March 12, 1968 W. H. HALL, JR 3,372,523

STRUCTURAL FASTENERS

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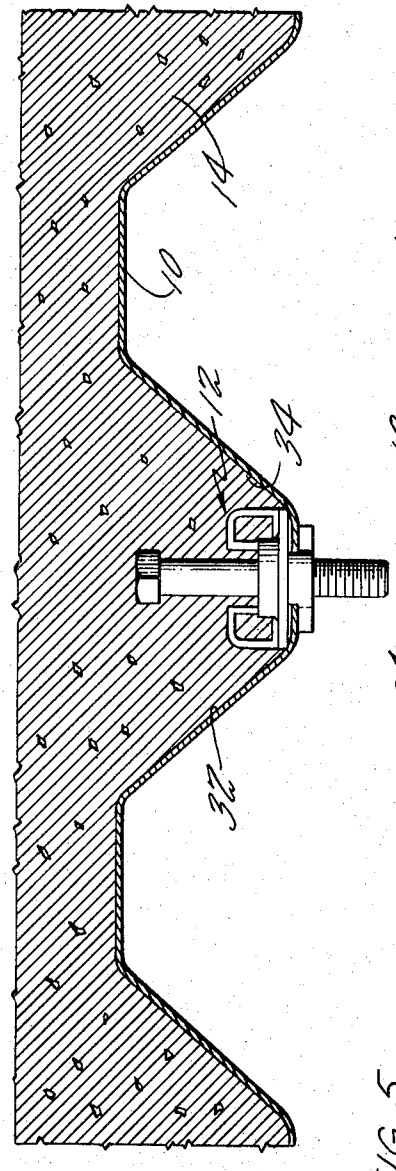

FIG. 1

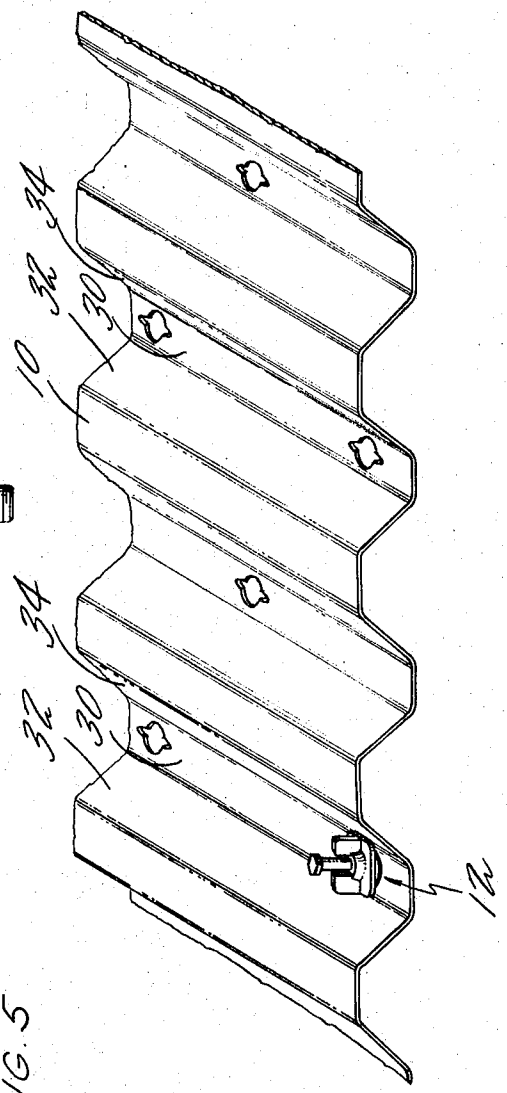

FIG. 5

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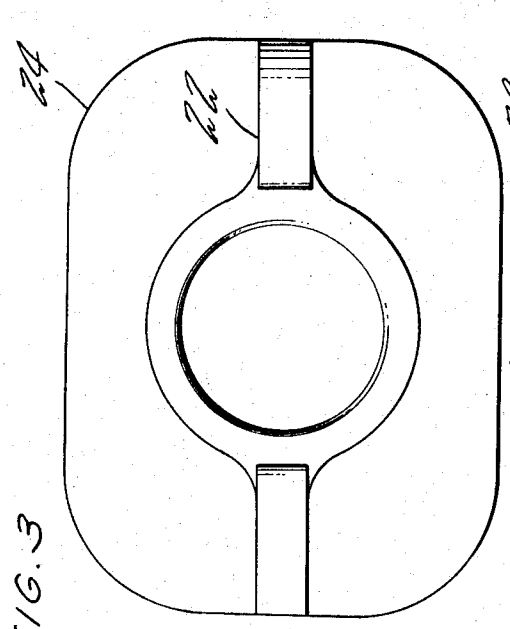

FIG. 3

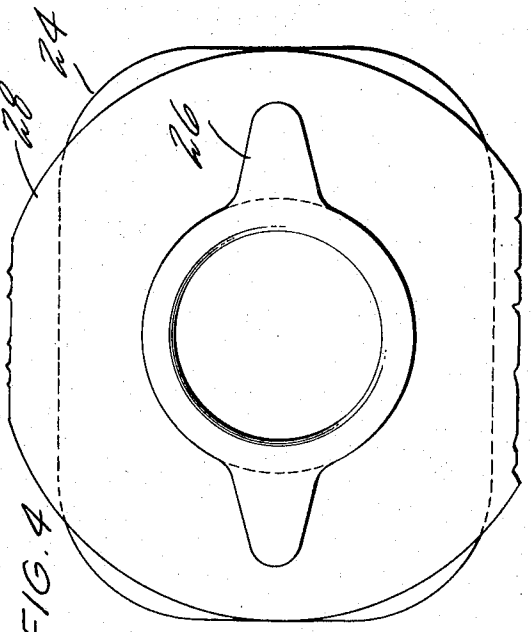

FIG. 4

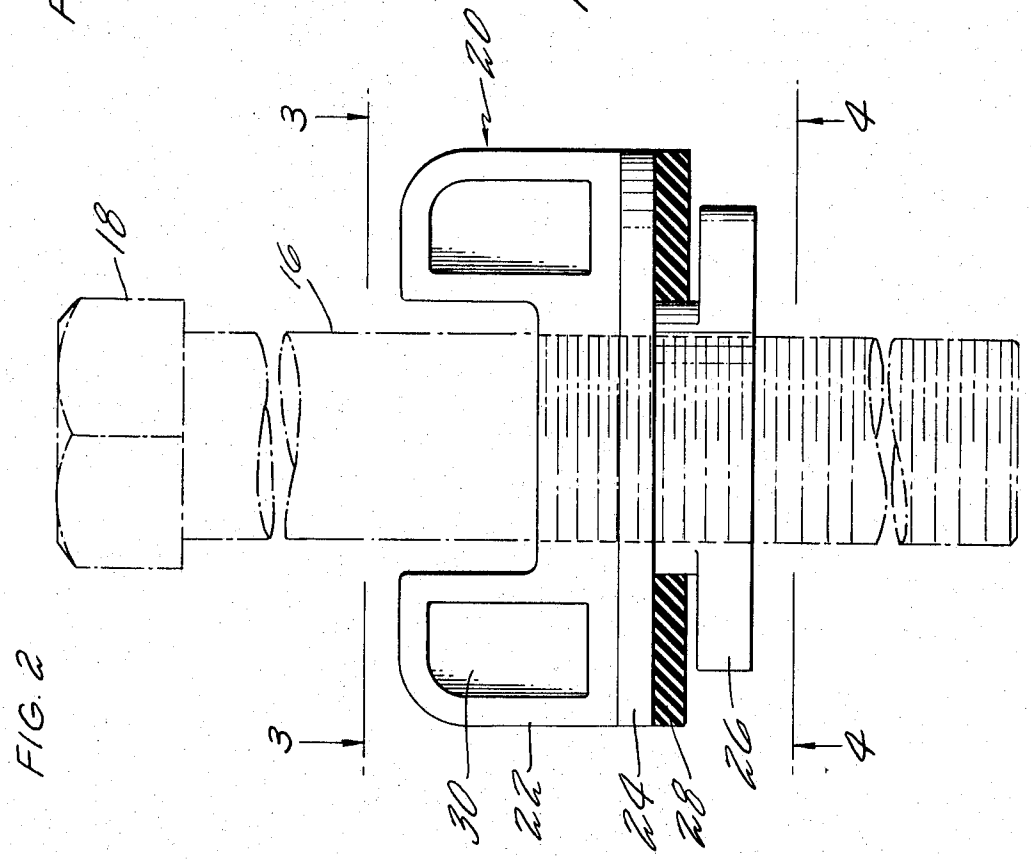

FIG. 2

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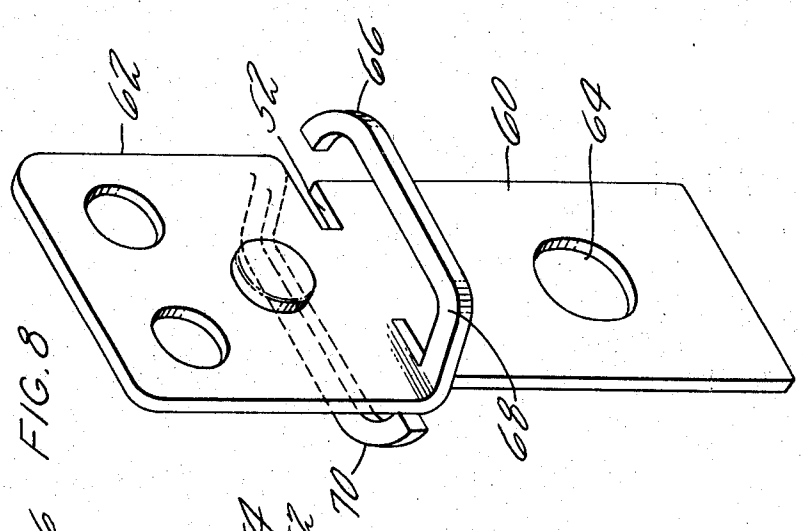

FIG. 8

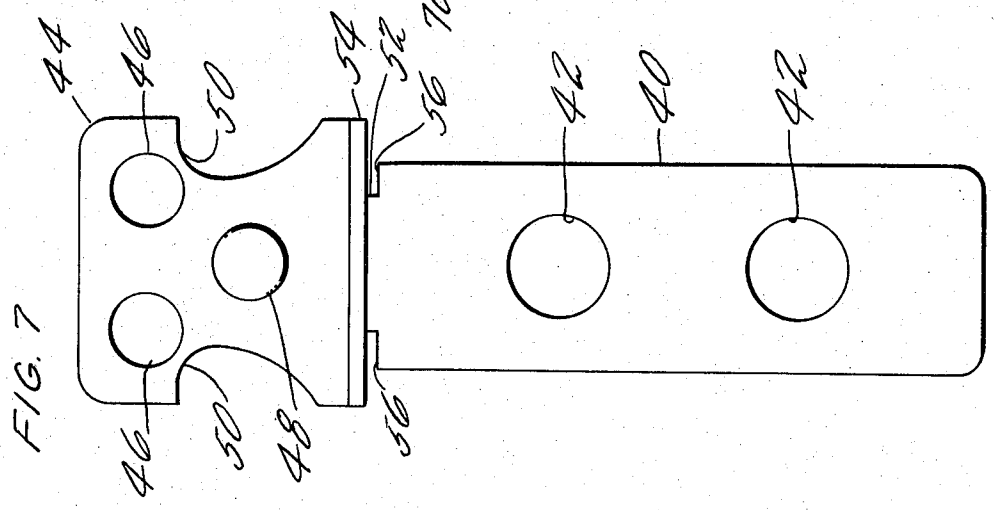

FIG. 7

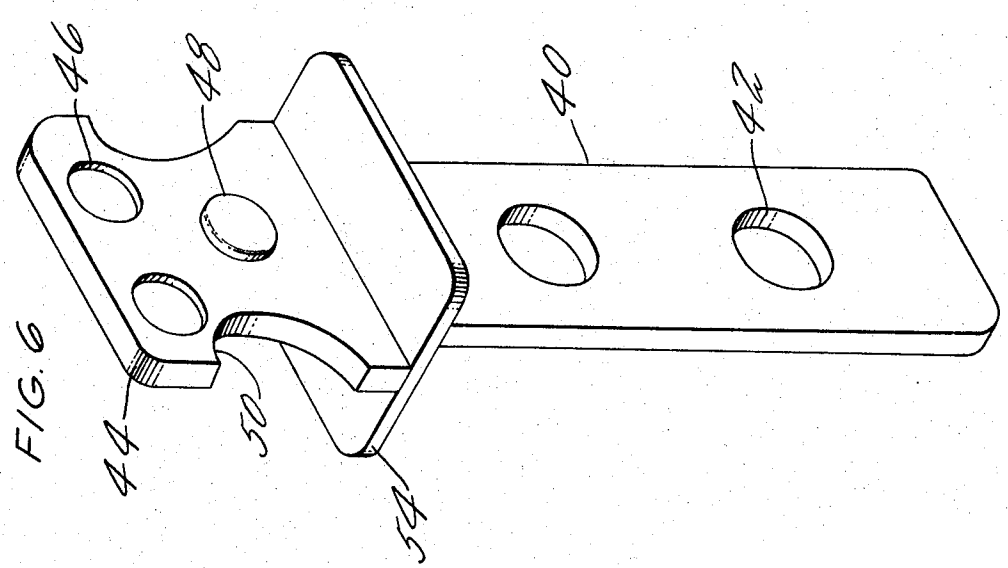

FIG. 6

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3,372,523

STRUCTURAL FASTENERS

William H. Hall, Jr., West Hartford, Conn., assignor to Structural Fasteners, Inc., West Hartford, Conn., a corporation of Connecticut

Filed June 13, 1966, Ser. No. 557,309
11 Claims. (Cl. 52—699)

This invention relates to structural fasteners. More particularly, this invention is directed to insert devices for suspending articles from structures comprised of a mass of coalesced material and the forms over which such material is deposited in an uncoalesced state. Accordingly, the general objects of this invention are to provide new and improved apparatus of such character.

While not limited thereto in its utility, the present invention is particularly well suited for use in the hanging of objects from building or structural members comprised of corrugated metal forms over which concrete has been poured, the forms being designed to be left in place in the structure. In the past, removable forms, usually of wood, were employed in the erection of concrete structures. Once assembled and properly positioned, the concrete in an uncoalesced state was poured on the forms and allowed to set. After the concrete had hardened, the forms were stripped therefrom and reused. The prior forms being wood and susceptible to repair, it was previously considered economically sound to attempt their salvage. However, due in part to increased labor costs and also due in part to advances in the metal fabrication arts, it is now more economical to employ forms comprised of sheets of corrugated metal which are left in place after the concrete has been poured thereon.

It is known in the art to make provision for the hanging of objects such as light fixtures, conduits and the like from the underside of concrete slabs by embedding insert members such as anchor bolts and other similar devices in the concrete. Hangers for the objects to be suspended are thereafter attached to the exposed portion of the embedded insert members, the suspended load thus being transmitted directly to the concrete. With the advent of left-in-place corrugated metal forms, it has become necessary to develop new types of concrete inserts. At the present time the most prevalent method of affixing inserts is to shoot studs through the form and into the coalesced material with a power charge. The design of inserts for corrugated metal forms is dictated not only by the configuration of the forms through which the inserts must extend since the forms are left in place, but also by the necessity that the inserts be susceptible to being rapidly locked in place on the forms to thus reduce labor costs. Coincident with rapid locking to the forms is the further requirement that, once in place, the inserts are not subject to tilting or loosening due to accidental impact thereon or to the forces to which they are subjected during the pour. Also, the inserts themselves must be susceptible to mass production so as to render their use economically feasible.

The present invention provides structural fastener insert apparatus which is intended to be embedded, in part, in a coalesceable material such as concrete, said insert being inexpensive, easy to install, inexpensive to manufacture, having desirable loading bearing characteristics and being peculiarly well suited for use with corrugated metal forms which are left in place in the structure.

As disclosed herein, a new type of insert is placed in holes specially prepunched in the metal forms. The insert with a load-fastening member is designed to have a part corresponding to the shape of the holes, and that corresponding part is placed through the hole to expose the fastening member to the underside of the form. The insert

is then rotated to be locked in place and to prevent leakage of the coalesced material during curing.

It is, therefore, an object of this invention to provide an improved structural fastener insert.

It is another object of this invention to provide a structural fastener insert which is designed to be embedded in part in a coalesceable material and which is easier to install than prior art devices of such character.

It is also an object of this invention to provide a concrete insert suited for use with forms which are to be left in place.

It is yet another object of this invention to provide a concrete insert which is suited for use with corrugated metal forms which are to be left in place, said insert being easier to install than prior art devices of such character.

It is also an object of this invention to provide a structural fastener insert for use with corrugated metal forms wherein the fastener has a threaded male member extending from the concrete.

It is also an object of this invention to provide a structural fastener insert with a fastener having a threaded member, and in which fouling of the threads by concrete water is prevented.

These and other objects of the present invention are realized by providing a concrete insert comprising a first end portion adapted to be embedded in concrete, a second end portion from which objects to be suspended from the structure may be hung and an intermediate portion which may be inserted partially through a hole provided therefor in the form and which may be securely locked in place on the form merely by rotation.

This invention may be better understood and its numerous advantages will become apparent to those skilled in the art by reference to the accompanying drawing wherein like reference numerals refer to like elements in the various figures and in which:

FIGURE 1 is an elevational view of a first embodiment of the present invention locked in place on a corrugated metal form and partially embedded in concrete.

FIGURE 2 is an enlarged elevational view of the embodiment depicted in FIGURE 1.

FIGURE 3 is a top view, along line 3—3 of FIGURE 2, of the apparatus of FIGURE 2.

FIGURE 4 is a bottom view, along line 4—4 of the apparatus shown in FIGURE 2.

FIGURE 5 is a perspective view of a portion of a corrugated metal form having a pattern of holes therein adapted for receiving the insert comprising the embodiment of FIGURES 1 through 4 of this invention, one of such first embodiment inserts being shown in position.

FIGURE 6 is a perspective view of a second embodiment of the present invention.

FIGURE 7 is an elevational view of the apparatus of FIGURE 6.

FIGURE 8 is a perspective view of a third embodiment of the present invention.

Referring now to FIGURE 1, a corrugated metal form is shown at **10**. In accordance with common practices in the art, form **10** is suitably positioned on supporting members. At the various points about the form, corresponding to the places on the underside of the final structure or slab where it is desired to provide means for suspending objects, fasteners such as the novel concrete insert shown at **12** are installed prior to the pouring of the concrete **14**. It is often impossible and always extremely inconvenient to install inserts **12** from the bottom of the form. Accordingly, the workmen move about installing inserts **12** from the upper side of the form and, when all the holes provided for inserts in the form have inserts placed therein or have been suitably capped, concrete **14** is poured and allowed to set. Once the concrete has been poured and set,

as can clearly be seen from FIGURE 1, a portion of the insert is embedded in the concrete and any load on the exposed portion of the insert will be transmitted directly to the concrete. With the metallic form being left in place, any pulling on the insert which would otherwise tend to pull it out of the concrete or shear the concrete must also pull the bolt or the concrete through corrugated metal form **10**. Obviously, then, the combination of the novel inserts of this invention and the corrugated metal forms has decided strength advantages.

The insert shown generally at **12** in FIGURE 1 may be better seen from the enlarged view of FIGURE 2. The insert comprises a bolt **16** having a head **18** of cross-sectional shape which is other than circular. Preferably, both in the interests of economy and to provide a good, non-slippable locking in the concrete, head **18** is hexagonal in shape. The end of bolt **16** which is intended to protrude from the underside of the form is threaded as shown.

A bushing **20** constitutes a locking mechanism, bushing **20** being machined or cast with an internally threaded bore so that it may be turned onto threaded bolt **16**. Bushing **20** comprises a wing nut element **22**, a stiff substantially rectangular washer or plate element **24** and a winged locking element **26**. Washer **24** and locking element **26** are displaced from one another by a distance slightly greater than the thickness of the corrugated form material. The substantially rectangular shape of washer **24** may best be seen from FIGURES 3 and 4 while the shape of winged locking element **26** may be best observed from FIGURE 4. As noted above, wing nut **22**, washer **24** and locking element **26** form an integral bushing unit **20** which may preferably be cast metal. A circular shaped flexible washer **28** of felt or rubber having a thickness corresponding to approximately ¾ of the spacing between stiff washer **24** and locking element **26** and having a diameter equal to the major axis of washer **24** occupies the space between these elements. Wing nut **22** may, in the interest of saving material, have portions **30** cut out of the wings as shown in FIGURES 1 and 2 or the wing portions be solid as shown in FIGURE 5. The holes in the corrugated form are commensurate in shape with winged locking element **26**. The corresponding shapes may be seen from a comparison of FIGURES 4 and 5. The insert is installed from the top side of the corrugated form in such a manner that flexible washer **28** rests on the upper surface of the floor of a valley **30** in the form. When inserted, the major axis of washer **24** is oriented lengthwise in the corrugation and the wings on element **26** thus pass through the aperture provided in the form. Installation is completed by merely rotating the insert 90° by means of wing nut **22**. As seen in FIGURE 1, this rotation causes the ends of stiff washer **24** to bite into the sloping sides **32** and **34** of the corrugations thus securing the insert in place. This securing action is sufficient to secure the insert so that the insert will not be tilted or otherwise affected by concrete being poured over the form or by normal workman traffic on the form prior to the pour. At the same time, locking wings **26** are rotated 90° to extend across the smaller dimension of the hole to prevent withdrawal through the hole and also to cam against the underside of the form to pull washer **24** into engagement with the sides **32** and **34**. Washer **28** acts as a spacer to compensate for various thickness of the metal forms and prevents leakage of water from the concrete around the insert. Such water seepage would, because of deposition of sand and other materials suspended therein, otherwise foul the threads on bolt **16** and necessitate a time consuming cleaning operation. After the concrete has been poured and set, any desired structure, such as light fixtures, ceiling supports, pipe supports, etc. may be screwed onto the exposed threaded portion of bolt **16**.

Referring now to FIGURES 6 and 7, a second embodiment of the present invention is disclosed. This second embodiment comprises an object supporting element **40** which is adapted to protrude from below a corrugated metal form such as form **10** of FIGURE 1. Element **40** has a plurality of holes **42** therein through which bolts or hangers may be passed thus permitting suspension of the objects to be suported. Integral with element **40** is a head element **44** which is designed to be embedded in the concrete above the corrugated form. Elements **40** and **44** are formed from a single piece of flat stock, the width of element **40** being less than the width of element **44**. Element **44** is pressed or punched to provide protrusions **46** which extend outwardly from a first side thereof and protrusion **48** which extends outwardly from the opposite side thereof. The sides of element **44** are also provided with oppositely disposed cutouts **50**. As should be obvious, the purpose of protrusions **46** and **48** and cutous **50** is to provide irregular surface areas to assist the thorough embedding of element **44** in the concrete. The end of hanger element **40** adjacent to element **44** is provided with a notch **52** having shoulders **56**. A stiff washer **54** having the same rectangular shape as washer **24** of the embodiment of FIGURES 2 through 4, said washer having a rectangular slot therein corresponding in size and shape to the cross sectional area of hanger element **40**, is inserted over element **40** and permanently attached as by welding or staking to element **44**. Notch **52** is of sufficient width between elements **40** and **44** that, with washer **54** installed, the width of the notch will be approximately equal to the thickness of the metal comprising the corrugated forms. Shoulders **56** serve the function of the locking wings **26** of the previous embodiment. A flexible washer such as washer **28** of the embodiment of FIGURES 2 through 4 is not necessary with the embodiment of FIGURES 6 and 7 since there are no threads to foul. As should be obvious, the concrete insert depicted in FIGURES 6 and 7 is installed on the corrugated form in the same manner as the embodiment of FIGURES 2 through 4, with washer **54** biting into the sloping sides of the corrugations after turning, and it functions in the same manner.

Turning now to FIGURE 8, a third embodiment of the present invention is shown. Like the first two embodiments described, the insert of FIGURE 8 comprises an element **60**, designed to extend from the underside of the finished structure thus enabling the suspension of objects therefrom, and a head element **62** adapted to be embedded in the concrete above the form. The embodiment of FIGURE 8 is shown with but a single hole **64** in element **60** and with the same depression-protrusion concrete locking structure in head element **62** as described above in relation to the embodiment of FIGURES 6 and 7. Element **62** does not have the oppositely disposed side cutouts which the embodiment of FIGURES 6 and 7 possesses. However, if desired or necessary, such cutouts may be provided.

The embodiment of FIGURE 8 differs from the other two embodiments disclosed in that it is formed from a single piece of material, an assembly step in the manufacture of the insert thus being obviated. The foregoing manufacturing advantage is achieved by forming a washer **66** by means of splitting element **60** lengthwise along both sides and thereafter bending the thus split side portions **68** and **70** upwardly and around as shown to substantially encircle the insert. The washer **66** is thus formed from side strips from element **60** which would otherwise be wasted, and this forming of the washer **66** eliminates the requirement for the separate washer **54** in the FIGURE 6 embodiment and the associated assembly labor. In use, the embodiment of FIGURE 8 is identical to the embodiments above described.

While preferred embodiments have been shown and described, various modifications and substitutions may be made thereto without departing from the spirit and scope of this invention. For example, with the embodiments of FIGURES 6, 7 and 8, the holes in form **10** may be rectangular slots rather than having the shape shown in FIGURE 5. Accordingly, it is to be understood that

this invention has been described by way of illustration and not limitation.

What is claimed is:

1. A structural fastener insert for use with a corrugated building form having holes through the floors of the valleys between sloping walls of the corrugations, such holes being adapted for the insertion of the insert therethrough, the insert comprising:

a load supporting member, said load supporting member having a head section and a fastening section, at least part of said head section being other than circular in cross section, said fastening section extending from said head section;

attachment means in said fastening section for enabling an article to be supported from said fastening section;

a washer element having a major and a minor axis mounted on said load supporting element, said major axis being greater in length than the width of the floors of the valleys between the sloping walls of the corrugations;

said fastening section passing through one of said holes in a valley floor in said corrugated building form and extending from said building form on one side thereof in an installed position of said load supporting element; said washer element and said head section extending from the other side of said building form in said installed position, and

locking means on said load supporting member, said locking means being on said one side of said building form in said installed position and preventing withdrawal of said load supporting member, and said major axis of said washer extending across said valley and engaging the sloping walls of a corrugation in said installed position of said load supporting element.

2. A structural fastener insert as in claim 1 wherein said head section and said fastening section form a unitary and substantially flat structure, said head section having engaging means thereon for engaging a coalesced material poured on said other side of said form.

3. A structural fastener insert as in claim 1 wherein said fastening section is substantially flat and has article engaging holes therein.

4. A structural fastener insert as in claim 1 wherein

said washer element is a stiff member secured to said load supporting member.

5. A structural fastener insert as in claim 1 wherein said fastening section is a substantially flat element, and wherein said washer element comprises side strips cut from said fastening section, said side strips bending and substantially encircling said load supporting member.

6. A structural fastener insert as in claim 1 including a flexible washer between said washer element and said form.

7. A structural fastener as in claim 1 wherein said washer element and said locking means comprise a unitary bushing.

8. A structural fastener as in claim 7 wherein said fastening section includes a threaded bolt member, and wherein said bushing is threadably secured to said bolt, and including a wing nut element on said bushing, said washer element being substantially rectangular.

9. A structural fastener as in claim 1 wherein said fastening section is a substantially flat plate, and wherein said washer element comprises side strips from said fastening section bending and substantially encircling said load supporting member.

10. A structural fastener as in claim 8 wherein said locking means includes shoulder means on said fastening section.

11. A structural fastener as in claim 1 wherein said fastening section is a substantially flat plate, and wherein said washer element is a substantially rectangular plate secured to said load supporting member, and wherein said locking means includes shoulder means on said fastening means.

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