United States Patent [19]

Maier

[11] **3,815,861**

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[54] **COLLAPSIBLE FORM FOR ERECTING OF MONOLITHIC STRUCTURES**

[76] Inventor: **Josef Maier,** Kreuzluhlstrasse 5, 7611, Steinach, Germany

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[52] **U.S. Cl.** **249/19,** 249/27, 249/181, 249/185

[51] **Int. Cl.** **E04g 11/02**

[58] **Field of Search** 249/11, 12, 19, 24, 26–29, 249/178, 180–182, 184–185, 218

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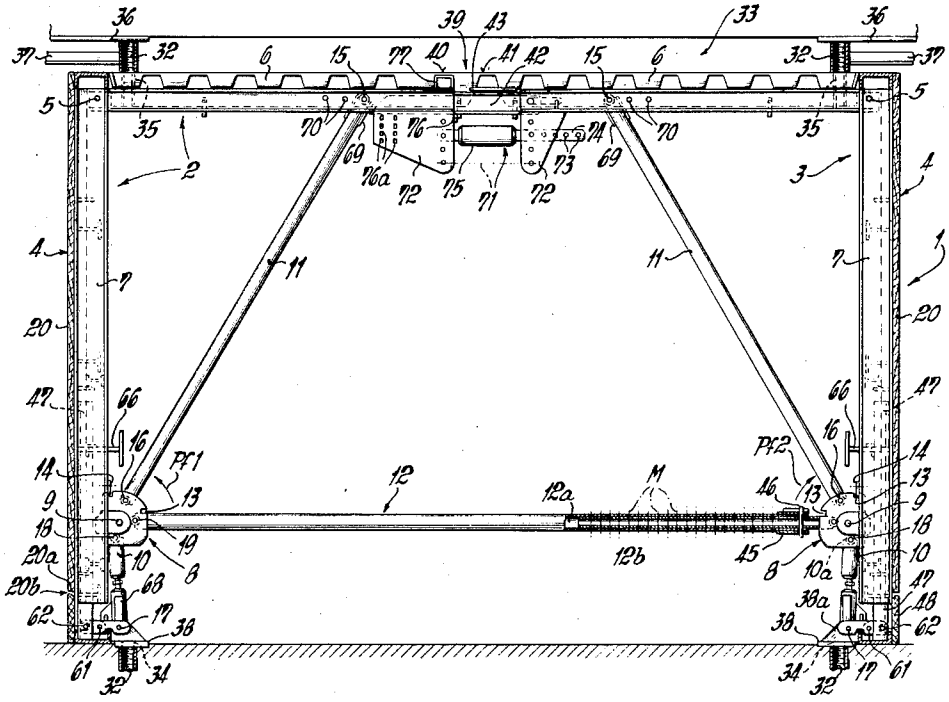
Primary Examiner—Robert D. Baldwin
Assistant Examiner—John McQuade
Attorney, Agent, or Firm—Michael S. Striker

[57] **ABSTRACT**

A pair of transversely spaced upright angle units each have upper end portions and an upright wall panel provided with a lower end portion. Ceiling panels are pivoted to the respective upper end portions, and adjustable braces pivotally connect the angle units with one another and with a floor, and also pivotally connect the ceiling panels with the respective angle unit. Each angle unit has at least one rotatable element associated with it and with its braces, and the rotatable elements are turnable about respective horizontal axes and are connected with the braces so as, when turned, to displace the angle units toward or away from one another and also to raise or lower the ceiling panels, depending upon the direction of rotation of the rotatable elements, for respectively erecting and striking the form.

49 Claims, 10 Drawing Figures



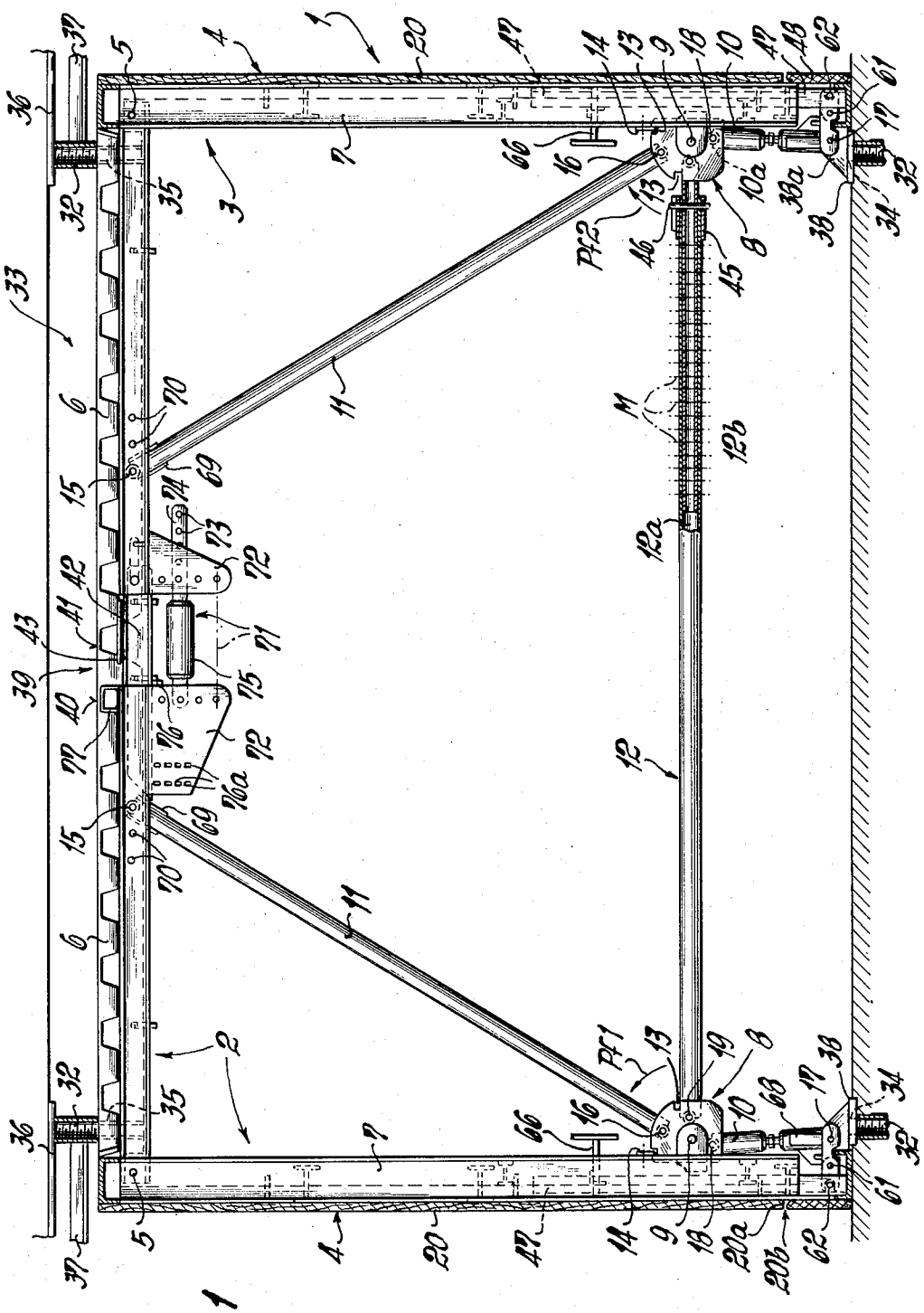


FIG. 1

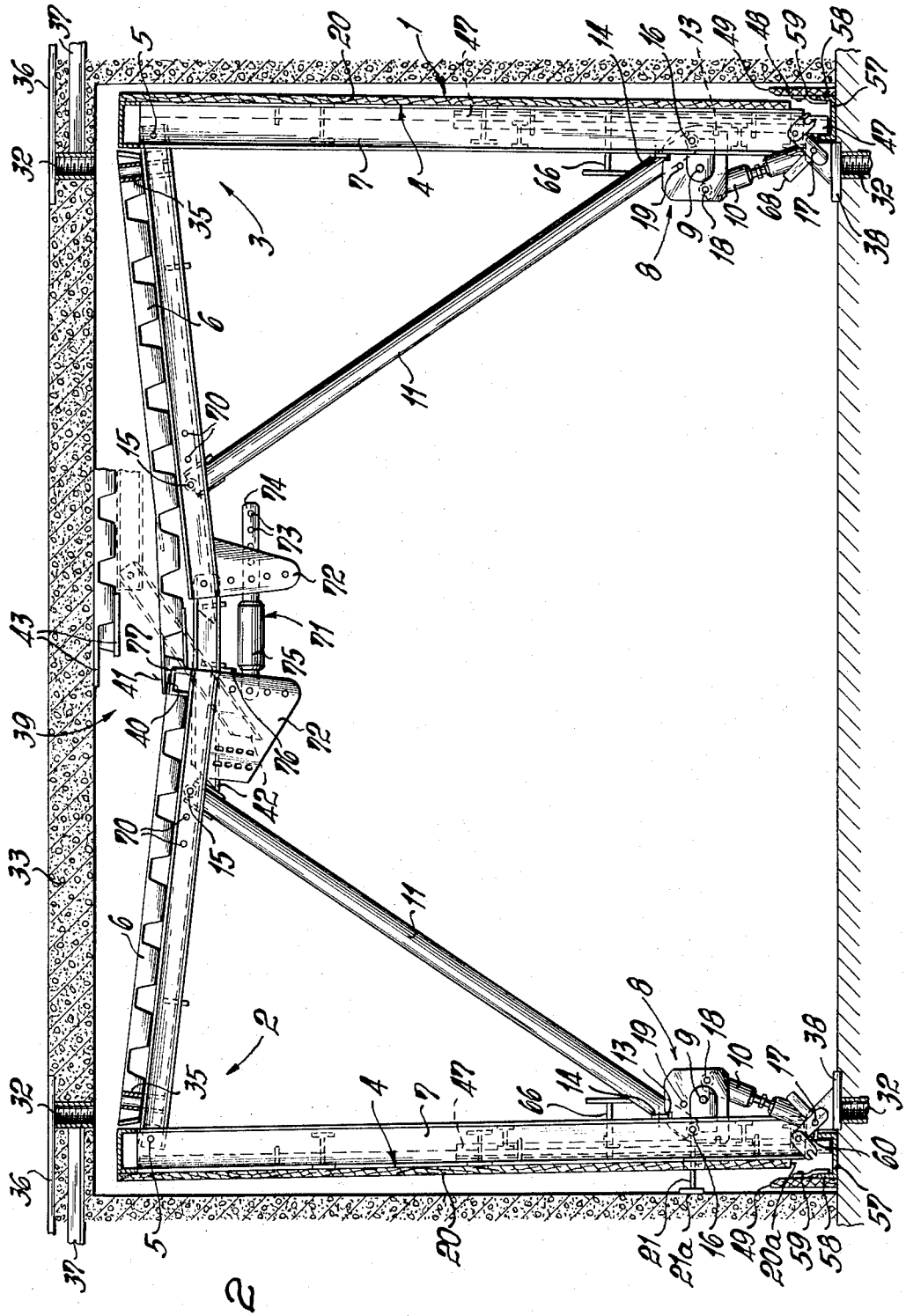
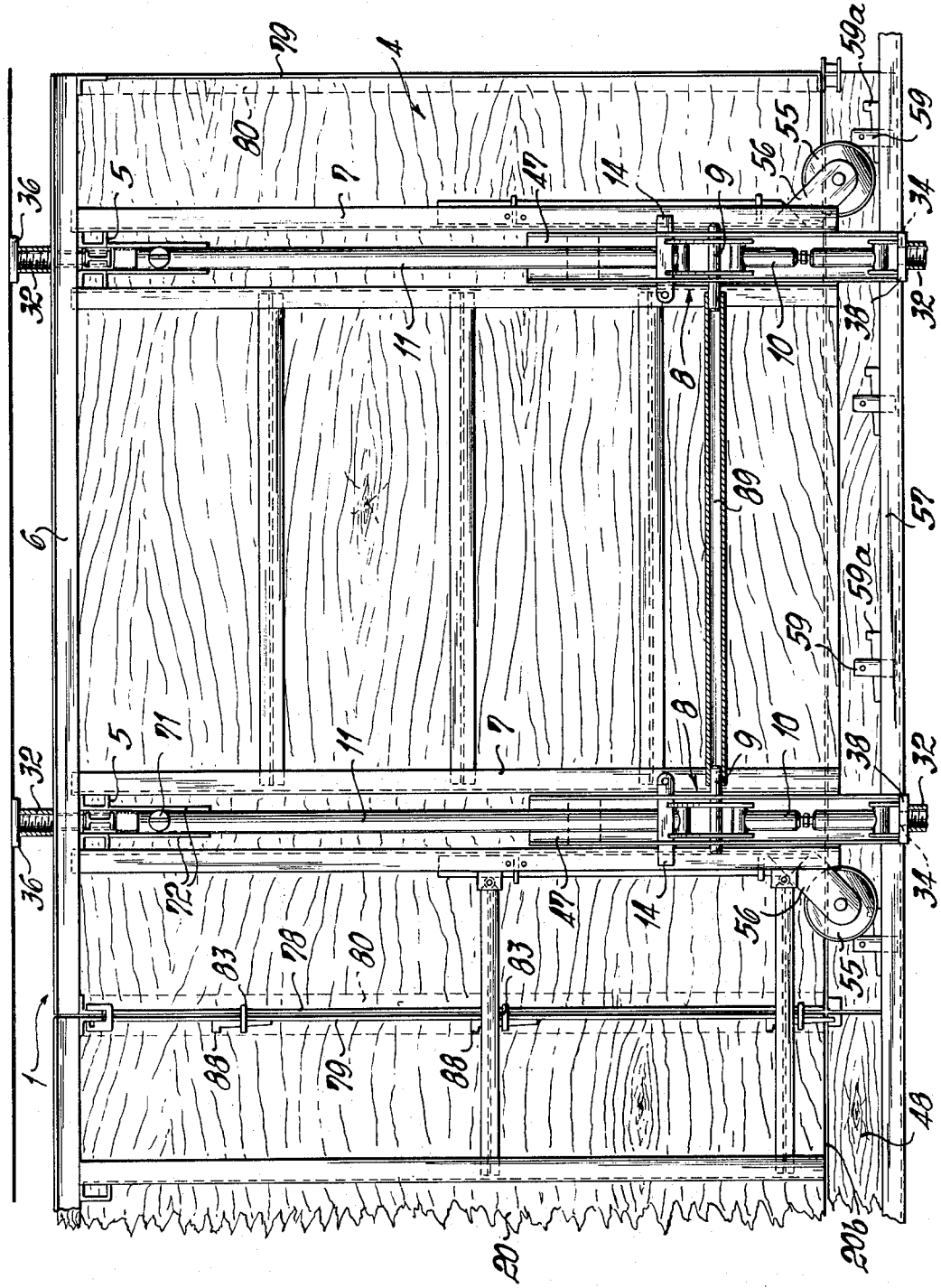


FIG. 2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59a
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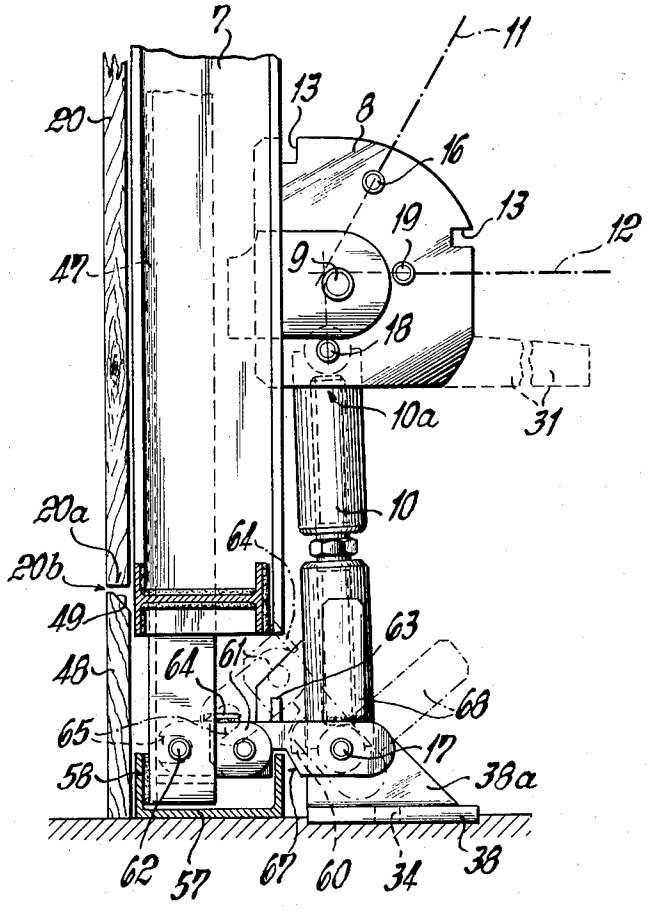
FIG. 3

FIG. 4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38a
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FIG. 5

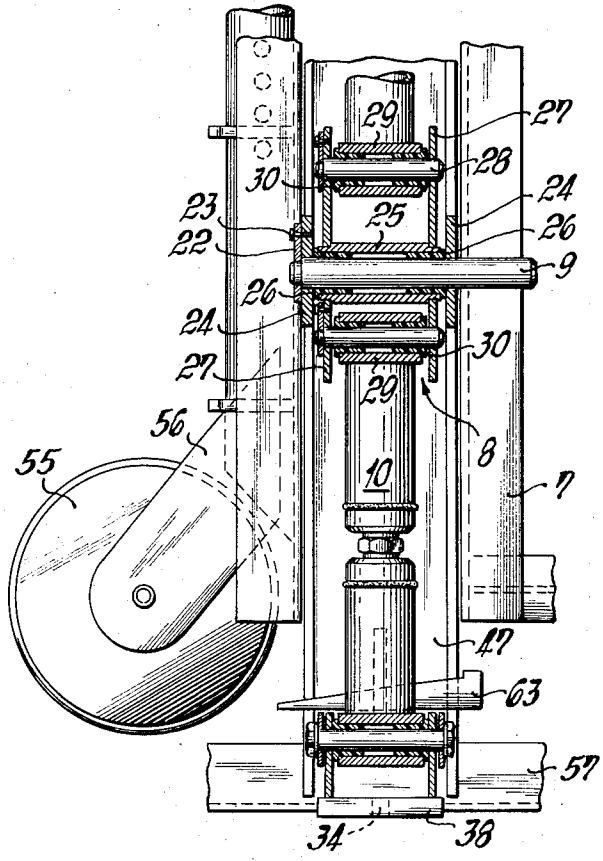
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FIG. 6

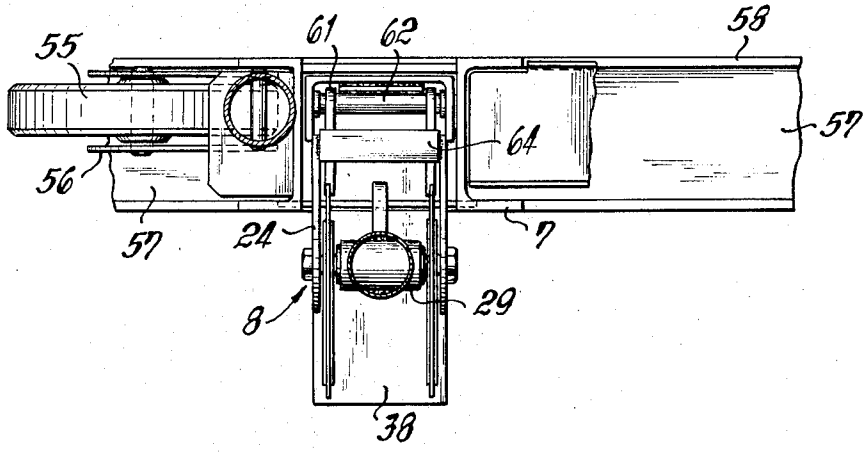
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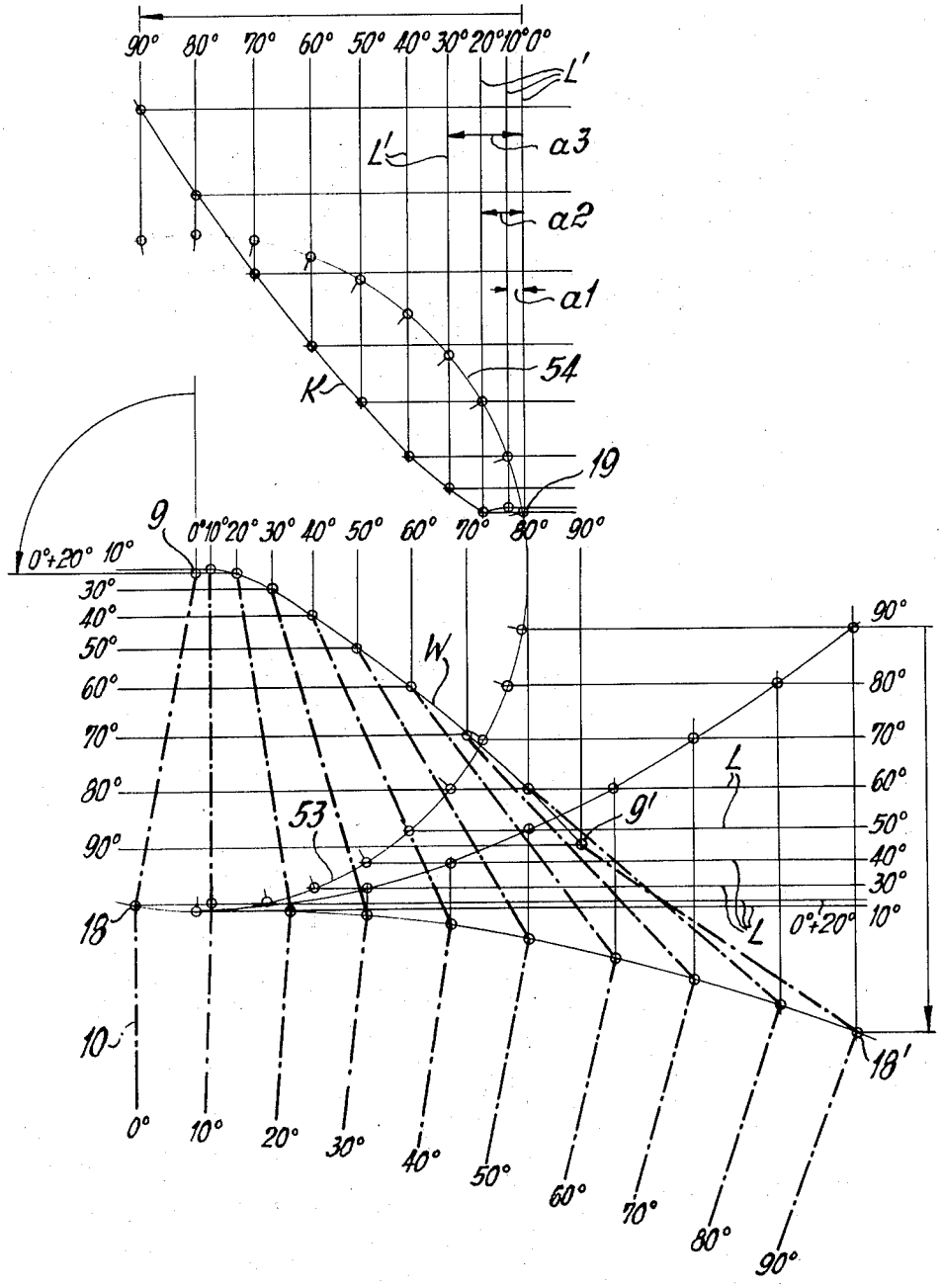
FIG. 7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L'
L'
a3
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a1
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K
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0°+20° 10°
30°
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0° 10° 20° 30° 40° 50° 60° 70° 80° 90°
9'
L
L
0°+20°
10°
18'

FIG. 8

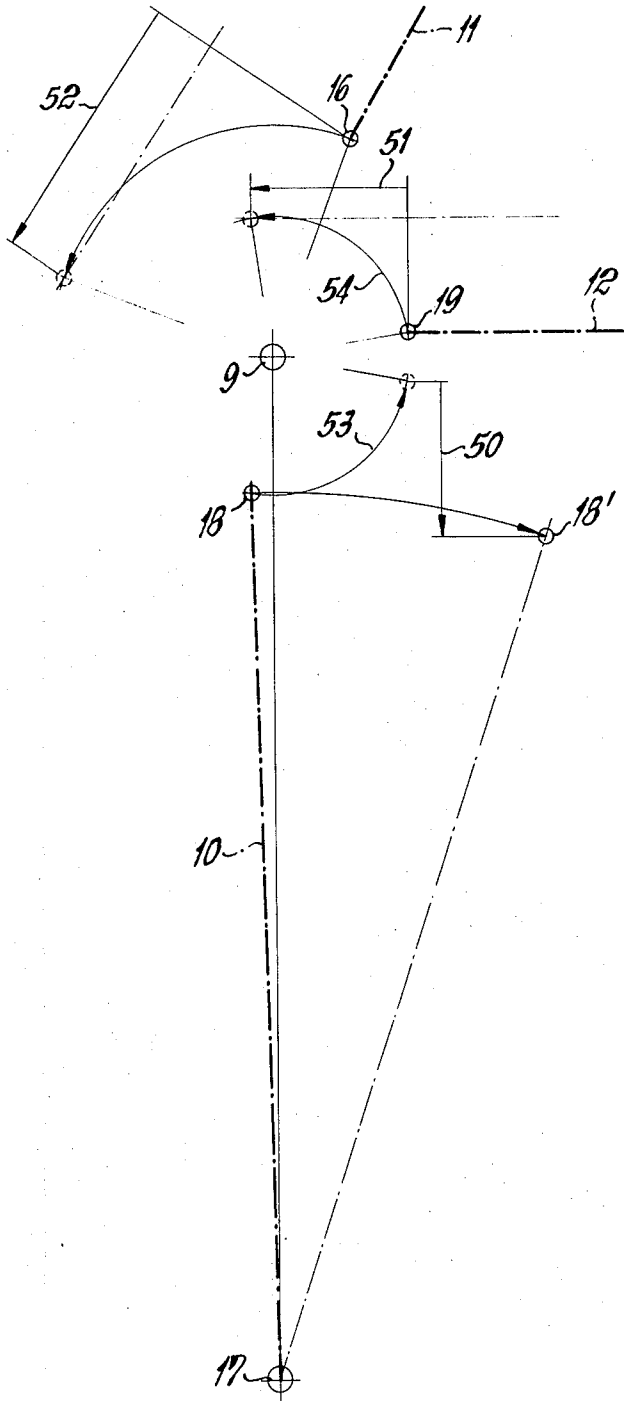

FIG. 9

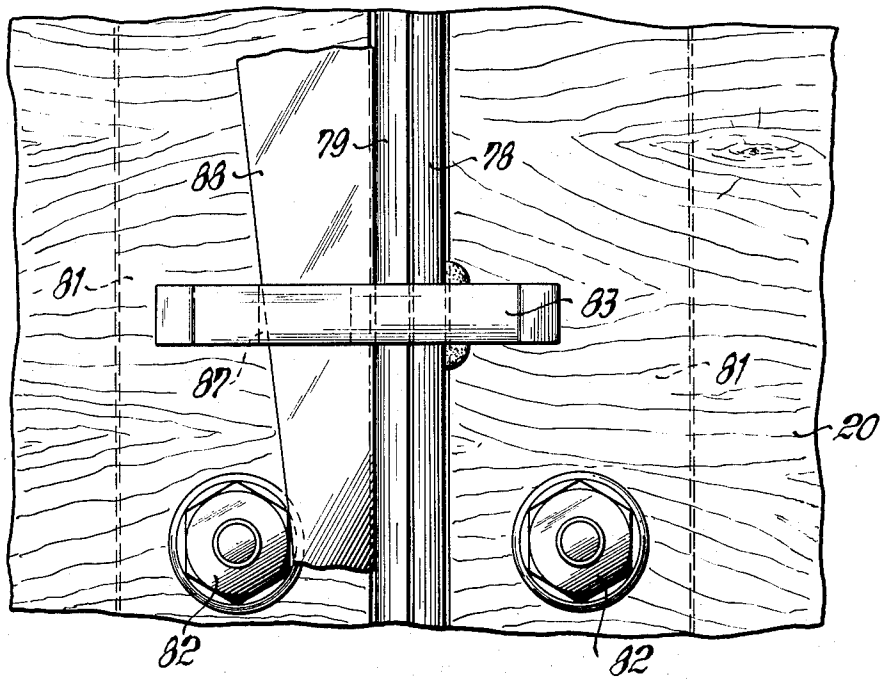
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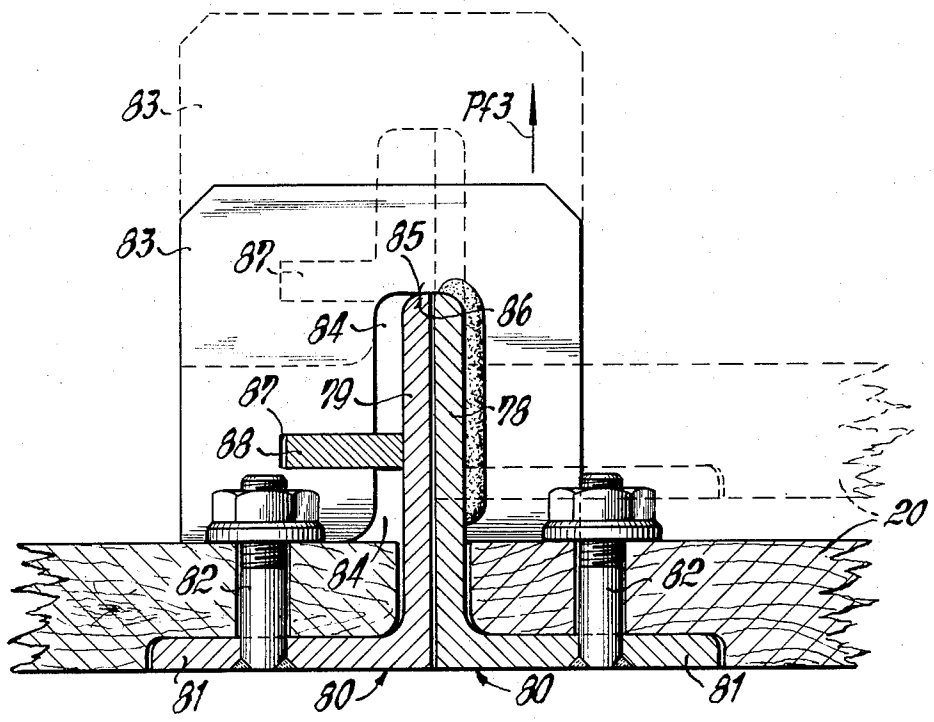
FIG. 10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COLLAPSIBLE FORM FOR ERECTING OF MONOLITHIC STRUCTURES

BACKGROUND OF THE INVENTION

The present invention relates generally to a form for erecting of structures having side walls and a ceiling, and more particularly to such a form by means of which rooms, buildings, tunnels or the like can be concreted.

Forms of this type are already known in the art and are erected to permit the pouring of concrete. After the concrete has hardened the form is removed, leaving behind the erected structure, such as a tunnel lining, a passage, a room or any other structure which can be so produced.

A particular type of form is utilized when multi-story buildings are erected, and permits the pouring of the walls and ceiling of an entire story at one time. Such forms must, of course, provide a construction which permits the pouring of the walls and ceiling and must, therefore, themselves have side wall panels and ceiling panels. It is possible to arrange such forms laterally adajcent one another in various desired arrangements, for instance each form may permit the pouring of the complete walls and ceiling of a room, so that several of them together can be used for simultaneously pouring the concrete for erecting an entire story of a building. Interior partition walls can then be constructed later.

While this type of form represents a definite advance in the state of the art, it does have certain disadvantages which make it less than ideal for its intended use. In particular, these forms require that the surface on which they are erected be provided with an upwardly extending soffit or base, to serve as a stop and a means of alignment for the erected form. Evidently, this is disadvantageous because there will be many instances where such a socket or base cannot be accepted. Thus, such sockets must be considered disadvantageous and constitute a source of unnecessary trouble and expense.

A further disadvantage of the known forms of this type is that when they must be struck, that is when they are disassembled and removed, the length of the supporting braces and/or base supports must be changed in order to permit the removal of the form from the newly-set concrete. If the form is subsequently reused, for instance if the next story of a building is to be poured using the same form, then the elements in question must be readjusted as to their length to bring them back to the desired dimensions.

Yet a further problem with these known constructions is that in order to remove them, that is to strike them, a series of operations must be carried out in a certain order which, if the order is not strictly adhered to, makes the striking of the form very much more difficult. Since, however, this is work that is usually performed by unskilled or at most semi-skilled labor, it is quite often observed that due to carelessness or possible ignorance, the operations are not carried out in proper sequence with the result that the removal of the form becomes very difficult and time consuming.

SUMMARY OF THE INVENTION

It is, accordingly, a general object of the present invention to provide an improved form of the type under discussion, which is not possessed of the disadvantages outlined above.

More particularly, it is an object of the present invention to provide such an improved form which can be readily erected and struck without requiring special equipment or adjustments.

A further important object of the invention is to provide such a form which can be erected and struck repeatedly without requiring any variations in the dimensions of its various components. This means that when the form is struck and subsequently re-erected, it is not necessary to carry out any adjustments to bring the form back to the dimensions required to identically duplicate the previously produced concreted structure.

A further object of the invention is to provide such a form which can be erected and struck without requiring the use of a socket.

In keeping with these objects, and with others which will become apparent hereafter, one feature of the invention resides in a form for erecting of structures having side walls and a ceiling. Briefly stated, this form comprises a pair of transversely spaced upright angle units having upper end portions and an upright wall panel provided with a lower end portion. Ceiling panels are pivoted to the upper end portions. Adjustable braces are pivotally connected to the angle units with one another and with the floor, and they pivotally connect the ceiling panels with the respective angle units. At least one rotatable element is associated with each angle unit and with the braces, and these elements are turnable about respective horizontal axes and are connected with the braces so as, when turned, to displace the angle units toward or away from one another and also raise or lower the ceiling panels, depending upon the direction of rotation of the rotatable elements, in order to respectively erect or strike the form.

More particularly, the braces are so connected with the respective rotatable element that, when the same is turned in requisite direction, it will change the position of the braces in such a manner as to either move the associated angle units and ceiling panels to erected position, or from erected position to struck position.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a partially sectioned end view, showing a form according to the present invention is erected operational condition;

FIG. 2 is a view similar to FIG. 1, showing a slightly modified embodiment in partially struck position;

FIG. 3 is a interior view of FIG. 1, on an enlarged scale;

FIG. 4 is a partially sectioned fragmentary side elevation of a detail of the embodiment in FIG. 1;

FIG. 5 is a view similar to FIG. 4, showing another detail as seen from the inside of the erected form;

FIG. 6 is a fragmentary plan view of a detail of the embodiment in FIG. 1;

FIG. 7 is a diagram showing the path traversed by certain components of the embodiment in FIGS. 1 and 2 during erecting and striking of the form;

FIG. 8 is a diagrammatic view showing the initial position of braces of the embodiment in FIGS. 1 and 2 while the form is in erected position, and the magnitude of positional changes undergone by these braces during striking of the form;

FIG. 9 is a side elevational view, in fragmentary illustration, showing the connection between two forms which are to be used together; and

FIG. 10 is a partly sectioned plan view of FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Before entering into a detailed description of the Figures, it is emphasized that FIGS. 1 and 3–8 all refer to a single embodiment of the invention. FIG. 2 refers to a slightly modified embodiment, but in reading this specification it should be kept in mind that aside from this slight modification, FIG. 2 is identical with FIG. 1. Thus, insofar as the consideration of the embodiment of FIG. 1 in a partially struck position is concerned, reference may be had to FIG. 2, because the modification in FIG. 2 over FIG. 1 does not effect the manner in which the form is struck. In other words: the manner in which the form is struck, that is moved from erected towards struck position, will be the same in FIG. 1 as well as in FIG. 2 so that the latter Figure can readily be considered as illustrating the position assumed by the embodiment of FIG. 1 as it is moved from erected to struck position.

Referring now to the embodiment of FIGS. 1 and 3–8, and referring insofar as necessary for an understanding to FIG. 2, it will be seen that reference numeral 1 identifies a form of the type in question. FIG. 1 shows the form in erected position and it will be seen that it utilizes two angle units 2 and 3. Each of these angle units has a vertical wall panel 4 at the exterior of which is located an outer form panel 20. The panels 4 and 20 have the height required for producing a concreted side wall of a structure to be erected with the aid of the form, and for purposes of explanation it shall be assumed that this structure is of the height of one story of a building, so that the height of the panels 4 and 20 is correspondingly that of the height of a story of a building. At the upper ends the angle units 2 and 3 have hinged thereto, by means of pivots 5, respective ceiling panels 6. It is clear, of course, that this form could equally as well be used for concreting of tunnels or the like.

Each of the angle units 2 and 3 is provided with an upright girder 7, on which there is mounted on the region of the lower end a turnable element 8. The elements 8 are rotatable about horizontal axes in opposite directions, that is each element 8 can be rotated in one and in opposite direction. The axes of rotation of the elements 8 are defined by journals 9 which are stationary and on which the elements 8 are mounted. The journals 9 extend in parallelism with the floor on which the form is erected.

FIGS. 4–6 show the turnable elements 8 in more detail and will be discussed subsequently. It will already be seen from FIG. 1, however, that each turnable element 8 is connected with and acts upon at least three braces, namely a base support brace 10 by means of which the unit is supported on the floor, a brace 11 connecting the panel 4 (via the element 8) with the ceiling panel 6, and a brace 12 which extends substantially horizontal and substantially normal to the panel 4 and in the exemplary embodiment joins the two angle units 2 and 3. The connection between these braces and the respective turnable element 8 is such that when the latter is turned about the turning axis defined by its journal 9, the pivots at which the braces are connected with the turnable element 8 are forced to move in a circular path about the axes defined by the journal 9, resulting in a positional change of the braces 10, 11 and 12. This positional change takes place in the longitudinal direction of the braces 10, 11 and 12 to a greater or lesser degree, and thus serves to move the panels 4 and 6 towards or away from erected position of the form, depending upon the direction in which the element 8 is rotated. FIG. 1 shows the form in erected condition and, by appropriately turning the elements 8, the form can be moved to the struck position shown in FIG. 2 wherein the panels 4 and 6 are moved out of engagement with the side walls and ceiling which have been concreted while the form was in the position of FIG. 1.

FIG. 1 shows also that the braces 10, 11 and 12 are all located substantially at least in a common upright plane which is substantially normal to the side walls and ceiling to be produced while the form is in erected condition. This means that turning of the respective turnable element 8 does not produce any tilting moments which could act on the element 8 and its journal 9, but will result only in the development of tensile forces.

It is apparent from a comparison of FIGS. 1 and 2 that the retraction of the panels 4 and 6 from the completed and concreted walls and ceiling (which are not yet present in FIG. 1 but which are shown as having been produced in FIG. 2) requires the respective turnable element 8 to be rotated in counterclockwise direction for the unit 2 (see the arrow Pf1) and in clockwise direction for the unit 3 (see the arrow Pf2). The movement of the illustrated form in the particular embodiment shown between erected and struck position (FIGS. 1 and 2) requires the elements 8 to be turned through 90°, and in their two end positions the elements 8 can be arrested by an appropriate retaining device. For this purpose, each element 8 is provided with two slots 13 which are spaced apart by 90° and into which a latching member 14 mounted on the respective girder 7 can engage, as shown in FIG. 1.

It is important according to the invention that the brace 8 be pivoted at its upper end with the ceiling panel 6, approximately near the middle of the same, and that it be pivoted at its lower end to the turnable element 8 at a point outside an imaginary straight line (not shown in the drawing) which joins the pivot 15 securing the brace 11 to the panel 6 and the journal 9 about which the turnable element 8 can be rotated. At this point the brace 11 is pivoted by pivot 16 to the turnable element 8, and this pivot 16 is therefore located in a zone wherein rotation of the turnable element 8 will immediately produce a relatively considerable longitudinal movement of the brace 11. This has the desirable effect of insuring that the ceiling panel 6 will be pulled downward at its free edge, that is the one closest to the other angle unit, as soon as the turnable element 8 begins to turn, thus causing the panel 6 to be-

come detached from the concrete ceiling (see FIG. 2) from this free edge outwardly in progression.

FIG. 4 shows that the base brace **10** is pivoted to the respective turnable element **8** at a pivot point **18.** The positions of the pivot **16** connecting the brace **11** with the turnable element **8,** and the pivot **19** connecting the brace **12** with the turnable element **8,** are also shown in FIG. **4,** and the braces **11** and **12** are illustrated in chain lines with their defective lines being shown in the form of dots extending beyond the chain lines. FIG. **4** shows also that the upper end portion **10***a* of the brace **10,** that is the end portion remote from the floor on which the form is erected, is pivoted at **18** to the turnable element **8** in a point outside an imaginary straight line (not shown) passing through the journal **9** and the lower pivot **17** at which the brace **10** is also mounted. This means that the pivot **18** is located in a zone which, as soon as turning of the element **8** begins, must pass through a point of closest approach to the pivot **17** while traveling in its circular path. Therefore the pivot **18** will at first execute a predominently sideways movement without immediately generating a tensile force along the brace **10.** In fact, there will even initially be a small compression which acts upon the brace **10** but which will be taken up by the overall play in the form and, possibly, by the resiliency of the materials involved. In itself this compressive force would tend to press the form towards the ceiling, rather than permitting it to move from the erected to the struck position. However, due to the provision of the pivot **16** for the brace **11** in the manner outlined earlier, the initial rotation of the turnable element **8** assures that detachment of the associated ceiling panel **6** from the cast ceiling will begin only at the edge of the ceiling panel **6** which is closest to the respective other angle unit so that it is not necessary for all detaching forces to become active simultaneously. This means that the initial compressive force acting upon the brace **10** and tending to lift the ceiling panel **6** at its edge remote from the one which will begin to become detached from cast ceiling (the left-hand edge in the ceiling panel associated with the angle unit **2**) is therefore of no consequence.

The pivoting of the more of less horizontal brace **12** to the respective turnable elements **8** at the pivots **19** assures that the turning of the elements **8** transmits the rotary motion thereof (see arrow Pf1 in FIG. **1**) in form of a lateral translatory movement which serves to inwardly withdraw the respective panels **4** (and the associated panels **20**) from the newly-cast concrete side walls (see FIG. **2**). It is evident that by turning the turnable element **8** in the direction of the arrow Pf1 relative to the angle unit **2,** and thereafter turning the other turnable element **8** of the angle unit **3** in the direction of the arrow Pf2, the pivots **19** associated with the opposite ends of the brace **12** will attempt to move apart, which will however be impossible because the brace **12** is rigid. The result must therefore be an inward movement of the respective girders **7** with their wall panels **4.**

It is of course necessary in accordance with the present invention that the three braces **10, 11** and **12** each be connected to a respective one of the turnable elements **8,** and the brace **12** is actually connected to both of them, that is the two associated with the respective angle units **2** and **3.** Moreover, at least two of their pivots must be offset from each other. In the exemplary embodiment disclosed herein the pivots **16, 18** and **9** are in fact all three of them mutually offset relative to one another on associate turnable element **8.**

It is appropriate at this point to mention the slight modification shown in FIG. **2.** It will be seen that here the brace **12** has been omitted, and in its place each of the angle units **2** and **3** is provided with a support bar **21** passing through the respective outer form panel **20** which is for this purpose provided with an appropriate hole. Outwardly of the respective panel **20** each support bar is provided with and end-pad **21** which overlies and closes the hole when the form is in erected position so that no concrete can enter into the hole. It is advantageous for the respective bar **21** to be pivoted to the turnable element **8** at the same pivot **16** as the brace **11,** although another pivot location could also be utilized.

In this embodiment, when the turnable element **8** is turned from its initial position of FIG. **1** in the direction of the arrow Pf1, the support bar **21** will be pressed against the newly-produced concrete side wall located exteriorly of the panel **20,** and at the same time it will slightly tilt. Since the concrete side wall and the bar **21** are of course both rigid, the panels **4** and **20** with the associated girder **7** will be pushed inwardly away from the concrete side wall.

Returning now to the embodiment of FIG. **1,** it will be seen, especially in FIGS. **1** and **4,** that the pivots **19** of the brace **12** linking the two turnable elements **8** of the units **2** and **3,** are located at points which are offset—in the direction of rotation of the turnable elements **8** during the striking of the form—by a certain distance beyond a straight line joining the forces of rotation of the two turnable elements **8,** that is the journals **9** thereof. This offset is, however, smaller than the corresponding offset—in the same direction of rotation—of the pivots **16** of the braces **11** beyond a straight line joining the respective axes of rotation and the pivot **15.** In consequence, the pivots **19** will begin to perform a component of movement in longitudinal direction of the brace **12** as soon as the respective element **8** is turned in the direction of the arrow Pf1, but this component of movement will be considerably smaller than their component of movement in the direction of the brace **11.** For this reason, the previously described laterally inwardly directed movement of the panels **4** will not begin until the detachment of the ceiling panel **6** from the concreted ceiling has already become initiated. If desired or required, the longitudinal center line of the brace **12** could be made to coincide with the imaginary straight line joining the axes of rotation of the two turnable elements **8,** and it would be done if it were desirable to alter the time sequence of the various retracting or detaching operations to some extent. In fact, the positions of the other pivot points on the turnable elements **8** could similarly be changed to accommodate different requirements.

It is thus clear that the aforementioned features result during turning of the respective turnable elements **8** in the direction of the arrow Pf1 (or Pf2) will first cause the respective panels **6** to be pulled at its inner edge (the one closest to the respective other angle unit) downwardly away from the concreted ceiling (see FIG. **2**), and shortly thereafter the action of the brace **12** (or of the bars **21**) results in a lateral inward movement of the panels **4** and **20,** beginning at the bottom of these panels. This movement is finally followed by a downward movement of the entire panel **4** as the brace **10**

of each angle unit 2, 3 is retracted. The result of this striking operation is shown in FIG. 2 and will be true whether or not the brace 12 or the bars 21 are utilized.

The effect of this time sequence of movements can be further amplified by pivoting the braces 11 to the respective turnable elements 8 at pivot points which are located further from the respective journals 8 than the distance at which the pivot points of the braces 10 and 12 are spaced from the journal. If this is done, then a greater degree of translation of the rotation of the respective turnable elements 8 into linear displacement of the brace 11 will result.

Quite naturally, it is possible to readily modify the illustrated embodiments so that the striking of the form will take place if the turnable elements are moved opposite to the directions Pf1 and Pf2. It would merely be necessary to appropriately site the pivots 16, 18 and 19 on the opposite side of the aforementioned imaginary lines. The direction of rotation chosen in the illustrated embodiments has, however, the advantage that an operating lever applied to the elements 8 for the purpose of turning the same must be moved in upward direction in order to effect turning in the direction of the arrows Pf1 and Pf2. Usually, it easier to obtain a good leverage when pulling in upward direction than in downward direction. Such an operating lever is diagrammatically shown in FIG. 4 and will subsequently be described further. It is also evident that for erecting purposes the elements 8 must be turned in the direction opposite the arrows Pf1 and Pf2, respectively.

As seen most clearly in FIG. 5, the journals 9 for the turnable elements 8 are fixed, and the latter turn about them. In order to fix the journals 9 against rotation, they are each provided at their respective ends with a flange 22 which is in turn fixed with the journal 9 and secured by a bolt 23 or analogous means to a bearing plate 24 which is itself secured to a girder 7. This construction has the advantage that premature wear of the relatively narrow bearing surface of the journals 9 is prevented. FIGS. 5 and 6 also show that each of the turnable elements 8 consists of at least two disc portions 27 which are axially spaced and joined by at least one central sleeve 25 which accommodates pivot bearings 26. The disc portions 27 carry journals 28 for the respective braces 10, 11 and 12 which are pivoted to them by means of bushes 29 and bearings 30. The bearings 26 and 30 are advantageously made of a plastic material, or else may be self-lubricating bearings. A suitable plastic would be nylon, to name one possibility. However, the bearings can also be made of a material specifically chosen to provide an adequately smooth co-action with journals 9 and 28.

It has already been mentioned that a lever 31 is diagrammatically illustrated in FIG. 4 and can be provided for turning the respective turnable elements 8. Such a lever can be secured to one or both of the disc portions 27, or to one of the journals 28. When it is used to turn the resective element 8, the braces 10, 11 and 12, or in FIG. 2 the braces 10, 11 and bar 21, will perform not only relative longitudinal movements but also tilting movements. It is for this reason that these braces are also pivoted at their opposite ends remote from the respective turnable element 8. The brace 12 fulfills this condition in any case because each of its ends is pivoted to one of the turnable elements 8. Brace 11 is pivoted at pivot point 15 to the respective ceiling panel 6, as previously outlined, and the brace 10 is pivoted at 17 as also pointed out. Insofar as the bars 21 are concerned, these can tilt about one edge of their end-pads 21a in contact with the concreted wall (see FIG. 2) and thus also fulfill this requirement.

It is within the scope of the invention that it would be possible to provide a further arrangement wherein an upright base or socket is provided as a support for the bottom edge of the panels 4, instead of the brace 12 of the support bars 21. In this case, the turning element 8 would be pivotally connected with at least the braces 10 and 11.

According to a particularly important feature of the present invention, the form 1 is characterized by the provision of an anchoring piece 32 for the braces 10. This anchoring piece 32 can be concreted into the ceiling 33 being formed, and which will subsequently form the floor on which the form 1 will be erected for the casting or pouring of the next-higher story. FIGS. 1 and 2 show that the ceiling panel 6 of each angle unit 2 and 3 has provided in it a fastener 35 which is located at the position corresponding to the anchoring point 34 for the brace 10, and which can accommodate the anchoring piece 32. The purpose of this is to assure that the anchoring piece 32 will be embedded at the point where the brace 10 will subsequently require to be anchored when the form is used for pouring the next-higher story. This assures that the walls of all superimposed stories will be properly and truly aligned. This dispenses with the need for an upstanding base or socket for positioning and aligning the form.

The anchoring piece 32 in the present embodiment is in form of a threaded sleeve whose length is approximately equal to the thickness of the ceiling 33. Such a sleeve permits a ready connection with the fastener 35 during the concreting of the ceiling and also permits ready connection with the base 10 by means of a bolt. To prevent the sleeve from becoming partly or completely obscured and thereby difficult of access during the pouring or subsequent finishing operations on the ceiling 33, the anchoring piece 32 can be provided with a plate portion 36 which covers its upper open end until the pouring of the ceiling is completed. This assures a proper engagement and positioning for the respective brace 10, even given differing ceiling thicknesses or other problems.

The anchoring piece 32 in this case is threaded internally, the thread at one end being intended for connection with the respective ceiling panel 6 and threaded at the other end for connection with the respective brace 10. It is desirable to have two separate threads, and for the bore or center passage of the sleeve constituting the anchoring piece 32 to be discontinuous, that is not go all the way through the sleeve. This provides better insulation between two adjacent stories of the building being erected.

It will be appreciated that the anchoring piece 32 actually serves a dual purpose. It not only serves to secure the brace 10, thus providing for taking-up of the tensile forces acting on the brace 10 as the form is being struck, but also assures accurate adjustment of the entire form on the next-following story (when it is erected on the previously poured ceiling 33) without any requirement for separate positioning devices.

Contrary to an objectionable feature of the prior art, the form according to the present invention does not require any change in the length of the braces 10, 11

and 12 during striking or erecting of the form. This means that once the form has been adjusted to the desired dimensions, it can be struck and erected any desired number of times without having to be readjusted, so taht each time it is erected and used for pouring further side walls and a further ceiling, proper dimensioning of the newly-poured walls and ceiling will be assured. The anchoring pieces 32 which are immediately adjacent one another are, incidentally, interconnected within the concrete of the ceiling 33, as FIGS. 1 and 2 show. For this purpose connecting rods 37 are providd which are secured to the respective anchoring pieces 32.

FIGS. 4 and 5 show most clearly that the brace 10 utilizes a threaded tension and compression bar onto which there are threaded two internally tapped sleeves, one of which is pivoted to a base plate 38 for pivoting movement about an axis parallel to that about which the other sleeve can pivot at its upper end 10*a* about the pivot 18 of the turnable element 8. So constructed, the brace 10 can act as a spindle, and in particular in this embodiment, as a double-acting spindle, permitting the length of the brace 10 to be adjusted to thereby make it possible to accommodate the form to structures of different heights which are to be erected. The change in the length of the brace 10 can be carried out even after the latter has already been anchored to the floor, and it will be appreciated that once the length has been adjusted, no further adjustment in the height of the form (by means of adjustments of the lengths of the braces 10) is required until all structures or part of structures having the same height have been completed with the aid of the form.

It is desirable to expand the potential of the form 1 still further, by making its transverse span adjustable. To this end, it is an important feature of the present invention that in the zone 39 of the adjacent edges 40 and 41 of the respective ceiling panels 6 of the units 2 and 3, provision is made for the supports 42 which are slidable from one angle unit into the other and which in the operating position are in essentially horizontal orientation. It is the function of the supports 42 to support equalizing elements 43. The details of this will be discussed in due course.

Furthermore, the adjustment of the transverse span of the form 1 is, of course, facilitated in an embodiment utilizing the brace 12, by making the brace adjustable in its length. This is not required, for instance, if the support bars 21 are used. As long as the brace 12 is used, however, it is advantageous if the latter is composed of two tubes 12*a* and 12*b* which are telescopable together. At least one for instance the inner tube 12*b*, is perforated with a series of longitudinally spaced holes which are indicated by the lines M in FIG. 1. The outer tube 12*a* in this case is provided at its one end with a threaded sleeve 45 which can be threaded along the tube 12*a* in mutually opposite directions and which is provided with at least one hole through which a bolt 46 or similar locking device can be inserted. The end portion of the outer tube 12*a* into which the inner tube 12*b* is inserted may either be provided with holes similar to the holes marked M in FIG. 1, or it may be provided with at least one longitudinal slot so that the bolt 46 or the like can be passed through the hole in the sleeve 41, a hole or the slot in the tube 12*a*, and then into a selected hole M of the tube 12*b*. With such an arrangement, the length of the brace 12 can first be coarsely preselected by choice of an appropriate hole in the tube 12*b*, and thereafter by turning the sleeve 45 a fine adjustment to the required length can be obtained. Of course, a sleeve 45 having only one hole necessarily involves small discrete steps in the length variation, dependent upon the pitch of the thread and the half-turn of the sleeve required to align the hole of the sleeve with one of the holes M. However, these variations are well within the tolerance variations permissible in the erection of buildings and can, if desired, be further reduced by providing several holes along the length or around the circumference of the sleeve 45.

As has been pointed out before, it is an essential aspect of the present invention to avoid the need for an upstanding base or socket on the floor on which the form is to be erected. Thus, the outer form panel 20 is required to extend all the way to the floor. On the other hand, the greater part of the panel 20 must be able to move downward relative to the newly-produced side wall when the form is to be struck. These contradictory requirements are resolved by having the vertical girders 7 terminate at a certain distance above the base plate 38, that is above the floor on which the base plate is provided, and by providing a telescopically advanceable or retractable extension piece 47 which directly or indirectly supports a skirting board 48. This skirting board 48 is placed below the lower edge of the panel 20 and forms a continuation of the latter, because obviously there must be no gaps between the lower edge of the panel 20 and the floor, since the side wall being poured must, of course, also extend to the floor. With this arrangement the otherwise existing gap is closed by this skirting board 48. On the other hand, during the downward movement of the form, and thereby of the panel 20, the extension piece 47 can be retracted into the associated girder 7. During this movement, the skirting board 48 can remain in position. It is desirable that the top edge of the skirting board 48 should be at least partly chamfered on the side facing inwardly, that is away from the concrete wall being poured, because this facilitates the next striking motion of the panel 20 which, as previously described, is first moved inwardly away from the wall before it moves downwardly.

Before proceeding further, it will be advantageous at this point to explain in detail, with reference to FIGS. 7 and 8, the movements performed and the loci followed on rotation of the respective turnable element 8 from the positions shown in FIGS. 1 and 4 to the position shown in FIG. 2. This will also clearly show the accuracy of the above statement, namely that the skirting board 48 can remain in place while the form is being struck. The explanation will necessarily combine a description of the striking procedure and, with the reverse order of movements, of the erecting procedure.

Referring to FIG. 8 it will be seen that the axes of rotation defined by the journal 9 for its associated turnable member 8 is diagrammatically represented as a fixed constant reference point. In actual fact, however, this point 9 moves on rotation of the turnable element 8 in a manner that will be described later with reference to FIG. 7. The initial positions of the braces 10, 11 and 12 are shown in chain lines in FIG. 8. The pivot points, 18, 16 and 19 of these braces are also shown in their starting and finished positions. Given a fixed pivot point 17 for the brace 10, the pivot point 18 of the brace 10 on the turnable element 8 is necessarily shown in the terminal position to be at a greater distance from

the axis of rotation of the element **8** than is actually the case. This is so because, contrary to the explanatory illustration in FIG. **8**, the axis of rotation defined by the journal **9** will in fact itself perform a lateral movement together with the pivot **18**, this being due to the displacement of pivot **19** and the action on pivot **19** of the brace **12**. FIG. **7** shows this in more detail.

The travel of the pivots **16**, **18** and **19** longitudinally of their respective braces **11**, **10** and **12**, between the initial and apparent terminal positions of the pivots, is shown in each instance by a vector arrow in FIG. **8**. The vector arrow **50** thus indicates the magnitude of downward movement, the vector arrow **51** that of lateral movement, and the vector arrow **52** that of the longitudinal displacement of the brace **11**. Since the pivot **17** is in actuality a fixed point and always remains so, the locus of pivot **18** must travel in an arc of a circle about the pivot **17**, about which arc its actual terminal position (denoted in FIG. **8** by numeral **18'**) must also necessarily lie.

It has been previously described, and should here be recalled, that the force-transmitting lines of the brace **10**, **11** and **12** do not pass through but past the axis of rotation of the respective turnable element **8** when the form is in its erected position shown in FIG. **1**. These force-transmitting lines of the braces **11** and **12** both pass laterally of these axes of rotation on one and the same side thereof, while the force-transmitting line of the brace **10** does so on the opposite side, both being seen with reference to the direction of rotation of the respective element **8**. Thus, under compressive load each brace exerts a torque on the turnable element **8** that would have to be taken up by the latching member **14**. By reason of the aforementioned arrangement of the force-transmitting lines, however, torques of unlike direction are generated which thus partly cancel out and relieve the member **14**.

Turning now to FIG. **7**, it will be seen that this shows the path W described by the axis of rotation of the turnable element **8**, defined by the journal **9** thereof. This path is described when the element **8** is turned. In the exemplary embodiment, the path W covers an angular displacement of the turnable element through 90° from one end position (the erected position of the form) to the other end position (the struck position). For ease of illustration, the points or positions occupied by the axis of rotation (which is of course the same as saying the position of the journal **9**) after each ten degrees of the element **8**, are plotted. It is shown in FIG. **7** in dot-dash lines that in the initial position of the element **8**, the brace **10** has its pivot **18** located 10° ahead of a straight imaginary line joining the pivot **17** and the journal **9**. The pivot **18** is thus located at the beginning of the quadrant, denoted with reference numeral **53** in FIG. **7**, along which it will move during rotation of the turnable element **8**. In traveling along this path, the pivot **18** must therefore move laterally and, more importantly, upwards with respect to the center of the circle defined by the path W. Since the pivot **17** is fixedly connected with the floor, however, the actual result of such movement must be a downward displacement of the journal **9**. Horizontal lines L have been drawn in FIG. **7** from the individual points on the quadrant, whose spacings represent the displacement of the journal **9**. It will be seen that from the initial position of the pivot **18** until it intersects the aforementioned imaginary straight line joining pivot **17** and journal **9**, there will occur a slight downward displacement of pivot **18** or, rather, a corresponding slight upward displacement of the journal **9**. This means that the spacing of the horizontal lines L must be plotted downward in reversed order beginning at the pivot.

The second geometrical position of the moving center of the circle (i.e., the journal **9**) is found by considering the horizontal brace **12**. In the illustrated embodiment, the pivot **19** of the brace **12** is located at the same distance from the center of rotation defined for the element **8** by its journal **9**, as the pivot **18**, but with a lead of 10° (i.e., an offset in the direction of rotation) beyond its dead-center line. The quadrant described by the pivot **19** about the journal **9** on rotation of element **8** through 90° is designated with reference numeral **54** in FIG. **7**. Pivot **19** has its movement plotted at ten degree intervals as it moves along the uadrant **54**, and the horizontal distances between these positions are found by drawing a perpendicular line L' through each. Because brace **12** is a rigid member, these positions are translated not into a displacement of the brace **12**, but into a lateral movement of the journal **9** and must therefore likewise be plotted in FIG. **7** in reverse order from the journal **9**. Thus, wherever the lines L' intersect the lines L, the point of intersection is representative of the true position of the center of the circles **54** and **54**, namely the center of rotation of the turnable element **8** after the respective angle of rotation has been completed.

Considering, by way of example, the position of the center of rotation (the journal **9**) when the turnable element **8** has been rotated through 30° from its one end position, it will be seen that at this time the pivot **18** will have undergone first a slight downward movement and then an upward movement by the same amount, followed by a further upward movement which results in a corresponding downward movement of the journal **9**. The corresponding lines L drawn from the three points of angular displacement plotted on the quadrant **53** are shown with reference to the zero point. The first line L, indicative of a 10° displacement, is located immediately above the zero line. After a 20° displacement, a horizontal line L is obtained which again coincides with the zero line, and finally the line L representative of the 30° displacement is drawn parallel thereunder towards the side and at the distance which has been determined. The distances *a*1, *a*2 and *a*3, starting from the zero point, are now marked off by vertical lines and these distance will be understood to have been generated by the aforementioned movement of the pivot **19**. The appropriate point of intersection then indicates the actual position of the center of rotation (the journal **9**) at the time in question.

The actual position of the pivot **18** during this rotational movement can also be found in a simple manner. As previously pointed out, the pivot **18** describes an arc of a circle about the pivot **17**. Because the distance of the pivot **18** from the center of rotation (the journal **9**) always remains constant, the distance must be determined from each ascertained actual position of the center of rotation to intersect the position of pivot **18** on its arcuate path, and the resultant plotted points of intersection are then determined in order to establish the movement of pivot **18**. Given the position chosen in the embodiment for the brace **10**, there will also be a certain downward movement of pivot **18** which affects the

overall downward movement of the center of rotation, i.e., the journal **9.**

The movement of pivot **19** of the horizontal brace **12** has been plotted on curve K in FIG. **7** with respect to the centers of the discs **27,** that is the journal **9.** Actually, the pivot **19** changes position only relatively slightly. The curve K would seem to imply a lateral and upward movement of pivot **19,** but is in effect overlaid by the travel path W so that the resultant displacement of pivot **19** is fairly slight.

The path W also reflects in actual practice the movement of the entire form in the region where the turnable element **8** is mounted on the girder **7.** It will be seen, therefore, that the lower part of the form accomplishes a predominently lateral movement during the first 20° of rotation of the element **8,** so that it is carried laterally off the skirting board **48.** Only thereafter the desired downward motion will gradually increase, thereupon causing a lowering of the entire panel **4** relative to the concreted side wall. Of course, prior to this, the ceiling panel **6** has been substantially detached from the concrete ceiling **33.** A description of how the upper part of the panel **4** is also caused to move laterally away from the side wall will be given later.

FIGS. **1, 2** and **5** show that wheels **55** are secured to the vertical girders **7** of the angle units **2** and **3.** The axes of rotation of the wheels are essentially normal to the vertical walls and the wheels are mounted on the girders **7** at such a height that with the turntable element **8** in one end position, they are seated on the tracks **57** (see FIG. **2**), whereas with the turntable element **8** in the other end position, corresponding to the erected position of the form, the wheels **55** are lifted clear off the tracks **57** (see FIGS. **1** and **5**). The latter Figure also shows the mounting of the wheel **55** in relation to a girder **7,** and it will be apparent that the wheel is journalled on a laterally projecting arm **56** which advantageously is also adjustable in vertical direction. The track **57** is of U-shaped or similar cross section and, when the form is in the erected position (see FIGS. **1, 4** and **5**) the telescopic extension **47** of the girder **7** engages with a positive lock on the leg **58** of the rail **57,** preferably being lockable by a locking device engaging the brace **10.** The rail **57** will thus be seen to have a dual function, namely it firstly serves to retain the skirting borad **48,** and in addition it will secondly serve as a runway for the wheel **55** and thus for the entire form. This makes it possible to have the track **57** be installed over the entire length of a structure to be concreted with the aid of the present form, so that on completion of a part of the structure corresponding to the dimensions of the form, the latter can simply be advanced alon the tracks **57** to the next-adjacent location. In fact, the rails can be run outside the location where the structure is to be erected, and when the structure is completed the form can be moved out of the structure and can be engaged by a hoist or the like.

It is advantageous for the track **57** to have an internal width which is slightly less than the lateral travel performed by the telescopic extension **47** during the striking of the form. This width should, however, be slightly larger than the dimension of the extension **47** in direction normal to the side wall having been erected. This assures that as the panel **4** with the girder **7** and the extension **47** move laterally inwardly away from the concrete side wall, when the wheel **55** is lowered into the rail **57,** the girder **7** can first move sideways with its panel **4** while the rail **57** remains unchanged in its position. Eventually, the wheel **55** or the extension **47** will bear upon the inside face of the outer leg of the rail or track **57** and push the track **57** away from the concrete wall. This means that during the last stage of the inward lateral movement away from the concrete wall, the skirting board engaged by the rail will also be moved away from the concrete, just as long as a connection is established between the skirting board **48** and the rail **57,** as will be described with reference to FIG. **2.**

Here, the skirting board **48** is provided with a fastener **59** which is positively locked to the adjacent leg **58** of the track **57.** This means that when the track **57** is moved away from the concreted wall, the skirting board **48** moves with it and it is clear that due the dimensioning of the internal width of the track **57,** this will occur only when the wall panel has already been moved an appreciable distance away from the surface of the concrete wall. FIG. **3** shows that the skirting board **48,** when the form is in erected position, is forced vertically upwardly by means of wedges **59***a*, acting via the fastener **59,** until it is in engagement with the lower edge **20***a* of the panel **20** so as to provide no or at most a very minimal gap with reference to the same.

A comparison with FIGS. **1** and **2** shows that the portion **38***a* of plate **38** is provided with a lug **60** or the like which fits over the track **57** on the side thereof away from the concrete side wall, and holds the track down. This is shown in FIG. **2.** FIG. **4** shows that the lug is still clear of the track, here shown in the erected condition of the form. After lateral displacement of the track **57,** to the new position in which it will serve as a runway for the wheels **55,** the lug serves to hold down the rail so that the same cannot shift.

FIG. **4** shows that the track **57** and the extension piece **47** engaged therewith when the form is in erected condition, can be fixed to the portion **38**a which is secured to the anchoring piece **32.** For this purpose a swivel latch **61** is provided which, when the form is in erected position, engages over a projection **62** on the extension piece **47** by means of an elongated slot **65.** In turn, it is fixable in relation to the brace **10** by a removable device, for instance a wedge **63** or the like, and the latch **61** is swivel-mounted to the portion **38** and formed of two hinged parts which are foldable relative to one another opposite to the swing-out direction of the latch. A stop **64** is provided for limiting the folding of the two latch parts in the opposite direction. This construction lessens the space required for swing-out and swing-in of the latch **61.** In addition, the latch enables the projection **62** to be engaged from either side by the previously mentioned slots **65,** so that the extension piece **47** is not only restrained in vertically downward direction but also transversely against the concrete side wall.

To prevent the top end portion of the extension piece **47** from leaning inwardly away from the concrete side wall under the transverse pressure of the latch **61** against its lower portion, whether during the erection or during the actual concreting operation, a pressure-exerting set screw **66** or similar device is provided (see FIG. **1**) at the top of the extension piece **47,** being mounted on the girder **7** or the panel **4** and pressing against the upper end portion of the piece **47** to prevent such undesired movement.

When the bottom end of the extension piece 47 is fixed, the latch 61 also engages the track 57, for which purpose it is provided with a recess into which the leg of the track 57 on the side away from the wall (the inward side) engages when the form is in the erected position. The latch 61 can be thus hinged lower relative to the girder as a whole than would otherwise be possible, and thus fix the extension piece 47 at the lowest possible point. A handle 68 is shown in FIG. 4 by means of which the latch 61 can be swiveled, so that on swinging-out (after the wedge 63 has been loosened) the relative folding movement of the two latch parts will automatically take place. Of course, the wedge 63 and the latch 61 must be disengaged before the turntable element 8 can be turned.

Referring to FIG. 1 it will be seen that two different types of braces 11 have been shown. In particular, the right-hand unit 3 has a brace 11 which could of course be equally well used in both of the units 2 and 3. This brace 11 is provided at its upper end with a sleeve 69 into which the actual body of the brace 11 is threaded. The sleeve 69 is removably and pivotally connected with the ceiling panel 6, for instance by means of a cotter-pin or the like. This makes it possible, after removing the pin, to turn the sleeve 69 relative to the remainder or main portion of the brace 11 so as to adjust the length of the brace 11 by merely turning the sleeve 69 in the desired direction. One half turn of the sleeve 69 is envisaged as the minimum adjustment. In this manner a certain prestress can be applied to the ceiling panel 6, and inaccuracies in the initial adjustment of the entire form can be compensated for in this manner also. Moreover, several holes 70 may be provided in the ceiling panel to permit the pivot point at which the sleeve 69 is secured to the ceiling panel 6, to be changed if and as required.

In the region 39, the two angle units 2 and 3 could be abutted, for instance by providing centers or bolts or the like. However, in the illustrated embodiment, the angle units are joined at the adjacent edges of the respective ceiling panels 6 by a brace 71 which has two ends each of which is hingedly connected. This arrangement facilitates and improves the striking operation and a particular importance attaches to it, as will be described subsequently. This is especially true if the ends of the brace 71 are joined to respective lever arms 72 projecting downwardly from the ceiling panels 6, so that the brace 71 is located beneath the junction of the two panels 6 and will be positioned substantially horizontally. Thanks to the lever arms 72 a greater force is exerted on the upper portions of the units 2 and 3 when the ceiling panels 6 move downwardly. Evidently, when for instance the ceiling panel 6 of the unit 2 are tilted into the position of FIG. 2 from that shown in FIG. 1, by rotation of the associated turnable element 8, its inner edge 40 will describe an arc. In so doing, the edge 40 itself will be located in a part of that arc which involves only very slight lateral movement of the edge 40. The pivot point of the brace 71 to the associated lever arm 72 is situated with respect to the ceiling panel pivot 5 in a part of an arc that involves the addition to the downward motion of an appreciable lateral movement. Since outward lateral movement is prevented by the brace 71, lowering of the ceiling panel 6 must necessarily be accompanied by an inward lateral movement of the pivot point 5 leading, at any rate after a small descent of the ceiling panel 6 has taken place, to an essentially horizontal inwardly directed pulling-off movement of the upper end of the panel 4. Thus, by turning the element 8, say first on the unit 2, a lateral detachment will be achieved through the intermediary of the brace 71, for the upper end of the panel 4. This is highly advantageous from the point of view of the invention.

It is advantageous in order to provide yet another aid for altering the transverse span of the form, if the brace 71 is length-adjustable. For this purpose a part 74 of the brace 71 may be provided with holes 74, in order to permit a course adjustment via cotter pins or the like on the respective lever arm 72. A threaded sleeve 75 can also be utilized, if required for fine adjustment.

As previously mentioned, in the region 39 where the two panels 6 of the angle units 2 and 3 join, a swivel-support extension 42 is fitted as a hinged extension of one ceiling panel 6, that is one of the girders thereof. In the illustrated embodiment, this is the panel associated with the angle unit 3. According to a feature of the invention, the extension 42 engages into the girder of the panel of the other unit, here the unit 2, and is slidable relative thereto. The second angle unit 2 is provided with a seat 76 on which the extension 42 bears vertically. This makes possible, as shown in FIG. 2, a lateral displacement, and more importantly, a relative tilting of the two ceiling panels 6. It will be understood that it is best first to lower the panel 6 of for instance the angle unit 2, to thereby obtain a downward tilting of the extension 42. With the unit 2 partly or fully in the struck position, the turnable element 8 of the unit 3 is then rotated, causing the extension 42 to counter-tilt, and it is advantageous if an expansion joint is provided in the sheeting of the ceiling panels 6 so that the panel 6 of the last-lowered angle unit (here the unit 3) can slide over that of the first-lowered angle unit (here the unit 2). This is most clearly shown in FIG. 2. For fixing the extension 42 in the erected position of the form, the arm 72 may be provided with one or several vertical slots 76a horizontally and vertically spaced in the zone beneath the extension 42 and intended for taking a cotter pin or the like as a safety measure and also a second seat for the extension 42.

It is advantageous for the edge of the respective apnel 6 of the unit 2, with its seat for the extension 42, to be supported in the zone of junction with the panel of the unit 3 upon a hollow section support 77 or the like, and for the corresponding edge of the panel 6 of the unit 3, or an equalizing element 43, to do likewise when the form is in erected position. In other words, the edge of panel 6 of unit 3 will project somewhat beyond its own terminal support and onto the section support 77 of the panel 6 of the unit 2. In this manner, after the ceiling panel 6 of the first angle unit has been lowered, the panel 6 of the other angle unit can, during its own subsequent lowering movement, readily slide over the panel 6 of the first-lowered angle unit and come to rest thereon as shown in FIG. 2.

If it is desired to alter the pulling-off effect on the upper portion of the panel 20, the horizontal linking brace 71 can be made vertically adjustable by lengthening or shortening the lever arms 72. This would allow adaptation to a wider transverse span of the form, or the utilization of a slightly arched roof or the like.

It should be noted that although FIG. 2 shows primarily the form in struck position, it also indicates the position assumed by the extension 42 when only the left-

hand unit 2 is moved to the struck position, with the right-hand unit 3 still in the erected position.

FIGS. 3, 9 and 10 show that the angle units 2 and 3 are provided with terminal flanges 78 and 79 permitting abutting connection with other angle units serving to extend them. In the exemplary embodiment, these flanges 78 and 79 are each formed by one side of an angle aisle 80 whose other side 81 is flush with the respective panel 20 and sectured thereto via a bolt 82. The abutting flanges 78, 79 are approximately normal to the surface which is due to be concreted, that is the wall to be erected, and the flange 78 has secured to it at least one clamp 83. The clamp 83 in the illustrated embodiment is welded to the flange 78, but could be otherwise secured. Several such clamps 83 are distributed along the height of the flanges 78 and 79, as shown in FIG. 3, and each of them has a slot 84 dimensioned so as to straddle both flanges 78 and 79 when in position. The top 85 of the slot 84 then bears upon that edge 86 of the flange 79 which is located away from the surface to be concreted, that is the wall to be erected. When so assembled, the sides 81 of the contiguous angles 80 will lie flush with each other. In addition, each clamp 83 has a secondary slot 87 intended for taking a wedge 88 or other retaining member. The slot 87 extends transverse to the main slot 84 and intersects it. The secondary slot 87 must, of course, also be on that side of the main slot 84 where the flange 79 is to be located because this is the movable flange that can move relative to the clamp 83 and the flange 78. In the position shown in heavy lines in FIG. 10, the clamp 83 is shown to cooperate with the wedge 88 in order to secure the two contiguous angle irons 80 firmly together. When the form is to be struck, the wedge 88 is first removed in order to allow the angle iron 80 to whose terminal flange 78 the clamp 83 is welded, to be displaced in the direction of the arrow Pf3 by movement of the associated turnable element 8. The length of the terminal flanges 78, 79 and that of the clamp 83 that holds them together, and of its slot 84, should be slightly smaller than the path which will be travelled by the vertical girder 7 while the latter is being detached from the concrete wall during the striking of the form. This assures that on loosening of the flange 78 the latter, and the part of the clamp 83 which holds the flange 79 normally when the form is in erected position, can be moved clear of the flange 79 in order to permit separation from the unit that has not yet been struck.

It will be seen that when the form is in erected position and is to be struck, the first action to be taken is to remove the wedges 88 and the wedges 83. Thereupon the latch 61 is disconnected and the units 2 and 3 can thereafter be quickly and simply struck by turning the respective elements 8.

FIG. 3 shows that each of the units 2 and 3 has two parallel and preferably interconnected girders 7 which together form a girder system. Each of these systems can be assembled from several sections, and this is true both for the girders 7 supporting the panels 4 and for the illustrated girders which support the ceiling panels 6. The elements 8 associated with each of these girder systems are interconnected by a linkage rod 89 or the like so that only one of the elements 8 so interconnected need be turned, or the rod 89 itself can be turned, in order to secure synchronous rotation of both the elements 8 of a particular angle unit 2 or 3.

If the form according to the present invention is required only for use in pouring a ceiling, that is if the side walls are already in place and only a ceiling needs to be provided, the ceiling panels 6 can be provided with extensions projecting literally over the vertical girders 7 and which are then capable of being attached to the pivots 5 and braced to the girder 7. The girders 7 and the braces 10 will then only serve for the purpose of supporting the ceiling panels 6 with their extensions. Such an arrangement permits the ceiling panels to be lowered in the manner described already, that is the operation will be identically the same as previously described. Utilized a brace 12 as described before, the angle units 2 and 3 can of course be pulled closer together inwardly away from the existing side walls, causing the aforementioned extensions to the ceiling panels to be pulled downward via their braces.

The form according to the present invention offers a multiplicity of advantages, as will be understood from what has been set forth heretofore. Perhaps the most meritorious of these advantages is the fact that the striking operation by turning the respective turnable elements 8 removes all difficulties of handling, that is that the striking operation is very simple and requires little or no skill at all. Moreover, due to the particular sequence of movements which necessarily takes place without requiring any particular attention or skill on the part of an operator, an upstanding base or socket previously required for the known forms, is superfluous. Nevertheless, if such a base or socket should already be in existence in situ, at the time that the form according to the present invention is to be installed for use, the form according to the invention can nevertheless be used to equally good effect. In fact, the novel form is so widely adaptable that it can be used for an extremely diverse range of applications. Because it need be adjusted to particular dimensions only once, and then can be struck and re-erected any desired number of times without requiring further adjustments of this type, its use is highly economical in terms of eliminating labor previously required for such adjustments.

If desired, the pivots where the braces are connected with the respective turnable elements 8, can be made adjustable, for instance by means of eccentrics of provision of several alternative pivots, so that the position at which the braces engage the respective turnable element 8 can be varied in order to obtain desired variations in the action of the form during erecting and striking.

It should still be pointed out that although the form has been described herein with reference to the erection of two side walls and a ceiling connecting them, it will be appreciated that it is possible to utilize the form in a different orientation in which three upright side walls extending at angles to one another, can be simultaneously erected, that is poured. In such a case, it is possible for instance to connect the braces 10 with another element completing the form so that it has four sides and all four walls of a room can then be cast simultaneously. In fact, the other form so-linked with it could provide for the simultaneous casting of a forth wall and a ceiling so that then all four walls and the ceiling of a room could be cast at once. Wheels would then, of course, not be needed.

It will be understood that each of the elements described above, or two or more together, may also find

a useful application in other types of constructions differing from the type described above.

While the invention has been illustrated and described as embodied in a form for erecting structures having side walls and a ceiling, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims.

1. A form for erecting of structures having side walls and a ceiling, comprising in combination, a pair of transversely spaced upright angle units having upper end portions and an upright wall panel provided with a lower end portion; ceiling panels pivoted to said upper end portions; adjustable braces pivotally connecting said angle units with one another and a floor, and pivotally connecting said ceiling panels with the respective angle units; and at least one rotatable element associated with each angle unit and said braces, said rotatable elements being turnable about respective horizontal axes and being connected with said braces so as, when turned, to displace said angle units toward or away from one another and also raise or lower said ceiling panels, depending upon the direction of rotation of said rotatable elements, for respectively erecting and striking said form.

2. A form as defined in claim 1, said braces comprising first bracing members for bracing the respective angle units to said floor, at least one second bracing member connecting the respective angle units, and third bracing members connecting each angle unit with its associated ceiling panel.

3. A form as defined in claim 2, said angle units having upright girders provided with lower regions; said turnable elements being mounted on said girders in said lower regions; said first and third bracing members each having one end portion pivoted to the turnable element of a respective angle unit, and said second bracing member having two end portions pivoted to the turnable elements of the respective angle units, all of said bracing members being located at least substantially in a common upright plane.

4. A form as defined in claim 3, wherein said third bracing members each having an other end portion pivoted to a respective ceiling panel at a pivot point, and wherein said one end portion is pivoted to the respective turnable element at a location which is circumferentially spaced from an imaginary straight line connecting said pivot point of said other end portion and the axis of rotation of said respective turnable element.

5. A form as defined in claim 2, wherein said first bracing members each have a lower end portion pivoted in a first pivot point to a base, and an upper end portion pivoted to the respective turnable element in a second pivot point which is circumferentially spaced from an imaginary straight line connecting said first pivot point and the axis of rotation of said respective turnable element.

6. A form as defined in claim 2, wherein said second bracing member is pivoted to the respective turnable elements eccentrically relative to their axes of rotation.

7. A form as defined in claim 2, wherein each of said first, second and third bracing members is pivoted to the turnable element of a respective unit at a respective pivot point, and wherein at least two of said pivot points on the same turnable element are mutually offset.

8. A form as defined in claim 4, wherein said second bracing member is pivoted to the turnable elements of the respective angle units at pivot points which are offset relative to an imaginary straight line connecting the axes of rotation of said turnable elements, by a distance which is smaller than the offset of said location from said imaginary straight line connecting said pivot points of the respective other end portion of said third bracing members with the respective axis of rotation.

9. A form as defined in claim 7, wherein the pivot point at which a respective third bracing member is pivoted to one of said turnable elements is farther spaced from the axis of rotation of such turnable element than the pivot points at which said second and third bracing members are pivoted to the same turnable element.

10. A form as defined in claim 1, wherein said turnable elements have two end positions which are spaced apart through 90° of rotation of the respective turnable element and in which said form is respectively erected and struck; and further comprising arresting means for arresting said turnable elements in said end positions thereof.

11. A form as defined in claim 1; further comprising fixed journals mounting the respective turnable elements for rotation.

12. A form as defined in claim 2, wherein each of said turnable elements comprises at least two parallel spaced disc portions, a central sleeve portion connecting said disc portions, a stationary journal extending into said sleeve portion, bearings mounting said sleeve portion and disc portions on said journal for rotation relative thereto, and pivot means pivotably connecting the respective bracing members with at least one of said disc portions.

13. A form as defined in claim 1; and further comprising a lever connectable with the respective turnable elements for rotating the same about said horizontal axes.

14. A form as defined in claim 1, wherein said braces comprise bracing members for bracing the respective angle units to said floor, and additional bracing members connecting each angle unit with its associated ceiling panel; and further comprising support portions adapted to engage said lower end portions of the respective upright wall panels.

15. A form as defined in claim 2, said first bracing members each having an upper portion pivoted to a respective turnable element, and a lower portion; and further comprising an anchoring piece for each of said first bracing members, connected with said lower portion thereof and adapted to be fixed in said floor.

16. A form as defined in claim 15; and further comprising anchoring piece fasteners, each provided in one of said ceiling panels in vertical alignment with a first bracing member of the associated angle unit.

17. A form as defined in claim 15, wherein said anchoring piece is a threaded sleeve.

18. A form as defined in claim 17, wherein said threaded sleeve has an upright orientation when in use, and is provided with an upper open end; and further comprising a removable cover for closing said upper open end.

19. A form as defined in claim 17, wherein said threaded sleeve has two spaced axial ends each provided with a tapped bore, and wherein each of said bores extends towards but short of the other.

20. A form as defined in claim 15; and further comprising connecting means for connecting adjacent ones of said anchoring pieces with one another.

21. A form as defined in claim 2, wherein said first bracing elements each comprise a base plate, an elongated bar having two spaced end portions, a first pivot connecting one of said end portions to said base plate, and a second pivot connecting the other end portion to a respective turnable element, the pivot axes of said pivots extending parallel to one another and to said horizontal axis of said respective turnable element.

22. A form as defined in claim 2, wherein said first bracing elements comprise screw-spindles whose length is adjustable.

23. A form as defined in claim 2, wherein said first bracing elements comprise double-acting screw-spindles whose length is adjustable.

24. A form as defined in claim 1, wherein said ceiling panels have adjacent edge portions; and further support elements in the region of said edge portions mounted on one and slidable into engagement with the other of said ceiling panels.

25. A form as defined in claim 2, wherein said second bracing member is a substantially horizontal tie-rod of adjustable length.

26. A form as defined in claim 2, wherein said second bracing member is a substantially horizontal tubular member composed of at least two telescoped-together tubular sections, and arresting means for arresting said sections in positions in which they are telescoped together to different extents.

27. A form as defined in claim 26, wherein said arresting means comprises a plurality of holes in an inner one of said sections, a threaded sleeve on the exterior of an outer one of said sections and meshing with external screw-threads thereon, said threaded sleeve and outer section each having at least one aperture, and a pin insertable through said apertures into a registering one of said holes.

28. A form as defined in claim 2, said first bracing elements each comprising a base plate for engagement with said floor; and said angle units each comprising at least one upright girder having a lower end portion upwardly spaced from the respective base plate, and a telescopable extension mounted in said girder and extendable downwardly below said lower end portion to selectable different extents.

29. A form as defined in claim 28; and further comprising a skirting board provided for each unit and arranged to be supported by the respective extensions.

30. A form as defined in claim 29, said skirting boards each having an upper edge portion and a side facing laterally outwardly with reference to the associated angle unit; and wherein said upper edge portion has a bevelled edge at said side.

31. A form as defined in claim 1; wherein said units each further comprise a track member extending along a lower edge of the respective unit, and wheels mounted on the respective unit and arranged to be raised out of and lowered into contact with said track member when said form is in erected and struck condition, respectively.

32. A form as defined in claim 31, said first bracing elements each comprising a base plate for engagement with said floor; said angle units each comprising at least one upright girder having a lower end portion upwardly spaced from the respective base plate, and a telescopable extension mounted in said girder and extendable downwardly below said lower end portion into engagement with said track member when said form is in erected condition.

33. A form as defined in claim 32; further comprising a skirting board for each of said units, each skirting board being adapted to engage the associated track member.

34. A form as defined in claim 33, wherein each skirting board comprises fasteners engageable with the associated track so that the skirting board is in close contact with said lower end portion of the upright wall panel of the respective angle unit.

35. A form as defined in claim 32, wherein said first bracing members each comprise a projection engageable with the associated track member and preventing upward movement of the same when said form is in struck condition.

36. A form as defined in claim 32; further comprising a pivotable latch associated with each of said first bracing members and arranged to engage said extension and track member when said form is in erected condition; and releasable means for releasably fixed said latch against movement relative to the associated first bracing member.

37. A form as defined in claim 36, wherein said latch is of two parts which are connected so as to be foldable relative to one another from an overlying to an extended position.

38. A form as defined in claim 32, said extension having an upper region; and further comprising a set screw provided on the respective angle unit and engaging said upper region for preventing tilting of said extension relative to such unit.

39. A form as defined in claim 2, wherein said third bracing members each comprise a tapped sleeve pivoted to one of said ceiling panels, and an elongated rod having one end portion threaded into said tapped sleeve.

40. A form as defined in claim 39; and further comprising pivot means pivotably but removably connecting said tapped sleeves to the respective ceiling panels.

41. A form as defined in claim 1, said ceiling panels having respective adjacent edge portions; and further comprising a brace element hingedly connected with both of said edge portions and connecting said ceiling panels.

42. A form as defined in claim 41; further comprising lever arms provided on and projecting downwardly from the respective ceiling panels; and wherein said brace element has spaced end portions which are respectively pivoted to said lever arms.

43. A form as defined in claim 41, wherein said brace element is of adjustable length.

44. A form as defined in claim 1, said ceiling panels having adjacent edge portions; further comprising a hinged tiltable extension member provided on one of said angle units extending across said edge portions and being slidable relative to the latter; and a seat for said extension member provided on the other of said angle units.

45. A form as defined in claim 1, wherein said edge portions of said ceiling panels are arranged to overlap at least when said form is in erected condition.

46. A form as defined in claim 42; and further comprising mounting means for mounting at least one of said end portions of said brace element on the associated lever arm so as to be movable toward and away from the ceiling panel on which such lever arm is provided.

47. A form as defined in claim 1, wherein said angle units each comprise respective terminal flanges adapted for connection to a similar terminal flange of a laterally adjacent additional angle unit; and further comprising a clamping element mounted on each such terminal flange and provided with a slot accommodating a portion of the flange and adapted to accommodate a portion a similar flange of a laterally adjacent additional angle unit.

48. A form as defined in claim 47, wherein said clamping element comprises an additional slot intersecting the first-mentioned slot and adapted to receive a wedge for wedging said flange portions in said first-mentioned slot.

49. A form as defined in claim 1, wherein each of said angle units comprises two spaced parallel upright girders each composed of a plurality of sections.

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