums are mounted on the working frame of the machine, and one pair of cables leads from each drum and passes about the tip of the boom to be attached to a suspension bar from which the bucket is suspended. One cable from each pair is attached to an equalizer beam at one end of the suspension bar, and the other cable from each pair is attached to the other end of the suspension bar, this arrangement resulting in equal sharing of the load by the two hoist drums.

BACKGROUND OF THE INVENTION

This invention relates but is not necessarily limited to a hoist mechanism for a dragline excavator. More particularly, it resides in a hoist mechanism wherein there are two independently driven hoist drums for the bucket and a cable and suspension arrangement which results in the two drums equally sharing the load of the bucket.

It is common to suspend a dragline bucket by means of chains which lead from the sides of the bucket to a hoist link, with a single hoist cable or set of cables leading upwardly from the link and around the tip of the boom to a single hoist drum on the working frame. A single hoist drum is not satisfactory for large machines, since it is difficult to provide the required capacity. A single cable arrangement is not suitable for extremely large machines either since the hoist cable would have to be too large and heavy to be handled or to be bent around a usual hoist drum or pulley.

To overcome these difficulties, it is desirable to be able to use more than one cable or set of cables and more than one drum. This presents serious problems, however, primarily because it is difficult with a plurality of cables and drums to insure that the load of the bucket is shared equally.

SUMMARY OF THE INVENTION

It is the general object of this invention to provide a bucket hoist mechanism for dragline excavators or the like which includes two independently driven hoist drums, two sets of cables, and a suspension arrangement that insures equal sharing of the load by the hoist drums.

Specific objects of the invention include providing a hoist mechanism of the foregoing type which is adaptable for use in various types of machines, and that is quite strong and readily adaptable to very large machines, all while providing a mechanism that is relatively simple and inexpensive to manufacture and maintain.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view in perspective illustrating a dragline working frame and boom and a hoist mechanism according to the invention.

FIG. 2 is an enlarged side view in elevation further illustrating the bucket suspension arrangement of the mechanism of FIG. 1, and

FIG. 3 is an enlarged front view in elevation of the bucket suspension arrangement of FIGS. 1 and 2.

2

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1, the reference numeral 11 designates the working frame of a conventional dragline excavator, the numeral 12 designates a boom (only the bifurcated foot and tip actually being shown) footed on the frame 11, and the numeral 13 indicates a drag bucket. Various types of draglines and the elements thereof are well known in the art; and for this reason and because the invention herein is equally suitable in other environments, the complete machine has not been shown herein. One showing of a large dragline excavator in which this invention can be incorporated can be found in the copending application of Kraschnewski et al., Ser. No. 506,207, filed Nov. 3, 1965.

A first hoist drum 14 and a second hoist drum 15 are suitably mounted on the frame 11, and are independently driven by suitable driving means 14' and 15', respectively. It is contemplated that the driving means will be of any conventional type that operates with a drooping torque-speed curve. Direct current electric motors are usually most preferred as driving means for the drums in machines of this type, but other drivers having the desired torque-speed characteristics can be employed, such as certain types of alternating current electric motors, hydraulic motors, gasoline or diesel engines, or the like.

The drums 14 and 15 are divided into left and right sections (as seen in FIG. 1) by flanges 20, and a pair of cables leads from each drum and passes about pulleys 21 rotatably mounted on a shaft 22 fixed to the tip of the boom 12. The first pair of cables leads from the first hoist drum 14 and consists of a left cable 16 and a right cable 17. The second pair of cables leads from the second hoist drum 15 and consists of a left cable 18 and a right cable 19.

The ends of cables 16 through 19 are attached to a suspension bar, designated generally by the numeral 23, from which the bucket 13 is suspended by means of hoist chains 24 which lead to opposite sides thereof. An equalizer means in the form of a pivotal beam 25 is mounted at one end of the suspension bar 23 by means of a two-pin type of universal connection 26; and one member of each pair of cables, the left cables 16 and 18 in this case, is attached to the opposite ends of the equalizer beam 25 to be connected to the equalizer means. The other, right, member of each pair of cables, i.e., cables 17 and 19, is attached to a rigid link 27 mounted at the other end of the suspension bar 23 by means of another two-pin universal connection 26. As will be discussed below, the net effect of the connection of the cables 17 and 19 is an intent to be to have them connected to the bar 23 at substantially a common point at the opposite end from the equalizer means.

A spreader bar 28 is provided intermediate the suspension bar 23 and the bucket 13 to separate the hoist chains 24 and keep them off the sides of the bucket 13. A dump block 29 is conveniently mounted on the bar 23 intermediate its ends. A dump rope 30 passes about the dump block 29, one end of the rope 30 being attached to an arch 31 welded on the bucket 13 and the other end being attached to a drag line 32. A drag chain 33 is attached to the link 32 and the bucket 13, and a drag rope 34 is also attached to the link 32 and to the machine proper, such assembly being adapted for usual drag and dump operations.

Assuming the cables 17 and 19 to be connected to the bar 23 at substantially a common point, the arrangement shown insures that the independently driven drums 14 and 15 will always share the load equally while the bucket 13 is being lifted. Assuming a suspended load "X," each end of the suspension bar 23 supports one-half "X." There-

3

fore, the sum of the forces in the left cables 16 and 18 equals one-half "X," or

$$f_{16} + f_{18} = \frac{X}{2}$$

Likewise, the sum of the forces in the right cables 17 and 19 equals one-half "X," or

$$f_{17} + f_{19} = \frac{X}{2}$$

The sum of the forces in the first pair of cables 16 and 17 is directly proportional to the torque or load in the first hoist drum 14, or

$$f_{16} + f_{17} = f_{14}$$

Similarly, the sum of the forces in the second pair of cables 18 and 19 is directly proportional to the torque or load in the second hoist drum 15, or

$$f_{18} + f_{19} = f_{15}$$

Because of the action of the equalizer beam 25, the force in the cable 16 equals the force in cable 18, or

$$f_{16} = f_{18}$$

Therefore, any differences in force in the cables when a suspended load is being hoisted must necessarily show up as a difference in force between cables 17 and 19.

Assuming a torque differential in the two hoist drums, the following equation can be written:

$$f_{14} - f_{15} = (f_{16} + f_{17}) - (f_{18} + f_{19})$$

Since $f_{16} = f_{18}$, it follows that $f_{14} - f_{15}$ (the difference in load on the drums) $= f_{17} - f_{19}$ (the difference in load on the cables). A force differential between cables 17 and 19 will, therefore, resolve itself as a torque differential between drums 14 and 15.

Since each hoist drum is independently driven by a driving means of the type that operates with a drooping torque-speed curve, preferably D-C electric motors, any difference in torque between the two hoist drums will result in the drum with the higher torque slowing down permitting the drum with the lower torque to catch up and increase its torque, thus equalizing the load between the two drums and keeping it equalized. The net effect of the arrangement shown, therefore, is to keep the two hoist drums 14 and 15 substantially in step at all times. It will be obvious that the arrangement shown for the cables, drums, suspension bar and bucket is relatively simple and easily adaptable to even very large machines.

As previously indicated, the analysis of the operation of the arrangement shown presupposes that the cables 17 and 19 are connected to a common point on the bar 23; and the simplest possible form of the invention would have this sort of connection and would also probably have the equalizer beam 25 pivotally mounted more directly on the bar 23. As a practical matter, however, such direct connections are difficult to use, especially for very large machines. It is highly desirable, for example, to provide for some lateral movement of the bar 23 and the suspended bucket 13 during swinging movements, and it is to provide for such movement that universal connec-

4

tions, which can be the two-pin types of connections 26 that are shown or equivalent connections, are interposed between the ends of the cables and the bar 23. It is also necessary to have some sort of connecting socket at the end of each cable, the sockets for all the cables being indicated by the reference numeral 35 in the drawings, and two of the conventional sockets shown cannot and are not readily adaptable to be connected to a single pin or point. Accordingly, it is necessary to have the connections for the cables 17 and 19 laterally spaced on the link 27 (such spacing would be necessary even if the cables 17, 19 were connected directly to the bar 23) although this spacing should be kept to a minimum. Any variations caused by the actual method of connecting are minimal; however, and for all practical purposes, as will be apparent to those skilled in the art, the cables 17 and 19 can be considered as leading to substantially a common point. Actual operation will be, therefore, substantially as has been described.

Although a preferred embodiment of the invention has been shown, it will be obvious that various modifications are possible without departure from the true spirit and scope of the invention. The invention, of course, is not necessarily limited to dragline excavators and may be useful with other types of machines whenever it is desired to use two sets of cables and two drums. As previously noted, other types of connections between the cables and suspension bar are possible; and various other forms of equalizer means, such as pulleys, which are fully equivalent to the particular beam construction shown could be used. It is not intended, therefore, that the invention be limited by the showing herein or in any other way except insofar as specifically required.

What is claimed is:

1. In a hoist mechanism for the bucket of a dragline excavator or the like, the combination comprising: two independent hoist drums; two independent drive means, one operatively associated with each hoist drum, both of said drive means being of a type having a drooping torque-speed curve; two pairs of hoist cables, one pair leading from each drum; an elongated suspension bar; a bucket supported from the suspension bar; equalizer means pivotally attached to the bar at one end thereof, one member of each pair of cables being attached to the equalizer means; and non-equalizing means to connect the other member of each pair of cables to the other end of the suspension bar at an effectively substantially common point.

References Cited

UNITED STATES PATENTS

1,025,155	5/1912	Penfield	254—144
2,633,649	4/1953	Page	37—116

FOREIGN PATENTS

400,631	8/1924	Germany.
915,621	7/1954	Germany.

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37—116; 254—135, 139