United States Patent

Huber et al.

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[54] **FOLDABLE CONSTRUCTION BLOCK**

[72] Inventors: **William C. Huber**, Seabrook; **Dale L. Ritter**, Houston, both of Tex.

[73] Assignee: **The United States of America as represented by the Administrator of the National Aeronautics and Space Administration**, by said Huber

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[52] **U.S. Cl.**.....**52/284**, 52/594, 229/DIG. 11

[51] **Int. Cl.**.....**E04c 1/10**

[58] **Field of Search**....229/38, DIG. 11; 52/594, 593, 52/284, 578

[56] **References Cited**

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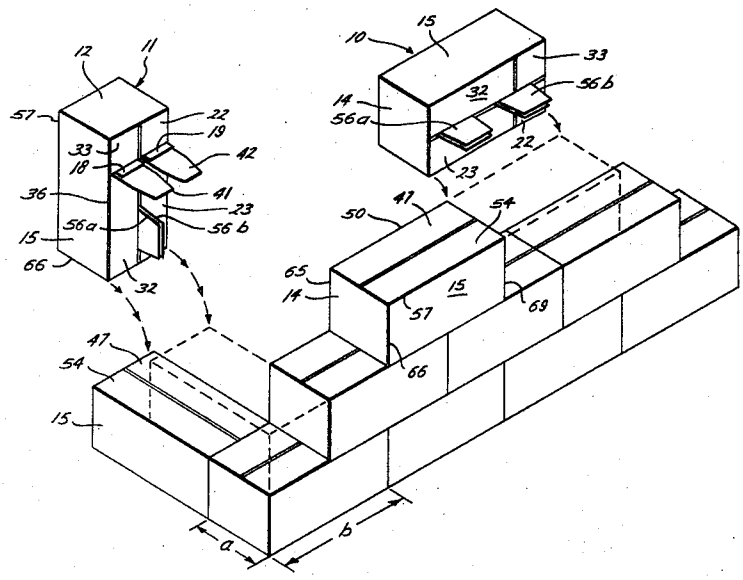
Primary Examiner—Alfred C. Perham

Attorney—Edward K. Fein, Marvin F. Matthews and John R. Manning

[57] **ABSTRACT**

A construction block foldable from a flat sheet of material to form a container which may be filled with available solid material and stacked with other such blocks in staggered courses. Interlock tabs project from the center of one horizontal wall of the block and the other horizontal wall is provided with a lateral, central slot arranged to receive interlock tabs from other such blocks. The block may be folded to provide either, two symmetrical lateral interlock tabs for making lateral wall runs, or to provide lateral and transverse tabs for wall corners.

4 Claims, 2 Drawing Figures



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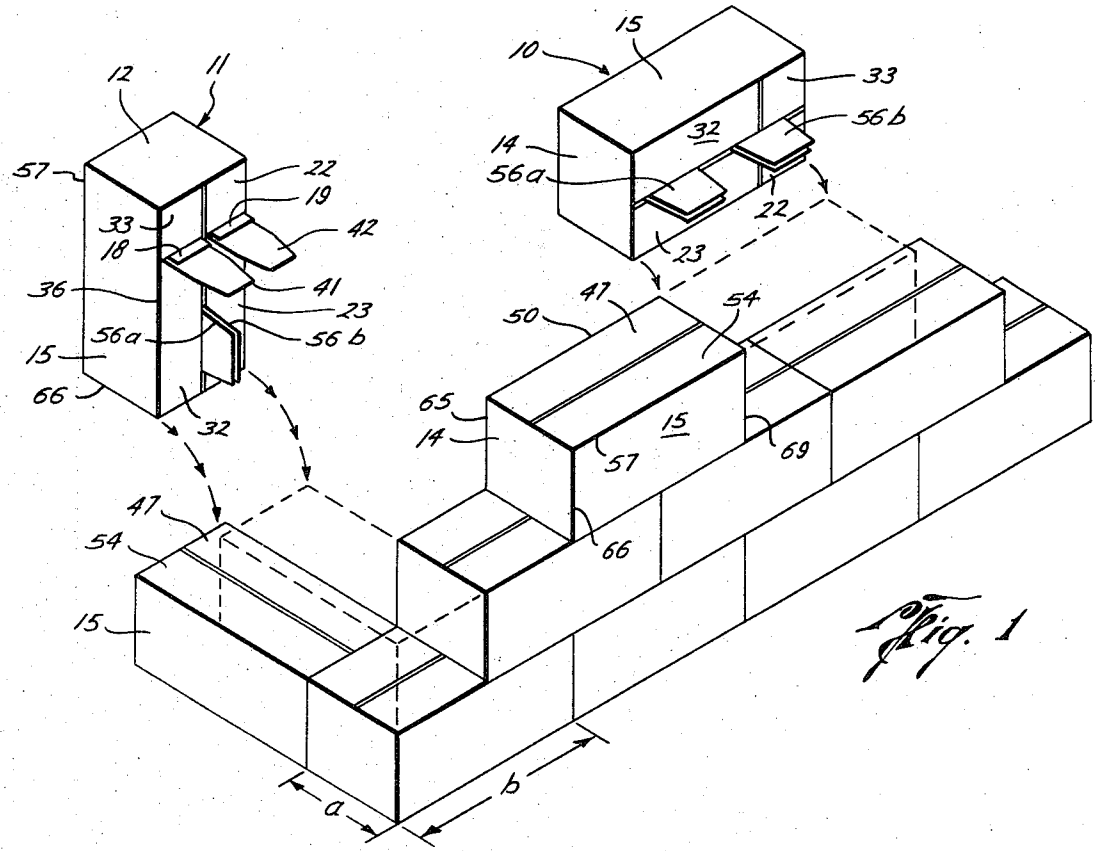


Fig. 1

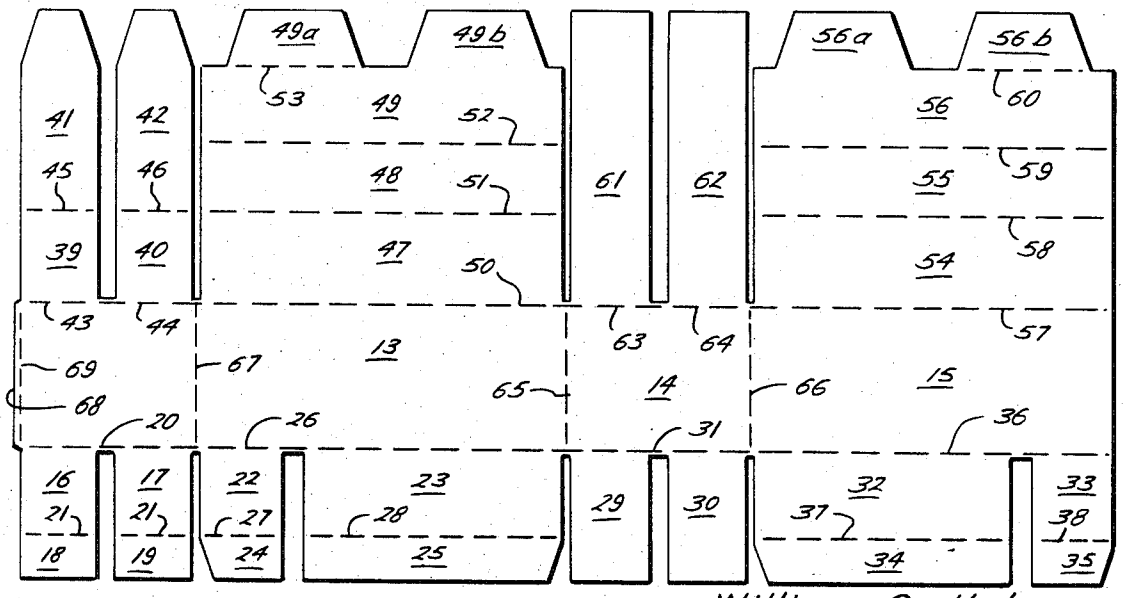


Fig. 2

William C. Huber
Dale L. Ritter
INVENTORS

BY W. A. Marcontell

ATTORNEY

FOLDABLE CONSTRUCTION BLOCK

ORIGIN OF THE INVENTION

A co-inventor of the invention described herein is an employee of the United States Government. Accordingly, this invention may be manufactured and used by or for the Government of the United States of America for Governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to on site formable building blocks.

2. Description of the Prior Art

Frequently in the proposed construction of low-cost permanent or semi-permanent static structures suitable for human habitation, the cost of construction using conventional techniques would exceed the value of the proposed structure. This problem is particularly encountered when housing is proposed for remote areas in underdeveloped countries. In many such instances, there are no locally available inexpensive building materials and the cost of transporting conventional supplies from an available source is prohibitive. This problem also arises in other situations when a structure is needed for short-term use and would have little or no salvage value.

One prior art solution to this problem has been the use of locally available water, clay and binder material, such as straw, for on site preparation of adobe bricks which are, in turn, used for construction of the structure. This solution is only applicable in selected geographical areas where the necessary materials and the climate permit. Even in those instances, a certain minimum of construction tools is required and the preparation process can be lengthy.

An alternate solution frequently adopted in these situations is the use of sand bags or similar containers which may be filled with any available material and stacked to form walls of the structure. This solution is frequently unsuitable, however, due to the instability of the walls and the inability of the walls to support a roof load.

Neither of the foregoing prior art solutions is suitable when a relatively dust and lint free environment is required within the structure. This problem is frequently encountered when a temporary medical treatment facility must be constructed in a remote area, for example.

Another solution to this problem is shown in U.S. Pat. No. 3,665,669, issued May 30, 1972, to one of the co-inventors of the instant invention, William C. Huber, entitled "Foldable Construction Block and Method of Construction." The construction blocks disclosed in that patent overcome many prior art problems by providing foldable construction blocks which may be assembled, filled and stacked in courses at the construction site. The instant invention improves upon the Huber construction block by providing laterally symmetrical interlock tabs, a lateral central block divider, and a central interlock tab receiving slot.

SUMMARY OF THE INVENTION

The invention disclosed herein involves a construction block which may be assembled by folding a pre-cut flat sheet of material to form a closed container having: single or double thickness, laterally symmetrical, interlock tabs projecting from one horizontal wall; and, a lateral interlock tab receiving slot generally in the center of the other horizontal wall. The block may be folded to provide either two laterally symmetrical interlock tabs for lateral wall runs or one lateral and one transverse tab for wall corners. Due to the lateral symmetry of the block, a plurality of these blocks may be stacked one upon another without creating transverse steps in the wall surface. It is preferred that the ratio of the length of the side walls to end walls of the block be approximately 2 to 1 to provide corner symmetry.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is n isometric view showing a partially constructed wall and corner using the block of this invention.

FIG. 2 is a layout of the blocks shown in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, a preferred embodiment of this invention is shown in plan layout in FIG. 2 and in folded isometric in FIG. 1. This form of the invention may be die cut from a blank, such as a flat sheet of material, in a single die cutting operation, following the layout of FIG. 2, and may be folded at the construction site along the indicated broken lines to form the lateral wall block generally designated as **10** in FIG. 1 or to form the corner wall block generally designated as **11** in FIG. 1. Throughout the balance of this description, the horizontal wall of the blocks having interlock tabs projecting therefrom will be referred to as the bottom of the blocks and the horizontal wall having the central lateral interlock tab receiving slot will be referred to as the top of the blocks. These references are for convenience of discussion only, as these blocks may be stacked with either upwardly or downwardly projecting interlock tabs to form a wall, as described below.

The flat blank of FIG. 2 has four substantially rectangular adjoining panels which form the end walls **12** and **14** and side walls **13** and **15** of the completed block. Depending from end **12** are bottom closure flaps **16** and **17** having closure tabs **18** and **19**, respectively, thereon, which flaps and tabs are arranged to be folded along fold lines **20** and **21**, respectively, as described below. Extending downward from side **13** are bottom flaps **22** and **23** having closure tabs **24** and **25**, respectively. These flaps and tabs are arranged to be hinged along fold lines **26**, **27** and **28**, as described below. Depending from end wall **14** are bottom flaps **29** and **30**, which flaps are hinged along fold line **31** during assembly of the block. The remainder of the bottom of the block depends from side **15** and is formed by flaps **32** and **33** and corresponding closure tabs **34** and **35**, respectively. These panels are arranged to be hinged along fold lines **36**, **37** and **38** during block assembly.

The top horizontal surface of the block, the interlock tabs and the central block dividers are formed during assembly of the block from the panels which extend up-

wardly from ends **12** and **14** and sides **13** and **15**. Panels **39–42** extending upwardly from end **12** form the transverse interlock tabs for the completed corner wall block configuration when folded along lines **43–46**, as described below. Panel **47**, which is hinged to side **13** along line **50**, forms one-half of the top cover of the assembled block, with panel **54**, hinged to side **15** along line **57**, forming the other one-half of the top. Panels **48** and **49** and panels **55** and **56** form lateral central dividers for the assembled block and are hinged to panels **47** and **54**, respectively, along fold lines **51** and **52** and fold lines **58** and **59**, as indicated. The lateral interlock tabs which extend downwardly from the center line of the completed lateral wall block configuration are formed from tabs **49*a*** and **49*b*** on panel **49** and from tabs **56*a*** and **56*b*** on panel **56**.

Since tabs **49*a*** and **56*b*** are utilized only in the blocks **10** used for lateral wall runs, these tabs are provided with fold lines **53** and **60**, respectively, along their bases so that they may be folded 180° under when a corner block **11** is being assembled, as described below. The final top closure portion of the block is formed by flaps **61** and **62** which extend upwardly from end **14** and are hinged to end **14** along fold lines **63** and **64**, respectively.

The first step in forming a construction block from the blank shown in FIG. **2** is to fold the blank intermediate its opposite ends along central fold line **65**. While this fold may be made in either direction, the remainder of this discussion will treat the surface of the block shown in FIG. **2** as the outside surface of the block. For storage and shipment of the block blanks, it would be convenient to make a 180° fold along line **65**, with that fold opened to 90° at the time of assembly of the block. After making the 180° fold along line **65**, tab **68** which extends outward from end **12** is folded over 180° along line **69** and is secured to the outside end of side **15**, as described below. At the construction site, the 180° folds along lines **65** and **69** are opened to 90° and similar 90° outward folds are made along lines **66** and **67**, thereby forming the blank into a rectangular, open-top and open-bottom configuration. Next, flaps **61** and **62** are folded inward 90° toward the center of the block along lines **63** and **64**, respectively.

At this point, the partially completed block can be folded into either a lateral wall block **10** or a corner wall block **11**. To form a block **10**, panels **39** and **40** are folded inward 90° along lines **43** and **44** into overlapping relation with flaps **61** and **62**, so that panels **39–42** and flaps **61** and **62** extend horizontally across the top of the block. No fold is made along lines **45** and **46** for this block. Temporary downward folds of approximately 45° are now made along lines **52** and **59** and 90° folds are made along lines **50** and **51** and lines **57** and **58**. As these 90° folds are made, panels **49** and **56** are directed into the block through the openings between panels **41** and **42** and flaps **61** and **62**. As the 90° folds along lines **50** and **51** and lines **57** and **58** are completed, tabs **49*a*** and **49*b*** and tabs **56*a*** and **56*b*** will protrude out of the lateral center line of the bottom of the block and the temporary folds along lines **52** and **59** are opened. Tabs **49*a*** and **56*b*** are adjacent and parallel, as are tabs **49*b*** and **56*a***, thereby forming double thickness central, lateral interlock tabs. Panels **48** and **49** and panels **55** and **56** are now flat sheets and form central vertical walls which laterally bisect the block.

With the top and sides of a lateral wall block **10** now completed, the partially completed block may be turned upside-down and each half of the block may be filled with available solid material. The block **10** is completed by folding flaps **16, 17, 29** and **30** inward 90° along lines **20** and **31**, respectively, and by folding bottom flaps **22, 23, 32** and **33** inward 90°. Closure tabs **24, 25, 34** and **35** are then folded down 90° and are forced into the block adjacent the central vertical walls **49** and **56**.

If the block blank is to be formed into a corner wall block **11**, rather than a lateral wall block **10**, the initial 90° folds along lines **65, 66, 67, 69, 63** and **64** are made as as described above. Then 90° downward folds are made along lines **43–46** so that panels **41** and **42** extend through the inside of the block parallel to the ends **12** and **14** and extend out the bottom of the block to form transverse interlock tabs. Folds of 180° are then made along lines **53** and **60** so that tabs **49*a*** and **56*b*** are doubled back on panels **49** and **56**, respectively, since tabs **49*a*** and **56*b*** are not used in corner block **11**. Temporary downward folds of approximately 45° are then made along lines **52** and **59** and 90° downward folds are made along lines **50** and **51** and along lines **57** and **58**. As these 90° folds are made, panels **49** and **56** are directed into the block through the openings between panels **39,41 — 40,42** and flaps **61–62**. As the 90° folds along **50,51** and **57,58** are completed, tabs **49*b*** and **56*a*** will protrude out of the center of the bottom of the block and the temporary folds along lines **52** and **59** are opened. Panels **48** and **49** and panels **55** and **56** are now flat sheets and form central vertical walls which laterally bisect the block.

With the top and sides of a corner wall block **11** now completed, the partially completed block may be turned upside down and each half of the block may be filled with available solid material. To close the bottom of the block, flaps **16, 17, 29** and **30** are folded inward 90° along lines **20** and **31**, respectively, and tabs **18** and **19** are folded outward 90° along lines **21** so that tabs **18** and **19** are parallel and adjacent to panels **41** and **42**. Closure of the bottom is completed by folding tabs **24, 25, 34** and **35** 90° downward and by folding flaps **22, 23, 32** and **33** over 90° so that tabs **24, 25, 34** and **35** extend into the block adjacent the central vertical walls.

This construction block may be formed of any desired sheet material, such as sheet steel or plastic. However, waterproofed cardboard is preferred due to its weight, flexibility and cost. When forming the blank of cardboard, the fold lines may be scored or pressed into the blank during or after the die cutting to form hinges between the various panels. Using cardboard, the connection between tab **68** on end wall **12** and side wall **15** may be provided in any conventional manner, as by the use of staples through tab **68** and side **15** or by the use of glue or adhesive tape.

Although not required, it is desirable to form the blocks with length *b* to width *a* ratio (as shown in FIG. 1) of 2 to 1 so that corners formed with the blocks may conveniently assume an interlocking planar relationship. It has been found that a practical size for the blocks is 16 inches long by 8 inches wide by 8 inches high. Using this size, the blocks, when filled with available solid material, are not too heavy to be moved by one person and yet have sufficient base area and struc-

tural rigidity for stacking to wall height. Since the bottom of each block is closed, no substantial problem of rigidity arises upon settling of the material filling each block.

In constructing a wall with the above described construction blocks, such as the wall illustrated in FIG. 1, a plurality of lateral wall blocks **10** and corner wall blocks **11** are assembled and a first row outline of the wall is laid. The blocks of this outline row can be placed with the interlock tabs **49***b* and **56***a* extending either upward or downward, since both horizontal surfaces of the block are closed. If this first row is laid with upwardly extending tabs, then corner blocks **11** should be used for all corners on this row. When this first row is laid with tabs **49***b* and **56***a* downward and folded over, either type of block may be used in any location. In either case, blocks **11** are used for corners on subsequent rows and blocks **10** are used for lateral wall runs. If desired, a more rigid and permanent wall can be constructed by using adhesive or glue to bind the blocks together. If the blocks are not bound together, they may be conveniently unstacked, emptied and unfolded, and subsequently re-used to construct other structures.

Further modifications in the apparatus of this invention will become apparent to those skilled in the art in view of the foregoing description.

What is claimed is:

1. A construction block foldable from a flat sheet of material to form a container suitable for filling with available solid material and which may be stacked with other such blocks in staggered interlocking relation, said block comprising:

a box member having a pair of side walls, a pair of end walls connected to said side walls at adjacent vertical edges and top and bottom horizontal walls connected to said side walls and arranged for closing the top and bottom of said box member;

a longitudinal vertical partition formed by upward extensions of said bottom horizontal wall forming a longitudinal slot means in said bottom horizontal wall; and

interlock tab means extending from said longitudinal vertical partition through the construction block and projecting beyond said top horizontal wall arranged to be insertable into the longitudinal slot means of another of said blocks in a lateral wall run.

2. The invention as claimed in claim 1 wherein:

the ratio of the length of said side walls to said end walls is approximately 2 to 1.

3. The invention as claimed in claim 1 comprising:

transverse interlock tab means projecting from said top horizontal wall, said transverse tab means being disposed in a plane generally parallel to said end walls and more proximate of one end wall, arranged to be insertable into the longitudinal slot means of another of said blocks at an angle of 90° thereto.

4. The invention as claimed in claim 3 wherein:

the ratio of the length of said side walls to said end walls is approximately 2 to 1 and the ratio of the distances from said one end wall to said transverse slot means and to said other end wall is approximately 1 to 4.

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