Aug. 21, 1962 A. E. SHLAGER 3,050,161

SQUARE COLUMN

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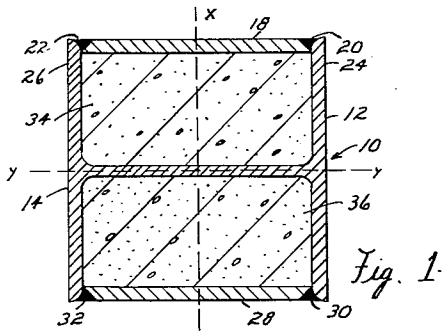


Fig. 1

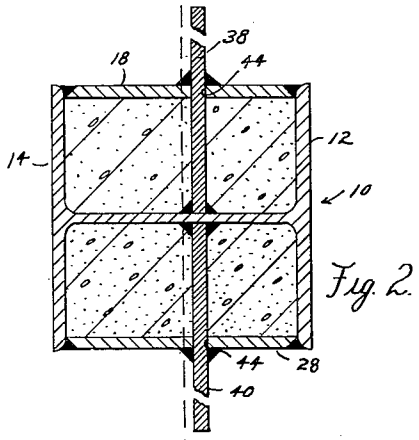


Fig. 2

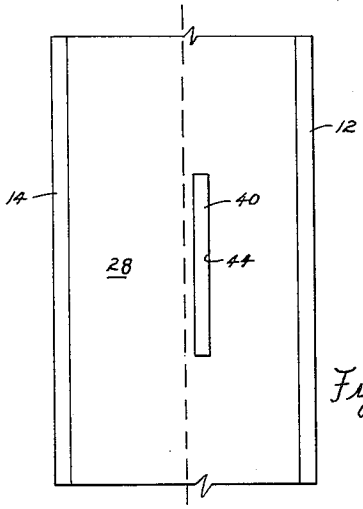


Fig. 3

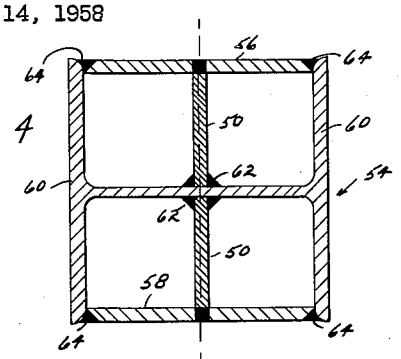


Fig. 4

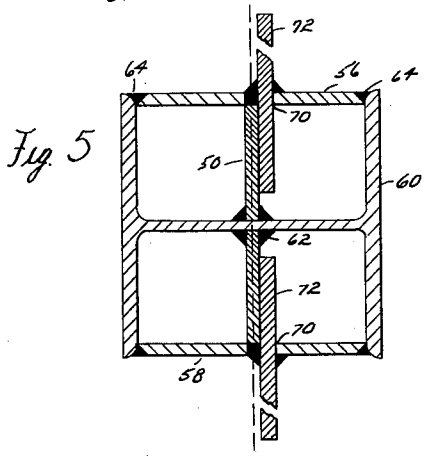


Fig. 5

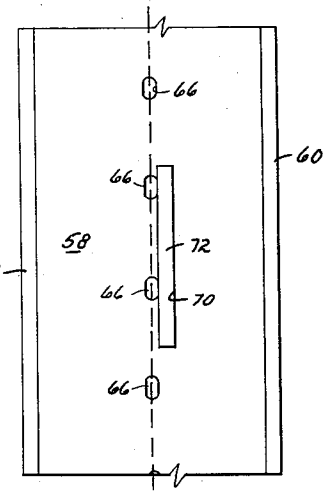


Fig. 6

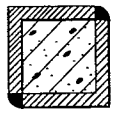


Fig. 7

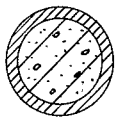


Fig. 8

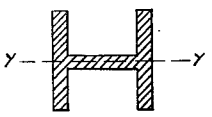


Fig. 9

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SQUARE COLUMN

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4 Claims. (Cl. 189—38)

This invention relates to vertical structural supports and more particularly comprises a new and improved square or rectangular column.

The building industry, particularly in recent years wherever possible has sought to reduce the cross-section of load carrying members in order to limit the loss of space and carry more load to enlarge clear span distance and area free column space in factories and high buildings. Any structural member that could occupy a smaller cross-sectional area than conventional columns and carry more load would meet with wide acceptance.

The primary object of my invention is to provide a load carrying column having a smaller cross-sectional area than other members now available for supporting a given load.

Another important object of my invention is to provide a square column having a greater load carrying capacity than other square columns now available having the same cross-section.

Still another important object of my invention is to provide a square column which enables eccentric loads to be at least partially supported at the center of the column.

To accomplish these and other objects, the several embodiments of my invention include H-beams which form the column core. Side plates are welded to the edges of the H-beam flanges to present a square cross-section. This section is substantially equal in carrying capacity in both directions of the axis whereas without the side plates the column can carry substantially less on the axis aligned with the web than on the other axis normal to it. Concrete fills the chambers on each side of the web which adds to the carrying capacity of the columns. In a second embodiment of my invention, the concrete is omitted and additional plates are welded on one side to the centers of the side plates and on the other side to the center of the web of the H-beam. These additional plates provide means for transferring eccentric loads to the center of the column.

These and other objects and features of my invention along with its incident advantages will be better understood and appreciated from the following detailed description of several embodiments thereof, selected for purposes of illustration and shown in the accompanying drawings, in which:

FIGURE 1 is a cross-sectional view of a square column constructed in accordance with my invention;

FIGURE 2 is a view similar to FIGURE 1 and illustrating the manner in which eccentric loads may be applied to the column;

FIGURE 3 is an elevation view of the column shown in FIGURE 2;

FIGURE 4 is a cross-sectional view of another square column constructed in accordance with my invention;

FIGURE 5 is a cross-sectional view similar to FIGURE 4 but showing the manner in which an eccentric load may be secured to the column;

FIGURE 6 is an elevation view of the embodiment of my invention shown in FIGURE 5; and

FIGURES 7, 8 and 9 are cross-sectional views of conventional columns now available.

The embodiment of my invention shown in FIGURES 1–3 includes an H-beam **10** having a pair of parallel flanges **12** and **14** interconnected by a web **16**. This beam is of conventional design and may be fabricated

in the customary manner. A side plate **18** is welded at **20** and **22** across the beam to the adjacent ends **24** and **26** of the flanges **12** and **14**. A similar side plate **28** is welded at **30** and **32** to the other ends of the flanges **12** and **14**. In FIGURE 1, the reader will note that the plates **18** and **28** along with the flanges **12** and **14** define the vertical walls of a square column and the web of the H-beam separates the enclosed space into closed chambers **34** and **36**. Each of the chambers is filled with a structural grade of concrete.

Tests have demonstrated that a column constructed in accordance with my invention shown in FIGURE 1 has a much greater carrying capacity than the conventional columns shown in FIGURES 7–9, namely, two-angle concrete filled square columns, concrete filled pipe columns, and H-section columns, respectively. The American Institute of Steel Construction and the American Concrete Institute substantiate the claim that my column has a substantially greater capacity than the conventional columns illustrated. The following tables illustrate graphically this fact, wherein 8 inch and 12 inch two angle columns, concrete filled pipe columns and H-columns of the type illustrated are compared with applicant's column shown in FIGURE 1.

EIGHT INCH COLUMN

Height, feet	Column, Fig. 1		Column, Fig. 7	Column, Fig. 8	Column, Fig. 9, y—y Axis
	x—x Axis	y—y Axis			
	Kips	*Kips*	*Kips*	*Kips*	*Kips*
10	291	290	186	191	139
12	285	283	182	181	132
14	276	273	178	171	124
16	266	263	175	161	115
18	255	251	171	151	104
20	249	245	170	146	98

TWELVE INCH COLUMN

10	642	638	291	396	344
12	635	630	289	383	337
14	627	621	286	370	328
16	618	611	282	357	319
18	608	600	278	244	308
20	597	584	275	331	296

Not only is it clear from an inspection of the tables that my column has a much greater carrying capacity than conventional columns of equivalent size now available, but further it is clear that to support a given load, a column constructed in accordance with with my invention may have a much smaller cross-section than conventional columns. For example, it will be noted that an eight inch-ten feet high column constructed in accordance with my invention has the same carrying capacity as a twelve inch-ten feet high column of the type shown in FIGURE 7.

In FIGURES 2 and 3 I have shown the manner in which an eccentric load may be carried by the column. In those figures, a pair of load carrying members **38** and **40** are welded to the web **16** and extend through openings **44** formed in the side plates **18** and **28**. These members **38** and **40** are normally secured to the web during the fabrication of the column. After welding the members to the web, the side plates **18** and **28** are placed against the edges of the flanges of the beam by inserting the members through the preformed slots. Thereafter, the various joints are welded and additional welding is used to secure the side plates to the members. To complete the fabrication, it is only necessary to fill the chambers with concrete.

It will be noted in FIGURES 2 and 3 that the members **38** and **40** are not centered on the *x*—*x* axis. This is done

to allow the eccentric loads (not shown) which are later to be connected to the members **38** and **40** to be aligned with that axis. Thus, the loads would be secured to the members **38** and **40** on their left side as viewed in FIGURE 2.

The reader will immediately recognize that the members **38** and **40** allow these eccentric loads to be transferred to the center of the column. The bottom of the slots **44** through which the members **38** and **40** extend serve as fulcrums for the members, and the eccentric loads are transferred as an upwardly directed force on the concrete and the web of the H-beam.

In the embodiment of my invention shown in FIGURES 4–6, the concrete filling the chambers **34** and **36** is replaced by additional plates **50** which are secured to the center of each face of the web **52** of the H-beam **54** and the centers of the side plates **56** and **58**. The additional plates **50** preferably extend throughout the height of the column. Thus, as shown in FIGURE 4, the square column consists of an H-beam **54** having a web and flanges **60**, plates **50** which are secured to the center of each face of the web **52** and are disposed parallel to the flanges **60**, and side plates **56** and **58** which are secured to the ends of the flanges **60** and the plates **50**. The additional plates **50** may be welded to the web **52** by continuous beads at the joints as suggested at **62**. The side plates **56** and **58** are welded to the ends of the flanges **60** as suggested at **64**. To weld the side plates **56** and **58** to the outer ends of the additional plates **50**, slots **66** are formed intermittently along the centre line of the plates **56** and **58** adjacent the location where each abuts against the plate **50**. Plug welds may be employed to fill the slots **66** to secure the plates together.

A number of advantages are derived from a square column constructed in the manner shown in FIGURE 4. Particularly they are well suited to support eccentric loads. In FIGURES 5 and 6 I have illustrated the manner in which eccentric loads may be secured to the columns to best advantage. It will be noted in those figures that elongated slots **70** are cut in the side plates **56** and **58** immediately adjacent the edges of the plates **50** and are adapted to receive load bearing connecting members **72**. The load bearing members **72** extend through the slots and are secured to the plates **50** by any desired means such as welding, etc.

The peculiar advantages derived from such a construction may best be realized by a study of FIGURE 5. Consider the effects of a load attached to the outer ends of either of the members **72**. When such a load is applied, the lower margin of the slot **70** serves as a fulcrum for the member **72** and the load is transferred by the member **72** and the plate **50** to the web **52** of the H-beam. The load applied to the end of the member **72** thus is transferred to the web **52** as a force directed upwardly in a vertical direction along the web. The transferred force supplements the load carrying capacity of the column. Unlike any of the prior art devices heretofore known, my square column shown in FIGURES 4–6 provides means for transferring eccentric loads to the center of the column. Moreover, loads transferred in this manner actually increase the load carrying capacity of the column by the transferred upwardly directed force. In the calculations set forth above, this force has been ignored.

Just as the column shown in FIGURES 1–3, the column of the second embodiment of my invention has a much greater carrying capacity than the concrete filled pipe columns or square columns presently available. As a result, to support a given load, a column of much smaller cross-section is required.

I have suggested in the introduction the importance of reducing the cross-sectional areas of members of the class of my invention. In a major piece of construction such as a large multi-story office building, literally thousands of additional cubic feet of space may be obtained within a given perimeter by the use of the types of columns disclosed herein.

Having described in detail several embodiments of my invention, numerous modifications will suggest themselves to those skilled in the art. Therefore, I do not intend to limit the breadth of my invention to those embodiments illustrated and described. Rather, it is my intention that the breadth of my invention b determined by the appended claims and their equivalents. What I claim as new and desire to secure by Letters Patent of the United States is:

1. A vertical column comprising a beam having a pair of flanges integrally formed with and interconnected by a web, said flanges and web being disposed in a vertical plane, a pair of vertically oriented plates each parallel to the web and substantially the same width and height as the web, said plates being welded along their edges to the sides of the flanges, means interconnecting the web and the plates, said means being distinct from the flanges and being substantially equal in length to the plates, and eccentric load bearing members extending through the plates and secured to the means, said load bearing members being displaced from the vertical center lines of the plates.

2. A vertical column comprising a beam having parallel flanges integrally formed with a web, said flanges and web being disposed in vertical planes, a plate parallel to the web and secured on one side of the web to the adjacent edges of the flanges, a second plate parallel to the flanges and secured along its edges to the center of the web and the center of the first-named plate said plates being substantially equal in length, a slot formed in the first-named plate adjacent the second plate, and an eccentric load carrying member extending through the slot and secured to the first and second plates, said member being disposed face to face with the second plate.

3. A vertical column comprising a beam having a pair of parallel flanges integrally formed with a web, plates substantially the same width and height as the web and having their edges secured to the edges of the flanges, said plates and flanges forming a rectangle in horizontal cross-section, additional plates disposed parallel to the flanges and welded to the mid-portions of the web, slots formed in the first named plates opposite the outer edges of the additional plates, plug welds filling the slots and securing the additional plates to the first named plates, and eccentric load bearing members extending through the first-named plates and parallel to the additional plates, and means connecting the load bearing members face to face with the additional plates.

4. A vertical column comprising a beam having a pair of flanges integrally formed with and interconnected by a web, said flanges and web being disposed in vertical planes, a pair of vertically oriented plates each parallel to the web and substantially the same width and height as the web, said plates being welded along their edges to the side edges of the flanges, the plates, flanges and web forming two vertically elongated cavities of rectangular horizontal cross section, and eccentric load carrying member having one end secured to the web and extending through one of the plates, said member being disposed parallel to the flanges and nearer to one flange than the other, and concrete filling the two cavities and surrounding the portion of the member disposed between the plate and the web.

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