

[54] WALL STRUCTURES

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[56]

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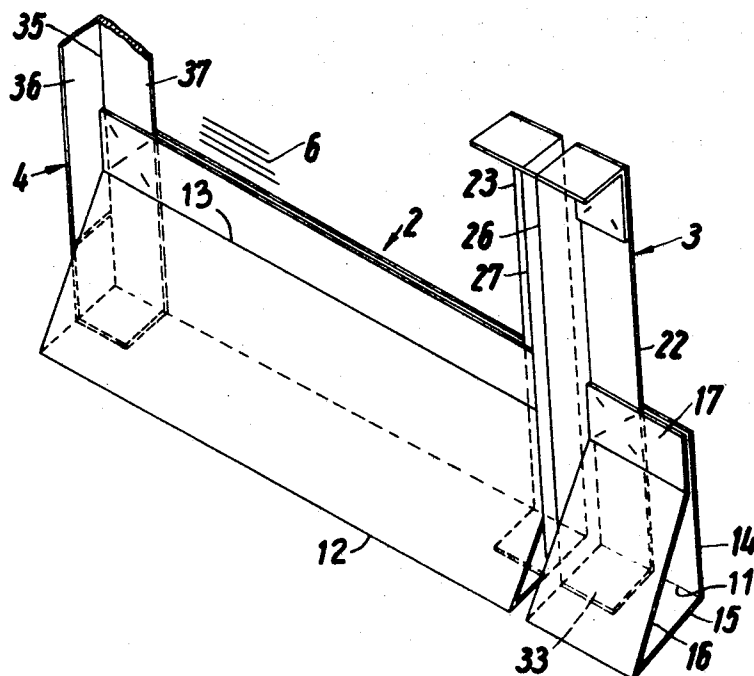
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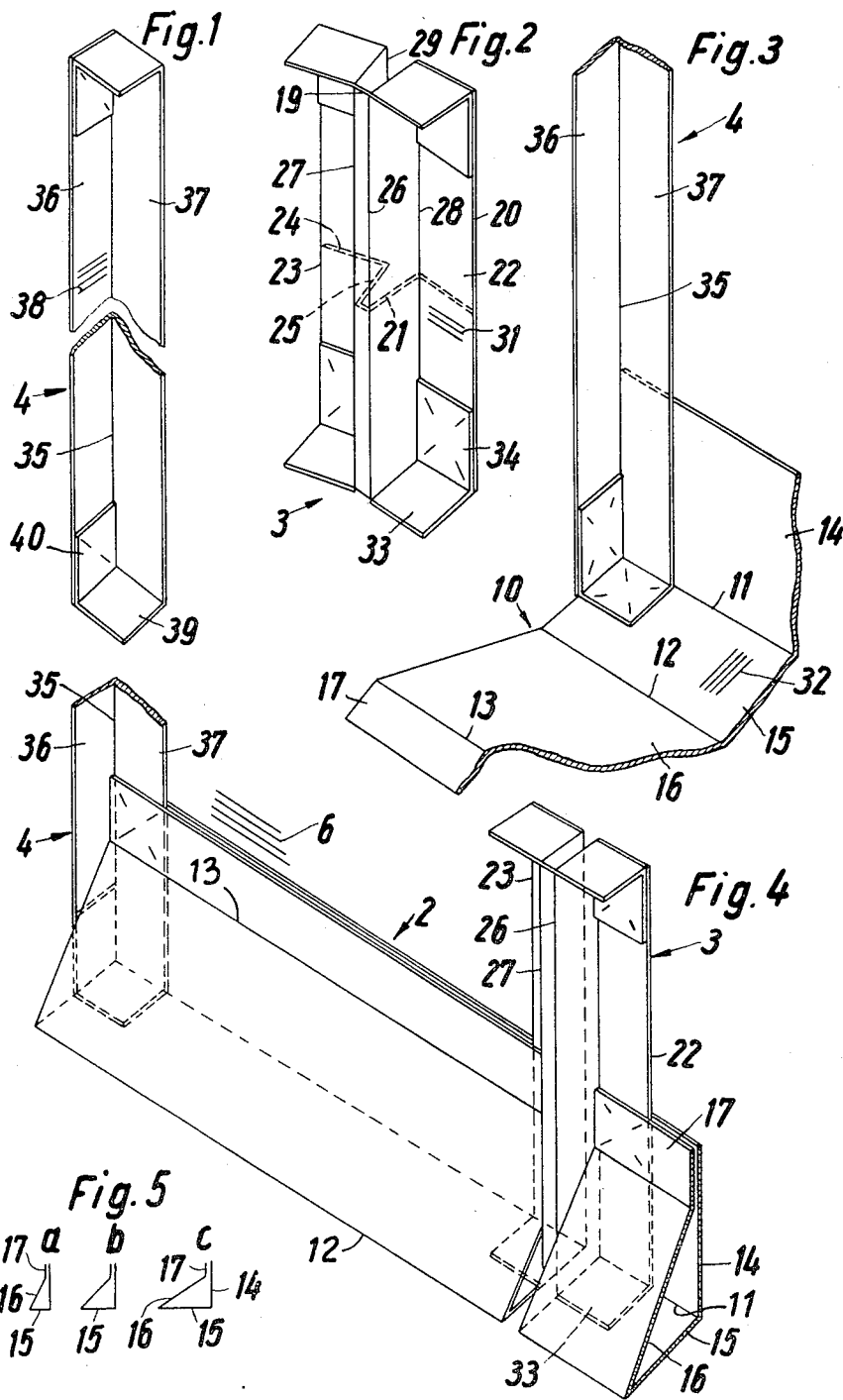
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ABSTRACT

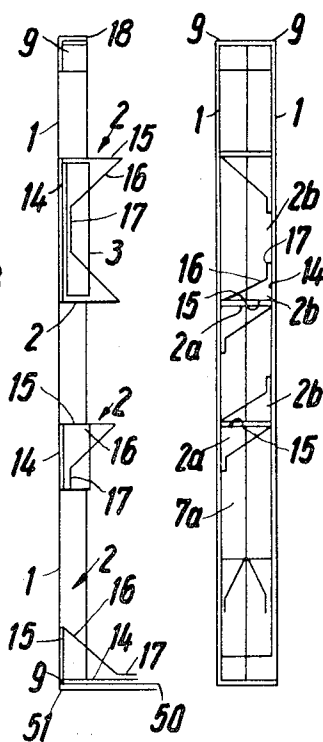
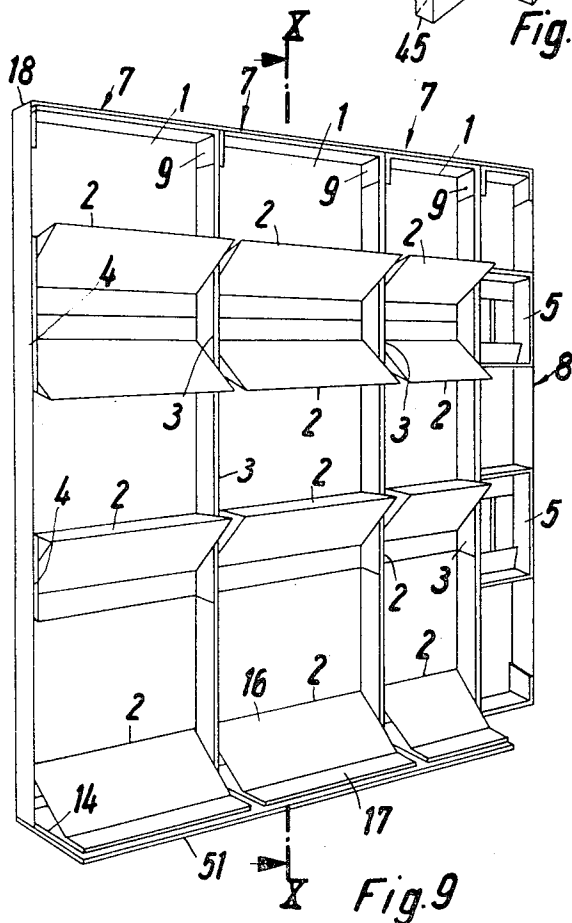
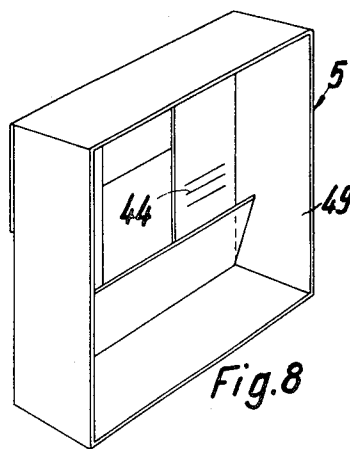
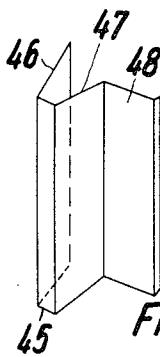
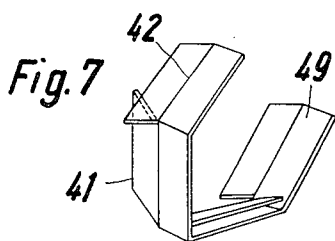
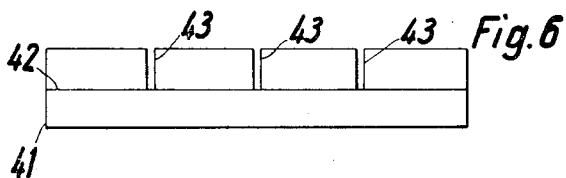
A component for the production of ornamental units, such as walls, having at least one flat blank of collapsible material of which one side is provided with stiffening or reinforcing elements consisting of a similar material, while the other side is not reinforced.

13 Claims, 12 Drawing Figures





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WALL STRUCTURES

The invention relates to wall structures, built up from components. Such structures are used for example for scenery for theatrical productions, filmsets or for advertising. Known structures use wooden frames which serve as supports for slabs of material, particularly wood, and/or stretched sheets of flexible material particularly fabrics such as canvas. The production of such scenery partitions is expensive, and their adaptation to particular conditions arising is also difficult and costly. In addition, structures and their component parts are heavy, rendering them difficult to handle. The expense involved in such walls is increased by the fact that at least those individual parts thereof which are made of wood or similar material have to be used several times, owing to their cost, and thus have to be stored.

The object of this invention is to provide a wall structure which can be produced cheaply and which can be assembled and dismantled easily and also adapted simply to prevailing conditions.

According to the invention a basic element is provided consisting of at least one flat-shaped blank of a collapsible material such as corrugated cardboard, of which one side (the reverse side) is provided with stiffening elements also of a collapsible material, while the front having no reinforcement. The nature of the collapsible material selected depends on the particular requirements. This can be made of corrugated cardboard, as mentioned or cardboard or similar material capable of being folded.

With the arrangement of the invention the prefabricated constructional elements can be joined together simply at the location where the structure is to be erected. The cost of producing ornamental walls of this kind, consisting of corrugated cardboard, is so low that they can be discarded after they have been used once only.

In a preferred embodiment, the basic element consists of a corrugated cardboard blank, with for example, a rectangular basic surface with the corrugations at a right angle to the maximum distance of the basic element, particularly to the height of its wall, folding flaps being attached to its sides, those adjacent at the corners being interconnected. The maximum distance is covered in the direction of the strip of corrugated cardboard in the form in which it leaves the machine in which it is produced. In practice, therefore, there is no limit to the maximum length. It is possible to produce walls of 3-4 meters high without setting any limits to the distance which can be covered by the basic element. The width is preferably made to standards in order to obtain uniform reinforcement profiles.

Although it is intended that the structural components be used mainly for the assembly or ornamental walls such as for scenery, they can also be employed for the construction of ceilings. By the use of reinforcement elements on the rear side, they can be made sufficiently rigid to enable them to be used for the construction of platforms.

The reinforcement element preferably consists of corrugated cardboard profiles folded at least once and extending between the folding flaps and connected thereto. These reinforcement elements can be grooved at the manufacturing works in order to fix the position of the particular folding edges required.

The reinforcement element preferably consists of a strip of corrugated cardboard, with three folds, its length being equal to the internal distance between those folding edges which are perpendicular to the corrugations of the base surface, the triple folds creating four surfaces of which one edge surface (connecting surface) serves to connect the reinforcement element with the base surface of the basic element and of which one central surface (base reinforcing surface) is situated at an angle to the said base surface and preferably perpendicular thereto, and of which the second central surface (folding-flap reinforcing surface) is turned back so that it is oblique with respect to the said connecting surface (base-reinforcing surface), and of which the other edge surface (end connecting surface) is parallel to the first edge surface and connected thereto.

The distance between these reinforcement elements (as measured in the direction of the maximum distance covered by the floor of the box-like assembly) depends on requirements. Normally a constructional component of about 3-4 meters in height only requires about three or four such reinforcement elements.

The folding flap which rests against the upper edge of the constructional component normally requires no reinforcement, whereas the lower folding flap of the constructional component is preferably stiffened by such a reinforcement element, and even the connecting surface of this reinforcement element can then extend beyond the free edges of the folding flaps of the basic element.

For the connection of the individual basic elements which are adjacent by their lateral folding flaps, connecting elements of collapsible material, particularly of corrugated cardboard are required. The mutually adjacent folding flaps of the basic elements are reinforced and interconnected by a quadruply folded connecting element, which extends in the manner of a bridge by the aid of two surfaces (folding flap reinforcing surfaces) of approximately equal length and more or less perpendicular to the basic surface, and by the aid of a short bridge surface, over two mutually adjacent folding flaps and which, by the two edge surfaces, is connected with those of the reinforcement element and with the surface of the box-like assembly.

By means of their folding-flap reinforcement surfaces, the said connecting elements stiffen those folding flaps of the basic element extending parallel to its maximum length. After the installation of the reinforcement elements and the connecting elements, a constructional component is thus formed which has a flat front surface and which is extremely resistant to bending or twisting and to impacts or vibrations which might occur in use. The connecting elements preferably adjoin one another in the direction of the maximum length of the constructional component. This normally will result in an adequate reinforcement of the folding flaps of the basic element, preventing them from bending out of shape. It is also sufficient however, if the connecting elements are only slightly spaced as viewed in the direction of the maximum length of the constructional component, this distance being smaller than the collapsing length i.e., the unsupported length over which buckling can occur. The best reinforcement is naturally obtained if the connecting elements are uninterrupted over the whole distance vertically.

In a further improved version, two constructional components are interconnected by a double wall plate, to form an ornamental wall, in such a way that at least some of the reinforcement elements of one constructional component point by their vertical base-reinforcing surfaces in one direction (perpendicular to the direction in which the constructional components extend longitudinally) while the corresponding reinforcement elements of the other constructional component point by their vertical base-reinforcing surfaces in the other direction, both groups of reinforcement elements extending from the plane of the folding flaps of their respective constructional components, while the two said constructional components are interconnected back to back by mounting one group of reinforcement elements on the other group. This provides an ornamental wall which is flat on both sides and which is extremely firm and stiff. As this ornamental wall is made up of two components according to the invention it is inexpensive to produce. It is emphasized that the height of the reinforcement elements is simple to adjust. All that is necessary is to use correspondingly wider strips of corrugated cardboard, from which these reinforcement elements are then folded. Thus, as very high reinforcement profiles have to be used in producing the ornamental wall made up of two constructional components the increase in expense involved in the construction of the system is small.

The reinforcement of the constructional component, however, is not confined to the above preferred type of reinforcement element. In another version the reinforcement profile consists of a filling piece consisting of an angular member of corrugated cardboard folded a number of times preferably four. This reinforcement can be produced in a simple manner; it is especially suitable for constructional components which differ from the standard width.

As a general principle the individual connections can be effected in any desired manner, e.g. by adhesive. A particularly advantageous method, however, is to interconnect the basic elements, the reinforcement elements, the connecting elements and the filling pieces by means of wire stitching or stapling. In the corrugated cardboard packing materials industry staples are available in a number of sizes. They are inserted in the usual manner, with the use of pneumatic tools, so-called pneumatic staplers, and can be used almost without distinction for all corrugated cardboard units in accordance with the invention.

The invention can be carried out by making the base surfaces flat and positioning the corrugations of the basic element perpendicular to the maximum path covered by the constructional component in the longitudinal direction. It is also possible however, for the base surfaces to be curved in one direction, the corrugations of the basic element being parallel to the axis of curvature. In this case however, the reinforcement elements are made up of a number of flat individual reinforcement elements, each assembled to form a polygon, since a three-dimensional profile constructed from corrugated cardboard cannot be bent.

The corrugations of the reinforcement elements of the connecting elements and of the profiles for the filling pieces preferably are perpendicular to the folding edges.

The constructional component can be reinforced in a simple manner by the reinforcement elements, and it

is easy to produce an ornamental wall from a number of constructional components. A process for the assembly of a constructional component according to the invention is to place the basic elements side by side on a floor, and the first edge surfaces of the reinforcement elements, of which the length is equal to the width of the individual floors of the box-like assemblies, are joined to the connecting elements, after which the basic elements are pushed on over the folding flaps and fixed, the floor reinforcing surfaces and the folding-flap reinforcing surfaces of the reinforcement elements then being straightened up and the end connecting surface of the reinforcement elements being jointed to the connecting surface of the connecting elements and with the base surface of the basic element.

Not only the basic elements but also the individual reinforcement and connecting elements, as well as the entire ornamental wall are assembled, almost entirely corrugated cardboard parts on the site, the construction of an ornamental wall being thereby considerably simplified. Even if the dimensions of such a finished ornamental wall are large, its moderate weight and great rigidity enable it to be transported with ease and assembled to form any desired room or even houses.

Preferred embodiments according to the invention will now be described with reference to the accompanying drawings, in which:

FIG. 1 illustrates a lateral reinforcement element;

FIG. 2 illustrates a connecting element constructed showing its cross-section;

FIG. 3 illustrates a lateral reinforcement element connected to a reinforcement element which has only been partly folded;

FIG. 4 shows a fully installed reinforcement element of which one side is connected with a lateral reinforcement element while the other side is joined to a connecting element to enable it to be connected up to a further reinforcement element, the relevant base surface of the basic element not being shown. This view only indicates the normally preferred direction for the corrugation of the relevant basic element;

FIGS. 5a, b and c show cross-sections of other reinforcement elements, of which the basic structure however, is in accordance with that of the reinforcement element of FIGS. 3 and 4;

FIG. 6 is a view of a blank for a corrugated cardboard angle piece serving to enable a filling piece to be mounted thereon;

FIG. 7 is a view of the corrugated cardboard angle piece shown in FIG. 6, partly folded in order to provide a filling piece;

FIG. 8 shows a completely assembled filling piece made from the corrugated cardboard angle piece shown in FIG. 6;

FIG. 9 is a view of an ornamental wall constructed in accordance with the invention;

FIG. 10 is a section on the line X—X of FIG. 9 through an ornamental wall constructed in accordance with the invention;

FIG. 11 is a sectional diagram similar to that of FIG. 10 but showing two constructional components assembled back to back to form a double ornamental wall smooth on both sides; and

FIG. 12 illustrates another form of lateral reinforcement element.

Each constructional component according to the invention consists essentially of the basic area of a basic

element 7, 8, this area being referenced 1 in FIGS. 9, 10 and 11, and also a reinforcement element which is generally referenced 2 (see FIG. 4 in particular), and of connecting elements (see FIGS. 2 and 4 in particular) which are referenced 3, and of lateral reinforcement elements referenced 4 in FIG. 4. The reinforcement can also be provided by a filling piece, which is shown in detail particularly in FIG. 8, and which is generally referenced 3. The basic area 1 of each constructional component 7, 8 has standardized unit widths, for example. It can be of any desired height, generally 3-4 m. The corrugations of the cardboard of which a basic element is made are parallel to the width, i.e., perpendicular to the height, in the example shown. They are referenced 6 in FIG. 4. In FIG. 9 three constructional components are situated mutually parallel. A further constructional component in FIG. 9 is referenced 8. It is considerably narrower than the constructional components 7 and also differs therefrom in that it is reinforced by filling pieces 5 shown in FIG. 8, while the reinforcement of the constructional component 7 is provided by the reinforcement elements 2, which are shown in particular in FIG. 4 but which also appear in FIG. 5. In the reinforcement elements and the connecting elements all of the corrugations of the cardboard are perpendicular to the folding edges in each case.

Each basic element 7, 8 has a basic surface 1 of corrugated cardboard and a folding flap attached completely around the edge. This folding flap 9 preferably is made unitary with the surface of the basic element, the folding flap being attached to the separate edges by grooving and slitting. The connections at the corners are also produced by a known method.

The reinforcement of the individual basic elements 7 and 8 is effected in the transverse direction, i.e., in the horizontal direction in the example shown in FIGS. 9-11 by reinforcement elements. The construction of a preferred form of reinforcement element will now be explained by reference to FIGS. 3 and 4. This reinforcement element consists of a corrugated cardboard strip 10 which has three folding edges 11, 12, 13 so that four surfaces 14, 15, 16 and 17 are formed. One edge surface referenced 14 constitutes a connecting surface. One middle surface referenced 15 is designated as a floor reinforcing surface. The other middle surface referenced 16 (see FIG. 3) is termed a folding-flap reinforcing surface.

Finally, the other edge surface is referenced 17 and is termed an end connection surface. The length of this reinforcement element 2 is equal to the internal width of the relevant basic element 7. After two basic elements have been laid side by side by their folding flaps 9 on a horizontal floor, for instance, the strip of corrugated cardboard 10, which has been grooved in advance and which is intended in the end to form the reinforcement element 2 after this at the end points has been joined to the connecting elements 4 and 3, is inserted at the desired point in the basic surface 1. The connecting surface 14 is then joined to the basic surface 1 of the basic element 7, 8, e.g. by wire stitches or staples. This operation is preferably carried out with a compressed air nailing machine of the usual kind.

Before the further description of the method by which an ornamental wall constructed in accordance with the invention is erected by the aid of individual constructional components, a more detailed description will be given, by reference to FIG. 2, of a connect-

ing element referenced generally 3. The said connecting element 3 consists generally of two angle pieces 20 and 23 of corrugated cardboard connected together by a crosspiece 19. The width of the crosspiece 19 is substantially equal to the distance as measured on the external surfaces between two adjacent folding flaps 9 of two adjacent basic elements 7. One angle piece 20 of this connecting element 3 comprises branches 21 and 22, while the other angle piece 23 of the said connecting element comprises branches 24 and 25.

The connecting element 3 is mounted on the two adjacent folding flaps 9 of the two basic elements 7 and 8 so that the branches 21 and 25 of the two angle pieces 20 and 23 are parallel to the folding flaps 9, i.e., perpendicular to the basic surface 1 of the basic elements 7, 8. The bridge-shaped crosspiece 19 and the two branches 22 and 24 of the two angle pieces 20 and 23 are accordingly parallel to the basic surface 1 of the basic element 7, 8. The branches 21 and 25 are approximately of the same height as the folding flaps 9. It is emphasized that although the connecting element basically consists of the two angle pieces 20 and 23, which are interconnected by the bridge-shaped crosspiece 19, the said connecting element has nevertheless been produced from a strip of corrugated cardboard by folding it around the folding edges 26, 27, 28 and 29. The corrugations of this strip are shown at 31.

After a connecting element 3 has been placed over two adjacent folding flaps 9 of two adjacent basic elements (after the reinforcement element 2, not yet assembled, has been connected with the said basic element in the manner described in the foregoing) the surfaces 15, 16 and 17 of the reinforcement element 2 are turned over, in the manner shown in FIG. 4, the end connecting surface 17 of the reinforcement element 2 being connected both with the connecting surface 14 and with the branches 22 or 24 of the connecting element 3 or with the branch 37 of the lateral reinforcement element 4. The corrugations of the connecting element 2 are shown at 32 in FIG. 3.

When the surfaces 15, 16 and 17 have been inserted in the manner described, the individual basic elements are drawn towards each other horizontally, by the oblique surface 16. The horizontal reinforcement of the basic elements and the preservation of the required distance between them are thus already fundamentally established by the said oblique surface 16. FIG. 5 shows alternative forms for the cross-section of the reinforcement element 2. From this view it will be seen that the height of the surface 15 can be varied within wide limits. The surface 15 is preferably at least as high as the folding flaps 9. It may nevertheless be considerably higher and under certain circumstances extend from the plane of the said folding flaps 9.

In the direction in which the constructional components extend longitudinally, therefore, the connecting elements 3 of FIG. 2 provide an excellent reinforcement system. It is advisable, under certain circumstances, for the connecting elements 3 to be placed with edges touching. Instead however, it is also possible to leave a small gap which is less than the "buckling length" of the relevant basic surface 1 and, in particular, of its folding flaps 9 between the separate connecting elements.

A connecting element as above can be taken over the entire height of the constructional component without interruption, so that the connecting element will have

a length, for example of 3-4 m. Such a uniform connecting element provides the maximum reinforcement in the direction in which the constructional component extends longitudinally and is of particular use in cases in which basic elements 7 and 8 are assembled vertically.

The ends of the connecting element are preferably fixed to the base reinforcing surface 15 of the reinforcement elements 2. For this purpose the angle flange 21 is converted, by slitting and folding, to form one flange surface 33 and a further flange surface 34. The flange surface 34 serves for the connecting with the flange surface 22, and the flange surface 33 serves for the connection with the floor reinforcing surface 15 of the reinforcement element 2.

The reinforcement of the outer longitudinal edges of the constructional component is effected in a similar manner, by the aid of a lateral reinforcement element, which is shown, in particular, in FIGS. 1, 3 and 4 and which generally bears the reference 2. It consists of a corrugated cardboard angle piece of which the folding edges is referenced 35, while the two branches are referenced 36 and 37. The corrugations of this angle piece are indicated at 38. At the ends, the branch 37 is slit and folded to form two angle surfaces 39 and 40. The surface 40 is connected with the branch 36 of the angle piece, while the surface 39 serves to connect the lateral reinforcement element 4 with the floor reinforcing surface 15 of the reinforcement element 2.

FIG. 11 shows two basic elements placed back to back, forming an ornamental wall which is flat on both sides. The component 7a includes the two reinforcement elements 2a, of which the floor reinforcing surfaces 15 face upwardly. The other basic element 7b includes the two reinforcement elements 2b, of which the floor reinforcing surfaces 15 face downwardly. The reinforcement elements 2b are now placed over the reinforcement elements 2a, so that the constructional component 7b is carried by the constructional component 7a. It is also possible for a greater number of surfaces to rest against each other. The folding flaps 9 of the constructional plate shown in FIG. 11 and passing the whole way round can be additionally interconnected by corrugated cardboard strips.

The upper folding flap 9 of the constructional component shown in FIG. 10 is reinforced and stiffened by a double strip of corrugated cardboard 18 placed around it in U-fashion. The lower folding flap 9 of this constructional component and the connecting surface 14 which belongs to the reinforcement element 2 used as a floor element and which faces downwards are reinforced and made of equal area by means of additional strips 50 and 51 of corrugated cardboard.

The front surfaces (front side) of the constructional component 7 and 8 and facing outwardly are provided in the zone of the folding flaps 9 with a narrow slit which can be completely covered by sticking a thin paper or plastic film over them and by finishing off with a spatula. If the constructional component, such as the constructional component 8 shown in FIG. 9 is narrow, it may be advisable for the reinforcement to be effected in some other manner. For this purpose a filling piece 5 is provided for the constructional component 8 shown in FIG. 9 and which piece consists of an angle strip 41 (see FIGS. 6, 7 and 8) and is provided with a groove 42 formed by folding and with three incisions 43. FIG. 7 shows the filling piece already partly assem-

bled, while FIG. 8 shows the completed filling piece, of which the individual angle piece 18 are now in a manner not shown in the drawing, connected with each other and with the folding flaps of the basic element which are to be reinforced. The corrugations of this filling piece are shown at 44. The constructional component 8 is rendered extremely rigid because filling pieces 5, situated closely together, extend over the entire height of the constructional component. The reinforcements, however, can also be constructed in the form of the lateral reinforcement elements 4. In this case lateral reinforcement elements are clamped into the basic elements in a position in which they are parallel to the direction taken by the corrugations, their angular surfaces 39 being connected with the folding flaps 9 of the basic elements.

As already discussed above, the parts 9 shown in FIGS. 10 and 11 are preferably constructed as folding flaps, which are made unitary with the basic surface 1.

FIG. 12 shows an additional reinforcement element for reinforcing the exposed lateral folding flaps 9 of a constructional component 7, 8. This additional reinforcement element consists of a bridge-shaped cross-piece 45, of two folding flap reinforcing surfaces 46, 47, which pass under the folding flap 9, and of a flange surface 48 which serves for the connection with the basic surface of the basic element 7, 8.

The foregoing description concerns certain preferred directions for the corrugation of the individual corrugated cardboard parts of the constructional component. It should also be noted, however, that the corrugations can take any other desired directions. For example, the constructional component is rendered far more rigid vertically if the corrugations are vertical. In the present case preference has been given to horizontal corrugations, in view of the way in which corrugated cardboard is normally made in which the width of the strip of corrugated cardboard (parallel to the direction taken by the corrugation longitudinally) is subject to certain limits. In other cases, particularly in exceptional cases in which greater reinforcement in the vertical direction is important, preference may nevertheless be given to vertical corrugations.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a wall structure having a plurality of prefabricated structural elements which are connected on the building site and which are each composed of at least one surface element and at least one of a plurality of support elements, wherein the improvement comprises said surface element being formed of a rectangular corrugated material blank having edge strips which are folded on all side edges to form a box, said support element being formed of a rectangular corrugated material blank separate from said surface element and which is foldable to varying shapes, said surface element being reinforced by said support element in a zone which is defined by said folded edge strips, said folded edge strips being held planar by said support element and are connected by fastening means to said support element which abut them.

2. A wall structure according to claim 1, wherein a first of said plurality of support elements is composed of a corrugated paper strip which is folded three times to define a first edge surface, a first central surface, a second central surface and a second edge surface, the

length of said paper strip equaling the distance between a pair of said edge strips of one surface element, said first edge surface connecting the respective first support element to the associated surface element, said first central surface extending angularly, to said associated surface element, said second central surface being folded back inclined to said first central surface and said second edge surface lying parallel to said first edge surface and being connected thereto.

3. A wall structure according to claim 2, wherein a second of said plurality of said support elements consist of a corrugated paper angle, the ends of which have additional anchor surfaces which are integrally formed through slotting and folding, said anchor surfaces being connected to adjacent surfaces of said first support element.

4. A wall structure according to claim 2, wherein two wall structures are connected so that said first central surface of said first support element of the one wall structure faces downwardly and extends in a direction perpendicular to the plane of said surface element of one wall structure and the corresponding part of said first support element on the other wall structure faces upwardly and extends perpendicular to the plane of said surface element of the other wall structure, and that both groups of said first support elements project from the plane of the edge strips of their associated wall structures and the two wall structures are connected back by slipping one of said first support elements onto the other of said first support elements.

5. A wall structure according to claim 2, wherein said first support element serves as a floor element and said first edge surface abuts the lower edge strip of the associated surface element and the first central surface abuts the surface element.

6. A wall structure according to claim 1, wherein abutting edge strips of a pair of adjacent surface elements are reinforced by four times folded connecting

elements which are connected to said surface element, said connecting element comprising at least two legs of equal length which extend approximately perpendicularly to the plane of said surface elements and a narrow interconnecting web surface, said two legs and said web being adapted to fit over two abutting edge strips.

7. A wall structure according to claim 6, wherein said legs are only slightly spaced from one another, said spacing being equal to the combined thickness of a pair of mutually adjacent edge strips on said surface elements.

8. A wall structure according to claim 6, wherein said surface elements, said support elements and said connecting elements are connected together.

9. A wall structure according to claim 1, wherein said edge strips which lie on the lateral edges of said surface element are reinforced by at least one of said support elements.

10. A wall structure according to claim 1, wherein said surface element is reinforced by at least one third support element which is constructed as a fill piece, the width of said third support element being equal to the width of said surface element and in a direction perpendicular to its greatest longitudinal extent.

11. A wall structure according to claim 10, wherein said third support element lies side-by-side in a direction of the greatest longitudinal extent of the associated surface element.

12. A wall structure according to claim 1, wherein said surface element is planar.

13. A wall structure according to claim 1, wherein the foldings of the rectangular corrugated material blank for said surface element and said separate support element are formed through pregrooved folding lines and slots, said corrugations of said corrugated material extending perpendicularly to the folding lines.

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