United States Patent

Martin

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[54] HANGER DEVICE USEFUL IN FORMING CONCRETE STRUCTURAL SLABS

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 850,735, Aug. 18, 1969, abandoned.

[52] **U.S. Cl.** **249/25**

[51] **Int. Cl.** **E04g 11/38**

[58] **Field of Search** 249/23–25, 28

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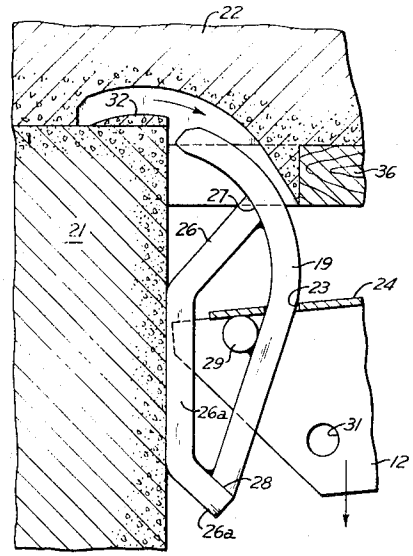
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Attorney—Meyer Neishloss and Alvin E. Ring

[57] **ABSTRACT**

A hanger device useful in conjunction with temporary decking or forms for pouring concrete structural slabs, such as roofs or floors, is constructed of a channel bearing a curved, pivoting tongue-shaped member. The channel is adapted to hold a joist for supporting the temporary decks on which the concrete is poured. The tongue-shaped member protrudes upwardly through a slot in the top of the channel and rests at its downwardly curved end on a preformed support, such as a joist or beam. Rotational movement of the tongue-shaped member is prevented by a locking pin cooperating therewith. In forming the slab, the poured concrete covers the protruding portion of the tongue-shaped member, the preformed support and the form decking. After hardening of the concrete, the hanger device carrying the supporting joist is readily removed by withdrawing the locking pin and applying a downward force on the channel is the vicinity of the tongue shaped member, resulting in a slight vertical displacement of the tongue-shaped member from the concrete contiguous thereto and rotation thereof out of the concrete without binding. The device may then be reused in forming another slab.

5 Claims, 6 Drawing Figures



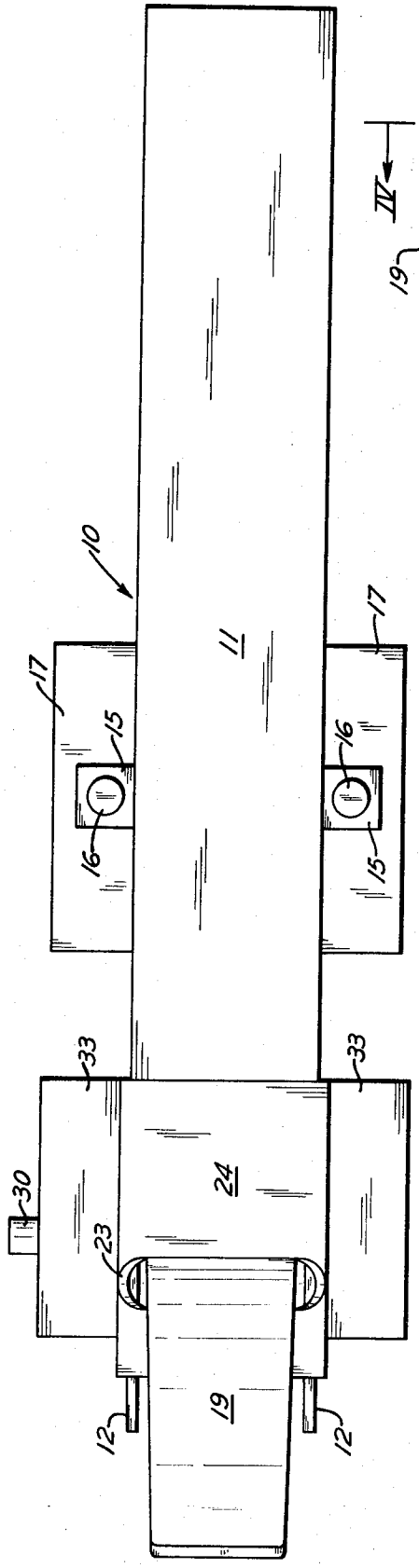


Fig. 1

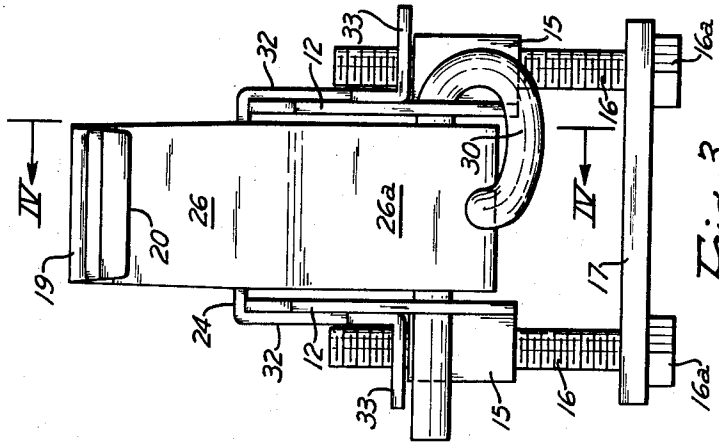


Fig. 3

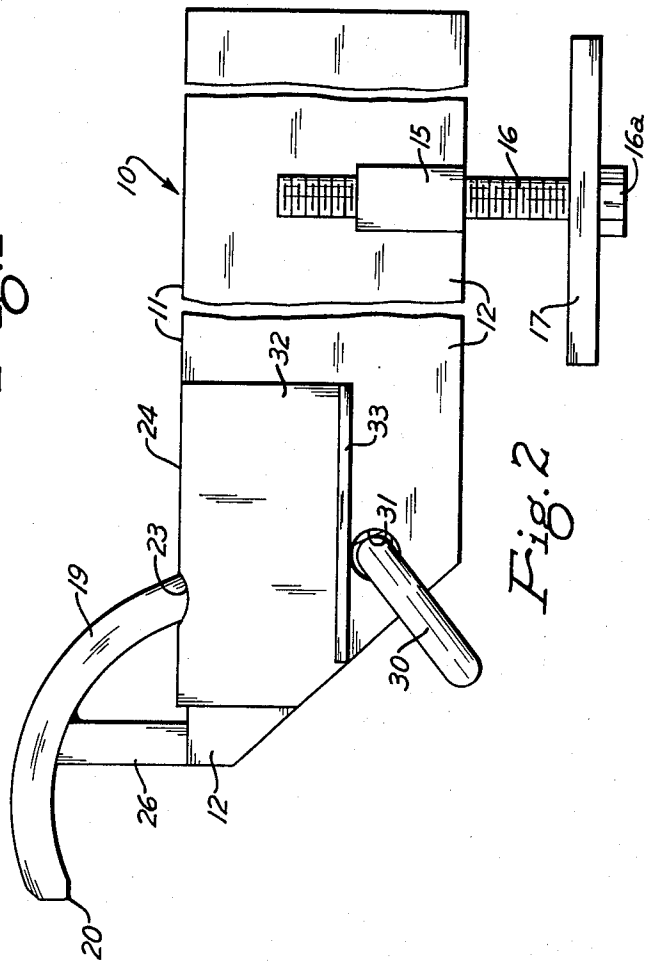


Fig. 2

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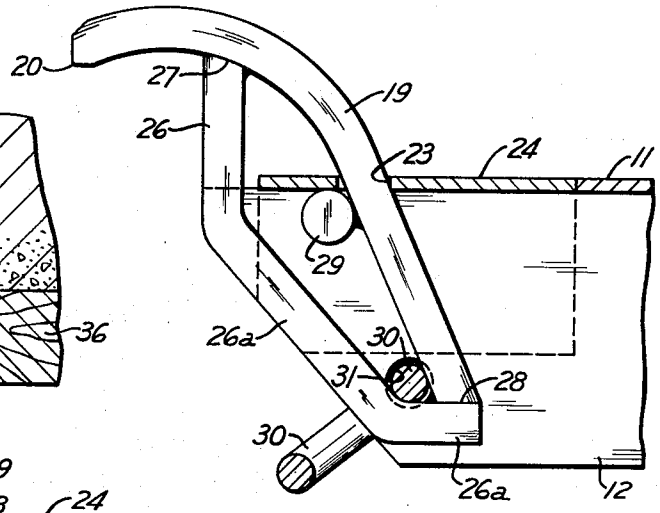


Fig. 4

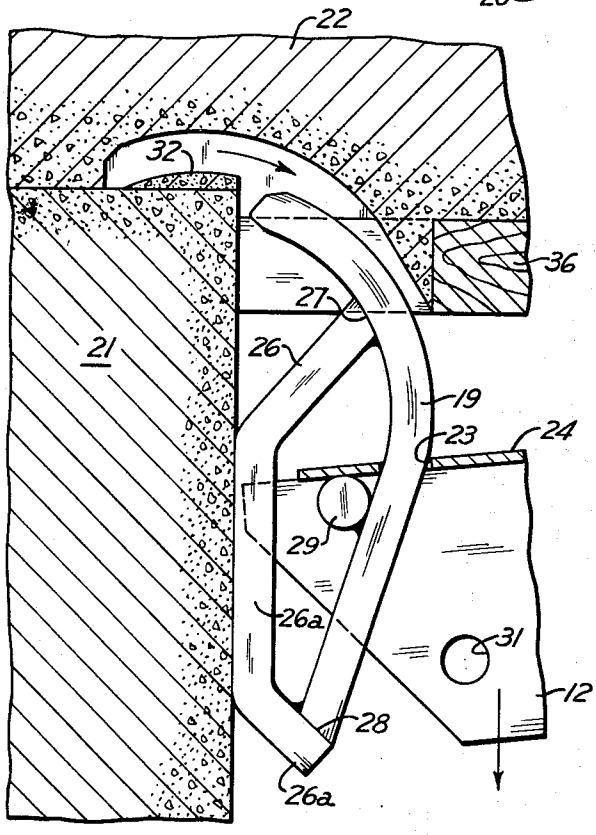


Fig. 5

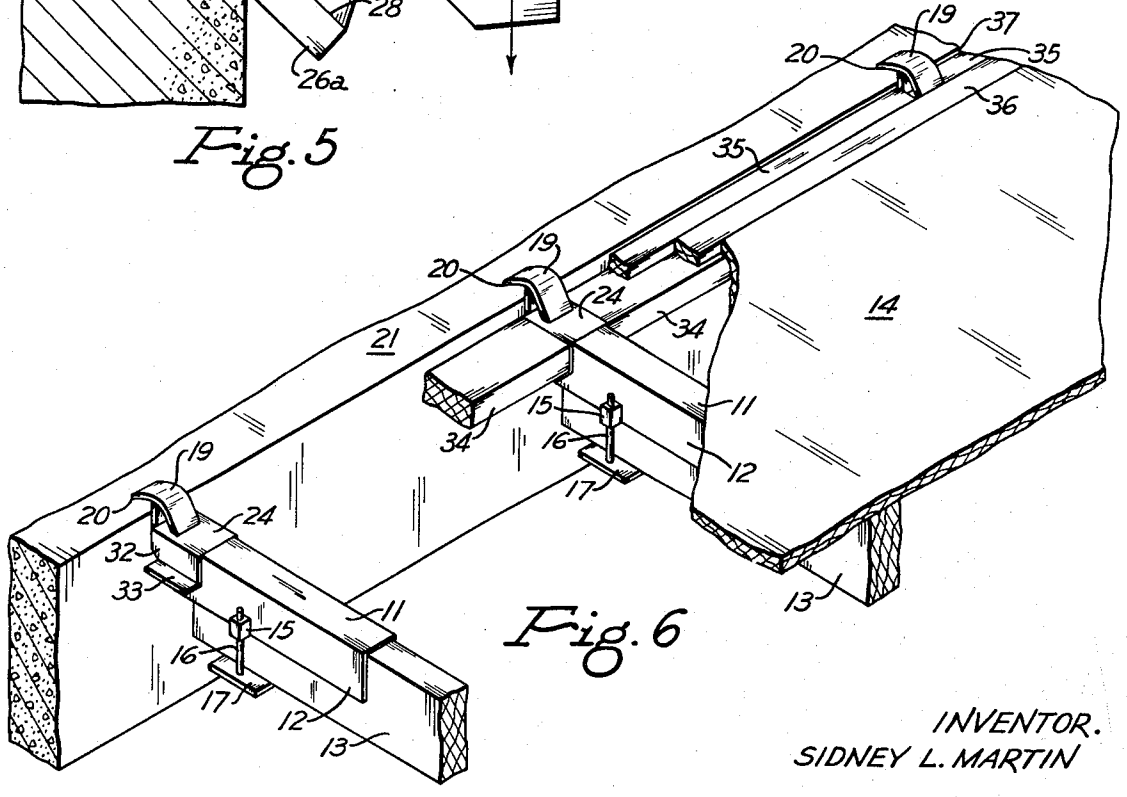


Fig. 6

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HANGER DEVICE USEFUL IN FORMING CONCRETE STRUCTURAL SLABS

This application is a continuation-in-part of my copending application, Ser. No. 850,735, filed Aug. 18, 1969, now abandoned.

SUMMARY OF THE INVENTION

This invention relates to a hanger device useful in forming substantially horizontal concrete structural slabs, such as floors and roofs. More particularly, it comprises support means having inner and outer surfaces, such as an inverted channel or a rectangular or tubular conduit, adapted to hold a joist for supporting temporary forms or decks for the concrete and carrying a movable tongue-shaped member protruding above and below the top of the support means through a slot adjacent one end thereof. The portion of the tongue-shaped member protruding above the support means is curved, defines an arc which is substantially a segment of the circumference of a circle, and is adapted to rest at its downwardly curved end on a preformed support for the concrete slab. The device is provided with locking means preventing rotational movement of the tongue-shaped member during pouring of the concrete while the curved end of the member is resting on the preformed support and is being covered by the concrete. A circular pivot means is fixed to the portion of the tongue-shaped member within the support means immediately adjacent the slot and interiorly of the tongue-shaped member. The pivot means cooperates with the tongue-shaped member to rotate the member free of the hardened concrete without binding upon removal of the locking means.

THE DRAWINGS

In the drawings

FIG. 1 is a plan view of the hanger device of the invention;

FIG. 2 is a side elevation of the device of FIG. 1;

FIG. 3 is a front elevation of the device shown in FIGS. 1 and 2;

FIG. 4 is a view, partly in section, taken along the line IV—IV of FIG. 3 in the direction of the arrows;

FIG. 5 is a view similar to that of FIG. 4 showing withdrawal of the hanger device and its tongue-shaped member from a hardened concrete slab; and

FIG. 6 is a fragmentary perspective view showing the hanger device and accompanying form joists and decking in position for pouring a concrete structural slab.

DETAILED DESCRIPTION

Referring to the drawings, the hanger device of the invention comprises a support means having inner and outer surfaces, such as the inverted channel shown generally at **10**. The inverted channel has a top portion **11** and side portions **12**. Typically, the channel can be made of ⅛ inch steel and can have a length of about 14 inches, both dimensions depending upon the load to be carried The interior of the channel may be shaped to fit over the ends of wood joists **13**, for example, 2 × 6 or 2 × 8 inch joists, or the ends of suitable steel joists (not shown) which support the form decks or decking **14** on which a concrete slab is to be formed.

Welded to each side **12** of the inverted channel **10** are female threaded lugs **15** through which pass bolts **16**. As shown, a clamping plate **17** extending beyond the width of the channel is carried by the heads **16*a*** of the bolts and, as best shown in FIG. **6**, the clamping plate serves to furnish a hanger support for the joists **13**. As is apparent from the drawings, the distance from the inner surface of the top **11** of the inverted channel to the surface of the clamping plate may be varied to accommodate the particular size of joist being used.

Adjacent that end of the channel to which the joist is fastened, there is provided a movable tongue-shaped member **19** which is adapted to rest or bear at its downwardly curved end **20** on a preformed support **21** for the concrete slab **22**. The preformed support can be a flush-sided concrete beam or a steel beam having projecting flanges, such as an I-beam. As best shown in FIGS. **1** and **4**, the tongue-shaped member protrudes above and below the top of the channel through a slot **23** in a continuation **24** of the top **11** of channel **10**. As will be described later, the continuation **24** also forms part of a hanger device spacing assembly which is attached to the sides of the inverted channel.

The portion of the tongue-shaped member **19** protruding above the channel defines an arc which is substantially a segment of the circumference of a circle, as shown in FIGS. **2** and **4**. A substantially vertical position limiting lug **26** is fixedly secured, as by welding, at position **27** on the inner (concave) surface of the curved protruding portion of the tongue-shaped member **19** approximately midway of the horizontal distance between the slot **23** and the end **20** of the tongue-shaped member. An integral continuation **26*a*** of lug **26** is also welded to the lower end **28** of the portion of the tongue-shaped member terminating within the inverted channel **10**. The position **27** at which the limiting lug is welded to the member **19** is not critical; the length of the tongue-shaped member overhanging the support **21** should be sufficient to prevent slipping of the end **20** thereof off the preformed support **21** after the entire hanger assembly and decking are in place and the concrete has been poured. By way of example, for an inverted channel having a length of about **14** inches, and the tongue-shaped member and limiting lug being fabricated from relatively heavy steel of about ⅜ × 1½ inches, the horizontal distance from the end **20** of the tongue-shaped member and the outer surface of the vertical portion **26** of the lug can be 1¼ inches.

As shown in FIGS. **4** and **5**, a cylindrical pivoting lug **29** is fixedly attached, as by welding, across the width of that portion of the inner surface of the tongue-shaped member **19** disposed within the inverted channel **10** and immediately adjacent slot **23**, whereby the tongue-shaped member **19**, all of lug assembly **26–26*a***, and pivoting lug **29** pivotally move or rotate as a unit. A removable locking pin **30** is loosely fitted through openings **31** in sides **12** of the inverted channel to prevent such rotational or pivoting movement until necessary, as described later.

Lug assembly **26–26*a*** performs several functions. First, the vertical portion **26** serves to bear laterally against the preformed support **21**, and to define the limiting distance at which the downwardly curved end **20** of the tongue-shaped member rests on the preformed support. Second, the portion **26*a***, angled as

shown toward the portion of the tongue-shaped member **19** disposed within channel **10** and welded to said member at its lower end **28**, cooperates with said member and locking pin **30** to permit the latter to prevent substantial movement, particularly rotation, of the tongue-shaped member while the locking pin is in place. Third, lug assembly **26–26***a* absorbs and distributes the stresses upon the tongue-shaped member when the latter is in locked position, locking pin **30** also assisting in this function, thus tending to prevent distortion or breaking of the curved portion of the tongue-shaped member because of the heavy load of joist **13**, form decking **14** and concrete **22**.

When the hanger device is assembled with supporting joists **13** and form decks **14** with the locking pin **30** in place, as shown for example in FIG. **6**, the pivoting lug **29** will bear against the inner surface of continuation **24** of the top **11** of inverted channel **10** immediately adjacent the slot **23**, as shown in FIG. **4**. At the same time, locking pin **30** will bear against the inner surface of the angle formed by the tongue-shaped member **19** and continuation **26***a* of lug **26** within inverted channel **10** to prevent movement of the tongue-shaped member and its integral lug **26–26***a*. When the locking pin is removed for removing the hanger device after the poured concrete has hardened sufficiently, free play of the assembly of the tongue-shaped member and lug **26–26***a* in relation to inverted channel **10** is permitted. The downward force then applied to channel **10** by reason of its own weight and the weight of joist **13** causes pivoting lug **29** to continue to bear against the inner surface of continuation **24** of channel **10** but to roll along said surface from a position immediately adjacent slot **23** in a direction displaced horizontally therefrom toward the end of channel **10** away from the joist **13**. The result is to cause the upper (convex) surface of tongue-shaped member **19** to be displaced slightly vertically from the contiguous surface of hardened concrete immediately above it and to pivot the tongue-shaped member out of the hardened concrete without binding thereto.

Pivoting lug **29** performs an important function in the removal operation of the hanger device of the invention from the hardened concrete because it translates the downward movement of channel **10** into rotational movement of tongue-shaped member **19** out of the concrete. As has been indicated, the portion of the tongue-shaped member protruding above channel **10** is curved to define an arc which is substantially a segment of the circumference of a circle, such as a quarter of a circle. The relationship between the cross-sectional diameter of cylindrical pivoting lug **29** and the radius of curvature of the described portion of the tongue-shaped member protruding above the top of channel **10** is also important to successful removal of the tongue-shaped member from the hardened concrete. As has been described, upon removal of locking pin **30**, pivoting lug **29** rolls along the inner surface of continuation **24** and provides a migrating center of rotation for the tongue-shaped member. If the cross-sectional diameter of lug **29** is too small in relation to the radius of curvature of the portion of the tongue-shaped member protruding through and above the top of channel **10**, the tongue-shaped member will not be withdrawn completely from the hardened concrete. If the diameter of lug **29** is too large in relation to the radius of curvature of the described portion of the tongue-shaped member, rotation of the tongue-shaped member will be excessive, causing binding of the upper surface of the tongue-shaped member against the overlying concrete. Therefore, the ratio of the diameter of lug **29** to the radius of curvature of the described portion of the tongue-shaped member must be sufficiently large to rotate the tongue-shaped member completely out of the hardened concrete but not so large that binding against the concrete occurs. From the above and the following description, a desired ratio sufficient to rotate the tongue-shaped member completely out of the hardened concrete will be apparent to those skilled in the art.

The radius of curvature of the described portion of the tongue-shaped member, particularly when considering the sub-portion between the downwardly curved end **20** thereof and the outer surface of the vertical portion **26** of the position limiting lug, is relatively large so as to result in almost horizontal movement of the tongue-shaped member out of the hardened concrete. It is to be noted, however, that such movement is not entirely horizontal, experience having shown that the small amount of hardened concrete **32** formed between the top of joist **21** and the inner surface of the tongue-shaped member, which is thin and weak, is many times left intact but sometimes may be readily and easily broken during withdrawal of the tongue-shaped member from the space it has formed in the concrete. As noted above, the radius of curvature of the portion of the tongue-shaped member embedded in the concrete is so correlated with the cross-sectional diameter of pivoting lug **29** as to permit the above-described slight vertical displacement and pivoting of the tongue-shaped member completely out of the hardened concrete without binding. By way of example, for a hanger device of the dimensions previously given, the above-mentioned radius of curvature of the tongue-shaped member is 1¾ inches and the cross-sectional diameter of the cylindrical pivoting lug is ½ inch. For the purpose of further facilitating withdrawal of the tongue-shaped member, it is desirable, but not essential, slightly to taper a portion of the tongue-shaped member between the downwardly curved end **20** thereof and the outer surface of the vertical portion **26** of the position limiting lug.

The apparatus of the present invention severs the adhesive bond between the upper surface of tongue-shaped member **19** and the contiguous overlying concrete **22** by applying two components of stress against such bond. The first component is a downward tensile stress and the second is a torque or shearing stress. These two stress components are applied concurrently against the bond and tend to cooperate in fracturing the bond. The rotational (torque) or shearing stress is a highly advantageous feature of the present invention since shearing forces are especially effective in fracturing adhesive bonds between unlike materials. Of course, these same stresses also apply to that portion **32** of the hardened concrete contiguously underlying the inner (concave) or lower surface of tongue-shaped member, although here the tensile stress component is in an upward direction. However, as has been noted earlier, lay **32** of the hardened concrete is thin and weak and may be easily fractured at times during withdrawal of the tongue-shaped member.

Reference has been made to continuation **24** of the top **11** of inverted channel **10**. As stated, continuation **24** forms part of a hanger device spacing assembly attached to the sides **11** of the inverted channel. Such assembly itself is an inverted channel having vertical sides **32** integral with top **24** and horizontal flanges **33** integral with sides **32**. The entire assembly is attached, as by welding, to the sides **12** of the inverted channel where the top **11** thereof ends.

The invention will now be described with reference to its use in forming a concrete structural slab, such as a roof or floor. First, a joist **13** of suitable size and length is fitted into two of the hanger devices described above, one at each end of each joist, and the clamping plates **17** are fastened to hold the joist firmly in place. As will be apparent, the joist is not inserted so far into channel **10** as to interfere with movement of the tongue-shaped member. Depending upon the span of the concrete slab to be formed, several joist and hanger device assemblies are employed. For example, spans of 8 to 10 feet can be employed, and the spacing between joist centers may vary from 16 to 32 inches.

Each joist and hanger device assembly is then positioned on the preformed supports **21** for the concrete slab to be formed, the hanger and joist assembly resting on the preformed supports at each end of the hanger device at downwardly curved ends **20**. At this point is is desirable to ascertain that all locking pins **30** are firmly in place. Since several joist and hanger device assemblies are employed, it is also desirable to space them equidistantly from each other to distribute the load of concrete evenly. To this end, wooden spacer strips **34**, for example 2 × 2 or 2 × 4 inch, of equal length are placed on flanges **33** of the hanger devices and the hanger device and joist assemblies are firmly fitted against the ends of the spacer strips. Next, wooden spacer strips **35** are placed between each protruding tongue-shaped member **19** to assure a substantial continuity of the poured concrete slab between those members and to eliminate the work required for cutting appropriate spacing either in the continuous strip **36**, to be described, or in the form deck **14**. These strips **35** may have a thickness of 1 inch, a width equal to the horizontal distance between the edge of the outer surface of the vertical portion **26** of the position limiting lug abutting preformed support **21** and the outermost edge of the portion of the tongue-shaped member **19**, protruding above channel **10**, and a length sufficient to fit snugly against each tongue-shaped member and limiting lug assembly. Continuous wooden strips **36** are then placed snugly abutting strips **35**. The width of strips **36** is desirably sufficiently less than the width of strips **34** to allow the edge of form decking **14**, which may be ¾ inch plywood, to rest on spacer strips **34** and permit nailing of the decking thereto if necessary. It will be apparent that strips **36** can be omitted, if desired, by merely widening decking **14**. Desirably, the thickness of the strips **34**, **35** and **36** in relation to the position of horizontal flanges **33** on the hanger device is such as to leave a small distance or offset **37**, on the order of ¼ inch or so, between the top surface of the preformed support **21** and the top surface of strips **35** and **36**. In this manner, after the concrete slab has been poured and has hardened, relative movement of the slab and preformed supports is prevented.

After the form decking **14** is put into place, the entire assembly of spacer strips and form decking is secured in place by nailing, using as few and as small nails as possible. Desirably, nailing should be confined to securing strips **35** and **36** to strip **34**, nailing of the plywood decking to strip **34** being required only when a severely warped plywood sheet is used as decking.

It will be apparent to those skilled in the art that the assemblies described and shown, for example, in FIG. **6** are duplicated on the other side of the preformed support **21** and as many times as necessary with other preformed supports to provide a unitary concrete slab spanning as many such supports as required and as may be limited in area and span by the particular job under construction.

After the desired number of assemblies are in place, concrete is poured and allowed to harden to form the structural slab. After the concrete has reached its required strength, each hanger device-supporting joist assembly is ready to be removed. To accomplish this, locking pin **30** is first removed, if necessary by knocking it out. If the channel and joist assembly does not begin to lower because of its weight when the pin is removed, a sharp downward rap and pull may be applied to clamping plate **17**. In either case, as the above downward force is applied to the hanger device in the vicinity of the tongue-shaped member **19**, that member will drop slightly and pivot out of the hardened concrete as previously described. Normally, as the one end of the hanger device is removed from the hardened concrete, continued lowering of the hanger device-joist assembly will cause rotation out of the concrete of the tongue-shaped member of the hanger device at the other end of the joist without removal of the locking pin. However, if joist length or an obstruction prevents sufficient rotation of the tongue-shaped member at such other end, removal of the locking pin and the other procedure described above is followed.

The hanger device of this invention permits the pouring of concrete structural slabs having a thickness of 4½ or more inches spanning 8 to 10 or more feet between supports, although it may, of course, be used for thinner slabs of considerably smaller span. It eliminates the costly shoring, wedging and nailing required for form decks for such thick slabs, along with the labor costs required to erect and remove them. In addition to the above savings of lumber and scaffolding, the hanger device of this invention has the advantage of being readily removed from hardened concrete without binding and is capable of repeated reuse despite any roughness of the surface metal of the portion of the tongue-shaped member protruding above the inverted channel, or build-up of concrete film thereon.

What is claimed is:

1. An apparatus useful in conjunction with a preformed support and form decking for pouring a substantially horizontal concrete structural slab supported by said preformed support, comprising:

support means for holding a joist for supporting said form decking,

said support means having inner and outer surfaces and a slot adjacent one end thereof,

a movable tongue-shaped member carried by said support means and protruding through said slot

above and below the top of said support means, the portion of said tongue-shaped member protruding above said support means being curved, defining an arc which is substantially a segment of the circumference of a circle, and being adapted to rest at its downwardly curved end on said preformed support,

locking means for preventing movement of said tongue-shaped member during pouring of the concrete while the downwardly curved end of said member is resting on said preformed support and the curved protruding surfaces of said member are being covered by the concrete,

circular pivot means fixed to the portion of said tongue-shaped member within said support means immediately adjacent said slot interiorly of said member, said pivot means being in contact with the inner surface of said support means,

said circular pivot means having a cross-sectional diameter the ratio of which to the radius of curvature of said portion of the tongue-shaped member protruding above said support means permits rolling migration of the circular pivot means along the inner surface of said support means in a horizontal direction toward the end of said support means and away from said joist upon removal of said locking means,

whereby after said concrete has been poured and has hardened said tongue-shaped member may be rotated completely out of the hardened concrete without binding upon removal of said locking means.

2. The apparatus of claim 1, wherein said support means is an inverted channel.

3. The apparatus of claim 1, wherein said circular pivot means is a cylindrical lug.

4. The apparatus of claim 1 wherein a position limiting lug is attached at its upper end to said curved protruding portion of the tongue-shaped member and at its lower end to that end of the tongue-shaped member within said support means.

5. An apparatus useful in conjunction with a preformed support and form decking for pouring a substantially horizontal concrete structural slab supported by said preformed support, comprising:

an inverted channel having a slot in its top adjacent one end thereof,

said inverted channel being adapted to hold a joist for supporting said form decking,

a movable tongue-shaped member carried by said inverted channel and protruding through said slot above and below the top of said inverted channel,

the portion of said tongue-shaped member protruding above said inverted channel being curved and having a downwardly turned end defining an arc which is substantially a quarter segment of the circumference of a circle, and being adapted to rest at its downwardly curved end on said preformed support,

the portion of said tongue-shaped member protruding below the top of said inverted channel having an end terminating within said channel,

a position limiting lug having a vertical portion which is attached at its upper end to the portion of said tongue-shaped member protruding above said inverted channel at about the midportion of the concave surface of said tongue-shaped member,

the remaining portion of said position limiting lug being angled toward, and being attached at its lower angled end to, that end of said tongue-shaped member terminating within said inverted channel,

locking means formed by a removable locking pin in contact with the surfaces of the angle formed by the end of said tongue-shaped member and the end of the position limiting lug attached thereto within said inverted channel,

a cylindrical pivoting lug attached across the width of that portion of said tongue-shaped member within said inverted channel and immediately adjacent said slot,

said cylindrical pivoting lug bearing on the inner surface of the top of said inverted channel,

said cylindrical pivoting lug having a cross-sectional diameter the ratio of which to the radius of curvature of said portion of said tongue-shaped member protruding above said inverted channel permits rolling migration of the cylindrical pivoting lug along said inner surface of the top of the inverted channel in a horizontal direction toward the end of said inverted channel and away from said joist upon removal of said locking pin,

whereby after said concrete has been poured and has hardened said tongue-shaped member may be rotated completely out of the hardened concrete without binding.

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