

# United States Patent [19]

Cox et al.

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[54] MATERIAL HANDLING APPARATUS

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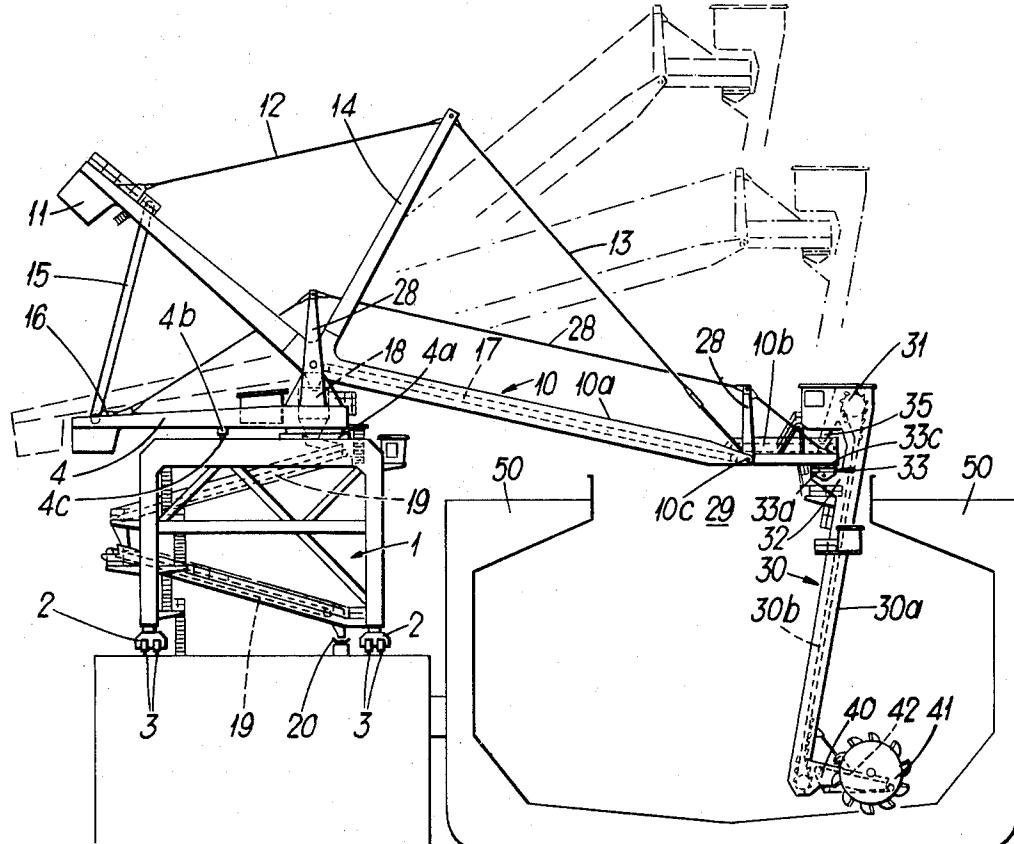
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[57] ABSTRACT

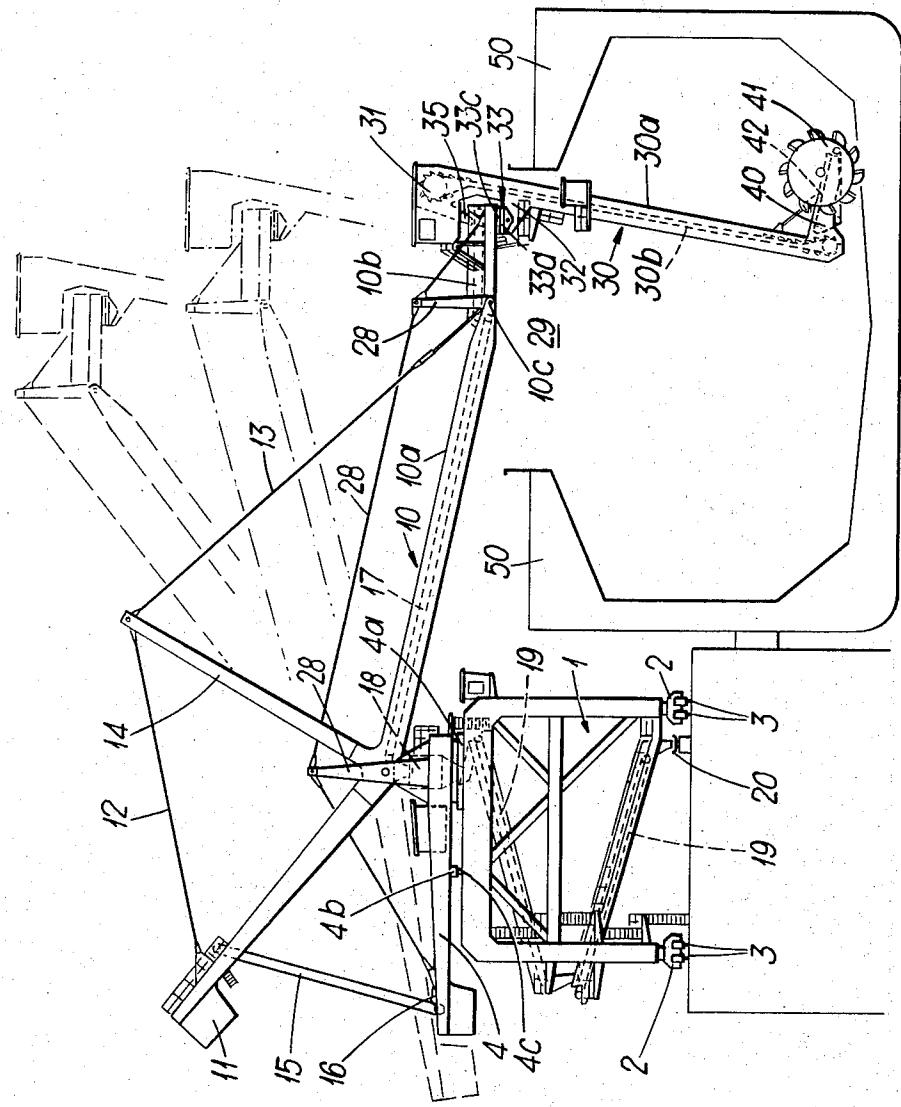
The invention relates to material handling equipment having an elevator unit depending from a conveyor boom. Means is provided for loading the elevator unit at a location spaced along the elevator unit from said boom. The connection between the elevator unit and the conveyor boom is such that the former can swivel about an axis transverse to the latter and means is also provided whereby material can pass from the former to the latter at any of the angles that the former can occupy relatively to the latter.

5 Claims, 1 Drawing Figure



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## MATERIAL HANDLING APPARATUS

This invention relates to material handling equipment and arose from a consideration of what is involved in unloading a large vessel containing bulk material such as ore, coal and other minerals.

According to the present invention there is provided material handling equipment including a boom conveyor means by which material may be moved along the boom, an elevator unit carried by the boom so as to be rotatable relatively to the boom about an axis extending transversely of the conveyor, the elevator unit including an elevator and means for effecting loading of the elevator at a location displaced along the elevator unit from the conveyor from a location laterally of the axis, and means whereby for any orientation within a range of the elevator unit relative to the boom material discharging from the elevator passes to the conveyor.

By way of example, an embodiment of the invention will now be described with reference to the accompanying drawing which shows in side view a ship unloader mounted on tracks at a quayside and suitable for the unloading of ore from a large carrier ship — in the order of 250,000 ton for instance.

The carrier includes a portal frame 1 provided with bogies 2 that run on parallel tracks 3 fixed to the quayside. A slewing platform 4 is mounted on the top of the frame 1 through a slewing ring 4a lying at the side of the frame 1 nearest the quayside. Bogies 4b fixed to the platform 4 and cooperating with an arcuate track 4c on the frame 1 enable the platform 4 to be swung vertically around the axis of the slewing ring to any orientation within a range.

A luffing boom 10 extends laterally of the frame 1 and is mounted on the platform 4 to pivot about a horizontal axis that intersects the vertical axis of the slewing ring 4a. The luffing boom 10 is provided with a counterbalance 11 and wire ropes 12 and 13 connect the outer ends of the counterbalance 11 and the luffing boom 10 to a post 14. The vertical angle of the luffing boom is controlled through the pulley arrangement 15 that is controlled by the motor 16.

A belt conveyor 17 extends along the boom 10 and is arranged to discharge into a hopper 18 that is concentric with the slewing ring. The hopper 18 leads to a lowering conveyor 19 that extends down the frame 1 to deliver material discharged from the conveyor into means, indicated at 20, by which the material can be removed from the site.

The boom 10 is in two parts, 10a and 10b connected together by a horizontal pivot at 10c. The part 10b is horizontal and by means of the parallel linkage 28, it will remain horizontal during variations of the inclination of the boom 10 to the horizontal.

An elevator unit 30 hangs from the outer end of the part 10b of the boom 10 into the hold of a ship, through the hatch 29. The unit includes a rigid spine 30a carrying an endless bucket conveyor 30b, the upper end of the spine having a superstructure 31 into which the buckets of the conveyor empty. Below the superstructure 31, and extending to the same side of the spine as the superstructure 31, is a bracket arm 32. A coupling indicated generally by 33, by which the elevator unit 30 hangs is connected between the part 10b and the bracket arm 32. The coupling 33 includes a part 33a that is connected to the part 10b of the boom 10 by

swivel means 33 that allows the parts to rotate relatively to each other about a vertical axis that passes through the conveyor 17, but prevents other relative movement. The part 33a is pivotally connected to the bracket arm 32, the pivot axis intersecting the axis of the swivel means 33c so that gravity maintains the orientation of the elevator unit constant. From the superstructure 31, there extends a chute 35 of which the outlet lies above the conveyor 17 in alignment with the axis of swivel means 33c. The inlet to this chute 35, is so disposed as to receive material brought into the superstructure 31 by the bucket conveyor 30b and the arrangement is therefore such that material from the bucket conveyor 30b will fall on the conveyor 17 throughout a range of rotation of the elevator unit 30 relatively to the boom 10.

From the lower end of the spine 30a of the elevator unit, a support 40 extends in the opposite direction to the bracket arm 32. Twin bucket wheels 41 are arranged for rotation about a horizontal axis on the outer end of the support and a gathering feeder conveyor 42 extends at a slight upward incline from this to the elevator 30b.

In use of the apparatus that has been described, the bucket conveyor 30b is fed by the bucket wheels 41 from a location laterally of it and this facilitates the emptying of bulk ore carriers easily and with high reclaim rates. The hatch 29 that gives access to the hold is of smaller cross-section than the hold, but the bucket wheel reaches under the overhanging part 50 of the deck structure. Since both the boom 10 and the elevator unit 30 may be slewed, there is considerable freedom of movement of the bucket wheels 41 within the hold so that the chance of a thick lining of material being beyond the reach of the unloader is small. Moreover since the boom 10 can be slewed it can be parked along the jetty when not in use to permit free access of ships to the jetty.

We claim:

1. Material handling equipment including a platform with a luffing boom pivotally connected thereto and extending outwardly therefrom, a second boom pivotally connected to the free end of said first boom, means carried by said platform and connected to said second boom to maintain said second boom horizontal during variations of the inclination of the first boom to the horizontal, conveyor means mounted on the first and second booms by which material may be moved along said booms, a depending elevator unit carried by the free end of said second boom, means on said elevator whereby material may be fed to said elevator from a location displaced laterally of the elevator so as to be conveyed by the elevator to the second boom, coupling means carried by the free end of said second boom and including a member for connecting the elevator unit to said second boom for swivel movement about a vertical axis passing through said conveyor means on said second boom, said coupling means being pivotally connected to said elevator unit with said axis of pivot intersecting the vertical axis of movement of said coupling means in order to maintain the elevator unit in a constant orientation relatively to the vertical throughout movement of the boom, and means whereby, for any orientation within a range of the elevator unit relative to the boom, material discharging from the elevator passes to the conveyor means.

2. Apparatus as set forth in claim 1 in which the means for effecting loading of the elevator includes a support extending laterally of the elevator and carrying means operable to remove particulate material from a bulk of particulate material and convey it to the elevator.

3. Apparatus as claimed in claim 2, in which there is mounted on the outer end of the support a bucket wheel and a conveyor extends between the bucket

wheel and the elevator.

4. Apparatus as set forth in claim 1 in which the platform is rotatably mounted about a vertical axis on a supporting frame.

5. Apparatus as claimed in claim 4 in which the axis about which the boom is luffable intersects the axis about which the platform is rotatable.

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