

Feb. 21, 1967

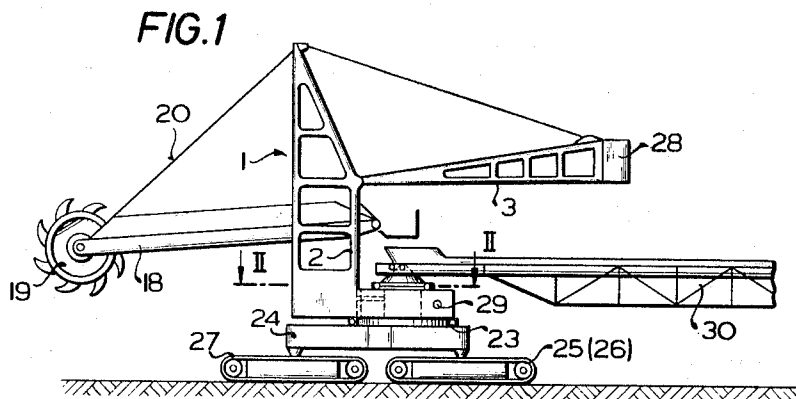
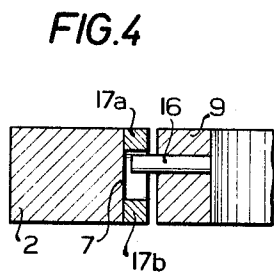
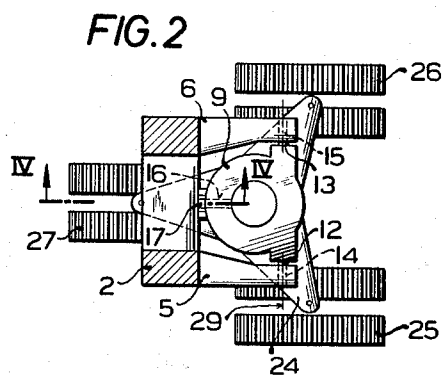
A. BECKER

3,304,634

EARTH WORKING MACHINE, SUCH AS A BUCKET WHEEL
DREDGE, OR THE LIKE

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2 Sheets-Sheet 1



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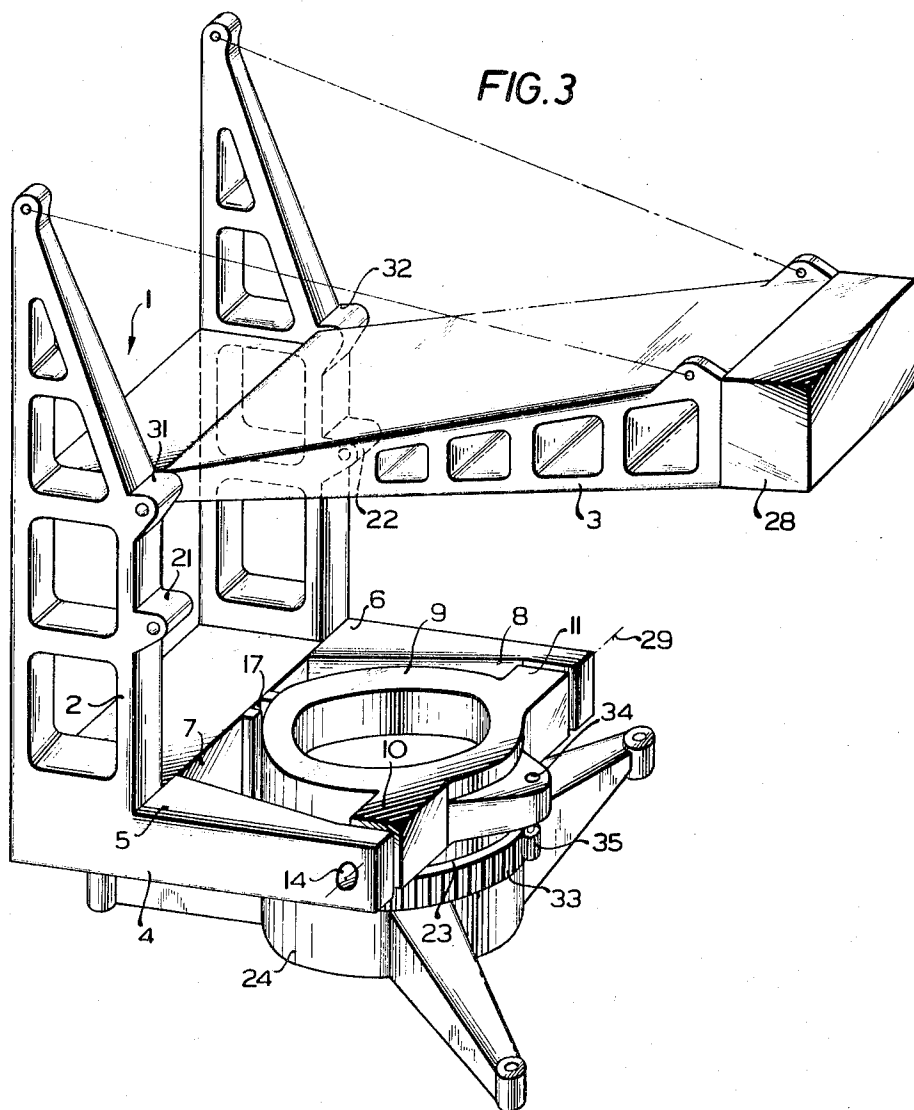
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EARTH WORKING MACHINE, SUCH AS A BUCKET WHEEL DREDGE, OR THE LIKE

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The present invention relates to an earth working machine, such as a bucket wheel dredge, which includes an upper substantially C-shaped support structure, a turntable connected to the upper support structure and supporting the same turntable about a substantially vertical turning axis, a lower preferably movable support structure adapted to rest on the ground and an annular antifriction thrust bearing fixedly carried by the lower support structure and supporting the turntable turntable about its turning axis.

The machine includes further a working boom preferably pivotally connected at one end thereof to an upright portion of the C-shaped upper support structure projecting to one side thereof and carrying at the outer end thereof earth engaging means, for instance a bucket wheel. The working boom is held in a preselected position relative to the upright portion of the upper support structure by elongated flexible means connected to the outer end of the boom and to the upright portion of the upper support structure. The construction is made in such a manner that the weight of the working boom and the load acting on the outer end thereof is properly balanced by the portions of the C-shaped upper support structure projecting in direction opposite to the working boom from the upright portion of the upper support structure, so that the center of gravity of the upper support structure is located substantially along the turning axis of the turntable during normal operating conditions of the machine. In this arrangement, and under normal operating conditions, the turntable will be properly supported on the annular antifriction thrust bearing and the various antifriction elements of the bearing will be uniformly loaded. If, however, the working end of the boom comes to rest on the material to be worked in such a manner that the boom is tilted in upward direction and the elongated flexible means connecting the outer end of the working boom to the upright portion of the upper support structure slacken, the center of gravity of the upper support structure will shift to a position spaced laterally of the turning axis of the turntable, so that the antifriction elements of the annular thrust bearing will not be uniformly loaded any longer; and in extreme cases this shifting of the center of gravity of the upper support structure may lead to a damage of the antifriction thrust bearing or even to a tilting of the turntable and the upper support structure connected thereto relative to the thrust bearing and even to a toppling over of the upper support structure.

The slackening of the elongated flexible means holding the working boom in a predetermined position relative to the upright portion of the C-shaped upper support structure can have various causes, for instance the material to be worked on by the working elements at the outer end of the boom may collapse and settle beneath the outer end of the boom to lift this outer end, or when a winch is provided to wind up the elongated flexible means more or less to change the angular position of the boom relative to the upright portion of the supporting structure a slackening of the elongated flexible means may occur during improper operation of the winch in direction lowering the boom, or due to failure of the

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winch brake, or due to various other circumstances.

It is an object of the present invention to avoid the aforementioned disadvantages of earth working machines of the aforementioned kind.

It is an additional object of the present invention to construct an earth working machine of the aforementioned kind in such a manner that during change of a load on the free end of the working boom thereof the upper support structure may tilt relative to the turntable without affecting the position of the latter relative to the annular antifriction thrust bearing.

It is a further object of the present invention to provide a machine of the aforementioned kind in which the position of the turntable relative to the annular antifriction thrust bearing is not affected during change of the load on the free end of the working boom, and which is composed of relatively few and simple parts so that the machine may be constructed at reasonable cost and will stand up trouble-free under extended use.

With the objects in view, the earth working machine, such as a bucket wheel dredge or the like, according to the present invention mainly comprises a lower support structure adapted to rest on the ground, an upper substantially C-shaped support structure having a substantially upright portion and an upper and lower substantially horizontal portion respectively projecting from opposite ends and to one side of the upright portion, a working boom connected at one end thereof to the upright portion projecting to the other side therefrom, a turntable having a turning axis, a ring of antifriction elements carried by the lower support structure coaxially with a turning axis of the turntable and supporting the latter turntable about the turning axis, mounting means mounting the lower portion of the upper support structure on the turntable tiltable about a tilting axis located laterally of and substantially normal to said turning axis, and cooperating means on the turntable and the upper support structure for limiting tilting movement of the upper support structure relative to the turntable, whereby during change of a load on the free end of the working boom the upper support structure may tilt relative to the turntable without affecting the position of the latter relative to the ring of antifriction elements.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a schematic side view of the machine according to the present invention;

FIG. 2 is a schematic sectional view taken along the line II—II of FIG. 1;

FIG. 3 is a perspective view drawn to an enlarged scale and illustrating especially the turntable and the substantially C-shaped upper support structure tiltable mounted thereon; and

FIG. 4 is a partial sectional view taken along the line IV—IV of FIG. 2 and drawn to an enlarged scale.

Referring now to the drawings, it will be seen that the earth working machine according to the present invention comprises an upper substantially C-shaped support structure having a substantially upright portion constituted by a pair of rigid frame members 2 and an upper substantially horizontal portion 3 as well as a lower substantially horizontal portion 4 respectively projecting from opposite ends and to one side, that is the right side as viewed in FIGS. 1 and 3, of the upright portion 2. The upper horizontal portion or frame 3 of

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the upper support structure 1 may be either rigidly connected to the upright frames 2 or, as clearly shown in FIG. 3, be pivotally connected thereto at bearing portions 31 and 32 respectively projecting from the upright frames 2 intermediate the ends thereof. The outer end of the frame 3 preferably carries a balancing weight 28 and the outer end of the frame 3 is preferably connected by elongated flexible means 20 which may be formed from wire ropes or the like to the upper ends of the upright frame members 2. A winch not shown in the drawings, may be carried on the upper ends of the frames 2 and the wire ropes 20 may be connected to the winch and be wound up thereon to a greater or lesser degree so as to change the angular position of the frame member 3 with respect to the upright frame members 2. The lower portion 4 of the upper support structure includes a transverse portion 7 connecting the frame members 2 at the lower ends thereof and a pair of arms 5 and 6 projecting spaced from each other from opposite ends of the transverse portion 7 to define between the inner surfaces of the arms an open space 8. A preferably ring-shaped turntable 9 having a pair of bosses 10 and 11 projecting aligned with each other respectively to opposite sides of the ring-shaped turntable 9 laterally from the ring axis toward the free ends of the arms 5 and 6. A pair of pins 12 and 13 fixed to the bosses 10 and 11 and aligned along a common axis project respectively into appropriate bores 14 and 15 formed in the region of the free ends of the arms 5 and 6 so as to support the upper support structure 1 on the turntable 9 tiltable about a tilting axis 29 coinciding with the common axis of the pins 12 and 13. The pins 12 and 13 together with the bearing bores 14 and 15 form therefore means for supporting the upper support structure 1 on the turntable 9 tiltable about a tilting axis.

The arrangement includes further cooperating means on the turntable 9 and on the upper support structure 1 for limiting tilting movement of the upper support structure about the tilting axis 29 relative to the turntable. These cooperating means preferably include an additional pin 16 projecting substantially normal to the tilting axis 29 toward the transverse portion 7 of the lower portion 4 of the upper support structure 1, a pair of guide members 17 extending spaced from each other and in substantial vertical direction fixed to the inner surface of the transverse portion 7 and a pair of stops 17a and 17b are fixedly arranged between the guide members 17 respectively at the upper and lower ends thereof (FIG. 4) and forming thereby with the guide members 17 an elongated groove on the transverse portion 7 in which the free end of the pin 16 projects.

A working boom 18 is pivotally mounted at its rear end, that is the right end as viewed in FIG. 1, on a pair of bosses 21 and 22 (FIG. 3) projecting rearwardly from the upright frame members 2 of the upper support structure and the boom 18 extends from its attached rear end between the upright frame members 2 forwardly of the same and carries at its front end earth engaging means, for instance a bucket wheel 19, as schematically shown in FIG. 1. The bucket wheel 19 is rotated about its axis by motor means not shown in the drawing so that the buckets carried thereby will dig into material such as for instance earth located in front thereof and to transfer the material during rotation of the bucket wheel onto a conveyor carried by the boom 18 so that the material is transported toward the rear end of the boom. The construction of the bucket wheel itself as well as the construction of the conveyor on the boom 18 and the means for driving the bucket wheel 19 and the conveyor do not form part of the present invention and such arrangements are well known in the art and specific details of such an arrangement which are immaterial for the present invention have therefore not been illustrated in the drawings. Instead of a bucket wheel 19 and a separate conveyor it is also possible to use

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a bucket conveyor on the boom 18 in which the buckets at the front end will dig into the material to be worked on and transport the material picked up by the buckets to the rear end of the boom 18. The angular position of the boom 18 relative to the upright portion 2 of the upper support structure 1 is maintained by elongated flexible means 20, for instance wire ropes connected at one end thereof to the front end of the boom 18 and at the other end thereof to the top of the upright frame members 2. Preferably two wire ropes extending parallel to each other are used and preferably a winch is provided (not shown in the drawing) at the top of the upright members or at any other convenient location of the upper support structure 1 on which the ropes 20 connected to the front end of the boom can be wound up to a greater or lesser degree to change thereby the angular position of the boom 18 relative to the upright members 2. Such a construction is likewise well known in the art and the specific winch construction does not form part of the present invention and therefore the winch is not illustrated in the drawings. Under normal operating conditions the elongated flexible means 20 connected to the front end of the boom 18 and to the rear end of the member 3 will be in taut condition and the pin 16 projecting from the turntable 9 will abut against the upper stop 17a as shown in FIG. 4.

The turntable 9 rests with its lower surface on an annular antifriction thrust bearing or ring of antifriction elements 23, as schematically indicated in FIG. 1, which in turn is supported on the lower support structure, which includes an upper member 24 having three radially outwardly projecting arms respectively supported at the outer ends thereof on carriages 25, 26, and 27. The carriages 25-27 are preferably provided with caterpillar tracks which are driven in a known manner by means not shown in the drawings. The carriage 27 is arranged substantially along a longitudinal center line of the lower support structure, whereas the pair of carriages 25 and 26 are arranged rearwardly of the first carriage 27 and respectively to opposite sides of the aforementioned center line, symmetrically with respect thereto. Instead of providing carriages with caterpillar tracks it is also possible to use other means for transporting the dredge and for instance the dredge may also be arranged on rails and appropriately wheeled carriages, or other means known in the art may be used for transporting the dredge.

FIG. 1 shows also schematically a conveyor bridge 30 having a front end supported in any known manner on the top surface of the turntable 9 and this front end is located beneath the delivery end of the boom 18 to receive the material therefrom and to transport it to any desired location. The specific construction of the conveyor bridge 30 does not form part of the present invention and therefore this conveyor bridge is only schematically illustrated in FIG. 1. Instead of a conveyor bridge 30 supported at the front end thereof on the top surface of the turntable 9, it is also possible, when the turntable is ring-shaped as shown in the drawings and provided with an ample central opening, to arrange a conveyor beneath the turntable so that the material discharged from the discharge end of the boom 18 will drop through the opening in the turntable 9 and be transported from there through the conveyor arranged beneath the turntable opening.

In order to turn the turntable 9 and the upper support structure 1 including the boom 18 about the axis of the turntable, the upper member 24 of the lower support structure is provided with a gear ring 33 and a pinion 35 connected to the turntable 9 and driven by drive means 34, schematically indicated in FIG. 3, meshes with the gear ring 33 so that during rotation of the pinion 35 by the drive means 34 about its axis the turntable 9 and the upper support structure 1 will be turned about the axis of the turntable 9. As can be seen from FIG. 3 the pinion 35 is arranged diametrically opposite the guide 17

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and the pin 16 projecting thereinto along a line which is normal to the tilting axis 29 about which the upper support structure 1 may tilt with respect to the turntable 9.

If for some reason the elongated flexible means 20 connecting the front end of the boom 18 to the upper portion of the upper support structure 1 should slacken, the counter weight 28 will act to tilt the upper support structure 1 about the tilting axis 29 until the aforementioned elongated flexible means connecting the front end of the boom 18 to the upper portion of the upper support structure 1 become taut again. During such tilting the upper stop 17a shown in FIG. 4 will move away from the pin 16 whereas the lower stop 17b will move towards the pin. The upper support structure may therefore tilt relative to the turntable 9 about the tilting axis 29 through an angle determined by the free space between the stops 17a and 17b. During such tilting of the upper support structure 1, the position of the turntable 9 on the thrust bearing 23 will not be affected, but the turntable 9 will properly rest on the antifriction elements or balls of the thrust bearing 23 and uniformly load the same. Damage to the antifriction elements due to one sided overloads thereof will therefore be positively avoided.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of earth working machines, such as bucket wheel dredges of the like differing from the types described above.

While the invention has been illustrated and described as embodied in an earth working machine having a turntable and an upper support structure mounted on the turntable tiltable about a tilting axis located laterally of the turning axis of the turntable and means for limiting tilting of the upper support structure relative to the turntable, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In an earth working machine, such as a bucket wheel dredge or the like, in combination, a lower support structure adapted to rest on the ground; an upper support structure having a substantially upright portion and a substantially horizontal lower portion projecting to one side of said upright portion; means permanently tending to tilt said upper support structure in direction of said one side thereof; a working boom connected at one end thereof to said upright portion projecting to the other side therefrom; a turntable having a turning axis; an annular thrust bearing carried by said lower support structure coaxially with said turning axis of said turntable and supporting the latter turnably about said turning axis; mounting means mounting said lower portion of said upper support structure on said turntable tiltable about a tilting axis located laterally of and substantially normal to said turning axis; and cooperating means on said turntable and said upper support structure for limiting tilting movement of said upper support structure relative to said turntable, whereby change of a load on the free end of said working boom said upper support structure may tilt relative to said turntable without affecting the position of the latter relative to said thrust bearing.

2. In an earth working machine, such as a bucket wheel dredge or the like, in combination, a lower support structure adapted to rest on the ground; an upper substantially

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C shaped support structure having a substantially upright portion and lower and upper substantially horizontal portions respectively projecting from opposite ends and to one side of said upright portion; means associated with said upper substantially horizontal portion and permanently biasing the same downwardly so as to permanently tend to tilt said upper substantially C-shaped support structure in direction of said one side thereof; a working boom pivotally connected at one end thereof to said upright portion of said upper support structure and projecting from said connected end to the other side of said upright portion; elongated flexible means connecting the other end of said boom to said upright portion so as to hold said boom in a preselected position relative to said upright portion; an annular thrust bearing carried by said lower support structure coaxially with said turning axis of said turntable and supporting the latter turnably about said turning axis; mounting means mounting said lower portion of said upper support structure on said turntable tiltable about a tilting axis located laterally of and substantially normal to said turning axis; and cooperating means on said turntable and said upper support structure for limiting tilting movement of said upper support structure relative to said turntable, whereby during change of a load on the free end of said working boom said upper support structure may tilt relative to said turntable without affecting the position of the latter relative to said thrust bearing.

3. In a machine as set forth in claim 2, wherein said lower portion of said upper support structure is fixedly connected to said upright position.

4. In a machine as set forth in claim 2, wherein said annular thrust bearing includes a plurality of anti-friction elements arranged substantially along a circle.

5. In a machine as set forth in claim 2, wherein said lower portion of said upper support structure includes a transverse portion and a pair of arms projecting spaced from each other respectively from opposite ends of said transverse portion to said one side of said upright portion, and wherein said turntable is arranged in the space between said arms.

6. In a machine as set forth in claim 5, wherein the maximum width of said turntable is substantially equal to the width of the space between said arms.

7. In a machine as set forth in claim 2, wherein said cooperating means for limiting said tilting movement of said turntable include a pin fixed to said turntable projecting from the outer periphery thereof and a guide groove having opposite closed ends provided on said lower portion of said upper support structure in which an end portion of said pin is guided.

8. In a machine as set forth in claim 7, wherein said lower portion of said upper support structure includes a transverse portion and a pair of arms projecting spaced from each other respectively from opposite ends of said transverse portion to said one side of said upright portion, wherein said turntable is arranged in the space between said arms, and wherein said guide groove is provided on said transverse portion and said mounting means are located in the region of the free ends of said arms distant from said transverse portion.

9. In a machine as set forth in claim 8, wherein said turntable is substantially ring shaped and has a pair of bosses aligned along said tilting axis and respectively projecting to opposite sides of said turntable toward said arms, and wherein said mounting means include a pair of pins aligned along said tilting axis and extending respectively through corresponding bores in said bosses and said arms.

10. In a machine as set forth in claim 2, and including turning means for turning said turntable about said turning axis and comprising a gear ring fixed to said lower support structure coaxial with said turning axis and a pinion meshing with said gear ring and turnably carried by said turntable laterally of said turning axis.

11. In a machine as set forth in claim 10, wherein said cooperating means for limiting said tilting movement of said turntable include a pin fixed to said turntable projecting from the outer periphery thereof and a guide groove having opposite close ends provided on said lower 5 portion of said upper support structure in which an end portion of said pin is guided, and wherein said pinion is arranged diametrically opposite to said pin in a plan of symmetry normal to said tilting axis.

12. In a machine as set forth in claim 1, wherein said 10 lower support structure comprises a first movable carriage arranged substantially along a longitudinal center line of said lower support structure, a pair of additional

carriages respectively arranged to opposite sides of said center line and spaced in the direction of the latter from said first carriage and an upper member having three radially outwardly projecting arms respectively supported at the outer ends thereof on said carriages.

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HUGO O. SCHULZ, *Primary Examiner.*