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Kistler

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[54] **SUPPORT STRUCTURE FOR OVERHEAD CONCRETE MOLDING FORMS**

[76] Inventor: **Laurenz Kistler,** Steinhauserstrasse 25, Zug, Switzerland

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Feb. 7, 1972 Switzerland 1724/72

[52] **U.S. Cl.** .... **248/354 P,** 52/263, 52/632, 52/646, 248/357, 249/18

[51] **Int. Cl.** **E04g 25/00**

[58] **Field of Search** .... 248/354 R, 354 S, 354 P, 248/188.4, 185.5, 357; 52/118, 632 X, 637, 638, 263, 646, 655; 249/18, 210; 182/179

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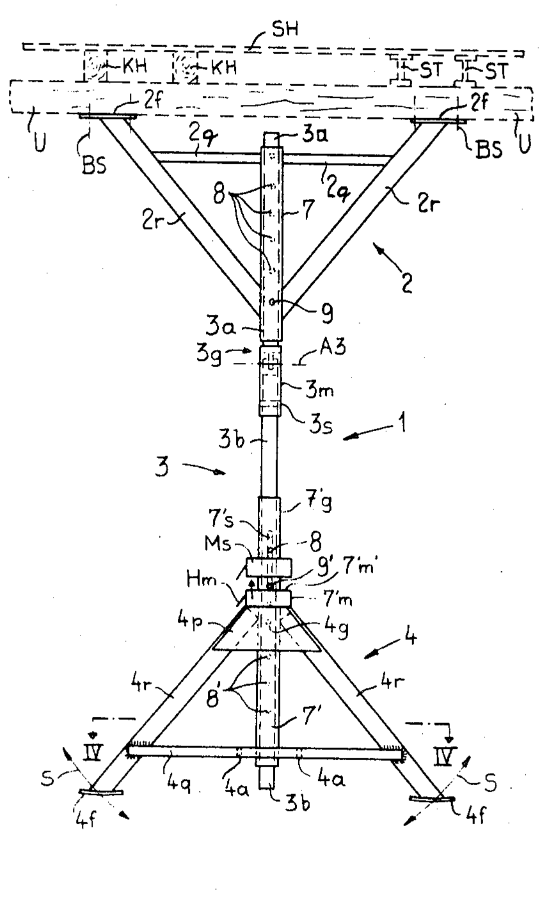
Primary Examiner—Marion Parsons, Jr.
Assistant Examiner—Thomas J. Holko
Attorney, Agent, or Firm—Flynn & Frishauf, P.C.

[57] **ABSTRACT**

Floor and ceiling supports, both generally V-shaped, are connected by a central post-like intervening spacer structure portion, the open arms of the V bearing against the ceiling, to be poured, and the floor or support, which may be a previously poured cement construction, respectively; the V-shaped support portions are preferably made of welded pipes, connected with the central spacer portion by holes and cross pins fitting into the holes to adjustably space the floor and ceiling portions, and permit limited swinging movement to allow for slight misalignments. The erected support structure of the double-V form is laterally maintained in position by stiffening members, preferably clamped to the post-like spacer and providing laterally extending clamp connections for pipe length to hold the support structure in lateral alignment.

9 Claims, 15 Drawing Figures



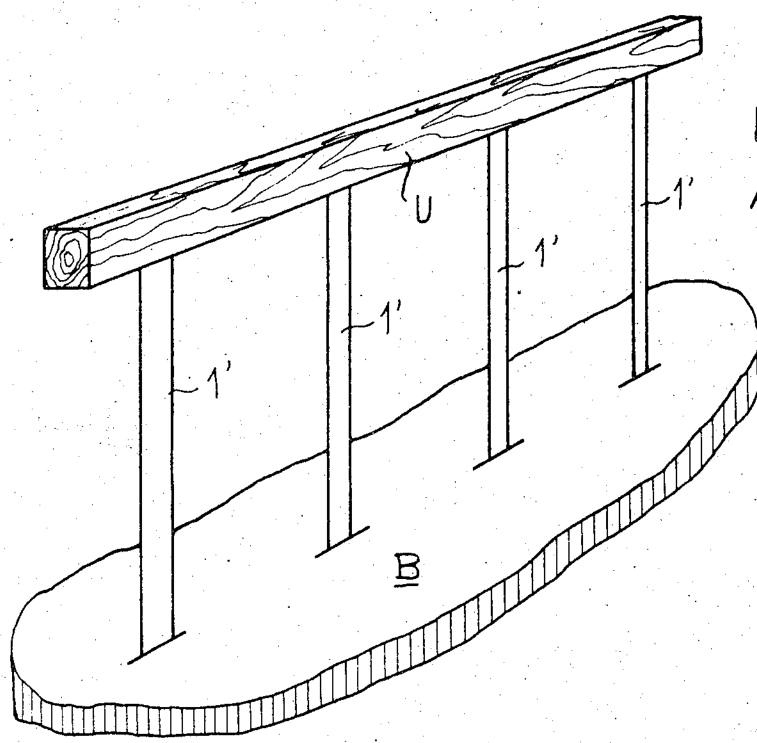


Fig. 1

PRIOR ART

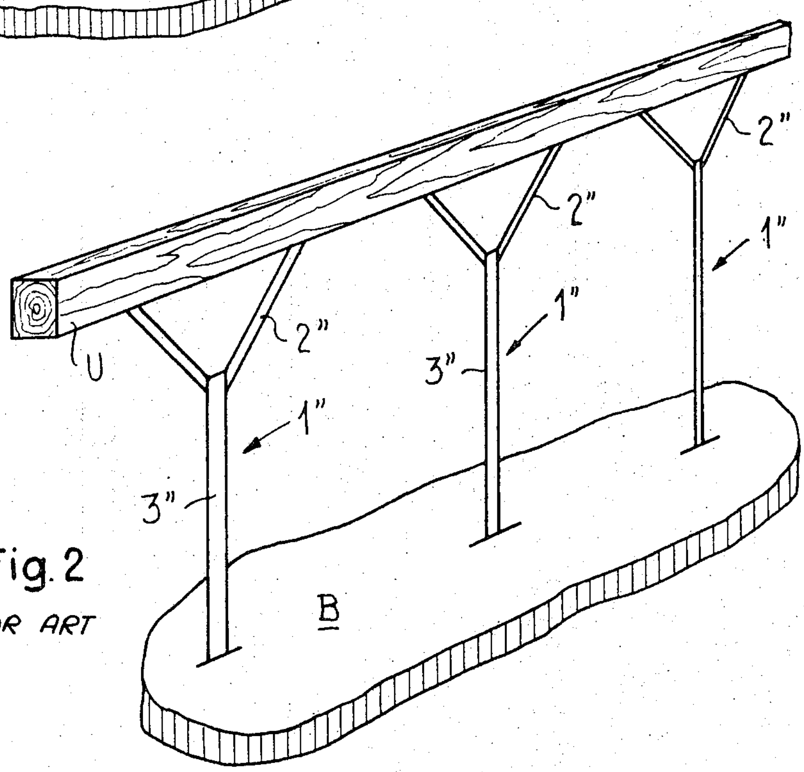


Fig. 2

PRIOR ART

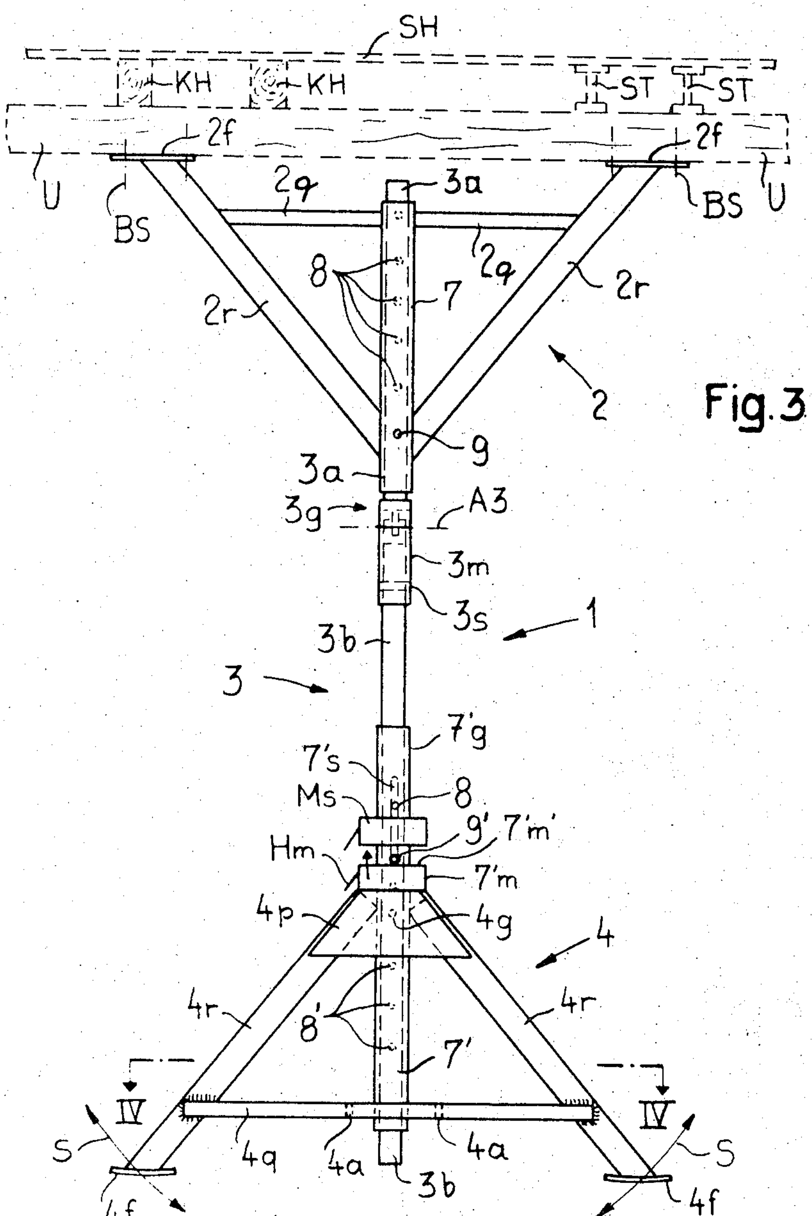

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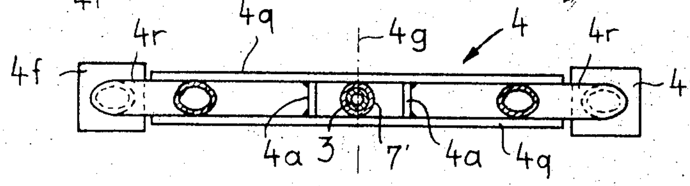
Fig. 3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4r
4g
4
4r
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3
7'
4a
4q

Fig. 4

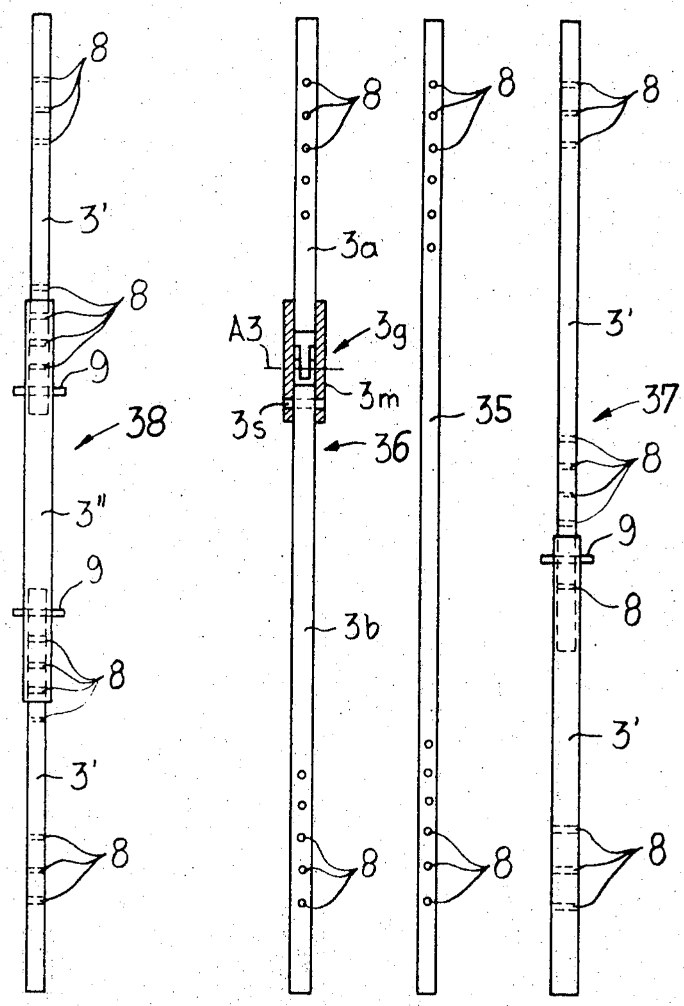

Fig. 8 Fig. 6 Fig. 5 Fig. 7

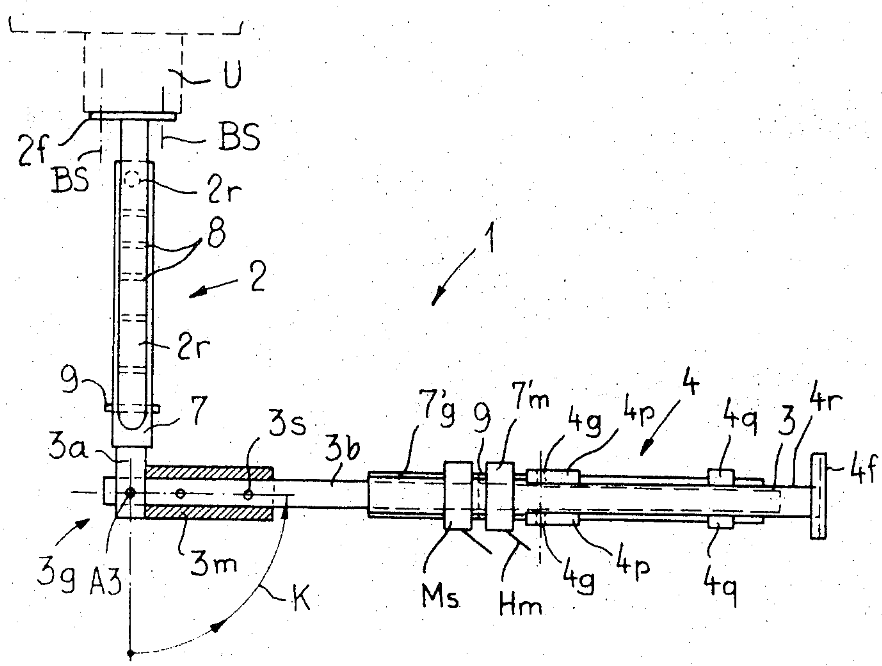
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Fig. 9

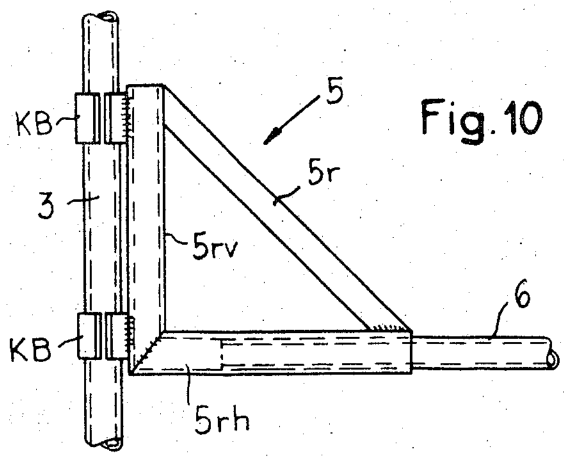


Fig. 10

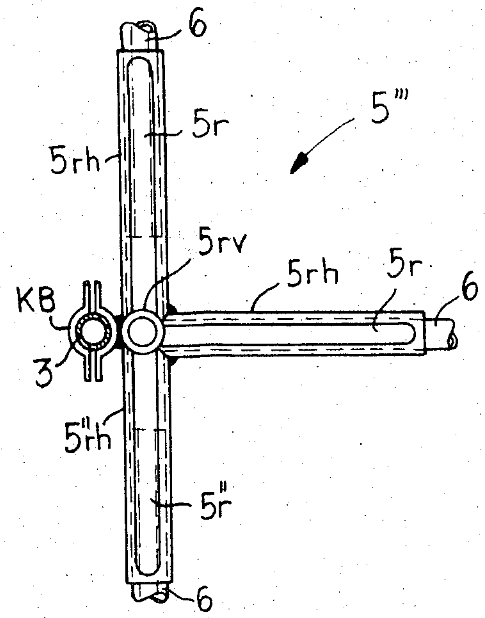


Fig. 12

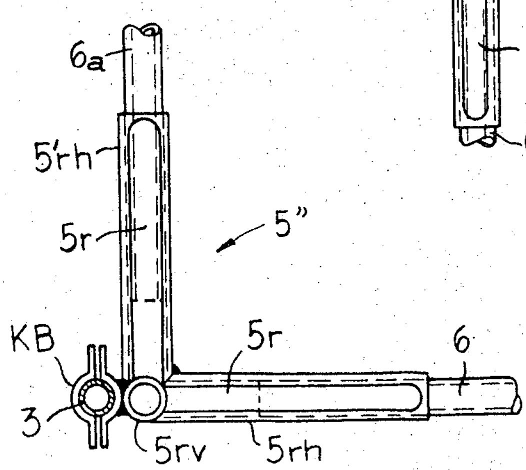


Fig. 11

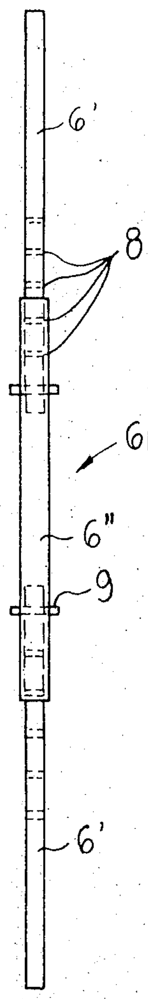


Fig. 14

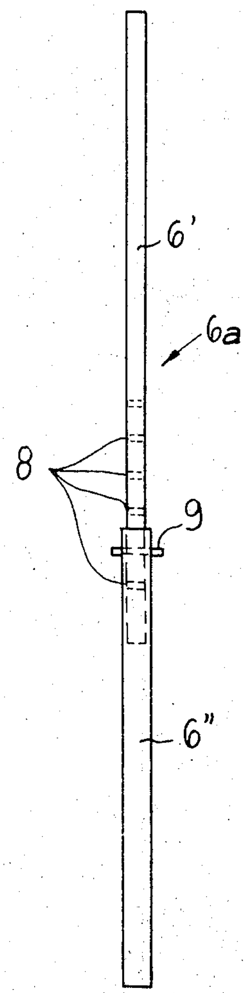
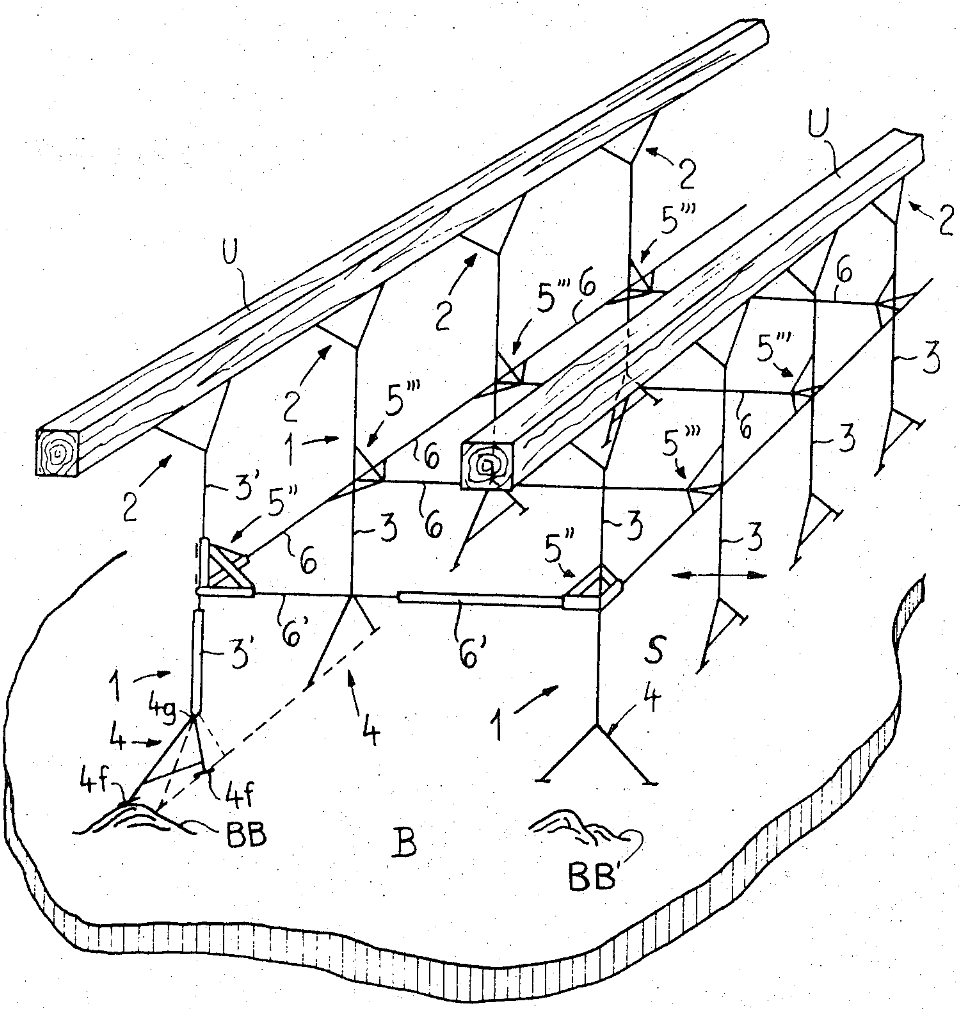


Fig. 13

Fig. 15



SUPPORT STRUCTURE FOR OVERHEAD CONCRETE MOLDING FORMS

The present invention relates to a support structure for overhead concrete molding forms, and more particularly for the type of concrete molding form which is removable, to be moved from floor to floor as soon as concrete which has been poured on the form from the top has set sufficiently to have some load bearing strength.

Various types of support structures are used in building construction. The most common type, which is the older conventional construction, uses straight pieces of timber, in the form of vertical posts. Forming the upper part of these supports in V-shape, so that together the posts with the upper V-shaped part become a Y-shaped structure, provides for better load distribution and has the distinct advantage that the number of the ceiling supports which have to be used, and thus the initial costs as well as the installation costs can be reduced by about half. Additionally, the time necessary for erection and disassembly, when first placing the mold form, and later removal of the mold form after the concrete has at least partially set, is reduced.

Known Y-shaped support arrangements have the advantage that cross beams or stringers which support the mold boards themselves, and which are usually made of beam-type timber, are supported at two spaced points for each vertical support, so that the general distribution of weight on the support posts, that is, the loading on the beams and the mold form, is improved if the same number of vertical posts are used as in the older conventional arrangement with a single vertical post or timber. The dimensions of the single vertical timber can therefore be reduced.

The Y-shaped support arrangement has the disadvantage of poor weight distribution on the lower floor, against which the Y-shaped supports bear. The two V-shaped upper portions of the support arms transfer the loading from two points on the lesser number of vertical extension pieces which bear only against a single bearing point on the floor below. This results in loading on the floor below which is substantially point-shaped, unless additional floor plates are placed. The point-loading results in very substantial weight per square area concentration, which require a solid support floor. If the support floor is a cement ceiling and floor structure of a lower story, or floor level, which has previously been poured, substantial time is required in order to provide for sufficient strength in the lower, poured cement. Recently poured cement floors may not have the necessary strength to carry and support such high point-loading. Permitting time to elapse until the cement has sufficiently cured to be able to accept such high point-type loading is frequently undesirable. The Y-supports in their vertical plane additionally require stiffening structures connected to the straight portions of the support elements.

It is an object of the present invention to provide a support structure for overhead concrete mold forms, into which concrete is to be poured, which is easily assembled and disassembled, is capable of universal use, and of transferring large forces without requiring a support surface which has high point-loading capabilities.

SUBJECT MATTER OF THE PRESENT INVENTION

Briefly, the floor support portion as well as the ceiling support portions are made in V-shaped configuration, with the divergent ends of the V bearing against the floor, and ceiling molding, respectively; the support portions are interconnected by a post-like central spacer portion which interconnects the V-supports, near the apex of the respective support portion, the interconnection being preferably by means of cross pins extending through holes in the central post-like spacer portion so that rough height adjustment is provided. Lateral guidance of any one of these support elements formed of the two V-shaped support portions and the central spacer portion is obtained by stiffening elements which are removably secured to the support elements to transfer forces in a plane perpendicular to the axis of the spacer or post-like structure. These stiffening elements preferably are clamped to the spacer portions and connected to stiffening rods which are arranged to interconnect laterally adjacent support elements. The various portions, and the stiffening structure can readily be manufactured of steel pipe stock, or the like, thus can be easily assembled and reassembled, provide spread-out bearing surfaces and being easily erected or moved to different floor levels.

The invention will be described by way of example with reference to the accompanying drawings, wherein:

FIG. **1** is a perspective view of one example of a prior art structure;

FIG. **2** is a perspective view of another example of a prior art structure;

FIG. **3** is a front view of a support structure in accordance with the present invention;

FIG. **4** is a cross-sectional view along line IV—IV of FIG. **3**;

FIGS. **5, 6, 7** and **8** are front views of various embodiments of central support posts;

FIG. **9** is a fragmentary view of the support structrue of FIG. **3** with the central post hinged and swung at right angles;

FIG. **10** is a side view of a simple stiffening element;

FIG. **11** is a top view of a double stiffening element to provide stiffening in two transverse vertical planes;

FIG. **12** is a top view of a triple stiffening element to provide stiffening in two manually transverse vertical planes, and extending in three directions;

FIGS. **13** and **14** are front views of two embodiments of stiffening rods; and

FIG. **15** is a generally perspective, highly schematic view of placement of the elements of the present invention to support beams or stringers which are, in turn, adapted to support concrete molding boards.

The present invention will best be described by considering the development of this technology in connection with FIGS. **1** and **2.** In FIG. **1**, support posts **1'** are located on a support base B. The support posts are straight post-like elements such as 2 × 4, or 4 × 4 lumber or the like. The load of the wet concrete is transferred from a molding board (not shown) to a ceiling beam or stringer U. The weight Of the cement, and of the stingers is transferred essentially in point-contact along the transverse cross-sectional area of posts **1'**, then over the posts **1'** and to the base B, the entire weight of the wet cement to be poured on a mold support by stringer U being transferred to the small areas beneath the bottom faces of posts **1'**. The distance between the support posts **1'** must be relatively small, that is, a sufficiently large number of posts **1'** must be used to provide sufficient force transfer; alternatively, very heavy timber beams U must be used, possibly in combination with similar timber beams or sole plates at the bottom of posts **1'**, to distribute the weight being transferred and to prevent excessive loading beyond maximum permissible loading of the beams U.

The specific loading, that is, the loading per square area (in kg/cm^2) on a support B must not exceed certain limits, particularly if the support B is the upper floor structure of a previously poured ceiling or floor level in which the concrete has not completely set. Thus, in order to provide for sufficient weight bearing capability of the structure B, sufficient time must be given to permit the concrete of the lower floor level B to set so that it, itself, can accept the loading of another wet concrete layer on top of it.

The supports **1'** illustrated in FIG. **2** provide an improvement. The general structure is Y-shaped, in that a vertical support post is terminated by V-shaped upper support portions. The vertical support post **3''** thus ends in spread-out V-shaped support portions **2''** which, in turn, support the beam or stringer U. This structure results in a more uniform distribution of the weight of cement, and thus more uniform loading. The number of support assemblies, **1''** can be reduced by about half with respect to the support posts of FIG. **1**, and thus the costs become about half (slightly more due to the greater complexity of the structure), and erection as well as disassembly costs are reduced since a lesser number of support assemblies is used. In commin with the embodiment of FIG. **1**, however, the loading on the support B is point-like, and even higher than that in the embodiment of FIG. **1** since only a lesser number of support assemblies **1''** is being used. The high local specific loading (in kg/cm^2) on the support base B may be excessive for freshly poured concrete bases, which have not yet completely set. To provide for safety against collapse, long waiting times must be permitted to elapse until the concrete of the base B has reached the strength to permit high specific loading as would be transferred by the structure of FIG. **2**. The V-shaped upper portion **2''** of the support structure **1''** provides for some stiffening in the Y-plane; no stiffening against lateral twist is available, however, in the lower portion of the supports **1''** within the same plane.

Referring now to the structure **1** of the present invention, FIG. **3**: The upper portion **2** is V-shaped, similar to portion **2''** (FIG. **2**) and connected to a straight post-like portion or support **3**, to form a Y-shaped subassembly. The lower part of the support is not straight, however, but rather terminates also in a V-shaped lower support portion **4**, with the V of the portion **4** being inverted with respect to that of the V of portion **3.** Usually, and in a preferred form, the planes of the V of portions **2** and **4** will be the same. The lower portion **4** has a reception part **7'** to receive the post or center support **3.** Reception part **7'** is connected to the V to be swingable over a limited angle, as will appear.

The swinging connection of the V-shaped brace elements **4r** of the support portion **4** with respect to the reception element **7'** for post **3** is obtained by connecting the V-braces by means of a bearing pins ***4g***, extending transversely to a plane through the V, extending inwardly from connecting reinforcement plates ***4g*** (FIGS. **3, 9**) and fitting into the reception element **7'**, to provide for limited swinging movement in the direction of arrows S.

The braces or legs of the V, of both the upper and lower support portions and shown at **2r**, of welded pipes, such as steel pipes, connectable with the central post **3** by a pin **9, 9'** fitting through holes **8, 8'**. The reception element **7** of the upper support portion **2**, as well as the reception element **7'** of the lower support portion **4** are formed as guide tubes or pipes which have regularly spaced, staggered holes **8.** Post **3** can slide longitudinally, that is axially, in the guide pipes **7, 7'** respectively, and are secured in position by the cross pins **9, 9'** inserted in suitably matching holes. The spacing of the upper and lower support portions **2, 4** can thus be roughly adjusted by suitably locating cross pins **9, 9'** in holes **8, 8'**. The guide tubes **7, 7'** are independently adjustable on the post **3**, with respect to each other. The location of the holes **8, 8'** through post **3** may be so selected that the beginning of a sequence of holes to fit the lower support portion is offset by half the stagger distance from the upper support portion, to provide for finer adjustment in placing.

The central spacer portion, or post-like element **3** may take various forms (FIGS. **5–8**); as shown in FIG. **3**, it is hinged intermediate its length, to form two parts ***3a***, ***3b***, connected by a hinge or joint ***3g***, having a hinge axis A_3 which is transverse to the plane of the upper, or lower V. The extended, erected position of post **3** is maintained by providing a slip element or sleeve ***3m*** which is longitudinally slidable over post **3** and can be maintained in predetermined position by a cross pin ***3s***. As best seen in FIG. **9**, the post **3** can be hinged or jointed and secured in position not only in stretched, straight alignment (FIG. **3**) but also in 90° offset. To swing the lower half or part of the post ***3b***, together with the lower support portion **4** in the direction of the arrow K (FIG. **9**), the cross pin ***3s*** is first removed from the sleeve ***3m***, permitting sleeve ***3m*** to slide off joint ***3g*** and on the lower half of the post ***3b***. The post can then be hinged by 90° and to maintain the hinge position as seen in FIG. **9**, the sleeve is slid forwardly to bear against the upper post part ***3a***, and again be secured in position by inserting pin ***3s*** in a suitable hole through the lower part ***3b*** and sleeve ***3m***. The facing edge of the sleeve ***3m*** will then maintain the two parts ***3a***, ***3b*** in relatively fixed angular position.

The support assembly formed of upper support portion **2**, lower support portion **4** and central spacer post **3** can be adjusted, roughly, in steps as set forth by suitably placing cross pins **9, 9'** through openings **8, 8'**. Additionally, and in order to provide for fine adjustment and levelling of the concrete form to be supported by the structure, with respect to possibly irregular surfaces, a fine positioning and location arrangement is provided to bridge the gap between the coarse positioning obtained by locating cross pins in holes. The guide tube **7'** (or both guide tubes **7, 7'**), FIG. **3**, is formed with an outer thread **7'g**, on which an adjustment nut **7'm** is threaded. Adjustment nut **7'm** is formed with a handle Hm, and an upper bearing surface **7'm'** which engages the lower side of cross pin 9′ extending through the lower guide tube 7′ and central post 3. The cross pin 9′ is guided in a longitudinal slit 7′s of guide tube 7′, the longitudinal slit 7′s having a length which corresponds to the vertical position of the continuously variable fine adjustment of the distance between the upper and lower support portions 2, 4; preferably, the length of slit 7′s is at least half the distance between the coarse positioning steps, and preferably longer, and may extend to a length somewhat over the full distance.

A locking nut M_s, and essentially similar to adjustment 7′m, prevents loose movement of the lower support element when not in erected, bearing position, for example when being disassembled or transported over an abutment, a terrace railing, or the like; it is provided to prevent longitudinal sliding of the lower portion 4 over the still free part of the vertical slit 7′s, not taken up by vertical adjustment when the support is erected. The counter nut M_s is screwed from the top downwardly towards the cross pin 9′ so that cross pin 9′ is securely locked in position between the two nuts 7′m and M_s, thus locking the lower support 4 with respect to the center post 3, and prevent sudden and undesired sliding of the lower support 4 with respect to post 3 during transport or other handling.

Guide tube 7′ of the lower support 4 is connected by pin *4g*, as described, with a pair of reinforcement plates *4p* welded on both lateral sides of the V-arranged pipes *4r*, to provide for limited swinging movement. It is guided in its swinging movement with respect to the pipes *4r* by a pair of cross braces *4q*, located at the lower, divergent part of the legs *4r* and connecting them crosswise (see FIG. 4), guide tube 7′ extending between the braces *4q*. The swinging distance or movement of the guide tube 7′ is limited by a pair of transverse stops and reinforcement brackets *4a* (FIG. 4) extending between the cross braces *4q*, and, for example, being welded thereto. The chord of the arc through which the guide tube 7′ may swing is small with respect to the distance between the floor plates *4f*.

The swing joint provided by pin *4g* between the V-arranged braces *4r* and the reception pipe 7′, and hence the center post 3 permits compensation for possible misalignment and unevenness of the support on which the brace is to be used. This support typically would be a concrete poured floor of the next lower floor level of a building. Permitting limited swinging movement provides for effective compensation since the position of the lower support *4r* can be matched to depressions or bulges in the support, while permitting vertical positioning of post 3, and thus proper positioning of the upper support part 2, in exact vertical alignment. In spite of possible uneven support surfaces, the support assembly 1, with its two V-arranged legs or braces *4r* provides for solid support against any base support surface encountered in construction work, so that the entire support assembly reliably rests on its base, capable of transferring substantial weight without bending moments, since the post 3 can be placed in exact vertical alignment. To provide for good matching and weight transfer, the V-arranged legs *4r* have base plates, or sole plates *4f* secured thereto which are slightly bulged or bowed, as clearly seen in FIG. 3, in somewhat exaggerated form.

FIG. 4 is a top view of the guiding arrangement of the movable, swingable guide tube 7′ of the lower support

portion 4, and illustrates limiting of the swing path of the guide tube 7′ from its normal vertical position, towards the right or the left, until engaged by the cross brackets *4a*. As can be seen, the swing path, that is the limits of deflection of the V-arranged legs *4r* from symmetrical vertical alignment need not be very great. The deflection towards the right or the left (see also the arrows S in FIG. 3) need only be small since the unevenness of the support surface, usually encountered in construction work, is comparatively slight (compare for example FIGS. 1 and 2), so that the overall angular deflection of the lower support portion 4, in angular degrees, with respect to the vertical can be quite small, as illustrated, roughly to scale, in FIGS. 3 and 4.

Various types of center supports 3 are shown in FIGS. 5 to 8; the most simple form is a straight post or rod as seen in FIG. 5, having holes 8 passing therethrough. Pipe 5 is a single unitary pipe, formed with the cross bores 8 which permit step-wise adjustment of the height of the upper support 2 above the base B, that is, with respect to the lower support 4, the adjustment between upper and lower supports being independent.

FIG. 6 illustrates a two-part post 36 which includes two parts *3a*, *3b* connected by a hinge joint *3b*, and secured in vertical, or 90° alignment by the sleeve *3m*, as previously explained in connection with FIGS. 3 and 9.

FIG. 7 illustrates a post 37 which is particularly suitable for construction in which substantial distances have to be bridged. In order to permit better adjustment of longitudinal adjustment range, post 3 is formed of a pair of telescopically fitting pipes 3′, connected together by cross pins 9 extending through cross bores 8.

FIG. 8 illustrates a post 38 which has a still wider range of rough adjustment. Three telescopically arranged pipes 3′, 3′′ are provided, the upper and lower pipes 3′ being for example similar, and fitting into a larger central pipe 3′′. Both the upper and lower pipes 3′, as well as the central pipe 3′′ are formed with cross bores to receive cross pins 9. The range of rough adjustment, in steps, is thus further extended. Of course, hinge joints as discussed in connection with post 3 (FIGS. 3, 9) can be placed on any one of the posts of FIGS. 5–8, for example locating the hinge on the central pipe section 3′′ (FIG. 8), intermediate the length of the unitary single post 35 (FIG. 5) or offset from the cross bores 8 in post section 3′ of FIG. 7.

The post 3 of FIG. 3 is shown in 90°-bent position in FIG. 9, on which the slidable sleeve 3m is clearly seen to secure the post either in extended position (FIG. 3) or in 90° offset position as seen in FIG. 9.

The capability of folding post 3 is of substantial technical advantage in construction. In any construction in which there are terrace or cantilivered projections, particularly with upstanding guards or railings, which are cast together in one operation with the connected ceiling, that is, the floor of the next upper floor level, removal of the support posts is difficult if the support elements cannot be folded, particularly when transport over the cast edge of the cantilivered floor together with an upstanding projection wall is needed. Usually, the support beam U (FIGS. 1, 2, 3) is secured to the support posts or brace assemblies by means of screws and, preferably, should be left in place to save time and labor. Referring to FIG. 3, the beam U is connected to the top plate *2f* of the upper support portion 2 by means of screws BS. Beam U, in turn, is secured to stringers KH, for example of 2 × 4 or 4 × 4 lumber, and on which the actual mold plates, or mold shuttering boards SH are fixed. The mold plates SH support the cement as it is being poured. The beam and mold board construction, not forming part of the present invention, is shown in broken lines in FIG. **3.**

The general arrangement of the support structure, and the stiffening elements is best seen in FIG. **15,** which shows in highly schematic representation the principle of the support structures to carry beams U over which concrete pouring mold boards are to be secured. The weight of the concrete being poured is uniformly distributed over the beams U due to the V-shaped upper support portions **2.** The load distribution is quite even, so that the substantial distance between support structures **1** still provides for adequate load carrying capability of the beam U, without requiring excessive or unusual dimensions of the beam U. This permits use of only a reduced number of supports **1,** approximately half the number usually required, thus reducing the erection and disassembly time by about half. The lower portions **4** provide for good distribution of weight on the lower support surface B, due to the double weight-bearing legs of each portion **4.** The specific loading, that is, the loading in weight per unit area of the surface B is substantially reduced, so that the surface B which may, for example, be a rather freshly poured cement surface itself which is still setting, is not excessively loaded. The time consuming and hence, in construction, expensive delays to permit complete setting or curing of the lower concrete floor surface is thus avoided. If the lower surface should not be flat or smooth, but have a bulge BB, then the swinging capability of the lower support portions **4** will automatically compensate for unevenness of the support. The central post **3** is still maintained in its exact vertical position, and securely transfers weight, that is, is secure and steady on both legs. If the bulge is excessively high, as seen, for example, at BB′, the lower leg portion **4** may be twisted 90° with respect to the upper portion **2,** if the post **3** is formed with cross bores which are not only vertically staggered but also offset 90° with respect to each other. Various sets of such bores may be provided, if desired.

The vertical support structures are laterally connected by stiffening braces **6, 6′** which are connected to the posts **3, 3′** by means of brackets **5, 5″** or **5‴.** The braces **6, 6′** are telescopically arranged so that they can be fitted to the distance between the respective support structures **1,** to provide for an easily erected, quickly assembled solid stiffening interconnection. The height adjustment of the beams U, and hence the ceiling to be poured from the floor B is set by a combination of pin and hole connections, for rough adjustment and for fine adjustment by means of screw-extension as previously explained. These adjustments can be made independently for each support structure. FOr assembly, and when using a jointed post, the posts are first placed roughly, then aligned, and then snapped into erected position, similar to a toggle or snap action, and secured in erected alignment. The brackets **5″, 5‴,** or similar brackets, which may have been clamped on the posts **3** already, or are clamped thereafter, are then assembled to stiffening rods or bars **6, 6′** (which, themselves, may be pipe elements with lateral length adjustment similar to the posts **3**) so that the entire support structure for the beams U and the superposed concrete mold forms will be statically rigid, yet quickly erected, with accurate height adjustment for each support structure **1.** Use of jointed posts **3** permits removal of subassemblies including the jointed structure together with brackets **5″, 5‴,** for example even over railings, or other impediments, stairwells or the like. Yet, when erected, the joint is held in statically reliable load-bearing position, secure against possible deflection or collapse upon application of weight to the beams U.

The braces and brackets generally shown at **5, 6** are illustrated in greater detail in FIGS. **10–14;** referring to FIG. **10:** A right-angled triangle **5** has a pair of clamping bridges KB, located and dimensioned to be clamped to a post **3.** A horizontally extending portion **5**rh projects from the vertical portion **5**rv. Portions **5**rv and **5**rh preferably are made of pipes, welded together, and secured by a triangular stiffening bracket **5**r. Pipe **5**rh receives guides and secures a stiffening rod or pipe **6,** as will be explained in greater detail in connection with FIGS. **13** and **14.** All pipes **5**rv, **5**rh, and brace **5**r, which preferably also is in pipe form, are welded together, and the clamps, or clamping bridges KB are likewise welded to the triangular structure, as shown to pipe **5**rv. Pipe **6,** forming the horizontal brace, is telescopically received in pipe **5**rh and secured by means of a rapid connection clamp of known type (not shown), for example including a slit pipe section (which may be an extension of pipe **5**rh) to which a lateral flange is welded which has a screw cast passing therethrough, which carries an inclined track, fitting against a nut, a thread, or a cam surface on the flange. Upon rotation of the threaded element, for example by a handle, the split extended section is securely clamped to the outside of pipe **6.** Other clamp connections may be used. Such rapid release clamps are known. The bracket of FIG. **10** secures the post **3** in one direction in a vertical plane. In the embodiment of FIG. **10,** the brace **6** is received telescopically within the lower pipe **5**rh, so that the pipe section **5**rh serves simultaneously as part of the stiffening element and additionally as a receptacle for brace **6.** The brace **6** can be secured to the stiffening element **5** also by welding clamps similar to clamps KB to the section **5**rh, at their side, for example, to permit clamping of braces or rods **6** in the auxiliary clamps laterally of the portion **5**rh. This construction, in some instances, may have the advantage that the braces **6** can be pushed through the clamps to any desired extent, laterally at the side of the post **3,** since neither the vertical pipe **5**rv nor the post **3** are in the way of unlimited sliding insertion of the brace **6** with respect to the bracket **5.** In the construction of FIG. **10,** the portion **5**rh simultaneously receives the brace **6** and additionally, by means not shown, provides for its attachment to the brace directly; in an alternate for, additional clamps similar to clamps KB are provided so that the portion **5**rh acts only indirectly as the element to which the braces **6** are secured.

FIG. **11** illustrates a double stiffening element **5″** having a pair of transversely arranged horizontally located receiving pipes **5**rh, one for one brace **6** each, in order to provide for secure aligned positioning of a post **3** in two mutually perpendicular vertical planes, or in two main directions, respectively. The stiffening element **5″**, in essence, is similar to that of the simple stiffening element **5** as seen in FIG. **10.** The clamping bridge KB is clearly shown, except that clamping screws to clamp the semi-circular portions of the clamp KB have been omitted for clarity in the drawings.

The stiffening rods **6** may, as explained in connection with FIG. **10**, be located adjacent the elements **5**rh, if additional clamps similar to clamps KB are provided on the portions **5**rh, extending in their mutually perpendicular directions. As described in connection with FIG. **10**, the two horizontal pipes **5**rh then do not act directly as the clamping elements for braces **6**, but rather indirectly by additional clamps KB. In such a construction, the additional clamps KB would be located laterally adjacent the horizontal portion **5**rh (in FIG. **11**, below the representation of portion **5**rh), permitting the stiffening brace **6** to pass laterally adjacent vertical pipe **5**rv and post **3**, and extend to the left past element **5**rv, **3**. The clamps KB to be attached to the vertically extending portion **5**'rh can then be located beneath the portion **5**'rh, that is, in a vertical plane beneath the horizontally extending portion **5**'rh, so that a stiffening pipe **6***a* can be pushed any desired distance from top to bottom, adjacent post **3**, beneath portion **5**'rh and section **5**rh and, possibly, a brace **6** located laterally thereof.

FIG. **12** illustrates a stiffening bracket element **5**''' having two oppositely directed pipe sections **5**'rh, **5**''rh, and another pipe portion **5**rh extending perpendicularly thereto, so that three stiffening brackets or pipes **6** can be clamped by such a bracket, to provide for secure and reliable location of a support structure **1** in two perpendicular vertical planes, but extending in three directions. The construction of the bracket **5**''' is a result of further developments of the double elements **5**'' of FIG. **11**, by adding the additional pipe **5**''rh, and the associated stiffening brace **5**''r.

The stiffening elements of FIGS. **10–12** permit quick clamping, as loose parts, on posts **3**, or anywhere along the supports **1**; they further permit ready clamping of stiffening elements **6**, such as pipes, at any desired location, utilizing quick-release or quick-coupling clamps of known types.

The stiffening elements **6** may be single pipe sections or, as seen in FIGS. **13** and **14**, may themselves be composites. FIG. **13** illustrates pipe sections **6**', **6**'', telescopically received, and connected by cross pins **9** fitting into openings **8** formed in one or the other (or both) of the elements **6**', **6**''. FIG. **14** illustrates a composite arrangement in which three telescopic parts **6**', **6**', **6**'' are provided, the elements **6**' fitting into the elements **6**'' of greater diameter and being likewise connected by cross pins fitted through cross bores or holes. The range of adjustment of the brace **6***a* of FIG. **14** is greater than that of brace **6***a* of FIG. **13**.

The support system, and the individual support elements or structures of the present invention permit use of well-known and standard construction material. The various pipes can be made of standard steel, or galvanized piping, of standard size (for example ¾ to 1½ inch) steel pipe, depending on weight carrying capacity. The clamps and quick-coupling - quick-release connections are likewise standard articles of commerce. The entire construction is thus simple and can readily be adapted for use with standard construction lumber which is usually available, without modification of existing, customarily used and available materials.

Various changes and modifications may be made within the inventive concept, and features disclosed and described in connection with any one of the drawings may be applied, within the inventive concept, to structures described in connection with other drawings or features.

I claim:

1. Support structure for overhead concrete molding forms comprising

a floor support portion (**4**) adapted to be placed on a support surface (B);

a ceiling support portion (**2**) adapted to support an overhead ceiling mold form (U, KH, ST, SH);

and an elongated intervening spacer portion (**3**) connecting and spacing said ceiling and floor portions;

wherein the floor support portion (**4**) comprises an inverted V-structure having spaced terminal floor support ends (**4f**);

the ceiling support portion (**2**) comprises an upright V-structure having spaced terminal ceiling support ends (**2f**);

the spacer portion (**3**) comprises a single post having a longitudinal extent less than the distance between lines connecting the floor ends (**4f**) and the ceiling ends (**2f**);

respective attachment means (**7, 7', 8, 9, 9'**; 4g) removably and longitudinally adjustably securing each said support portions to the spacer portion adjacent the apex of the V-structure at opposite end portions of the post to provide a support structure (**1**) transferring weight from two spaced points at the terminal ends of the V-structure of the ceiling support portion to the single post, and then spread the load to two spaced points at the terminal ends of the inverted V-structure of the floor support portion;

the attachment means between the floor support portion (**4**) and the post (**3**) being movable to permit swinging movement of the floor support portion about an axis transverse to the axis of the post and in a plane which includes the post and the inverted V-structure;

and stiffening means (**5, 6**) removably secured to the support structure (**1**) transferring forces in a plane perpendicular to the axis of the intervening spacer portion.

2. Structure according to claim **1**, wherein the stiffening means comprises brackets (**5**) clamped to the spacer portion (**3**) adjacent the post and elongated stiffening elements (**6**) removably and adjustably secured to the brackets (**5**) and extending between adjacent brackets when the support structure is erected.

3. Structure according to claim **1**, wherein the attachment means for at least one of the support portions (**4**) comprises holes (**8**) formed in the spacer portion extending transversely to the plane of the V-structure of the respective support portion, and pins (**9**) extending through both the floor support portion and the holes in the spacer portion.

4. Structure according to claim **1**, wherein the attachment means for the floor support portion comprises

a reception tube (**7, 7'**) telescopically and longitudinally adjustably secured to the spacer portion; and bearing pin means (**4g**) swingably connecting the inverted V-structure adjacent its apex to the reception tube.

5. Structure according to claim **4**, wherein the reception tube is formed with transverse openings;

a connection plate (**4p**) is provided connecting the legs of the V of the inverted V-structure at the apex of the V;

and the bearing pin (4g) means swingably connects the connection plate (**4p**) and the reception tube (**7, 7'**).

6. Structure according to claim **5,** wherein a pair of connection plates are secured to either side of the V-structure;

a pair of cross braces (4q) are provided, connecting the legs of the V in the region of the spaced floor support ends and at either side thereof, the reception tube (**7'**) being guided between the cross braces and the connection plates;

and stiffening elements (4a) connecting the cross braces of the pair at either side of the center line between the V-structure to reinforce the V-structure and form a stop to limt swinging movement of the reception tube and the V-structure, respectively.

7. Structure according to claim **1,** wherein the stiffening means comprises a stiffening bracket in form of a right-angle triangle, having a horizontally extending portion (**5**rh), the stiffening bracket comprising at least three welded pipe elements (**5**r, **5**rv, **5**rh);

a brace element (**6**) secured to said horizontally extending portion;

and clamps (KB) welded laterally to at least one of said pipe elements (**5**rv) and adapted for clamping the respective pipe element to the post (**3**) adjacent, and parallel to the post.

8. Support element for structural systems for overhead concrete mold forms comprising

a floor support portion (**4**) adapted to be placed on the support surface;

a ceiling support portion (**2**) adapted to support the overhead ceiling mold form;

an elongated spacer post (**3**) to connect and space said ceiling and floor portions, and transfer weight therebetween wherein

the floor support portion (**4**) comprises an inverted V-structure having spaced terminal floor support ends (**4f**);

the ceiling support portion comprises an upright V-structure having spaced terminal ceiling support ends (**2f**);

the post having a longitudinal extent less than the distance between lines connecting the floor ends (**4f**) and the ceiling ends (**2f**) to provide for transfer of weight, the floor ends and the ceiling ends through the V-structures and the post;

respective attachment means (**7, 7', 8, 9, 9'**) removably and longitudinally adjustably securing each said support portions to the post adjacent the apex of the V-structure at opposite end portions of the post;

the attachment means between the floor support portion (**4**) and the post (**3**) including hinge means having a hinge axis transverse to the axis of the post and transverse to a plane including the inverted V-structure to permit swinging movement of the floor support portion (**4**) about hinge axis and adjustment for uneven floor surfaces;

and means (**4**a) limiting the extent of swinging movement to an arc, the chord of which is small with respect to the distance between the floor support ends (**4**f).

9. System according to claim **8,** further comprising stiffening means (**5, 6**) adapted to be removably secured and to be fitted to the post adjacent said post to form a laterally secured element to transfer forces in a plane perpendicular to the axis of the elongated post (**3**), the stiffening means comprising brackets, and clamps to clamp the brackets, removably, and adjustably to the post.

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