Dec. 5, 1967 R. D. RAMBELLE 3,356,330

ADJUSTABLE SHORING MEMBER

Filed April 23, 1965 2 Sheets-Sheet 1

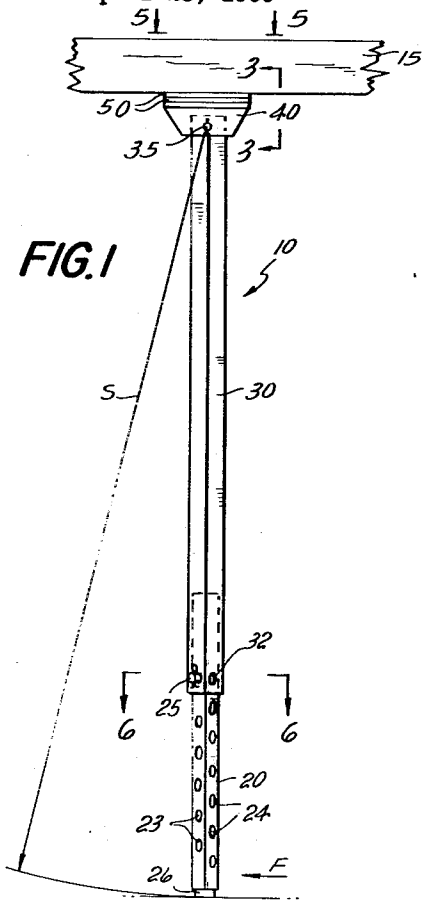


FIG. 1

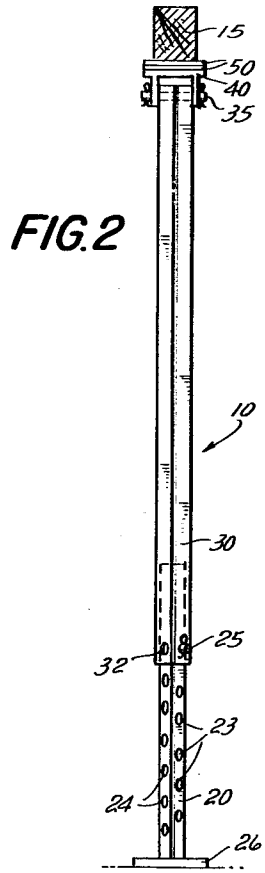


FIG. 2

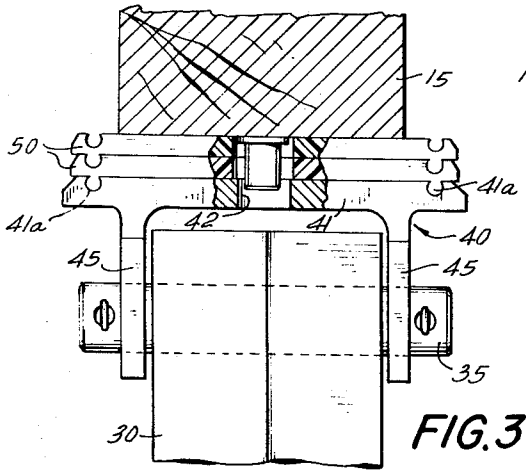


FIG. 3

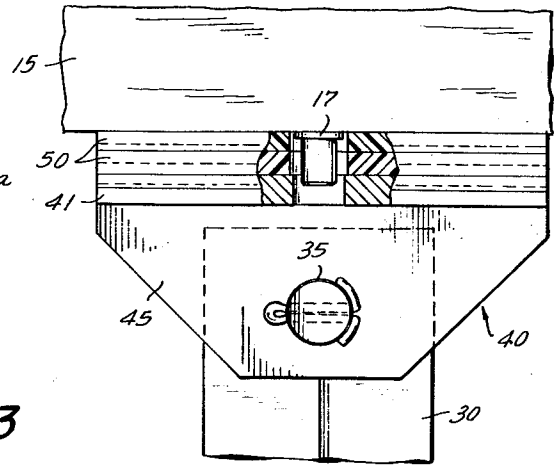


FIG. 4

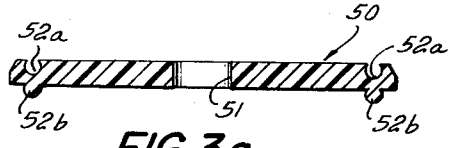


FIG. 3a

Dec. 5, 1967 R. D. RAMBELLE 3,356,330

ADJUSTABLE SHORING MEMBER

Filed April 23, 1965 2 Sheets-Sheet 2

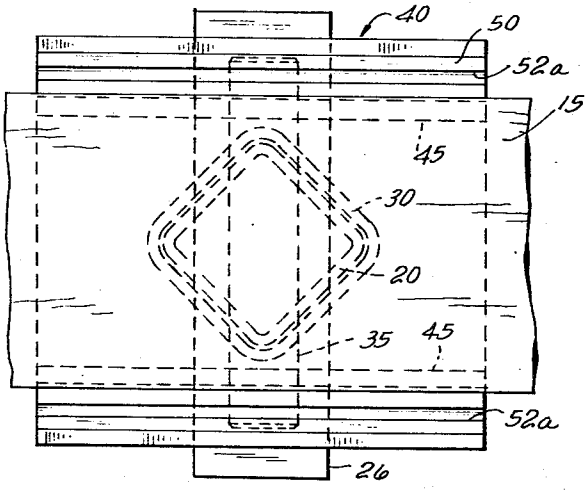


FIG. 5

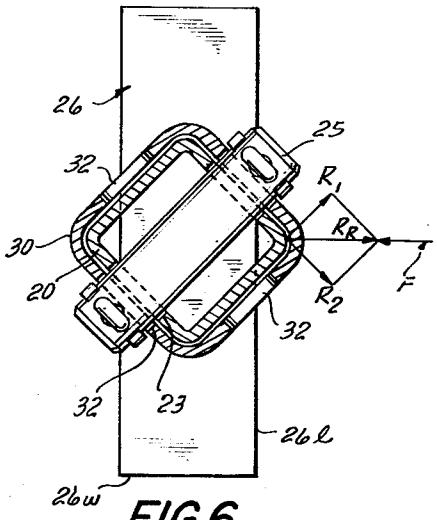
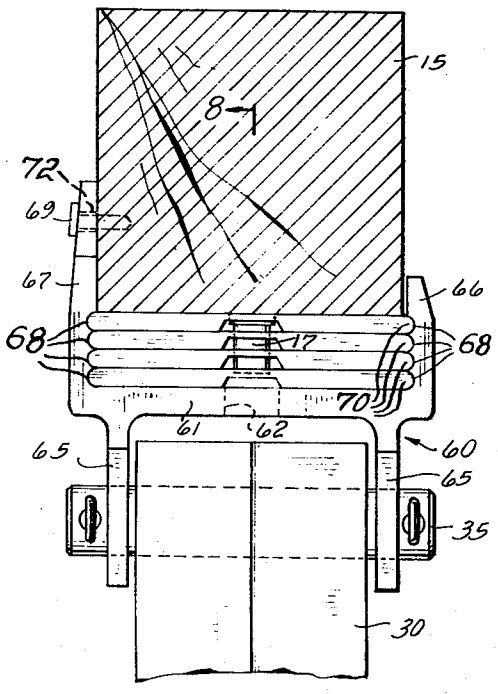


FIG. 6



8 FIG. 7

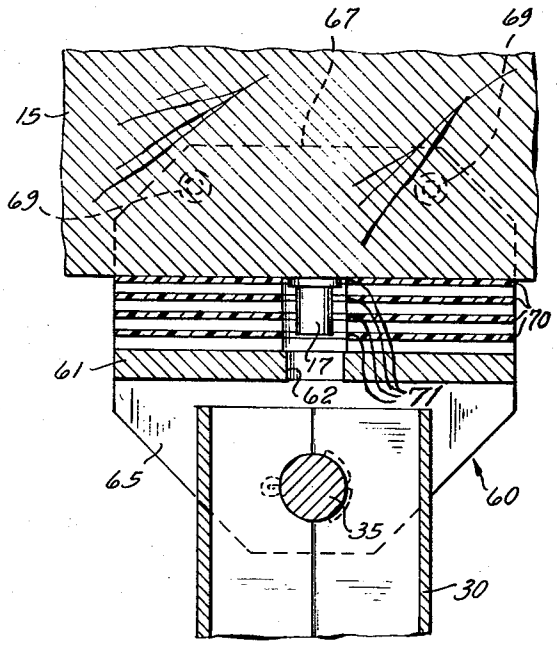


FIG. 8

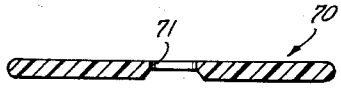


FIG. 7a

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ADJUSTABLE SHORING MEMBER

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6 Claims. (Cl. 248—354)

The present invention relates to an adjustable shoring member for use in providing temporary support of building forms and the like which has significant advantages over shoring members heretofore utilized for this purpose. The present invention may be used with particular economic and practical advantage during the formation of concrete floors in multi-storied buildings where the elevation between floors remains constant throughout all or most of the building structure.

Concrete used in large structural construction is a heavy, semi-liquid material, comprised of various proportions of sand, gravel, cement and water, and requires a firm base on which to be poured, so that it can set and harden. In the formation of concrete slabs and floors, a structural framework comprised of horizontal joist members (also called stringers) supported at spaced locations by vertical shoring members is employed to provide temporary support for a plywood or other form upon which the concrete is poured. After the concrete is hardened, the joists, shoring and plywood forms are then removed, as the concrete slab, which typically is reinforced with steel rods, has become self-supporting and capable of bearing substantial loads.

Conventional shoring members used to support the joist members are in the form either of heavy wooden posts cut to size, or adjustable steel jacks. In the latter type of shoring, which is typically comprised of two round tubular members telescoping one inside the other, the inner member of the jack is provided with pairs of diametrically-opposed holes spaced along its axis, and the upper portion of the outer member is provided with a single pair of slots through which a fastener pin can be inserted. In addition, an internally-threaded circular sleeve element is provided for engagement with a threaded portion on the outer tube member of the jack.

During erection of the jack, the inner member is extended out to the approximate height required, and a fastener pin is inserted through the slots in the outer member and into an aligned pair of holes in the inner member to lock the jack in this extended position. The jack is then adjusted to the exact elevation required by rotation of the threaded sleeve element. Stripping of the jack involves the same operations, but in a reverse sequence.

It is readily apparent that the above-described method of erection and stripping, employed with jacks of conventional design, is both bothersome and time consuming. The recurring operations of extension, fine adjustment, and lowering of the jack during stripping, which must be performed each time a concrete floor is poured, are expensive and render the use of such jacks economically unfeasible for the high-rise, multi-storied structures which are being built today. Accordingly, wooden shoring members, custom-cut to the exact length required, are now used almost exclusively instead of adjustable steel jacks in the construction of high-rise buildings. However, wooden shoring members deteriorate rapidly due to the combined effects of environment and wear and they therefore have but a limited number of reuses before they must be scrapped.

In contrast to these disadvantages and limitations possessed by shoring members heretofore known to the art, the present invention provides an adjustable shoring member which can be readily erected and stripped in but a fraction of the time required with conventional steel jacks. Once adjusted and set to the length required, the shore of

the present design can be readily stripped down by a special technique without the necessity of lowering the member, and can be reerected for the formation of a subsequent stage of concrete flooring at the same elevation without any further adjustment in length being required.

In an exemplary embodiment of the invention, the shoring member is of lightweight metal construction and is comprised of two tubular elements of generally square cross-section, one telescoping into the other. A plurality of opposed sets of holes are incrementally spaced on the sides and along the length of the inner tube element, and a set comprised of at least a single pair of opposed holes are similarly provided in the outer tube element. The horizontal joist, which the shoring member supports, rests on a head section of generally ⊓-shaped configuration which is connected to the body of the shore. A pivot pin, passing through the two side wings of the head section and the upper, extended end of the outer tube element, permits rotation of the shore relative to its head section in a single direction.

With the above-described arrangement, the length of the shore, when extended, can be adjusted to within a small increment of the required height and then locked by the insertion of a fastener pin through the aligned holes of the overlapping portions of the outer and inner tubular elements. A fine adjustment in the effective height of the shoring member is then accomplished by the insertion, between the bottom of the supported joist and the base of the head section, of one or more thin sheets of plastic or metal which act as shims to incrementally raise the joist to the final elevation required.

After formation of the slab structure, the shoring member of the present invention may be readily stripped by directing a hammer blow against the body of the shore at a point near its bottom and parallel to the long axis of the supported joist. The force of the hammer blow will cause the body of the shore to rotate, like a hinge, about the pin which pivotally connects it to the ⊓-shaped head section, and the shore will then fall out from beneath the propped joist as desired. As the shoring member remains locked in the extended position, which roughly corresponds to the elevation required for the supported joist, the shore can be readily reerected to support a subsequent stage of floor construction without any further gross adjustment being required.

To facilitate the stripping of the shoring member in the special manner described above, the extended, bottom end of the inner tubular element is preferably terminated in a base plate of flat, rectangular configuration whose short dimension is smaller than the diagonal of the inner tube and lies in the direction of the stripping action (i.e., parallel to the supported joist). As will be hereinafter explained, such a base plate configuration minimizes the amount of force required in the hammer blow to knock the shore member from beneath its supported joist.

By reason of its simplified construction, and its ability to be readily stripped down without lowering its length, the novel shoring member design of the present invention is exceedingly economical both in its manufacture and in its use. Particularly in the construction of multi-storied, high-rise buildings, where the elevation between floors is generally invariant throughout the structure, the utilization of the shoring member disclosed herein is especially attractive in view of the considerable time and expense saved in the erection and stripping of the temporary support forms used for the formation of the concrete slabs.

It is therefore a principal objective of the present invention to provide a novel design for an adjustable shoring member, for use as a temporary support for building

forms and the like, which may be readily stripped down without lowering the length of the shore.

It is a further objective of the present invention to provide a novel design for an adjustable shoring member, for use as a temporary support in the formation of concrete slabs, which can be readily adjusted to a desired length, and then stripped down and re-erected without requiring any readjustment in length.

It is another objective of the present invention to provide an adjustable shoring beam of novel design which is especially advantageous for use in forming the concrete floors and slabs of multi-storied, high-rise building structures.

It is still another objective of the present invention to provide in an adjustable shoring beam a means for providing a fine length adjustment which comprises a plurality of thin insert shims of plastic or metal.

The foregoing and other objectives, features and advantages of the present invention will be more readily understood upon consideration of the following detailed description of the invention, taken in conjunction with the accompanying drawings.

FIG. 1 is a front elevational view of an illustrative embodiment of an adjustable shoring member constructed in accordance with the present invention.

FIG. 2 is a side elevational view of the shoring member shown in FIG. 1.

FIG. 3 is an enlarged side detail view, taken along the line 3—3 in FIG. 1 and partially broken away, showing the head section of the shoring member.

FIG. 3*a* is a cross-sectional view of one of the insert shims shown in FIG. 3.

FIG. 4 is a front view, partially broken away, of the head section shown in FIG. 3.

FIG. 5 is an enlarged plan view of the shoring member, taken along the line 5—5 in FIG. 1.

FIG. 6 is an enlarged sectional view of the shoring member, taken along the line 6—6 of FIG. 1, together with a vector diagram illustrating certain force relationships present during the stripping operation.

FIG. 7 is an enlarged side detail view of a modification of the head section of the shoring member shown in FIG. 1.

FIG. 7*a* is a cross-sectional view of one of the insert shims adapted for use in the modified head section shown in FIG. 7.

FIG. 8 is a sectional view of the modified head section, taken along the line 8—8 in FIG. 7.

Referring now to FIGS. 1 and 2, there is shown an illustrative embodiment of an adjustable shoring member, constructed in accordance with the teachings of the present invention. The shore, designated generally by **10**, is shown in use supporting a wooden joist member **15**, and is fabricated from a suitably strong and lightweight metal, such as aluminum.

In this exemplary embodiment, the shore **10** is comprised of three major parts; an inner tubular element **20**, an outer tubular element **30**, and a pivotable head section **40**. The two tubular elements are of substantially square, hollow cross-section, with the inner tube **20** telescoping into the outer tube **30**. A plurality of holes are arranged by pairs in two staggered sets **23** and **24** on opposing sides of the inner tube **20**, with the holes in each set being incrementally spaced, typically about 2″ apart, along the length of the inner tube element. Two pairs of holes **32**, similarly located on opposing sides, are provided near the lower end of the outer tube element **30**.

With the shore adjusted to the approximate height desired for the supported joist, a fastener pin **25** is passed through the aligned holes of the overlapping portions of the outer and inner tubular elements **20**, **30** to lock the shore in the extended position. As contrasted with the use of round tubular elements, the square shape of the tubes **20** and **30** prevents rotary displacement of one relative to the other, and thus facilitates alignment of the holes in the inner and outer tube members for insertion of the fastener pin.

As best shown in FIGS. 3 and 4, the upper end of the shore is terminated in a head section **40**, which, in a preferred embodiment, is of generally ⊓-shaped configuration having a horizontal base portion **41** and a pair of downwardly projecting side wings **45**. This head section **40** is pivotally secured by a pin **35** passing through the side wings **45** and the upper end of the outer tube element **30**. Sufficient clearance between the base **41** of the head section and the terminal end of the outer tube **30** is provided to permit the ⊓-shaped head portion to be freely rotatable in an arc about the pivot pin **35**.

In use, the shore is erected with the head section **40** positioned as shown, that is, with the pivot axis (pin **35**) perpendicular to the long axis of the supported joist **15**, so that the shore head **40** is freely tiltable only in a plane parallel to the joist. It should be noted, however, that this pivoting-head construction of the shore member does not adversely affect the stability of the support structure against tipping since, when fully erected, the joist member **15** will pass over the heads of several such shores. Furthermore, the pin connection of the head section **40** to the body of the shore **10** ensures that the shore member will be subjected to concentric loading conditions under the weight of the joist **15**, as the head section will tilt as needed to follow the deflection of the joist under load, thus preventing the establishment of undesirable bending moments in the shore.

After the shore has been adjusted to within a small increment of the required height, by the insertion of the fastener pin **25**, a fine adjustment is then accomplished by the insertion, between the joist member **15** and the base **41** of the shore head section, of a number, as needed, of thin shims **50** comprised of plastic or metal material. These insert shims **50**, the details of which are best shown in FIG. 3*a*, are exemplarily of ¼″ thickness and are provided on one side with a pair of projecting ridges **52***b*, and on the other side with mating keyway grooves **52***a*. The base **41** of the shore head section **40** is similarly provided with a pair of keyway grooves **41***a*. This arrangement permits a large number of the shims to be vertically stacked in an interlocked fashion on top of the shore head section.

If desired, a marker pin **17** may be located at predetermined intervals along the bottom of the joist member **15** to facilitate the spacing of the vertical shores. In such an arrangement a central opening **42** in the base of the shore head section **40**, as well as corresponding holes **51** in the insert shims **50**, are then provided to accommodate the marker pin **17**.

In a preferred embodiment, the shore **10** is supported upon a flat base plate **26** rigidly secured to the lower end of the inner tubular element **20**. As is best shown in FIG. 6, the base plate **26** is of rectangular configuration and is arranged so that its long dimension, indicated by **26***l*, is perpendicular to the axis of the supported joist (i.e., parallel to the pivot pin **35**), and its short dimension, indicated by **26***w*, is smaller than the diagonal length of the shore's inner tube element **20**, in order to facilitate the stripping operation hereafter described.

After the overlying concrete construction has hardened and it is desired to remove the building forms and the supporting framework, the shore **10** may be readily stripped by directing a hammer blow, as indicated by the arrow F in FIG. 1, at a point near its bottom and parallel to the long axis of the support joist **15**. This blow will cause the body of the shore to rotate about the pivot pin **35** along a circular arc whose radius is represented by the arrow S.

By having the size of the base plate **26** in the direction of the stripping action of small dimension, the amount of force required in the hammer blow to knock out the shore **10** from beneath the joist **15** is minimized. If this width dimension of the base plate were made too great (for

example, considerably larger than the cross-sectional size of the shore body), then it would be quite difficult to strip the shore in the manner described above. Correspondingly, it is not practical to reduce the width dimension of the base plate **26** to a relative size much smaller than that shown, because of excessive bearing stresses which would then be produced in the concrete foundation on which the shore rests.

The force-vector diagram shown in FIG. 6 illustrates a further important advantage of the square tube design utilized in the shore member of the present invention. In stripping, the hammer blow "F," directed against the corner of the inner tube element **20** of the short body, generates a reaction force "R_R" in opposition thereto which can be resolved into two components "R_1" and "R_2." With the use of square sections for the shore's inner and outer tubular elements **20** and **30**, these component forces R_1 and R_2, which are aligned along the walls of the tube section, are equalized in magnitude. Accordingly, there is no tendency during the stripping action for the shore body to rotate in a direction other than parallel to the axis of the joist **15**. This minimizes the amount of force required to strip the shore, since all of the force of the hammer blow is transferred into a moment-arm producing rotation of the shore body about the pivot pin **35**, and no energy is dissipated in directions in which movement is restrained.

FIGS. 7, 7*a*, and 8 are directed to a modification of the head section of the shore embodiment which is described in the present invention. In this modification, the ⊓-shaped head section **60**, similar to the preferred embodiment shown in FIGS. 3 and 4, has a base portion **61** and a pair of side wings **65** pivotally connected by a pin **35** to the upper end **30** of the shore body. However, in this variation, the head section **60** also includes a pair of upwardly projecting flanges **66** and **67** whose interior surfaces are provided with grooves **68** to slidably receive and retain a plurality of thin insert shims **70** of the modified design shown in FIG. 7*a*. In this modified shim design, which is somewhat more simplified than that of the embodiment shown in FIG. 3*a*, the interlocking arrangement of ridges and keyways have been eliminated since the lateral support provided by the walls of the head flanges **66** and **67** are sufficient to retain the shims in position.

In order to accommodate the marker pin **17** projecting from the bottom of the supported joist **15**, both the base of the shore head section **60**, as well as the insert shims **70**, are provided with central openings **62** and **71**, respectively. If desired, the modified head design shown in FIGS. 7 and 8 may also include means, such as tacks **69** passing through openings **72** in the longer one of its two flange portions, for fastening the head section **60** to the body of the joist **15**. Such an arrangement provides a firmer support base for the pivot axis provided by the pin **35** during the stripping operation, and thus further facilitates the removal of the shore by the simplified manner hereinbefore described.

The terms and expressions which have been employed here are used as terms of description and not of limitation, and there is no intention, in the use of such terms and expressions, of excluding equivalents of the features shown and described, or portions thereof, it being recognized that various modifications are possible within the scope of the invention claimed.

What is claimed is:

1. A rapidly-strippable shoring member, for use in providing temporary vertical support of building forms and the like, comprising

(a) a vertically-positioned columnar member,

(b) a head element having a horizontal base surface for contacting the undersurface of a building form,

(c) means for pivotally connecting said head element to the upper extremity of said columnar member in a manner permitting said head element to be rotatable in a vertical plane relative to said member, and

(d) a flat, substantially rectangular base plate rigidly secured to the lower extremity of said columnar member, said base plate having its long dimension arranged parallel to the axis of rotation of said head element, and its short dimension being smaller than the thickness of said member in order to facilitate stripping of said shore by the application of an impulse force against said vertically-positioned columnar member in a horizontal direction substantially perpendicular to said axis of rotation of said head element.

2. A rapidly-strippable shoring member, for use in providing temporary vertical support of building forms and the like, comprising

(a) a vertically-positioned shore body of adjustable length,

(b) fastening means for locking said shore body in an extended position,

(c) a head element of generally ⊓-shaped configuration with a horizontal center section and two downwardly-projecting side wings spaced apart by the thickness of said shore body.

(d) means for pivotally connecting the two side wings of said head element to the upper extremity of said shore body interposed therebetween, in a manner permitting said head element to be rotatable in a vertical plane relative to said vertically-positioned shore body, and

(e) a flat, substantially rectangular base plate rigidly secured to the lower extremity of said shore body, said base plate having its long dimension arranged parallel to the axis of rotation of said head element, and its short dimension being smaller than the thickness of said shore body in order to facilitate stripping of said shore by the application of an impulse force against said shore body in a horizontal direction substantially perpendicular to said axis of rotation of said head element, said stripping action being effected without retraction of said shoring member from said extended position.

3. An adjustable shoring member, for use in providing temporary vertical support of building forms and the like, comprising

(a) a shore body having an inner tubular element telescoping into an outer tubular element,

(b) means for grossly adjusting said shore to a predetermined height by locking said inner tubular element to said outer tubular element in an extended vertical position,

(c) a head element secured to the upper extremity of said vertically-positioned shore body and having a horizontal base surface adapted for contacting the undersurface of a building form,

(d) means for finely adjusting said shore to said predetermined height comprising a plurality of thin shims adapted to be inserted, as needed, between said base surface of said shore head element and said undersurface of said building form, and

(e) slidably-engaging means formed by mating portions on said shims and said head element for securing said shims to said head element in stacked form.

4. An adjustable, rapidly-strippable shoring member, for use in providing temporary vertical support of building forms and the like, comprising

(a) a shore body having an inner tubular element telescoping into an outer tubular element,

(b) means for grossly adjusting said shore to a predetermined height by locking said inner tubular element to said outer tubular element in an extended position,

(c) a head element of generally ⊓-shaped configuration with a horizontal center section and two down-

wardly projecting side wings spaced apart by the thickness of said shore body,

(d) means for pivotally connecting the two side wings of said head element to the upper extremity of said shore body interposed therebetween, in a manner permitting said head element to be rotatable in a vertical plane relative to said vertically-positioned shore body,

(e) means for finely adjusting said shore to said predetermined height comprising a plurality of thin shims adapted to be inserted, as needed, between the upper surface of the center section of said head element and the undersurface of a building form, together with means formed by mating portions on said shims and head element for slidably engaging and securing said shims in stacked form to said head element, and

(f) a flat, substantially rectangular base plate rigidly secured to the lower extremity of said vertically-positioned shore body, said base plate having its long dimension arranged parallel to the axis of rotation of said head element, and its short dimension being smaller than the thickness of said shore body in order to facilitate stripping of said shore by the application of an impulse force against said vertically-positioned shore body in a horizontal direction substantially perpendicular to said axis of rotation of said head element, said stripping action being effected without requiring either removal of said stacked shims from said head element or retraction of said shoring member from said extended position.

5. The adjustable shoring member set forth in claim 4 characterized in that said gross-adjustment means is comprised of a plurality of opposed sets of holes incrementally

spaced on the sides and along the length of one of said tubular elements of said shore body, at least a single pair of opposed holes similarly provided in the other of said tubular elements, and a fastener pin passed through the aligned holes of the overlapping portions of said telescoping outer and inner tubular elements.

6. Means for finely adjusting a shoring member to a predetermined height comprising, a shore, a plurality of thin extension shims adapted to be inserted, as needed, between an end of said shore and a support surface, and first means on the end of said shore mating with second means on said shims, said first and second means connecting by slidable engagement to secure said shims in stacked form on said shore end.

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