Dec. 9, 1958 P. N. YOUTZ 2,863,313

LIFT-SLAB FLOOR-TO-COLUMN CONNECTOR

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FIG. 1

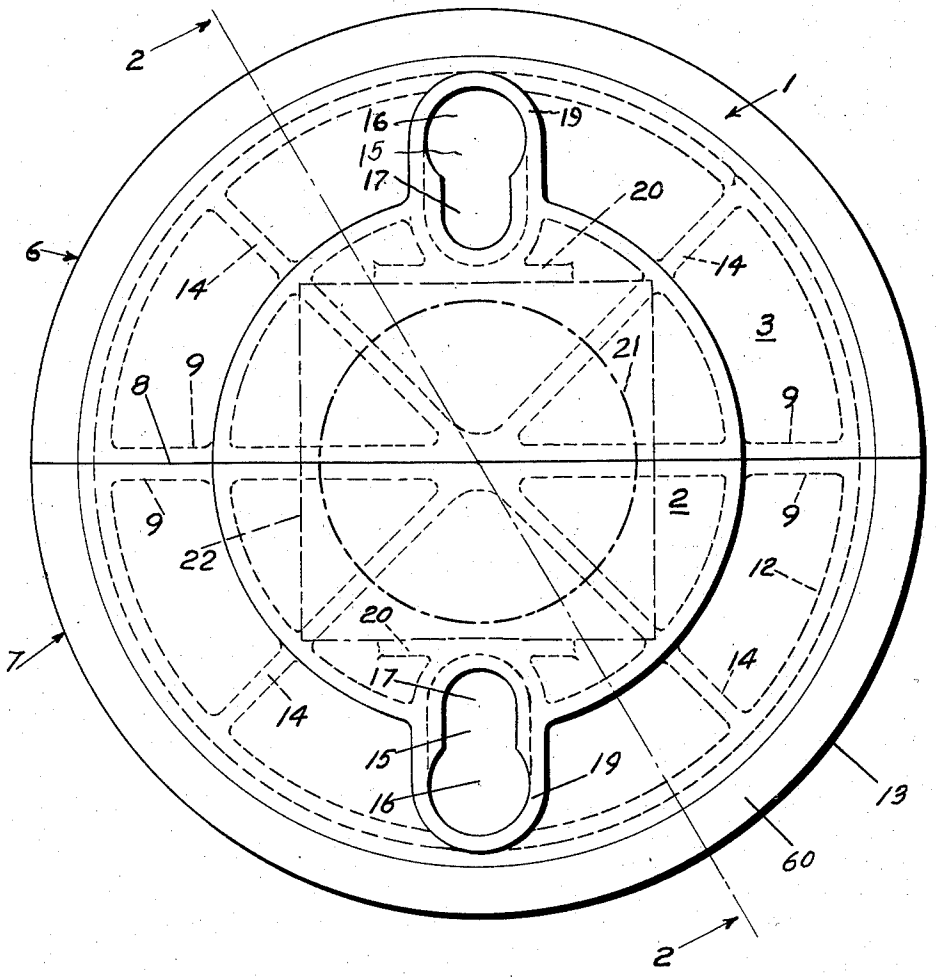
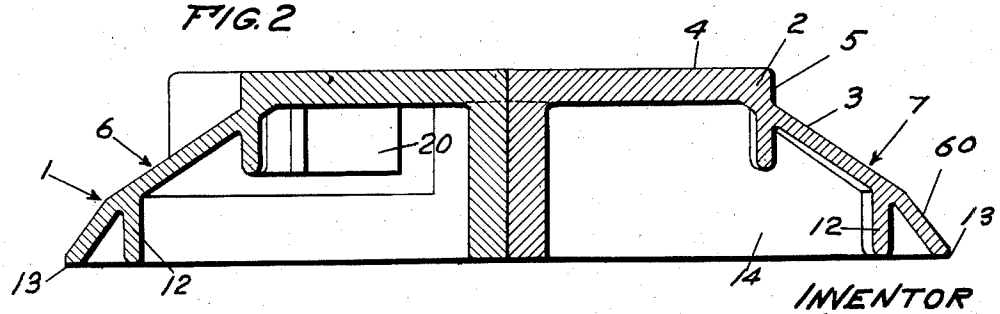


FIG. 2



INVENTOR
PHILIP N. YOUTZ
BY Louis C. Smith
ATTORNEY

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FIG. 3

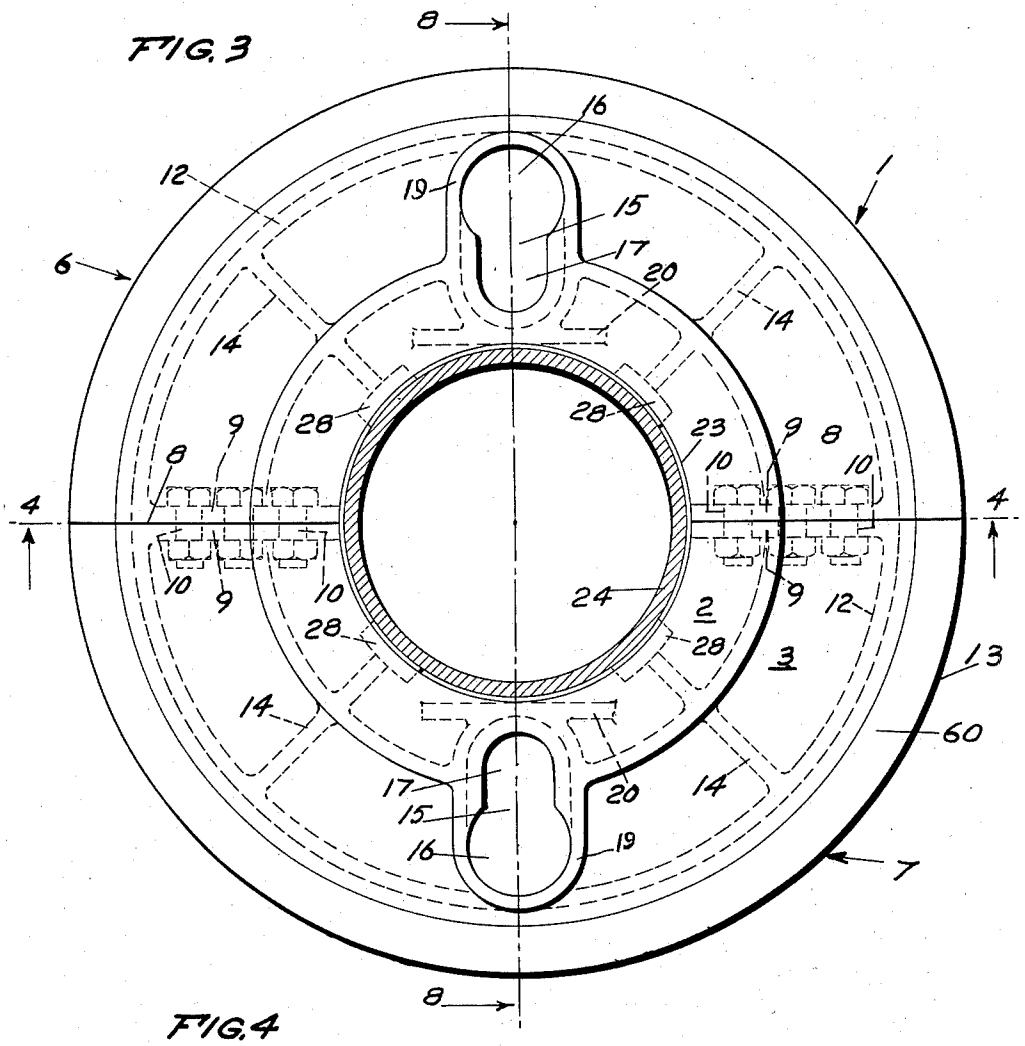
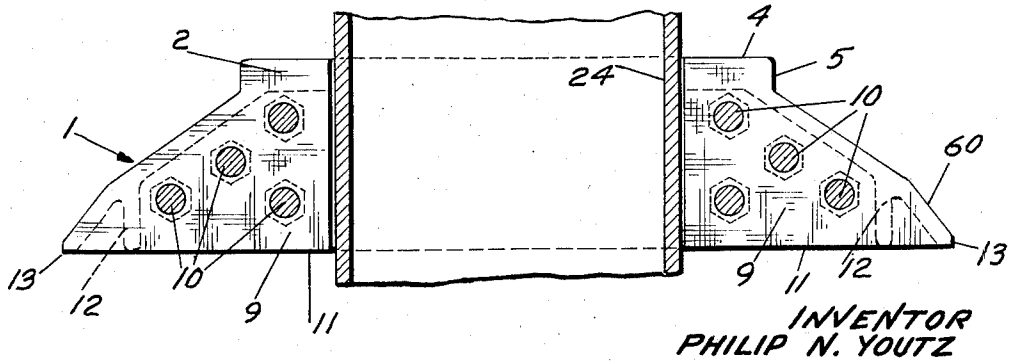


FIG. 4



INVENTOR
PHILIP N. YOUTZ
BY Louis C. Smith
ATTORNEY

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FIG. 5

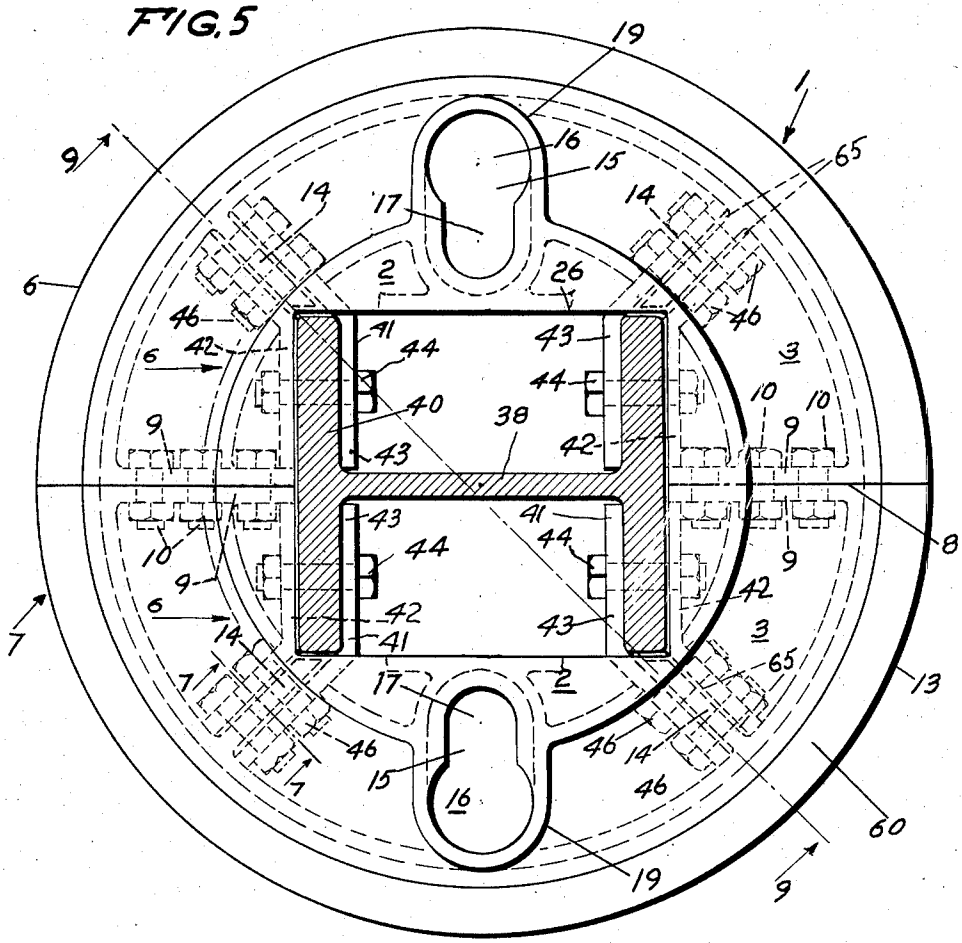


FIG. 6

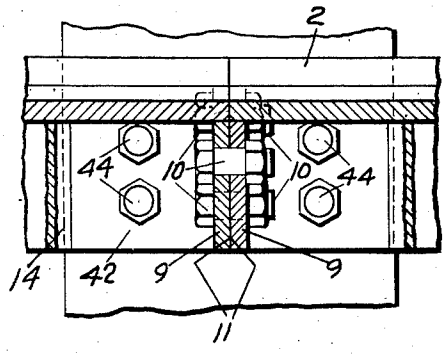
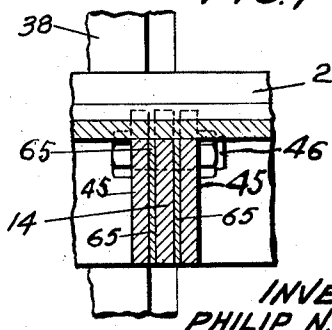


FIG. 7



INVENTOR
PHILIP N. YOUTZ
BY Louis C. Smith

ATTORNEY

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LIFT-SLAB FLOOR-TO-COLUMN CONNECTOR

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FIG. 8

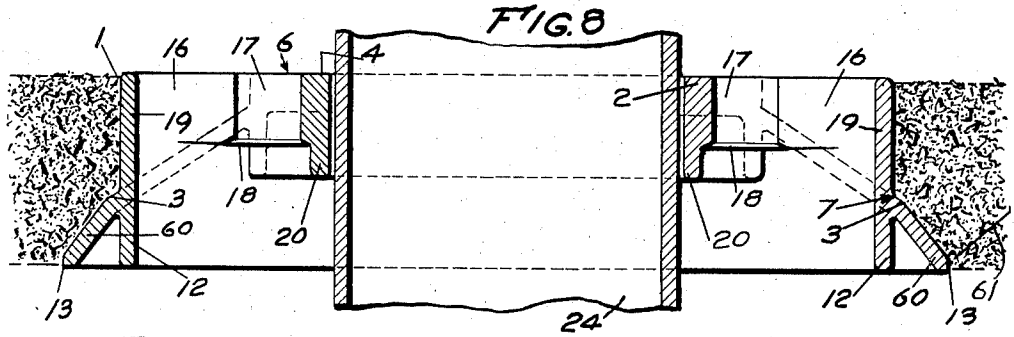


FIG. 9

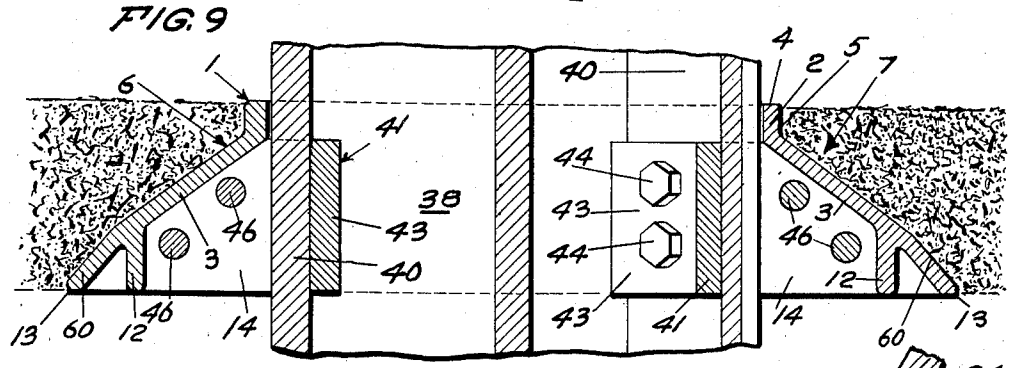


FIG. 10

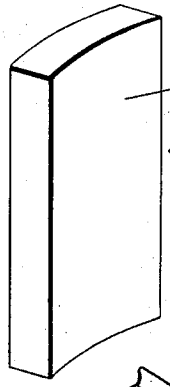


FIG. 11

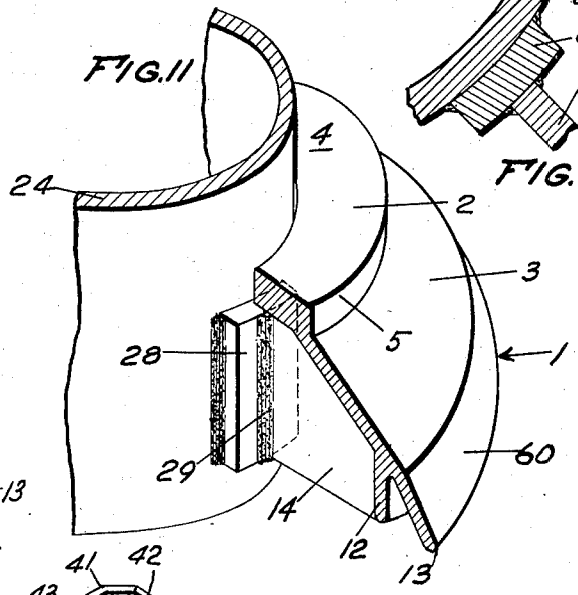


FIG. 12

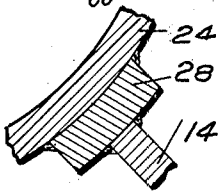


FIG. 13

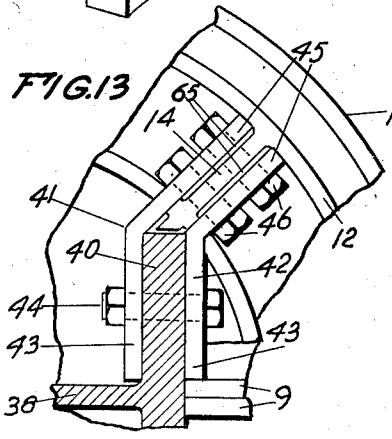
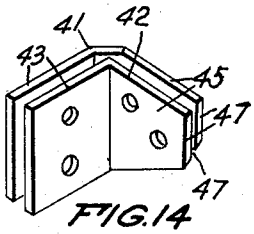


FIG. 14



INVENTOR
PHILIP N. YOUTZ
BY Louis C. Smith
ATTORNEY

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FIG. 15

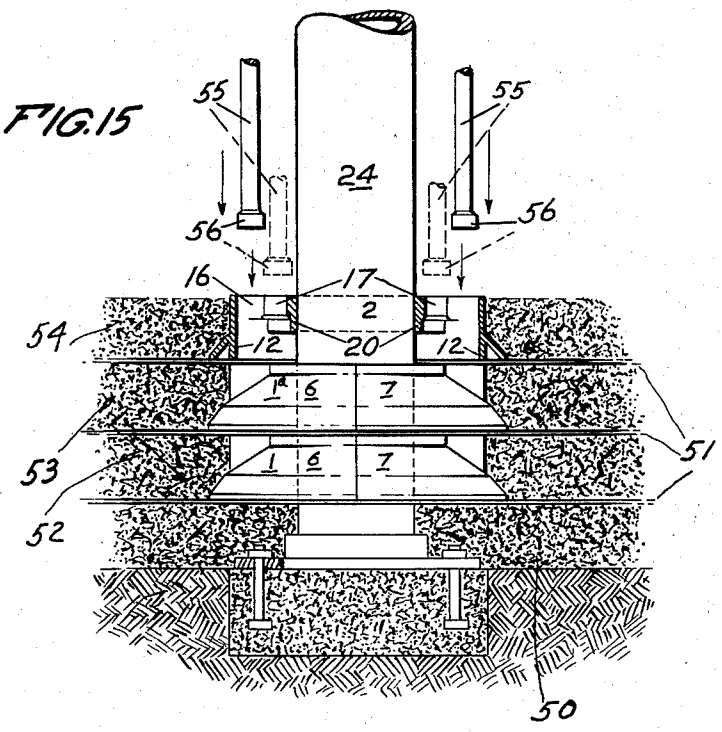
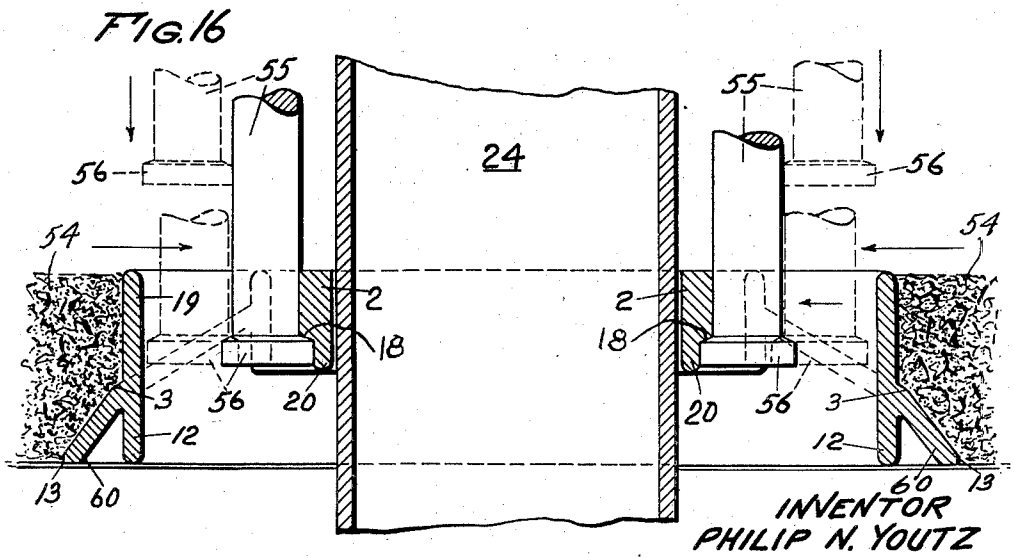


FIG. 16



INVENTOR
PHILIP N. YOUTZ
BY Louis C. Smith
ATTORNEY

United States Patent Office 2,863,313 Patented Dec. 9, 1958

2,863,313

LIFT-SLAB FLOOR-TO-COLUMN CONNECTOR

Philip N. Youtz, Yorktown Heights, N. Y.

Application April 13, 1955, Serial No. 501,159

4 Claims. (Cl. 72—1)

One method of erecting buildings having concrete upper floor slabs consists in first erecting at the building site a plurality of structural columns which eventually from the supporting columns for the various upper floors, and then pouring the ground floor slab around and in molding contact with the columns, and subsequently pouring the upper floor slabs on the ground floor slab at ground level to form a stack of floor slabs, and finally raising the various floor slabs, preferably one by one, to their elevated positions by means of jacks mounted on the columns which are connected to each floor slab to be lifted by means of depending lifting rods.

In carrying out this method it is customary to employ metal collars which are placed around the various columns and which are molded into the upper floor slabs as they are poured, these collars providing means for attaching the lifting rods to the slabs for lifting them to their elevated position, and also providing means for attaching the slabs when raised to the columns.

The present invention relates to a metal collar of this type, and it has for one of its objects to provide such a collar which is adapted for use with columns of different cross sectional shapes, such as round columns, wide flange columns, or box columns.

Another object of the invention is to provide a collar which is constructed to facilitate the operation of anchoring it to the column after the corresponding floor slab has been raised to an elevated position, either by means of plates secured to the collar or by a welding operation.

Another object is to provide a collar of this type in which the means for securing the collar to the column is located within the collar and thus within the vertical dimension of the corresponding floor slab.

A further object of the invention is to provide a collar of this type which when attached to a column and in use supporting a floor slab, will develop a diagonal shear line in the slab as distinguished from a vertical shear line. An advantage of this feature is that it is possible to use a smaller collar for supporting a slab than if the collar was so constructed as to develop a vertical shear line.

Other objects of the invention will be apparent from the following description of one embodiment of my invention.

In the drawings:

Fig. 1 is a plan view of a collar embodying my invention;

Fig. 2 is a section on the line 2—2, Fig. 1;

Fig. 3 shows a plan view of a collar embodying the invention attached to a circular column, the latter being shown in section;

Fig. 4 is a section on the line 4—4, Fig. 3;

Fig. 5 is a view similar to Fig. 3 but showing the collar as used in connection with a wide flange column;

Fig. 6 is a section on the line 6—6, Fig. 5;

Fig. 7 is a section on the line 7—7, Fig. 5;

Fig. 8 is a section on the line 8—8, Fig. 3;

Fig. 9 is a section on the line 9—9, Fig. 5;

Fig. 10 is a view of a shear block adapted to be welded to a round column and to serve as a support for the collar;

Fig. 11 is a sectional perspective view showing a collar supported by the shear block illustrated in Fig. 10;

Fig. 12 is a fragmentary sectional view of the shear block welded to the round column and to the collar;

Fig. 13 is a sectional view showing the manner in which the collar is secured to a wide flange column by means of attaching plates;

Fig. 14 is a perspective view of the attaching plates shown in Fig. 13.

A collar embodying my invention is indicated at 1, and in the preferred embodiment it is circular in contour and has the general shape of a truncated cone. The collar presents a top plate portion 2 and an annular skirt portion 3 which extends downwardly and outwardly from the periphery of the plate portion, thereby giving the collar the truncated cone shape shown in Fig. 2. The thickness of the top plate portion is only a fraction of the vertical dimension of the skirt portion 3, which is shown as extending from the lower part of the plate portion so that the top surface 4 of the plate portion extends slightly above the skirt portion 3, thereby forming the shoulder 5.

The collar is preferably made in two similar half sections indicated at 6 and 7, said half sections being divided from each other along the diametrical line 8. These two half sections are bolted firmly together to produce a complete collar element, as will be presently described. Each of the half sections is formed with a depending plate or flange 9 which extends along the diametrical line 8, and when the two sections 6 and 7 are assembled to make a complete collar the two flanges or plate portions 9 are in contact with each other. The two sections 6 and 7 are secured together by means of bolts 10 extending transversely through the mating flanges 9, as indicated in Figs. 3 and 4. These flanges or plates 9 extend downwardly from the plate portion 2 and the skirt 3 and the plates terminate in bottom edges 11 which are in the plane of the peripheral edge 13 of the collar.

Each half section is formed with a depending reinforcing rib 12 located near and parallel to the outer edge 13 of the plate section, the ribs 12 of the two half sections 6 and 7 presenting together an annular reinforcing rib which strengthens the peripheral portion of the collar. The reinforcing ribs 12 terminate at their lower edge in the plane of the peripheral edge 13 of the collar, as shown in Fig. 2.

Each half section of the collar is also formed with radial depending webs 14 which are integral with the plate portion 2 and the skirt portion 3 and extend inwardly from the depending reinforcing rib 12. As illustrated in the drawings, each half section shows two of these depending webs 14, and said webs are so located that the webs in each half section are in line with similar webs in the other half section, as best indicated in Fig. 1. These webs 14 serve not only for strengthening the collar but also afford means by which a collar can be bolted to a wide flange column as will be presently described.

The collar is shown as being provided with two oppositely disposed through openings (hereinafter referred to as lifting rod openings) adapted to receive lifting rods by which the collar and the corresponding floor slab may be raised to a higher elevation. Each lifting rod opening is indicated generally at 15 and is of the keyhole type, it having a portion 16 of larger diameter that extends through the skirt 3 and a portion 17 of smaller diameter which extends through the plate portion 2. The portion 17 of smaller diameter is of a size to receive the lifting

rod and the lower end of the portion 17 of the opening 15 terminates in a seat 18 adapted for engagement with an enlarged portion or head 56 on the lifting rod. The portion 16 of the opening 15 has a diameter large enough to permit the head 56 of the lifting rod to be inserted therethrough, and the attachment of the lifting rod 55 to the collar is accomplished by lowering the end of the lifting rod with its head 56 through the larger portion 16 of the opening 15 and then moving the lifting rod inwardly toward the center of the collar to bring said rod into the portion 17 of the opening and the head on said rod in position to engage the seat 18.

The skirt portion 3 is provided with an upstanding wall 19 which bounds the portion 16 of the opening 15 and which extends from the skirt upwardly to the level of the top surface of the plate portion 2, as indicated in Fig. 8.

The collar is also formed with a depending reinforcing rib 20 which is integral with and depends from the plate portion 2 and forms the inner and side walls of the portion 17 of the opening 15, the lower portion of each rib being shaped to present the seat 18. Such reinforcing ribs 20 give added strength to the collar at the point where the lifting effort is applied thereto by the lifting rods during the operation of lifting a floor slab.

It has been stated that the improved collar is equally well adapted for use with a round column, a wide flange column, or a box column.

In one form of the invention the collar is initially made with a solid plate portion 2 and the collar is adapted for use with columns of different shapes by cutting a hole through the plate portion by means of an acetylene torch or otherwise which has a shape to fit the particular column with which the collar is to be used. If, for instance, the collar is being used with a round column, then a circular hole indicated by the dotted lines 21 in Fig. 1 will be cut through the plate portion 2 and the flanges 9 and webs 14, while if the collar is to be used with a wide flange column or with a square box column, then a square hole will be cut through the plate portion 2, the flanges 9, and webs 14, as indicated by the dotted lines 22, said square hole, of course, being of the proper size to fit the particular column with which the collar is to be used.

Fig. 3 shows the plate portion 2 of the collar as provided with a circular opening 23 to receive a round column 24 and Fig. 5 shows the plate portion 2 of the collar as having a rectangular opening 26 formed therein to receive a wide flange column 38 or a box column having a rectangular cross section.

A collar which is embedded in a floor slab that has been raised to an upper level may be attached to the round column 24 by a welding operation and for this purpose shear blocks 28 such as shown in Fig. 10 may be welded to the round column 24 after a floor slab has been raised to an elevated position and at a location below the raised slab, as shown in Fig. 11, and after the shear blocks have been thus welded to the columns 24 the slab with its collar may be lowered so that the plate portion of the collar will rest on the shear blocks. If these shear blocks are placed in line with the webs 14, then the inner edges of the webs may be welded to the shear blocks shown at 29 in Fig. 11.

The collar herein described has been designed to provide for a bolted connection with the columns and especially with columns of the wide flange type as shown in Fig. 5. This bolted connection between the collar and the wide flange column includes pairs of attaching plates, each pair adapted to be bolted to one of the radial webs 14, and also to be bolted to one edge of one of the wide flanges of the wide flange column. The plates of each pair are indicated at 41 and 42, each plate being bent as shown in Figs. 5, 13, and 14.

In forming the plate portion 2 with a rectangular opening designed to receive the wide flange column 38, the opening is so positioned that the corners thereof match up with the radial webs 14, as best seen in Fig. 5. The plates 41 and 42 are bent to conform to the angular relation between the flange 40 of the column 38 and the web 14. Attaching plates 41 and 42 are placed on opposite sides of the web 14 and of the flange 40 of the column 38, and the ends 43 of the two plates are bolted to the flange 40 of the column by suitable bolts 44, while the portions 45 of the two plates, which are located on opposite sides of the web 14, are bolted thereto by suitable bolts 46. The ends 45 of the top edges of the bent attaching plates are shaped to fit against the under side of the inclined skirt 3, the ends 47 of said plates fitting against the reinforcing rib 12.

For bolting the collar to the column 38 four pairs of attaching plates are used, one pair being attached to each of the webs 14 and also to a flange 40 of the column 38 as best seen in Fig. 5.

It will be noted that the means for attaching the collar to a column, whether such means be in the nature of a welded connection or a bolted connection, are located within the skirt portion of the collar, the space within said skirt portion being of sufficient size for this purpose. No portion of the attaching means, whether it be a bolted or a welded connection, extends below the collar. An advantage of this construction is that all the connections between the collar and the column are concealed within the collar and are located within the vertical dimension or thickness of the floor slab, thus avoiding the unsightly appearance which would be the result if the connections were exposed below the collar.

Fig. 15 illustrates the manner in which the collars are used in connection with the pouring of a plurality of upper concrete floors on the ground floor, and in said Figure 24 indicates a round column which has been erected at the building site and 50 indicates the ground floor which has been poured in molding contact with the column. In pouring the next floor on the ground floor the latter will be covered with tar paper 51 or some other bond preventing material and the collar 1 will be placed around the column 24 resting on the bond preventing layer 51. The next floor indicated at 52 is then poured on the ground floor and in molding contact with the collar 1. The floor 52 is then covered with the bond preventing layer 51 and another collar 1*a* is placed around the column and the next floor 53 will be poured in molding contact with the collar 1*a*. This operation will be repeated until the necessary number of upper floor slabs have been poured.

When it comes to raising the slabs one by one the lifting rods indicated at 55, each of which is provided with a head 56 at its lower end, are lowered through the openings 15 in the collar of the top slab, the enlarged end 56 of each lifting rod passing through the enlarged portion 16 of a lifting rod opening 15 in the collar until the enlarged end 56 has moved into a position below the seat 18. The lifting rod is then moved inwardly to bring it into the smaller portion 17 of the opening 15 with the enlarged end 56 directly beneath and in position to engage the seat 18. The lifting rods are then in position to have the lifting force applied thereto for raising the top floor slab.

When the top slab has been raised to a lifted position and the collar therein has been attached to the column 24, the lifting rods are lowered through the openings 15 of the raised floor slab and the lower ends of said lifting rods are lowered through the openings 15 in the collar of the next floor slab to be raised, as above described, and after the enlarged portions 56 of the lifting rods have been brought into position to engage the seats 18 of the collar of the slab next to be lifted, then said floor slab can be raised as above described and attached to the column.

The truncated conical shape of the collars is of advantage because when the floor slabs are being lifted, the

two halves of each collar will be under compression which will tend to hold the said two halves firmly in their proper position.

It will be noted that the peripheral edge portion **60** of the collar stands at a slightly different angle from the body of the skirt portion, the angle of inclination of such peripheral edge portion **60** being almost 45° from the horizontal. An advantage of this construction is that when the collar is in use supporting a floor slab the shear line through the concrete which starts at the peripheral edge of the collar will have an increased length. Said shear line starts at the periphery of the lower edge of the collar and is perpendicular to the plane of support so that with the construction shown in the drawings the shear line developed by the collar herein shown will be perpendicular to the angle of the face of the peripheral edge **60**, with the result that there is a greater area of concrete to resist shear than would be the case if the peripheral edge had the same angular inclination that the body of the skirt portion has. Figs. 8 and 9 show the portion of the floor slab immediately surrounding the collar and the inclined line **61** in Fig. 8 illustrates the shear line which would be developed by the collar herein shown.

While I have above described the column-receiving opening in the collar as being formed by cutting out an opening through the plate portion by means of an acetylene torch or other suitable implement, yet the invention would not be departed from if the collar were cast in the first instance with a hole of the desired size and shape extending through the top plate portion thereof.

I claim:

1. The combination with a wide flange column, of a concrete floor slab, a floor supporting collar embedded therein and provided with a top plate portion and an annular skirt portion extending downwardly and outwardly from said top plate portion, said top plate portion having a rectangular opening of a size to receive said column and through which the column extends, said collar having webs depending from the top plate portion and skirt portion and extending radially from each corner of said opening, and attaching plates for attaching the collar to the column, each attaching plate having one end portion lying flatly against a flange of said column and the other end lying flatly against one of the webs and bolts securing one end of each attaching plate to said flange of the column and the other end to one of the webs.

2. The combination with a wide flange column, of a concrete floor slab, a floor supporting collar embedded therein and provided with a top plate portion and an annular skirt portion extending downwardly and outwardly from said top plate portion, said top plate portion having a rectangular opening of a size to receive said column and through which the column extends, said collar having webs depending from the top plate portion and skirt portion and extending radially from each corner of said opening, and pairs of attaching plates for attaching the collar to the column, there being a pair of attaching plates for each web, the outer ends of each pair of attaching plates being located on opposite sides of one of the webs and the inner ends of each pair being located on opposite sides of a wide flange of the column, and bolts securing said attaching plates to said webs and wide flanges.

3. A metal collar adapted to be molded into and extend transversely through a concrete slab and to provide means for connecting said slab to lifting rods by which the slab may be raised, said collar having a vertical dimension substantially equal to the thickness of the concrete slab into which it is to be molded, said collar having the shape of a truncated cone and presenting a top plate portion provided with a central opening of a size to receive the column to which the collar is to be attached and of a shape corresponding to that of said column, an annular skirt portion integral with said plate portion and extending downwardly and outwardly from the peripheral edge thereof, the thickness of the plate portion being a small fraction of the vertical dimension of the skirt portion, a plurality of radial webs, each of which depends from both the plate portion and the skirt portion and is integral with both portions, said collar also having two lifting rod openings to receive said lifting rods, each opening being partially in the plate portion and partially in the skirt portion, the part of each lifting rod opening in the skirt portion being larger than the part of said opening in the plate portion, said collar also having a reinforcing rib integral with and depending from the edge of the plate portion which bounds the part of the lifting rod receiving opening therein, the lower edge of each rib presenting a seat against which an enlarged portion on a lifting rod located in said smaller portion of a lifting rod opening may have engagement for lifting the slab, the larger portion of each lifting rod opening being of a size to permit the enlarged portion of a lifting rod to pass therethrough, the space enclosed by the skirt portion being open at the bottom thereof and of sufficient size to receive the means for attaching the collar to a column.

4. The combination with a metal supporting column, of a concrete floor slab having a metal collar embedded therein, said collar presenting a top plate portion flush with the top face of said slab, and an annular skirt portion extending outwardly and downwardly from the periphery of the top plate portion and having its lower edge flush with the bottom face of said slab, the thickness of the top plate portion being a fraction of the vertical dimension of the skirt portion and the space enclosed by the skirt portion being open at the bottom of the slab, said top plate portion having an opening of a size to receive, and a shape conforming to, said column and through which the column extends, and means located entirely within the space enclosed by the skirt portion and thus positioned between the planes of the top and bottom surfaces of said floor slab for attaching the collar to the column, said means being accessible through the open bottom of the skirt portion.

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