United States Patent

Weaver et al.

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[54] CLAMPING DEVICE

[72] Inventors: **Richard L. Weaver,** Route 2, Myerstown, Pa. 17067; **Benjamin K. Smoker,** Myerstown, Pa.

[73] Assignee: **said Weaver by said Smoker**

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[21] Appl. No.: **26,490**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 720,687, April 11, 1968, Pat. No. 3,619,431.

[52] **U.S. Cl.** .....**249/196,** 25/131 CP, 249/166, 249/1, 25/DIG. 26

[51] **Int. Cl.** **E04g 9/00**

[58] **Field of Search** .....249/219, 1, 13, 163, 165, 166, 249/192, 196; 25/131 CP, DIG. 26

[56] **References Cited**

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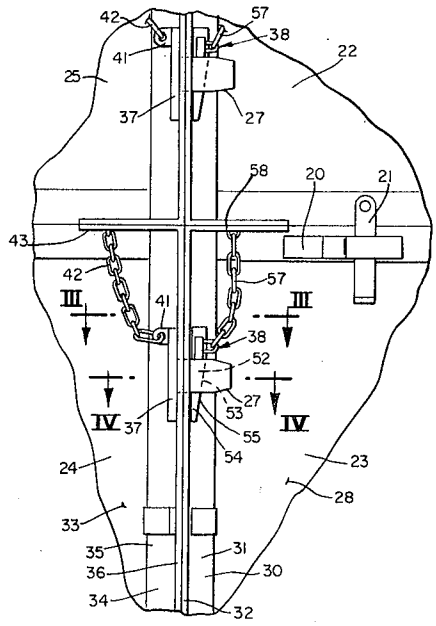
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Primary Examiner—J. Spencer Overholser
Assistant Examiner—De Walden W. Jones
Attorney—Paul & Paul

[57] **ABSTRACT**

A clamping device is provided, that is specifically designed for clamping together plates or other members that have flanges connected thereto and bent out of the planes of the plates, with the clamping device having one member adapted to be inserted through holes of flanges, up close to the plates, and having another pin adapted to engage within the first member, up close to the plates that are being secured together.

5 Claims, 4 Drawing Figures



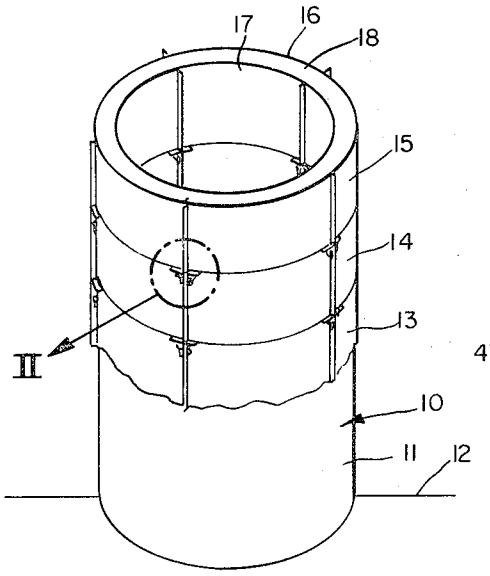


Fig. 1

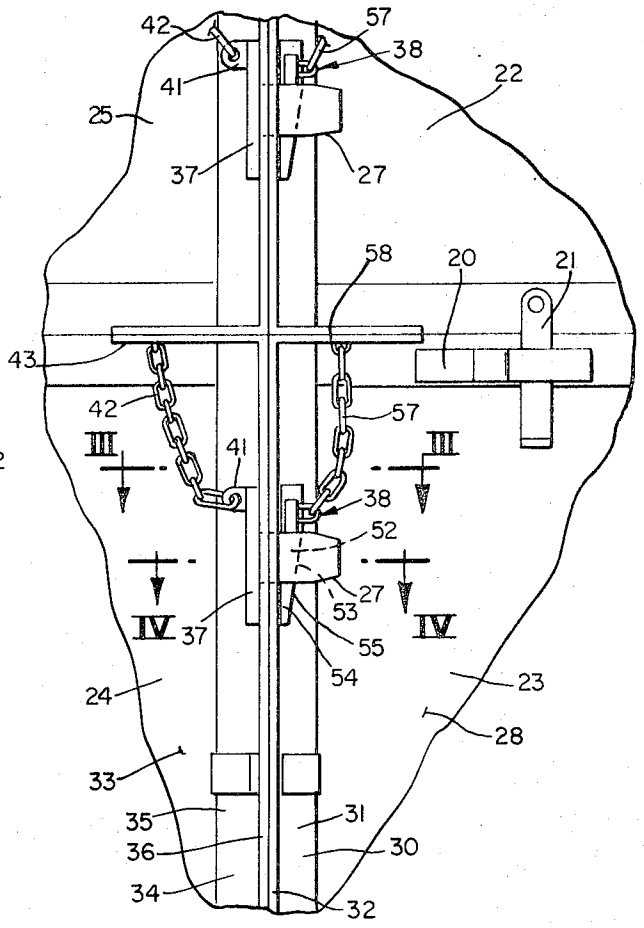


Fig. 2

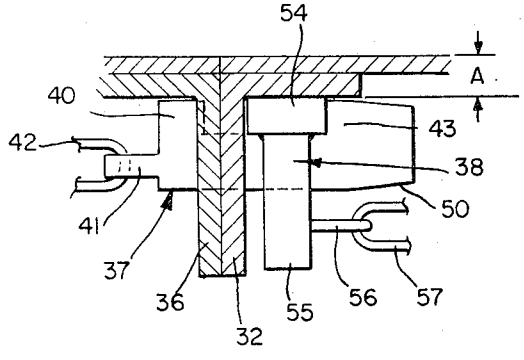


Fig. 3

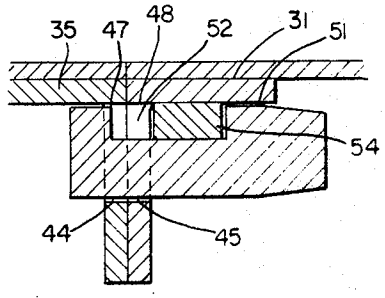


Fig. 4

INVENTORS.
Richard L. Weaver
Benjamin K. Smoker

BY

Paul + Paul
ATTORNEYS.

CLAMPING DEVICE

RELATED APPLICATIONS

This application is a continuation-in-part of our copending U.S. application Ser. No. 720,687, filed Apr. 11, 1968, now U.S. Pat. No. 3,619,431.

BACKGROUND OF THE INVENTION

In our prior copending application, there is described a system, including method and apparatus, for constructing silos and like structures, preferably from concrete. In the construction of silos and other structures generally of tubular upstanding configuration, a plurality of molds are used, for pouring concrete in between the molds, and generally accompanied by the insertion of steel rods for strengthening purposes and the like, with the concrete being disposed between the molds until the concrete "sets" or hardens, at which time the molds can be removed. The molds are constructed in arcuate sections which may be clamped together by any suitable means, both on the inside and on the outside of the silo being constructed. Thus, a plurality of inside and outside arcuate sections are utilized to form a given inside or outside mold form. Generally, a plurality of such sections cooperate to define an annulus adapted to receive concrete therein. A plurality of such annuli disposed one on top of the other, form the silo. Thus, it is necessary to utilize several layers or tiers of forms, each comprising inner and outer form portions, and each form portion comprising a plurality of sections.

Generally, in the formation of a silo, the forms are serially stacked, one on top of the other, and are filled with concrete. After the top or third form has been filled, the concrete within the bottom form has "set" or sufficiently hardened, that the inner and outer bottom mold form portions may be removed, by unclamping the individual inner and outer and mold sections, and by lifting them by means of a crane or the like, to another location above the then previous top mold, generally by the use of a crane mounted on a platform that is supported by the inner mold form sections. When the bottom mold form is in place on the top, it now becomes a top mold form, and the same is filled with concrete. The platform disposed inside the silo is then raised, and it is supported during such raising movement by exerting raising forces upon outer ones of the mold form sections. Thus, this procedure is continually repeated, such that a silo is built in "bootstrap" fashion, with the forms continually being connected and disconnected and lifted to new locations as a given ring or tier hardens.

Thus, clamping devices must be utilized for holding the various mold sections together. Generally the mold sections, particularly the outer mold sections, have flanges extending out of the planes of the mold plates, generally transverse thereto, which adjacent flanges of adjacent mold sections may be clamped together. Because there is considerable weight of concrete within a given mold ring, and especially if the given mold ring is the bottom one of a several tiered layer of rings each having wet or unhardened concrete disposed therein, substantial forces are exerted upon the mold sections, tending to separate them, which forces must be counteracted by the devices used to clamp the section flanges together. Also, the clamping device must be of the type which may readily be disassembled, for re-positioning of the mold sections. Still further, the clamping devices must be of the type which may be disconnected from a remote position, in that many such sections are utilized in the construction of a silo, and it is regularly necessary, because of the great heights at which silos are constructed above ground, that the clamping devices be disconnected by a mechanic located at some point in the structure of the silo being constructed that is rather remote from the location of the clamping device. Thus, the clamping device must be adaptable to being reached by an extended tool of a mechanic, and be readily disconnectable in such a manner.

These problems have, for the most part, been solved by utilizing clamping devices including lugs and pins of the type

set forth in the above-mentioned copending application. Such clamping devices have functioned very adequately from a standpoint of resisting the forces tending to separate flanges of adjacent sections, by placing the lugs in tension.

The present invention is an improvement upon the clamping device of the type disclosed in the above-mentioned copending application, in that it enables the clamping to take place up against the plates that form the mold sections, immediately against such plates, with a lug passing through holes in flanges protruding from the plates, and with the lug having a head in engagement with one such flange, and with a pin inserted into the lug in engagement with the other such flange, the pin also being disposed up against its adjacent plate. This arrangement is adapted to apply the clamping forces to the flanges, as close against the plates as possible, and it is made possible by inserting the pin into a groove in a surface of the lug that is adjacent a plate, rather than inserting a pin into a slotted hole that would go through the center of the lug, as with the clamping device disclosed in the above-identified copending application.

In this regard, the disclosure of the above-identified copending application is herein incorporated by reference. It will be noted that lugs of the type utilized therein also had heads in engagement with one of the flanges, which heads extended generally around a larger circumference than the body of the lug, requiring the lug to be spaced from the plates a predetermined amount, through holes in the flanges that were spaced from the angle iron bases or plates.

The advantage of the improved form of clamping device described herein is that, by gripping the flanges up close to the angle iron bases or plates, the forces that oppose the tendency of the sections to separate, or move endwise away from one another are applied close to the ends of the sections, thereby prohibiting a limited degree of bending of the flanges that may otherwise be possible, and also thereby prohibiting a slight separation occuring in the plates that comprise the adjacent sections, into which concrete could flow, that would leave an unsightly parting line down the side of the concrete silo between adjacent molded sections. Also, by clamping the flanges up close to the plates, size control of the outer circumference of the sections may be maintained, thereby eliminating undesirable form spread and loss of precise silo size control, and also thereby eliminating attendant stacking difficulties that may possibly occur if the spread were permitted, which could cause great difficulty in securing a next applied form to an upper form.

SUMMARY OF THE INVENTION

The present invention is directed toward providing a clamping device that is adapted to engage members, preferably outwardly protruding flanges from forms that are connected together in end-to-end relationship, and that are subjected to forces that tend to separate the forms or other plates, and thereby tend to separate the flanges, wherein the clamping device is applied as close as possible to the forms or plates to be secured together.

It is accordingly, a primary object of this invention to provide a novel clamping device.

It is a further object of this invention to provide a novel clamping device for use with concrete molds, in securing adjacent mold sections together, in opposition to forces tending to separate the molds, wherein the clamping forces are applied as close as possible to the major body or plate portions of the molds, across flanges thereof.

It is a further object of this invention to provide a novel clamping device utilizing a lug-and-pin arrangement, of novel overall construction, for general utility.

Other objects and advantages of the present invention will be readily apparent to those skilled in the art from a reading of the following brief descriptions of the drawing figures, detailed description of the preferred embodiment, and the appended claims.

IN THE DRAWINGS

FIG. 1 is a front perspective view of a silo being constructed in accordance with this invention, utilizing a plurality of inner and outer mold form sections that are capable of being connected and disconnected as discussed above.

FIG. 2 is an enlarged fragmentary detail view of the connecting device and portions of mold sections upon which it is used, of the detail within the zone designation by Roman Numeral II in FIG. 1.

FIG. 3 is a sectional view taken through the flanges and plates of mold sections of this invention, and illustrating the connecting device of this invention in plan, the view being taken generally along the line III—III OF FIG. 2.

FIG. 4 is a transverse sectional view of the clamping device of this invention, taken generally along the line IV—IV of FIG. 2.

Referring now to the drawings in detail, reference is first made to FIG. 1, wherein there is illustrated a partially erected silo, generally designated by the numeral 10, including a generally upstanding cylindrical concrete structure 11, sitting upon the ground 12, and having a plurality of form rows 13, 14 and 15, each of the form rows including inner form sections 17 connected together and outer form sections 16 connected together, and adapted to receive concrete poured in slurry form into the void 18 between mold sections 16 and 17.

The inner mold sections 17 may be connected together in any suitable manner, but preferably in the manner set forth in the above-identified copending application. Similarly, adjacent outer sections such as those illustrated in rows 14 and 15 disposed above and below one another may be connected together by suitable members 20 and 21, with the member 20 being fixedly mounted and the member 21 being pivotally mounted as discussed in said above-identified copending application.

With particular reference to FIG. 2, it will be seen that four outer mold sections 22, 23, 24 and 25 are illustrated. The mold sections 22 and 25 are connected together by a clamping device 26 in accordance with this invention, as are the mold sections 23 and 24 clamped together by a clamping device 27, in accordance with this invention. The function of both of the clamping devices 26 and 27 is identical, so only one need be described in detail.

The section 23 comprises a plate 28 having a piece of angle iron 30 secured thereto, as by welding or the like, or by any other suitable means, with the base 31 of the angle iron being disposed generally at right angles to the outwardly protruding leg 32, which is bent out of the plane of the base 31, and also out of the plane of the plate 28, at approximately right angles, or outwardly transversely. It will be noted herein that the angle iron having a base leg 31 is utilized, but that, for the purposes of this invention, the leg 32 could be formed as an outwardly bent portion of the plate 28. Accordingly, as used herein, and throughout the claims, the word "plate" is to be construed as encompassing not only a portion of member 28, but also the leg 31 of the angle iron 30. The leg 32 of angle iron 30 is generally referred to as a flange. Similarly, the section 24 has a plate 33 to which is secured an angle iron 34 having a base leg 35 and an outwardly extending leg or flange 36.

The flanges 32 and 36 are to be secured together in the manner illustrated in FIGS. 2, 3 and 4.

The clamping device 27 includes a lug 37 and a pin generally designated by the numeral 38. The lug 37 includes a head portion 40, generally of elongated but rectangular construction, and has a chain link 41 integral therewith, with the lug 37 being preferably cast in its manufacture. A chain 42 may be secured to the link 41, with its other end being connected to a suitable flange 43. The lug 37 is also provided with a body portion 43, of generally rectangular cross-section, in the form of a bar which passes through aligned rectangular holes 44 and 45 in the flanges 36 and 32, respectively, with the innermost edges 47 and 48 of the holes 44 and 45, respectively being disposed against the outer surfaces of the plates or legs 35 and 31, respectively, as close as possible thereto. The lug body portion 43 has chamfered corners 50, as illustrated at the far right end of FIG. 3.

One surface 51 of the lug body portion 43 that is disposed adjacent the outer surface of the plate 31 is provided with a groove 52 that extends from the top to the bottom of the lug body portion 43, as viewed in FIG. 2, and is cut inwardly from the surface 51, with preferably the right-most surface 53 thereof, as viewed in FIG. 2, being tapered as illustrated, for wedging engagement in a manner to be discussed herein. The depth of the groove 52, into the lug body portion 43, measured outwardly of the outer surface of the plate 31 is substantially equal to the thickness of a body portion 54 of the pin 38, which pin 54 is of varying cross-section, from a lesser cross-section at a lower end as viewed in FIG. 2, to a greater cross-section at its uppermost end, and has a side surface 54 that is complementally tapered with respect to the surface 53 of the lug body portion 43. Thus, when the pin body portion 54 is secured within the groove 52, in a manner illustrated in FIGS. 3 and 4, the lug 37 is firmly secured in position, with the flanges 32 and 36 firmly connected together in locked engagement.

The pin 38 is also provided with a projection 55, extending outwardly thereof, which overlies the upper surface of the lug body portion 43, as viewed in FIG. 2, such extending portion 55 being provided with a chain link connection 56, to which is secured a chain 57, carried by a flange 58 as illustrated in FIG. 2. The purpose of the chains 42 and 57, is to assure that upon disconnection of the clamping devices 27, the members 37 and 38 thereof will not become lost or discarded, but will always be connected to the sections 23 and 24, near their predetermined connecting location.

It will be noted, in accordance with the connection device 27 of this invention, the dimension designated "A" in FIG. 3 is minimized, with the clamping pin body portion 54 being disposed as close against the plate or leg 31 as possible securing the flanges 32 and 36 together, and placing that portion of the lug body portion 43 located in the holes 44 and 45 of the flanges 36 and 32, respectively, in tension, and with the head portion 40 of the lug 37 being in engagement with the flange 36 as close as possible to the junction thereof with the plate or leg 35.

It will also be noted, that by making the head 40 and body portion 43 of the lug 37 to be of rectangular cross-section, and by making the groove 52 to be of generally rectangular cross-section, the maximum bearing area is provided for the various parts being stressed. It will also be noted that, by providing an overhanging portion 55 for the pin member 38, the portion 55 may be struck from beneath by a hammer or the like, or by a suitable elongated bar, or even may be engaged and lifted by a bar being operated from a location remote from the connection device 27, for removal of the pin 38 from the lug 37. Also, the lug 37 may then readily be removed by engaging the chain 42 and pulling the same outwardly.

Thus, in addition to maintaining the circumferential size control of the outer forms, and eliminating attendant stacking difficulties, and also eliminating a possible unsightly appearance from a parting line formed outside the silo, due to spreading of adjacent mold sections across their connection, the removal of the elements forming the connection device 27 of this invention is facilitated. Even further, because the body portion 54 of the pin 38 is engaged within an open-sided groove 52, the pin body portion does not tend to become "boxed in" in such a manner as to become cocked or jammed, causing removal difficulties. Rather, in accordance with the present invention, the free side of the groove 52 permits increased degree of movement for prying the pin 38 free of the lug 37, if necessary.

It will be apparent to those skilled in the art that various modifications may be made in the details of construction and in the use of the clamping devices of this invention, as defined in the appended claims.

What is claimed is:

1. In the combination of a pair of plate members to be secured together in generally end-to-end relation, and wherein each plate is provided with a flange portion disposed generally transverse to the disposition of the plates, and with flanges of adjacent plates disposed immediately adjacent each other, and wherein a clamping device is provided for connecting adjacent flanges together through holes in adjacent flanges against separating forces, the improvement comprising said clamping device including a lug adapted for disposition through holes in adjacent flanges and having a head thereon for engagement against one flange, said lug having a groove opening on one side surface thereof, and a pin adapted for insertion into said groove, with said lug and said pin being in cooperative engagement to define means for maximizing a clamping load applied to said lug by said pin with said maximizing means including surface-to-surface engagement between a groove surface most remote from said lug head and an adjacent surface of said pin, and with said remote groove surface terminating toward the plates in an edge disposed generally parallel thereto through the length of the groove, wherein at least one of said groove and said pin include tapered surface means for camming of said pin into said groove as the pin is inserted into the groove in a direction transverse to the direction of insertion of the lug through the flange holes, including in the combination the plates and flanges, and wherein the holes are disposed through the flanges immediately adjacent said plates, wherein said holes and lug are generally of rectangular cross-section.

2. The clamping device of claim 1, wherein said side surface having the groove therein is disposed immediately adjacent one said plate, and said pin is disposed in said groove with one pin surface portion immediately adjacent said one plate in the seated position of said pin in said lug.

3. The clamping device of claim 2, wherein another surface portion of said pin is in immediately adjacent engagement with a flange that is connected to said one plate in the seated position of said pin in said lug.

4. The clamping device of claim 1, including chains connected to said lug and pin for attachment to plates.

5. The clamping device of claim 1, wherein said lug head is enlarged in a transverse direction, with said lug head being free of projections beyond the plane of said one side surface, and wherein said lug surface, a head surface and a pin surface are all substantially coplanar in the seated condition of said pin in said lug.

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