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(54) A BORING DERRICK HAVING A BORING BAR TRANSPORT DEVICE

(71) We, GROUPEMENT ATOMIQUE ALSACIENNE ATLANTIQUE, a French Body Corporate, of 20 Avenue Edouard Herriot, 92 Le-Plessis-Robinson France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a transport device for transporting boring bars or groups of boring bars between an upright position with a boring derrick and a substantially horizontal storage position which it to one side of the derrick.

According to the present invention, there is provided a boring derrick including a boring bar transport device incorporating first rail means extending transversely of the boring axis, second rail means incorporatng a rectilinear part which extends at an angle of between 45° and 60° to a line which is parallel to or coincident with the boring axis, a carriage provided with spaced supports which respectively engage the first and second rail means, and boring bar gripping means on the carriage, the arrangement being such that a boring bar or a group of boring bars may be engaged by the gripping means and transported between an upright position within the derrick and a storage position which is substantially perpendicular to the aforesaid position and which is to one side of the derrick.

In the greater portion of constructions designed by the Applicants, the second rail means is constituted by two rectilinear parts interconnected by a curve having a large radius of curvature, the rectilinear part nearest the derrick being substantially vertical. The first rail means is generally located in a horizontal plane. However, in some cases the first rail means may comprise, nearest to the derrick, a short portion curved in a vertical plane.

[Price 25p]

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1*a* is a side elevation of a boring derrick of the invention, with a group of three boring bars in an upright position;

Figure 1*b* is a front elevation of the derrick of Figure 1*a*;

Figure 2*a* is a side elevation of the derrick of Figure 1*a*, with the group of three bars in a storage position;

Figure 2*b* is a partial section along the line CC of Figure 2, illustrating an unloading operation;

Figure 3*a* is a side elevation of a carriage used in the derrick of Figure 1a; and

Figure 3*b* is a plan view of the carriage of Figure 3*a*.

In Figure 1*a* a group 1 of three boring bars is disposed upright within a derrick represented diagrammatically by its external contour 2 and by its median axis 3 which is the boring axis, the assembly being disposed on board a ship. The group of three bars 1 is disposed at a predetermined distance from the median axis 3 so that transport of a group of boring bars between the upright position and a storage position may be effected simultaneously with operation of the travelling block to raise or lower another group of bars within the derrick. A carriage 4 bears at its lower portion on a first, substantially horizontal pair of rails 5 and at its upper portion on a second pair of rails 6. The rails 6 have a rectilinear part which extends at an angle of between 45° and 60° to the median axis 3, and an upright part which is connected to the aforesaid rectilinear part by an arc having a large radius of curvature. The group of three bars is firmly secured to the carriage by four grippers 7, 8, 9 and 10.

Figure 1*b* illustrates the amount of bracing

necessary for imparting to the guide rail framework 6' a degree of rigidity which is adequate to ensure that the carriage 4 will not be subjected to excessive oscillations under the influence of swell. It will be seen that the framework has a lower horizontal portion connected to the derrick base and an upper portion also connected to the derrick. It will also be seen that the aperture 2' in the derrick, through which aperture the group of bars may pass, has a height which is substantially lower than that of the group of bars in the upright position, so that the derrick is more rigid than it would be if the group of bars were to be lowered from the upright position by pivotal movement about the lower end of the carriage.

Figure 2*a* shows the carriage 4, on which are supported the group 1 of three bars, in a substantially horizontal storage position. The group of three bars is positioned above the first element of a storage means diagrammatically represented by an elevator 11 having a receiving channel.

The section along CC, shown in Figure 2*b*, illustrates the grippers open and the group of bars 1 released from the grippers in the channel of the elevator.

Figure 3*a* shows the carriage 4 in more detailed fashion. This elevation shows one of the horizontal rails 5 and also the commencing portion of one of the ascending rails 6. The carriage engages with the rails 5 and 6 through the intermediary of complex bogie trucks 12 and 13 respectively.

The carriage comprises a lattice girder 14 having an end beam 15 which is pivotally connected at 16 to the bogie truck 12. The lattice girder 14 is pivotally connected at 18, to the bogie truck 13 through the intermediary of a beam 17. The grippers 7, 8, 9 and 10 for gripping a group of boring bars are secured to the beam 14. The bogie truck 12 comprises, at each side, two support rollers (19, 20, and 19', 20') and a counter roller 21. The bogie truck 13 also has four support rollers 22, 23, 22' and 23', and has four counter rollers 24 and 25.

In the plan view of Figure 3*b*, there is shown the lattice structure of the girder 14 and also the lower beam 15 and the upper beam 17; the pivotal axis 16 of the beam 15 is shown more clearly. In addition to the support rollers 19 and 20 at one side of the bogie truck 12, there may also be seen the support rollers 19' and 20' at the other side. The bogie truck 12 also has, at one side only, a set of four locating rollers 26, 27, 28 and 29. The other side of the bogie truck is not provided with locating rollers because, in a particularly vigorous swell, the rails may be subjected to a high degree of stress which results in relative deformation of the two rails, and it is necessary to minimise the amount of stress which may be consequently transmitted to the carriage and thus impede the movement thereof. Figure 3*b* shows that the bogie truck 13 also has, on the same one side as the bogie truck 12, a set of four locating rollers 30, 31, 32 and 33. As in the case of the bogie truck 12, the bogie truck 13 does not have locating rollers on its other side, so that the transport device as a whole has sufficient flexibility to be substantially unaffected by stresses caused by a high swell.

Operation of each of the four grippers may be conveniently controlled by two pairs of jacks. At each terminal position of the carriage (upright position and substantially horizontal storage position) there is a pair of jacks opposite each gripper, which jacks co-operate with a slide member on the respective gripper to open or close the gripper jaws. The jaws are adapted to receive one of two sets of jaw elements, permitting the handling of either 2.7 cm (5 inch) bars or 8.9 cm (3.5 inch) bars.

Operation of the transport device as a whole will now be described.

At the start of removing a group of three bars from the derrick, the group is put into an upright position in the derrick offset from the median axis 3 in such manner that the group does not hinder operation of the derrick travelling block. A sequence of automatic operations then displaces the group of three bars to the substantially horizontal storage position above the receiving channel of the storage means. Firstly under the action of the jacks, the jaws of the grippers 7, 8, 9, and 10 grip the group which is thus secured to the carriage 4. The carriage is controlled by a cable and comences to move in such manner that the upper portion descends the rails 6 whereas the lower portion is displaced along the rails 5. The cable tends to brake the descent of the carriage and serves as a traction cable during the reverse transport operation. When the carriage is exactly in the storage position, a contact triggers the jacks which open the jaws of the grippers 7, 8, 9 and 10, to release the group of bars. A group of bars may be hoisted from the storage to the upright position by performing the reverse transport operation.

The above described embodiment of the invention may provide the following advantages:

During movement of the group of bars, the centre of gravity of the assembly constituted by the bars and the carriage is displaced only very slightly, for example by not more than one metre, from the straight line connecting the terminal positions of the centre of gravity of the assembly. Thus, the transport operation is effected at an expenditure of power which is substantially constant, which requires a motor of minimum power.

On studying the trajectory of the head of the group of bars, it will be seen that the

head passes at a distance from the derrick travelling block, so that transport of a group of bars from the upright to the storage position may be effected simultaneously with operation of the travelling block to raise and lower another group of bars.

Examination of the trajectory of the groups of bars will show that the transport of the bars into and out of the derrick will necessitate an aperture of relatively small dimensions in the face of the derrick, so that the derrick is not appreciably weakened.

As a group of three boring bars is transported from the derrick to a storage position to one side of the derrick with the end of the group, at the instant of unloading, at a distance of approximately one bar length from the well, it is a relatively easy matter to provide a first element, such as an elevator, of a storage means, to receive a group of bars released from the gripping means of the carriage, without being hindered by the derrick understructures.

As the travel path of the lower end of the carriage is a straight line located in a substantially horizontal plane, the carriage may be controlled in a particularly simple manner by cables or chains acting solely on the lower end of the carriage.

Although the above described device appears advantageous for the carrying into effect of the invention in a particular technical situation, it will be understood that various modifications, relating particularly to the shape of the first rail means, which may be horizontal over a large portion to terminate in an ascending curve at the derrick, and also to the connection of the second rail means with the derrick, could be introduced without exceeding the scope of the invention as defined in the appended claims that some of the elements thereof could be replaced by others capable of performing an equivalent function.

WHAT WE CLAIM IS:—

1. A boring derrick including a boring bar transport device incorporating first rail means extending transversely of the boring axis, second rail means incorporating a rectilinear part which extends at an angle of between 45° and 60° to a line which is parallel to or coincident with the boring axis, a carriage provided with spaced supports which respectively engage the first and second rail means, and boring bar gripping means on the carriage, the arrangement being such that a boring bar or a group of boring bars may be engaged by the gripping means and transported between an upright position within the derrick and a storage position which is substantially perpendicular to the aforesaid position and which is to one side of the derrick.

2. A boring derrick according to claim 1, wherein the first rail means lies in a horizontal plane.

3. A boring derrick according to claim 1 or 2, wherein each support comprises a bogie truck which is pivotally connected to the carriage and which carries a set of rollers to engage the respective rail means.

4. A boring derrick according to claim 3, wherein the set of rollers for each bogie truck comprises at each side of the bogie truck a support roller and a counter roller mounted respectively above and below one rail of an associated pair of rails, and at one side of the bogie truck locating rollers mounted at each side of the respective rail with their axes of rotation substantially perpendicular to those of the support and counter rollers, said one side of each bogie truck being at the same side of the carriage.

5. A boring derrick including a transport device, substantially as hereinbefore described with reference to the accompanying drawings.

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Examination of the trajectory of the groups of bars will show that the transport of the bars into and out of the derrick will necessitate an aperture of relatively small dimensions in the face of the derrick, so that the derrick is not appreciably weakened.

As a group of three boring bars is transported from the derrick to a storage position to one side of the derrick with the end of the group, at the instant of unloading, at a distance of approximately one bar length from the well, it is a relatively easy matter to provide a first element, such as an elevator, of a storage means, to receive a group of bars released from the gripping means of the carriage, without being hindered by the derrick understructures.

As the travel path of the lower end of the carriage is a straight line located in a substantially horizontal plane, the carriage may be controlled in a particularly simple manner by cables or chains acting solely on the lower end of the carriage.

Although the above described device appears advantageous for the carrying into effect of the invention in a particular technical situation, it will be understood that various modifications, relating particularly to the shape of the first rail means, which may be horizontal over a large portion to terminate in an ascending curve at the derrick, and also to the connection of the second rail means with the derrick, could be introduced without exceeding the scope of the invention as defined in the appended claims that some of the elements thereof could be replaced by others capable of performing an equivalent function.

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