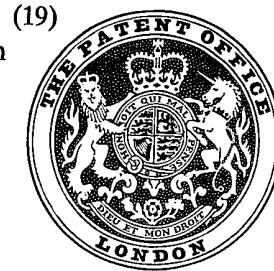


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(54) A SYSTEM FOR THE STORAGE, CONVEYANCE TO STORAGE, AND
 CONVEYANCE FROM STORAGE OF METAL SHEETS, PARTICULARLY FOR
 USE IN SHIPBUILDING

(71) We, B.V. KONINKLIJKE
 MAATSCHAPPIJ "DE SCHELDE", a
 Dutch limited liability company of Vlis-
 singen, The Netherlands, 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:-

The invention relates to a system for the
 storage, conveyance to storage and con-
 veyance from storage of metal sheets, par-
 ticularly for use in shipbuilding, and is par-
 ticularly applicable to the storage and sorting
 of large metal sheets of various sizes, particu-
 larly, but not exclusively for use in ship-
 building.

Systems of this type are known in practice.
 The sheets, which are usually supplied by
 ship or, as the case may be, by rail, are
 unloaded by a crane and deposited on the
 quay. A portal crane with a beam holding a
 lifting magnet and bridging a storage yard or
 a shed will then distribute the sheets one by
 one over the area of the yard or the shed
 according to size or to that section of the ship
 for which they are intended.

When a certain sheet is required, this sheet
 is lifted again and taken to a conveyor which
 will provide for supply to the ship-yard.

Such systems as known have various dis-
 advantages. The crane is adequate for a cer-
 tain area of the storage yard only. Extension
 of the storage yard in certain directions will
 require a reconstruction of the crane or even
 a new crane. The crane can convey only one
 sheet at a time. Consequently, this takes
 much time when the sheets are carried off
 again. Generally, a number of sheets in vari-
 ous sizes but belonging to a particular section
 of the ship under construction are piled in the
 storage yard. Now, when a particular sheet
 from the stack must be used first, the sheets
 lying on top will have to be removed tem-
 porarily. This requires extra sorting capacity.

According to the invention, there is pro-

vided a system for the storage, conveyance to
 storage and conveyance from storage of
 metal sheets, in which there is at least one
 storage area composed of parallel passages,
 each passage having a pair of rails, one at
 each side of the passage, and a support sur-
 face for sheets located between said pair of
 rails as seen in plan, there being a first vehicle
 movable on wheels on the rails of said pas-
 sages having pick-up means adapted to lift a
 sheet from one of the support surfaces by
 engagement with the top surface of the sheet,
 and there being along at least one side of the
 said storage area, a second set of rails, trans-
 verse to the passages, on which a second
 vehicle moves past the end of each said pas-
 sage, the second vehicle having a pair of rails
 registrable with the pair of rails of each pas-
 sage so that the first vehicle can move from
 the said passages onto the second vehicle and
 vice versa, the said rails on the second vehicle
 being above the rails on which the second
 vehicle runs and the second vehicle having an
 opening beneath the position assumed by the
 first vehicle when carried on the second vehi-
 cle, whereby a sheet carried by the first vehi-
 cle can be lowered through said opening.

Additionally there may be provided at
 least one sheet collector on which the metal
 sheets may be loaded and which is of a size to
 be lowered between the rails of the said pas-
 sages and is adapted to be detachably con-
 nected to the said first vehicle to be trans-
 ported thereby.

After the sheets have been unloaded,
 further conveyance and depositing in the
 required place may be effected by means of
 the vehicles, as a result of which no large
 portal crane will be required. If the storage
 yard should be extended, this will be easily
 and cheaply possible.

By use of one or more first vehicles and of
 one or more second vehicles, any point of any
 passage is within reach.

With the use of sheet collectors, it can be

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possible to pile a certain required combination and to carry this to the ship-yard as a stack. It is possible for the succession in the stack, too, to be as required. For that purpose, two sheet collectors may be set up in a certain passage. If, for instance, two sheet collectors are employed, the collector not intended for conveyance can be used as a temporary storage for the non-required sheets during piling.

Since the sheet collector may be situated over the other stacks in the passage in question, no separate sorting space may be required.

An embodiment of the invention will now be described by way of example, with reference to drawings in which:-

Figure 1 is a plan view of a dock area with a system according to the invention;

Figure 2 is a cross section through the storage shed of the system according to Figure 1 on a larger scale;

Figure 3 is a perspective view of a second vehicle, here called a transfer vehicle, having on top of it a magnet vehicle (a "first vehicle" whose pick-up means are magnetic) and a sheet/collector in position for transport of the system of Figure 1;

Figure 4 is a cross section through figure 3; and

Figures 5 and 6 are two schematic views of the functioning of a magnet beam (being the pick-up means of the magnet vehicle) subdivided into sections.

The dock area shown in Figure 1 includes a berth for a ship 1 from which sheets are supplied. A schematic view of a quay crane is given at 2, which crane transfers the sheets from the ship 1 to a buffer point 3. From the buffer point 3, the sheets are transferred one by one to a roller conveyor 4 and passed through a measuring and marking system 5. In this measuring and marking system, the dimensions and the like of the sheets supplied are measured and the sheets are marked with one or more code characters. The date of the measuring and marking system can be introduced into a computer, as will be described further on.

Thereafter, each sheet arrives on a short roller conveyor 6 situated in a passage 7 of a storage shed 8. In the example shown, the storage shed consists of two storage areas with the passage 7 between them. Of course, the storage shed 8 may also be made up of one single section or storage area with the passage 7 at one end or side thereof.

The storage shed 8 is subdivided into any suitable number of passages, marked here A to H.

Figure 2 is a cross section of the storage shed 8. Of course, if so required, storage may alternatively take place in the open air, but for protection from corrosion or for other reasons, it will be preferable generally to

make use of a roof. As appears from Figure 2, rails 9 extend between each passage A to H, each rail 9 serving for the or each adjacent passage. These rails 9 form the support for a magnet vehicle 10.

A pair of rails (not shown in the drawing) extends in the passage 7. These rails extend perpendicularly to the rails 9. A transfer vehicle can move over the rails in the passage 7.

A more detailed view of this transfer vehicle 11 is given in figure 3. This vehicle consists of a rectangular open frame with longitudinal girders 12 and transverse girders 13. The frame of the transfer vehicle 11 is supported by wheels 14 movable over the rails in the passage 7. Rails (not shown) are mounted upon the longitudinal girders 12, at the level of the rails 9.

It will be understood that the magnet vehicle 10 can be placed upon the transfer vehicle 11 and then moved along the passage 7. When the transfer vehicle 11 comes to a standstill in front of a particular passage (A to H) the magnet vehicle 10 can move off the transfer vehicle 11 and travel along the rails 9 of this passage. It will be clear that, in this manner, any point in any passage of the storage shed 8 is within reach.

The magnet vehicle 10 consists of a cage-like frame with an open lower side (see figures 3 and 4). This frame is made up of four longitudinal girders 15, 16, 17 and 18. Vertical girders 19 extend between the longitudinal girders 15 and 16 between the longitudinal girders 17 and 18, and horizontal transverse girders 20 between the longitudinal girders 16 and 17. The wheels 21 for moving over the rails 9 and the rails mounted on the girders 12 are supported in the frame.

The magnet beam 22 is of sheet form and is subdivided into a number of sections in the longitudinal direction of the magnet vehicle 10 (see also figures 5 and 6). Each section can be moved up and down with respect to the frame of the magnet vehicle. The lifting means for the upward and downward motion of each section are shown in figure 4 and consist of a winch 24 with hoisting ropes. In order to prevent the section of the magnet beam 22 from oscillating with respect to the magnet vehicle 10, each section is guided by vertical guide rods 25.

A sheet collector in the form of a flat framework support is also shown in figures 3 and 4. As appears from figure 4, the rails 9 are mounted on small walls 27, the upper edge of which in each case is stepped so as to receive the longitudinal edges of a sheet collector 26 in the idle position. This idle position is marked with dot-and-dash lines in figure 4. The sheet collector 26 can be lifted when the magnet vehicle 10 is situated over the sheet collector 26. For this purpose, a number of driving mechanisms for vertical screw-threaded spindles 28 are present in the

magnet vehicle 10. These threaded spindles 28 are indicated by dot-and-dash lines in figures 2 and 4. The lower ends of the threaded spindles are connectible onto threaded nut members 29 at the upper side of the collector 26. In this manner, it will be possible to move the collector 26 upwards into the position for transport indicated by full lines in figure 4, in which the longitudinal edges of the sheet collector 26 are adjacent to the lower side of members 30 of the frame of the magnet vehicle 10. In this manner, the sheet collector 26 can be conveyed with the magnet vehicle 10.

Figure 4 shows that, even with the sheet collector 26 in the idle position, there will be sufficient space under it to receive a stack of sheets with a considerable height. In figure 4 dot-and-dash lines indicate how the uppermost sheet from the said stack can be lifted by means of the magnet heads 23. It goes without saying that this will be possible only when the magnet vehicle 10 carries no sheet collector 26.

As appears from figure 1 a fixed roller conveyor 31 is mounted in one of the passages of the storage shed 8, said conveyor being connected to a fixed roller conveyor 32 outside the storage shed 8 carrying the sheets off to the ship-yard.

When a sheet is lying on the roller conveyor 6, the transfer vehicle 11 with the magnet vehicle 10 upon it is placed over the conveyor 6. By means of the magnet heads 23, the sheet is lifted through the frame of the transfer vehicle 11, after which the vehicle 11 is moved to opposite the required passage. Thereupon, the magnet vehicle 10 with the sheet suspended within it enters the passage as far as the required place, after which the magnet beam 22 is lowered so as to deposit the sheet upon the floor between the rails 9. In this manner, the sheets supplied can be deposited in a desired place of the storage shed one by one, with the possibility of collecting a number of matching sheets into a stack.

It will be possible to automate the storage by means of a computer. The measuring and marking system 5 can transmit the data of each sheet to the computer which will then control the movements of the transfer vehicle 11 and of the magnet vehicle 10. Furthermore, the computer can be used for registration of the storage location of each sheet. In this manner, each separate sheet can be rapidly traced. Storage systems operating with the aid of a computer are known, in general.

When one or more sheets are to be conveyed to the ship-yard from the storage shed 8, one or more sheet collectors 26 are either set up in a passage next to the passage from which the sheets are to be collected or in the passage next to the fixed conveyor 31. By means of the magnet vehicle 10 (and, as the

case may be, the transfer vehicle 11, when sheets are to be taken from other passages), the sheets are then placed upon a sheet collector 26 one by one. In this manner, a stack of sheets of the required combination is formed. When the required stack is built up, the magnet vehicle 10 is placed over the sheet collector 26 and picks it up. It is then moved with the help of transfer vehicle 11, to above the roller conveyor 31, after which the sheet collector 26 with the stack of sheets upon it is put down upon the roller conveyor 31 and carried off to the roller conveyor 32.

The sheet collectors 26 may also be used for the sorting of a stack of sheets. When, for instance, a stack of sheets of a certain combination is situated in a certain passage, and only one of these sheets from the middle of the stack is to be taken out and carried off to the ship-yard, the sheets are transferred to a sheet collector 26 one by one by means of the magnet vehicle 10 until the required sheet is reached. This sheet is then deposited upon another, empty sheet collector 26. This sheet may be carried off as described above with the aid of the magnet vehicle 10 and, as the case may be, of the transfer vehicle 11. When more sheets are involved, the second sheet collector 26 is also carried off. The sheets on the first sheet collector 26 are then put back in their place as desired.

Figures 5 and 6 show the action of the magnet beam 22 subdivided into sections. The sections are marked here 22a, 22b, 22c, 22d and 22e.

It will be clear from figures 5 and 6, how one or more sections may be used to lift or to lower certain sheets. In this manner, more effective use is made of the space in the passages and the sheets can be put closer together longitudinally.

Although this is not shown in the drawing, it will be clear that the magnet vehicle 10 and the transfer vehicle 11 are fitted with suitable drive means. The magnet vehicle 10 has a drivers cabin 33 for the operator.

WHAT WE CLAIM IS:-

1. System for the storage, conveyance to storage and conveyance from storage of metal sheets, in which there is at least one storage area composed of parallel passages, each passage having a pair of rails, one at each side of the passage, and a support surface for sheets located between said pair of rails as seen in plan, there being a first vehicle movable on wheels on the rails of said passages having pick-up means adapted to lift a sheet from one of the support surfaces by engagement with the top surface of the sheet, and there being along at least one side of the said storage area, a second set of rails, transverse to the passages, on which a second vehicle moves past the end of each said passage, the second vehicle having a pair of rails registrable with the pair of rails of each pas-

sage so that the first vehicle can move from the said passages onto the second vehicle and vice versa, the said rails on the second vehicle being above the rails on which the second vehicle runs and the second vehicle having an opening beneath the position assumed by the first vehicle when carried on the second vehicle, whereby a sheet carried by the first vehicle can be lowered through said opening.

2. A system according to claim 1 in which there is at least one sheet collector on which metal sheets may be loaded and which is of a size to be lowered between the rails of the said passages and is adapted to be detachably connected to the said first vehicle to be transported thereby.

3. System according to claim 2 wherein means for lifting the sheet collector include a plurality of vertical screw-threaded spindles mounted on the first vehicle, the lower ends of which spindles are connectible to the sheet collector.

4. System according to either of claims 2 and 3, wherein the second vehicle consists of an open rectangular frame with longitudinal girders, at the upper side of which are the said pair of rails on which the first vehicle runs, the open area of the frame being sufficient to allow said sheet collector to pass through.

5. System according to any one of the preceding claims wherein the second set of rails is mounted in a transverse passage between two said storage areas which are rectangular.

6. System according to any one of the preceding claims wherein at least one of said parallel passages has in it a conveyor, for the conveyance of sheets away from the storage area.

7. System according to any one of the preceding claims wherein a conveyor is mounted between the rails of said second set of rails, which conveyor is arranged to receive sheets from another conveyor which supplies the sheets to the system.

8. System according to any one of the preceding claims wherein the rails of the parallel passages are raised above the said support surfaces for the sheets.

9. System according to claim 8, as dependent on claim 2, wherein adjacent each rail of the parallel passage is a support surface for said sheet collector, so that said collector can be located between the rails and above the support surface for the sheets.

10. System according to any one of the preceding claims, wherein the first vehicle consists of a cage-like frame with an open lower side and with horizontal lower girders supporting the wheels and a beam which extends over substantially the entire length of the vehicle and can be moved up and down with respect to the frame by lifting means.

11. System according to claim 10 wherein the said beam is guided vertically by vertical guide rods.

wherein the said beam is guided vertically by vertical guide rods.

12. System according to claim 10 or claim 11, wherein the beam is subdivided into a number of sections in the longitudinal direction of the first vehicle, which sections can be moved up and down independently from each other.

13. System for the storage, conveyance to storage, and conveyance from storage, of metal sheets substantially as herein described with reference to and as shown in the accompanying drawings.

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fig-1

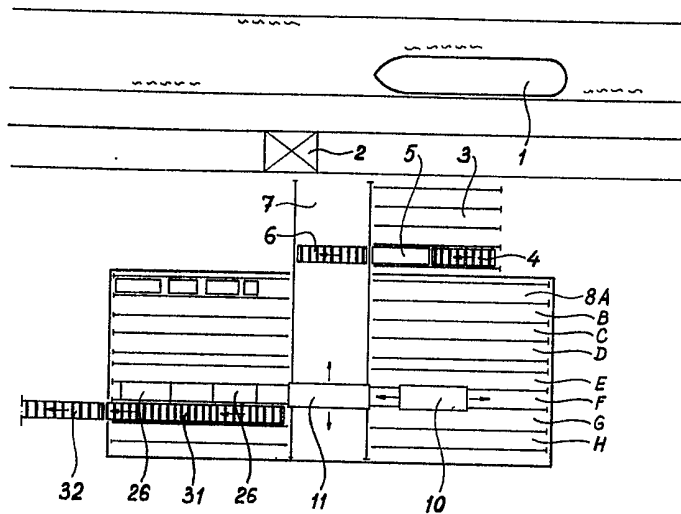


fig-2

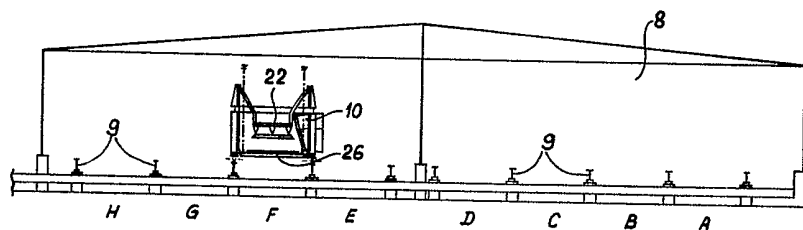


fig-3

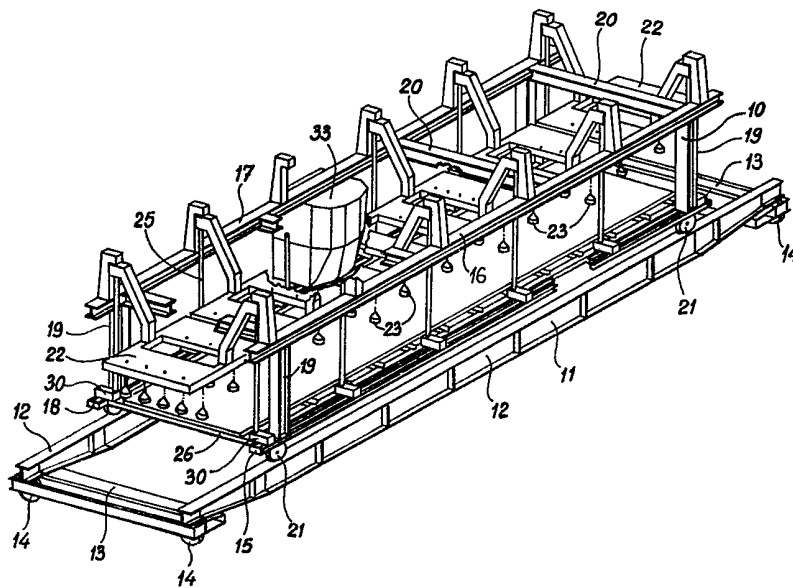


fig-4

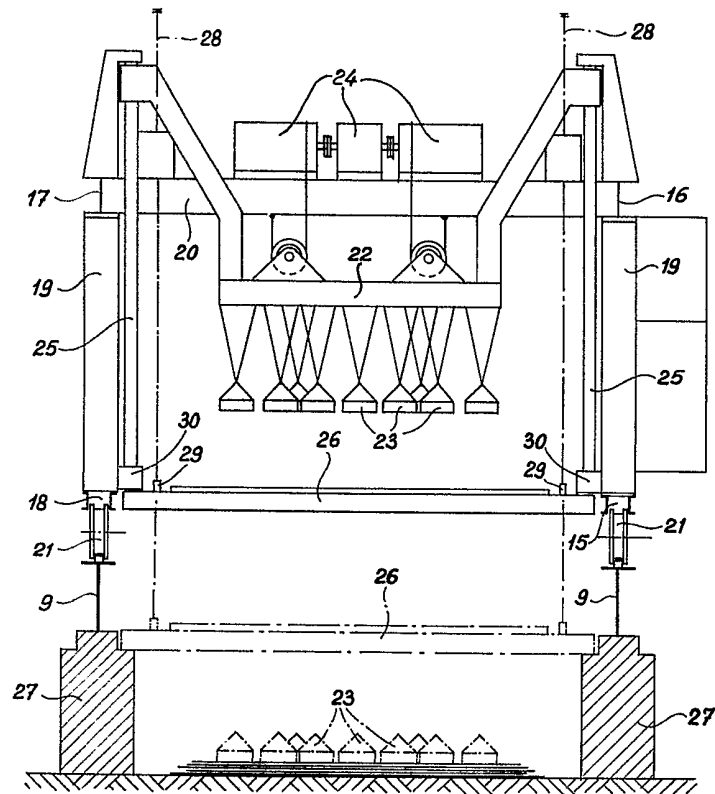


fig-5

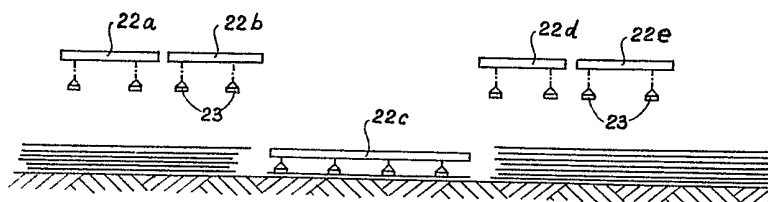


fig-6

