Nov. 15, 1960 A. K. STRONG 2,960,244

TRANSPORTATION UNIT AND LIFTING SLING THEREFOR

Filed Dec. 6, 1956

8 Sheets-Sheet 1

FIG. 1

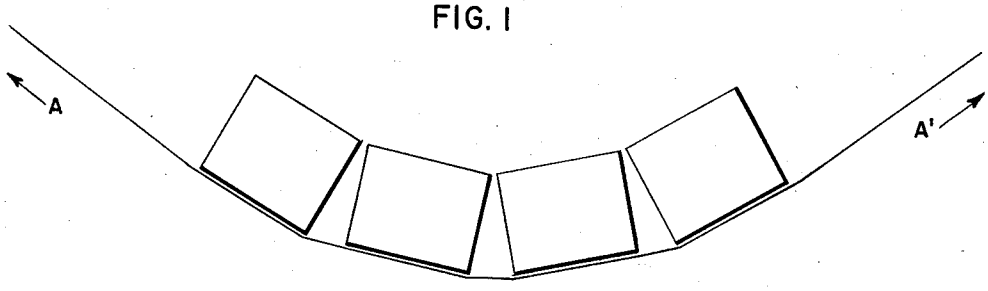
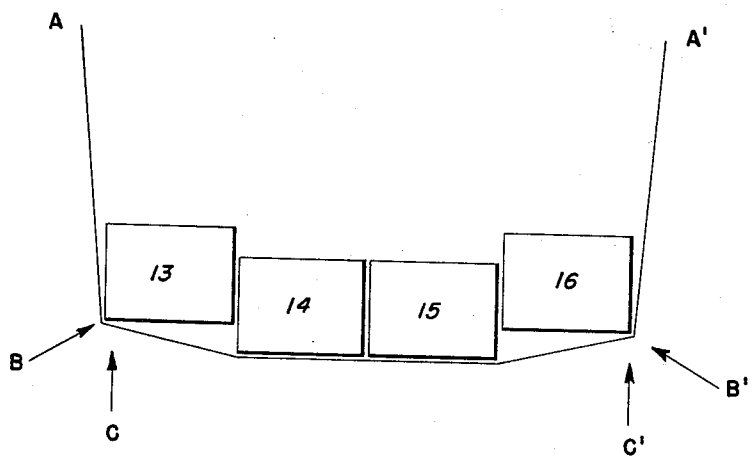


FIG. 2



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TRANSPORTATION UNIT AND LIFTING SLING THEREFOR

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FIG. 3

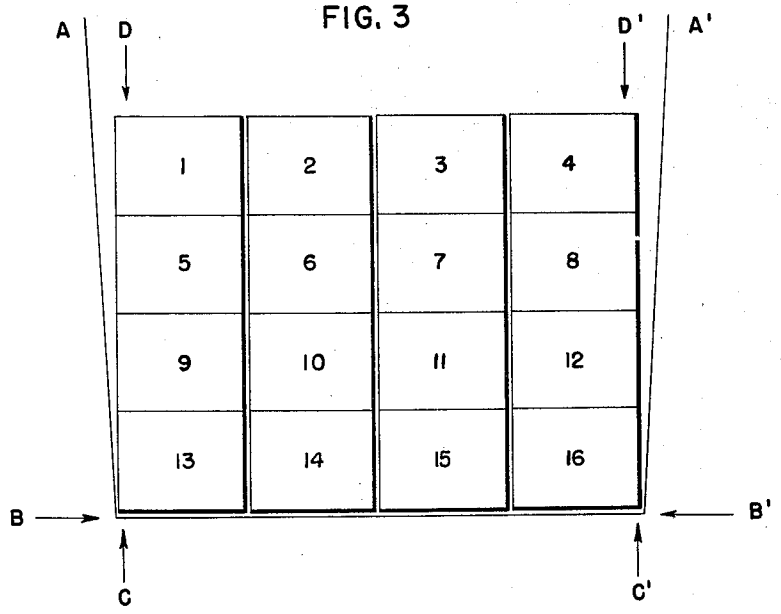
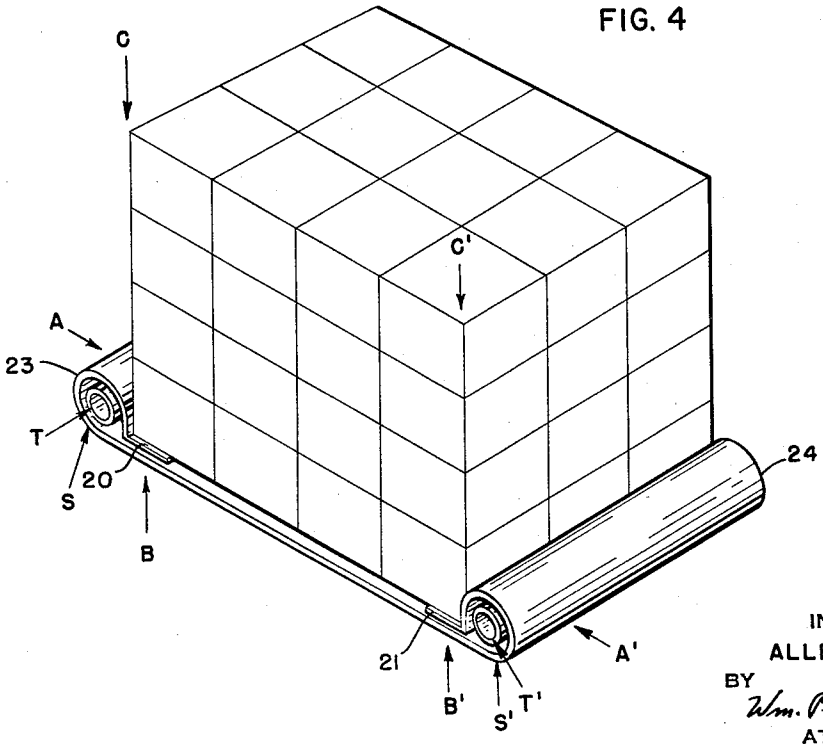


FIG. 4



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TRANSPORTATION UNIT AND LIFTING SLING THEREFOR

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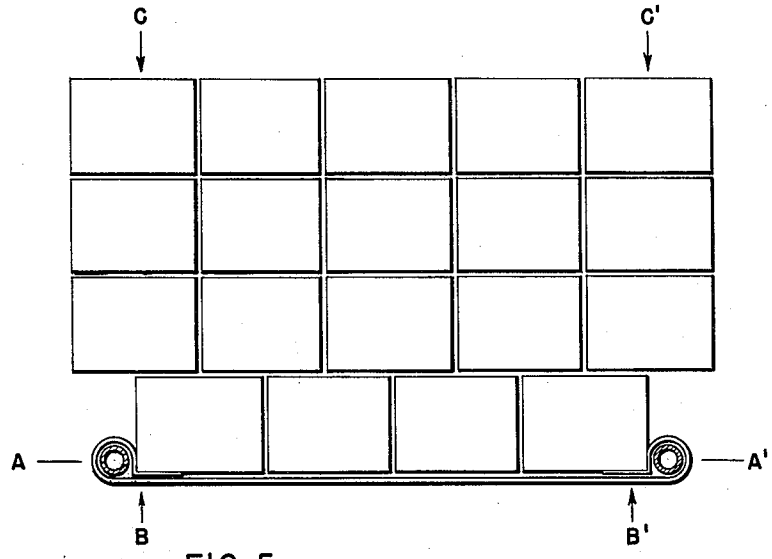
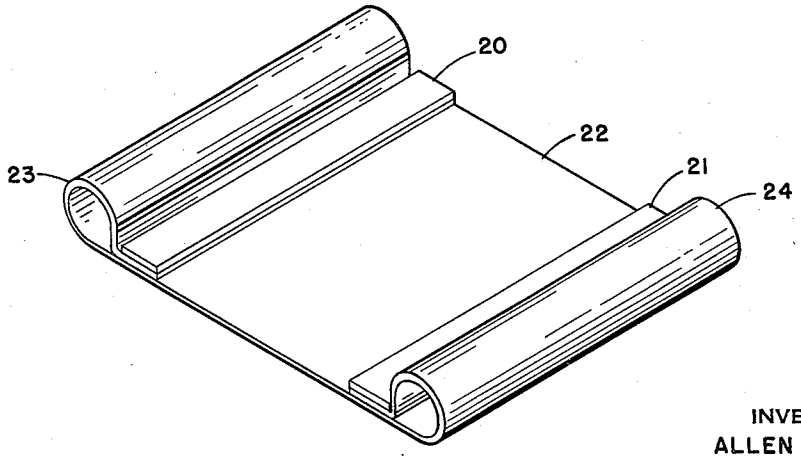


FIG. 5

FIG. 6



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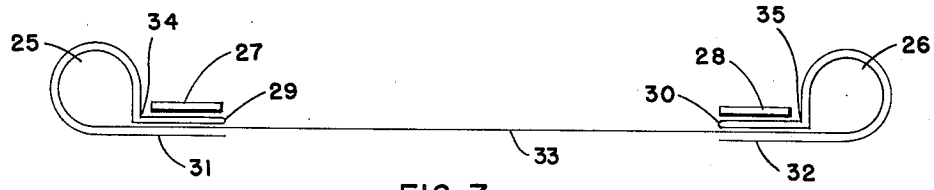

FIG. 7

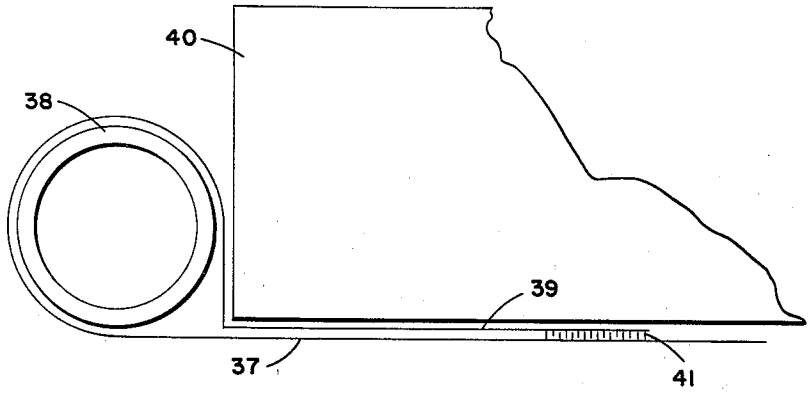

FIG. 8

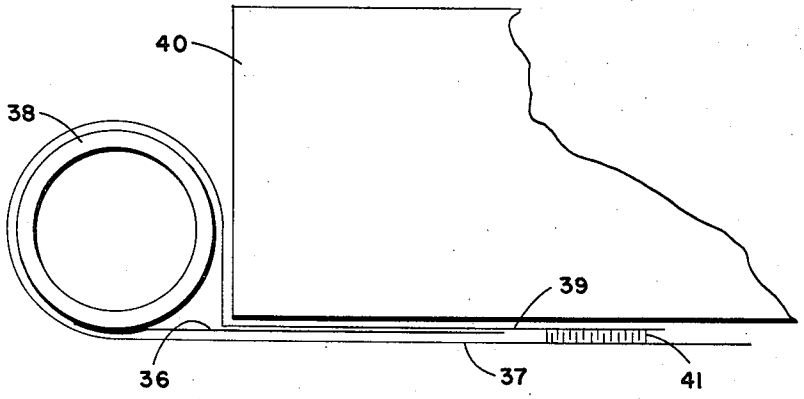

FIG. 9

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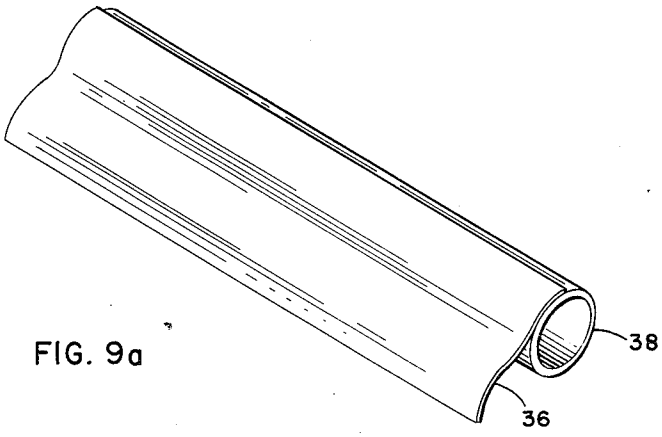

FIG. 9a

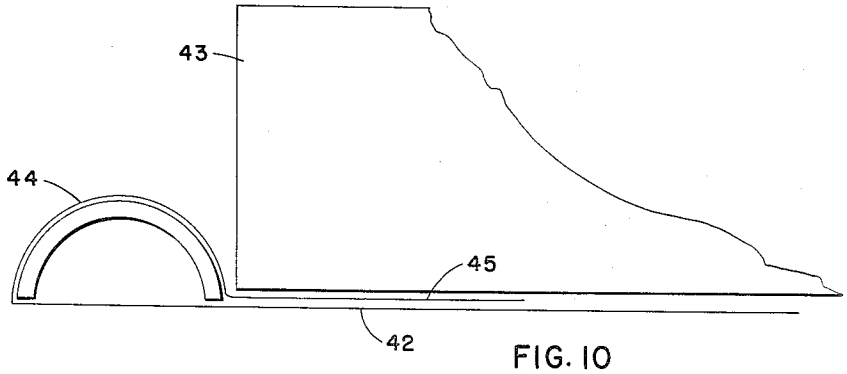

FIG. 10

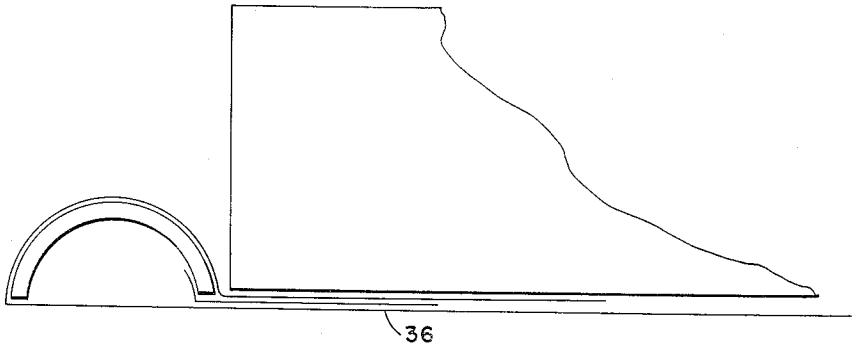

FIG. 11

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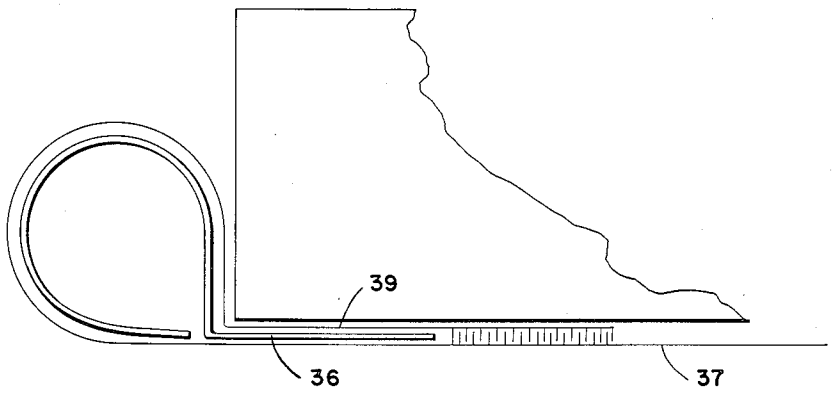

FIG. 12

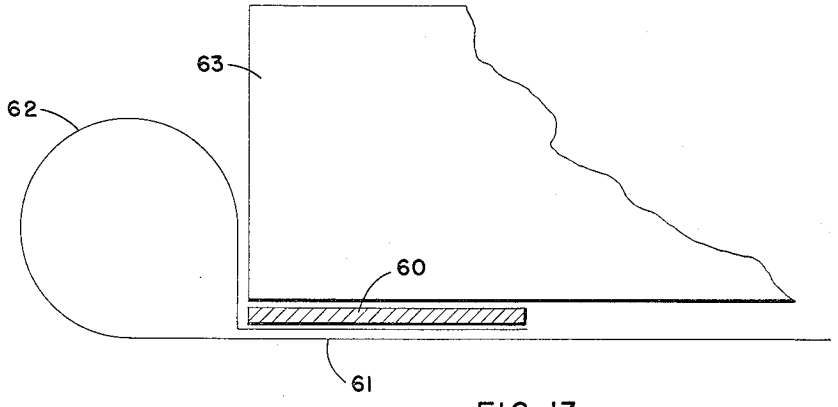

FIG. 13

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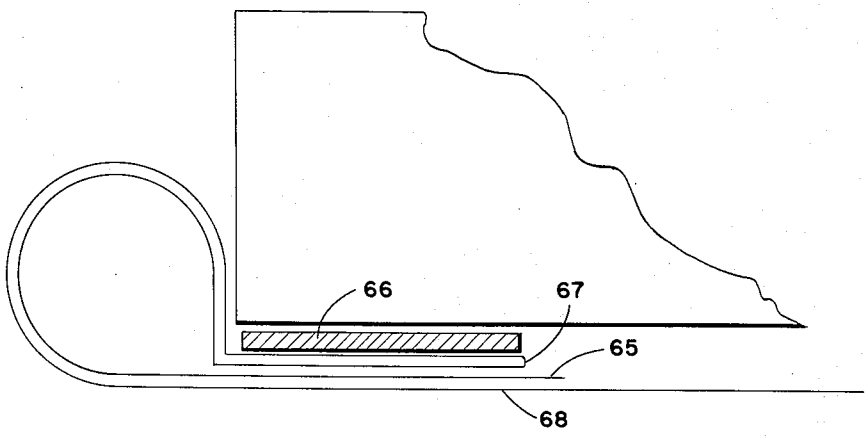

FIG. 14

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FIG. 15

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United States Patent Office 2,960,244
Patented Nov. 15, 1960

2,960,244

TRANSPORTATION UNIT AND LIFTING SLING THEREFOR

Allen K. Strong, Larchmont, N.Y., assignor to American Cyanamid Company, New York, N.Y., a corporation of Maine

Filed Dec. 6, 1956, Ser. No. 626,646

4 Claims. (Cl. 214—10.5)

This invention relates to an improved system and method for lifting, transporting and shipping or storing rectangular solids of the type of cartons, cases and similar solid packages. In its broadest aspects the invention is based on the concept of applying to the base of a pile of such rectangular solids arranged in courses a force having both a lifting component and a transverse or lateral compressive component sufficient to hold the solids together; when this is done the bottom course becomes in effect a beam or integral unit on which the upper courses can rest and be transported by means of a very simple and inexpensive lifting sling of the type hereinafter described.

The principles of my invention and the preferred forms of slings for applying these principles to the transportation of rectangular solids will be more fully described with reference to the accompanying drawings, wherein:

Figures 1, 2 and 3 are diagrammatic illustrations of the underlying principles involved in practicing the invention.

Figure 4 shows a transportation unit composed of a pile of rectangular solids arranged in courses and supported on a flexible lifting sling in accordance with the invention and illustrates the forces involved.

Figure 5 shows the piling of several upper courses of rectangular solids in overhanging relation to a bottom course functioning as a beam or integral supporting unit when a sling embodying the invention is fitted thereto.

Figures 6 and 7 illustrate the idea of utilizing stiffening reinforcing strips in conjunction with a flexible web to simplify the sling construction.

Figure 8 illustrates the use of a cylindrical tube as one form of distending means in the hollow outer portions of the sling adapted to receive the forks of a lift truck.

Figure 9 shows the use of a positioning or anchoring flap attached to the distending means of Figure 8 to assist in holding the distending means in place and in supporting the load.

Figure 9*a* is a detail perspective of the distending means and flap of Figure 9.

Figure 10 shows an embodiment of the sling formed from a single sheet of paper having its ends folded back under the load without gluing, and also shows a modified form of distending means and Figure 11 shows the same arrangement with a positioning flap attached to the distending arch.

Figure 12 shows the use of a semi-stiff bent or preformed sheet as a combined positioning flap and distending means. Figures 13 and 14 show the use of non-rigid loops or sleeves used in conjunction with the stiff reinforcing strips of Figures 6 and 7, and

Figure 15 is a photolithograph showing the invention in operation and a typical load that can be lifted and transported by applying the principles thereof.

Figures 1 and 2 illustrate the underlying principles of the invention. Referring to Figure 1 it will be seen that if a row of cubes, cartons or boxes is placed on a strip

of flexible material and the entire assembly is lifted and supported as by forces A—A′ the mass will assume approximately the cradle shape indicated and will be a dead weight on the strip, which must therefore be sufficiently thick and strong to support this weight. If, however, the lifting forces A—A′ are directed upwardly at only a small angle to the vertical sides of the outer cubes 13 and 16, lateral or compressive forces B—B′ are applied which squeeze the cubes together and create the arrangement shown in Figure 2. Central cubes 14 and 15 remain intact on the flexible supporting strip but the outer cubes 13 and 16 tend to shift upwardly under the operation of vertical forces C—C′ during the initial movement of the lift, and the cubes therefore assume the arrangement shown in Figure 2.

Figure 3 shows that by inceasing the amount of load or pressure on the outer units of an assembly of cubes supported on a sheet of flexible material as in Figure 2 the downward forces D—D′ created by the added weight of cubes 1, 5 and 9 and cubes 4, 8 and 12 will increase forces B—B′ (the lateral or compressive components) sufficiently to cause cubes 13—16 to remain in substantially the same plane, thereby forming a rigid beam on which the entire load can be carried. The discovery and application of this principle constitutes one of the important features of my invention.

Figure 4 shows a practical application of the principle illustrated diagrammatically in Figure 3. By supporting the outer ends of a flexible load carrying sheet or sling at the outer sides of the first or bottom course of cubes and using tubes T—T′ inserted in loops or sleeves S—S′ formed at each end of the load carrying sheet, the upward force exerted within or on the tubes T—T′ by the forks of a lift truck causes the sling to pull taut and exert the upward and inward pressures B—B′ and A—A′ on the lower course of cubes. The cubes are thereby held in alignment as a beam and at the same time the entire mass is lifted without substantial distortion or disarrangement.

When it is desired to reduce loss of space at either side of a load of rectangular solids stacked as in Figure 4, caused by the area occupied by the sleeves and tubes S—S′ and T—T′ the arrangement shown in Figure 5 can be used. In this arrangement the courses of rectangular solids above the bottom course are arranged in overhanging relation. This arrangement is particularly useful in stacking unit loads in a box car, truck or warehouse, since the units can be piled or stacked with the outer sides of the upper courses in abutting relationship while the sleeves and tubes remain in place for convenience in unloading or unstacking by means of another lift truck.

From the foregoing description it will be seen that the principles of the invention require a fitting or adjustment of a flexible lifting sling to a pile of rectangular solids arranged in courses in such a manner that a flexible central or web portion of the sling passes under and around the outer corners of the bottom course and is attached to a pair of hollow members located at the sides of this bottom course so that both compressive and lifting forces are exerted on the outer solids of the bottom course. The length of the flexible web portion of the sling must therefore bear a definite relationship to the width of the bottom course. Figures 6–11 of the drawings illustrate particular forms which the sling may take in order to ensure this relationship. Referring to Figure 6, which illustrates one of the cheapest yet most effective forms of the sling, a pair of stiff or semi-stiff reinforcing strips 20 and 21 are attached at opposite ends of a web 22 of paper or other flexible material. The length of this paper web is such that it will pass under and around the outer

solids or units of the pile and form loops 23 and 24 at the outer sides of the bottom course thereof as shown in Figure 4, when the reinforcing strips 20 and 21 are located under the outer corners of the pile. Liners or distending means, such as those shown in Figures 8 and 10, may or may not be inserted into the loops 23 and 24 depending on the weight of the load to be carried, the stiffness of the web, and other factors. The ends of the web carrying the strips 20 and 21 need not ordinarily be glued or otherwise attached to the central web portion 22, since in most cases the weight on the outer rows of solids in the bottom course will hold them in place. It will be seen that with this arrangement the sling can easily be adjusted to the size of the bottom course simply by cutting a sheet of paper to the desired length and attaching the strips 20 and 21 to the ends thereof. Since the strips are not attached to the web 22 the paper may be folded or rolled around these strips one or more times if it is desired to reduce the effective length of the web.

A ready adjustment of the width of the sling to that of the bottom course can also be obtained by the arrangement shown in Figure 7, wherein a longer sheet of paper or other flexible material is used and the ends are folded back around the outer loops 25 and 26. The reinforcing strips 27 and 28 are attached adjacent to the folds 29 and 30. The outer ends 31 and 32 may be bonded to the adjacent portions of the web 33 by gluing, stapling or otherwise to provide additional strength. It will be understood that the greatest strain on the sling occurs at the inner portions 34 and 35 of the loops 25 and 26 when the load on the strips 27 and 28 is lifted; therefore doubling back and bonding each end of the web on itself provides a stronger construction at the areas of greatest strain and permits the use of lighter materials.

In the construction of Figure 8, the flexible web 37 of the sling is looped around cylindrical tubes or distending means 38 and its ends 39 are brought back and held under the outer corners of the load 40 and attached to the web by a bond 41 as by gluing or stapling. Figure 10 shows a similar arrangement in which the bond 41 is omitted and in which a different form of distending means is used. It will be understood that distending or load-carrying means of other cross-sectional shapes may be employed; the particular shape will usually depend on the type of lift truck forks that are used. With the shafts shown in Figures 15–17 of the drawings the cylindrical liners are preferred whereas triangular, rectangular, or other shapes may be used with lift truck forks of other types.

If the lift truck forks are not brought into exact alignment with the tubes 38 or other distending means there is sometimes a tendency for the forks to push these tubes out of their sleeves. In order to overcome this difficulty, the arrangement shown on Figures 9, 9*a* and 11 of the drawings may be used. These figures illustrate the idea of attaching positioning or anchoring flaps 36 to the tubes 38 to prevent lateral displacement thereof when the lift truck forks are inserted or withdrawn. As is shown in Figure 9a, the flaps may consist of strips of paper or other flexible material glued or otherwise attached to the tubes 38, or the flaps may be integral therewith as shown in Figure 9*a*, the flaps may consist of strips of paper or other tioning flaps extend inwardly between the outer portions of the web 37 and its ends 39 and the pressure of the load 40 holds the tubes in place.

Figure 10 also illustrates another effective arrangement for adjusting the width of the sling to that of the bottom course. In the embodiment shown the flexible web 42 is passed under the bottom course of the pile of packages 43 and is looped into sleeves 44 at the sides thereof and its ends 45 are then brought back between the web 42 and the bottom of the pile where they are held in place by the weight of the load. If desired, one of the ends 45 may be attached to the web 42 by gluing or stapling, in which case it may be either on the inside or the outside of the web, and the other end may be brought across between the web and the load as far as may be necessary to adjust the sling to the desired width, or both ends may be left free and brought across in overlapping relationship between the web and the load.

From the foregoing description of illustrative embodiments thereof it will be seen that the flexible lifting slings of the invention comprise essentially a flexible web portion adapted to pass under and around the outer corners of the load and loops or other hollow members attached to or integral with the ends of the web and adapted to fit against the outer sides of the bottom course of the load. With this arrangement, and when a pile of rectangular solids arranged in courses is lifted by means of the loops, the units forming the bottom course are compressed into a supporting beam and the major proportion of the weight of the pile is carried by the outer rows of solids therein. The central portion of the web therefore carries only a small proportion of the load, and for light loads it can be made of light and cheap material such as ordinary kraft paper having a basis weight of about 50–75 lbs., and a width corresponding to the length of the pile of rectangular solids in the unit. I have found, however, that much more rugged and durable slings are obtained when reinforced paper is used, and the preferred material is a multi-ply paper in which reinforcing threads or strips of jute, string, glass fiber or other material of high tensile strength are laid between the layers. In Figure 15 of the drawings the flexible portion of the sling is composed of a glass-reinforced paper known as "Scrimtex," which is described in the September 1954 issue of "Modern Packaging." This is a paper having a basis weight of about 120 lbs. carrying a mesh of non-woven glass fiber, or scrim, that is impregnated into the paper by introduction onto a paper machine prior to the formation of the sheet; its tensile strength is about 60–70 pounds per linear inch of cross section. As compared with other web-forming materials it has the advantage of high tensile strength and tearing resistance, relatively low weight and cost and sufficient flexibility to conform to the loads to be carried but enough stiffness to form loops that will remain open to receive the forks of a lift truck without the necessity of inserting distending means. A lifting sling made by attaching reinforcing strips 60 to the ends of a sheet of "Scrimtex" 61 is shown on Figure 13 of the drawings; the loops 62 are sufficiently stiff and strong to receive the forks of a lift truck without a liner or distending means and yet they can be folded against the side wall 63 of the bottom course of packages to permit stowing adjacent unit loads closer together than when rigid distending means are used. Figure 14 shows how the folded construction of Figure 7 may be adapted to this material, the ends 65 of a "Scrimtex" sheet being folded back under the load and the reinforcing or load-supporting strips 66 being attached thereto inwardly from these ends and adjacent the fold 67. In this construction the ends 65 are preferably glued or stapled to the central portion 68 of the web as this results in a desirable stiffening of the loops 25 and 26.

Figure 15 is an illustration of the remarkable results that have been obtained by applying the principles of the invention to typical unit loads. In Figure 15 the arrangement illustrated diagrammatically by Figure 5 is applied to a pile of rectangular cartons of a condensed milk, the upper courses being arranged in overhanging relation to the bottom course to conserve space in stacking. The photograph shows clearly how the cartons of the bottom course are compressed together to form, in effect, a continuous lateral beam or platform on which the remaining courses are carried.

In another illustrative embodiment of the invention a load of concrete tile weighing approximately one ton is lifted and held together by lifting slings of the type shown in Figure 6, wherein reinforcing strips are attached to the ends of a single sheet of glass fiber-reinforced paper of the type described above as "Scrimtex." It is evident that

loads of this size and weight could not be carried without shifting by a light-weight and inexpensive paper lifting sling if the entire mass were a dead weight on its web; it is only by virtue of the lateral compressive forces, which convert the bottom courses of the load into a truss or platform, that the mass can be transported as a unit.

Although the invention has been described and illustrated by reference to particular embodiments thereof it will be understood that in its broadest aspects the invention is not limited to such embodiments, and that variations and substitutions of equivalents may be resorted to within the scope of the appended claims.

What I claim is:

1. A transportation unit comprising in combination a pile of rectangular solids arranged as a bottom course composed of lateral rows of said solids in abutting relationship and upper courses resting on said bottom course and means for applying to the outer solids of said bottom course both a lifting force sufficient to lift a major proportion of the weight of said pile and laterally compressive forces sufficient to hold the solids composing it in substantially the same plane, said means comprising a flexible web passing under and around the outer corners of said bottom course and looped at the sides thereof into sleeves of a size to receive the forks of a lift truck and having end portions with stiffer reinforcing strips attached thereto located under the outer corners of the bottom coarse between said course and said flexible web, said strips being otherwise unattached so that the web may be rolled therearound to reduce its effective length.

2. A lifting sling for moving a pile of rectangular solids arranged in courses and having the solids of the bottom course in abutting relationship comprising a flexible web having a stiffer reinforcing strip attached adjacent to each of two opposite ends thereof but not otherwise attached to said web, said sling having a length such that the flexible web portion thereof will pass under and around the outer corners of the outer solids of said bottom coarse and form loops fitting against the outer sides thereof and of a size sufficient to receive the forks of a lift truck when said reinforcing strips are located under said outer corners of the bottom course of the pile between the bottom surfaces thereof and said web.

3. A lifting sling according to claim 2 in which the flexible web is composed of glass fiber-reinforced paper.

4. A lifting sling for moving a pile of rectangular solids arranged in courses and having the solids of the bottom course in abutting relationship comprising a flexible sheet of paper having its ends folded back and attached to its main body portion and having a pair of relatively stiff parallel reinforcing strips attached only adjacent to the outer folded edges thereof, the length of said sheet and said folded ends being such that when said reinforcing strips are located under the outer corners of said bottom course the folded ends will form double thickness loops at the sides of said bottom course of a size sufficient to receive the forks of a lift truck and the central portion of the sheet will fit closely under the bottom of the pile.

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UNITED STATES PATENT OFFICE

CERTIFICATION OF CORRECTION

Patent No. 2,960,244 November 15, 1960

Allen K. Strong

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 3, line 61, strike out "Figure 9a, the flaps may consist of strips of paper or other" and insert instead -- Figure 12. When the lifting sling is assembled the posi- --.

Signed and sealed this 23rd day of May 1961.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents