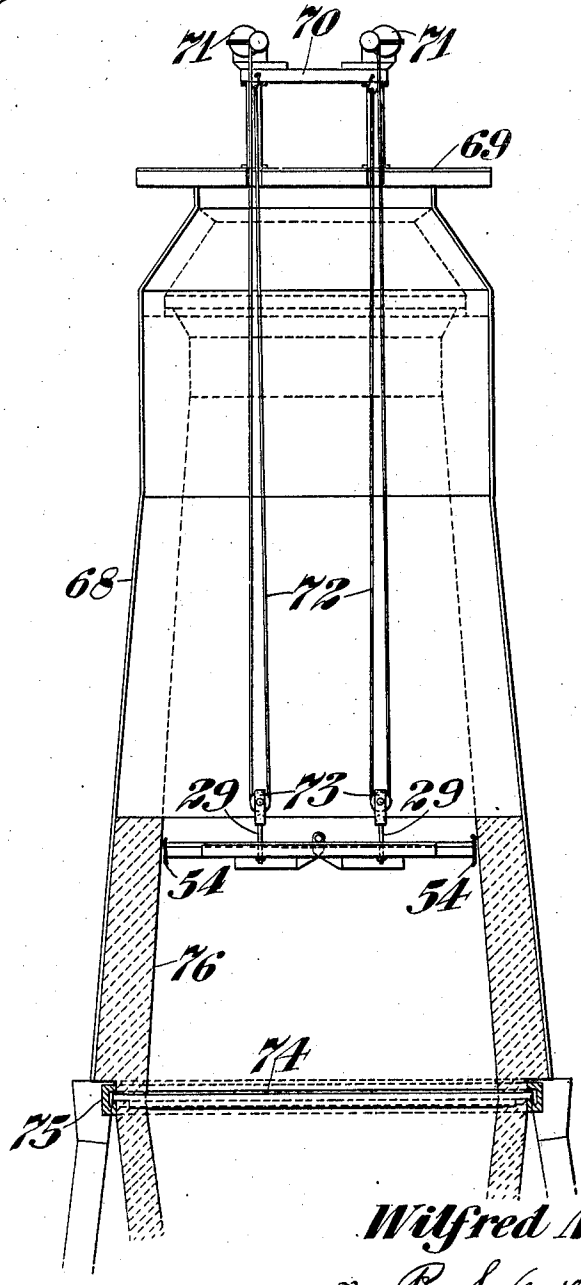
April 4, 1944. W. M. JORDAN 2,346,033

CIRCULAR SCAFFOLD

Filed May 26, 1943 3 Sheets-Sheet 1

Fig. 1.



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CIRCULAR SCAFFOLD

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Fig. 2.

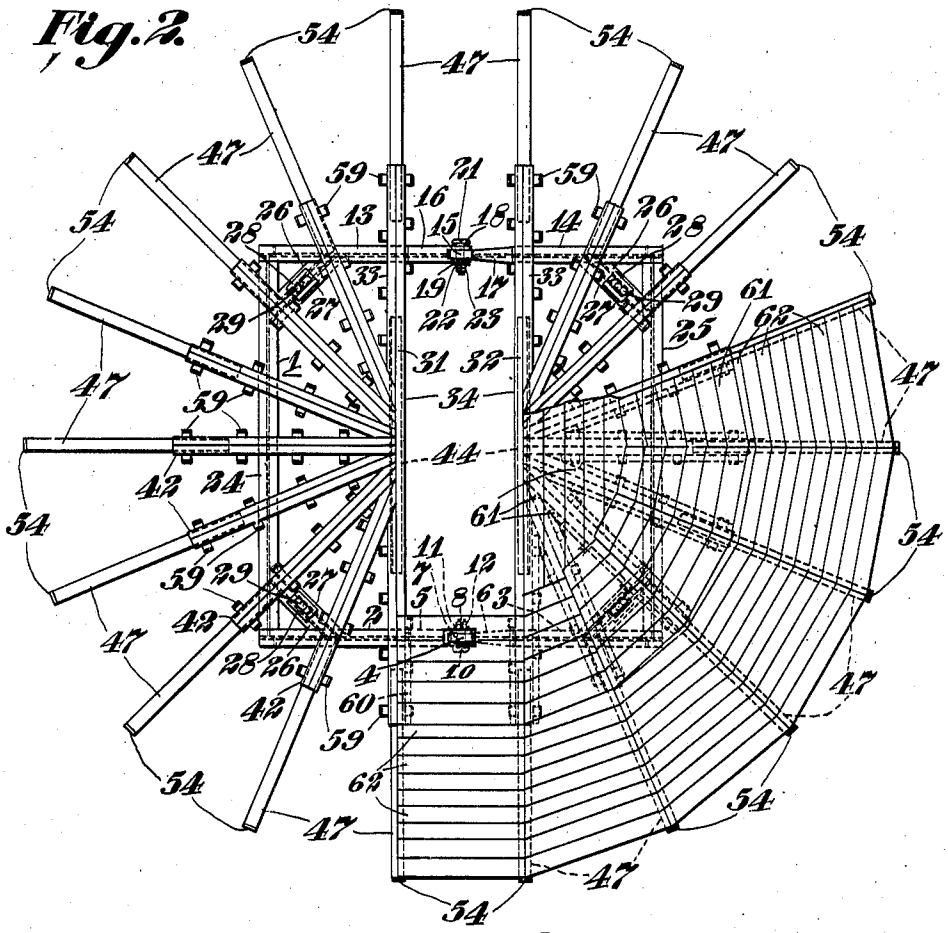


Fig. 3.

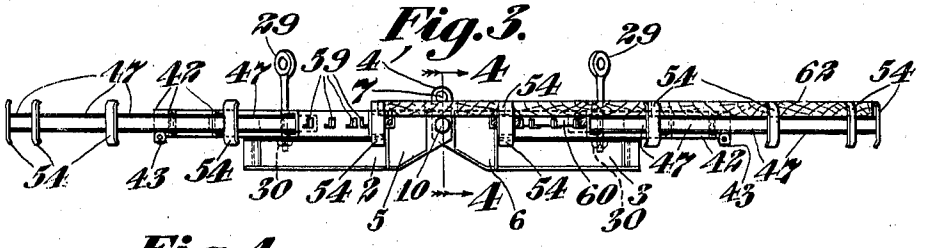
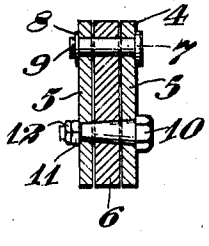


Fig. 4.



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Fig. 5.

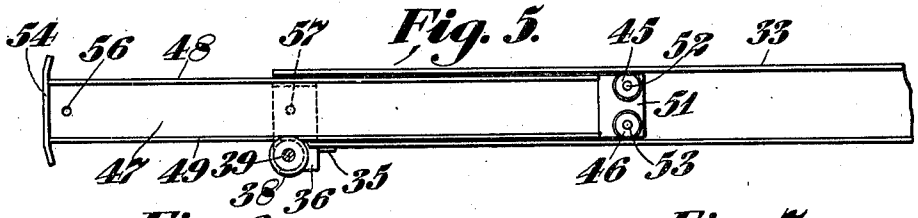


Fig. 6.

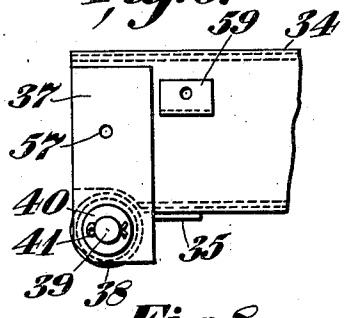


Fig. 7.

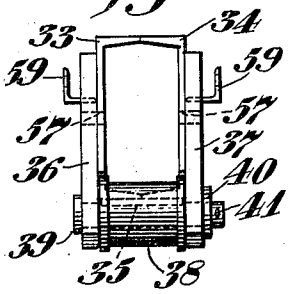


Fig. 8.

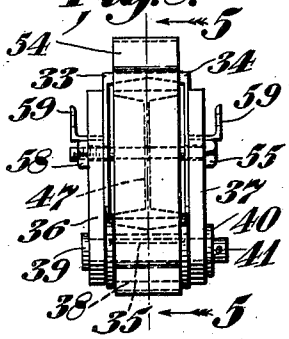


Fig. 9.

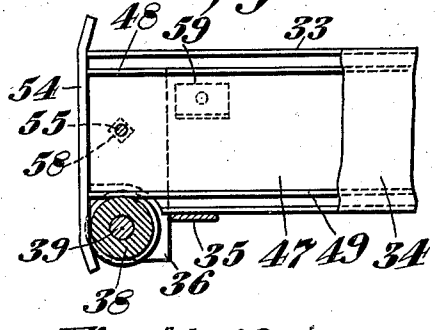


Fig. 10.

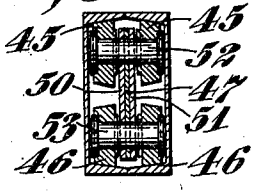
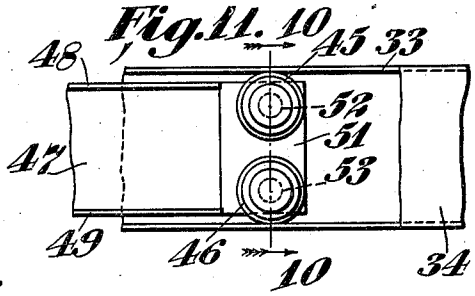


Fig. 11.



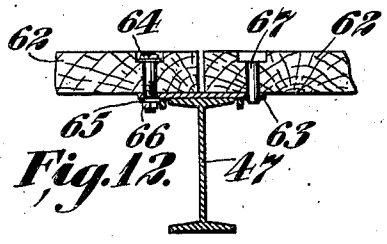


Fig. 12.

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Patented Apr. 4, 1944

2,346,033

UNITED STATES PATENT OFFICE

2,346,033

CIRCULAR SCAFFOLD

Wilfred Marsden Jordan, Johnstown, Pa., assignor to Bethlehem Steel Company, a corporation of Pennsylvania

Application May 26, 1943, Serial No. 488,490

13 Claims. (Cl. 304—12)

My invention relates in general to suspended scaffolds and more particularly to circular scaffolds adapted for use in relining blast furnaces and similar tubular structures of large dimensions.

The typical modern blast furnace is a tall circular structure, 90 to 100 feet high, built of fire-brick, reinforced externally by a close-fitting steel shell, and encasing a circular space varying in diameter from about 16 to 22 feet at the top, or throat, to about 22 to 28 feet at the mandle, just above the bosh. In the relining of such a furnace, which is necessary at fairly regular intervals, close to the equivalent of 1,000,000 nine-inch firebricks may be required to be torn out and replaced by the bricklayers.

The bricklayers' scaffold commonly used for this purpose consists of a rigid frame upon which a timber platform is laid, suspended in use inside the furnace stack and lowered as the work of tearing out the old lining progresses. To conform to furnace lines the timber platform is extended at each step of lowering by nailing a layer of planks on the periphery of the platform. When it reaches the mantle, where the furnace diameter is greatest, the accumulated extensions to the platform result in an unsafe structure cantilevered from the inner scaffold frame. In relining the furnace the process is reversed, and the outer perimeter of the timber platform must be reduced to conform to the furnace lining before each step of hoisting.

One object of my invention, therefore, is to provide improved supporting means for the scaffold.

Another object is to provide a sturdy circular scaffold peripherally extensible and contractible to conform to furnace lines.

A further object is to provide a hinged scaffold which can be easily folded and conveniently inserted into and removed from the blast furnace.

Other objects, advantages and purposes of my invention will appear hereinafter in the specification and in the appended claims, and in order to describe my invention more clearly I shall now refer to the annexed three sheets of drawings forming a part of this specification and in which like figures of reference indicate like parts.

Figure 1 is a vertical section illustrating the operating arrangement of the scaffold in a blast furnace;

Fig. 2 is a top plan view of the scaffold with the wooden flooring partly broken away to show the metal supporting frame;

Fig. 3 is a side elevation of the scaffold shown in Fig. 2;

Fig. 4 is an enlarged section taken along the line 4—4 of Fig. 3, and showing in detail the hinge connection;

Fig. 5 is a vertical section of a box channel and extension beam, taken along the line 5—5 of Fig. 8;

Fig. 6 is an enlarged side elevation of the outer end of the box channel;

Fig. 7 is an end view of the box channel;

Fig. 8 is an end view of the extension beam;

Fig. 9 is an enlarged broken side view of the roller carrying the front end of the extension beam;

Fig. 10 is a section taken along the line 10—10 of Fig. 11;

Fig. 11 is an enlarged view showing the rollers on the inner end of the extension beam; and

Fig. 12 is a detail view of a flooring tie-plate.

My scaffold is constructed in the following manner. A strong square supporting frame 1 is made by joining the short lengths of I-beams 2 and 3 with the hinge 4, constructed of heavy welded flanged plate sections 5 and 6 pivoting on flat head hinge-pin 7 retained by round plate washer 8 and cotter-pin 9 and held in open position by the tapered bridge bolt 10 and the heavy nut 11 and jam nut 12; spaced parallel thereto are placed similar short I-beams 13 and 14, joined by hinge 15 made of flanged plate sections 16 and 17, pivoting on flat head hinge-pin 18 retained by washer 19 and cotter-pin 20, and held open by bridge-bolt 21 and nuts 22 and 23; the remaining sides of the square frame 1 being formed by the long I-beams 24 and 25 welded to the outer ends of said short I-beams. It is geometrically obvious that the length of each side of the square frame 1 may not exceed the diameter of a chord subtending a 90° angle, or approximately 7/10 the smallest diameter of the enclosing structure. Corner braces 26 consist of short channel-shaped members 27 welded diagonally at the corners of the frame 1, strengthened by flat stiffening plates 28, and perforated for the insertion of eye bolts 29 held by nuts 30.

Upon the supporting frame 1, near the center and spaced equidistant from each side of the hinges 14 and 15, are welded long hollow box girders 31 and 32, each consisting of a pair of

channel-shaped members 33 and 34 welded together at their flanges and provided at their outer ends with welded bottom stiffening plate 35 and welded side plates 36 and 37 between which is journalled a lower roller 38 on a flat head pin 39 held by a round plate washer 40 and cotter-pin 41. Short hollow box girders 42 similarly made and provided with lower rollers 43 are welded radially to the central portions of each channel-shaped member 33, the other channel-shaped member 34 of each of the long girders 31 and 32 being cut away suitably and braced by conventional welded angle 44.

Movable in and out on said lower rollers 38 and 43 and on upper and lower beveled wheels 45 and 46, within the hollow box girders 31, 32 and 42, are the extension I-beams 47. At the inner end of each I-beam 47 the top and bottom flanges 48 and 49 are cut away for a short distance and the remaining end web portion is strengthened by welded stiffening plates 50 and 51, upon which on peened flat head pins 52 and 53 are journaled the beveled wheels 45 and 46 which align and support the inner end of the I-beam.

The outer end of each extension I-beam 47 is supported on lower roller 38 or 43, and has terminally attached thereto an end plate 54 bent slightly inwardly at top and bottom. Bolt 55 may be passed through suitable holes 56 and 57 in the I-beam 47 and enclosing box girder and secured by the nut 58 when it is desired to prevent outward movement of the I-beam 47.

Clip angles 59 welded to the sides of the hollow box girders 31, 32 and 42 provide support for wooden nailing strips 60 to which the inner or central planking 61 is secured. When the I-beams 47 are extended to enlarge the scaffold, the outer planks 62, which may be of greater thickness than the central planking 61 to provide an even platform surface, are secured to flanged tie-plates 63 resting on I-beams 47 by bolts 64, washers 65, and nuts 66, and/or by pins 67, which pins may be integral with the tie-plates as shown in Fig. 12.

In rebuilding the blast furnace 68 with the use of my scaffold, the furnace top is first removed, the folded scaffold inserted, and a temporary wooden platform 69 installed at the top. Upon this platform 69 is placed hoist structure 70 and the motor operated hoists 71, from which by ropes 72 passing through sheaves 73 on the eyebolts 29 the completed scaffold is suspended and may be raised or lowered as desired. The old refractory lining is then removed, the hearth and bosh relined with firebrick, and a tight wooden platform 74 is installed at the top bosh band 75. Refractory brick 76 is then laid inside the stack to the top, the end plates 54 contacting the lining brick 76, and the outer planks being removed as the scaffold is made smaller. There is ample space for conventional elevators and/or ladders (not shown) to pass through the open central portion of the scaffold as desired.

Although I have described my invention in considerable detail, I do not wish to be limited strictly to the exact and specific details above shown and described, but I may also use such substitutions, modifications or equivalents thereof as are embraced within the scope of the invention or as are pointed out in the appended claims.

Having thus described my invention, what I claim as new and useful and desire to secure by Letters Patent is:

1. A scaffold adapted to be suspended within a tubular structure, comprising a substantially square supporting frame made in two sections, hinges pivotally joining the two sections of the frame, telescoping radial members attached to the top of the frame, and planking mounted on the radial members.

2. A scaffold adapted to be suspended within a tubular structure, comprising a hinged supporting frame, radial hollow members each consisting of a pair of welded channels fastened to the frame, an I-beam telescoping normally horizontally within each radial member, and a curved end plate at the outer end of each I-beam for making contact with the tubular structure.

3. A scaffold adapted to be suspended within a tubular structure, comprising a horizontal square supporting frame having corner braces, a plurality of spaced telescoping radial members on said frame, planking fastened to the radial members, and means attached to the corner braces for suspending the scaffold from the top of the tubular structure.

4. A scaffold adapted to be suspended within a tubular structure, comprising a hinged supporting frame, radial hollow box-like members welded to said supporting frame, wooden planking sections secured to said box-like members, I-beams adapted to be horizontally extended from the hollow box-like members, and separate wooden planking sections removably fastened to said I-beams.

5. A scaffold adapted to be suspended within a tubular structure, comprising a substantially square supporting frame consisting of two sections, a pair of hinges pivotally uniting the two sections, means for holding the hinges in open position, a plurality of hollow radial members mounted on the supporting frame, an extension member telescoping within each hollow radial member, and removable wooden planking on the hollow radial members and the extension members.

6. A scaffold adapted to be suspended within a tubular structure, comprising a pair of symmetrical welded sections each forming a rectangular frame open on one side, hinges joining the pair of rectangular frames together on their open sides, means inserted through the hinges for holding the hinges in open position, radial telescoping members fastened to each rectangular frame, and removable plank flooring on the telescoping members.

7. A scaffold adapted to be suspended within a tubular structure, comprising a pair of hinged parallel main girders, connecting girders secured at the ends of the main girders to form a square supporting frame, a plurality of telescoping radial members on the square supporting frame, and a plank flooring mounted on the telescoping radial members.

8. A scaffold adapted to be suspended within a tubular structure, comprising a pair of short I-beams, a hinge foldably joining the pair of I-beams, a second pair of short I-beams parallel to the first pair, a second hinge foldably joining the second pair of I-beams, a pair of long I-beams rigidly connecting the outer ends of the short I-beams to form a square supporting frame, a plurality of radially extensible members mounted on the square supporting frame, and plank flooring on the radially extensible members.

9. A scaffold adapted to be suspended within a tubular structure comprising a pair of rectangular welded sections, a pair of heavy flanged plate hinges between the welded sections, a pin on which each hinge pivots, a tapered bridge-bolt

and nut for holding open each hinge, a plurality of radial extension members secured to the welded sections, and planking on the radial extension members.

10. A scaffold adapted to be suspended within a tubular structure, comprising two equal supporting sections, a pair of hinges joining the two sections, a plurality of radial hollow box-like beams mounted on the supporting sections, a pair of side plates welded to the outer portion of each of said box-like beams, a roller rotatably journaled between said side plates, an I-beam having wheels at its inner end and disposed in each box-like beam with web vertical and slidable on its bottom flange over the roller, and removable wooden planking covering the box-like beams and the I-beams.

11. A scaffold adapted to be suspended within a tubular structure, comprising a hinged supporting frame, a plurality of radial members welded to the supporting frame, a plurality of clip angles welded to the sides of the radial members, wooden nailing strips held by the clip angles, and floor planking nailed to the nailing strips.

12. A scaffold adapted to be suspended within a tubular structure, comprising a square supporting frame, a plurality of hollow radial members welded to the supporting frame, a rolled beam member extending out of each hollow radial member, a flanged tie-plate on each rolled beam member, and floor planks secured to each tie-plate.

13. A scaffold adapted to be suspended within a tubular structure, comprising a substantially square supporting frame, telescoping radial members fixed to the supporting frame, floor planking secured to the radial members, a short channel-shaped member welded diagonally across each corner of the supporting frame, a flat stiffening plate welded to strengthen each channel-shaped member, an eye-bolt secured to each channel-shaped member, a sheave fastened to each eye-bolt, a rope passed through each sheave, and motor-driven hoisting means secured to each rope at the top of the tubular structure for raising and lowering the scaffold.

WILFRED MARSDEN JORDAN.