Aug. 26, 1958 E. I. CARLSSON ET AL 2,849,133

DIGGING MACHINE

Filed May 20, 1955 3 Sheets-Sheet 1

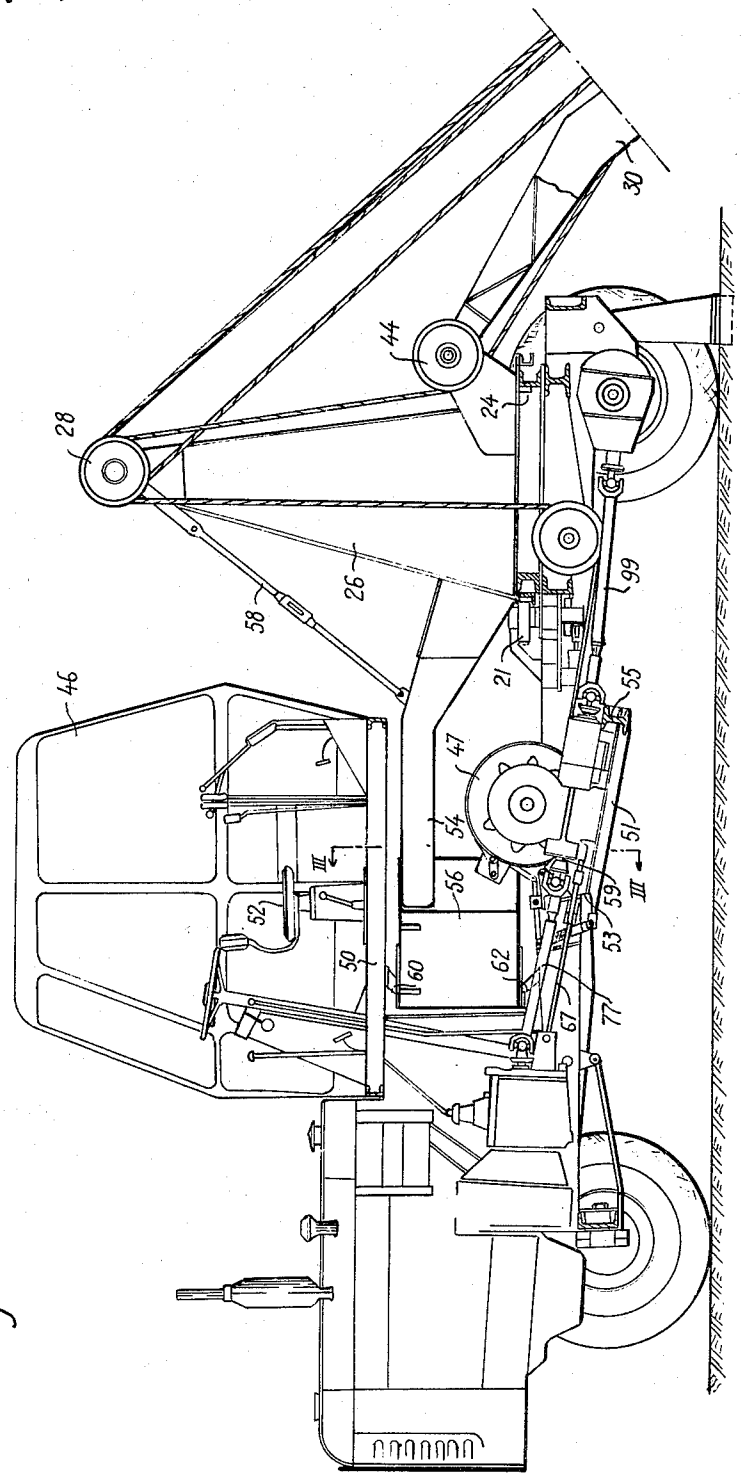


Fig. 1

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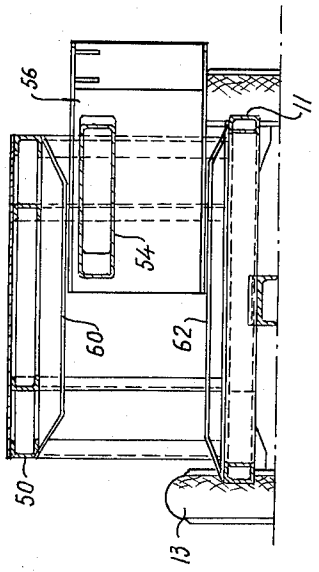


Fig. 3

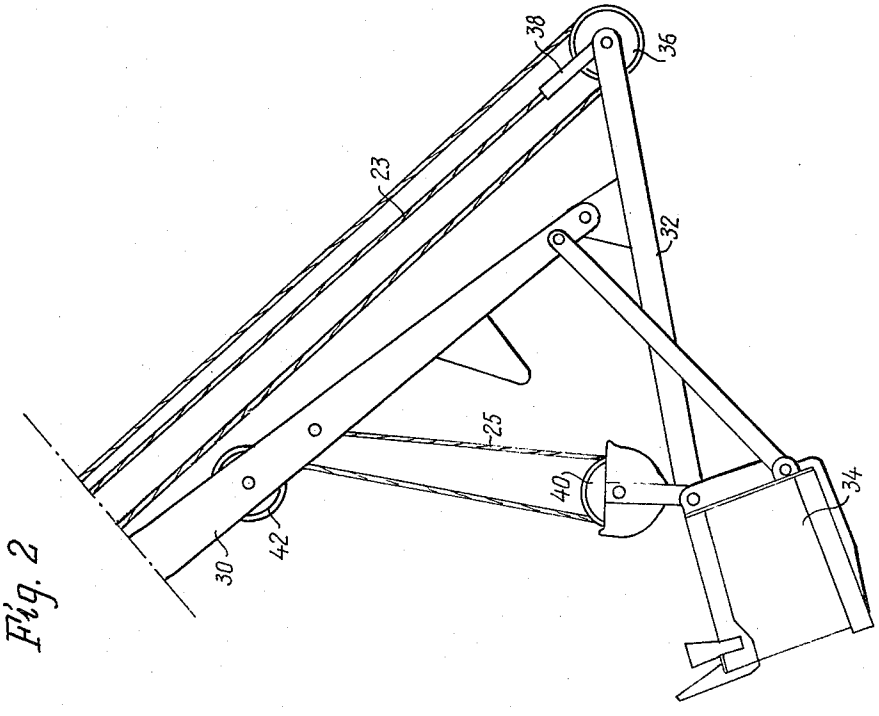


Fig. 2

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DIGGING MACHINE

Filed May 20, 1955 3 Sheets-Sheet 3

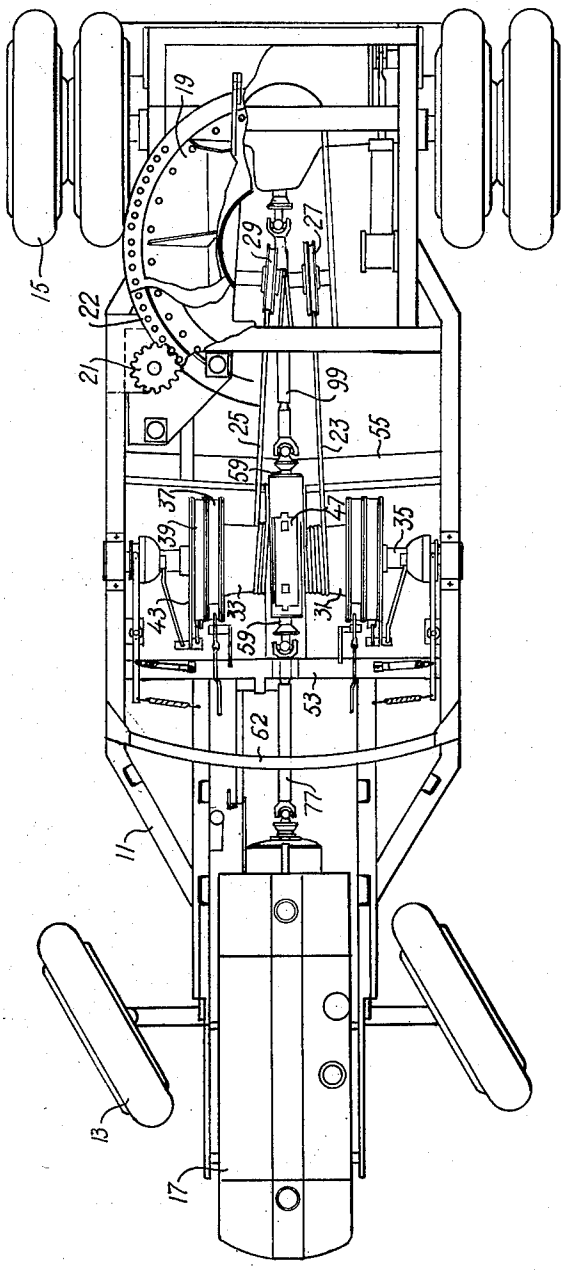


Fig. 4

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2,849,133

DIGGING MACHINE

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12 Claims. (Cl. 214—142)

In the most commonly used digging machine, a rotating platform is arranged on a driven undercarriage, which carries the bucket as well as a motor for driving thereof, the motor being placed diametrically opposite the bucket and serving as a counterweight for the same. The manoeuvring means for the drive of the digging machine are also located on the rotating platform, and therefore the operator must also be placed on the same. In another commonly known type of digging machine the motor and the manoeuvring means are located on the undercarriage, which is stationary when the machine is digging. In this case the operator does not take any part in the turning, and is not subjected, nearly as much, to the strong shocks and vibrations, as when he is located on the turning platform. As a consequence he has a better command of the control levers, has a much clearer view of the digging site, and is not as quickly tired out, as when working with a digging machine of the first-mentioned type. The latter type has however the disadvantage, that the motor effectively serves as a counterweight only when the same is in a position exactly opposite the motor, the stability of the digging machine being considerably reduced, when the bucket is at an angle with the length direction of the undecarriage.

The present invention has for its object to do away with this difficulty present in the last-mentioned type of digging machine, and, as far as stability is concerned, to make the same about as good as the first-mentioned type, where the motor at all times balances the bucket. This purpose is principally achieved by providing on the platform a special counterweight, which will act in conjunction with the motor, which partly serves as a counterweight on the undercarriage. Further defined, the invention concerns a digging or loading machine of the type, in which a driven undercarriage carries a drive motor and a platform or structure, which can be rotated around a vertical axis and on which is mounted a bucket or other digging or lifting means, which is manoeuvred with the help of wire ropes running on rope drums driven by the motor and supported on the undercarriage, and the desired increased stability is, according to the invention, accomplished by means of a counterweight arranged on the rotating platform or structure diametrically opposite the bucket, or the digging or lifting means. In order that the counterweight may have the highest possible balancing effect, it should be located as far away as possible from the center of the rotary platform or structure. On the other hand, it is desirable to place the operator as close to said center as possible, in order to obtain as good a view as possible. In order to satisfy both of these purposes, according to a useful development of the invention, a free space is provided between the carrying framework of the undercarriage and a cabin built thereupon for the operator, in which cabin all necessary manoeuvring means for the drive are located, through which space the counterweight can swing from one side of the undercarriage to the other. The cabin is preferably secured at its front part, and projects towards the swinging platform, and the counterweight fastened to the same can swing in under the cabin. The above-mentioned free space forms a crosswise passage through the undercarriage, and is at least of the same height and width as the counterweight. In a preferable embodiment of the invention, a practical and concentrated design of the undercarriage is obtained by locating this free space for the counterweight between the rope drums and the drive motor, at approximately the same level as these, the counterweight being fastened to an arm, which is located closely above the rope drums, and may have a limited height dimension, so that the free space between the rope drums and the floor of the cabin may be considerably smaller than the height of the free space for the counterweight.

According to the invention, arrangements are also made to let even the motor serve as a counterweight, when the bucket takes a position diametrically opposite the motor, and this can be accomplished without the balancing forces being transmitted by the bearings of the platform or structure on the undercarriage. For this purpose, according to the invention, a supporting member is located on the undercarriage, which member suitably is arranged as a runway, located close to that part of the travel of the counterweight, that lies below the cabin. With a powerful digging effort, the counterweight is lifted on account of the resilient yielding of the bearing support of the platform, and is thereby brought in contact with the above-mentioned supporting member on the undercarriage, so that the reactional forces to a great extent are transferred to the undercarriage through this above-mentioned supporting member. After the counterweight has made a contact with the above-mentioned supporting member, the undercarriage and the motor are resting against the counterweight, and are increasing its stabilizing effect. Preferably a corresponding supporting member fastened to the undercarriage, is also arranged below the travelling path of the counterweight, so that the counterweight, when it passes under the cabin, is enclosed between the said supporting members, and is only able to execute small movements in a vertical direction. Furthermore, there are present suitable diverging arms or similar means for the purpose of catching and governing the swinging counterweight in between the above-mentioned supporting members. The supporting members are preferably made up as arched bent beams, the middle part of which lie in a horizontal plane, and which with their ends, bent slightly upwards or downwards respectively, form the above-mentioned means to catch the counterweight and lead the same in between the beams.

A digging machine according to the invention is shown as an example on the accompanying drawing wherein:

Figures 1 and 2 are side views of the machine, partly shown in vertical section;

Figure 3 is a fragmentary end view, partly shown in vertical cross-section taken on the line III—III in Figure 1; and

Figure 4 is a top plan view of the machine, parts having been broken away.

The digging machine shown on the drawing is built upon an undercarriage, consisting of a framework **11**, which can be driven on wheels. The frontwheels **13** may be steered, and the backwheels **15** are driven by a combustion motor **17** located at the front of undercarriage. The undercarriage is thus in principle made up as a truck chassis. Located at the back of the undercarriage is a platform **19** rotary in the horizontal plane, which can be turned by means of a pinion **21**, which meshes with a motor-driven gear **22** fastened to the platform **19**. On the platform **19**, which is supported by a bearing **24** of practically as large a diameter as the gear **22**, is built up a central structure or column **26**, made up of sheet steel

welded together or of some kind of truss construction. At its top this column carries two rope sheaves **28**. To the platform is also articulated a boom **30** to the end of which an arm **32** is attached with a point between its ends. The one end of this arm carries a bucket **34**, and at the other end are located a rope sheave **36** and a rope anchor **38**, at which a wire rope **23** is fastened. Another wire rope **25** is fastened to the arm **30** and leads over the sheaves **40**, **42**, **44** to one of the rope sheaves **28**. The boom **30** and the arm **32** are so attached, that they can swing in a vertical plane, and by means of the wire ropes **23**, **25**, the bucket can be manoeuvred in such a way, that it moves in a desired manner in this plane. From the two rope sheaves **28** located at the top of the column, the wire ropes run vertically downwards through the center of the column to two rope sheaves **27**, **29**, supported in bearings on the undercarriage, and from there to the rope drums **31** and **33**, respectively. These drums are carried by and can be turned on a driven axle **35**, which runs in a crosswise direction on the undercarriage, and the ends of which are supported by bearings located on the longitudinal side beams of the framework. Each rope drum is combined, on the one hand, with a brake drum **37**, around which is fitted a hand operated brake that can be manipulated from the operator's cabin, by means of which the rope drum can be held in any desired position, and on the other hand with a brake drum **39**. By means of a coupling arrangement **41**, which also may be manipulated from the operator's cabin, said last-mentioned brake drum **39** is caused to engage a disc **43**, fastened to the driven axle **35**, so that the rope drum may be rotated. Between the rope drums a worm gear is located, the worm wheel of which is keyed to the axle **35**. The housing of the worm gear **47** is fastened to a bridge **51**, that runs between two cross beams **53**, **55**, in the framework. The worm of the worm gear is loose upon an axle **59** but can be coupled thereto by means of a claw coupling. At the one end the axle **59** is coupled to an axle **77** coming from the motor, and at the other end it can be coupled by means of a further claw coupling to an axle **99** driving the back wheels **15**. The one or the other of the above-mentioned claw couplings can be alternatively thrown in by a manoeuvring lever **67** located in the operator's cabin, and the motor can thus be brought either to drive the back wheels for moving the digging machine or to drive the axle **35**, from which the movement of the bucket is derived.

Located approximately midway between the front and the back wheels is a cabin **46**, rising above the carrying framework of the undercarriage, in which the operator stays while engaged in either driving the machine on the roads or digging. The cabin is supported in the front by a number of vertical beams **48**, which are welded to the carrying framework of the undercarriage. From these beams the cabin projects unsupported backwards to about half-way towards the column **26**. The floor **50** of the cabin is located about at the same level as the upper part of the motor or at the level of a point located at between ⅓ to ½ of the height of the column **26** above the platform **19**. From this elevated cabin, which all around is supplied with windows, the operator has an excellent view of the work site. In the front of the cabin are located all necessary manoeuvring means for driving, such as steering wheel, shifting lever, coupling pedal, brake pedal, and foot throttle, and also a lever for manipulating the claw couplings for the wormgear. At the back of the cabin are located the manoeuvring means controlling the drives of the rope drums and the pinion **21** for turning of the platform. A revolving chair **52** is placed in the center of the cabin, so that the operator only has to make half a turn, when changing to operate one or the other of the two sets of manoeuvring means.

In a direction, which in regard to the turning axis of the platform is diametrically opposite the boom **30**, a long practically horizontal arm **54** projects from the column **26**. This arm carries at its end a counterweight **56**, which may consist of a box filled with iron or lead scrap. A stay rod **59** ties together the arm **54** and the top of the column, in order to relieve the stresses in the arm attachment.

When the platform **19** is turned in order to swing the bucket sidewise, the counterweight **56** and its arm **54** move in a circular path, which partly projects through the free space situated between the floor **50** of the cabin and the carrying framework of the undercarriage underneath, the arm **54**, which has a limited height extension, passing over the rope drums in the space that is formed between these and the floor of the cabin, while the counterweight, which has greater height extension, moves in the free space that is formed between the rope drums and the rear supporting columns **48**.

At the underside of the cabin floor is located a supporting rail **60** which lies in a horizontal plane immediately above the path, that is travelled by the outer part of the top side of the counterweight. Below this rail a similar rail **62** is fastened to the frame of the undercarriage, which rail lies in a horizontal plane immediately below the counterweight. Looked at from above, these rails are bent in arch-form, with a radius that is equal to the radius formed by the path of the counterweight. The ends of the rails **60** and **62** are bent with a slight angle upward or downward respectively. On account thereof they like a funnel catch the counterweight, when the same is swinging in between the rails, so that the counterweight will not be pushed against the ends of the beams, in case it does not exactly hold its height position.

On the sides of the counterweight, hooks or other fastening means could be arranged, on which weights could be hung, if it were found necessary to increase the weight. This would occur, especially in the exceptional case, when it would be desired to dig with the bucket placed at an angle with the longitudinal direction of the undercarriage.

The invention is applicable, to the same advantage, for both deep-digging and high-digging. The shape of the bucket is of no importance to the invention, and the shown bucket may thus be replaced by a grab. It would even be possible to hang some other kind of digging or lifting implement from the boom. In some cases it might thus be more correct to call the machine a loading machine instead of a digging machine. The appearance of the undercarriage, and the manner of driving the same, may also be different from that which is shown. The undercarriage may thus be driven through the front wheels, or driven through four wheels, or run on caterpillar tracks. Even in other respects, the design may be varied, without going beyond the scope of the invention, as stated in the following claims.

We claim:

1. A material handling machine, wherein a driven undercarriage carries a drive motor and a structure rotary about a vertical axis to which structure material handling means are attached, and which material handling means are manoeuvred by means of wire ropes running over rope drums driven by the motor and supported by bearings located on the undercarriage, characterized in an arm extending from the turning structure in a direction diametrically opposite to the material handling means, respectively, said arm carrying a counterweight and being arranged in certain positions of the turning structure to take up such a position close to a member of the undercarriage as to abut thereagainst and stabilize the turning structure during a heavy material handling operation, and further characterized in a free space being arranged between the carrying framework of the undercarriage and a cabin for the operator built on same, and in which cabin all necessary manoeuvring means are placed, through which free space the arm and the counterweight pass while swinging from the one side of the undercarriage to the other.

2. A material handling machine, wherein a driven undercarriage carries a drive motor and a structure rotary

about a vertical axis to which structure material handling means are attached, and which material handling means are manoeuvred by means of wire ropes running over rope drums driven by the motor and supported by bearings located on the undercarriage, characterized in an arm extending from the turning structure in a direction diametrically opposite to the material handling means, respectively, said arm carrying a counterweight and being arranged in certain positions of the turning structure to take up such a position close to a member of the undercarriage as to abut thereagainst and stabilize the turning structure during a heavy material handling operation, and further characterized in a free space for the counterweight being located between the rope drums and the drive motor, at approximately the same level as these, and the arm carrying the counterweight running closely above the rope drums.

3. A material handling machine, wherein a driven undercarriage carries a drive motor and a structure rotary about a vertical axis, to which structure material handling means are attached, and which material handling means are manoeuvred by means of wire ropes running over rope drums driven by the motor and supported by bearings located on the undercarriage, characterized in an arm extending from the turning structure in a direction diametrically opposite to the material handling means, respectively, said arm carrying a counterweight and being arranged in certain positions of the turning structure to take up such a position close to a member of the undercarriage as to abut thereagainst and stabilize the turning structure during a heavy material handling operation, said machine being further characterized in having a supporting rail on the undercarriage placed closely above the part of the path of the counterweight, that runs between the motor and the turning center of the counterweight, said supporting rail being bent in the horizontal plane in the form of an arch, and having its ends bent at a slight angle upwards and downwards, respectively, from said plane.

4. A material-handling machine having a chassis; a prime mover mounted on said chassis; a turnable structure mounted on said chassis for rotational movement relative thereto about a vertical axis; said prime mover being spaced on said chassis from said turnable structure; a boom engaged with said turnable structure and mounted for angular movement in a vertical plane; material-handling means on said boom and said turnable structure; an arm fixed relative to said turnable structure and extending away therefrom in a direction opposite to said boom; a counterweight mounted on said arm; means positioned normally out of engagement with said arm but engageable therewith upon limited vertical movement of said arm due to unbalanced loads on said boom and said turnable structure for causing said chassis and said prime mover to act together as a counterweight against such unbalanced loads.

5. The combination defined in claim 4 and further comprising an operating platform; means on said operating platform for operating and controlling the material-handling machine; said operating platform being secured to said chassis and cantilevered over the horizontal arcuate path of said arm to a position adjacent said mast, whereby an operator situated thereon and controlling the operation of the material handling machine will have an optimum view and perspective of the operation of the material-handling means.

6. A material-handling machine having a chassis; a prime mover mounted on said chassis; a turnable structure mounted on said chassis for rotational movement relative thereto about a vertical axis; said prime mover being spaced on said chassis from said turnable structure; a boom engaged with said turntable structure and mounted for angular movement in a vertical plane; material-handling means on said boom and said turnable structure; an arm fixed relative to said turnable structure and extending away therefrom in a direction opposite to said boom; a counterweight mounted on said arm; means for bracing unbalanced loads on said boom and said turnable structure by limiting vertical movement of said arm comprising a member fixed to said chassis and extending over a portion of the horizontal arcuate path of said arm and disposed closely adjacent thereto; said means being operable on tilting movement of said turnable structure relative to said chassis and the lifting of said arm to bear against said member whereby said chassis and said prime mover will then act together as a counterweight against such unbalanced forces.

7. The combination as defined in claim 6 in which said member fixed to said chassis comprises a rail arcuately formed in a horizontal plane, and further including a similar member fixed to said chassis and extending under the same portion of the horizontal arcuate path of said arm, said similar member comprising a rail arcuately formed in a horizontal plane, the free ends of each of said rails being bent outwardly relative to the other of said rails.

8. A material-handling machine having a chassis; a prime mover mounted on said chassis; a platform mounted on said chassis for rotational movement relative thereto about a vertical axis; said prime mover being spaced on said chassis from said platform; a mast fixed to said platform; a boom engaged with said platform and mounted for angular movement in a vertical plane; material-handling means mounted on said boom and said mast; an arm fixed relative to said platform and extending away from said mast in a direction opposite to said boom; a counterweight mounted on said arm; cable means for manipulating said material-handling means; drum means engageable with said prime mover and mounted on said chassis for manipulating said cable means; said drum means being located between the horizontal arcuate path of said counterweight and said platform, the arrangement being such that the path of said arm is above, but adjacent to, said drum means; means for bracing unbalanced loads on said boom by limiting vertical movement of said arm and said counterweight comprising a member fixed to said chassis and extending over a portion of the horizontal arcuate path of said arm and disposed closely adjacent thereto whereby any tilting movement of the said platform and said mast will lift said arm to bear against said member and whereby said chassis and said prime mover and said drum means will then act together as a counterweight against such unbalanced forces.

9. The combination defined in claim 8 and further comprising an operating platform; means on said operating platform for operating and controlling the material-handling machine; said operating platform being secured to said chassis and cantilevered over the horizontal arcuate path of said arm to a position adjacent said mast, whereby an operator situated thereon and controlling the operation of the material-handling machine will have an optimum view and perspective of the operation of the material-handling means.

10. The structure defined in claim 8 in which said member fixed to said chassis comprising a rail arcuately formed in a horizontal plane, and further including a similar member fixed to said chassis and extending under the same portion of the horizontal arcuate path of said counterweight, said second member comprising a rail arcuately formed in a horizontal plane, the free ends of each of said rails being bent outwardly relative to the other of said rails.

11. A material handling machine including a chassis; a turntable structure mounted for rotational movement about a vertical axis at one end of said chassis, a material handling boom operatively associated with said turntable for angular movement in a vertical plane; arm means fixed to said turntable structure and rotatable therewith; said arm means extending outwardly beyond the extremi-

ties of said turntable structure in a direction diametrically opposite to said boom and terminating in a substantially horizontal plane above the horizontal plane of said turntable structure; and means fixed to said chassis and positioned directly above the path of said arm means for engagement with said arm means upon limited vertical movement of said arm means due to an unbalanced load on said boom whereby said chassis serves as a counterweight against said load.

12. A material handling machine including a chassis having a cab thereon, said cab being spaced vertically from said chassis; a turntable structure mounted for rotational movement about a vertical axis at one end of said chassis; a material handling boom operatively associated with said turntable for angular movement in a vertical plane; arm means fixed to said turntable structure and rotatable therewith; said arm means extending outwardly

beyond the extremities of said turntable structure in a direction diametrically opposite to said boom and terminating in a substantially horizontal plane above the horizontal plane of said turntable structure but below said cab whereby said arm means pass beneath said cab in certain positions of said boom; and means positioned between said cab and said chassis directly above the path of said arm means for engaging said arm means upon limited vertical movement thereof due to an unbalanced load on said boom whereby said chassis and cab serve as counterweights against said load.

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