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(72) Inventor: **Seethaler, Markus Franz**
80805 München (DE)

(74) Representative: **Grünecker Patent- und
Rechtsanwälte
PartG mbB
Leopoldstraße 4
80802 München (DE)**

(71) Applicant: **Seethaler, Markus Franz**
80805 München (DE)

(54) **RETRACTABLE SHIP LOADING BAY COVERS**

(57) The present invention provides a retractable cover for vessels moored laterally along the side of a pier of a loading bay, and also for a portion of the pier itself, to provide protection against inclement weather during loading operations. The retractable cover comprises of a series of structural arches which are movable parallel to the pier. On the land side these arches are supported on motorized trolleys and on the water side on floatation

devices. Between these arches flexible canvases are fitted. When the retractable covers gets deployed, the arches are moved apart from each other, the canvases get spread out and will provide the cover for the vessel moored underneath at the loading bay. A swinging spreader bar system moves the arches apart and at the same time provides the lateral stability once the cover is deployed.

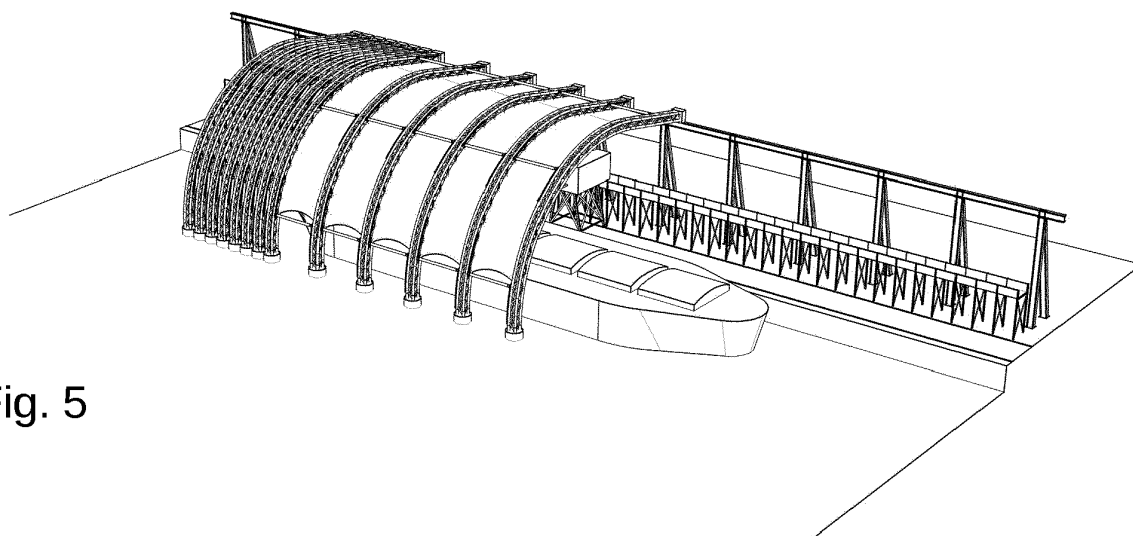


Fig. 5

Description

TECHNICAL FIELD

[0001] The present invention relates to ship covers, in particular to ship covers for vessels moored laterally along the side of a pier of a loading bay to provide protection against inclement weather during loading operations.

BACKGROUND OF THE INVENTION

[0002] A fair amount of today's international shipping is bulk materials and a substantial part of the bulk goods have to stay dry like grains, iron ore and some minerals. On land and on the vessels the dry goods are closed up, but during the loading operations of the vessel the bulk goods get exposed to the elements. If loading operations are suspended and delayed for any reason, additional costs are incurred due to lost time. Therefore, to facilitate vessel loading operations also during inclement weather conditions, in particular during rainy periods, will greatly increase the degree of utilization of the port and streamline the ship running schedules.

[0003] There are two conventional approaches known in the art to protect the bulk goods during the loading operations, viz. covers for the hatches only and covers for the vessel in its entirety. References EP 2 754 629 A1 and WO 99/55578 A1, for instance, disclose flexible covers which may be provided for each hatch of the vessel to prevent water and moisture getting into the holds of the vessel during the loading operation. However, this only works for fairly light bulk goods which can be extracted from the holds with conveyers.

[0004] The loading of the bulk carrier vessel require that the whole vessel is loaded and unloaded evenly. That requires that the bulk material is added or removed evenly over all the holds - that the bulk holds of a bulk carrier vessel needs to be loaded up or unloaded more or less in parallel, so that the vessel as a whole is loaded to the same level in all compartments. This in turn requires that bulk loaders have to have access to all hold openings at the same time. Therefore systems for hatch covers are fairly impracticable. Either there are as many hatch covers as there are holds on the vessel or the hatch covers need to be moved all the time. Both options require extensive handling of the hatch covers.

[0005] Reference WO 2008/074112 A1, on the other hand, discloses a balanced spatial structure with a wing-shaped profile that provides a cantilevered roof for covering the whole vessel. This system requires a fairly large foundation at the pier side to counter balance the cantilevered roof and it does not provide protection against driving rain coming from the water side.

[0006] Although the alternate solution to cover the whole vessel (including part of the pier that is required to move the loader) is a much more practical approach, such structures are substantially larger than single hatch

covers. A cantilevered cover is a fairly inefficient structural system and requires extensive foundations on the pier, which makes this system very heavy and costly.

[0007] For smaller vessels, floating shelter constructions are known, for instance, from references US 6,062,243, US 6,397,774, and WO 2007/082403 A1. These systems are not suitable for the loading operation of large vessels, since they provide no protection for the part of the pier, where the loader and the material conveyor systems are located. In addition, large vessels require sufficient room to land at the pier; therefore, the water side needs to be clear to manoeuvre.

SUMMARY OF THE INVENTION

[0008] The object of the present invention is to provide a ship cover for protecting vessels moored laterally along the side of a pier of a loading bay, as well as a portion of the pier itself, against inclement weather during loading operations, thereby increasing the efficiency of the port operation of bulk loading.

[0009] Most ports have already a very well established infrastructure and any system to protect the bulk loading operation against rain has to be able to be fitted to existing facilities such as loading cranes and conveyor systems. Hence, it is a further object of the present invention to provide a ship cover that allows for cost effective construction and maintenance. In particular, it is an object of the present invention to address a low cost retrofit of existing port facilities, and to provide a system that can be installed with little impact on to the ongoing operation of the port activities.

[0010] Further, it is also an object of the present invention to provide a ship cover that does not hinder vessels in manoeuvring.

[0011] This is achieved by the features as set forth in the independent claim. Preferred embodiments are the subject matter of dependent claims.

[0012] It is the particular approach of the present invention to provide a plurality of structural arches with a flexible canvas fixed there between. The arches are moveable parallel to the pier, with one end of each arch being mounted, e.g., on a rail on the land side and the other end being supported by a floating member on the water side. When the retractable covers get deployed, the arches are moved apart from each other, the canvases get spread out and will provide the cover for the vessel moored underneath at the loading bay.

[0013] According to a first aspect of the present invention, a cover for protecting a moored vessel and part of a pier during a loading operation against inclement weather is provided. The cover comprises a plurality of arches with a first end and a second end for traversing the moored vessel in a transverse direction from a land side to a water side, a canvas fitted to the plurality of arches, a plurality of floating bodies for supporting the first end of a respective one of the plurality of arches on the water side, and a plurality of support members for

supporting the second end of a respective one of the plurality of arches on the land side.

[0014] Preferably, the plurality of support members is movable in a longitudinal direction, for instance on a rail mounted on the land side. In this manner, the cover can be moved out of the way in order to allow the vessel to freely manoeuvre.

[0015] More preferably, the arches are movable relative to each other in the longitudinal direction. The cover is thus foldable to give space for the vessel to manoeuvre.

[0016] Moreover, the plurality of arches is preferably movable from a retracted position to a deployed position and vice versa, wherein the canvas is folded between the arches in the retracted position and spread out between the arches in the deployed position.

[0017] Advantageously, each arch is connected with a hinge to the respective support member to take on any vertical movement of the arch.

[0018] In a preferred embodiment, the cover further comprises a support driving member for driving at least one of the plurality of support members in the longitudinal direction. Additionally, or alternatively, the cover further comprises a floating body driving member for driving at least one of the plurality of floating bodies in the longitudinal direction. These driving members may be instrumented for transforming the cover from the retracted position to the deployed position and vice versa. These driving members may also be instrumented for moving the cover along the pier, e.g., from a parked position to a deployment position.

[0019] In a preferred embodiment, the cover further comprises swinging spreader bars fitted between adjacent arches to provide a horizontal brace and lateral stability of the cover. At least one end of each of the swinging spreader bars may be mounted to a respective one of the plurality of arches in a manner that allows a sliding linear movement of the one end in a vertical direction, such that the swinging spreader bars perform a rotational movement when the arches are moved from a retracted position to a deployed position or vice versa.

[0020] In a particularly preferred embodiment, the cover further comprises driving means for driving the swinging spreader bars from a vertically oriented position to a horizontally oriented position when the arches are moved from the retracted position to the deployed position and/or for driving the swinging spreader bars from the horizontally oriented position to the vertically oriented position when the arches are moved from the deployed position to the retracted position. The driving means for the swinging spreader bars may thus control folding and unfolding of the cover.

[0021] Preferably, the cover further comprises means for synchronizing the rotational movement of the swinging spreader bars fitted between two adjacent arches, to ensure an even movement of the arches when being moved from the retracted position to the deployed position or vice versa. Synchronizing the movement of spreader bars between a single pair of to adjacent arches

guarantees that the two arches remain parallel to each other during the folding and unfolding operation.

[0022] Preferably, each swinging spreader bar is fitted with a longitudinal damping element to take on any differential movement of adjacent arches.

[0023] In a preferred embodiment, the cover further comprises locking members for locking the swinging spreader bars into position, when the arches are in the retracted position or in the deployed position, thereby further increasing stability of the entire structure.

[0024] Preferably, the canvas is light translucent, so that no artificial light is required during day time.

[0025] The above and other objects and features of the present invention will become more apparent from the following description and preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 shows a cross section of a retractable vessel cover according to an embodiment of the present invention;

Fig. 2 shows a perspective view of the retractable vessel cover of Fig. 1;

Fig. 3 shows a detailed view of the spreader bar system according to an embodiment of the present invention;

Fig. 4 shows a perspective view of the retractable vessel cover of Fig. 1 in a fully retracted position;

Fig. 5 shows a perspective view of the retractable vessel cover of Fig. 1 in a partially deployed position;

Fig. 6 shows a perspective view of the retractable vessel cover of Fig. 1 in a fully deployed position;

Fig. 7 shows a detailed view of the floatation and ballast element as it may be used in embodiments of the present invention; and

Fig. 8 shows a detailed view of the damped linear extension of the spreader bar as it may be used in embodiments of the present invention.

DETAILED DESCRIPTION

[0026] Bulk carriers vessels calling ports are moored along side the pier and a conventional loader either loads or unloads the bulk material into the holds of the vessels. During the loading operation the hold covers of the vessels have to be opened and at this stage the bulk material will get exposed to the weathers. Therefore, the loading operation of dry bulk material has to be undertaken during clement weather conditions, unless the loader and bulk holds can be covered. The present invention provides

such cover, which may be deployed as soon as the weather conditions could disrupt the loading operations.

[0027] Specifically, the present invention provides a retractable cover for vessels moored laterally along the side of a pier of a loading bay, and also for a portion of the pier itself, to provide protection against inclement weather during loading operations, in particular for dry bulk material. The cover will preferably be water proof and at the same time highly light translucent so that additional artificial light will not be required.

[0028] A preferred embodiment of the invention comprises of a series of structural arches, which are moveable parallel to the pier. On the land side these arches are supported on motorized trolleys on rails and on the water side on floatation devices. Between these arches flexible canvases are fitted. When the system of retractable covers gets deployed, the arches are moved apart from each other, the canvases get spread out and will provide the cover for the vessel moored underneath at the loading bay. A swinging spreader bar system moves the arches apart and at the same time provides the lateral stability once the cover is deployed.

[0029] The system will only need to be deployed, if the weather is becoming too adverse for the loading operations. Otherwise the system can stay retracted away from the loading bay. The system of covers will be deployed after the vessel has been moored and will be retracted before the vessel leaves the port. The system does not interfere with the landing operations of the vessels.

[0030] Figs. 1 and 2 show a cross section and a perspective view, respectively, of the retractable vessel cover according to an embodiment of the present invention. The vessel cover comprises arches (1) running at a right angle parallel to the pier (9). Between these arches a foldable canvas (5) is spanned. When the system is in a parked position, the arches are pushed together and canvases fold. In the deployed position the canvases span horizontally between the arches and provide a cover over the bulk holds, the loader (8) of the moored vessel (7) and the material conveyer system (13). On the pier side the arches are driven by motorized trolleys (3), such as standard industrial drive trains. These trolleys run on a rail system (4). On the water side the arches are supported with floatation and ballast devices (2). To deal with the irregular vertical movements of the floating supports at the water side all arches (1) are hinged to the trolleys (3). Swinging spreader bars (6), which are fitted at intermediate location along the arches, drive the retraction and deployment operation of the system. They also provide lateral support of the system and stabilize the arches against tipping.

[0031] The vessel cover has to withstand dynamic loads of the deployment operations as well as significant wind loads due the large curved areas of the canvases (5) and vertical and irregular movements of the floating supports (2) at the water side due to tidal movements and waves.

[0032] Due to the curved profile of the canvases (5)

there will be some wind pressure downward, but to a much larger extend there will be wind uplift similar to an air foil of airplane wings. At the land side the rail system (4) and the motorized trolley (3) need to be constructed in such a way to ensure that these vertical loads can be transferred into the foundations and the foundations have to be able to take on this load as well. A similar situation arises on the water side. Therefore, the floatation devices (2) not only need to be able to have enough water buoyancy to uphold against the vertical down ward loads, but also there needs to be enough ballast (14) in these supports to withstand the wind up lift forces. Fig. 7 shows a detailed view of a floatation device (2) with ballast (14).

[0033] The proposed system can easily be fitted to existing port facilities. On the pier side only a rail system (4) has to be installed. The rail system (4) has to take on some vertical and some horizontal wind loads. There is also some uplift to be expected from the curved shaped canvas panels. On the water side, no further installations are required.

[0034] The maximum clearance underneath the proposed system of covers is derived from the geometry of the parked system, when the canvas is folded and the centre of the canvas drops below the bottom chord of the arches. The proposed system has to be sized such that the existing loader systems (8) and the maximum cross section of bulk carrier vessels fit underneath at all levels of the tide and anticipated swell of waves in the harbour. The size of bulk carries is limited to the width and depth of major sea channels (i.e. Panama and Suez). The dry draft of bulk carries is limited to bridge clearances. The overall length of the system and how many arches comprise one unit can easily be extended or reduced at a later expansion stage, since the system is modular. Therefore, the general dimensioning of the system once determined will not change for the foreseeable future.

[0035] The arches (1) of the proposed system are the main structural component. Because the supports on both ends of the arches are hinged and the floating supports only provide a vertical bearing, the only member forces of the arches are bending moments. Wind up lift exerts the largest load contribution. Since there are little limitations to structural depth, the arches can be constructed either as a light weight lattice type system as shown here in the figures. But any other light weight structural design can be applied. The canvas (5) is preferably connected to the bottom chord and the swinging spreader bars (6) are preferably connected to the top chord. In this arrangement the canvas can fold without obstruction of the spreader bars during the retraction and parking of the system.

[0036] The floatation and ballast devices (2) at the bottom end of the arches (1) at the water side have to have enough buoyancy to take on vertical downward forces. But to withstand the wind up lift forces enough weight (14) has to be placed at the very bottom of the floating supports. This arrangement will also add some more lateral stability to the arches.

[0037] The motorized supports or trolleys (3) are the principal drive system. Sitting on the rail system (4) they move laterally to the pier and their position also in relation to the adjacent unit determine the position of the attached arches (1), the main structural components. In the parked or deployed position of the cover system the trolleys will be able to move the whole unit of arches to the desired location. But they can also house the drive system of the swinging spreader bars (6), which facilitate the retraction and deployment of the covering canvas (5). The overall control system of the cover system controls all trolleys (3) simultaneously and therefore the entire system.

[0038] The rail system (4) is placed behind the loader (8) and conveyer system (13) for the bulk material along the harbour pier. The vertical elevation can be at ground level up to apex of the arches (1). This depends on the geometric requirements of the existing port facilities. The supports (12) of the rail system have to be able to transfer the vertical and horizontal loads into the foundations.

[0039] The canvas (5) of the retractable ship loading bay covers may be made of flexible, waterproof and light translucent membrane. The material is preferable a coated fabric such as PES fabric coated with PVC. But any other type of flexible canvas or film can be used.

[0040] Fig. 3 shows a detailed view of the spreader bar system. Each end of a spreader bar (6) is mounted to a respective one of two adjacent arches (1) in a manner that allows at least one end to perform a sliding movement along the arch, thereby resulting in a rotational movement of the spreader bar as the two arches are pushed together or pulled apart and the protective canvas between these arches is folded or spanned. To this end, each end of the spreader bar (6) may be pin connected to a slider (11) running on a slider rail (10) along the arch (1).

[0041] In a preferred embodiment of the vessel cover the swinging spreader bars (6) are connected with pin supports at both ends to sliders (11), which run along the slider rails (10), which in turn are fitted to the top chord of the arches. There may be at least three spreader bars per bay - between two arches (1). In the parked position the spreader bars are nearly vertical and during the deployment of the proposed system one side of the spreader bar will move downward and the other side upward. In the final deployed position the spreader bars are orientated horizontally. The motion of the spreader bar during deployment and retraction operation of the overall system is a rotation around the mid point of the spreader bar itself. Since the arches should basically stay parallel to each other, the linear motion and therefore also the rotation of the spreader bars between two adjacent arches need to be synchronized. This can easily be achieved by using a rope pulley system, which connects the sliders (11) of the spreader bars (6) of one side of each arch like a looped daisy chain. The rope system may then be driven with a motorized winch at the top end of the arches at the motorized supports (3). The two ends of each spreader bar do not need to be synchronized, only all

ends running along each arch. Alternatively, the rope can be replaced with chains or with controlled hydraulic or pneumatic pistons, etc.

[0042] Fig. 8 is a schematic drawing of a spreader bar, as it may be employed in particular embodiments of the present invention. The spreader bar (6) is fitted with a damped longitudinal extension system like a shock-absorber strut for a linear suspension (15) in order to take up differential movements of the arches due to wave movements. Other linear or non-linear damping systems are possible, including rotational damping systems. The amount of linear extension and the amount of damping may be adapted for the prevailing expected vertical differential displacements of the arches i.e. the maximum expected swell at the port.

[0043] To ensure that the vessel cover does not uncontrollably retract or deploy, a locking system of the spreader bar system for the parked and deployed position may be provided. This can be achieved by installing breaks to the rope winches or a mechanical bolt lock system between the sliders (11) and the slider rail (10). Other implementations are also possible.

[0044] Other ways of implementing spreader bars are possible. For instance, only one end of a spreader bar may be linked to a slider while the other end is hinged to the arch in a non-sliding fashion. In another example, X-type spreader bars may be employed instead of or in addition to the swinging spreader bar.

[0045] Since the spreader bars (6) may be placed at various intermediate locations along the curved arches (1) they restrict not only the lateral movements of the overall system but also differential vertical movement of the arches. Contrary to tidal changes in water level, which are uniform, waves are irregular and will cause differential vertical movements of the floating supports (2), i.e. each arch will move vertically different to the adjacent ones. This will have little effect on the flexible canvas (5). But to avoid an over stressing of the arches (1) and in particular the spreader bars (6), these spreader bars are preferably also fitted with a damped longitudinal extension system (15).

[0046] The operation of the vessel cover is illustrated in the perspective views of Figs. 5 to 6.

[0047] The operation of the retractable ship loading bay cover starts out at the parked position shown in Fig. 4. The arches (1) are pushed together and the canvases (5) are folded. The system is stowed away to give room for coming vessels to moor at the pier for loading. The rail system has to extend far enough beyond the sections of the pier allocated for mooring the bulk carrier vessels. The motorized supports (3) working in parallel can move the parked pack of the cover system in either direction along the pier.

[0048] As soon as it becomes necessary that the loading operation of the moored bulk carrier vessels has to be protected from the weathers, the retractable ship cover are deployed. First the parked pack gets moved as close as necessary over the area of the loading operation

that needs to be protected. For the actual deployment of the cover, the arches get pushed apart by swinging the spreader bars (6) from a vertical position into a horizontal one. More than one bay - two adjacent arches (1) with a folding canvas (5) spanning in between - can be deployed, as shown in Fig. 5. During this operation the motorized supports (3) of the moving arches are disengaged to allow the supports to move freely. A mechanical lock or break system will lock the spreader bars into position to ensure that proposed system stays in place and the spanned canvases do not flutter in the wind and get torn. Fig. 6 shows the system in its fully deployed state.

[0049] For retracting the system, the swinging spreader bars are rotated from the horizontal back to the vertical position. Then the pack of parked bays gets moved out of the way for the vessel to leave port unobstructed, as shown in Fig. 4.

[0050] The speed of the deployment and retraction operation depends on how fast the floating supports (2) can be moved in the water. These supports are subjected to a certain water resistance, which is related to the speed the supports move through the water. Therefore, the speed of deployment all depends on the power sizing of the drive systems.

[0051] The deployment and retraction operation of the ship loading bay cover is preferably controlled by a central control system covering all drive systems, including the drive system for the rail supports, the drive system for the floating bodies, and the drive system for the swinging spreader bars. Moving the parked or deployed system is independent from the deployment operation. For the deployment only one end of the swinging spreader bars (6) along each arch (1) need to be synchronized and this can be achieved mechanically. The only necessary control of the overall system is to make sure that the motorized trolleys (3) are disengaged during deployment or retraction of the arches (1).

[0052] To support the movement of the overall system, parked or deployed, the first and last floatation device may be fitted with an additional drive like an engine driven water propeller or a rope pulley system running along the sea bed.

[0053] As an additional option to prevent large differential movement of the arches the floatation devices may be fitted with a locking system that attaches itself to the hull of the vessel, for example with electromagnets or other suitable means. Summarizing, the present invention provides a retractable cover for vessels moored laterally along the side of a pier of a loading bay, and also for a portion of the pier itself, to provide protection against inclement weather during loading operations. The retractable cover comprises of a series of structural arches which are movable parallel to the pier. On the land side these arches are supported on motorized trolleys and on the water side on floatation devices. Between these arches flexible canvases are fitted. When the retractable covers gets deployed, the arches are moved apart from each other, the canvases get spread out and will provide the

cover for the vessel moored underneath at the loading bay. A swinging spreader bar system moves the arches apart and at the same time provides the lateral stability once the cover is deployed.

Claims

1. A cover for protecting a moored vessel (7) and part of a pier (9) during a loading operation against inclement weather, said cover comprising:

a plurality of arches (1) with a first end and a second end for traversing the moored vessel (7) in a transverse direction from a land side to a water side,
a canvas (5) fitted to the plurality of arches (1);
a plurality of floating bodies (2) for supporting the first end of a respective one of the plurality of arches (1) on the water side; and
a plurality of support members (3) for supporting the second end of a respective one of the plurality of arches (1) on the land side.

2. The cover according to the preceding claim, wherein the plurality of support members (3) is movable in a longitudinal direction, preferably on a rail mounted on the land side.

3. The cover according to any of the preceding claims, wherein the arches (1) are movable relative to each other in the longitudinal direction such that the cover is foldable to give space for the vessel (7) to manoeuvre.

4. The cover according to any of the preceding claims, wherein the plurality of arches (1) is movable from a retracted position to a deployed position and vice versa, wherein the canvas (5) is folded between the arches (1) in the retracted position and spread out between the arches (1) in the deployed position.

5. The cover according to any of the preceding claims, wherein each arch (1) is connected with a hinge to the respective support member (3) to take on any vertical movement of the arch (1).

6. The cover according to any of the preceding claims, further comprising a support driving member for driving at least one of the plurality of support members (3) in the longitudinal direction.

7. The cover according to any of the preceding claims, further comprising a floating body driving member for driving at least one of the plurality of floating bodies (2) in the longitudinal direction.

8. The cover according to any of the preceding claims,

further comprising swinging spreader bars (6) fitted between adjacent arches (1) to provide a horizontal brace and lateral stability of the cover.

9. The cover according to claim 8, wherein at least one end of each of the swinging spreader bars (6) is mounted to a respective one of the plurality of arches (1) in a manner that allows a sliding linear movement of the one end in a vertical direction, such that the swinging spreader bars (6) perform a rotational movement when the arches (1) are moved from a retracted position to a deployed position or vice versa. 5
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10. The cover according to claim 8 or 9, further comprising driving means for driving the swinging spreader bars (6) from a vertically oriented position to a horizontally oriented position when the arches (1) are moved from the retracted position to the deployed position and/or for driving the swinging spreader bars (6) from the horizontally oriented position to the vertically oriented position when the arches (1) are moved from the deployed position to the retracted position. 15
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11. The cover according to claim 9 or 10, further comprising means for synchronizing the rotational movement of the swinging spreader bars (6) fitted between two adjacent arches (1), to ensure an even movement of the arches (1) when being moved from the retracted position to the deployed position or vice versa. 30

12. The cover according to any of the claims 8 to 11, wherein each swinging spreader bar is fitted with a longitudinal damping element (15) to take on any differential movement of adjacent arches (1). 35

13. The cover according to any of the claims 8 to 12, further comprising locking members for locking the swinging spreader bars (6) into position, when the arches (1) are in the retracted position or in the deployed position. 40

14. The cover according to any of the preceding claims, wherein the canvas (5) is light translucent. 45

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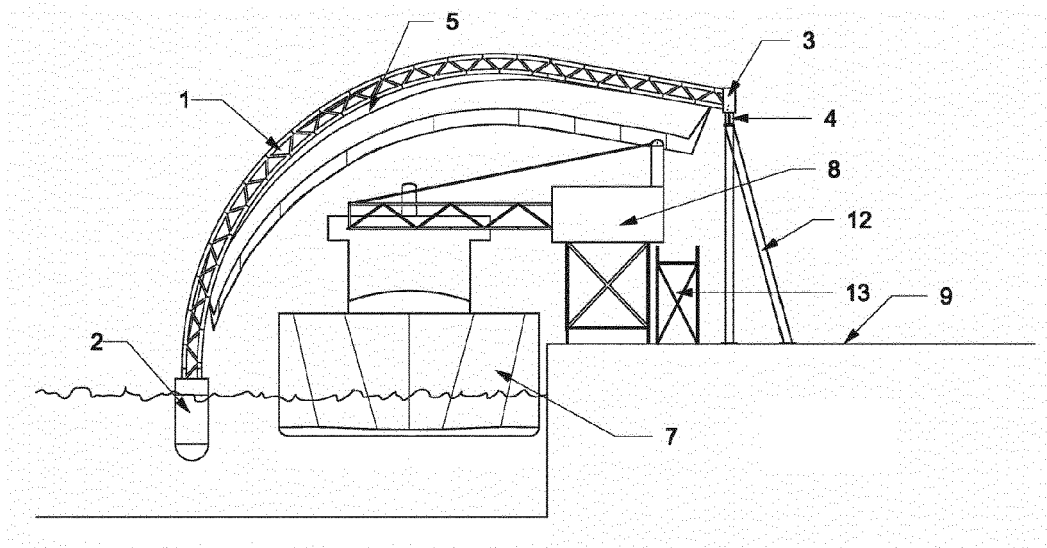


Fig. 1

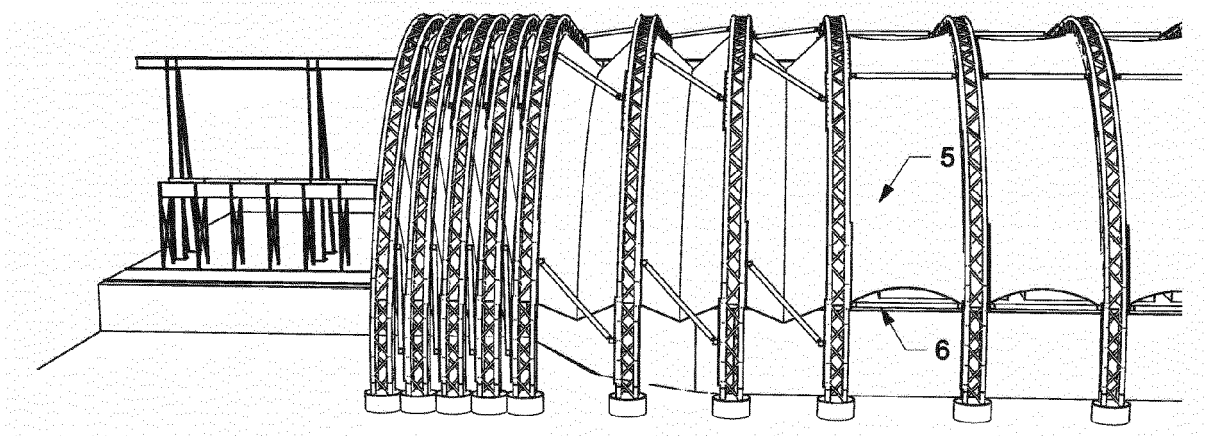


Fig. 2

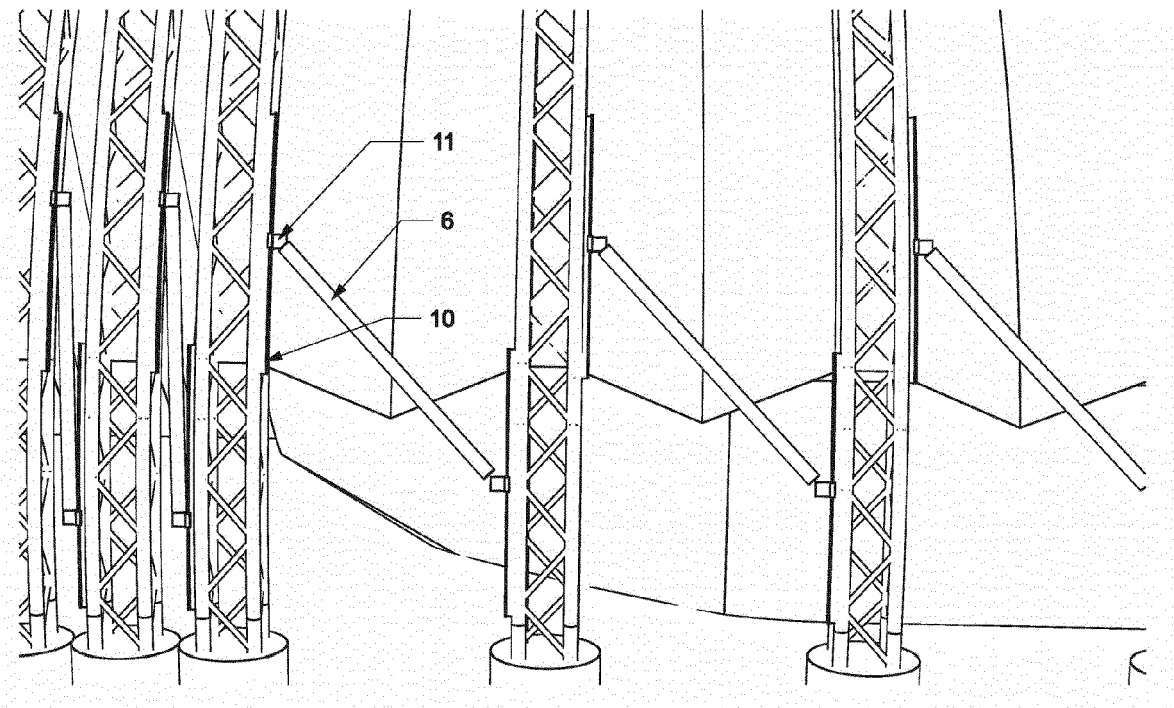


Fig. 3

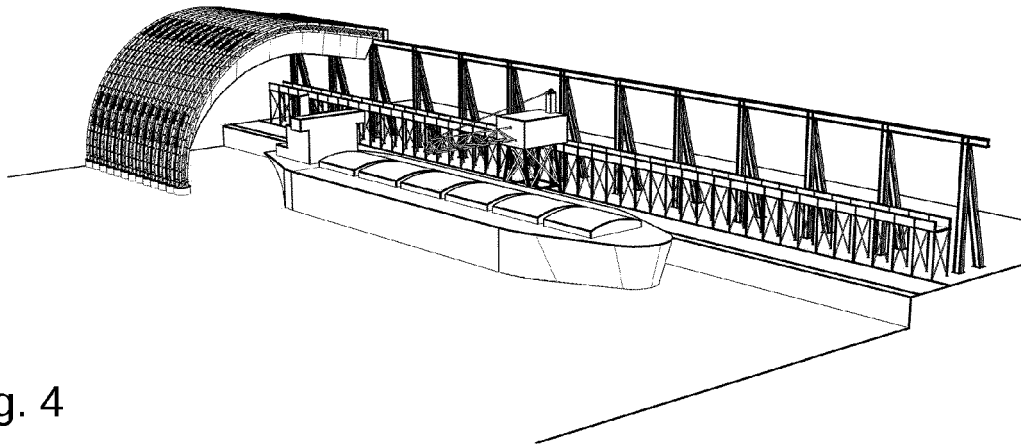


Fig. 4

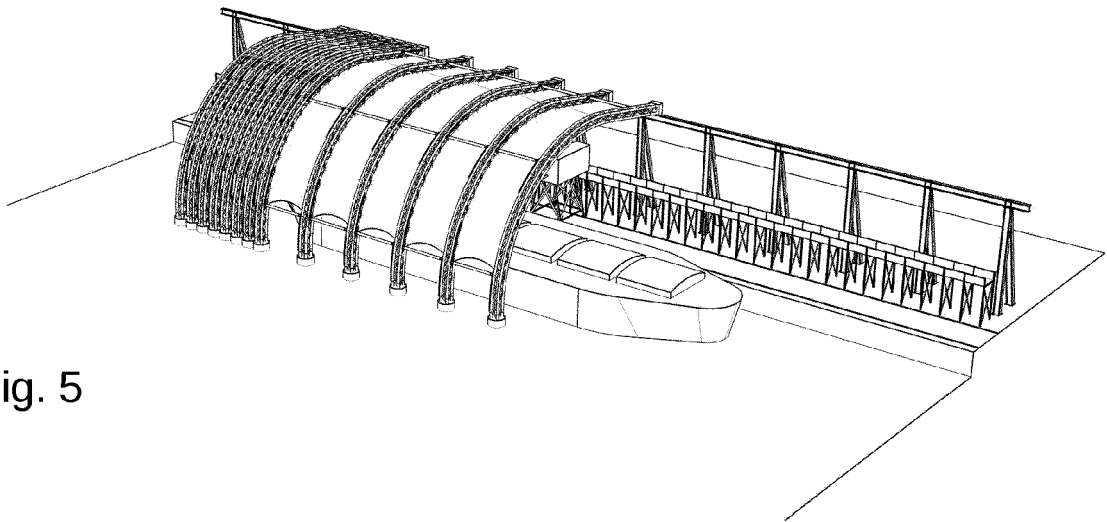


Fig. 5

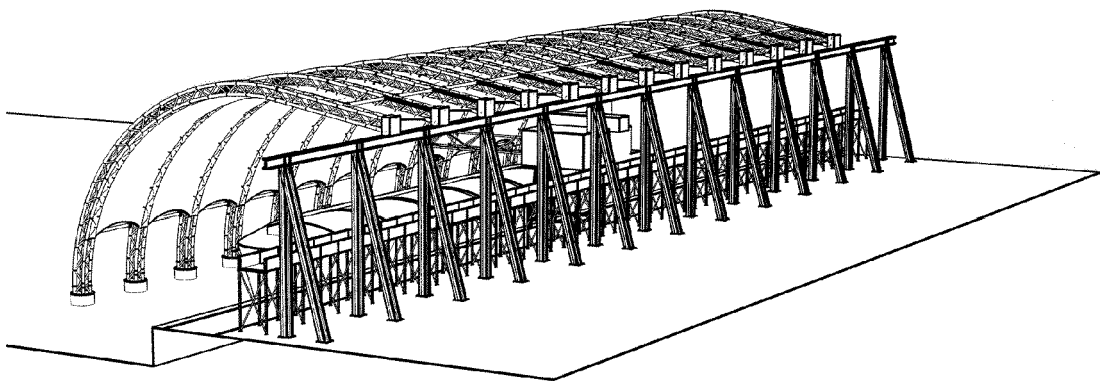


Fig. 6

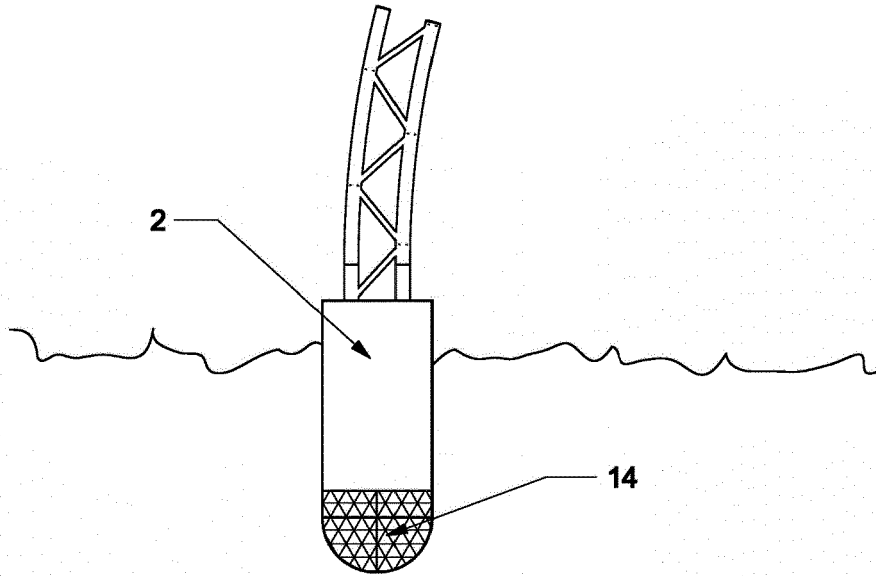


Fig. 7

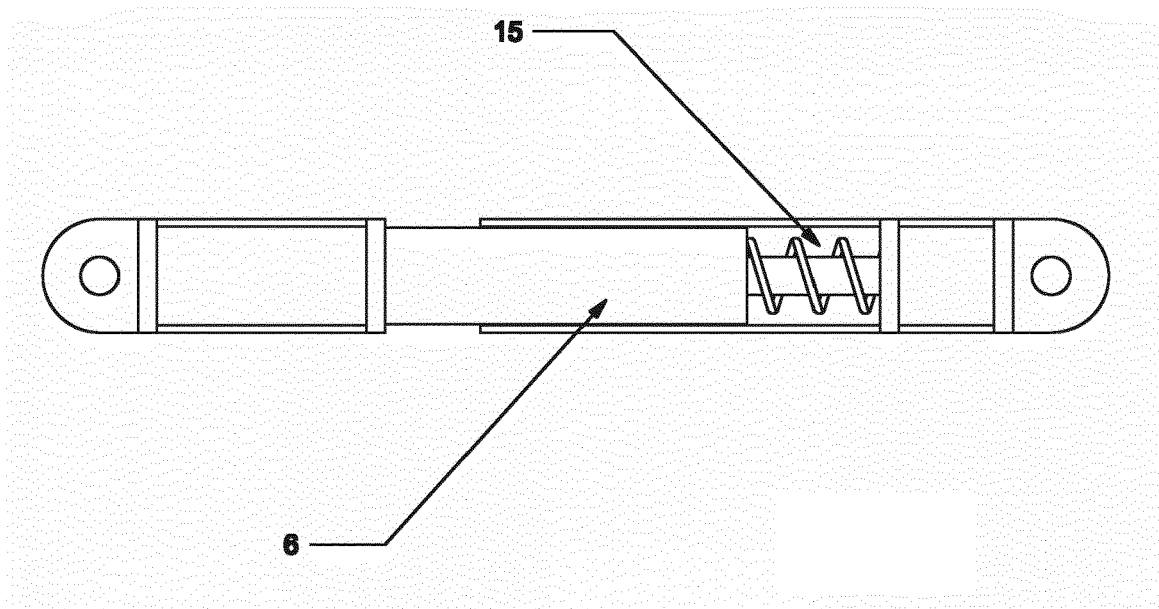


Fig. 8



EUROPEAN SEARCH REPORT

Application Number
EP 15 17 8861

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 99/46154 A1 (ACTA MARITIME DEV CORP [US]; ARNTZEN JOHN [US]; THORSEN RICHARD [US]) 16 September 1999 (1999-09-16) * page 8, line 7 - page 9, line 16; figure 1 *	1	INV. E02B3/20 B63B17/02 E04B7/16 E04H4/08
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			E02B B63B E04B E04H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 7 January 2016	Examiner De Coene, Petrus
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