United States Patent

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[33] **France**
[31] **178043;**
Nov. 27, 1969, France, No. 6940871

[54] **APPARATUS FOR ELEVATING BULK MATERIAL**
4 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **198/9,**
37/190, 198/71, 214/10, 214/14
[51] **Int. Cl.** **B65g 65/28**
[50] **Field of Search** 214/14, 15,
10; 198/9, 36, 103, 71; 37/189, 190

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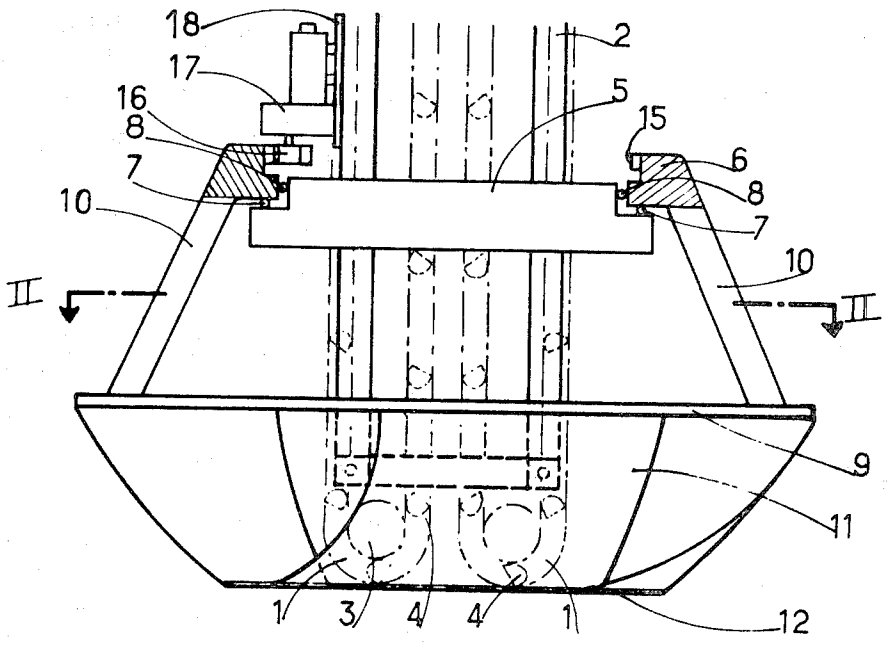
ABSTRACT: A bulk-material-elevating apparatus which includes an arm suspended from a lifting device, the arm at its lower end having a rotatable element carrying blades which in operation will deliver material radially inwardly to the foot of an elevator carried by the arm.



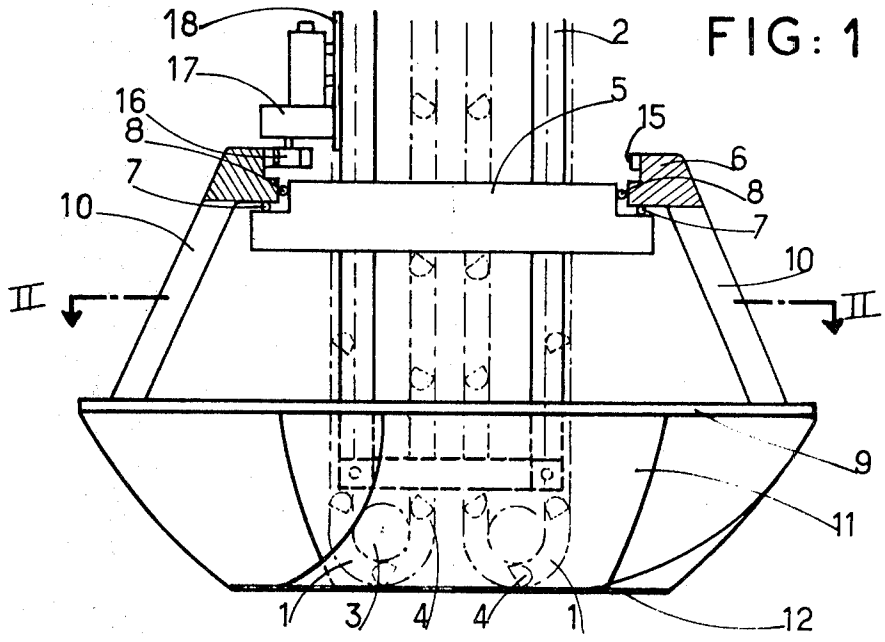

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FIG: 1

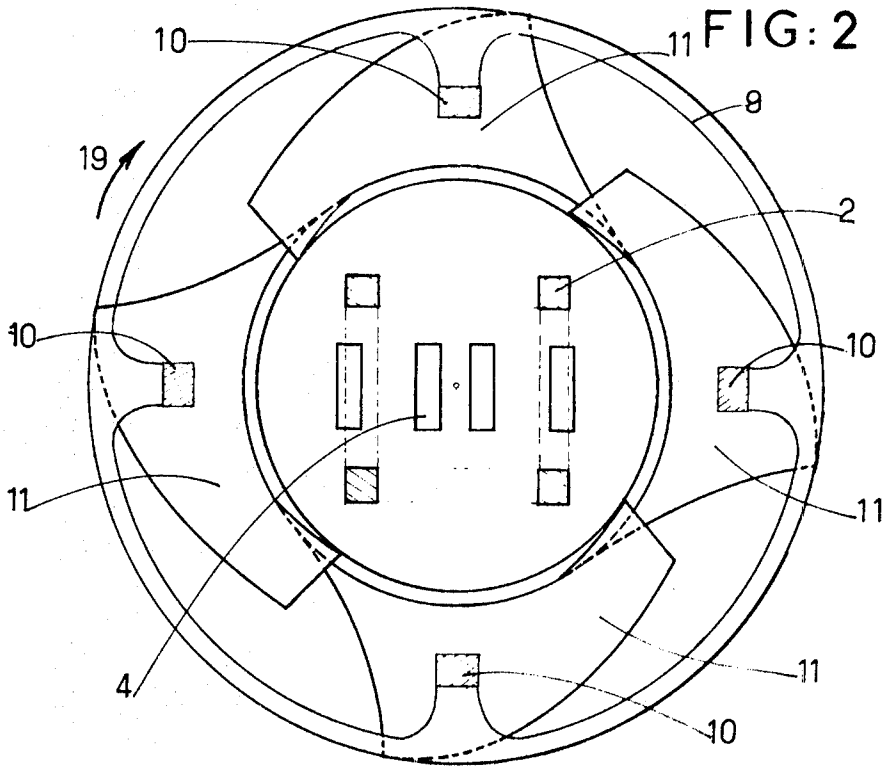
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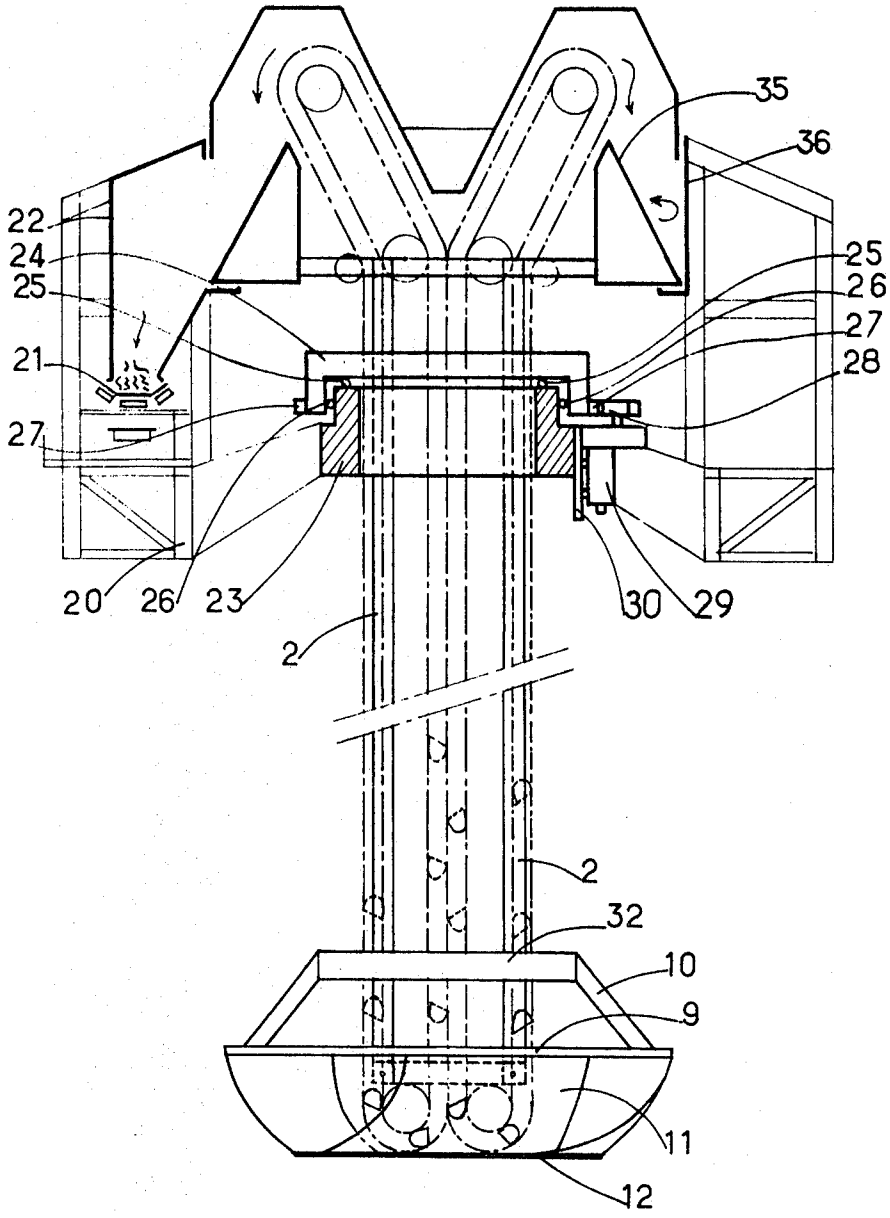
FIG: 2

FIG: 3



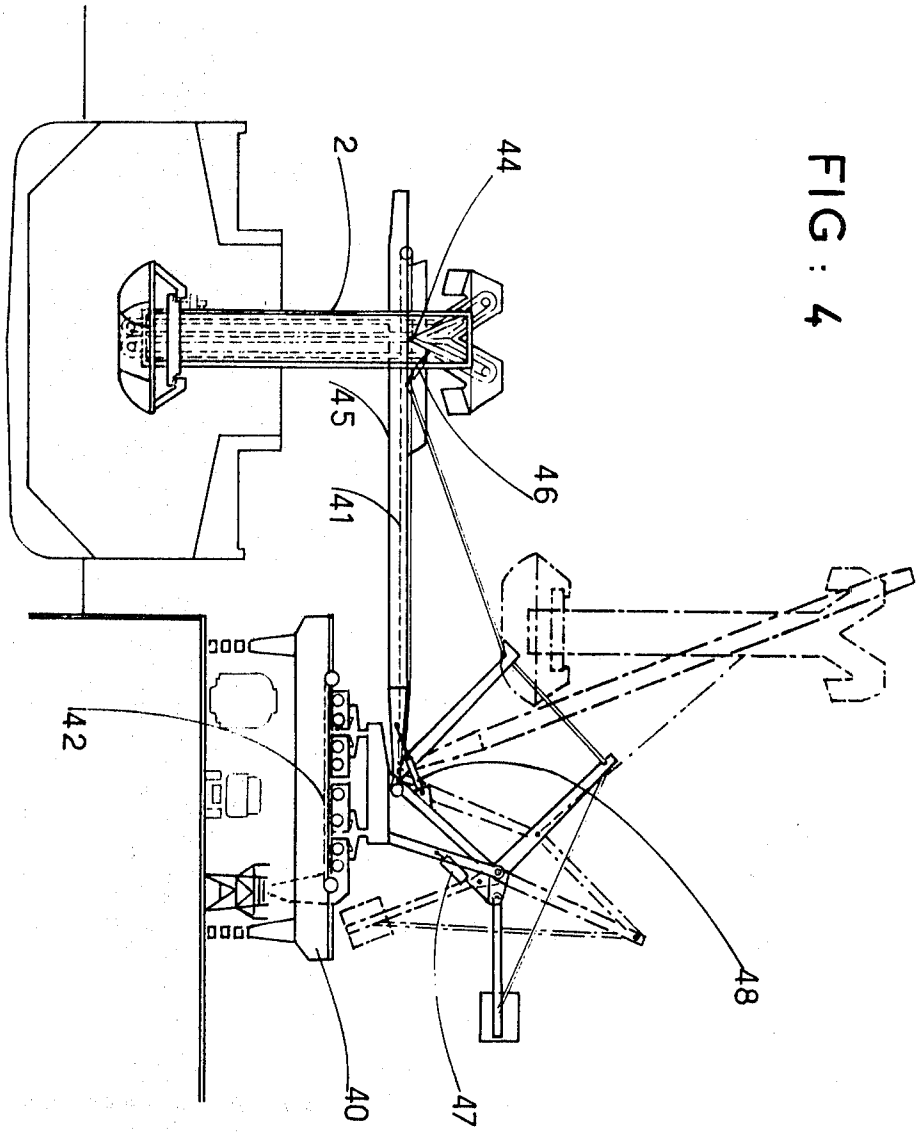


FIG. 4

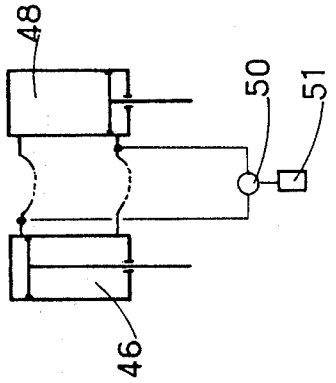


FIG: 6

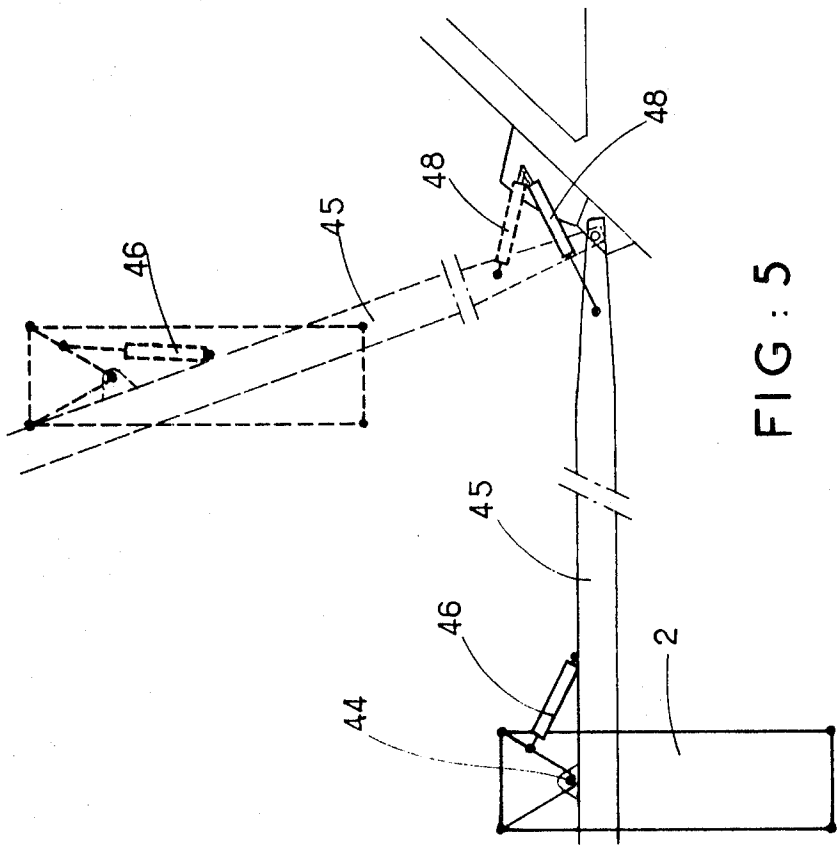


FIG: 5

APPARATUS FOR ELEVATING BULK MATERIAL

This invention relates to bulk materials elevating equipment, more particularly, for example, for ship-unloading equipment.

The various bucket- or grab-type elevators all have the disadvantage of being difficult to supply so that in order to obtain a high rate of delivery the base of the elevator has to be moved horizontally at high speed into the product. The reason for this is that each element of the elevator can engage only the material situated in its path and the amount of material engaged is limited to the volume resulting from the section of the furrow cut in the material by the base of the elevator multiplied by the speed of horizontal movement of the elevator.

This invention obviates these disadvantages by a system whereby material can be fed to the base of an elevator borne by a substantially vertical movable arm, which is itself borne by a lifting means having means for discharging the materials at their exit from the elevator.

According to the invention there is provided bulk material elevating apparatus comprising an elevator system borne by an arm suspended from a lifting device comprising means for discharging material delivered by the elevator system, an element adjacent the lower end to the arm rotatable about the axis of the arm and blades carried by the rotatable element and disposed substantially at the same level as the bottom point of the elevator system the blades having an altitude relative to the rotation axis to form guide means to drive material towards the axis of rotation and the elevator system.

The invention will now be described in greater detail with reference to specific embodiments, given by way of example and illustrated in the drawings, in which:

FIG. 1 is a simplified illustration of the bottom part of an elevator, the bottom end of which is provided with a rotating element according to the invention;

FIG. 2 is a section on the line II—II in FIG. 1;

FIG. 3 is a simplified diagram of another embodiment wherein the rotating element is rigidly secured to the arm of the elevator and rotates therewith;

FIG. 4 shows the elevator equipment pivotally connected to the jib of a ship-unloading system, and the relative movement of the arm and jib on the lifting movement of the jib;

FIG. 5 is a diagram showing the means for controlling the movement of the arm with respect to the jib;

FIG. 6 is a hydraulic diagram of this control mechanism.

Referring to FIGS. 1 and 2, the elevator consists of two endless chains 1, the ascending runs of which are situated opposite one another. The chains are supported by a vertical arm 2; each of them is rotated by a driving wheel disposed at the top of the elevator while at the bottom part shown in the Figure the chains pass over reversing wheels 3. The chains 1 bear buckets 4 which, depending upon the nature of the product to be elevated, may be replaced by forks or pallets.

The bottom part of the framework of the arm 2 supports an annular plate 5 rigidly secured to the arm 2. The plate has two runways forming a vertical and radial abutment for a ring 6 resting on the plate 5 through the agency of bearings 7 and 8.

A ring 9 is suspended from the ring 6 by means of four arms 10. Four scoops or blades 11 are secured by their top part beneath the ring 9 while their bottom part is connected to a ring 12.

The ring 6 has an internal toothing 15 meshing with an output gearwheel 16 of a motor and reduction gear 17. The latter is mounted on a support plate 18 rigidly secured to the framework 2 of the elevator arm.

To use the equipment constructed according to the invention, the motor 18 is started when the base of the elevator approaches the material which is to be handled, and the four blades 11 are rotated as a result. The blades 11 rotating in the direction of the arrow 19 detach the material at the periphery and feed it to the center where it is taken up by the elevator buckets. The range of operation of the elevator is thus increased—during penetration into the material—to cover the entire circular area bounded by the ring 9. If the elevator is then moved transversely in the material, the width of the operative front corresponds to the diameter of the ring 9 and not just to the width of the buckets.

Reference will now be made to FIG. 3 to describe another embodiment of the invention. In this case the elevator assembly is supported by a framework 20 which may, for example, be the jib of a crane or a horizontal element of a travelling crane. The framework laterally supports a belt conveyor 21 and a hopper 22 discharging into the conveyor.

The framework also supports an annular plate 23 through the aperture of which passes the framework 2 of a bucket elevator of the same type, for example, as that shown in FIGS. 1 and 2. The plate 23 comprises two runways forming a vertical and radial abutment for a ring 24 rigidly secured to the framework 2. The ring 24 rests on the plate 23 through the agency of bearings 25 and 26. The ring 24 has an external toothing 27 meshing with the output gearwheel 28 of a motor and reduction gear 29 which is mounted on a support plate 30 rigidly secured to the fixed annular plate 23.

At the bottom, the framework 2 of the elevator is rigidly secured to an annular plate 32 from which there is suspended an assembly of four blades 11 disposed in the same way as described in connection with FIGS. 1 and 2.

In this embodiment, therefore, the entire system comprising the elevator and the blades disposed at its bottom part can be rotated by the motor 29.

At the top of the elevator, the materials are discharged into a conical hopper 35 which rotates at the same time as the elevator. The hopper rotates inside a circular casing 36 closed over its entire periphery except opposite the hopper 22 feeding the conveyor 21. During rotation of the system, therefore, the materials accumulate between the hopper 35 and the casing 36 until they are discharged opposite the hopper 22 and onto the conveyor 21.

FIG. 4 shows the use of equipment of the first type as described in FIGS. 1 and 2, disposed on the jib of a gantry unloader 40. This equipment comprises in the conventional manner a series of conveyors, e.g. 41 or 42, or intermediate conveyors (not shown), for feeding the material discharged by the elevator to its final destination.

The framework 2 of the elevator is pivotally connected at 44 to the jib 45 of the equipment and its inclination to the jib is governed by a jack 46 connected to the jib and to a member of the framework 2. The movement for inclining the jib is produced by the jack 47. The arm 2 of the elevator is held in a vertical position when the inclination of the jib 45 varies, by means of a pilot jack 48 which acts on the arm inclination jack 46. The jack 48 is disposed between the jib and the fixed frame of the equipment.

FIGS. 5 and 6 show more clearly how the position of the arm 2 is governed by the inclination of the jib 45. In the position shown in solid lines in FIG. 5, which corresponds to a substantially horizontal position of the jib and a substantially vertical position of the elevator arm, the jack 46 is practically completely retracted while the jack 48 is practically completely extended. The jacks 46 and 48 are double-acting jacks of the same cross sections and the respective like chambers of which correspond to one another, i.e., the chamber at the rod end of the jack 46, for example, permanently communicates with the same chamber of the jack 48, and the same applies to the chambers of the end of the jack, as shown by the elementary hydraulic diagram in FIG. 6. The oil flow between the two jacks 46 and 48 is therefore a closed circuit and the initial relative adjustment of these two jacks is such that when one is fully retracted the other is fully extended.

When the jib 45 is raised by the action of the jack 47, the piston rod 48 enters the jack body to a greater depth and this results in a corresponding movement in the direction of extension of the jack 46. It is a simple matter to determine the points for fixing the jacks 46 and 48 on the fixed frame of the equipment, the jib 45, and the arm 2 so that their respective travels result in identical angular movements of the jib 45 and the arm 2. Under these conditions, the arm 2 retains the same

inclination for all positions of the jib **45**. Of course, this inclination of the arm **2** is not strictly limited to the vertical and may be modified by introducing an offset between the initial positions of the pistons of the two jacks **46** and **48**, e.g. by means of a circulating pump **50** driven by a motor **51**.

The invention is not strictly limited just to the embodiments described by way of example, but also covers other embodiments differing therefrom only in detail. Thus we have described an embodiment using two combined elevators in which the ascending runs are situated opposite one another but the invention could be embodied by using any other type of elevator and more particularly a single-bucket elevator or double elevator in which the descending runs are situated opposite one another.

I claim:

1. Bulk-material-elevating apparatus comprising an elevator system borne by an arm suspended from a lifting device comprising means for discharging material delivered by the elevator system, a long axis for said arm, an element adjacent the lower end of the arm rotatable about the long axis of the arm and blades carried by the rotatable element and disposed substantially at the same level as the bottom point of the elevator system the blades having an attitude relative to the rotation axis to form guide means to drive material towards the axis of rotation and the elevator system, said lifting device including means for rotating the arm and the elevator system about the long axis of the arm, the rotating element being rigidly secured to the arm.

2. Apparatus according to claim **1**, wherein the arm includes means for rotating the element in relation to the long axis of the arm.

3. Apparatus according to claim **2**, wherein the lifting device comprises a jib to which the arm is pivotally coupled, a first hydraulic jack controlling the arm relative to the jib, a second hydraulic jack of the same diameter connecting the jib to a frame of jib-lifting means, like chambers of the two jacks being interconnected by conduits in a closed circuit.

4. Apparatus according to claim **1**, wherein the blades are interchangeable.

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