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Patented Oct. 29, 1901.

S. W. VAUGHEN.
BLAST FURNACE TOP.

(Application filed Dec. 5, 1899.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 2.

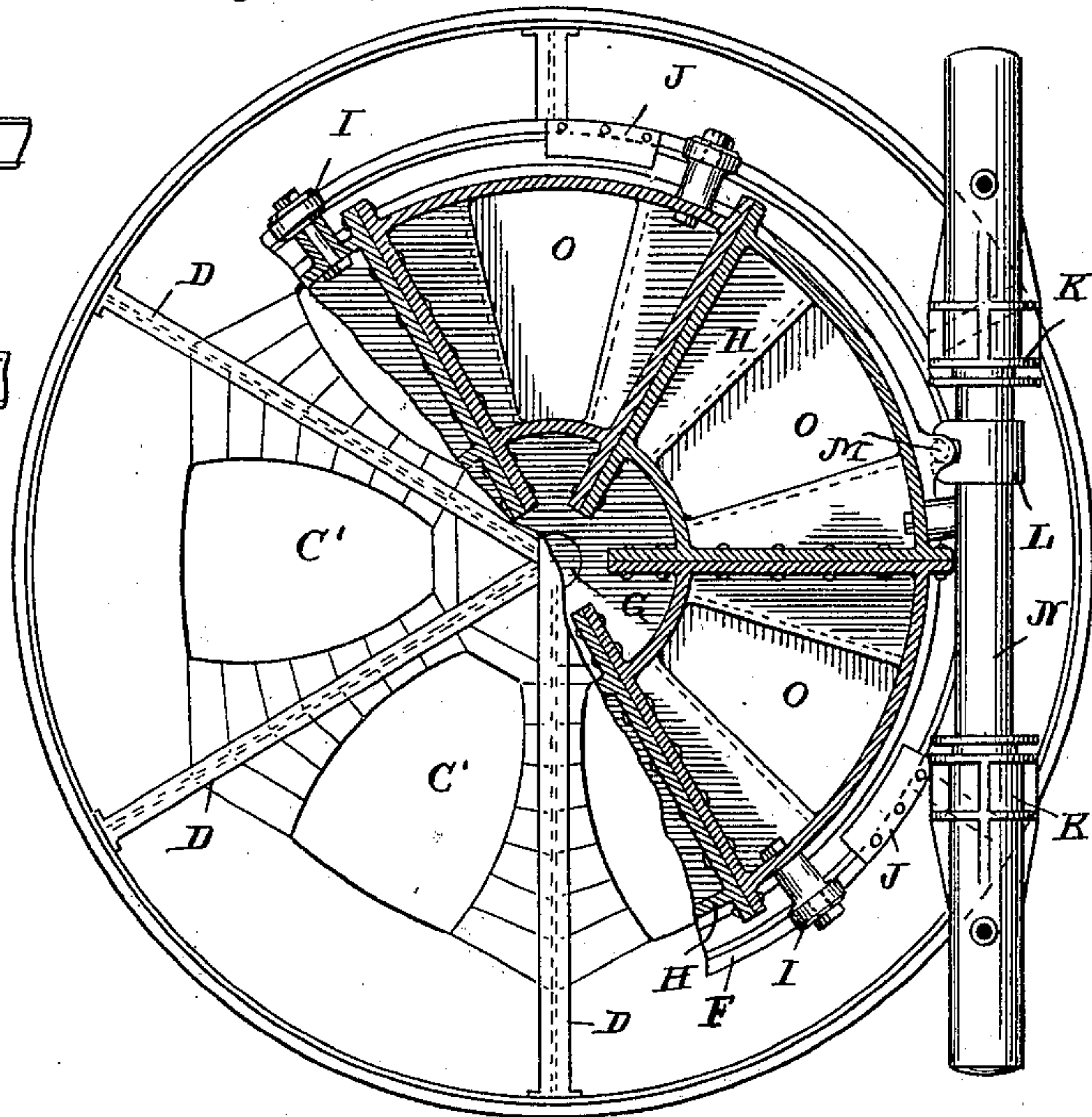


Fig. 1.

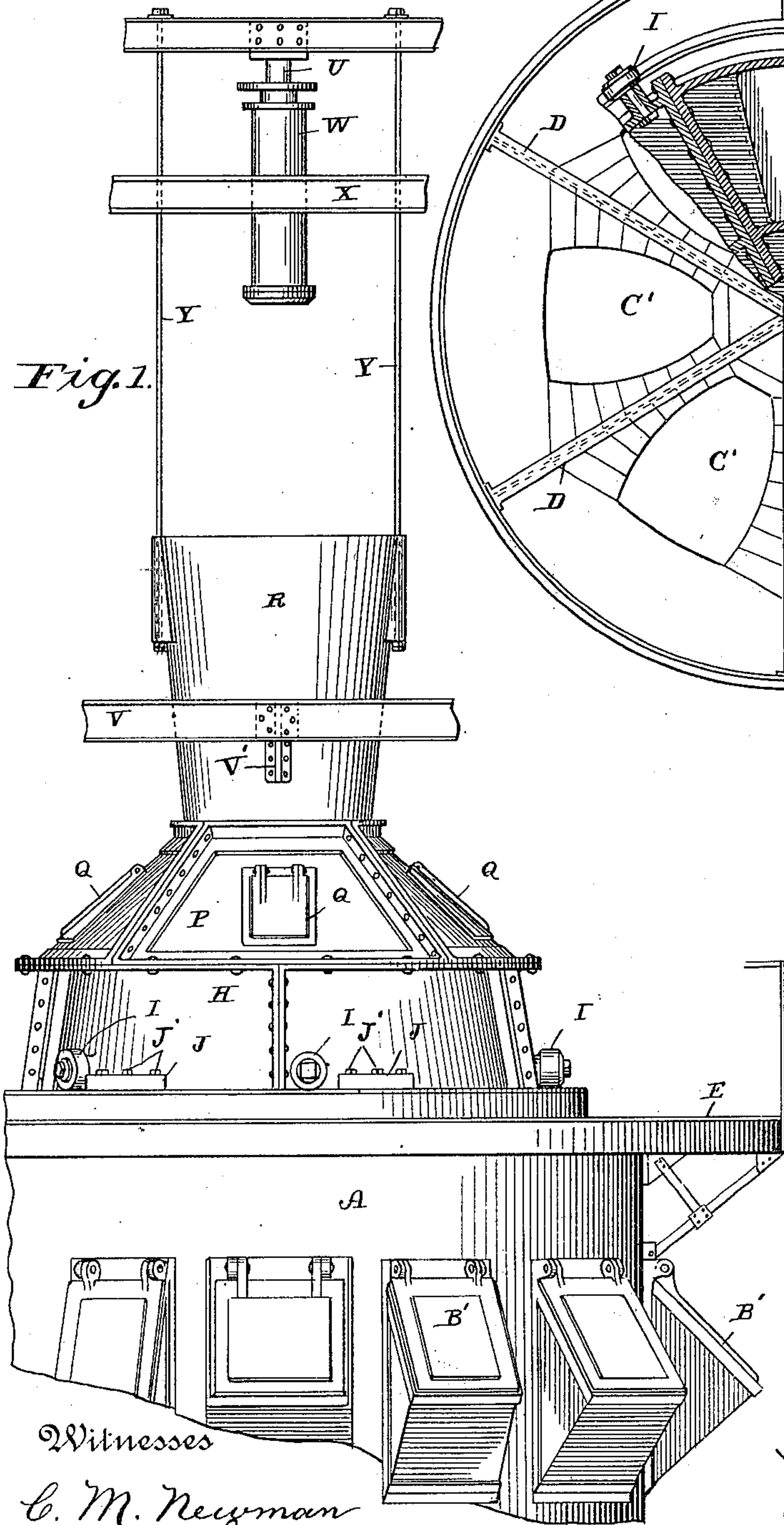
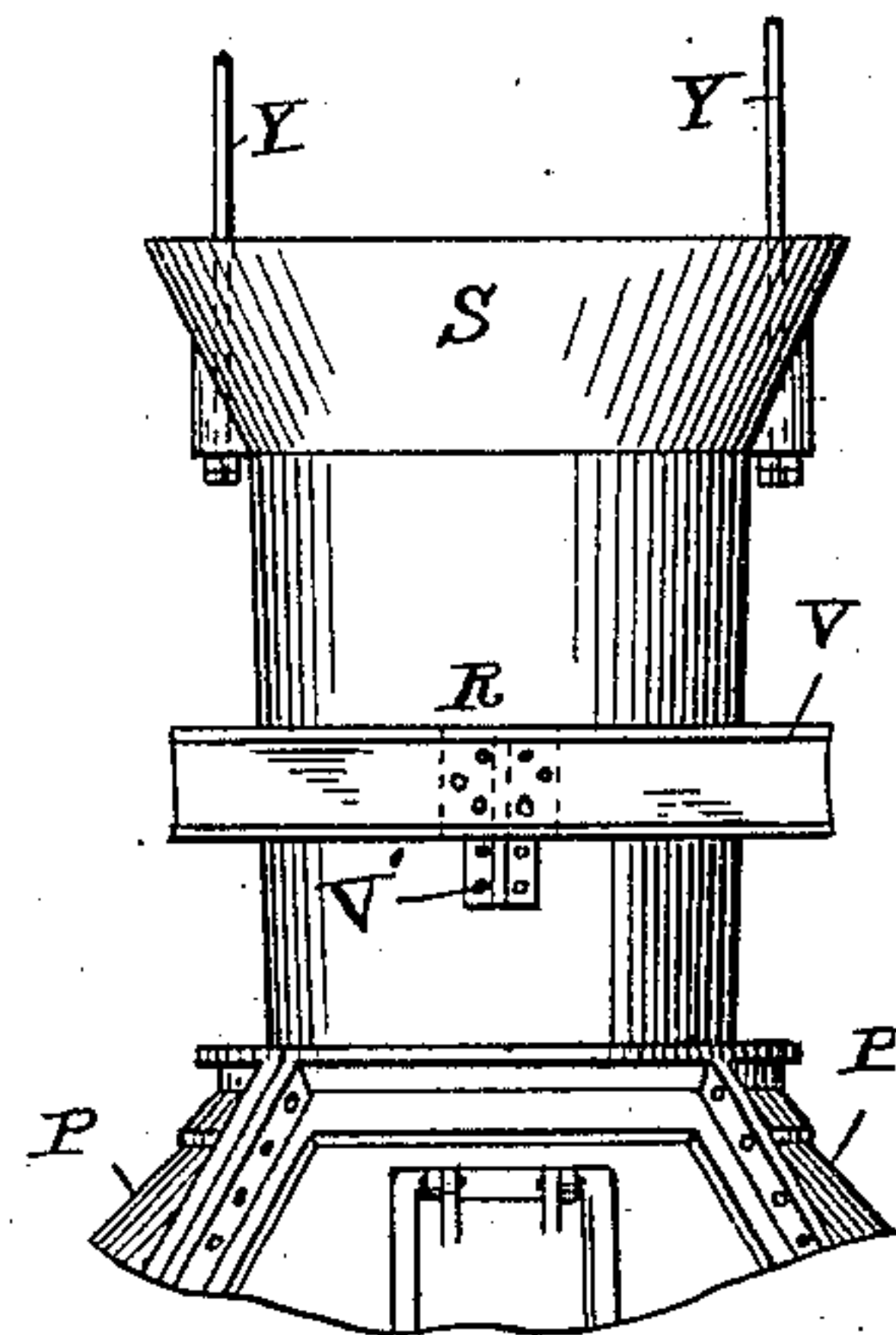


Fig. 3.



Witnesses

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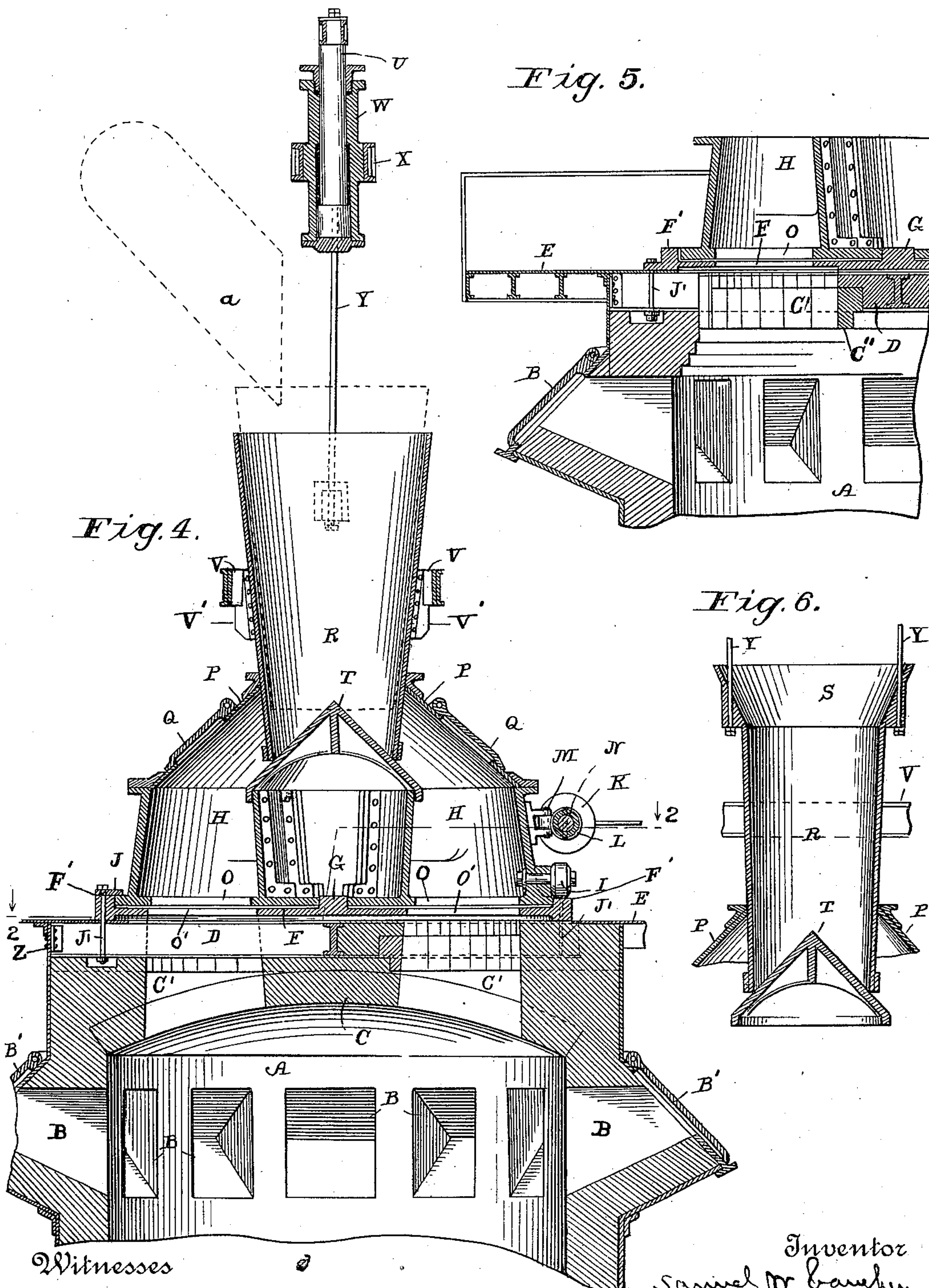
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UNITED STATES PATENT OFFICE.

SAMUEL W. VAUGHEN, OF JOHNSTOWN, PENNSYLVANIA.

BLAST-FURNACE TOP.

SPECIFICATION forming part of Letters Patent No. 685,498, dated October 29, 1901.

Application filed December 5, 1899. Serial No. 739,247. (No model.)

To all whom it may concern:

Be it known that I, SAMUEL W. VAUGHEN, a citizen of the United States, residing at Johnstown, in the county of Cambria and State of Pennsylvania, have invented certain new and useful Improvements in Blast-Furnace Tops; and I hereby declare the following to be a full, clear, and exact description of my invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to new and useful improvements in the tops of blast-furnaces whereby they may be charged with stock in a proper, convenient, and expeditious manner, and the construction and operation of my improved blast-furnace top are such that a furnace provided with it may be charged without the necessity of the employment of workmen or top-fillers to dump the stock into the upper receptacle, and for this reason the difficulties and dangers consequent upon the employment of said top-fillers are thereby obviated.

It is also an object of my invention to provide a top-filling apparatus which is firmly secured to the shell or body of the furnace in such a way that it will not become disarranged by the dust or gas explosions which occur in smelting certain kinds of ores, and in order to give proper and sufficient vent to the gases occasioned by such explosions I provide a large number of safety-valves or explosion-doors through which the excess of pressure may be discharged, thus leaving the charging apparatus intact and ready for operation at all times.

My improved apparatus is so constructed that a charge is dropped into the furnace-top at a number of points, thus providing for the uniform distribution of the charge throughout the cross-sectional area of the blast-furnace, which is conducive of best results in the reducing and smelting operation. In addition to this my apparatus is so constructed that as the top is opened for the introduction of the charge the gases are not permitted to escape, but are retained by an upper closure forming a gas seal, and by this means practically all the combustible gases are preserved for use in heating the hot-blast stoves or boilers and the upper apparatus of the furnace

is preserved from destructive contact with the flames which are ordinarily occasioned when the gases are permitted to escape into the air at the time of dropping a charge.

Having thus given a general description of the objects of my invention, I will now proceed to describe my improved apparatus with reference to the accompanying two sheets of drawings, which form part of this specification and in which like letters refer to like parts.

Figure 1 is a vertical elevation of my improved blast-furnace top. Fig. 2 is a horizontal sectional plan taken on the line 2 2 of Fig. 4. Fig. 3 is an alternative arrangement of the receiving-hopper R, the body of which has a less taper than that shown in Figs. 1 and 4 and is provided with a funnel-shaped top to make its upper diameter sufficiently large to receive the material properly. Fig. 4 is a central vertical section of my improved blast-furnace top, also showing a skip in dotted lines in position for discharging material into the receiving-hopper. Fig. 5 is a partial vertical section of an alternative form of my improved top, in which the upper spider or supporting-framework is protected by fire-proofing bricks or other material, so as to provide a flat arch, thus decreasing the amount of room required for the construction. Fig. 6 is a central vertical section of the alternative arrangement of my receiving-hopper, as shown in elevation in Fig. 3.

Referring now to the various characters of reference marked upon the drawings, A is the upper portion of a blast-furnace provided with my improved apparatus.

B represents ports or passages formed within the upper furnace-walls connecting the interior of the furnace with the exterior air, said ports being normally closed by means of the explosion-doors B', said doors being hinged so as to automatically open with excess of pressure in the furnace and close by gravity when said excess has been relieved.

C, as shown in Fig. 4, is a brick arch composing the top of the blast-furnace, in which I provide the vertical openings C', through which the stock or material is fed to the furnace, and C'' is the equivalent flat-arch construction as shown in Fig. 5.

D represents beams forming a spider or

support for the upper portion of my charging apparatus, said beams being securely fastened to the shell of the furnace by means of the connections Z, thus securing the charging apparatus from displacement by explosions or other causes. Although this spider or support is shown in the drawings as composed of I-beams, I do not limit myself to this exact design, as other equivalent construction may be used.

E is a platform surrounding the charging apparatus, so as to give access thereto, if required, and F is the bottom plate of my charging apparatus, which is securely fastened to the spider D by means of the bolts J', said bottom plate being provided with a number of openings O', as shown.

G is a central pivot provided on the bottom plate F, which is fitted into a corresponding central opening in the upper revoluble distributing-chamber H.

I represents wheels on the revoluble distributing-chamber H, said wheels being supported on the track F' of the lower plate F, and said chamber H is retained in place by means of the clips J, as shown.

K represents fluid-pressure cylinders provided with the plunger N and cross-head L, which latter is connected by means of the pin N to the revoluble distributing-chamber H for the purpose of turning it about its center.

O represents openings in the lower portion of the distributing-chamber H, which are arranged to register with the corresponding openings O' of the bottom plate F when desired, thus making communication between said chamber H and the upper portion of the blast-furnace by the action of the cylinders K and their connections, or, similarly, the said distributing-chamber H may be revolved throughout a portion of its circumference in such a way that said openings O are opposite the solid portions of the plate F, thus closing communication between said distributing-chamber and the upper portion of the blast-furnace.

P is the upper conical portion of the distributing-chamber H, forming part of the cover thereof, in which are provided the doors Q for permitting access to said chamber, if desired, and said doors also will act as relief-valves if occasion requires, as may be readily understood.

R is the receiving-hopper, which is in the form of the frustum of a cone, as shown in Figs. 1 and 4, while in the alternative form shown in Figs. 3 and 6 said receiving-hopper R is of similar form, but with less taper and is provided with an upper funnel-shaped top S.

T is the distributing and closing cone, forming a portion of the distributing-chamber H, upon which the lower portion of the receiving-hopper normally rests, and said cone also serves to support the stock when it is contained within the receiving-hopper R.

W is a fluid-pressure cylinder provided with supports X, plunger U and rods Y connecting

it to the receiving-hopper R, whereby said receiving-hopper may be lowered as desired or raised, as indicated by the dotted lines in Fig. 4.

V represents guides and side supports for the receiving-hopper R, and V' represents slides formed on said receiving-hopper for guiding it in its vertical motion within the supports V.

In Fig. 4 the skip *a* is indicated by dotted lines, said skip being one means of transporting the stock or charge to the receiving-hopper R.

The various movements of the different portions of my apparatus may be controlled by valves located below the furnace-top on the ground-level or otherwise, as desired.

Having thus described my improved apparatus in detail, I will now proceed to describe its operation as follows:

The normal or non-operative position of the distributing-chamber H is adjusted by means of the cylinders K and their connections in such a way that the openings O of the same are opposite the solid portions of the lower bottom plate F. Meanwhile the receiving-hopper R is in its lower position, as shown in Fig. 4, whereupon the stock or charge is dumped into said receiving-hopper R by means of the skip *a* or otherwise, as desired. The receiving-hopper R is preferably so proportioned as to hold an entire skip-load consisting of either fuel, ore, flux, or mixture, as desired. After the charge has thus been placed in the receiving-hopper R said hopper is raised by means of the cylinder W and its connections, thus causing the stock to slide down the distributing and closing cone T in all directions into the annular portion of the distributing-chamber H. After this has been accomplished the distributing-chamber R is lowered into contact with the distributing and closing cone T, and the distributing-chamber H is then turned through a portion of a revolution by means of the cylinders K and their connections, thus causing the openings O in the bottom of said distributing-chamber to register with the openings O' in the bottom plate F, whereupon the stock is discharged from the annular portion of the distributing-chamber H through said openings O O', thence through the openings C' in the brickwork, and thereby deposited in the upper portion of the furnace. It will be observed that this operation of charging the stock into the furnace takes place at a large number of points, thus securing a very uniform and even distribution of the materials. In charging a furnace with my apparatus I prefer to dump each skip-load or hopperful of material separately into the furnace by means of the revoluble chamber H; but I may otherwise hold two or more hopperfuls in the receiving-chamber and dump them together into the furnace if this practice is considered to be expedient or desirable. In case two or more hopperfuls are re-

tained within the distributing-chamber to be dumped into the furnace at once the said distributing-chamber should obviously be large enough to contain the number of hop-
 5 perfuls desired, and I therefore do not limit myself to any exact proportions of these various receptacles.

In the drawings of my apparatus I have shown the bottom of the distributing-chamber H as provided with six solid portions and six openings O, with a similar number of openings O' and C' in the bottom plate F and through the brickwork of the furnace, respectively; but it is obvious that I could use
 15 a greater or less number of openings if convenient or desirable.

I do not limit myself to the details of the construction shown, but may make such modifications as are fairly included in the scope of
 20 my invention and set forth in the claims.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a blast-furnace top, the combination
 25 of a covered distributing-chamber provided with a closing-cone arranged therein, a support for and beneath said cone carried by the top of the furnace, a receiving-hopper movably arranged in the upper part of the distributing-chamber and in position to seat on
 30 said cone, and means for raising and lowering said receiving-hopper.

2. In a blast-furnace top, the combination of a port-plate provided with a series of openings and intervening solid portions, a closed
 35 distributing-chamber revolubly mounted thereon having a similar series of openings arranged to register with the openings in said port-plate, and means for revolving said distributing-chamber as desired.

3. In a blast-furnace top, the combination of a metal port-plate on the top of the furnace provided with a series of radially-arranged openings and intervening solid portions, a revoluble closed distributing-chamber mounted
 45 thereon provided with a similar series of radially-arranged openings adapted to register with the openings in said port-plate, and means for revolving said distributing-chamber as desired.

4. In a blast-furnace top, the combination of a circular port-plate provided with a series of radially-arranged openings and intervening solid portions, a distributing-chamber revolubly mounted thereon and provided with
 55 a similar series of radially-arranged openings adapted to register with the openings in said port-plate, the outer side walls of said distributing-chamber being sloped outwardly and the inner side walls being sloped inwardly
 60 to facilitate the discharge of material therefrom, and means for revolving said distributing-chamber as desired.

5. In a blast-furnace top, the combination
 65 of a port-plate provided with a series of radially-arranged openings and intervening solid portions, a distributing-chamber revol-

ubly mounted thereon and provided with a similar series of radially-arranged openings adapted to register with the openings in said
 70 port-plate, a distributing and closing cone centrally located above said openings forming part of said distributing-chamber, and means for revolving said distributing-chamber as desired.

6. The combination with a blast-furnace,
 75 of a port-plate secured on the top thereof and provided with a series of radially-arranged openings, a distributing-chamber revolubly mounted upon said port-plate and provided
 80 with a similar series of radially-arranged openings adapted to register with the openings in the port-plate aforesaid, a distributing-cone located centrally above said openings, and a receiving-hopper located above said cone and
 85 adapted to be lowered upon or raised from said cone.

7. The combination with a blast-furnace,
 90 of a port-plate secured on the top thereof and provided with a series of radially-arranged openings, a distributing-chamber revolubly mounted upon said port-plate and provided with a series of radially-arranged openings adapted to register with the openings in the
 95 port-plate aforesaid, a distributing-cone placed centrally above said openings and forming part of said distributing-chamber, and a receiving-hopper located above said cone, adapted to be lowered upon or raised from the cone aforesaid, said hopper being
 100 provided with guides to direct its movement.

8. The combination with a blast-furnace,
 105 of a port-plate secured on the top thereof and provided with a series of radially-arranged openings, a distributing-chamber revolubly mounted upon said port-plate and provided with a series of radially-arranged openings adapted to register with the openings in the
 110 port-plate aforesaid, a distributing-cone placed centrally above said openings and forming part of said distributing-chamber, a receiving-hopper located above said cone, adapted to be lowered upon or raised from the cone aforesaid, said hopper being provided with guides to direct its movement, and
 115 a skip or other means for supplying material to said receiving-hopper.

9. A blast-furnace having a top-closing portion provided with radially-arranged openings, a closed distributing-chamber revolubly
 120 mounted thereon and provided with radially-arranged openings adapted to register with those aforesaid, and means for revolving said chamber as desired.

10. In a blast-furnace, the combination of
 125 a frame having radially-arranged members extending horizontally over the top of the furnace and rigidly secured to the top thereof, a charging apparatus firmly fastened to said frame, and a number of explosion-ports
 130 arranged in the upper walls of said furnace and provided with doors which will automatically open with excess of pressure.

11. The combination with a blast-furnace,

of a frame having radially-arranged members extending horizontally over the top of the furnace and secured to the top thereof, said frame being protected by fireproof material, 5 and a charging apparatus supported by said frame.

12. In a blast-furnace, the combination of a brick arch formed in the top thereof and provided with a series of radially-arranged 10 openings, a port-plate having corresponding openings superimposed thereon, a closed revoluble distributing-chamber mounted thereon having a similar series of openings adapted to register with those aforesaid, means for sup- 15 plying stock to said distributing-chamber, and mechanism for revolving the same as desired.

13. The combination with a blast-furnace, of a circular port-plate mounted on the top 20 thereof provided with series of radially-arranged openings, a track on the outer circumference of said plate, a distributing-chamber revolubly mounted on said plate and provided with a series of openings adapted to register 25 with those in the port-plate aforesaid, wheels on said distributing-chamber arranged to roll on said track, and means for revolving said distributing-chamber as desired.

14. The combination with a blast-furnace 30 provided with a series of radially-arranged openings in the top of the brickwork thereof, of a circular port-plate mounted thereon and provided with a similar series of openings connecting with those aforesaid, and a distribut- 35 ing-chamber revolubly mounted on said port-plate and provided with a corresponding series of openings adapted to register with the openings in the port-plate aforesaid.

15. In a blast-furnace top, the combination 40 of a port-plate provided with a series of radially-arranged holes and intervening solid portions, a distributing-chamber revolubly mounted thereon and provided with a similar series of radially-arranged holes adapted to 45 register with the holes in said port-plate, and

a distributing and closing cone, centrally arranged above the aforesaid holes, forming part of said distributing-chamber, said distributing-chamber being also provided with a dome or cover having a central opening 50 therein for the reception of material upon said cone.

16. The combination with a blast-furnace, of a port-plate secured to the top thereof and provided with a series of radially-arranged 55 holes, a distributing-chamber revolubly mounted upon said port-plate and provided with a similar series of radially-arranged holes adapted to register with the holes in the port-plate aforesaid, a distributing-cone 60 placed centrally above said holes, said distributing-chamber being also provided with a dome or cover having a central opening therein, a receiving-hopper located within said central opening above said cone and 65 adapted to be lowered upon or raised from the cone aforesaid.

17. In a blast-furnace-charging apparatus, the combination of a port-plate secured to the furnace-top and having a series of ra- 70 dially-arranged holes, a distributing-chamber mounted thereon provided with a series of radially-arranged holes in the bottom thereof, adapted to register with the holes aforesaid, a centrally-arranged closing and distributing 75 cone placed above said holes and forming part of said chamber, a dome or cover on said chamber provided with a central opening, and a receiving-hopper located within said central opening above the cone aforesaid and 80 adapted to rest upon or be raised above said cone for the purpose of discharging material into said chamber and closing said central opening.

In testimony whereof I hereto affix my sig- 85 nature in the presence of two witnesses.

SAMUEL W. VAUGHEN.

Witnesses:

GEO. E. THACKRAY,
D. J. JONES.