

PATENT SPECIFICATION (11)

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(54) MEANS OF CONNECTING PUSHER BOAT AND BARGE

(71) We, TAISEI SEKKEI KOMU K.K. residing at Central Bldg., No. 2 1-chome, Kyobashi, Chuo-ku, Tokyo, Japan, a Corporation organized and existing under the laws of Japan, 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 means of connecting a pusher boat and a barge.

Barges are commonly used to transport bulky freight on rivers and canals or in harbours. There are two conventional methods to move the barges, that is, one is to tow by a tug boat and the other is to push by a pusher boat. The present invention relates to the latter case in which the barge is pushed by a pusher boat where said barge is connected with the pusher boat to form a pusher-barge combination system. More particularly, the invention relates to an improved pusher-barge combination system with excellent performance.

In general, the method of connecting the pusher boat and the barge by means of ropes has been widely employed. In this method, however, the stern portion of the barge and the bow portion of the pusher boat come in contact with each other, thus the vertical relative sliding of said portions can not be avoided, and it is especially so in wavy conditions. This relative sliding of the two water-craft causes heavy wear and tear of the buffer means which are fitted on and between said two water-craft. Furthermore, when the positions of fixing rope ends are not properly selected, the connecting ropes are often subjected to undue and excessive tension owing to the relative pitching motions and partly the relative yawing motions between these two water-craft, and the difficulties of navigation in a heavy seaway by using such pusher-barge combination systems are principally due to the above-mentioned disadvantages.

The object of the present invention is to provide novel means of connecting a pusher boat and a barge, which can eliminate such

disadvantages of the hitherto widely employed rope connection and realize, without any trouble-some preparation work, such as draft adjustment and relative fore-and-aft pre-positioning, a reliable articulatory connection of these two watercraft assuring easy and safe navigation in a heavy seaway.

According to the present invention, there is provided a means of connecting a pusher boat and a barge having a notch at its stern portion to receive a bow portion of said pusher boat, which comprises a pair of vertically disposed channels on the sides of the inner wall of said notch, one channel being disposed on each side thereof; a pair of pins each bearing a contact shoe provided one on each side of the bow portion of said pusher boat; wherein, the axis of each pin is transverse to the pusher boat; each pin being movable axially to cause coupling of the boat and barge and wherein the relative rotation of each pin and said pusher boat takes place about the pin axis, and wherein coupling is effected by frictional co-operation of the shoes and the channels.

Other and further objects and features of the invention will become more apparent upon the understanding of the illustrative embodiment about to be described or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice. Two embodiments are shown in the drawings, in which the same parts are indicated by the same numerals.

In the drawings:—

Figure 1 is a schematic plan view of one embodiment of the present invention before connection;

Figure 2 is a plan view of said embodiment after connection;

Figure 3 is a vertical sectional view of the embodiment taken along the line A—A in Figure 2; and

Figures 4, 5 and 6 are schematic plan views of another embodiment with the pre-positioning arrangement showing several steps of the process of connecting operation.

[Price 33p]

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Referring now to Figs. 1 to 3, which show the first embodiment of the present invention, the barge 1 is provided with a notch or well 2 at its stern portion for receiving the bow 4 of the pusher boat 3. The configuration and size of said notch 2 are such that, when the pusher boat 3 is connected to the barge 1, a predetermined clearance is left between said bow 4 of the pusher boat 3 and said notch 2 of the barge 1. Each side of the inner wall of said notch 2 is provided with a connecting channel 5 having a trapezoidal cross-section, opening towards the inside of the notch 2 and extending in vertical direction. A pair of said channels 5 on both sides of the inner wall of the notch 2 forms a pressure engagement portion by receiving, at any vertical position, the respective pressing shoes on both sides of the bow 4 of the pusher boat 3, which will be explained further hereinafter.

Each side of the bow 4 of the pusher boat 3 is provided with a cylindrical connecting pin 7 which is supported by and slides along a long bearing 6 fixed on each side of said bow portion. The outboard end of this connecting pin 7 is pivotally fitted with a pressing shoe 8 by means of a horizontal pin 9 or spherical bearing on the back side of said shoe. This pressing shoe 8 has a cross-section corresponding to that of said connecting channel 5 and an appropriate length, further, high friction material 10 such as a rubber material is adhered to the outer surface of said pressing shoes 8 which are to be engaged with the inner surfaces of said channels 5, whereby when the barge 1 and the pusher boat 3 are connected with each other, the inclined side surfaces of said pressing shoe 8, assisted by their wedge effect, are firmly engaged with the inclined side surfaces of said connecting channel 5 to give a sufficient friction force. Said connecting pin 7 can be forced out and retracted by means of a hydraulic means, such as hydraulic cylinder 11, and it can be also kept at the outermost position by hydraulic pressure from a pump or a pressure accumulator.

In the following, the functions and operations of the above-explained connecting means of the present invention will be disclosed. Before the connection of the barge 1 and the pusher boat 3, the connecting pins 7 at the bow 4 of the pusher boat 3 and the pivotable pressing shoes 8 at the top portions of said pins 7 are retracted as shown in Fig. 1. In this position, the width between the outer ends of said pressing shoes 8 is smaller than the width of the entrance portion of said well or notch 2, so that the bow 4 of the pusher boat 3 can be easily inserted into said notch 2 of the barge 1. At the same time, the position of said shoes 8 is brought in line with the above-mentioned connecting channels 5 by operating the

pusher boat. And after this relative prepositioning, the hydraulic cylinders 11 are actuated to move the connecting pins 7 outwards, whereby the pressing shoes 8 on said pins 7 are pushed into the connecting channels 5 as shown in Fig. 2. In this position, the inclined side surfaces of each pressing shoe 8 are forced into contact with the inclined inner surfaces of the connecting channel 5 in wedge-like manner and they are connected tightly by the friction force without causing any sliding of said two members, thereafter the pressure within said cylinders 11 is kept as it is by a pump or a pressure accumulator. Thus the connection work between the barge 1 and the pusher boat 3 can be completed.

When both water-craft are connected in the above manner, no relative rotation between the barge 1 and the pressing shoes 8, i.e. the connecting pins 7 is possible. However, the relative motion corresponding to the relative pitching between two water-craft is allowed between the connecting pins 7 and the hull of the pusher boat 3. Thus, in order to allow this relative motion, the inboard ends of said connecting pins 7 are connected to the force transmitting pieces 12 of the hydraulic cylinders 11, by means of suitable coupling members 13 which permit the relative rotational motions. Thereby the relative pitching of two water-crafts can be permitted without causing any trouble or disorder.

As has been explained in the above, the barge 1 and the pusher boat 3 can be connected by using the connecting means of the present invention in easy and quick manner by simple operation without any troublesome work. Further, the condition of the connection is very firm and reliable owing to the frictional engagement between the pressing shoes 8 and the connecting channels 5. Still further, the connecting means of the present invention can be applied in any draft relationship between two water-craft, which is one of the characteristic features of the present invention. In the connecting means of the present invention, the connection is accomplished by the frictional engagement of the pressing shoes 8 with the connecting channels 5, and even when the condition of connection is slightly loosened and the draft relationship of the two water-craft is absolutely changed as often is the case in dumping barges, the positions of the pressing shoes 8 to contact with the connecting channels 5 can vary so as to follow the change of the draft relationship.

Between the pusher boat and the barge which are connected by thus constructed connecting means, there exists only relative pitching motion, and other relative motions such as rolling, yawing, heaving, drifting and surging are not permitted. Further, the dis-

placement of the pusher boat is generally one tenth or less of the full load displacement of the barge, so that all motions of the pusher boat other than the pitching thereof follow the motions of the barge, and therefore, the overall motion of the pusher boat becomes gentle and slow, and the operation and control of the pusher boat can be made much easier.

As disclosed in the above, the first embodiment of the present invention has excellent performance as a means of connecting a pusher boat and a barge, however one problem is left yet unsolved. That is, in the relative pre-positioning of the water-craft, the above-mentioned pressing shoes 8 must be brought into line with the connecting channels 5, and this operation is not so easy particularly in wavy conditions. Therefore, it is desirable to perform this preparation work without great loss of time and labour. Accordingly, the second embodiment of the present invention includes the supplementary arrangement for the above-mentioned relative pre-positioning in order to realize easy and quick connecting operation, which will be explained hereinafter with particular reference to Figs. 4 to 6.

In said figures, the connecting channel 5 of the barge 1 is provided with inner edge 5b and outer edge 5a. As will be understood from the drawings, the width between two inner edges 5b of the channels 5 is smaller than that between two outer edges 5a. Further, the width of the notch 2 at the position of the inner edges 5b is smaller than the width between the outer ends of both pressing shoes 8 in the retracted position, while the width of the notch at the position of the outer edges 5a is larger than the width between the outer ends of both pressing shoes 8 in the retracted position. And the width of the notch 2 in the portion forward of the connecting channels 5 is of course made larger than the width of the bow of the pusher boat 3 to be received therein, and the width between the outer ends of both retracted pressing shoes 8 of the pusher boat 3 is determined in such a manner that, when the bow 4 of the pusher boat 3 is received within the notch 2 of the barge 1 for the preparation for connection, the pressing shoe 8 of any side cannot go forward to the bottom of the notch 2 beyond the inner edge 5b, even when the hull of the pusher boat 3 is moved aside by waves or else against one side wall of said notch 2.

The portion of the connecting channels 5 of the barge 1 being constructed as stated in the above, when the barge 1 is connected to the pusher boat 3, the pusher boat 3 is stopped at the position shown in Fig. 5 in which the pressing shoes 8 of the pusher boat 3 are pushed against the rearward faces of the inner edges 5b of the connecting chan-

nel 5, and the pusher boat cannot move forward further. Accordingly, if the pusher boat 3 keeps its impellent force so as not to be moved backward, the relative positioning of both water-craft, that is, the relative positioning of the pressing shoes 8 and the connecting channels 5 can be automatically established. So that, by carrying out the serial procedure as explained with regard to the foregoing embodiment, both water-craft can be connected as shown in Fig. 6.

It is to be noted that the pusher boat and the barge can be effectively connected by using the connecting means of the present invention, in addition to which, the relative pre-positioning of both water-craft which is indispensable for the connecting work can be attained automatically, and the construction, characteristics and functions of this connecting means may be fully understood from the description of the embodiments in the above.

It should be emphasized, however, that the specific embodiments described and shown herein are intended as merely illustrative and in no way restrictive of the invention.

WHAT WE CLAIM IS:—

1. A means of connecting a pusher boat and a barge having a notch at its stern portion to receive a bow portion of said pusher boat, which comprises a pair of vertically disposed channels on the sides of the inner wall of said notch, one channel being disposed on each side thereof, a pair of pins each bearing a contact shoe provided one on each side of the bow portion of said pusher boat; wherein the axis of each pin is transverse to the pusher boat; each pin being movable axially to cause coupling of the boat and barge, and wherein relative rotation of each pin and said pusher boat takes place about the pin axis, and wherein coupling is effected by frictional cooperation of the shoes and channels.

2. A means of connecting a pusher boat and a barge as claimed in claim 1, in which said pair of channels are provided with a pair of inner edges and another pair of outer edges, the width between said inner edges being smaller than the width between the outer ends of said shoes on said pins in the retracted position, and the width between said outer edges being larger than the width between the outer ends of said shoes on said pins in the retracted position.

3. A means of connecting a pusher boat and a barge as claimed in claim 1, in which the horizontal cross-section of each of said channels is trapezoidal and the engaging surfaces of said shoes are lined with friction material.

4. Means of connecting a pusher boat and a barge substantially as herein described with reference to and as illustrated in Figures 130

placement of the pusher boat is generally one tenth or less of the full load displacement of the barge, so that all motions of the pusher boat other than the pitching thereof follow the motions of the barge, and therefore, the overall motion of the pusher boat becomes gentle and slow, and the operation and control of the pusher boat can be made much easier.

- 10 As disclosed in the above, the first embodiment of the present invention has excellent performance as a means of connecting a pusher boat and a barge, however one problem is left yet unsolved. That is, in the
15 relative pre-positioning of the water-craft, the above-mentioned pressing shoes 8 must be brought into line with the connecting channels 5, and this operation is not so easy particularly in wavy conditions. Therefore,
20 it is desirable to perform this preparation work without great loss of time and labour. Accordingly, the second embodiment of the present invention includes the supplementary arrangement for the above-mentioned relative
25 pre-positioning in order to realize easy and quick connecting operation, which will be explained hereinafter with particular reference to Figs. 4 to 6.

- 30 In said figures, the connecting channel 5 of the barge 1 is provided with inner edge 5b and outer edge 5a. As will be understood from the drawings, the width between two inner edges 5b of the channels 5 is smaller than that between two outer edges 5a. Further,
35 the width of the notch 2 at the position of the inner edges 5b is smaller than the width between the outer ends of both pressing shoes 8 in the retracted position, while the width of the notch at the position
40 of the outer edges 5a is larger than the width between the outer ends of both pressing shoes 8 in the retracted position. And the width of the notch 2 in the portion forward of the connecting channels 5 is of course made
45 larger than the width of the bow of the pusher boat 3 to be received therein, and the width between the outer ends of both retracted pressing shoes 8 of the pusher boat 3 is determined in such a manner that,
50 when the bow 4 of the pusher boat 3 is received within the notch 2 of the barge 1 for the preparation for connection, the pressing shoe 8 of any side cannot go forward to the bottom of the notch 2 beyond the inner
55 edge 5b, even when the hull of the pusher boat 3 is moved aside by waves or else against one side wall of said notch 2.

- The portion of the connecting channels 5 of the barge 1 being constructed as stated in the above, when the barge 1 is connected
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nel 5, and the pusher boat cannot move forward further. Accordingly, if the pusher boat 3 keeps its impellent force so as not to be moved backward, the relative positioning of both water-craft, that is, the relative positioning of the pressing shoes 8 and the connecting channels 5 can be automatically established. So that, by carrying out the serial procedure as explained with regard to the foregoing embodiment, both water-craft
70 can be connected as shown in Fig. 6.

It is to be noted that the pusher boat and the barge can be effectively connected by using the connecting means of the present invention, in addition to which, the relative
80 pre-positioning of both water-craft which is indispensable for the connecting work can be attained automatically, and the construction, characteristics and functions of this connecting means may be fully understood from the description of the embodiments in the above.

It should be emphasized, however, that the specific embodiments described and shown herein are intended as merely illustrative and
90 in no way restrictive of the invention.

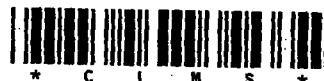
WHAT WE CLAIM IS:—

1. A means of connecting a pusher boat and a barge having a notch at its stern portion to receive a bow portion of said pusher boat, which comprises a pair of vertically disposed channels on the sides of the inner wall of said notch, one channel being disposed on each side thereof, a pair of pins
100 each bearing a contact shoe provided one on each side of the bow portion of said pusher boat; wherein the axis of each pin is transverse to the pusher boat; each pin being movable axially to cause coupling of
105 the boat and barge, and wherein relative rotation of each pin and said pusher boat takes place about the pin axis, and wherein coupling is effected by frictional cooperation of the shoes and channels.

2. A means of connecting a pusher boat and a barge as claimed in claim 1, in which said pair of channels are provided with a pair of inner edges and another pair of outer edges, the width between said inner edges
115 being smaller than the width between the outer ends of said shoes on said pins in the retracted position, and the width between said outer edges being larger than the width between the outer ends of said shoes on said
120 pins in the retracted position.

3. A means of connecting a pusher boat and a barge as claimed in claim 1, in which the horizontal cross-section of each of said channels is trapezoidal and the engaging surfaces of said shoes are lined with friction material.

4. Means of connecting a pusher boat and a barge substantially as herein described with reference to and as illustrated in Figures
130



1 to 3 and 4 to 6 of the accompanying drawings.

- 5 5. A pusher boat and barge incorporating the connection means claimed in any preceding claim.

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