A balanced boom stacker-reclaimer device wherein the balanced boom includes a bifurcated support tower straddling portion which is pivotally connected to the support tower. The boom is preferably of tubular construction and the bifurcated portion is pivotally connected to the support tower. A unitary, generally conical gantry structure provides a rigid, uniform support for the slew bearings which allow for rotation of the boom.

11 Claims, 6 Drawing Figures
STACKER-RECLAIMER MATERIAL HANDLING UNIT

BACKGROUND OF THE INVENTION

In industries which must stockpile large amounts of raw materials for processing or consumption, the efficient handling of large volumes of material is very important. The stacking and reclaiming of coal, ore, and other raw materials has lent itself to construction of massive, expensive material handling units which while having a variety of designs are commonly referred to as stacker-reclaimer units.

The basic function of these stacker-reclaimer units is to take the material which is delivered to the storage facility via ship, barge, or rail carrier, and to first build a stockpile of material. Thereafter, the same unit reclaims the material from the stockpile and deposits it on a conveyor which carries the material to its final destination.

A typical stacker-reclaimer unit employs a movable gantry structure which moves between stockpiles, and has a boom structure extending therefrom. The boom structure extends over the stockpile area, is of considerable length, and is swingable generally from side to side of the gantry to allow the entire stockpile area to be covered. A material gathering device such as a bucket wheel is typically disposed at the boom end. The bucket wheel is a massive piece of equipment, and gathers a significant mass of material. Thus, the gantry and boom structure are subjected to tremendous stresses during operation. Complicated and cumbersome superstructure supports and lifting systems have been used to support and carry out raising and lowering the boom structure. These cumbersome superstructures result in a considerable shifting of the center of gravity of the stacker-reclaimer unit as the boom is raised and lowered. In some prior art designs, inadvertent resting of the boom upon the stockpile could produce such imbalance as to cause damage to the boom supports or even toppling of the unit.

A stacker-reclaimer additionally includes a traveling tripper which is used to convey the material up to the boom for pile building.

It has been the practice when using a counterweighted boom with a stacker-reclaimer to dispose the counterweight from a superstructure support frame so that the counterweight would pass over the traveling tripper portion of the stacker-reclaimer. Otherwise, the boom could not be swung in the required arc of approximately 180°, in order to cover the storage piles on both sides, without interfering with the traveling tripper.

A slew bearing arrangement is provided atop a typical gantry structure to enable the boom to be rotatably mounted thereon. The boom is thus able to be moved in an arc across the stockpile. The boom will extend a considerable distance out from the gantry and support tower structure. The boom must be able to withstand the vertical shear and moments of the dead load of the structure, the bucket wheel, the weight of the material on the conveyor and in the buckets, and the digging force in the vertical plane of the bucket wheel. The boom is also subjected to horizontal shear and moments caused by slewing or swinging the boom into the pile and by side winds.

During operation it is important that a rigid support be provided for a slew bearing, and to uniformly distribute the loading to the movable support trucks at the base of the stacker-reclaimer. Prior art box or plate girder or trussed gantry structures were constructed attempting to uniformly distribute the loading.

SUMMARY OF THE INVENTION

A stacker-reclaimer material handling device is provided which comprises a movable support gantry, a boom support structure rotatably mounted on the support gantry. An elongated material handling balanced boom is pivotally connected to the boom support structure, and extends therefrom in opposite directions. In the improved design, the elongated balanced boom includes a bifurcated support structure straddling portion pivotally connected to the boom support structure. One end of the bifurcated portions is linked together and a material handling elongated boom extends therefrom, with a counterweight member disposed at the other ends of the bifurcated portions.

The balanced boom preferably has a tubular construction which simplifies erection of the apparatus, and eliminates the need for numerous diaphragms and stiffeners along the length of the boom. The balanced boom construction can be raised and lowered with fluid piston lifting means which are affixed to the support gantry and connected to the boom. This lifting means is greatly simplified over the cumbersome cable lifting systems generally employed in the art.

The balanced boom construction and simplified lifting means makes possible dispensing with complicated structures for supporting the boom in the preferred embodiment. The balanced boom is thereby fully rotatable through a 180° arc about the support gantry.

A unitary, generally conical gantry structure can be provided for the material handling gantry structure. The conical gantry provides economical, uniform, rigid support for the slew bearing, which is disposed on an annular flange surface disposed about the top rim of the conical gantry. The load forces are thus directly and uniformly transferred from the slew bearing through the generally conical gantry structure to the trucks at the base of the conical gantry.

The conical gantry structure and tubular boom structures find individual application with a wide variety of material handling vehicles.

The conical gantry is easily fabricated and erected. The closed-in walls provided by the conical gantry serve to provide an enclosure for the electrical control equipment used in the stacker-reclaimer, or other machinery desired.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the conical gantry structure of the present invention mounted upon movable support trucks.

FIG. 2 is an overall perspective view of a stacker-reclaimer combination incorporating the conical gantry structure of the present invention, and the balanced boom construction.

FIG. 3 is a side elevation of the central gantry tower portion and the balanced boom portion of the stacker-reclaimer of the present invention.

FIG. 4 is an elevational view of the stacker-reclaimer unit looking in the direction of boom counterweight extension, to show the traveling tripper.

FIG. 5 is a partial plan view of the unit highlighting the boom connection to the gantry.
FIG. 6 is a sectional view taken through a portion of the tubular boom.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention can be best understood by reference to the exemplary embodiments shown in the drawings. The invention will be explained with reference to a specific stacker-reclaimer unit 10 shown in FIG. 2. The stacker-reclaimer unit 10 includes the movable support trucks 11 which ride upon tracks 12 to permit the unit 10 to move between storage piles. A generally conical gantry 13 is mounted upon the support trucks 11. An annular flange 14 in the horizontal plane is provided at the top rim of the conical gantry 13, and conventional slew bearing 15 is supported upon this flange 14. A rotatable support cylinder 16 is mounted upon slew bearing 15, and a straight line balanced boom 17 is pivotally connected to the rotatable support cylinder 16. A traveling tripper unit 18 allows for conveyance and transfer of the material to be stored to a conveyor associated with the balanced boom 17 as will be described in greater detail later.

In constructing the conical gantry 13, of course the gantry can be fabricated as a unitary conical member with truncated base and apex portion. It is also possible to use a plurality of formed metal members 19, which are shaped to be fitted together as by welding the edges. In FIG. 1, the conical gantry is formed from four quarterly members 19, which are formed with the proper curvature to comprise the conical gantry 13 when assembled together.

The annular flange 14 which is in the horizontal plane substantially transverse to the cone can be welded at the top rim of the conical gantry 13. The slew bearing 15 is supported upon the annular flange 14. The slew bearing drive means 20 rotate the slew bearing and the support cylinder 16 to which the balanced boom 17 is affixed.

Conical leg extensions 21 are preferably provided at symmetrically spaced positions at the base portion of the conical gantry 13. The conical leg extensions 21, by way of example four, are affixed to a support structure 22 disposed upon the movable support trucks 11. Local stiffener members, not shown, may be provided affixed to the inside surface of the conical gantry 13, and particularly at the conical leg extensions 21.

The conical gantry 13, when completely fabricated, forms a unitary support cone for the slew bearing. The loadings which are associated with the unit 10 are thus uniformly carried by the conical gantry 13 because of its structural integrity, and transmitted via the conical leg extensions 21 at the base of the conical gantry 13 to the support trucks 11.

The stacker-reclaimer unit 10 is shown in greater detail in FIGS. 3-6. The balanced boom 17 comprises a bifurcated support cylinder straddling portion 23 which is pivotally connected via trunnions 24 mounted at the perimeter of the support cylinder 16. The boom 17 is thus pivotal in the vertical direction so that it can be directed at the base of a stockpile, or can be raised above the stockpile. Fluid piston luffing means 25 are affixed to the support cylinder 16 and to the boom 17 to effect the pivotal raising or lowering of the boom. A counterweight 26 is affixed to the farthest extending end of the bifurcated boom portion 23 and extends from the support cylinder 16 in approximately the same plane as the boom portion 27. An extending boom portion 27 is directed from the bifurcated boom portion 23 and terminates at a bucket wheel 28. An operator's cab 29 is also disposed at the same end of the extending boom portion 27.

The traveling tripper unit 18 is itself movable along the tracks 12 with the central gantry of the device. Material is carried up the conveyor of unit 18 and passed through opening 36 in frame extension 37 and is dumped onto reversible conveyor 30 mounted on the top of the extending boom portion 27. When stacking material, conveyor 30 carries the material out towards the end of the boom where it is discharged onto the stockpile. When the bucket wheel 28 is in operation to reclaim the material from the stockpile, the conveyor 30 carries the material back along boom portion 27 to the gantry where the material discharges through the center of the support cylinder 16, down through the gantry 13, and is deposited on conveyor 31 which carries it to the place of consumption. A material confining chute 32 can be provided within the frame of the gantry 13 for directing the material to conveyor 31.

The present combination of a straight line counterweighted balanced boom makes possible the swinging of boom 27 in an arc of about 180° with the counterweight 26 passing under the traveling tripper 18. The boom 27 should be pivoted to the position in FIG. 3 indicated in phantom lines, with the bucket wheel 28 up off the ground, in order to allow the counterweight 26 to easily pass under the traveling tripper 18. Thus, for example in FIG. 2, the boom can be rotated clockwise to extend toward a pile on the other side of tracks 12.

The balanced boom 17 is preferably of a tubular construction, with a portion of the extending boom portion 27 shown in section in FIG. 6. The tubular body 33 has a wall thickness and diameter which are determined by the design stress loadings. By way of example, for a boom which extends about 75 feet or more, the tubular boom may be formed of about % inch wall thickness steel pipe which has a diameter of approximately 6 feet. A plurality of internally disposed reinforcing or stiffening members 34 may be affixed within the tubular body 33, as a design alternative in handling the loading. The stiffening members 34 are elongated plates welded within the tubular boom wall 33, as chords. The stiffening members 34, when used, will be disposed within extending boom portion 27, particularly where boom portion 27 extends from the bifurcated portion 23.

A control gate 35 is provided mounted on a frame extension 37 above the support cylinder 16, whereby material from conveyor 18 can be directed onto conveyor 30 for stacking of the material upon a stockpile. The control gate 35 can also be adjusted so that the material discharging from conveyor 18 will be directed down through the center of the support cylinder 16, the gantry 13, via chute 32 to conveyor 31 for immediate usage.

The stacker-reclaimer unit 10 has been shown in the preferred embodiment without additional boom support structure, but it should be understood that such conventional structures can be used to assist in supporting the boom structure.

While the invention has been described by reference to a stacker-reclaimer combination, it should be understood that the preferred conical gantry structure described herein, as well as the preferred tubular boom
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construction are individually usable with material handling combinations in general.

We claim:

1. In a material handling device comprising a movable support gantry, a boom support structure rotatably mounted on the support gantry, an elongated balanced boom pivotally connected to the boom support structure and extending therefrom in opposite directions, a material handling means disposed at one end of the boom, and a counterweight disposed at the opposite boom end, the improvement wherein the elongated balanced boom includes a bifurcated section which straddles the boom support structure, with each prong of said bifurcated section being pivotally connected to the boom support structure at the balance point of the boom, one end of the bifurcated sections are linked together and a material handling elongated boom portion extends therefrom, with a counterweight member disposed at the other ends of the bifurcated sections.

2. The material handling device specified in claim 1, wherein fluid piston luffing means are mounted on the support gantry and connected to the boom whereby the boom can be pivotally raised and lowered.

3. The material handling device specified in claim 1, wherein the balanced boom portion comprises a tubular construction, wherein said material handling elongated boom portion extends from the linked end of the bifurcated sections and has its center line disposed midway between each prong of said bifurcated section.

4. The material handling device specified in claim 3, wherein the tubular boom portion includes reinforcing members disposed within the tubular portion.

5. The material handling device specified in claim 1, which comprises a stacker-reclaimer unit, wherein the balanced boom supports a reversible conveyor which is used for stacking material on a storage pile, and also for reclaiming the material from the storage pile.

6. The material handling device specified in claim 5, which includes a traveling tripper which extends from proximate the top of the boom support structure to a loading conveyor whereby material can be directed from the loading conveyor to the traveling tripper to the boom conveyor, and wherein the balanced boom is rotatable through an arc of about 180°, with the counterweight boom portion passing under the traveling tripper.

7. The material handling device specified in claim 1, wherein the movable support gantry is mounted upon a plurality of trucks, and the support gantry comprises a unitary generally conical member.

8. A material handling combination comprising a movable support gantry, a boom support structure rotatably mounted on the support gantry, with an elongated boom pivotally connected to the boom support structure, and material handling means disposed at one end of the boom, the improvement wherein the movable support gantry includes a unitary truncated, generally conical shell mounted on a plurality of movable trucks with a slew bearing mounted on the top rim of the truncated conical shell and with the boom support structure rotatably mounted on the slew bearing, whereby the slew bearing is uniformly supported by the unitary truncated, generally conical gantry, and the operational loading is uniformly transmitted to the movable trucks.

9. The combination specified in claim 8, wherein the base of the truncated generally conical shell comprises a plurality of symmetrically spaced leg extensions.

10. The combination specified in claim 8, wherein the unitary truncated generally conical gantry includes a horizontal, annular support flange disposed on the top rim of the truncated conical shell, with the slew bearing mounted on this flange.

11. In the combination of a material handling apparatus comprising a movable support gantry supported by a plurality of movable trucks, with a slew bearing supported by the gantry, and wherein material handling means are rotatably mounted on the slew bearing, the improvement wherein the support gantry comprises a unitary, truncated, generally conical shell of rolled plate with an annular flange affixed to the upper rim thereof for supporting the slew bearing, whereby the slew bearing is uniformly supported by the shell of rolled plate and the operational loading is uniformly transmitted to the movable trucks.

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