United States Patent [19]

Nijdam

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[54] **MATTRESS, METHOD OF SINKING A MATTRESS AND VESSEL SUITABLE FOR USE IN SAID METHOD**

[75] Inventor: **Ate Nijdam,** Schelluinen, Netherlands

[73] Assignee: **Aannemers, Combinatie Zinkwerken B.V.,** Gorinchem, Netherlands

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[30] **Foreign Application Priority Data**

Oct. 6, 1972 Netherlands 7213540

[52] **U.S. Cl.** **61/38;** 52/388; 61/72.3

[51] **Int. Cl.²** **E02B 3/12**

[58] **Field of Search** 61/38, 37, 7, 1, 34; 52/388, 386, 198

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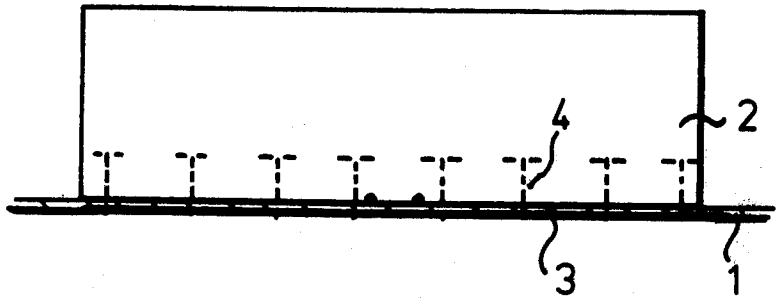
Primary Examiner—Jacob Shapiro

[57] **ABSTRACT**

A mattress is disclosed comprising a filter cloth into which at regular intervals metal bars are woven and spaced concrete blocks are connected to the bars, thus securing the blocks to the filter cloth. In use the space between the blocks may be filled with ballast such as rubble, gravel, etc.

20 Claims, 18 Drawing Figures



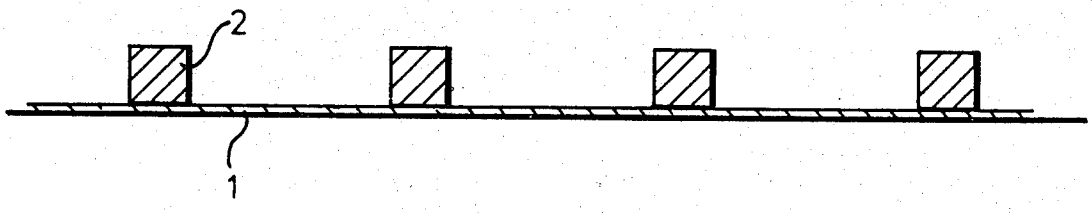


FIG. 1

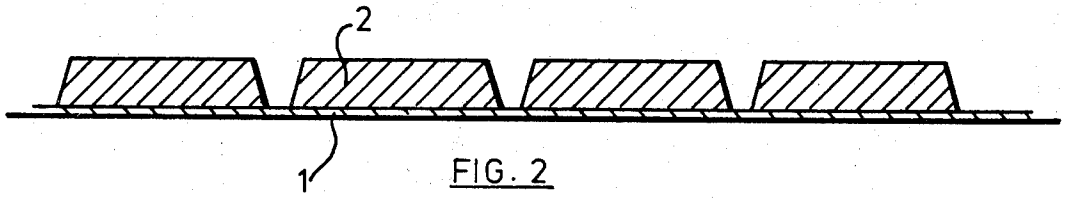


FIG. 2

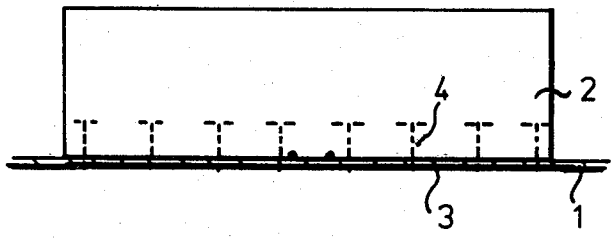


FIG. 3

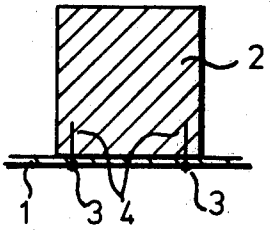


FIG. 4

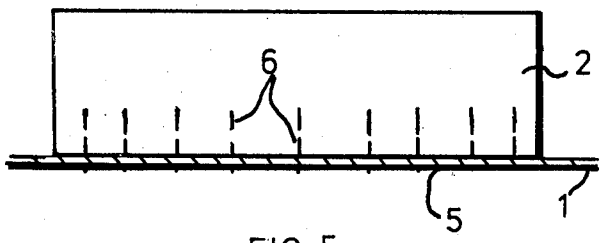


FIG 5

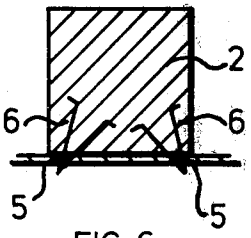


FIG 6

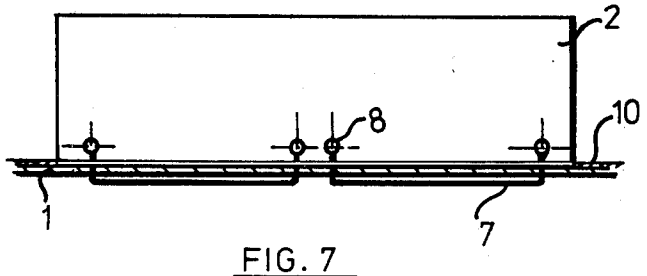


FIG. 7

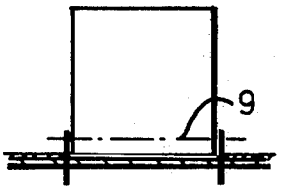


FIG. 8

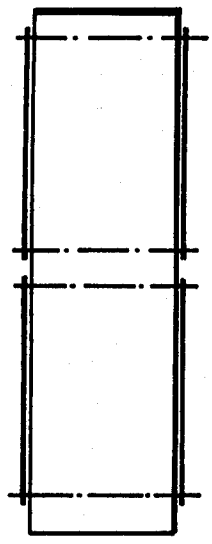


FIG. 9

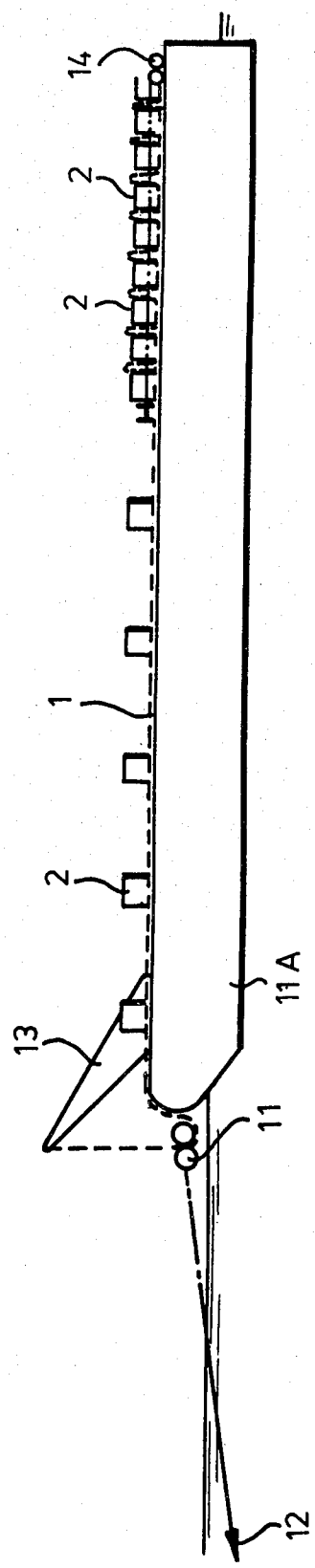


FIG. 10

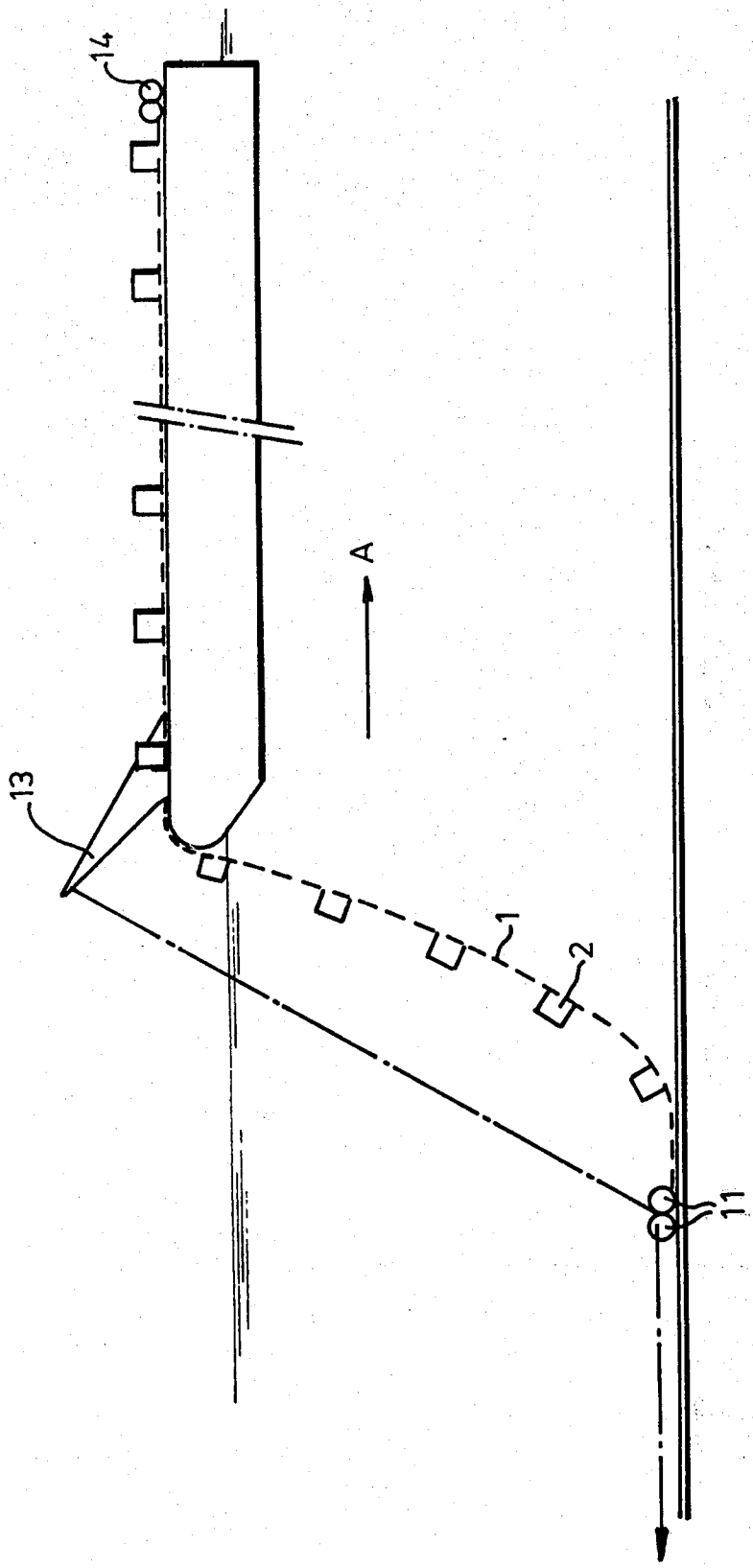


FIG. 11

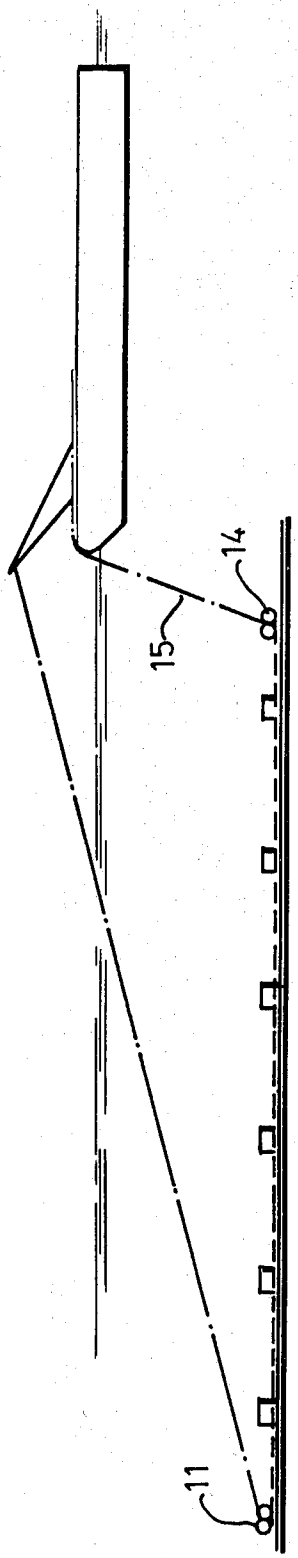


FIG. 12

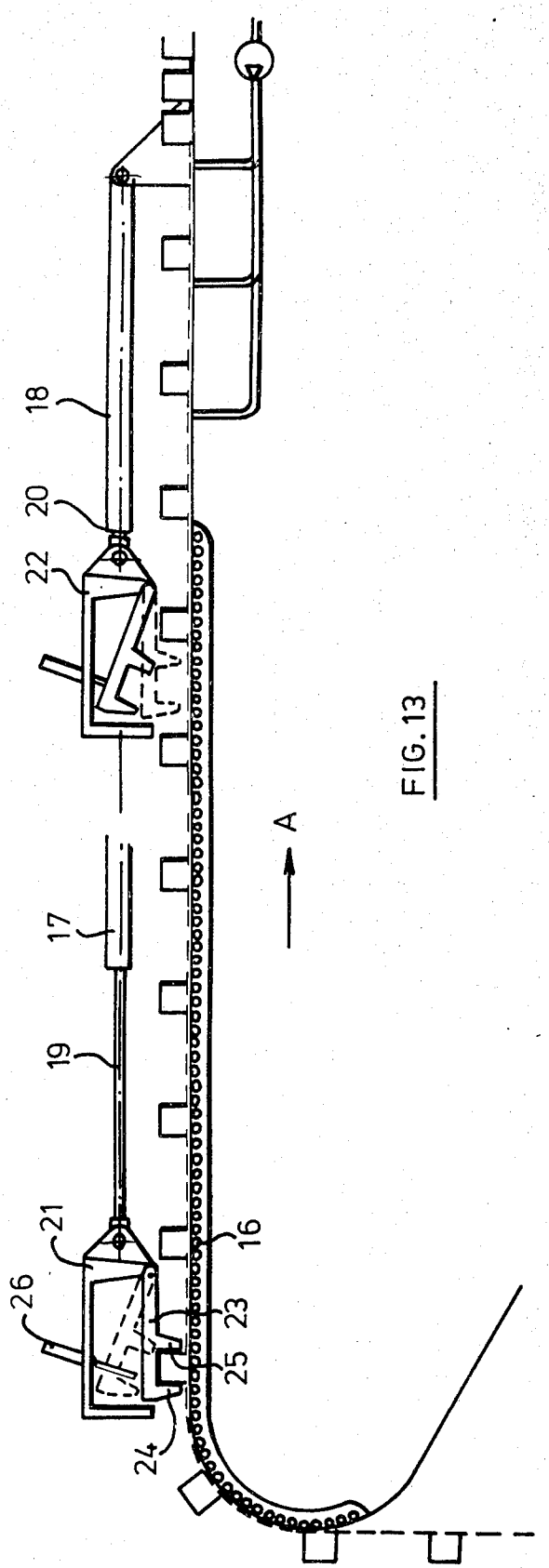


FIG. 13

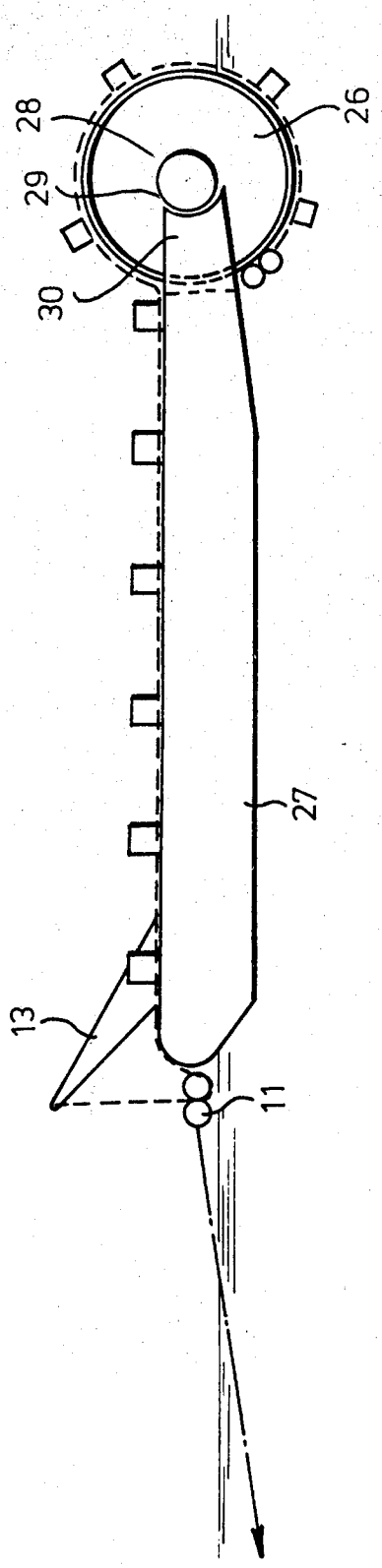


FIG. 14

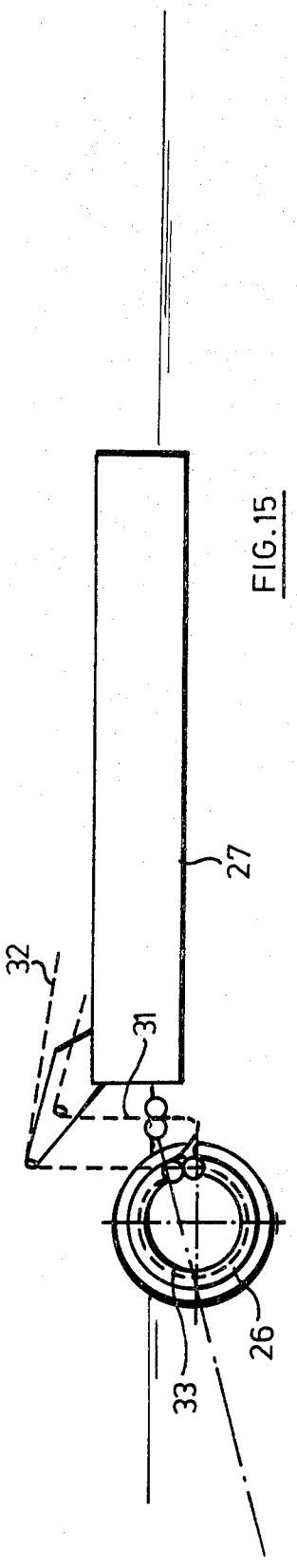


FIG. 15

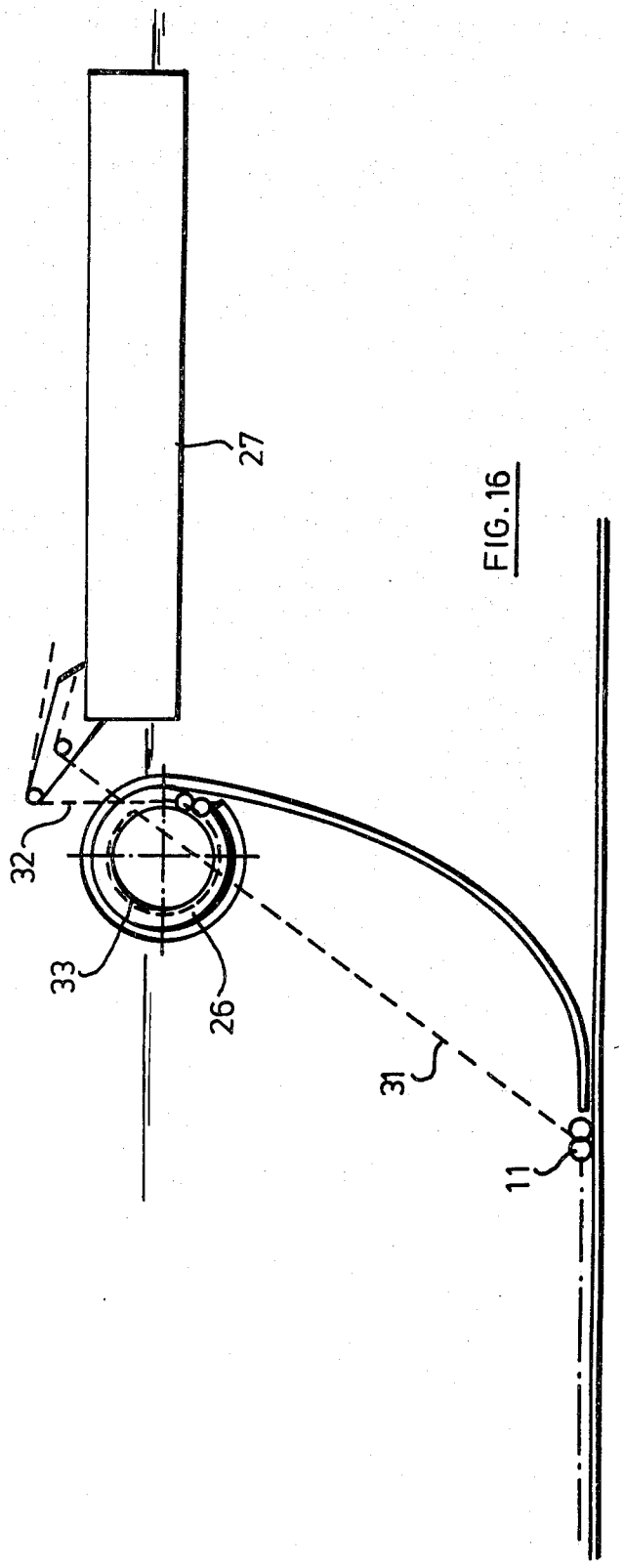


FIG. 16

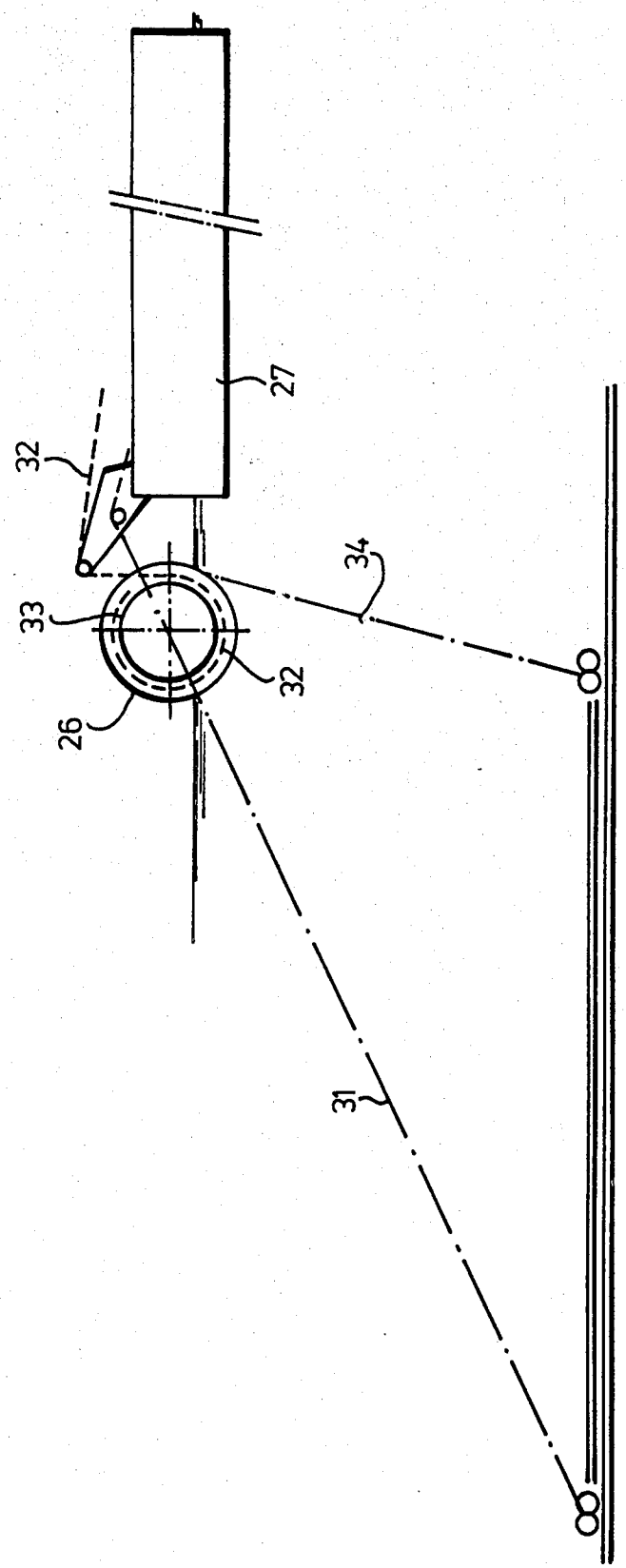


FIG. 17

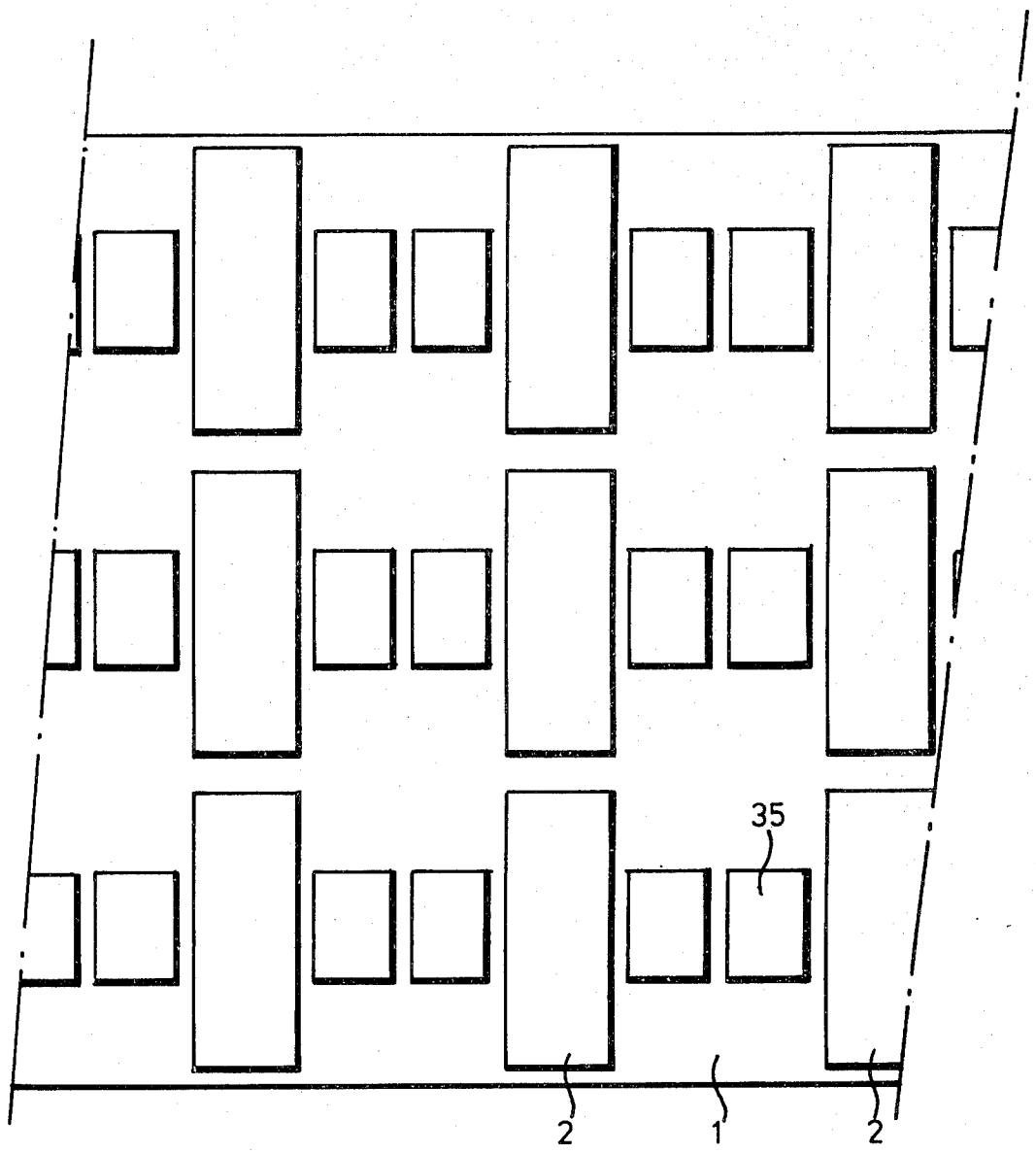


FIG. 18

MATTRESS, METHOD OF SINKING A MATTRESS AND VESSEL SUITABLE FOR USE IN SAID METHOD

The invention relates to a mattress comprising ballast.

Hitherto it has been common practice to make mattresses from such material that it can be transported whilst floating to the area where it has to be sunk, after which the mattress is lowered to the ground with the aid of ballast formed by gravel, stone or rubble. This method requires much labour and trouble, whereas fixation of the ballast material and the like with respect to the mattress is not ensured so that the ballast or the like may be cast off the mattress or may roll away from it.

The invention has for its object to provide a mattress which can be effectively manufactured and sunk, whilst a satisfactory fixation of the ballast material is ensured.

According to the invention this can be achieved by using filter cloth for the mattress, in which at regular intervals metal bars are woven, with which bars concrete blocks are coupled. The concrete blocks are rigidly secured to the filter cloth so that they cannot be loosened from said cloth by tidal currents or the like. The spaces between the concrete blocks can be filled with ballast for example, gravel, stone and/or rubble, which ballast will be satisfactorily enclosed between the concrete block so that even on comparatively sharply inclined surfaces to be protected rolling away of the ballast material is avoided.

According to a further aspect of the invention an effective method of sinking such a mattress is obtained by anchoring the mattress by one end to the ground, which end is sunk from a vessel to the ground, the mattress being deposited on the ground during the movement of the vessel in a direction away from the anchorage of the mattress. In this way the mattress can be gradually lowered to the ground and deposited thereon in a stretched state.

Sinking of the mattress can be carried out in a particular effective manner with the aid of a vessel comprising, in the direction of displacement of the mattress across the vessel, two grabs arranged one after the other, which can be coupled with the mattress and which are adapted to reciprocate with a given phase difference for controllling the movement of the mattress. It can thus be avoided that the mattress slips off the vessel too rapidly under the action of its own weight, in which case it would be incorrectly deposited on the ground.

The invention will now be described more fully with reference to a few embodiments illustrated in the accompanying Figures for a mattress and a vessel in accordance with the invention.

FIG. **1** is a schematic longitudinal sectional view of a mattress embodying the invention.

FIG. **2** is a schematic cross sectional view of a mattress embodying the invention.

FIG. **3** shows on an enlarged scale a first form of connection between the filter cloth and a concrete block.

FIG. **4** is a cross sectional view of the connection of FIG. **3.**

FIG. **5** shows schematically a second embodiment of a connection between the filter cloth and a concrete block.

FIG. **6** is a sectional view of the connection of FIG. **5.**

FIG. **7** shows schematically a third embodiment of the connection between the filter cloth and a concrete block.

FIG. **8** is a side elevation of the connection of FIG. **7.**

FIG. **9** is a plan view of the connection of FIG. **7.**

FIG. **10** shows schematically one embodiment of a vessel for depositing a mattress, the mattress being loaded thereon, when sinking of the mattress starts.

FIG. **11** shows the vessel of FIG. **10** with the mattress in a further stage of sinking.

FIG. **12** shows the vessel of FIG. **10** with the mattress after the termination of the sinking operation.

FIG. **13** shows on an enlarged scale part of the vessel with the grabs arranged thereon.

FIGS. **14** to **17** show schematically a vessel with a reel coupled herewith for transporting the mattress.

FIG. **18** shows a further embodiment of a mattress.

From FIG. **1** it will be apparent that a mattress embodying the invention comprises a filter cloth **1,** on which, viewed in the direction of length of the cloth, a plurality of rows of concrete blocks **2** are arranged one after the other. FIG. **2** shows that in the direction of width of the filter cloth a plurality of blocks of comparatively short length, for example a length of about **150** cms, having intervals of **25** cms are connected with the cloth instead of connecting a beam extending over the whole width of the cloth, so that the mattress can more satisfactorily match the unevennesses of the ground. The concrete blocks preferably have a square section having a width and a height of about **45** cms. As a matter of course, other suitable dimensions may be chosen.

The connection between a concrete block and a filter cloth may be established in various ways. In the embodiment shown in FIGS. **3** and **4** a metal bar **3,** for example, of armouring iron, is woven in the cloth anchoring members formed by T-sections **4** being welded to the bar **3.** After the manufacture of the filter cloth with the interwoven bars **3** provided with anchoring members **4,** the cloth is spread and casings are placed on the cloth for casting the concrete to form the concrete blocks **2.** It is ensured that in each concrete block at least on two parallel bars anchoring members **4** are embedded as is illustrated in FIG. **4.** In a preferred embodiment of a mattress in accordance with the invention the distance between two concrete blocks located one behind the other in the direction of length of the filter cloth is preferably about **155** cms.

A second form of connecting concrete blocks **2** with the filter cloth **1** is shown schematically in FIGS. **5** and **6.** In this embodiment only straight metal bars **5,** for example, of armouring iron, are woven in the filter cloth. Before the concrete blocks are arranged in place at least substantially V-shaped anchoring members are pierced through the filter cloth so that the interwoven bars **3** are located in the bend between the two limbs of the V-shaped anchoring members. (FIG. **6**).

In order to obtain a satisfactory connection between the anchoring members and the concrete the ends of the limbs of the anchoring members may be bent over as is shown in FIG. **6.** Also in this case it is ensured, when the bars are woven in, that two bars are comparatively near each other so that the anchoring members slipped around two bars will be embedded in a concrete block **2.**

A third method of connecting a concrete block with the filter cloth is illustrated in FIGS. **7** to **9.** In this em-

bodiment the filter cloth is provided with metal bars **7**, for example, of armouring iron, the ends of the bars being bent upwardly at right angles and being curled to form eyelets **8**. With the aid of these bars a prefabricated concrete block **2** can be coupled with the filter cloth **1**. For this purpose the distance between two bars located one behind the other viewed in the direction of length of the filter cloth is chosen to be equal to the width of a concrete block **2**. In pre-casting the concrete block **2** cavities are provided so that these cavities get in line with the eyelets **8**. It is thus possible to pass bolts through the eyelets **8** of two consecutive bars and the intermediate concrete block, nuts being subsequently screwed thereon so that a rigid connection between the bars and the concrete block is obtained. The Figures shows furthermore that on each side of a concrete block preferably two aligned bars **7** provided with eyelets **8** are woven in the filter cloth **1** so that each concrete block can be connected by four bolts **9** with the filter cloth. In the embodiment shown in FIGS. **7** to **9** a rush-mat is deposited on the filter cloth, said mat also being rigidly secured to the filter cloth after the concrete blocks are fastened. The use of such rush-mat may be useful to avoid damage of the filter cloth by the abrazing motion of concrete blocks and subsequently shed ballast along the filter cloth. The application of such rush-mat **10** is, of course, also possible in the embodiments described above.

For transporting the mattress thus manufactured it can be placed on a vessel, for example, a pontoon. In order to arrange a maximum length of mattress on the pontoon, the concrete blocks are preferably shifted against each other as is shown on the right-hand side of FIG. **10**, whilst the filter cloth located between successive concrete blocks is folded upwards and is clamped in between the successive blocks. For lowering the mattress a single or double sinking tube **11** is coupled with the front end of the mattress, which tube can be filled with water. The tube is furthermore anchored by means of an anchor **12** so that after it has been lowered by means of a crane or winch **13** on the vessel the tube will occupy a given position on the ground and will maintain such position. When the tube **11** is located on the ground, the mattress can be slid off the vessel and be deposited on the ground by gradually hauling the vessel **11a** in the direction of the arrow A, as is illustrated in FIGS. **11** and **12**. It is preferred to fasten also to the rear end of the mattress a single or double sinking tube to be filled with water **14**, which tube is lowered to the ground by means of a crane **3** when the last part of the mattress is sunk.

In order to avoid an acceleration of the movement of the mattress from the vessel under the action of its own weight, when part of the mattress has already slipped from the vessel, the latter is provided with a retaining member, an embodiment of which is shown in FIG. **13**, which shows on an enlarged scale one end of the vessel in further detail.

This Figure shows that the end of the vessel where the mattress is slipped from the vessel is provided with a roller track **16** formed by a plurality of successive rollers extending transversely of the direction of movement. The roller track **16** preferably extends along part of the horizontal deck and along a curved part in downward direction along that side of the vessel, as is illustrated in the Figure.

The mechanism for controlling the speed of movement of the filter cloth with respect to the vessel comprises two hydraulic cylinders **17** and **18**, arranged one behind the other in the direction of movement of the filter cloth and provided with piston rods **19** and **20** respectively, with the free ends of which yokes **21** and **22** respectively are coupled. To the yokes are pivoted gripping members formed by arms **23**, to which two spaced, downwardly extending tines **24** and **25** are secured, the distance between said tines corresponding to the width of a concrete block **2**. The arms **23** with the tines **24** and **25** are adapted to swing up and down with the aid of setting cylinders **26**, fastened to the yokes. When a yoke **22** occupies its extreme right-hand position, as is shown for the yoke **22**, the gripping member **23**, **25** coupled with said yoke can be turned downwards so that a concrete block gets in between the tines **24** and **25**. Then the yoke concerned can be displaced by regulating the fluid supply to the hydraulic cylinder **18** gradually further in the direction of the arrow B in order to regulate the speed with which the mattress slips off the vessel. Near the end of the stroke of the setting cylinder **18** the gripper concerned will be swung upwards with the aid of the setting cylinder **26**, after which the yoke **22** is moved back and the cycle described can be repeated. Between the movements of the setting cylinders **17** and **18** and those of the yokes **21** and **22** coupled herewith a given phase difference is made so that at the instant when the setting cylinder **18**, which may have a stroke of **4** ms, has arrived at **1** meter in front of its extreme left-hand position the setting cylinder **17** is competely withdrawn and is coupled with a block so that at the instant when the gripping member coupled with the yoke **22** is released from the concrete block **2** the setting cylinder is already coupled with a further concrete block and has performed already about **1** meter of its stroke. The yoke **22** is then rapidly moved back and the gripping member coupled herewith is again coupled with a concrete block at the instant when the setting cylinder **17** has performed about three quarters of its stroke. It will be obvious that by means of the setting cylinders **17** and **18** the speed of movement of the mattress is regulated in accordance with the speed of hauling the vessel in the direction of the arrow A.

A further possibility of transporting the mattress from the area of manufacture to the area of sinking resides in winding the mattress on a reel **26**, the floating capacity of which is sufficiently high for allowing floating transport together with a mattress wound thereon. Such a reel, which may have a diameter of **6** ms, is shown schematically in FIG. **14**. For sinking the mattress the reel is coupled with a vessel **27**, which is shown schematically in FIG. **14**. For this purpose the reel is provided at its ends with stub shafts **28** arranged opposite correspondingly shaped recesses **29** in arms **30**, secured to the rear end of the vessel, between which arms the reel is navigated.

The mattress is then shifted along the deck of the vessel toward the other end of the mattress and the sinking tube **11** secured to the front end of the mattress is again lowered in the manner described above with the aid of a crane **13**. The vessel is preferably also provided with the system shown schematically in FIG. **13** for the control of the speed of displacement of the mattress.

A further, particularly effective possibility of lowering a mattress with the aid of a reel **26** is illustrated in FIGS. **15** to **17**. In a similar manner as described above

a reel **26**, around which a mattress is wound, is coupled with a pontoon **27** with the aid of arms (not shown). In this case, however, the reel **26** is coupled with the rear side of the pontoon, viewed in the direction of displacement of the pontoon **27**, when a mattress is deposited.

Cables **31** are coupled with the ends of the sinking tube **11** connected with winches (not shown) arranged on the pontoon. Further cables **32**, also connected with winches (not shown) arranged on the pontoon, are fastened to drums **33** arranged at the ends of the reel.

When the pontoon **27** is hauled with the aid of the cables **31**, the tube **11** can be lowered to the ground as is shown in FIG. **16**, and when the pontoon is moved on the mattress is gradually released from the reel **26** and deposited on the ground. The speed of rotation of the reel **26** and hence the speed of lowering of the mattress are controlled by means of the winches to which the cables **32** are secured. During lowering of the mattress the cables **32** wind up around the drums at the ends of the reel. As a matter of course, the end of the mattress released last from the reel is still connected with the reel by means of a cable **34** wound on the reel in order to ensure gradual lowering of said end.

FIG. **18** shows a further embodiment of the mattress which is particularly suitable for being wound on a reel. This Figure shows that between the rows of closely adjacentt concrete blocks **2**, which rows as stated above are spaced apart by a distance of about **155** cms, further rows of comparatively short concrete blocks **35** are arranged. Viewed in the direction of length of a row of aligned blocks **35** a fairly large distance is left between the blocks **35**, but viewed in the direction of length of the mattress the distance between the blocks **35** and the blocks **2** is fairly small. It will be obvious that since the concrete blocks are spaced apart by a comparatively small distance from each other, viewed in the direction of length of the mattress, the mattress can be more satisfactorily wound regularly on the reel. However, since the concrete blocks **35** are comparatively small, they do not increase the weight of the mattress in an excessive manner. A further advantage of the provision of the short concrete blocks **35** between the concrete blocks **2**, which advantage also becomes manifest when the mattress is deposited in a different way, is that the material subsequently shed on the mattress is prevented from slipping off between the concrete blocks **2**, since this material is retained by the short concrete blocks **35**.

After the deposition of the mattress material can be shed thereon and this material gets in between the concrete blocks rigidly secured to the filter cloth so that it is firmly held and even on a fairly sharp slope of the ground the material will be retained on the mattress and will not readily roll off the same.

A further advantage of a mattress in accordance with the invention resides in that the filter cloth with the interwoven metal parts can be readily manufactured on a suitable place and can then be transported to the proximity of the area where the mattress has to be lowered. In general, a sufficient quantity of materials can be provided there for the manufacture of the concrete blocks so that the arrangement of the concrete blocks on the filter cloth can be carried out at fairly low costs in the neighbourhood of the area where the mattress has to be lowered, whilst transport of large quantities of materials over large distances, which was frequently required for the conventional mattresses is omitted. The concrete blocks can be fastened by unskilled labour, whereas the manufacture of the conventional mattresses requires high craftmanship.

As a matter of course various modifications and additions to the construction and method described above may be carried out. It will be obvious that also with the mattress shown in FIG. **18** a rush-mat may be arranged on the filter cloth beneath the concrete blocks. Moreover, instead of using metal bars for coupling the concrete blocks with the filter cloth bars of other material, for example synthetic resin or bars coated with synthetic resin may be employed, the synthetic resin having s higher corrosion-resistance.

In the embodiments given above it is stated that in depositing the mattress the vessel is displaced so that the mattress is lowered behind the vessel. In many cases it is, however, also possible to displace the vessel in the opposite direction, when the sinking tube is correctly anchored so that the vessel passes over the deposited mattress.

I claim:

1. A mattress comprising a filter cloth, bars of metal, plastic or the like being woven in said filter cloth at regular intervals, anchoring members being arranged so as to be linked to said bars woven in said cloth and extending from one face of said cloth, and concrete blocks cast on said filter cloth about said anchoring members.

2. A mattress as claimed in claim **1** wherein said anchoring members are welded to the bars.

3. A mattress as claimed in claim **2** wherein said anchoring members are substantially V- or U-shaped members, the apices of which extend into the filter cloth so that the bars in the cloth extend between the upright limbs of said members.

4. A mattress as claimed in claim **1** characterized in that a rush mat is arranged on the filter cloth and beneath the concrete blocks.

5. A mattress as claimed in claim **1** wherein said blocks are arranged in rows extending substantially the width of the mattress, said rows being substantially spaced apart longitudinally of said mattress.

6. A mattress as claimed in claim **1** including rows of spaced, shorter concrete blocks between said first mentioned rows.

7. A mattress comprising a filter cloth, bars of metal, plastic or the like woven in said filter cloth at regular intervals, the ends of said bars being bent so that said ends form eyelets extending from a face of said cloth, concrete blocks embraceable by pairs of said eyelets, and bolts extending through said eyelets into said blocks for coupling said concrete blocks with said filter cloth.

8. A mattress as claimed in claim **7** characterized in that eyelets are provided on each side of the blocks and a bolt is passed through each set of eyelets located on either side of the block and into the block.

9. A mattress as claimed in claim **7** characterized in that a rush mat is arranged on said filter cloth and beneath said concrete blocks.

10. A mattress as claimed in claim **7** wherein said blocks are coupled by said bars to said mattress in rows extending substantially the width of said mattress, said rows being substantially spaced apart longitudinally of said mattress.

11. A mattress as claimed in claim 10 including rows of spaced, shorter concrete blocks between said first mentioned rows.

12. A method of lowering a mattress, said mattress comprising a flexible filter cloth in which at regular intervals bars of metal, plastic or the like are woven, with which bars concrete blocks are coupled to be spaced apart longitudinally of said mattress, which comprises loading said mattress on a vessel with the concrete blocks shifted towards each other closely by folding the cloth parts situated between the concrete blocks, whereafter one end of the mattress is lowered from the vessel to the ground and anchored on the ground, the mattress being deposited on the ground while the vessel is hauled in a direction away from the anchorage of the mattress, and braking the movement of the mattress in order to ensure gradual lowering of the mattress to the ground such that the cloth is laid in a stretched position.

13. A method as claimed in claim 12 characterized in that a tube is fastened to the end to be anchored to the ground, said tube being filled with water for lowering said end with the aid of a winch or a crane.

14. A method for lowering a mattress comprising a flexible filter cloth in which at regular intervals bars of metal, plastic or the like are woven with which bars concrete blocks are coupled the mattress being wound on a reel having adequate floating capacity for holding the reel with the mattress in a floating state, the reel being coupled with a vessel, anchoring one end of the mattress to the ground, the mattress being wound off the reel for depositing on the ground while the vessel is hauled in a direction away from said end of the mattress.

15. A method as claimed in claim 14 characterized in that cables or chains fastened to winches or the like are coupled with drums provided at the ends of the reel for braking the reel.

16. A method as claimed in claim 14 characterized in that the mattress is lowered to the ground on the right-hand side of the reel.

17. A method as claimed in claim 14 characterized in that the reel is coupled with one end of the vessel, the mattress is guided across the vessel and is lowered to the ground at the other end of the vessel.

18. A method as claimed in claim 14 characterized in that at the rear end of the mattress at least one tube to be filled with water is provided, which tube is lowered to the ground with the aid of a winch or a crane.

19. A vessel intended for lowering a mattress comprising a filter cloth having bars of metal, plastic or the like woven thereinto at regular intervals and concrete blocks coupled to said bars, characterized in that the vessel comprises two consecutive gripping members including pivotable hooks adapted to grip around the concrete blocks, first drive means for reciprocating the gripping members on the line of mattress movement with a given phase difference for controlling the movement of the mattress over a deck of the vessel, and second drive means for pivoting the hooks between a gripping position wherein a hook grips a concrete block and a position free of said block.

20. A vessel as claimed in claim 19 wherein said first and second drive means are coordinated so that as one of said gripping members grips a block and begins movement with said mattress, the other said gripping member is gripping a longitudinally spaced block on said mattress and completing its movement with said mattress.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 3,922,865
DATED : December 2, 1975
INVENTOR(S) : Ate Nijdam

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Col. 4, line 59 "toward" should be --towards--

Col. 4, line 59, "mattress" should be --vessel--

Col. 5, lines 26 & 27, "adjacentt" should be --adjacent--

Col. 6, line 42 "the" should be --said--

Col. 7, line 30, "the" should be --said--

Signed and Sealed this

second Day of *March 1976*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks