Feb. 10, 1970 W. ROODENBURG ET AL 3,494,406

HATCHCOVER-SYSTEM

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FIG. 1

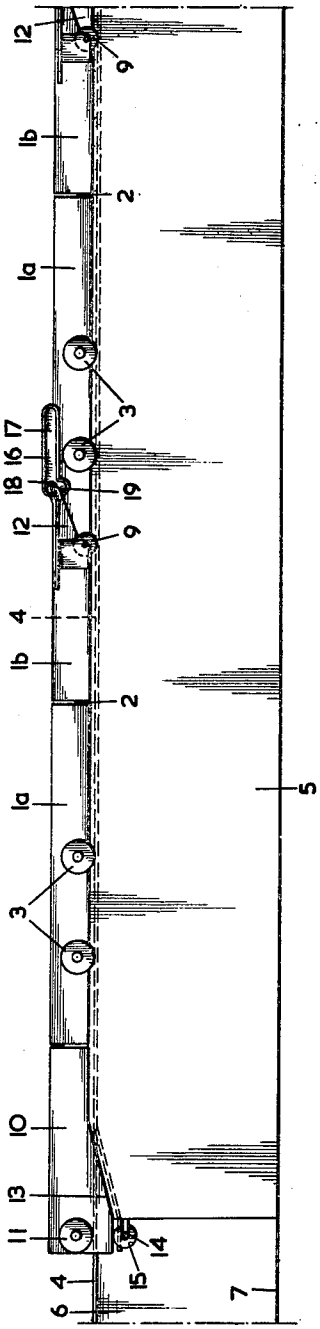

FIG. 2

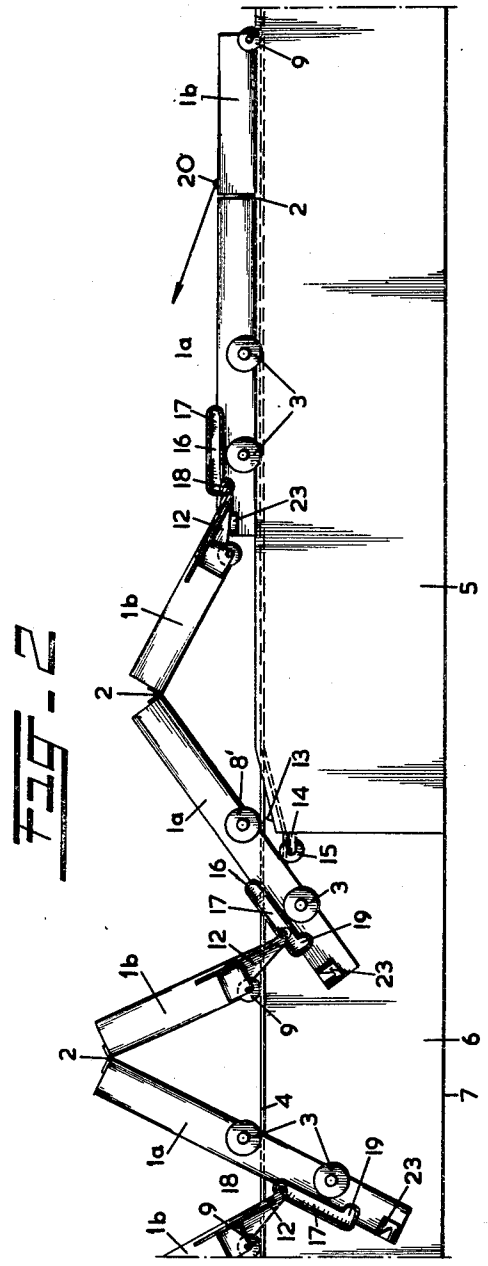

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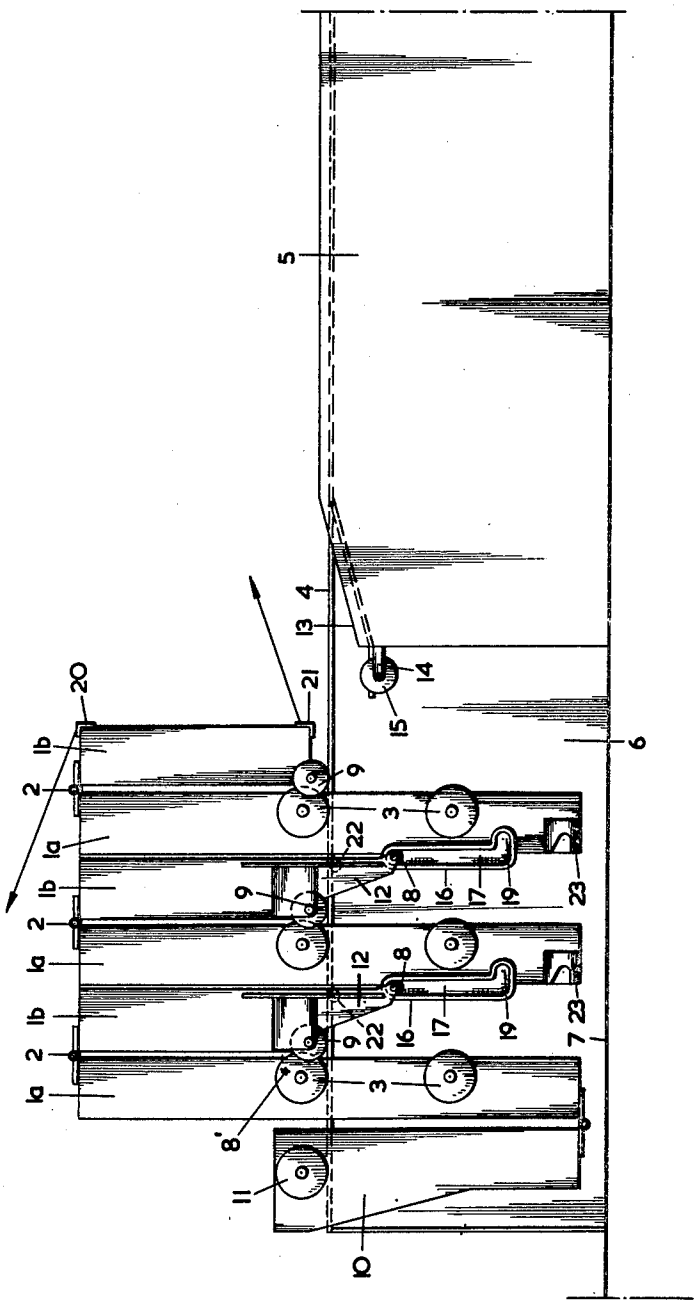
Fig. 2



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HATCHCOVER-SYSTEM

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U.S. Cl. 160—188 4 Claims

ABSTRACT OF THE DISCLOSURE

A hatchcover-system for a hatch-coaming comprises a plurality of alternately disposed relatively wide and relatively narrow hatch covers which are swingably interconnected by arms rigid with the narrow covers and slidable in slots provided on the wide covers. The covers thus swing vertically during movement between a folded storage position and an unfolded operative position; and, for this movement, the covers are supported on rollers whose axes are disposed below the center of gravity of each pair of adjacent covers, at least in the folded storage position of the covers. The center of gravity of each pair of covers is at substantially the same level in the folded position of the covers as in the unfolded position of the covers.

The invention relates to a hatch-cover system for a hatch-coaming, consisting of a number of hatch-covers with hinged connections, which can be stored in folded condition in a storage space on one or both sides of and in line with the hatch-coaming, each two adjacent hatch-covers forming a pair, consisting of a broad hatch-cover located on the side of the storage space and a corresponding narrow hatch-cover, while each hatch-cover is adapted to move by means of at least one set of rollers on guideways, which are located on the long sides of the hatch-coaming and extend on either side of the storage space, while further more means are present for moving all the hatch-covers towards and from the storage space respectively. A hatch-cover system of this kind, which can be stored in the storage space in folded condition, is disclosed in Dutch patent application 264,466 laid open to public inspection. This known hatch-cover system presents the advantage that for the storage of the hatch-covers a storage space of small dimensions suffices.

It is the object of the invention to provide for a hatch-cover system of the said type in which a considerably smaller force is required for opening the hatch-cover system.

According to the invention this object is achieved by the feature that in the folded condition of each pair of hatch-covers the axis of the set of rollers of each broad hatch-cover is placed at such a distance beneath the centre of gravity of the respective pair of hatch-covers that this centre of gravity lies at the same horizontal level in the folded as well as the straightened or unfolded condition of the pair of hatch-covers, while of each pair of hatch-covers the narrow hatch-cover is connected with the broad hatch-cover of the adjacent pair of hatch-covers by means of an arm which is pivotally connected at one end and rigidly fastened at the other end. Whilst in the case of the said known hatch-cover system during the folding of the hatch-covers the centre of gravity of each pair of hatch-covers has to be raised

and the swinging of each broad hatch-cover of a pair of hatch-covers has to be controlled by means of cams and slots, in the hatch-cover system according to the invention the centre of gravity remains at the same level, the said point moving only slightly about the axis of the set of rollers of the broad hatch-cover as the hatch-cover system is folded and straightened. Most of the pairs of hatch-covers are in balance, and also during the folding and straightening respectively of the hatch-cover system the situation is such that the weights and forces in the whole hatch-cover system compensate each other completely, or at least almost completely. For the storage of the hatch-covers in opening the hatch-cover system a very small force indeed will thus suffice, this force being required in particular to start the folding movement of the first pair of hatch-covers. After this starting operation the folding movement further proceeds as it were automatically, because the folding of each succeeding pair of hatch-covers is controlled by the connection, also proposed by the invention, between the narrow hatch-cover of a pair of hatch-covers and the broad hatch-cover of the adjacent pair of hatch-covers by means of an arm which is pivotally connected at one end and rigidly fastened at the other end. This is different from the similar connection in the said known hatch-cover system, which consists of an arm which is pivotally connected at both ends and does not exercise any controlling function.

According to a preferred embodiment of the invention each hinged connection between the narrow hatch-cover of a pair of hatch-covers and a broad hatch-cover of the adjacent pair of hatch-covers has the form of a sliding linkage, in which the hinge point is adapted to slide in a slotted means. Owing to this movability of the hinge point, smaller dimensions of the storage space will suffice. In the preferred embodiment the slotted means of the sliding linkage is attached to the broad hatch-cover, on the upper side of this hatch-cover, having its slot parallel to this upper side, the end of the slot directed towards the narrow hatch-cover connected therewith having a downwardly directed slot projection, while the fixed arm is provided with a pin which is adapted to slide in said slotted means. By means of the downwardly directed slot projection, the slotted means constitutes a kind of grip for the pin of the arm, by which grip during the folding of a pair of hatch-covers a downwardly directed pressure is exerted upon the broad hatch-cover of the adjacent pair of hatch-covers, which pressure is required to start the latter broad hatch-cover swinging to the vertical position.

In order to ensure that during the folding movement the said pin in the first instance moves towards the slot projection, according to another feature of the invention the fixed arm attached to a narrow hatch-cover is provided with a second pin, which in the straightened condition of the respective hatch-cover is accommodated in a seat fixed to the adjoining end of the adjacent broad hatch-cover.

The downwardly directed slot projection further extends along an arc of a circle having the pivot of the seat at its centre; that is, the second pin is at the centre of the arc when fully lodged in the seat. By means of this auxiliary linkage an automatic locking of the connection between adjacent pairs of hatch-covers (automatic cross-joint locking) is further obtained in the straightened condition of the hatch-cover system.

The downwardly directed pressure which is required to start the broad hatch-cover of the first pair of hatch-

covers, adjoining the storage space, swinging to the vertical position is obtained by weighting the side of this hatch-cover which is turned towards the storage space.

This weight may be formed by an auxiliary hatch-cover between the pair of hatch-covers adjoining the storage space and the adjacent side of the hatch-coaming, which auxiliary hatch-cover has a hinged connection to the broad hatch-cover of said pair and is supported by a pair of rollers only on the side adjoining the storage space. The use of an auxiliary hatch-cover, however, involves the drawback that room for the storage of this auxiliary hatch-cover must be reserved in the storage space, which implies larger dimensions of the storage space. It is therefore more efficient to bring about the weighting by means of a weighting means attached to the respective side of the broad hatch-cover adjoining the storage space.

A hatch-cover system consisting of a number of hatch-covers, in which the centre of gravity of the whole hatch-cover system remains substantially at the same horizontal level when said system is closed as well as when it is stored and during the storage operation, and in which therefore only a small force is required for opening the system, is disclosed per se in Dutch Patent No. 88,014. In this known hatch-cover system, in which unlike the hatch-cover system according to the invention the hatch-covers are not connected in pairs, but the hatch-covers represent independent units, each of the hatch-covers is supported at a point located on that side of the centre of gravity of the hatch-cover which is opposite from the storage space. When the hatch-cover system is stored therefore, the centre of gravity of each of the hatch-covers comes to rest beneath the point of support, which involves the serious drawback that during the storage operation each of the hatch-covers swings to and fro about its vertical position, so that damage of the hatch-covers tends to occur. Furthermore, in this known hatch-cover system each of the hatch-covers has to be provided with three pairs of rollers, whilst in the hatch-cover system according to the invention three pairs of rollers for every pair of hatch-covers suffice.

The invention will be elucidated more fully below with reference to an embodiment illustrated in the drawings. In the drawings:

FIG. 1 shows a part of the hatch-cover system according to the invention, in the straightened or unfolded condition;

FIG. 2 shows a part of the hatch-cover system in a position during the folding movement; and

FIG. 3 shows the whole hatch-cover system in folded condition in the storage space.

As appears from FIG. 1, the hatch-cover system consists of a number of hatch-covers **1***a* and **1***b*, a hatch-cover **1***a* being considerably broader than a hatch-cover **1***b*, while in each case a broad hatch-cover **1***a* and a narrow hatch-cover **1***b* form a pair of hatch-covers because they have such a hinged connection that during the folding of the hatch-cover system they are folded together through a hinge **2**. Each broad hatch-cover **1***a* is further movably supported by means of two pairs of rollers **3** on two pairs of guideways **4** extending along the long sides of the hatch-coaming **5**. Each pair of rollers **3** consists of two rollers each fitted on one end face of the respective hatch-cover **1***a*. The rollers **3** of the pair of rollers located in that half of a broad hatch-cover which is adjacent the storage space are disposed not so far outwards as the rollers of the second pair of rollers. The two pairs of guideways **4** are located in each case on the outside of the adjoining long side of the hatch-coaming **5**, which is provided on the deck **7** of the ship. Whilst the pair of guideways for the rollers in that half of a broad hatch-cover which is adjacent the storage space **6** extends only along the hatch-coaming, the pair of guideways of the other pair of rollers **3** extends further on either side of the storage space **6**. The imaginary axis of the said other pair of rollers **3** is located according to the invention in the vicinity of the centre of gravity **8** of the respective pair of hatch-covers consisting of a broad hatch-cover and a narrow hatch-cover, the arrangement being such that said centre of gravity **8** lies obliquely to the right above said roller axis when the respective pair of hatch-covers is straightened as well as when it is stored. Each of the narrow hatch-covers **1***b* is supported by a pair of rollers **9** only at the end opposite the corresponding broad hatch-cover **1***a*, which rollers, owing to a support provided further towards the lower side of the hatch-cover in its straightened condition have a smaller diameter than the rollers **3**. Owing to the described arrangement according to the invention of the second pair of rollers of each broad hatch-cover the effect is achieved that in each case a pair of hatch-covers is in a substantially balanced condition both when straightened and when stored away, so that in the whole hatch-cover system the weights and forces during the folding movement and the straightening movement respectively compensate each other completely, or at least almost completely.

Since furthermore adjacent pairs of hatch-covers are interconnected, it will be obvious that very little work indeed will be sufficient for the opening of the hatch-cover system. It is further necessary to move the hatch-cover system in the direction of the storage space **6** and to exert a downward pressure upon that side of the broad hatch-cover of the first pair of hatch-covers to be folded which is adjacent the storage space. This pressure can be exerted in any desired way, e.g. manually by an operator, as soon as the respective side of the broad hatch-cover has moved past the adjoining side of the hatch-coaming. This downward pressure serves only to start the folding movement of the respective pair of hatch-covers. Because the pair of hatch-covers is in the above-mentioned balanced condition, after the starting of the folding movement this pair of hatch-covers will itself complete the further folding movement without any further aid. It is naturally also possible to permanently apply the required downward pressure upon that side of the broad hatch-cover of the first pair of hatch-covers to be folded which is adjacent the storage space in the form of a weighting means of any suitable type fitted on the respective side.

In the embodiment of the hatch-cover system according to the invention shown in the drawings the downward pressure is obtained by the use of an auxiliary hatch-cover **10**, which is supported by a pair of rollers **11** only on the side adjacent the storage space **6**, while the other side of this auxiliary hatch-cover **10** finds a support in some suitable way on the adjoining side of the broad hatch-cover of the first pair of hatch-covers to be folded. In opening the hatch-cover system and after the pair of rollers **11** has passed the adjoining side of the hatch-coaming **5** the side of the broad hatch-cover **1***a* adjoining the auxiliary hatch-cover **10** will be forced downwards by the downward pressure which the adjoining side of the auxiliary hatch-cover exerts thereon, after which the further folding of the first pair of hatch-covers will be completed automatically. It is advisable to design the said support in such a way that during the closing of the hatch-cover system and in particular the straightening or unfolding of the pair of hatch-covers adjoining the storage space the auxiliary hatch-cover **10** is brought into the horizontal position via the support in question. It is further observed that for the starting of the folding movement of the first pair of hatch-covers the above-mentioned second possibility of the use of a weighting means is to be preferred to the possibility shown in the drawing, since in that case the space which the auxiliary hatch-cover **10** occupies in the storage space can be omitted.

When during the opening of the hatch-cover system the first pair of hatch-covers has started its folding movement, the folding movement of the next pair of hatch-covers is started by exerting a pressure upon that side of the broad hatch-cover of this second pair of hatch-covers which is

adjacent the storage space, which is effected by means of the connection between adjoining pairs of hatch-covers proposed by the invention, by means of an arm **12** which is pivotally connected at one end and rigidly fastened at the other end. Although this is not necessary, this arm **12** is rigidly fastened to the narrow hatch-cover **1***b* of the preceding pair of hatch-covers and has a sliding-hinged connection with the broad hatch-cover of the next pair of hatch-covers. From FIG. 2 it is clear that during the folding movement of a pair of hatch-covers a downward pressure is exerted upon the adjoining side of the broad hatch-cover of the next pair of hatch-covers, for which reference is made in particular to the position of the arm **12** between the two pairs of hatch-covers on the right.

From FIG. 2 it further appears that it is effective to bevel the parts of the long sides of the hatch-coaming **5** adjoining the storage space **6**, as is indicated by the reference number **13**. By this measure damage to broad hatch-covers during the opening of the hatch-cover system is prevented. A further guarantee against damage has been obtained by providing the short side of the hatch-coaming **5**, adjacent the storage space, with a guiding means for the broad hatch-covers. Although this guiding means may have any suitable form, in the embodiment shown in the drawings it consists of a support means **14**, having a guide roller **15** on its free end. The linkage of the arm **12** may have any suitable form. It is preferably designed in the form of a sliding hinge. According to the preferred embodiment shown in the drawings this sliding hinge consists of a slotted means **16** fitted on the upper side of the broad hatch-cover; the slot **17** extends parallel to this upper side. In this slot **17** a pin **18** fitted at the free end of the arm **12** is accomodated movably. The slot is further provided with a downwardly directed slot projection **19**, which represents a grip for the pin **18**.

In a preferred embodiment, in order to ensure that during the folding movement the pin **18** moves in the first instance towards the slot projection **19**, the arm **12** is provided with a second pin **22**, which in the straightened condition of the hatch-cover system is accomodated pivotally in a seat **23** fixed to the adjoining end of the broad hatch-cover. In the straightened or unfolded condition of the hatch-cover system this auxiliary linkage guarantees the correct relative position of the adjoining hatch-covers. At the same time this auxiliary linkage represents an automatic locking of the connection between adjoining pairs of hatch-covers (automatic cross-joint locking).

When the hatch-cover system is in the unfolded condition shown in FIG. 1, a pin **18** will be present in the slot above the slot projection **19**. In opening the hatch-cover system the pin **18** of an arm **12** first comes to rest in the slot projection **19** (FIG. 2, arm **12** on the right); subsequently this pin slides out of the slot projection (FIG. 2, arm **12** at center), after which the arm slides through the slot to the other end of the slot (FIG. 2, arm **12** on the left, and FIG. 3).

It will be evident that the application of the sliding hinge for folding a broad hatch-cover to the vertical position causes a decrease of the required space in the storage space with respect to the application of a link with a fixed position. Consequently the sliding hinge gives a better utilization of the storage space.

In the hatch-cover system according to the invention the energy required for opening said system consists only of the force required to move the hatch-cover system in the straighented condition in the direction of the storage space. The means for exerting this force having its point of application at point **20** on the narrow hatch-cover of the pair of hatch-covers farthest from the storage space, may have any suitable form. As soon as during said movement the foremost pair of rollers **3** has passed the end of their guideway, the first broad hatch-cover **1***a* starts the swinging movement to its vertical position, while at the same time the corresponding narrow hatch-cover starts the swinging movement to its vertical position. Since the weights and forces of each pair of hatch-covers compensate each other completely, or at least almost completely, substantially no energy has to be applied for the folding of each pair of hatch-covers.

The same applies to the straightening of the hatch-cover system. Here again a force is required only to pull away from the storage space the free end of the narrow hatch-cover of the last folded pair of hatch-covers. This force, which may act at any suitable point, preferably has a point of application at **21**.

It need not be stated that modifications of the embodiment described above are possible within the scope of the invention.

It is possible to have two storage spaces each on opposite sides of the hatch-coaming. In that case the invention can be applied in folding and unfolding a half of the hatch-cover system on the one side of the hatch-coaming and in folding and unfolding the half of the hatch-cover system on the other side of the hatch coaming.

What is claimed is:

1. A hatch-cover system for a hatch coaming, comprising a plurality of alternately disposed relatively wide and relatively narrow hatch covers, means swingably interconnecting said covers, rollers supporting said covers for folding and unfolding movement of said system between a folded storage position in which said covers are relatively upright and an unfolded operative position in which said covers are relatively horizontal, the axes of said rollers being disposed lower than the center of gravity of each pair of adjacent said covers in said folded position of said covers, said centers of gravity being disposed at substantially the same level in said folded position as in said unfolded position of said covers, said interconnecting means comprising an arm pivotally connected to one cover at one end and rigidly connected to the adjacent cover at the other end, said interconnecting means further comprising means mounting said one end of said arm for sliding pivotal movement on and relative to said one cover, said sliding pivotal mounting means comprising means defining a slot on the upper side of a relatively wide hatch cover, said slot being substantially parallel to said upper side and having a slot end that is downwardly directed when said covers are horizontal.

2. A system as claimed in claim **1**, said arm having a pin thereon, said relatively wide hatch cover having a seat spaced from said slot for receiving said pin.

3. A system as claimed in claim **2**, said slot end extending along an arc of a circle having said pin at its center when said pin is fully lodged in said seat.

4. A hatch-cover system for a hatch coaming, comprising a plurality of alternately disposed relatively wide and relatively narrow hatch covers, means swingably interconnecting said covers, rollers supporting said covers for folding and unfolding movement of said system between a folded storage position in which said covers are relatively upright and an unfolded operative position in which said covers are relatively horizontal, the axes of said rollers being disposed lower than the center of gravity of each pair of adjacent said covers in said folded position of said covers, said centers of gravity being disposed at substantially the same level in said folded position as in said unfolded position of said covers, horizontal track means on which said rollers of said relatively wide hatch covers roll, the last-named rollers being continuously in contact with said track means both in the open and in the closed positions of the hatch-cover system, further rollers on said relatively wide hatch covers, the axes of said further rollers being disposed on the side of the first-mentioned wide hatch-cover rollers which is opposite said center of gravity, and further track means on which said further rollers roll in and adjacent the closed position of said hatch-cover system, said further rollers being free

from said further track means in the open position of said hatch-cover system.

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