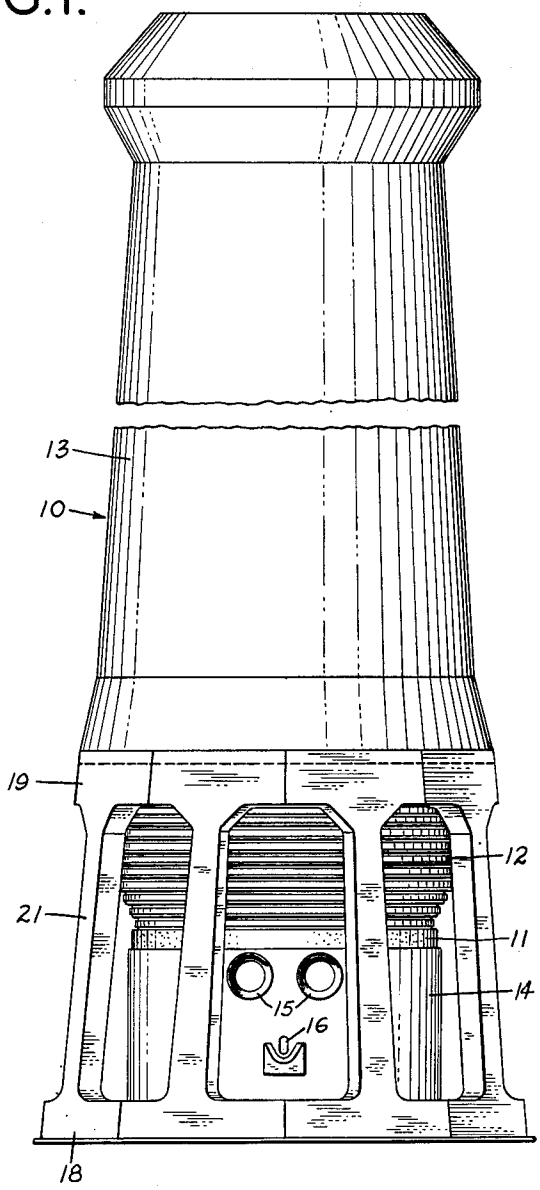
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BLAST FURNACE SUPPORT

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FIG. 1.



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FIG. 2.

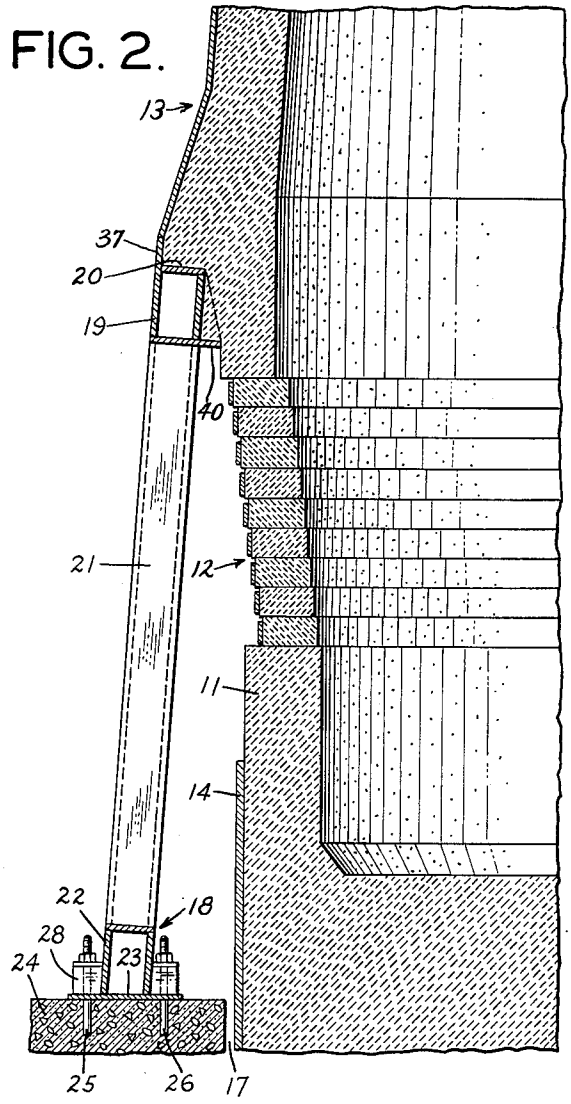
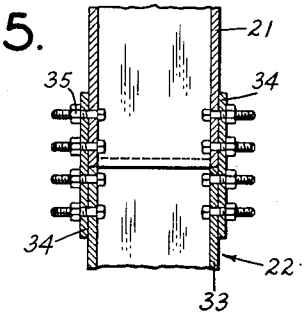


FIG. 5.



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FIG. 3.

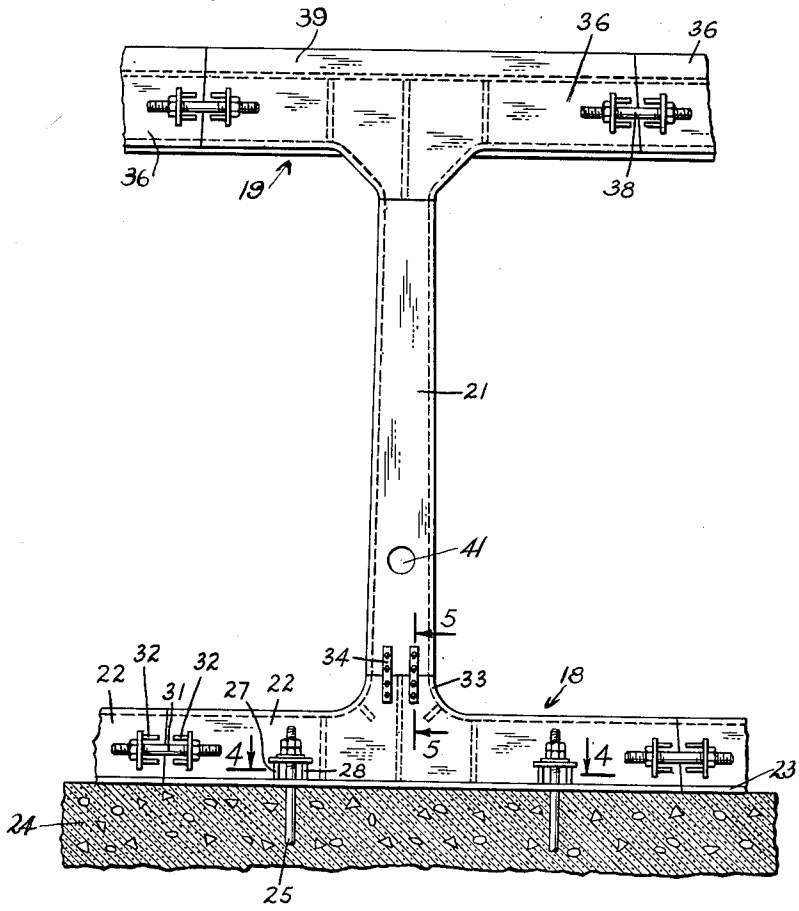
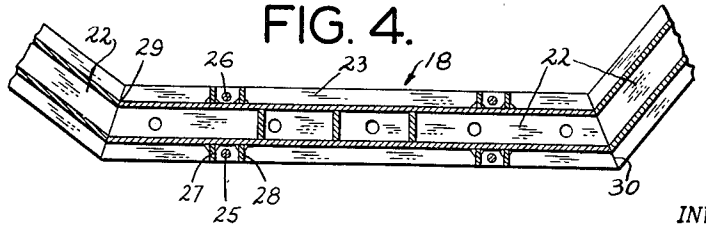


FIG. 4.



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UNITED STATES PATENT OFFICE

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BLAST FURNACE SUPPORT

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3 Claims. (Cl. 263—29)

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This invention relates to blast furnace structures, and it relates particularly to the supporting structure for the stacks or shafts of blast furnaces.

The stack or shaft of a conventional blast furnace is usually supported by an exterior structure that relieves the hearth and the bosh of the blast furnace of the weight of the stack. This exterior supporting structure usually consists of a mantle formed of a series of steel plates joined to form a ring and reinforced with steel angles. The steel shell and a part of the fire-brick lining of the shaft are supported by the mantle. The mantle is supported by means of a series of steel columns, arranged around the outside of the bosh and the hearth. The columns are mounted on a ring formed of a series of plates having reinforced ribs thereon. The ring is usually mounted on a concrete foundation extending around the hearth or the bottom of the blast furnace. Supporting structures of the type described above are entirely adequate to support the weight of the stack or shaft to resist some horizontally directed stresses, such as, those produced by the wind. These prior supporting structures have been found to be inadequate to support the blast furnace when subjected to violent horizontally directed shocks or stresses such as occur in countries subject to earthquakes and other seismic disturbances.

An object of the present invention is to provide blast furnace supports which are capable of withstanding violent horizontally directed shocks or stresses and thereby makes possible the use of blast furnaces in countries which are subject to earthquakes.

Another object of the present invention is to provide an improved form of exterior supporting structure for blast furnaces which makes better and more economical use of the material in the supporting structure and provides a more sturdy and less expensive type of supporting structure.

Other objects of the invention will become apparent from the following description of a typical form of blast furnace support embodying the invention described hereinafter.

In accordance with the present invention, I have provided a blast furnace supporting structure which is essentially monolithic in construction and makes use of supporting elements of box-like or rectangular section to provide increased strength and resistance to breakage or displacement by vertically or horizontally directed shock without requiring a greater weight of material than has been used heretofore.

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More particularly, blast furnace supporting structures of the type embodying the present invention are characterized by the provision of a ring-like supporting base of hollow box-like structure to which are united, as by means of welding, a plurality of supporting columns of box girder construction, which in turn are joined or united with a mantle of ring form and generally box or rectangular cross-section, which acts to support the shaft or stack of the furnace. The various components making up the supporting structure are constructed and arranged so that they may be assembled readily and efficiently at the site of the blast furnace, and when assembled, provide a rugged and strong support of substantially unitary construction which provides the greatest possible section moduli against bending, twisting and buckling forces.

For a better understanding of the present invention, reference may be had to the accompanying drawings, in which:

Figure 1 is a view in side elevation of a typical blast furnace supported by a supporting structure of the type embodying the present invention;

Figure 2 is a view in vertical section through a portion of the blast furnace and the supporting structure therefor;

Figure 3 is a view in side elevation of a portion of the supporting structure of Figure 1, illustrating the method of assembly of the various components of the supporting structure;

Figure 4 is a view in section taken on line 4—4 of Figure 3;

Figure 5 is a view in vertical section taken on line 5—5 of Figure 3, showing the structure for erecting a column on the base ring.

The form of the invention chosen for purposes of illustration is shown in Figure 1 for supporting a conventional blast furnace 10. The blast furnace includes the usual hearth 11, the bosh 12 and the stack 13.

The stack 13 is provided with the usual steel shell and fire-brick lining.

The bosh 12 is formed of staggered rings of fire-brick which are reinforced in the usual way with steel bands and may be provided with the usual cooling plates, not shown.

The hearth 11 is formed of fire-brick, or other refractory material and is provided with the usual steel shell 14. The hearth is also provided with the usual tuyère openings 15 and the tap opening 16. The bottom of the hearth 11 may be mounted

in a pit 17 which has a concrete bottom, not shown, to provide the necessary firm support for the hearth portion.

The supporting structure for the shaft 13 may, as shown in Figure 1, consist of a base ring member 18 and a mantle ring 19, which engages a shoulder 20 (Fig. 2) at the base of the furnace shaft 13. The mantle ring 19 is supported on the base ring 18 by means of a plurality of columns 21.

The present invention resides in the structure and arrangement of the base ring 18, the mantle 19 and the columns 21, these elements being designed to give maximum strength and resistance to horizontal and vertical forces, thereby to reduce to a minimum damage to the structure through buckling, bending or twisting stresses.

As best shown in Figures 2, 3 and 4, the base ring 18 is made up of a plurality of box-like sections 22 of similar shape and construction. In the form of the invention illustrated, eight of the sections 22 are provided to form a generally octagonal base ring 18. It will be understood that more or fewer sections may be used to form the base ring and that, if desired, the sections 22 may be curved to form a circular base ring 18, instead of the octagonal ring, as shown in Figure 4. Each of the sections 22 is of generally hollow structure and substantially rectangular in cross-section and may be provided with one or more reinforcing partitions, as required. Each section 22 is provided with a base flange 23 which is adapted to rest upon the surface of a concrete foundation ring 24 of suitable thickness and dimensions. The sections 22 are secured to the concrete foundation 24 by means of a series of bolts 25 and 26 in the inner and outer edge of the flange. The bolts 25 and 26 extend between outwardly projecting flanges or lugs 27 and 28 which are engaged by nuts and washers on the bolts 25 and 26, as shown in Figures 2 and 3. When the sections are so assembled, with their inclined ends 29 and 30 in abutment, they are welded together to form a continuous ring. The sections 22 of the ring may be retained in suitable abutting relationship by means of the tie bolts 31 which engage the flanges or lugs 32, 32 on adjacent ends of the sections 22, 22.

The columns 21 are also assembled on the base ring 18 and are joined thereto by welding to make them integral with the base ring. As shown in Figure 3, the columns 21 are of box-like cross-section and taper upwardly from their lower ends toward their upper ends. The lower ends are adapted to fit against and be joined to upwardly directed flanges 33 at about the mid-portion of each of the sections 22. As shown in Figure 4, the columns 21 may be secured to the sections 22 temporarily by means of a plurality of tie straps 34 which are secured to the sections 22 and the columns 21 by means of a plurality of bolts 35. After the columns have been assembled on the base ring 18 by means of the straps 34, they may be welded in place, and the tie straps 34 and bolts 35 are then removed.

The mantle ring 19 is assembled on the top of the columns 21 in a manner similar to the method of assembly of the base ring and the columns. Thus, each section 36 of the mantle ring 19 is of generally T-shaped form and hollow box-like section and is provided with inclined ends fitting against the next adjacent sections to form an octagonal ring. The sections 36, 36, etc. may be joined together temporarily by means of tie bolts 38 and may be secured in their proper relation to the columns 21 by means of tie straps similar to the straps 34 disclosed in Figure 5. When so assembled, the sections 36, 36 of the mantle ring 19 are welded together, and the ring is in turn welded to the upper ends of each of the columns. When the welding operation is completed, the tie bolts 35 and the retaining straps 34 may be removed, leaving the entire supporting structure as a unitary monolithic structure having great strength because of its box-like structure. Each section 36 is provided with an outer upwardly projecting flange 39 engageable with the outer surface of the shaft 13 below the shell of the stack and a lower inwardly projecting supporting flange 40 extending beneath the shoulder at the junction of the shaft and the bosh. The flange 40 may be suitably reinforced by one or more webs.

The supporting structure described above may be further reinforced and stabilized by filling the ring 18 and the columns 21 up to the floor line of the furnace with a ganister-clay mixture and fireclay brick-bats through the openings 41 in the columns 21. After the mixture has hardened, the openings 41 may be sealed by welding disks in the openings.

Structures of the kind described above have much greater resistance to horizontal stresses than any of the supporting structures heretofore used, and such increased strength is obtainable with less material and is less costly than the prior structures for the reason that it makes better use of the material in the structure by placing it at the perimeters of rectangular sections. Structures of the type disclosed herein are capable of withstanding severe seismic shocks and make possible the use of blast furnaces in countries and areas wherein earthquakes are common.

It will be understood that the size and shape of the supporting structure can be modified substantially, depending upon the size of the blast furnace with which it is used, and, therefore, the form of the invention disclosed herein should be considered as illustrative and not as limiting the scope of the following claims.

I claim:

1. A supporting structure for a blast furnace comprising a plurality of hollow box-like sections welded end-to-end into a base ring, means in said base ring for anchoring it directly to a foundation, a plurality of box-girder columns welded to about the mid-portions of said sections and extending upwardly from said ring, a plurality of box-like sections welded at about their mid-portions to the upper ends of said columns and welded end-to-end to form a mantle ring.

2. A supporting structure for a blast furnace comprising a plurality of hollow box-like sections having inclined ends welded end-to-end into a base ring, means in said base ring for anchoring it directly to a foundation, a plurality of box-girder columns welded to about the mid-portions of said sections and extending upwardly from said ring, a plurality of box-like sections having inclined ends welded at about their mid-portions to the upper ends of said columns and welded end-to-end to form a mantle ring.

3. A supporting structure for a blast furnace consisting of a plurality of elongated structural sections secured rigidly together end-to-end to form a base ring, means in said base ring for anchoring it directly to a foundation, a plurality of elongated structural sections secured rigidly together end-to-end to form a mantle ring, and a plurality of columns secured rigidly at their ends to and extending between the approximate mid-

portions of corresponding sections of both rings to rigidly space said rings in parallel vertical relation for supporting the shaft of the blast furnace.

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