April 25, 1939. A. F. HOWARD 2,156,155

TOY STRUCTURAL MATERIAL

Original Filed Nov. 23, 1936 2 Sheets-Sheet 1

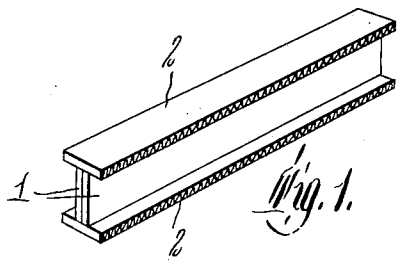

Fig. 1.

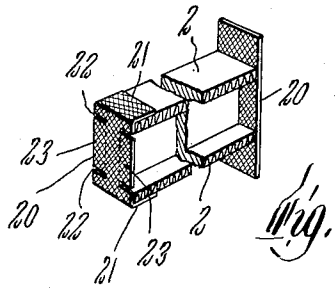

Fig. 2.

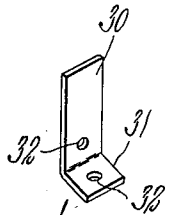

Fig. 3.

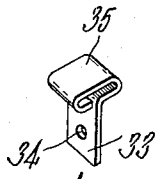

Fig. 4.

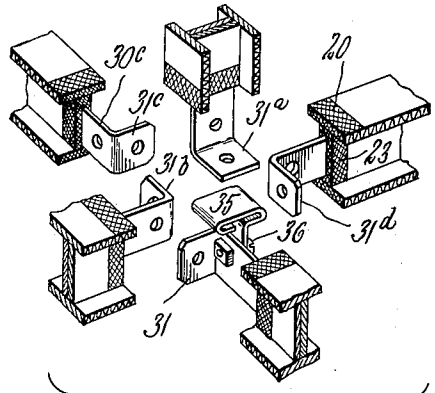

Fig. 5.

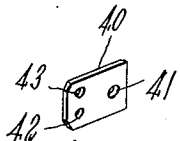

Fig. 6.

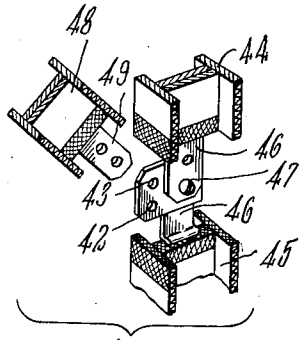

Fig. 7.

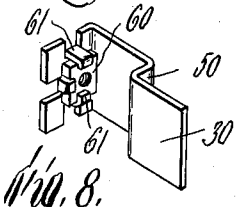

Fig. 8.

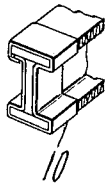

Fig. 9.

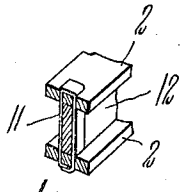

Fig. 10.

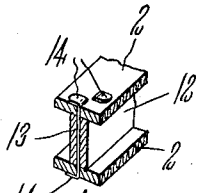

Fig. 11.

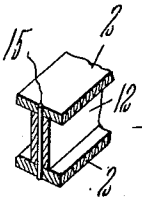

Fig. 12.

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TOY STRUCTURAL MATERIAL

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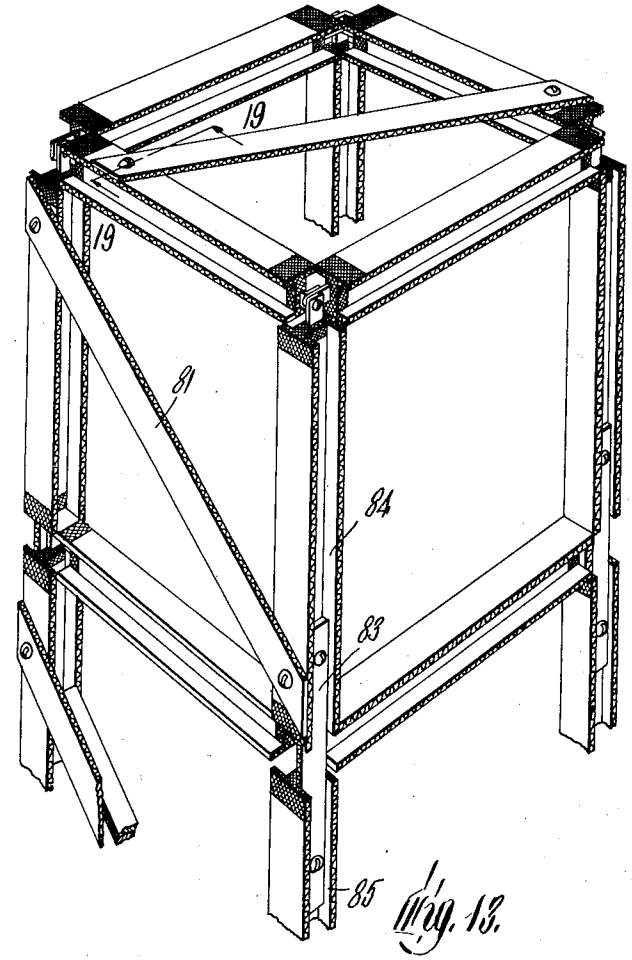

Fig. 13.

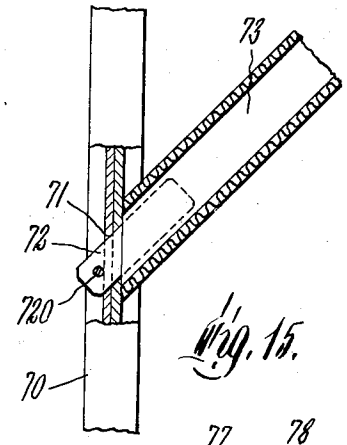

Fig. 15.

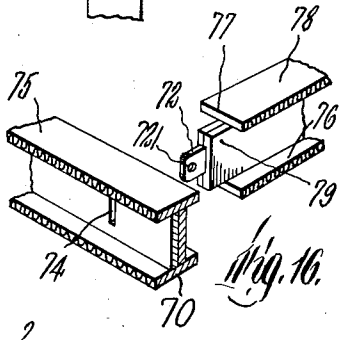

Fig. 16.

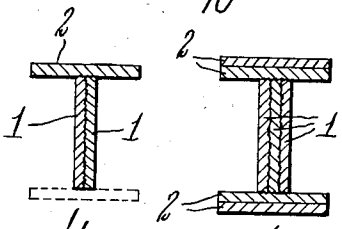

Fig. 17. Fig. 18.

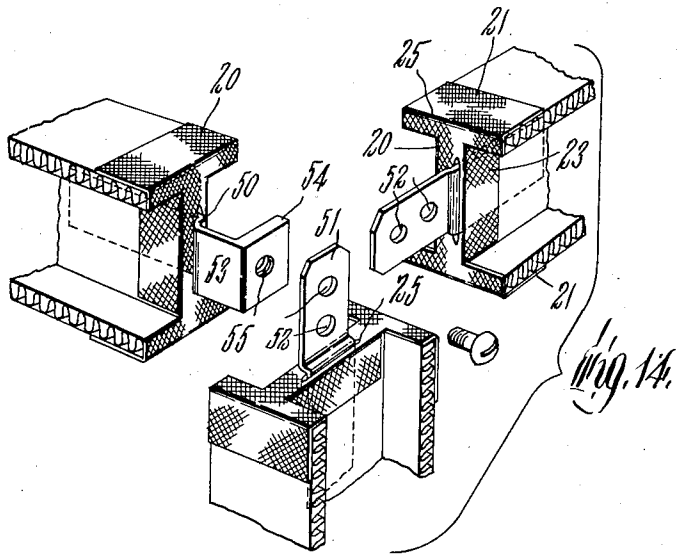

Fig. 14.

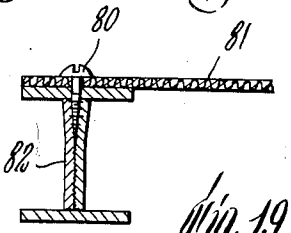

Fig. 19.

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UNITED STATES PATENT OFFICE

2,156,155

TOY STRUCTURAL MATERIAL

Alan F. Howard, Winchester, Mass.

Original application November 23, 1936, Serial No. 112,202. Divided and this application May 5, 1937, Serial No. 140,806

10 Claims. (Cl. 46—29)

This invention relates to toy structural material and has for one of its objects to provide such material which can be made in a simple and expeditious manner from plentiful inexpensive stock, such, for example, as cardboard, and preferably corrugated cardboard, so that a child can make his own structural material and then assemble it as he may desire.

A further object is to produce toy structural material sturdy in character and closely simulating in appearance and form steel structural shapes.

A further object is to produce such toy material which can be reinforced by elements which may be attached by screws, or the like, which may be engaged directly with the toy shapes.

A still further object is to provide means by which the structural members may be connected together in a simple and secure manner, and in various of selected arrangements.

For a more complete understanding of this invention, reference may be had to the accompanying drawings in which

Figure 1 is a perspective view of structural material of this invention made in the form of an I beam.

Figure 2 is a perspective view of such a beam and showing the application to its end of fabric reinforcements.

Figures 3, 4 and 6 are perspective views of certain attaching elements.

Figure 5 is an exploded perspective showing mating ends of pieces of the structural material provided with the attaching elements of Figures 3 and 4.

Figure 7 is a view similar to Figure 5, but showing also the use of an element such as is illustrated separately in Figure 6.

Figure 8 is a perspective view of another form of attaching element.

Figures 9 to 12, inclusive, are fragmentary perspective views showing various methods of securing together the individual elements of structural material of I section.

Figure 13 is a perspective view of a structure fabricated from various types of structural material made in accordance with this invention.

Figure 14 is an exploded perspective view showing structural members provided with other forms of attaching elements.

Figure 15 is a view partly in section and partly in elevation showing a further type of joint between attached members.

Figure 16 is an exploded perspective of the parts shown in Figure 15.

Figures 17 and 18 are cross sectional views showing further constructions of structural members.

Figure 19 is a detail section on line 19—19 of Figure 13.

This application is a division of my application Serial Number 112,202, filed November 23, 1936, for Toy structural material and method of and mechanism for fabricating the same.

The structural material of this invention is built up from strips of sheet material such as cardboard, or the like, one material particularly suitable because of its lightness, stiffness, ease of handling, cheapness, and ready availability being corrugated cardboard such as is commonly employed for the material of shipping cartons and which ordinarily is thrown away after it has served its purpose. This discarded material is an excellent source of supply for the structural material of this invention. It is cut in strips, preferably across the corrugations, and for many shapes these strips may be of uniform widths for all parts. These strips are then secured together to simulate structural shapes. For example, as shown in Figure 1, a plurality of such strips 1 are assembled and secured face to face with their side edges co-terminous, and similar strips 2 are then secured overlying the side edges of the strips 1 to form a structural member simulating an I beam. If one of these strips 2 is omitted, as shown in full lines in Figure 17, a beam of T section is produced. It is also evident that beams of other sections such as angles and Z bars may be formed by locating the web-forming members 1 at the edge of one or more members 2 which thereupon form flange elements. Preferably the strips are secured together by adhesive, sodium silicate having been found very satisfactory, although glue, or the like, may be used if desired. These structural shapes may be cut and built up with great facility by the employment of the devices shown and described in the parent application to which reference has heretofore been made.

Where the material employed for the making of these shapes is of light weight and consequently thin, or where a particularly rigid beam is desired, a plurality of strips may be secured in face to face relation, as shown in Figure 18, where an I beam is shown having three thicknesses of the strip material in the web and two thicknesses in each of the flanges. Where adhesive is used, it is preferable to maintain the assembled strips under pressure until the adhesive is set.

While adhesive securement of the strips is preferred, various other methods of securing the strips may be employed, if desired, as shown, for

example, in Figures 9 to 12. In Figure 9 a metallic strip 10 bent to surround the assembled fibrous strips is employed, this metallic strip being engaged about the outer faces of the fibrous strips and holding them in proper assembled relation.

In Figure 10 the flange elements 2 are shown as perforated for the reception of a securing metallic band 11 which passes down on each side of the central web 12, its ends being bent into overlapping relation.

In Figure 11 a single strip 13 having split ends 14 is employed, this strip passing through both the flange members 2 and the web member 12, and its ends being bent downwardly against the outer faces of the flange members 2.

In Figure 12 a wooden dowel pin, such as 15, is shown as passed through both the web member 12 and the flange members 2 and secured in position as by glue.

In order to reinforce the end portions of the structural beams, reinforcing tape or cloth may be applied thereto as shown in Figure 2. A strip of such cloth or tape 20, to the inner face of which adhesive has been applied, may be placed across the end of the beam and its ends 21 brought back and secured to the outer faces of the flange elements 2. The strip of reinforcing sheet material may then be slit as at 22 and the flaps 23 between the slits are then folded in against opposite sides of the web and there secured as shown best in Figures 5, 7 and 14.

The structural shapes may be secured to each other in various relationships in the building of structures, and to facilitate this, attaching elements of various constructions may be employed.

The ends of the beams are preferably slit through the reinforcing fabric, as shown best, for example, at 25 in Figure 14 for the purpose of receiving the securing elements. Various forms of these securing elements are illustrated in Figures 3, 8, 14 and 16. As shown these elements are strips of suitable material such as metal, narrower than the end of the beam, and which have end portions or shanks 30 which can be thrust into the slots in the ends of the beams and there secured as by adhesive or the like.

The fastening element shown in Figure 3 comprises a strip of uniform width including the shank 30, and bent to form an end flange 31, this end flange, as well as the main portion of the strip adjacent thereto, being provided with screw-receiving perforations 32. For co-operation with these elements, elements such as shown in Figures 4 and 6 may be provided. The element shown in Figure 4 has a shank portion 33 perforated as at 34 and provided with a looped end 35.

Figure 5 illustrates the ends of five different beams which can be associated together by the use of the fastening elements shown in Figures 3 and 4. One of the elements such as shown in Figure 4 is secured as by a bolt 36 to one of the elements of Figure 3, the loop 35 forming a socket for the reception of the flange 31*a* of one of the beams, while the flange 31*b* may be bolted to the shank 30*c* and the flange 31*c* may be bolted to the flange 31. The flange 31*d* may be secured by the bolt 36.

Where it is desired to secure beams angularly related, a gusset plate 40, shown detached in Figure 6, may be employed. This gusset plate is shown as provided with three bolt openings 41 and 42, and 43. The beams 44 and 45 are provided with straight attaching pieces 46, each having a pair of bolt holes therein and these are secured together and to the gusset plate 40 as by a bolt 47 which passes through the hole 41 of the gusset plate. To the projecting end of this gusset plate, as through either of the bolt holes 42 and 43, may be passed bolts engaging through mating holes in a straight securing piece 49 projecting from the beam 48.

In Figure 8 and also in Figure 14, the attaching strips are shown as having their shank portions offset, this offset portion furnishing a limiting shoulder as at 50, which may be engaged with the beam ends and thus determine the amount to which they may be inserted into the beams. This provides an easy method of insuring the proper extensions of these elements from the beams for co-operation with elements of other beams. Also as is shown in Figure 14, two of these attaching elements, as 51, have straight ends, each provided with a pair of perforations as at 52, while the element 53 has a thickened laterally projecting flange 54 provided with a threaded opening 55. This permits the use of screws for securing the parts together, the threaded opening 55 serving to engage the threads of the screw in the same manner that a nut would do, but without the possibility of loosening as in the case of a separate nut. In Figure 8 a modification of this is shown in which a nut 60 is employed, but this nut is held rigidly by the integral fingers 61 cut and bent up from the material of the securing strip so that loosening of the nut and detachment from the element is prevented.

In Figures 15 and 16 are illustrated constructions where the beams are secured at other angles relative to each other. The beam 70 of Figure 15 is provided with a slot 71 longitudinally through its web portion for the reception of a securing element 72 projecting from the end of the web of a mating beam 73. In Figure 16 the slot 74 is arranged crosswise of the web of the beam 75 and flanges 76 and 77 of the beam 78 are cut away so that the web extension 79 may pass between the flanges of the beams 75 and the ends of the cut away flanges abut the sides of the flanges of the beam 70 in Figure 15 and against the web in Figure 16. A suitable securing element such as a pin or match stick 720, or the like, is passed through a perforation 721 in the securing strip 72.

One of the particular advantages of employing fibrous sheet material in the fabrication of the structural material consists in the ability of such material to directly take fastening elements such as screws, or the like. For example, as shown in Figure 19, the screw 80 directly secures a single reinforcing or bracing strip 81 to the I beam 82. Both of these parts may well be formed of the corrugated board.

Figure 13 shows a partial assembly of various structural members which may be formed of the corrugated board, braces 81 as shown in Figure 19 being employed and also bridging strips 83 are shown which lie between the flanges of alined beams such as 84 and 85 and are directly secured as by screws to these flanges, thus affording additional stiffening reinforcement to the joints between the various members.

While the structures produced in accordance with this invention are particularly intended as toys, the parts are so sturdy and light that they might be found useful also in the manufacture of crates for shipping or other purposes, and where unusual strength is desired, the strips may be cut from fiber board or other similar material and assembled as previously described.

From the foregoing description of certain embodiments of this invention, it should be evident to those skilled in the art that various other changes and modifications may be made, those shown being merely illustrative, without departing from the spirit or scope of this invention as defined by the appended claims.

I claim:

1. An element comprising strips of fibrous sheet material adhesively secured together to simulate a metallic structural beam, and reinforcing sheet material overlying end and side faces of said beam and adhesively secured thereto.

2. An element comprising strips of corrugated cardboard each having outer flat face plies and a corrugated ply therebetween, the corrugations extending crosswise of said strips, a plurality of said strips being secured together face to face with their edges co-terminous, such co-terminous edges presenting faces at least one of which is adhesively securely to the side face of another strip to simulate a metallic structural beam and a layer of reinforcing sheet material overlying end and side faces of said beam and secured thereto.

3. An element comprising strips of corrugated cardboard each having outer flat face plies and a corrugated ply therebetween, the corrugations extending crosswise of said strips, a plurality of said strips being secured together face to face with their edges co-terminous, such co-terminous edges presenting faces each of which is adhesively secured centrally to the side face of another strip to simulate a metallic I beam structural member and a layer of reinforcing sheet material overlying end and side faces of said beam and secured thereto.

4. An element comprising a plurality of strips of sheet material secured to each other along their lengths to simulate a metallic structural beam, an end of said element having a layer of fabric overlying end and side faces of said beam and secured thereto.

5. An element comprising a plurality of strips of corrugated cardboard secured to each other along their lengths to simulate a metallic structural beam, an end of said element having a layer of fabric secured thereto.

6. An element comprising a plurality of strips of sheet material secured to each other along their lengths to simulate a metallic structural beam, and a fastening strip having one end portion embedded in said element and projecting therefrom, the projecting portion of said fastening strip being formed to receive means for securing a plurality of said elements together.

7. A fibrous element shaped to simulate a metallic structural member, a metallic strip having a shoulder intermediate its ends, one end portion of said strip being embedded in said element with said shoulder engaging the end thereof, the opposite end portion of said strip having one or more holes therethrough for receiving a fastener for securing a plurality of such elements together.

8. A fibrous element shaped to simulate a metallic structural member, a metallic strip having a shoulder intermediate its ends, one end portion of said strip being embedded in said element with said shoulder engaging the end thereof, the opposite end portion of said strip having a laterally arranged end flange perforated for the reception of a securing device by which a plurality of such elements may be secured together.

9. In combination, a plurality of structural-member-simulating-elements each having a strip extending from one end, one of said strips having an end flange laterally disposed and having an internally threaded aperture, and another of said strips having a plurality of holes through either of which a screw may be extended and engaged in said aperture.

10. In combination, a plurality of structural-member-simulating-elements, each having a strip extending from one end, one of said strips having a flattened loop into which an end of another of said member strips may be inserted, and means by which said looped end strip may be secured to another of said strips.

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