United States Patent

[11] 3,595,140

[72] Inventor **Curt Fredrik Lundin**
P.O. Box 45, 182 5, Djursholm, 1, Sweden

[21] Appl. No. **786,107**
[22] Filed **Dec. 23, 1968**
[45] Patented **July 27, 1971**
[32] Priority **Dec. 29, 1967**
[33] **Sweden**
[31] **18,020/67**

[54] **SUPPORTING OR PROTECTING MAT**
12 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **94/4**
[51] **Int. Cl.** **E01c 9/00**
[50] **Field of Search** ..... 160/231; 52/669, 5, 666; 94/13, 5; 14/27; 9/11, 11.1; 111/0.5 F

[56] **References Cited**

UNITED STATES PATENTS

1,549,775	8/1925	Keyser	238/14
2,068,029	1/1937	Klaff	52/666
2,111,108	3/1938	Bolyard	160/231 X
2,422,006	6/1947	Friedman	238/14
2,791,257	5/1957	Jacobson	138/14 UX
2,892,433	6/1959	Walker	14/27 X
2,912,909	11/1959	Hart	94/4 X
2,999,431	9/1961	Mitchell	94/13
3,094,907	6/1963	Hirst	94/4
3,160,199	12/1964	Culpepper	160/231 X
3,380,088	4/1968	D'Adesky	9/11 X

Primary Examiner—Jacob L. Nackenoff
Attorney—Strauch, Nolan, Neale, Nies & Kurz

ABSTRACT: A load supporting or structural protection mat assembled from a group of heavy duty elongate tubular members placed parallel and joined by ropes extending normally through the adjacent tubular members from one end to the others enabling the mat to be rolled if desired. The lengths and the arrangement of different length tubular members can be varied for weight reduction, and the tubular members can be made from metal or plastic. Fins, nails and embedded granular material can be incorporated in and on the tubular members. End members of the mat can be made as handles or, made with special shapes will enable end to end attachment of individual mats. Such mats are contemplated as bridge beds, roadways, runways or other reinforcement surface over the ground.

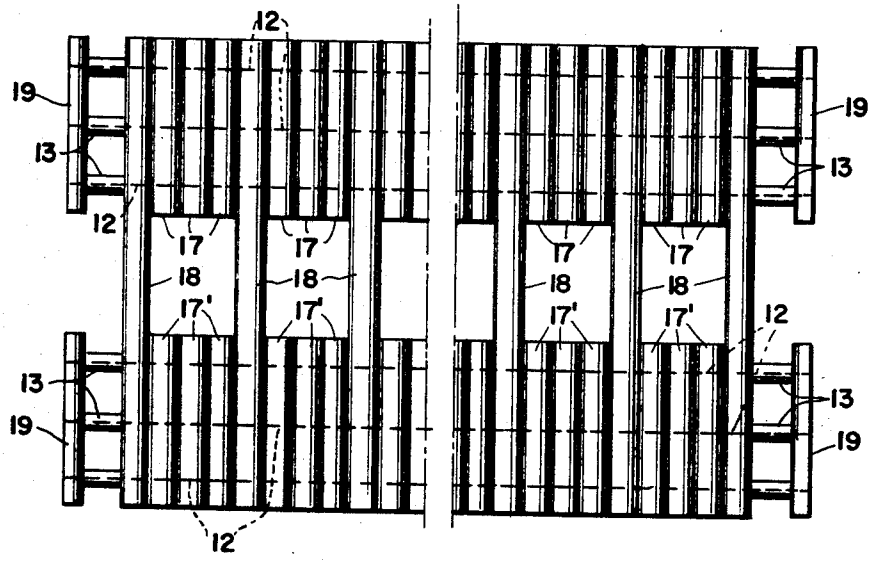


FIG. 1

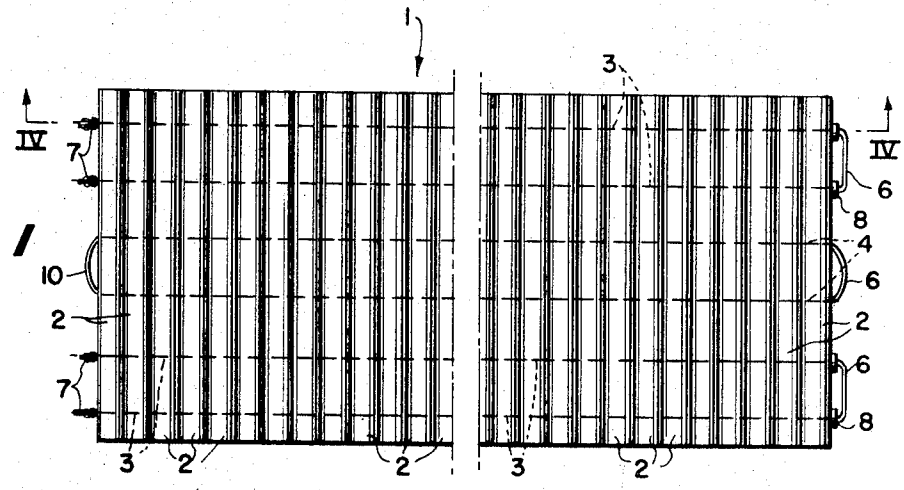


FIG. 2

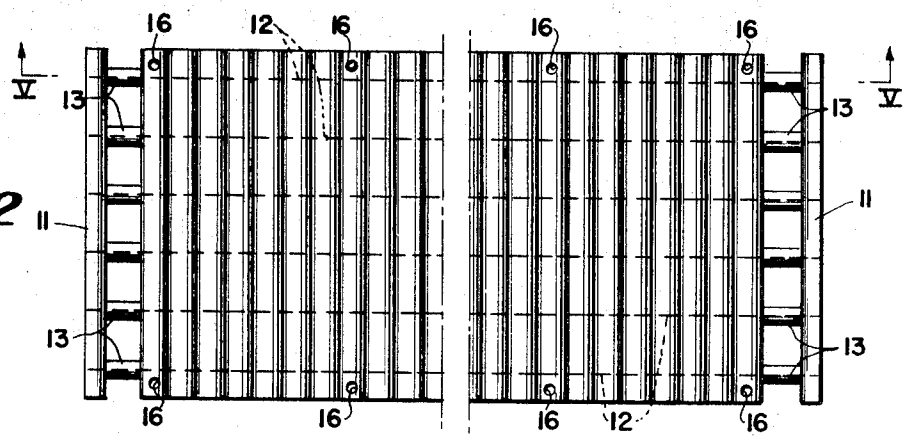
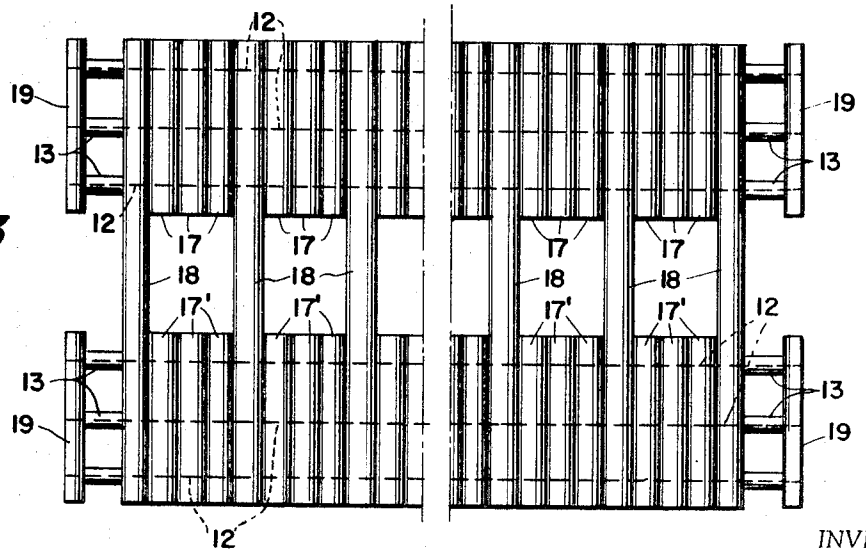


FIG. 3



INVENTOR
CURT FREDRIK LUNDIN

BY Strauch, Nolan, Neale, Nies & Kurz
ATTORNEYS

FIG. 4

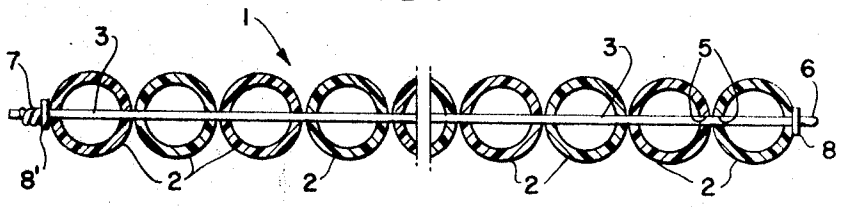


FIG. 5

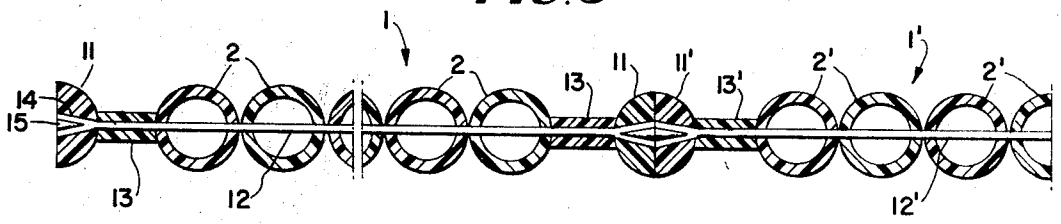
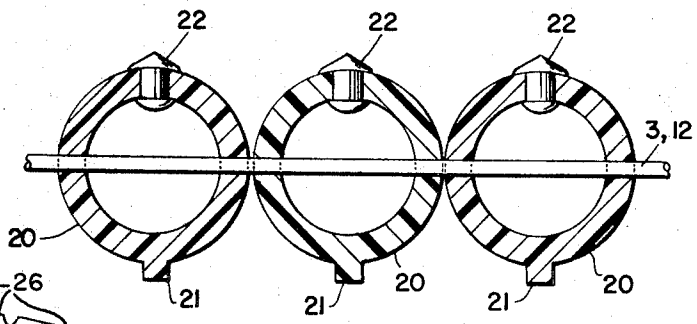


FIG. 6



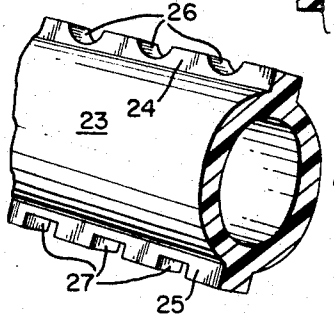


FIG. 7

INVENTOR
CURT FREDRIK LUNDIN

BY Strauch, Nolan, Neale, Nies & Kurz
ATTORNEYS

SUPPORTING OR PROTECTING MAT

The present invention relates to a supporting or protecting mat.

A mat according to the invention, intended for example as runway for caterpillar excavators, for vehicles with wheels or for artillery guns or other cars, or for use as a bridge of the crossbar bridge type or cable bridge type or for use as a landing platform, or for use as a reinforcement of the ground for other purposes, for example for stabilizing of clay, on which sand or gravel should be laid for forming a road or street surface, is characterized by a plurality of mutually parallel tubes located adjacent to each other and articulated to each other, said tubes being preferably of an elastic material, such as polyethylene or other plastic, or rubber, said tubes being kept together by a plurality of ropes extending at a right angle to the axis of the tubes, said ropes being, for example, of nylon or of stainless steel, and going through mutually registering holes in the walls of the tubes, so that the mat preferably is rollable or foldable.

A mat according to the invention is also characterized by the fact that at least some of said ropes are connected to or shaped as handles, said handles being located beyond the outermost tubes of the mat, each of said handles preferably comprising or being shaped as a rod or the like connected to the ropes, said rod being spaced from the outermost tube of the mat, and preferably being of the same length as the tubes.

According to the invention each of said rods may be arranged in such a way or may have such a cross-sectional form, that the rod may be easily connected to a similar rod of another, similar mat.

In order to prevent skidding of the mat in its longitudinal direction on the surface on which it rests, for example on a clayey marsh or undrained land, the tubes may be provided with rifles or fins, at least at their bottom surfaces, said fins extending the longitudinal direction of the tubes and preferably being made integral with each tube. Preferably, said fins may be provided with transversal recesses which can be made simultaneously with the extrusion of the tube, for example by means of a tooth wheel or the like, which is pressed against such fins before the hardening of the tube. For providing protection against skidding, the upper sides of the tubes may be provided with nails, for example steel nails. According to another alternative, sand may be embedded in the surface of the tubes for preventing skidding.

According to the invention, some of the tubes may be made of metal, for example steel or aluminum, and the rest of the tubes may be made of an elastomer, such as plastic or rubber. According to the invention, certain of the tubes may be relatively short and other tubes may be relatively long, said shorter tubes being comprised in two parallel groups which are interconnected by means of said longer tubes. By this arrangement, savings in costs and weight will be achieved.

According to the invention two or more mats of the kind indicated above may be connected together to form one single mat or mat composition of greater length.

The mat according to the invention may be used as a decking for a cable bridge, e.g. for military purposes. In that case, at least certain of the tubes of the mat may be provided with vertical holes at the ends of some tubes for insertion of removable posts for hand rails. Such rails may consist of plastic ropes so that the rails can be rolled together to form easily transportable units.

A mat according to the invention is easy to transport. It is capable of carrying heavy load and it has a low weight. A mat comprising tubes of an elastomer has proved to be surprisingly advantageous in said respect. A mat according to the present invention which is 15 m. long and 3,5 m. broad and which is made of a plastic called LD-polyethylene plastic, and the tubes of which have an outer diameter of 64 mm. and a wall thickness of 6,4 mm. and the ropes of which consist of nylon wires with a diameter of 12 mm., has proved to be able to

carry a caterpillar excavator weighing 15 tons on swamp, marsh or undrained land. In this test the tubes were slightly deformed but the form of the tubes was entirely restored when the load was removed.

A mat according to the invention, and, for example, made from polyethylene or other plastic, can also be used as a protecting cover outside a dock or an embankment, or as a cover for trees or for walls etc. in connection with building constructions.

In the following, the invention will be described more in detail, reference being made to the accompanying drawings, in which certain embodiments of the invention are illustrated.

DRAWINGS

FIG. 1 is a top view of a mat according to the invention.

FIG. 2 is a top view of a mat according to another embodiment of the invention.

FIG. 3 is a top view of a mat according to a further embodiment of the invention.

FIG. 4 illustrates on a greater scale a section along the line IV–IV in FIG. 1.

FIG. 5 illustrates partially and on a greater scale a section along the line V–V in FIG. 2.

FIG. 6 illustrates partially and on a greater scale, and similarly to FIG. 5, a section through some of the tubes in another embodiment of the invention.

FIG. 7 is a partial perspective view of an embodiment of one of the tubes of the mat, showing it provided with upper and lower, traversely recessed ribs.

In FIGS. 1 and 4 a mat 1 according to the invention is illustrated, comprising tubes 2 of polyethylene plastic, said tubes being kept together by nylon ropes 3, 4 which are penetrating holes 5 in the tubes. The ropes 3, 4 are passing the holes two times as illustrated, so that outside one of the outermost tubes a handle 6 in the shape of a loop is formed. Outside the other outermost tube 2, locking knots 7 are provided at each end of the rope 3. There are two knots at each end of the rope. The outermost knot is secured by means of burning. By means of annular spacing members 8, pushed onto the ropes as illustrated, it is always possible to grasp by the hand that part of the rope which forms the handle 6. Some of the ropes 3 may be adapted to form a handle 6 at the right end of the mat as shown in FIG. 1 while other ropes may form similar handles at the left end of the mat.

Alternatively, a handle 10 may be formed by joining together the ends of the two parts of the rope if, for example, the rope consists of a nylon rope of regular lay.

In FIGS. 2 and 5 there is a mat illustrated, said mat being provided with rods 11 which are forming handles and which are spaced from the outermost tubes of the mat by means of tubular spacing members 13 pushed onto the ropes 12. The ropes, which in this case are hollow, are kept in place in conical holes 14 in the rods 11 by means of conical or wedgelike plugs 15 which have been forced into the holes. For keeping the rope end in place during the forcing in of each plug 15, the outermost tube of the mat can be rotated for locking the line 12 during the forcing in of the plug 15. Such rotation can be facilitated by a rod (not shown) which is inserted in holes 16 provided in each of said outermost tubes.

In FIG. 5, there are two mats 1 and 1' partially illustrated, the handle forming rods 11, 11' of such mats being kept together by means of locking devices (not shown). Such locking devices may, for example, have the shape of U-shaped clamps or of split, annular members.

In FIG. 3 there is a mat illustrated, comprising two parallel groups of shorter tubes 17, 17', and longer tubes 18, which connect the groups to each other. In this embodiment there are rods 19 forming handles. Ropes 12 are pulled through all the tubes and plugs 15 are keeping the ropes 12 fixed to the rods 19 in the same manner as shown in FIG. 5.

In FIG. 6, there is illustrated a part of a mat provided with tubes 20 similar to the tubes 2, 17, 17' shown in FIGS. 1 to 5,

but provided with skid protectors on one of the normal outer surfaces, or at the bottom surface in the form of fins 21, extending in the longitudinal direction of the tubes, and with skid protectors on the other normal outer surface of the mat, or the top surfaces of the tubes in the form of nails 22. The nails 22 are forced into the tubes from the top surface through holes in the walls of said tubes 20. As used above, normal outer surface means the top and/or bottom horizontal planar surfaces of the mat, as distinguished from the vertical sides of the mat.

FIG. 7 illustrates a form of tube 23 making up the mat which includes, longitudinal ribs 24, 25 on the top and bottom, normal outer surfaces of the mat. Either or both ribs 24, 25 may be provided with a plurality of semicylindrical, transverse recesses 26 therealong, or rectangular recesses 27. These recesses further enhance the skid protective nature of the mat.

By using a mat according to the invention for the decking of a cable bridge or the like, removable posts for hand rails may be adapted in the holes 16 through the rods, said holes 16 being illustrated in FIG. 2. The holes 16 may be provided with reinforcements such as sleeves or bushings, for example of metal.

The ends of the rods 2, 17, 17' and 20 may be open or closed just to suit the purpose for which the mat is intended. Between the rods of the mat, space members may be provided, for example annular members or washers pushed onto the ropes.

The tubes of the mat are preferably of circular cross section. However, for certain purposes other cross sections may be suitable.

What I claim is:

1. A heavy duty structural mat comprising: a plurality of heavy duty elongate tubular members placed in a side-by-side parallel disposition; said tubular members being apertured at a plurality of spaced locations along their lengths in a direction normal to their elongate dimensions to provide a plurality of spaced apart series of aligned apertures extending from one end of said mat to the other end; and a plurality of rope means, each of which passes through a series of aligned apertures in said tubular members, said rope means having means cooperating with the ends of said mat for securing said tubular members as an assembled mat, said means for securing said tubular members as an assembled mat including graspable handle means at at least one end of the mat, comprising a rigid elongated handle member, spaced from the end tubular member of the mat, and spacing elements at spaced intervals between the rigid elongated handle member and said mat end tubular member, said rope means extending through the spacers and the rigid elongated handle member whereby said rigid elongated handle member may be used as a graspable handle and to tie adjacent similar heavy duty structural mats together.

2. A heavy duty structural mat according to claim 1, wherein the tubes consist of elastic material, such as plastic or rubber.

3. A heavy duty structural mat according to claim 1, wherein the tubes consist of polyethylene plastic.

4. A heavy duty structural mat as defined in claim 1, wherein said elongated handle member extends the width of said mat.

5. A heavy duty structural mat as defined in claim 1, wherein said rigid elongated handle members has a semicylindrical configuration in cross section enabling a matching surface to surface, parallel fit against a similar rigid elongated handle member of an adjacent heavy duty mat so that adjacent mats will fit and may be secured together via their adjacent graspable handle means.

6. A heavy duty structural mat as defined in claim 1, wherein at least some of said tubular members are provided with means projecting from the normal outer surface of said tubular members.

7. A heavy duty structural mat as defined in claim 6, wherein said means projecting from said tubular members are longitudinal ribs.

8. A heavy duty structural mat as defined in claim 7, wherein said ribs have transverse recesses.

9. A heavy duty structural mat as defined in claim 7, wherein said longitudinal ribs are disposed on both the upper and lower surfaces of said mat.

10. A heavy duty structural mat as defined in claim 6, wherein steel nails are embedded into the walls of said tubular members and portions of said steel nails constitute said means projecting from said tubular members.

11. A heavy duty structural mat as defined in claim 1, wherein a portion of said tubular members are shorter than half the width of said mat and others of said tubular members have a length equal to the width of said mat and said shorter tubular members are disposed in parallel, spaced-apart groups periodically intersperced with at least one of said longer members, and said longer members and said rope means maintain said shorter members in parallel, spaced-apart disposition.

12. A heavy duty structural mat as defined in claim 1, wherein at least a portion of said tubular members, at spaced locations along the length of said mat, have transverse holes disposed normal to the direction of said apertures for receiving removable posts for handrails, as desired when said mat is used as bridge decking.