Dec. 7, 1937. D. M. BOWES 2,101,019

MOLDING FORM FOR STRUCTURAL MATERIAL

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FIG. 1.

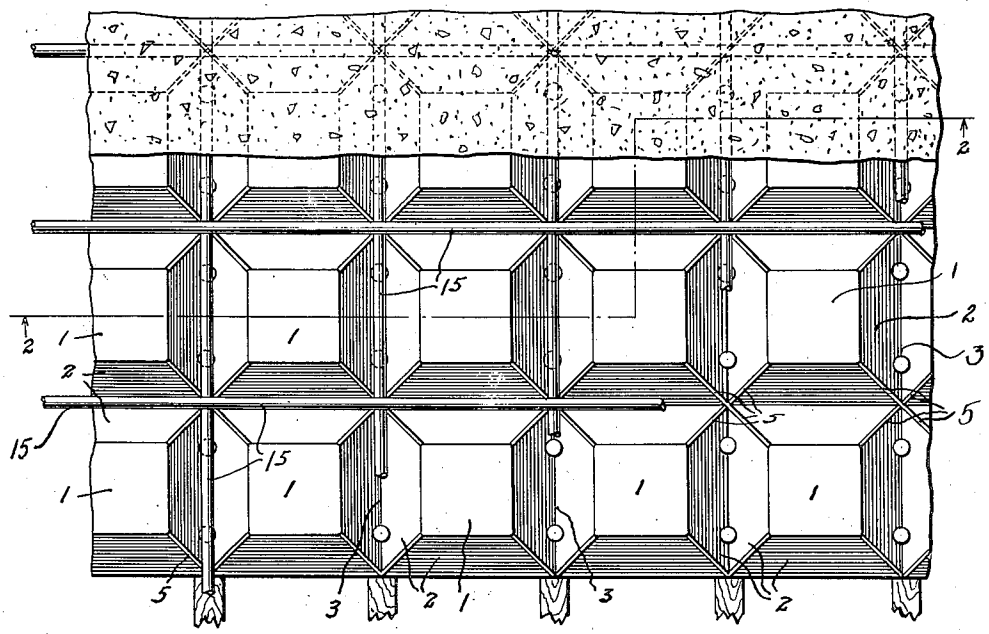


FIG. 2.

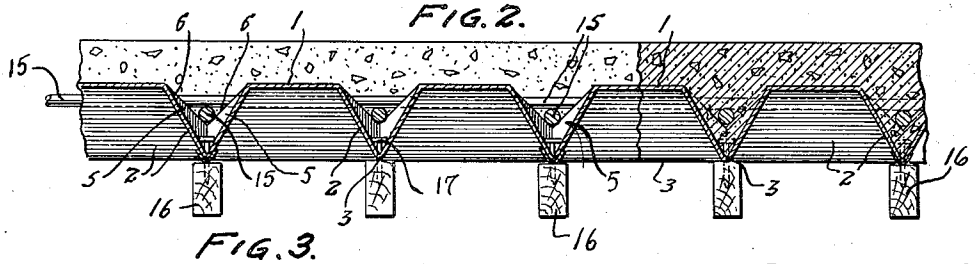


FIG. 3.

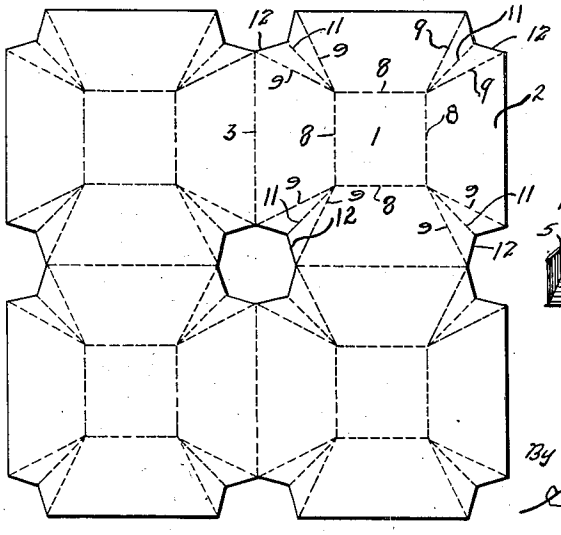
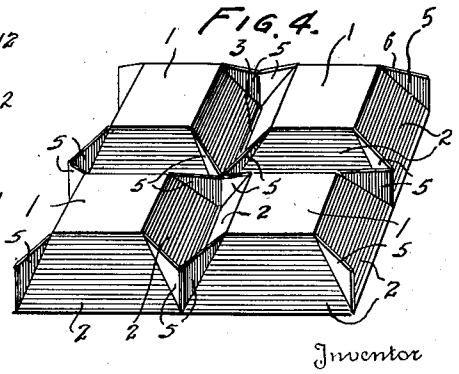


FIG. 4.



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FIG. 5.

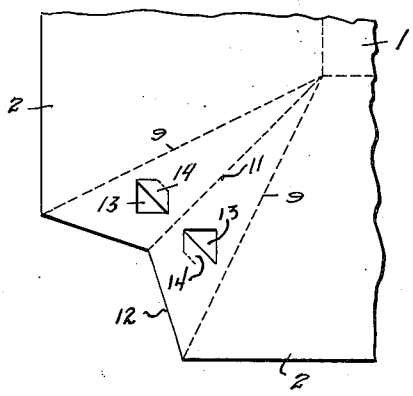


FIG. 6.

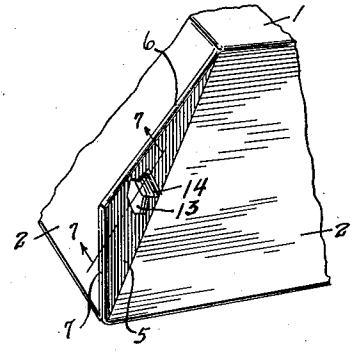


FIG. 7.

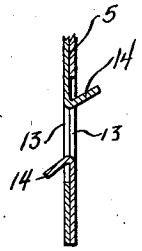


FIG. 8.

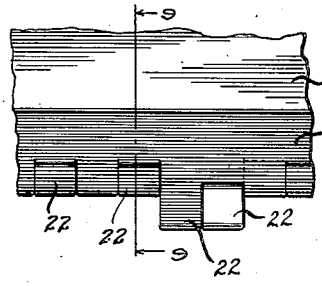


FIG. 9.

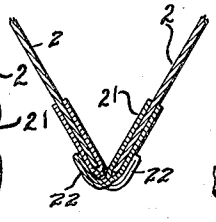


FIG. 10.

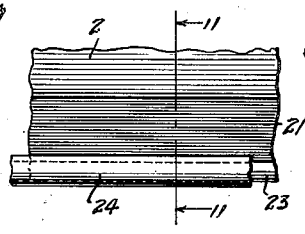


FIG. 11.

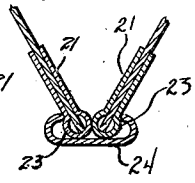


FIG. 12.

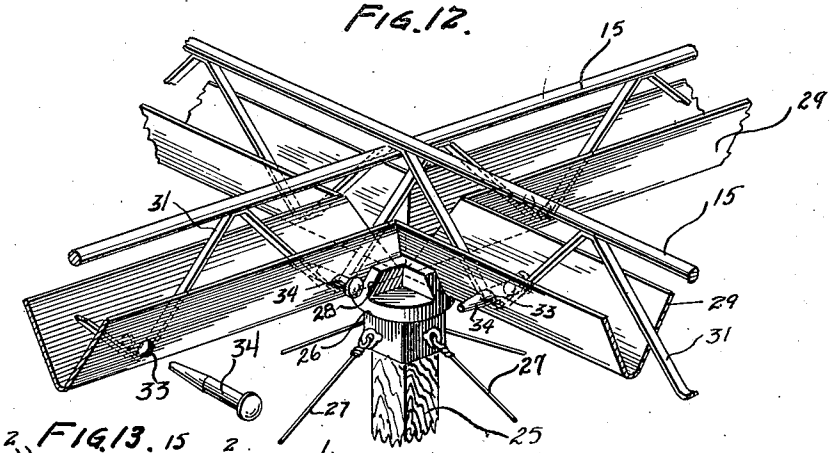
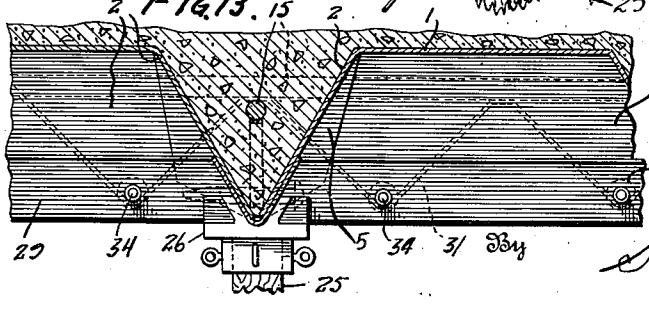


FIG. 13.



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FIG. 14.

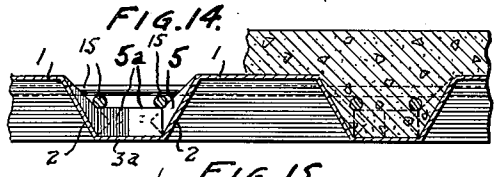


FIG. 15.

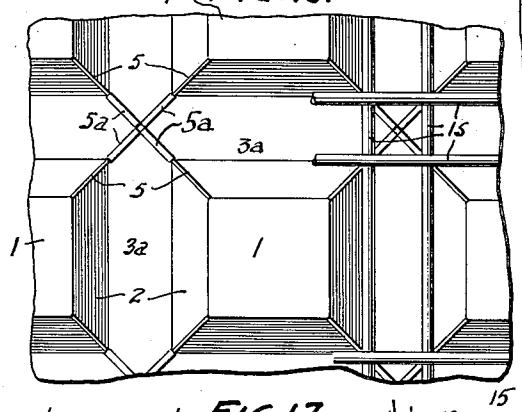


FIG. 16.

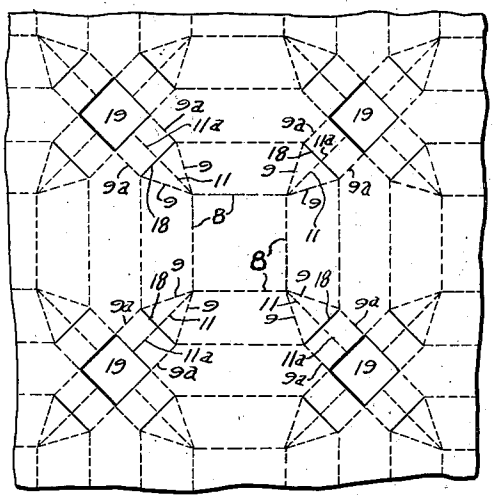


FIG. 17.

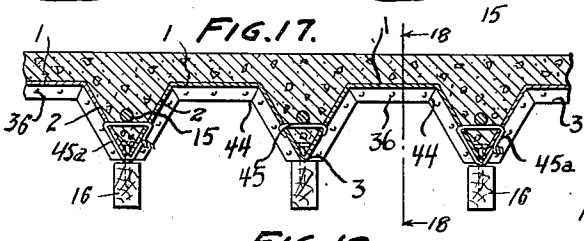


FIG. 18.

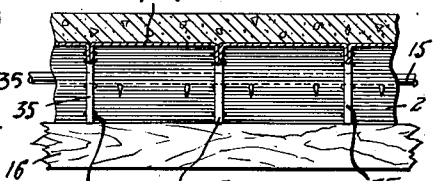


FIG. 19.

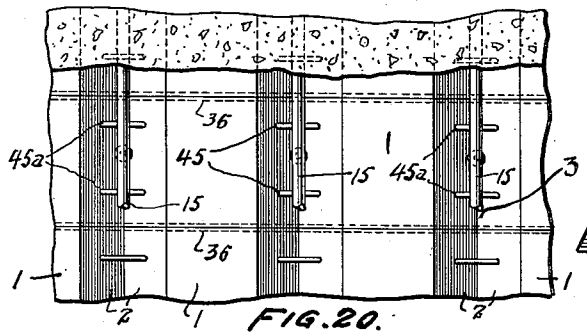


FIG. 21.

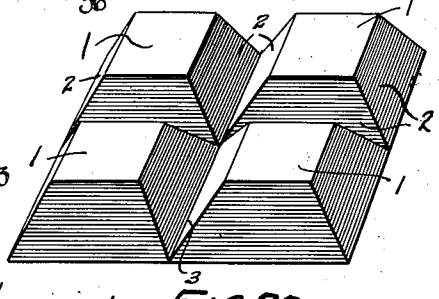


FIG. 20.

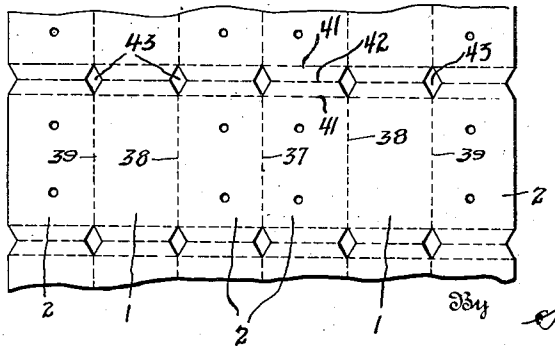
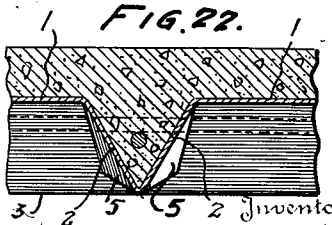


FIG. 22.



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Patented Dec. 7, 1937 2,101,019

UNITED STATES PATENT OFFICE

2,101,019

MOLDING FORM FOR STRUCTURAL MATERIAL

David M. Bowes, Bath, N. Y.

Application May 4, 1934, Serial No. 723,990

21 Claims. (Cl. 25—131.5)

This invention relates to the construction of buildings, and more particularly has reference to a form for the molding of certain structural materials.

In the pouring of concrete, and certain other materials used in the construction of buildings, it is of course necessary to provide forms in order to support and shape the poured material until it has developed the inherent qualities of such material by setting. The forms heretofore employed have been open to certain serious disadvantages. In the first place, such forms have been relatively expensive initially, and upon completion of the particular job in which they were used, they were either discarded or, if salvaged, required relatively expensive reconditioning. These former devices were difficult of construction and of removal from the set concrete. Also, transportation of prefabricated or factory made forms has been relatively expensive and difficult due to the fact that heavy materials are necessary to withstand the rough handling in use and re-use. Collapsible and portable forms or materials designed to create shapes and voids in poured concrete structures have heretofore been made of relatively heavy and cumbersome materials to fulfill their function and withstand the rough handling of use and re-use. There have also been numerous objections with respect to certain details of these prior forms.

To overcome the above objections, and others not specifically mentioned, is one of the objects of my invention.

Another object of my invention is to provide a form for the molding of structural materials that may be economically and readily manufactured and transported.

Yet another object of my invention is to provide such a form that is so inexpensive to manufacture that it may be readily discarded upon setting of the various structural materials or simply left in place.

A still further object of my invention is to provide a novel material from which a form may be manufactured.

With these and other objects in view, which may be incident to my improvements, the invention consists in the parts and combinations to be hereinafter set forth and claimed, with the understanding that the several necessary elements comprising my invention may be varied in construction, proportions and arrangement without departing from the spirit and scope of the appended claims.

In order that my invention may be more readily understood, reference is made to the accompanying drawings, in which several specific embodiments of my invention are depicted, it being distinctly understood, however, that various modifications may be made therein without departing from the spirit of my invention. In these drawings, in which similar numerals refer to corresponding parts:

Figure 1 is a top plan view of one embodiment of my invention, showing a portion of structural material deposited thereon.

Figure 2 is a sectional view along the line 2—2 of Figure 1, looking in the direction of the arrows.

Figure 3 is a plan view of the plane material from which the form is made up, and showing the scoring or stamping thereon and cut out portions necessary for the embodiment of Figure 1.

Figure 4 is a detailed perspective view of the device shown in Figure 1.

Figure 5 is a detailed view of the walls and ribbed member prior to folding.

Figure 6 is a detailed view showing that section of the device which is represented in Figure 5, after the same has been folded and assembled.

Figure 7 is a sectional view along the line 7—7 of Figure 6, looking in the direction of the arrows.

Figure 8 is a view of one means for binding two adjoining sections together.

Figure 9 is a sectional view along the line 9—9 of Figure 8, looking in the direction of the arrows.

Figure 10 is a detail view of an alternative means for binding two sections together.

Figure 11 is a sectional view along the line 11—11 of Figure 10, looking in the direction of the arrows.

Figure 12 is a view in perspective of a supporting means for the form, and also of one arrangement for the reinforcing means.

Figure 13 is a detailed view of the device shown in Figure 12, with the molding form and concrete in position.

Figure 14 is a sectional view of a slight modification of the device shown in Figure 1, and in which a pair of reinforcing rods are employed.

Figure 15 is a top plan view of the modified form of my invention shown in Figure 14.

Figure 16 is a plan view of the plane material prior to bending and folding to secure a structure such as shown in Figures 14 and 15.

Figure 17 is another modification of the molding form, in which all of the channels are longitudinal and parallel.

Figure 18 is a sectional view along the line 18—18 of Figure 17.

Figure 19 is a top plan view of the modification shown in Figures 17 and 18.

Figure 20 is a view of the plane material prior to bending and folding in order to secure a form such as shown in Figures 17 through 19.

Figure 21 is a view of a modified form of the device shown in Figure 1, and in which the reinforcing ribs are turned inwardly of the raised portions.

Figure 22 is a sectional view of the device shown in Figure 21, and with the strengthening ribs turned inwardly.

While I shall refer herein to my invention as being adapted for the pouring of concrete, it will of course be understood that it may be employed for various other materials, such as gypsum, for instance.

The substances of which my molding forms may be made are many and various, and will be referred to in more detail hereinafter. One of the principal characteristics of my invention is that I employ to advantage the strength and stiffness of a light plane material by so bending and shaping such material that there are provided a plurality of relatively small units. By this shaping sufficient strength is imparted to support large areas or masses of a superimposed material during a period sufficient to develop within such superimposed mass the inherent qualities of strength of that mass.

Inasmuch as a relatively heavy cardboard may be employed, I shall refer to the material of my molding form as such.

Referring to Figure 1, such cardboard may be bent so that there is formed a plurality of raised portions 1. I have shown this raised portion as a plane square surface, but as will be seen hereinafter, such raised portion may assume various shapes. Side walls 2 extend from the raised surface 1 to channels 3. As disclosed in the drawings, these side walls may be sloping. It will be noted that the channels 3 intersect one another and form, in effect, a mesh-like arrangement.

The size of the raised portions, walls and channels will vary with the type of material which is superimposed thereon. While not desiring to be limited to any specific figures, I have found that, when the form is made of corrugated fiber boards, and where the imposed material is reinforced, the reinforcement may be placed approximately sixteen inches on center, and the surface 1 will have an area of about sixty-four square inches. The bending of the form into the shape depicted in Figures 1 and 2 suffices to support approximately three inches of concrete for the necessary time to allow such concrete to set. The dimensions mentioned herein may be varied, however, as occasion warrants.

As best shown in Figures 2 and 4, I secure additional strength in my form by using the strengthening ribs 5. These ribs are, in effect, extensions of the side walls 2 at the point that such side walls join a contiguous wall. These ribs, therefore, are actually composed of two layers of the material bent back upon one another. As best shown in Figures 2 and 6, these ribs have a free edge 6 which slopes downwardly from the plane surface 1, and also a vertical edge 7. The vertical edge 7 is adapted to abut against the corresponding edges of adjoining units, as shown in Figure 4. The point of this abutment is substantially the center of intersection of the channels 3.

Referring to Figure 3, there is disclosed a view of the substance from which the form is made up, showing the scoring or stamping thereon for guidance in bending or folding of the material. In the drawings, for instance, the dotted lines 8 indicate the line along which the material must be bent in order to secure the plane surface 1. The lines 9 represent the bends that are necessary to form the junction between two side walls. A further fold 11 is made in the material 1, in combination with the folds 9, which forms a strengthening rib 5. It is necessary to cut away certain portions in order to secure the desirable arrangement of the form, and in Figure 3 the full lines 12 indicate a hexagonal cut out section.

In Figures 5 and 6 a more detailed view of the process of making the strengthening rib, and the completed rib, is shown. From this it will be noted that the fold 11 forms the free edge 6 of the completed rib, while a portion of the hexagonal cutaway section 12 forms the vertical edge 7. If desired, each folded half of the rib 6 may be cut out as at 13 and provided with a tab 14. As shown in Figure 7, the tab 14 is adapted to be inserted through the notch 13 of the opposed section and bent back. These tabs serve to maintain the several portions of the rib as a unit. The cutaway sections 13 permit the concrete to flow through the ribs into adjacent channels.

As best shown in Figure 2, reinforcing rods 15 may rest upon the intersecting ribs 5, and be supported above the base of the channels 3. The transverse rods are then arranged in the transverse channels and upon the other rods 15. It will be seen that the reinforcing rods 15 permit the flow of concrete therebelow, and thus become embedded well within the concrete.

There is also shown in Figure 2 a falsework 16, upon which the molding form and concrete may be supported until the concrete sets. Preferably the channel portions 3 rest upon this falsework and may be secured thereto by means of nails or other fastening devices 17. After the concrete has set, the falsework may be removed, while the nails remain embedded in the concrete. These nails may then be used to secure lathing or other covering means to the base of the concrete.

In Figures 1 through 4, I have shown a molding form that is adapted for use when only a single reinforcement is desired in each channel. Of course, the number of reinforcements can be increased, and there is disclosed in Figures 14 through 16 the slight modification that is necessary to accomplish this. Instead of providing a V-shaped channel such as in Figures 1 through 4, I here provide a flat base 3a for the channel. Referring to Figure 16, it will be noted that the lines 8, 9 and 11 are provided, along which folds are made, the same as in Figures 1 through 4. However, an additional area is left between contiguous designs, in order to provide for the flat base of the channel 3a. Furthermore, folds 9 and 11 are extended as at 9a and 11a in order to provide extensions 5a of the strengthening ribs. Also, it is necessary to slit the material along the line 18 in order to permit the angular adjustment between rib 5 and its extension 5a. As shown by the dotted lines in Figure 14, the rib 5 extends within the rib extension 5a. Also, a square cut out section 19 is made in lieu of the hexagonal cut away section 12 of Figure 3. It is of course obvious that tabs, such as 14, may be employed upon both the ribs 5 and extensions 5a of this modification.

With this arrangement it will be noted that the reinforcing rods 15 may be arranged in pairs within each channel, while the transverse rods

may be arranged in a similar fashion, but imposed thereover.

I prefer that the complete form for any particular job be made up of a series of units. Preferably, each unit should terminate in the base of a channel, as shown along the lower edge of Figure 1.

Although positive joints between the several units are not usually necessary, I find that it is preferable to join the units by adhesives or in other mechanical ways, particularly where the joints are not protected by falsework.

I have shown in Figures 8 through 11 two specific forms of mechanical joints. According to Figures 8 and 9, I would provide a reinforcing binding **21** which would fit over the free edge of the unit and firmly bind the same. These binders are preferably made of metal, although other equivalent materials may be used in lieu thereof. As shown in Figure 8, the binders **21** are provided with spaced tongues **22**, and these tongues may be bent over and around the binder of an adjoining section at the spaces between the tongues of such adjoining section. These spaces are preferably of the same width as the tongues. If necessary, suitable riveting may be employed to secure the binders to the form.

An alternative form of securing means is disclosed in Figures 10 and 11. Here also I employ a binder **21**, but beads **23** are formed on this binder in place of the tongues **22**. A spring clip **24** may be employed to clasp about the beads and hold such beads and their respective units in firm engagement. The clip may be continuous or not, as desired; and may be closed down on the beads by the use of a pair of pliers, if necessary. It will be observed that the securing means shown in Figures 8 through 11 permit of the ready assembly of a series of units. Therefore, the molding forms may be made up of standard size, and merely assembled in sufficient numbers for any particular job.

If desired, I may use additional structure in assembling my forms, such as shown in Figures 12 and 13. In this instance the falsework may embrace a plurality of suitable uprights **25**, provided with a mounting **26** at its top, to which guy ropes **27** may be attached. The mounting **26** may be provided with V-shaped and intersecting channels **28** which are adapted to receive V-shaped and intersecting channel members **29**. The members **29** are of substantially the same shape as the channels of the molding form, as shown in Figure 13. These channel members **29** are preferably made of metal, although of course other materials may be employed.

As stated, the channel members **29** correspond to the channels of the molding form, and are adapted to support such form. In assembling the form, the form is merely inserted in the channel member **29**. For this type of construction, I may use a special arrangement for the concrete reinforcing members. As shown in Figure 12, the reinforcing rods **15** are provided along one side with V-shaped truss members **31**.

The reinforcing rods **15** may be arranged either before or after the forms are arranged in the channel members **29**. In this type of structure the channel members **29** are provided with holes **33**, and corresponding holes may be formed in the channels of the molding form. Pins **34** are adapted to be inserted through these holes, and the trusses are so arranged within the mold channels that the pins **34** securely hold the reinforcing rods **15** in position.

As will be hereinafter pointed out, the strengthening ribs **5** may extend inwardly of each form, in contradistinction to extending outwardly into the channels as shown in Figure 4. In connection with the device shown in Figures 12 and 13, it is sometimes preferable to have such strengthening ribs extend inwardly and lie flat against one or the other walls from which the rib is formed. As shown in Figure 13, the rib **5** will therefore rest between one side of the channel member **29** and the corresponding wall **2**. Incidentally, when employing the channel member **29**, it is preferable to have the trusses of certain of the reinforcing rods **15** higher than the trusses of other rods, and the angle members are designed to overlap in the same amount and to compensate for the overlap of the rods, or the overlap may be taken up in the height of the truss.

While I have referred above to a mold form provided with transverse channels, it is within the scope of my invention to provide such a form which has only parallel channels. Such a form is disclosed in Figures 17 through 20. In this case, the flat surfaces **1** run the length, or the width, of the entire unit, as do also the channels **3**. When employing such a construction, I prefer to give additional support by reinforcing ribs **35**. These ribs preferably extend downwardly from the form, although they may readily extend above. These ribs may be fastened together by means of staples or rivets **36**, and may be properly reinforced if necessary.

Figure 20 shows the blank from which such a form is made. This blank is suitably scored or stamped to indicate the lines along which the folds should be created, and in Figure 20 the dotted line **37** indicates the fold at the base of one channel; the lines **38** indicate the folds at the top of that channel; and the lines **39** represent the folds at the top of the two contiguous channels. Lines **41** and **42** indicate the places at which the transverse folds must be made in order to form the reinforcing flanges **36**, the fold at line **42** being the lower part of such flange. Diamond-shaped cut out sections **43** are necessary in order to permit of the proper folding, such cut out portion **43** providing for the line **44** shown in Figure 17.

It will be observed that in the form of mold shown in Figures 17 through 20, no provision is made for the strengthening ribs **5**, or any equivalent structure. Therefore, in order to maintain the reinforcing rods **15** in position I provide a stirrup-like member **45**, which extends across the channel and is turned at its ends to grip the walls of the channel. I have shown at **45a** a modified form of stirrup-member which provides additional support for the form. In this modification, the stirrup extends down and around the outer side of the channel, and the free ends are twisted. The stirrup member **45a** may, if desired, be used in lieu of the device shown in Figures 8 through 11 as a means for securing two sections together.

It is of course obvious that the channel of Figures 17 through 18 may be increased in width if desired, the same as in the case of the form shown in Figures 14 through 15. This is accomplished by merely inserting an additional fold in the blank. As stated above, it is also to be noted that the strengthening ribs **35** may be upturned, and when this is done the stirrup **45** may be omitted, inasmuch as such upturned ribs

will serve to hold the reinforcing rod **15** above the base of the channel.

Reference has been made above to the fact that the strengthening ribs **5** may be turned inwardly. Such a construction is shown in Figures 21 and 22. The same pattern is employed in this case as in the case of Figure 3, and the sole modification resides in extending the ribs inwardly instead of outwardly. When so extended inwardly, as best shown in Figure 22, the rib **5** normally subtends the angle between the two adjoining walls. The ears **14** may be employed in this case, the same as when the ears extend outwardly, or other suitable securing means may be employed.

The molding form may be made up of various materials. As heretofore stated, corrugated fiberboard may be used, or relatively heavy cardboard, metal, or reinforced fabric. In all events, the material should have sufficient strength and stiffness so that when it is bent into the desired form it will meet the stresses and strains imposed upon it during the initial setting of such superimposed material. It will be apparent that various substances will meet such requirements, and I prefer that the most economical be employed. As stated, I prefer a sufficiently inexpensive material so that it will not be necessary to attempt to salvage the molding form after the concrete has set. In certain instances, the form may be removed upon completion of the job, but usually I prefer to merely let it remain, and to cover the same with lathing, plaster, or other such finishing material. For practical reasons, it may be advisable to employ a material that is weatherproof and fireproof.

One efficacious material for use in my molding form (particularly when the form is to remain after the concrete sets) is made up by the incorporation of two or more substances, whether by interweaving, compressing, or cementing. One of these substances should possess sufficient stiffness and tensile strength for effectiveness in structural design, whether as a tensional member or merely as a stiffener. The other substances should serve as a bulk or body, and should have relatively high absorptive qualities, so that it will adhere to the material superimposed upon it, and sufficient strength to retain the material during the required period. From the foregoing, it is obvious that a piece of wire lath, for example, shaped and coated with a sufficiently fibrous material as gypsum or asbestos cement or asbestos-asphalt would serve the purpose of the form. Or burlap or paper interwoven with wire reinforcement or such reinforcement cemented between or upon paper or felt would accomplish the same result; or a cloth or woven membrane with wire threads interwoven at suitable intervals, and, if necessary or desirable, starched or varnished or otherwise filled.

It is also obvious that I have provided a novel design for molding forms and with respect to this design, materials other than those mentioned above may be employed. For instance, the form may be made up from a ceramic material, such as terra cotta, metal, metallic material, or any other suitable substance.

It will be noted from the foregoing that I have provided an economical molding form that may be readily assembled, and which is sufficiently inexpensive so that it may be either left in the structure, or at least no effort need be made to salvage it. It will be appreciated that my basic invention is sufficiently flexible to meet varying conditions encountered in structural work. It is of course apparent that it may be used not only for the construction of flat surfaces such as floors and roofs, but may also be employed for walls, arches, pillars and other elements in buildings. Its light weight and small bulk facilitate transportation of it, and it may therefore be made up in standard units and manufactured at factories on a large scale. The small contact points to applied materials, such as metal, lathe and plaster, make a water-, moisture- and stainproof construction possible.

It will of course be apparent that various combinations may be made among the several individual elements referred to above and depicted in the drawings. For instance, the structure shown in Figure 1 may be provided with reinforcing ribs such as **35** shown in Figure 17, or with stirrup members **45** or **45***a* such as shown in the same figure. Again, the falsework and channeled members disclosed in Figures 12 and 13 may be employed with forms such as those shown in Figures 16 or 19. In other words, the details heretofore mentioned may be readily incorporated in any of the basic forms of my invention.

While I have shown and described the preferred embodiment of my invention, I wish it to be understood that I do not confine myself to the precise details of construction herein set forth, by way of illustration, as it is apparent that many changes and variations may be made therein, by those skilled in the art, without departing from the spirit of the invention, or exceeding the scope of the appended claims.

I claim:

1. A form for molding structural material comprising a strip of a pliable plane substance bent to form a plurality of raised sections separated from one another by intersecting channels.

2. A form for molding structural material comprising a pliable substance forming a plurality of raised and flat surfaces, sloping surfaces extending from such raised portions to intersecting channels which separate the raised portions.

3. A form for molding structural material comprising a relatively light and pliable substance bent to form a plurality of raised planular surfaces, surfaces extending from such planular surfaces to channels separating the raised portions, and means integral therewith to maintain above the base of each channel a reinforcing member for the structural material.

4. A form for molding structural material comprising a plurality of raised planular surfaces, surfaces extending downwardly from such planular surfaces to intersecting channels separating the raised portions, and means integral with the downwardly extending surfaces and located at the intersection of the channels to support a reinforcing member for the structural material above the base of each channel.

5. A form for molding structural material comprising a plurality of contiguous frusto-pyramids, so arranged as to form intersecting channels therebetween, each of the walls of the frusto-pyramids being extended to form strengthening ribs along the lines of junction of the walls.

6. A form for molding structural material comprising a plurality of contiguous frusto-pyramids so arranged as to form intersecting channels therebetween, each of the walls of the frusto-pyramids along the line of junction with an adjoining wall being extended into the correspond-

ing point of intersection of two channels to form a strengthening rib.

7. A form for molding structural material comprising a plurality of contiguous frusto-pyramids so arranged as to form intersecting channels therebetween, each of the walls of the frusto-pyramids along the line of junction with an adjoining wall being extended into the corresponding point of intersection of two channels to form strengthening ribs, one edge of said rib being adapted to abut against similar ribs from an adjacent frusto-pyramid.

8. A form for molding structural material comprising a plurality of contiguous frusto-pyramids so arranged as to form intersecting channels therebetween, each of the walls of the frusto-pyramids being extended to form strengthening ribs along the lines of junction of the walls, said ribs projecting inwardly of the frusto-pyramid.

9. In a form for molding structural material made up of a plurality of raised portions separated by channels, supporting walls extending from the raised portions to the adjacent channels, each wall being extended beyond the normal point of intersection with an adjoining wall, the extensions of two adjoining walls being coextensive and lying flush with one another, corresponding cut away sections in each extension, and means adapted to extend through such cut away sections to maintain the extensions together.

10. A form for molding structural material comprising a plurality of sections of a pliable substance bent to form a plurality of raised sections separated from one another by channels, each section being provided along one edge with a reinforcement, and spaced ears on the reinforcement adapted to engage a reinforcement on an adjoining section to securely bind the two sections together.

11. A form for molding structural material comprising a plurality of sections of a pliable substance bent to form a plurality of raised sections separated from one another by channels, each section being provided along one edge with a beaded reinforcement, and a clip adaped to engage the beads when two sections are juxtaposed to securely bind the two sections together.

12. A device for use in the pouring of structural material comprising suitable falsework, a channeled member mounted on said falsework, a molding form supported by the channeled member, and reinforcements for the structural material, said reinforcements being trussed in the channel below the center of gravity in the structural section.

13. A device for use in the pouring of structural material comprising suitable falsework, a channeled member mounted on said falsework, a molding form supported by the channeled member and provided with channels corresponding to the channels of the said member, and reinforcements for incorporation in the structural material below the center of gravity thereof, said reinforcements being supported within the channels of the molding form by means of a truss and pins extending through the channel member and engaging the truss.

14. A form for molding structural material comprising a plurality of raised sections separated from one another by channels, said channels being of sufficient width to accommodate a plurality of reinforcing members for the structural material, and means integral with the channels for maintaining the reinforcing members above the base of the channels.

15. A form for molding structural material comprising a strip of pliable substance bent to form a plurality of raised sections separated from one another by V-shaped channels, reinforcements formed by bending the strip at an angle to the channels, and stirrups extending across the channels and adapted to maintain a reinforcement for the structural material above the base of the channels.

16. A form for molding structural material comprising a strip of a pliable substance bent in one direction to form a plurality of raised sections separated from one another by parallel V-shaped channels and bent in another direction to form transverse strengthening ribs, and spaced stirrups extending across the channels and around the exterior of the base thereof.

17. A form for molding structural material comprising a strip of a pliable plane substance bent to form a substantial frusto-pyramid with a reinforcing rib along the junction of each side wall.

18. An article of commerce for use in construction comprising a strip of a pliable plane substance bent to form a central plane with other planes angularly extending from the perimeter thereof and intersecting one another, the excess material of the plane substance forming stiffening ribs at the intersections of the last-mentioned planes.

19. An article of commerce for use in construction comprising a strip of a pliable plane substance bent to form a central plane with other planes angularly extending from the perimeter thereof and intersecting one another, the excess material of the plane substance forming stiffening ribs which bi-sect the angles of intersection of the last-mentioned planes.

20. An article of commerce comprising a unit provided with a central plane, planes angular thereto about the perimeter of the central plane, said angular planes intersecting, and other planes angularly disposed at the intersection of the angular planes.

21. A form unit for molding structural material comprising a plurality of raised surfaces, and sloping surfaces extending from such raised surfaces and abutting corresponding sloping surfaces of adjacent raised surfaces, to thereby form intersecting channels which separate the raised surfaces.

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