This invention relates to plate handling apparatus and more particularly to plate handling apparatus to be used in operation in association with conveyor systems.

Metal plates may be of such size and weight that they are difficult to handle and cumbersome to control.

In certain types of operations, it is essential that large heavy metal plates be maneuvered for processing and it is an object of the invention to provide improved apparatus for the handling of such plates.

For example, in the processing of steel plates by shot blast equipment, it is necessary to convey steel plates in vertical position to a processing station. This frequently necessitates moving the plates from horizontal to vertical attitude.

It is a further object of the invention to provide improved apparatus for the above type of operation and, more particularly, to provide for moving heavy plates from horizontal to vertical position and vice versa.

In many instances, the handling of large plates is a time consuming operation which is wasteful of machine and operator time and it is accordingly a further object of the invention to provide for improved economy in these respects.

Another object of the invention relates to the avoiding of machine stoppage in the processing of heavy plates whereby the handling of said plates is made a substantial integral part of a continuous operation.

Still a further object of the invention is to provide an improved conveying phase for shot blast operations.

With regard to the above and other of its objectives, the invention contemplates the provision of plate carriers operatively associated with a conveyor system and adapted for tilting heavy plates from horizontal to vertical position.

In accordance with a feature of the invention, each plate is actually tilted beyond an absolutely vertical position to an inclined position whereat it is supported by specially provided means.

In accordance with a further feature of the invention, special engaging means are provided in operative association with the plate carriers for the engaging and disengaging of heavy plates.

Advantageously, devices provided in accordance with the invention are suited both for placing plates on or removing plates from conveyors. They are therefore useful both on the input and output side of conveyor systems operating with shot blast units. It is therefore possible to use a single type of unit for all phases of shot blast operations and the like in accordance with the invention.

Furthermore, the invention makes it possible to employ simple components to achieve its purposes, these components having been proven operative and reliable in many other applications.

Other objects, features and advantages of the invention will be apparent from the following description as illustrated in the accompanying drawings in which:

FIG. 1a is a diagrammatic view of the input phase of a shot blast system including a conveyor with a plate handling system provided in accordance with the invention;

FIG. 1b is a diagrammatic view of the output phase of the system of FIG. 1a and including units of the invention;

FIG. 2 is a side view in enlarged scale of a unit of the invention taken along line III-III of FIG. 1b and

FIG. 3 is a side view in enlarged scale taken along line II-II of FIG. 1b.

In the FIGS. 1a and 1b is diagrammatically illustrated a shot blast unit 10 and as is typical steel plates are conveyed in vertical position to said shot blast unit wherefrom they are taken in vertical position.

The problem contemplated by the invention is that it is normal to deliver these steel plates which are to be processed by the shot blast unit 10 in horizontal attitude. Also it is customary to remove these steel plates in horizontal attitude. Therefore it is necessary to bring the delivered steel plates from horizontal attitude to vertical attitude for processing in the shot blast unit 10 and when the treatment of these steel plates is completed it is necessary to bring the steel plates from vertical attitude to horizontal attitude for removal.

In FIGS. 1a and 1b are illustrated input and output conveyor systems 12 and 14 respectively. These systems each consist of lateral guides 16 and 18 as well as of rollers 20 which are linearly arranged and spaced from one another.

In accordance with the invention horizontal steel plates are to be positioned on end in substantially vertical position on the rollers 20 for movement into the shot blast unit 10 whereat the plates are processed and then delivered on end in substantially vertical position to the rollers 20 of the output conveyor system 14.

For this purpose and in accordance with the invention there are provided a plurality of plate carriers 22 operatively associated with the input conveyor system 12 and with the output conveyor system 14. The plate carriers 22 may be of any desired number. For example within the scope of the invention there is contemplated that one or more plate carriers 22 be operatively associated with the input conveyor system 12 and that similarly one or more plate carriers 22 be operatively associated with the output conveyor system 14.

Each of the plate carriers 22 operates in an identical manner which will be hereinafter indicated in greater detail. It is sufficient to note at this time that a plate carrier 22 preferably comprises a grid-like system of beams 24 and 26 connected so as to constitute a grill for supporting a steel plate. It is also to be noted that each plate carrier 22 further includes a terminal beam arrangement 28 at that side of the plate carrier which is adjacent the associated conveyor system.

In further accordance with the invention each plate carrier 22 is operatively associated with a pivotal support means 30 as well as with a means 32 adapted to effect a pivotal movement of the associated plate carrier 22. The function of means 30 and 32 is to raise the associated plate carrier 22 into a substantially vertical position and to pivot the associated plate carrier 22 past this substantially vertical position to a further extreme position whereat the plate carrier 22 is inclined to a vertical plane passing through the associated conveyor system. In its inclined position the plate carrier 22 will be inclined in a direction opposite to that which it normally occupies when in horizontal position as illustrated in FIGS. 1a and 1b.

The invention also contemplates the provision of plate engaging means 34 of which there are at least one and preferably two or more in number. It is the function of plate engaging means 34 to provide a support for a steel plate on carrier 22 when the latter is nearing vertical attitude so as to prevent the steel plate from slipping off. As will be indicated hereinafter in greater detail the
plate engaging means 34 is provided with means whereby the steel plate can be both engaged and disengaged. On the opposite side of the conveyor systems are arranged a number of plate supporting elements 36. Each of these plate supporting elements is of similar construction intended to perform the function of supporting steel plates in substantially vertical attitude while these steel plates are in engagement with the rollers 20. The form and operation of elements 36 will be considered in greater detail hereinafter.

Preferably the system provided in accordance with the invention operates by means of the judicious distribution of a pressure medium. In fact the invention preferably employs a hydraulic system.

For this purpose there is provided a pump system 38 which distributes fluid under pressure via lines 40 and 42 to the input and the output side respectively of the entire system.

Line 40 branches into lines 44, 46 and 48 with which are respectively associated valves 50, 52 and 54. Valve 50 controls the pressure, feeding into a line 56 whereas valves 52 and 54 respectively control the pressures in lines 58 and 60. Line 56 controls pivot means 32; line 58 controls plate support elements 36; and line 60 controls plate engaging means 34.

On the outlet side of the system, line 42 branches into lines 62, 64 and 66 with which are respectively associated valves 68, 70 and 72. Valves 68, 70 and 72 respectively control the pressure in lines 74, 76 and 78 which respectively control in the output part of the system plate engaging means 34, plate support elements 36 and pivot means 32.

FIG. 2 illustrates one of the units provided in accordance with the invention in side view and greatly enlarged to facilitate an understanding of the operation thereof.

In FIG. 2 are illustrated a plate carrier 22 on which is supported a plate engaging element 34, the carrier 22 being supported by a pivotal support 30 and being actuated for pivotal movement by a pivot means 32. On the opposite side of the conveyor is illustrated a plate supporting element 36.

Carrier 22 comprises aforesaid beams 26 and a terminal beam arrangement 28. To restrict carrier 22 to a horizontal position and to prevent an excess pivoting of the same the invention contemplates the provision of an abutment member 80 which supports at least a part of the weight of a steel plate mounted on the carrier 22.

The pivotal support 30 comprises a frame arrangement 82 including a horizontal shaft 84 upon which the carrier 22 is rotatably mounted by means of wings 86.

Integrally with either the wings 86 or the shaft 84, is a segment gear 88 which engages at its lowermost part a rack 90.

Rack 90 is connected with a ram or piston rod 92 of a piston and cylinder arrangement 94. To the cylinder of the piston and cylinder arrangement 94, is connected line 56.

It follows from the above description that when a pressure fluid is fed via line 56 to the piston and cylinder arrangement 94, that the ram 92 is forced outwardly of the arrangement 94. This in turn causes a rotation of the segment gear 88 which rotates the shaft 84 or in any event pivots the carrier 22 upwardly in counterclockwise direction around said shaft.

As shown in FIG. 2 the steel plate on carrier 22 passes through several phases indicated by reference characters a, b, c and d.

In position a, a steel plate S is shown at rest on carrier 22. In position b carrier 22 is shown in substantially vertical attitude. In position c, steel plate S has passed its vertical position and is tending to assume a position at which it is inclined by approximately 7° to a vertical plane passing through the conveyor system. Position d illustrates the position of the steel plate S after it has lost contact with carrier 22, and in which position the weight of the steel plate is borne by plate supporting element 36 and by the associated conveyor system.

To retain the plate S in its position d and to engage the plate S when the carrier 22 has assumed position c, the invention contemplates the provision of appropriate details for the plate support element 36.

In this regard plate support carrier 36 comprises at least one piston and cylinder arrangement 96 supported on a frame 98 which frame is stationary relative to the associated conveyor system. On the ram 100 of piston and cylinder arrangement 96 is positioned a freely rotatable roller 102. This roller with the piston and cylinder arrangement 96 fully extended, tends to assume a position wherein it engages the plate S which has assumed a substantially vertical attitude. The roller 102 is then withdrawn from this position as the carrier 22 continues to pivot past its vertical position it rests against said roller. The roller in its fully retracted position, as indicated at 102, supports the plate S inclined to the vertical by an angle of about 7° as aforesaid.

The invention contemplates the provision of more than one piston and cylinder arrangement 96 and a second is indicated by way of example as piston and cylinder arrangement 104. This arrangement similarly consists of a freely rotatable roller 106 mounted on the ram 108 of the piston and cylinder arrangement 104. It is to be noted that with both rollers 102 and 106 in fully retracted position that they cooperatively define the angle at which it is desired to support the plate S.

The reason why the invention contemplates the provision of extendable and retractable rollers 102 and 106 is that if the plate S were permitted to tip from vertical position into position d the shock which frame 98 would have to absorb would be rather harmful considering the weight of the plate which is likely to be processed. Accordingly, rollers 102 and 106 first make contact with the plate S when the latter is in vertical position so that the frame 98 gradually receives the portion of the weight which it is intended to support.

Going back to carrier 22 in its horizontal position it is seen, as is noted above, that the carrier 22 is provided with a plate engaging means 34. Plate engaging means 34 consists of a piston and cylinder arrangement 110, the ram 112 of which supports a pawl 114. By reason of the provision of piston and cylinder arrangement 110, pawl 114 is both extendable and retractable.

What is desired is a horizontal position and adapted for receiving a steel plate, the pawl 114 is brought to its retracted position. Thence as the carrier tilts towards its position a, and pawl 114 passes between the interstices between rollers 20, the weight of the plate S is borne by rollers 20 and the pawl 114 may be withdrawn, after having first been extended to fully complete the release of the steel plate S. It will be appreciated that in lifting steel plate S from the output conveyor system 14 that the opposite of the above operation is effected and that the pawl 114 is first fully extended and then retracted while engaging the plate S to draw the same into proper position on the associated carrier 22.

FIG. 3 illustrates a further construction of plate engaging member 34 in greater detail.

In FIG. 3 is illustrated terminal beam arrangement 28 of carrier 22. On this terminal beam arrangement is fixed a beam system 116 upon which is supported a cylinder 110. In the cylinder 110 is a piston (not shown) to which is attached a piston rod or ram 112. This ram engages a rod 122 in rigid manner so that the rod 122 moves with the ram 112. The pawl 114, as noted above, is rigidly connected with the rod 122 and a bearing 124 is provided which maintains the rod 122 in fixed attitude relative to the associated plate carrier 22.

Operation of the piston and cylinder arrangement
causes an extension or retraction of the ram 112 so that the pawl 114 moves between position 114 indicated by the use of solid lines and position 114a shown in dot dash lines. In position 114a the rod 122 has its pawl arranged so as to receive or discharge a steel plate in horizontal position.

The above apparatus is susceptible of various modifications within the scope of the invention. However, it will be evident from the description given above, that an arrangement is provided by the invention which is suited for handling large and heavy plates in association with conveyor systems. Moreover it will be appreciated that an arrangement has been provided whereby steel plates received in horizontal attitude can be displaced to vertical position for the feeding thereof to a shot blast unit wherefrom the plates are removed in vertical attitude and then horizontally discharged.

There will now be obvious to those skilled in the art many modifications and variations of the structure set forth. These modifications and variations will not however depart from the scope of the invention as long as they lie within the bounds of the following claims.

What is claimed is:
1. In combination with a conveyor apparatus for moving a plate between a horizontal position and an approximately vertical position on the conveyor, said apparatus comprising a plate carrier, support means pivotally supporting said plate carrier adjacent said conveyor for movement from a horizontal position through an angle of more than ninety degrees as well as through a position whereat the carrier is vertically superposed with respect to said conveyor, pivot means engaging said carrier for controllably effecting the pivoting of the same, plate engaging means on said carrier for engaging said plate and supporting the same during pivoting of said carrier, engagement control means coupled to the plate engaging means for displacing the plate engaging means relative to said plate, said plate carrier being adjacent a side of said conveyor, plate support means on the other side of said conveyor and adapted for receiving a plate from said carrier as the latter pivots through its vertical position, said plate support means supporting the plate in tilted position on the conveyor, said plate support means comprising superposed piston and cylinder arrangements and rollers thereupon for engaging said plate, said rollers having positions of minimum extension whereby they define cooperatively an angle with the vertical and are adapted to support said plate for movement along said conveyor.
2. Apparatus as claimed in claim 1, wherein said plate support means comprises a frame supporting said piston and cylinder arrangements.
3. Apparatus as claimed in claim 1, wherein said angle is approximately seven degrees.

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