(No Model.)

3 Sheets—Sheet 1.

J. M. HARTMAN.

BLAST FURNACE IRON NOTCH AND APPLIANCE.

No. 603,330. Patented May 3, 1898.

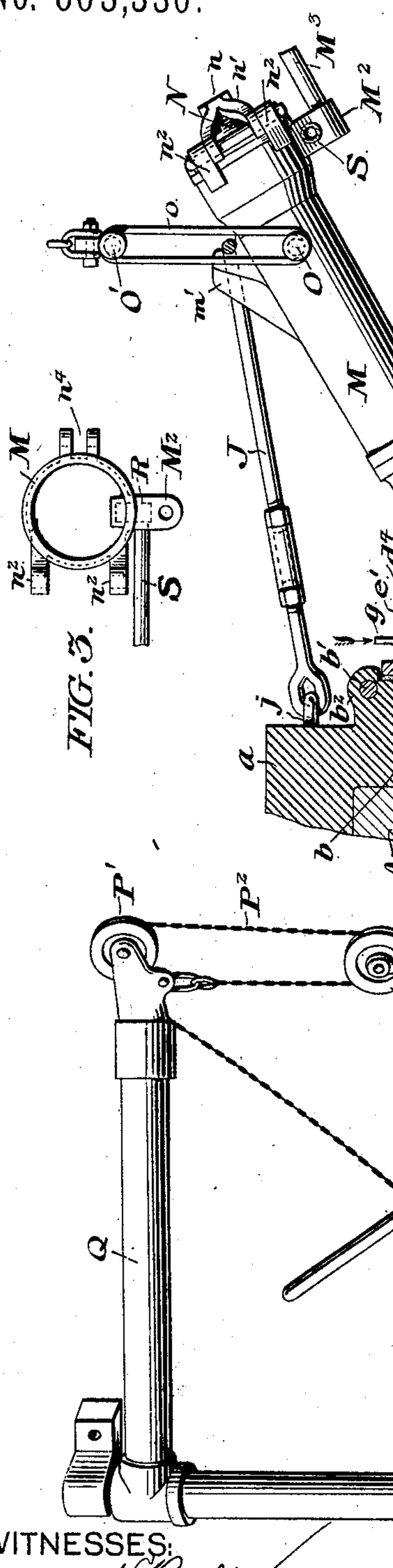

FIG. 3.

FIG. 1.

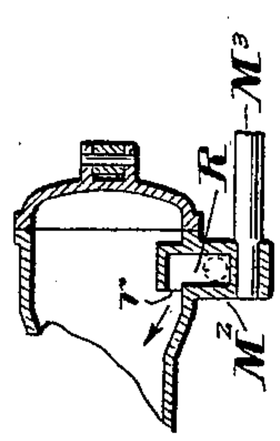

FIG. 4.

FIG. 2.

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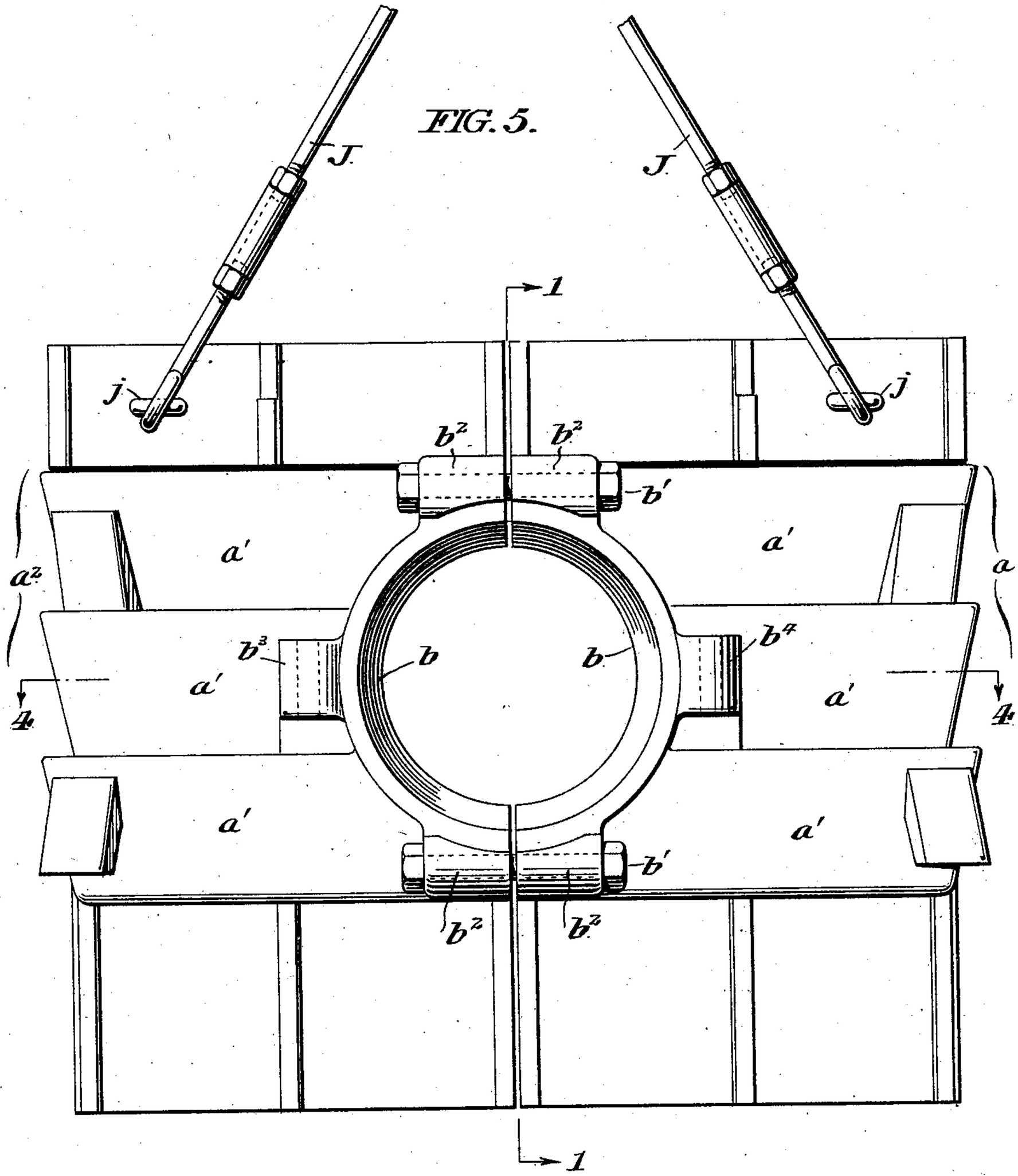
FIG. 5.



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BLAST FURNACE IRON NOTCH AND APPLIANCE.

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FIG. 7.

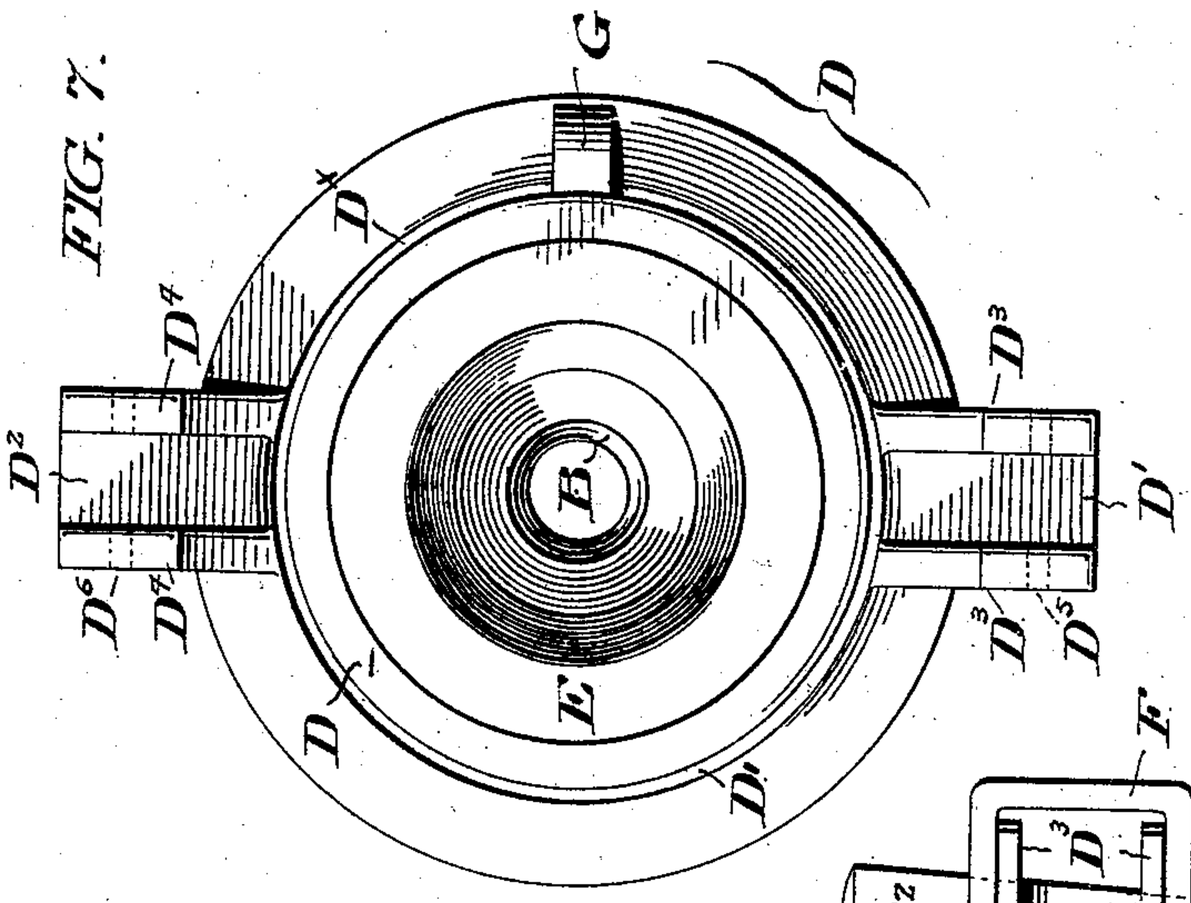


FIG. 8.

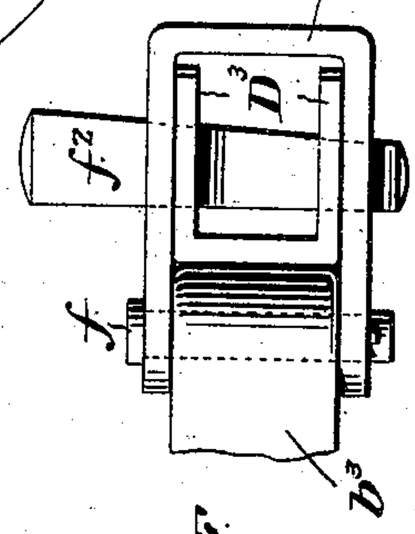
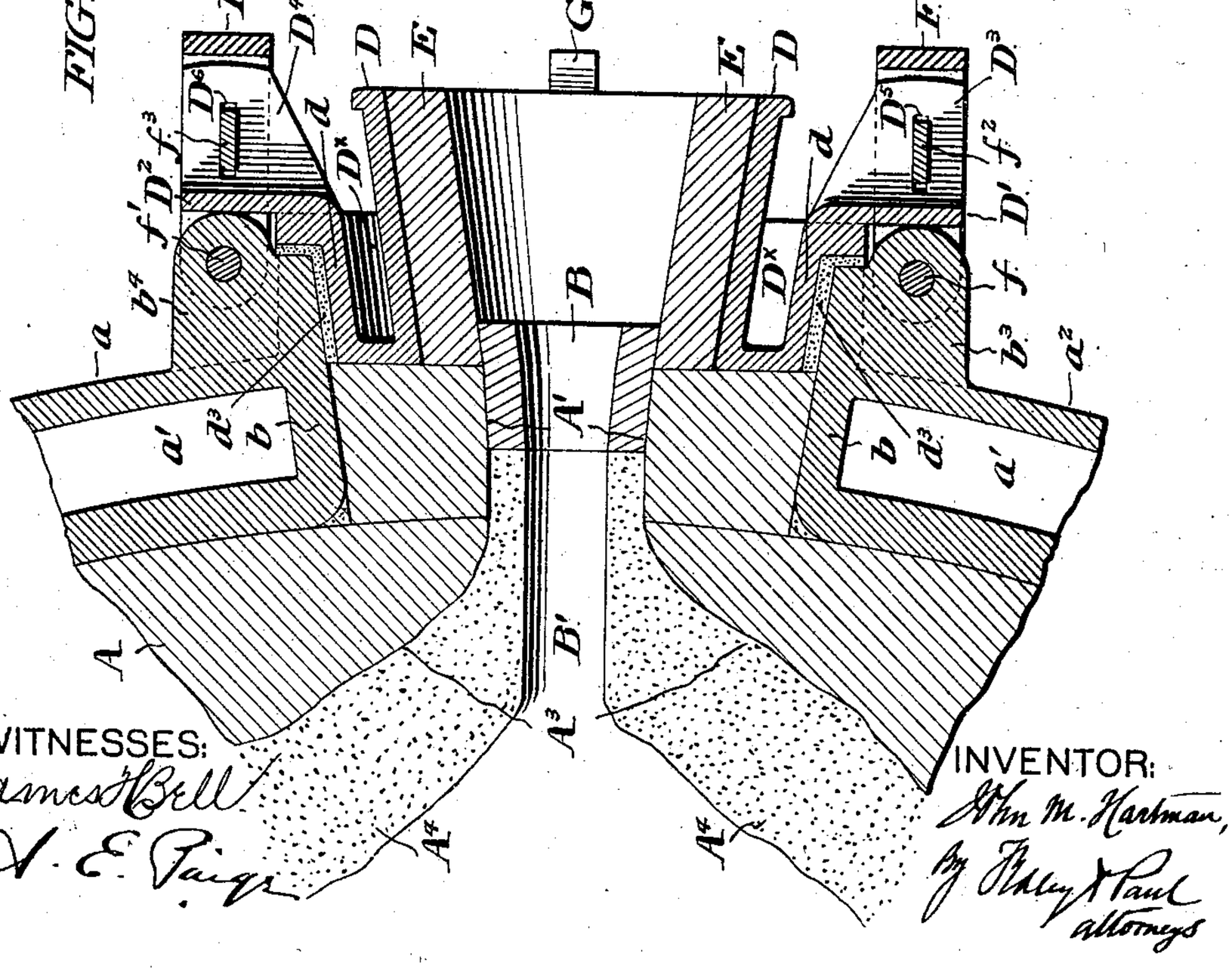


FIG. 6.



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BLAST-FURNACE IRON-NOTCH AND APPLIANCE.

SPECIFICATION forming part of Letters Patent No. 603,330, dated May 3, 1898.

Application filed June 17, 1897. Serial No. 641,153. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. HARTMAN, of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Blast-Furnace Iron-Notches and Appliances Used in Connection Therewith, of which the following is a specification, reference being had to the accompanying drawings.

In said drawings, Figure 1 represents a vertical central section through the iron-notch and adjacent parts, showing the "gun" or device for applying the stopping to the notch in side elevation. Fig. 2 is a view of said gun in perspective. Fig. 3 is a detail view showing the end of said gun with the cap removed. Fig. 4 is a partial section through the butt of said gun. Fig. 5 is a front view of a portion of the furnace-jacket, showing the opening for the iron-notch. Fig. 6 is a horizontal central section through the iron-notch and adjacent parts. Fig. 7 is a partial front view of the notch-holding devices, and Fig. 8 is a detail view showing the method of securing portions of the notch-holding device.

The object of my invention is to facilitate the ready manipulation of the parts which constitute and surround the iron-notch, to minimize the wear and tear thereof, and to control the flow of iron thereat efficiently and quickly.

Referring to the drawings, A indicates the furnace-wall, having an opening A′ for the iron-notch and having the usual external jacket. This jacket is constructed in sections a a^2, bolted or secured together and in the region of the crucible and adjacent to the iron-notch, comprising a series of open troughs a', adapted to contain water. At the region of the iron-notch two adjacent sections of the jacket are provided with semicircular flanged openings b b, (see Fig. 5,) which when said sections are secured together by means of bolts b', passing through the lugs b^2, constitute a deep circular aperture whose face converges inwardly. On either side of this aperture are lugs b^3 b^4, respectively, which support horizontally-swinging yokes F F′, pivoted thereto by vertical pins f f', which yokes carry and secure the retaining devices of the iron-notch.

The iron-notch itself consists of a hollow plug B, preferably of plumbago, in the form of a truncated cone whose inner end fits snugly within the opening A′ of the furnace-wall. The outer end of said plug B fits in a fire-brick lining E, which is supported within a swinging door D. Said door is made of considerable depth, as shown, converging inwardly, and has a deep circumferential flange d surrounding its inner end, so as to form an open channel $D^\times$ for the circulation of water, which is supplied at the top and bottom by means of the pipes g g', the water being played freely upon the surface and allowed to escape.

The outer face of the flange d fits approximately within the inclined face of the aperture formed by the flange b b, a small interspace for fire-clay or other packing d^3 being afforded. On each side of the horizontal diameter of the door D the exterior flange d is prolonged radially outward, as shown at D′ D^2. Each of these prolongations carries a pair of deep ribs D^3 D^3 and D^4 D^4, respectively. Through the pairs of ribs are formed vertical slots D^5 and D^6, respectively, which register with corresponding slots in the yokes F F′, to permit the insertion of keys f^2 f^3, by means of which the door is secured on each side to said yoke. By knocking out either of the keys and swinging back the yoke to which it was attached it will be seen that the door will be freed at that side and may be swung laterally by means of the other yoke, so that either a right or left hand swing may be obtained to suit the conditions which are most convenient in any given case. At the top of the door is an inwardly-extending strip e, whose inner end abuts against the iron-notch B to hold the same rigidly in position, said strip being secured by means of a hooked pin e', which engages with a flange d^4 around the outer periphery of the door itself.

At the bottom of the door is a lug G, which forms a support for the trough H, having a fire-brick bottom h, said trough leading in the usual manner to the casting-point, where the flow of iron is to be delivered.

The gun M, by means of which the stopping is applied to the iron-notch when desired, will now be described. This gun consists of a hollow tapering cylinder whose front or muzzle m is curved to adapt it to en-

ter the deep aperture of the door and fit within or against the iron-notch B. Near the butt of the gun M are two trunnions O, by means of which the gun is supported upon the links *o*, depending from a cross-piece O′, which in turn is carried by a pair of pulleys P P′ and chain P^2, mounted upon the swinging crane Q. A windlass P^3 enables the operator to raise or lower the gun. The butt of the gun is provided with a hinged cap N, pivotally secured at *n* to the transverse forked yoke *n′*, which is in turn pivoted to the lugs n^2, situated on one side of the butt and is secured by means of the pivoted latch n^4, mounted upon either side of the butt.

On the under side of the gun near the butt is a hollow lateral projection M^2, in whose outer end the guiding-bar M^3, is seated. The inner portion of said projection is hollow, as indicated at R, (see the sectional view of Fig. 4,) the opening terminating in a forward direction and at the lower side of the gun's bore, as shown at *r*. A lateral pipe S for the admission of steam or other propulsive fluid communicates with the opening R and is connected with a suitable source of supply. Upon the upper face of the gun is a rearwardly-prolonged lug *m′*, adapted to engage freely with a V-shaped rod J, whose arms extend to the furnace-jacket and are there secured by means of staples *j*, forming lateral stays, which can thus be quickly engaged with or disengaged from the lug.

The general operation of the device is as follows: Assuming that the furnace has been tapped and the iron discharged to the requisite level through the iron-notch B, when the time arrives for stopping said notch the gun M (which has been charged with clay stopping) is rapidly swung or lowered into position and the muzzle *m* thereof inserted into or caused to abut against the notch. The curved muzzle of the gun enables it to be inserted through the deep door of the notch and has the incidental advantage over a perfectly straight gun that the clay is not liable to settle to such an extent as to allow a passage-way above it through which the steam or other propelling fluid can escape. The steam admitted by pipe S is discharged through the orifice *r*, directly along the bottom portion of the gun's bore, and thus sweeps before it the lowest stratum of the clay, which tends to adhere to the bottom in these guns. Thus a complete and uniform discharge of the contents is obtained. The gun is of sufficient capacity to contain a very large mass of stopping—much more than would be required for merely filling the mouth of the iron-notch. Hence when the discharge takes place the stopping is ejected and forced through the aperture of the notch into the interior of the furnace. Usually the wall of the furnace adjacent to the notch is cut or worn away, as indicated at A^3, and the first effect of the surplus discharge is to distribute itself along the inside face of the wall, as indicated at A^4. The surplus material thus distributed not only tends to replace to a certain extent the burned-away wall, but forms a key, as it were, to lock the stopping in place within the notch and thus prevent it from being forced out by the internal pressure. When it is desired to reopen the notch for the next tapping, the pricker-bar is driven clear through the clay itself, as indicated at B′, Fig. 6, which thus forms a renewable bushing around the inner face of the opening. When it becomes necessary to renew the iron-notch B or for other purposes to obtain access to the interior, this may be quickly effected by knocking out one of the keys f^2 or f^3 and swinging back the door D upon the yoke, whose key still remains in position. If desired, an entirely new door can of course be quickly substituted for the old one by removing both keys f^2 and f^3. Thus the parts can be readily manipulated and the notch stopped very quickly, conditions which are of the utmost importance where nearly continuous or very frequent running of the iron is desired. For reasons which are now coming to be understood such method of running is highly advantageous, and the present organization therefore lends itself advantageously to other devices which tend toward this result.

I am aware that it is not new to use a mechanical discharging device or gun for the application of clay stopping to a notch; but as hitherto employed by others such devices have been provided with internal pistons for the ejection of the clay. This arrangement not only complicated the parts and rendered the apparatus liable to be impaired by the drying of the clay within the bore, but did not admit of the discharge of a large amount of stopping. Hence it was necessary with these former devices to apply several successive charges in order to obtain a proper amount of stopping in the notch. Not only is the delay incidental to such a method of procedure very undesirable and the risk of forcing out an incomplete stopping a serious disadvantage, but the stopping itself is not, even when complete, satisfactory in its character. The successive layers as they are applied do not coalesce thoroughly, since the surface of the first is usually dried to some extent before the second one can be applied. Consequently the stopping is weak and the advantage of obtaining an internal overflow to form a key to hold the stopping in the notch is not practically obtainable.

Having thus described my invention, I claim, in an iron-furnace, the following combination of parts:

1. The combination, with the furnace-wall and its jacket, said wall containing an opening in the usual region for the iron-notch; of a removable door suspended from said jacket and fitting snugly within said opening, said door being also provided with an opening; and an iron-notch fitting within the opening in the door itself, substantially as set forth.

2. The combination with the furnace-wall and its jacket, said wall containing the usual opening for the iron-notch, of the door D, having a surrounding flange *d;* water-pipes arranged to deliver water within the channel formed by said flange; and a pivoted support for said door, whereby the same may be swung laterally to permit access to the notch-opening, substantially as set forth.

3. The combination with the furnace-wall and its jacket, said wall containing an opening in the usual region of the iron-notch; of the door D, fitting snugly in said opening, said door itself containing an opening; the iron-notch supported in said opening within the door, said door having lateral projections D^3, D^4; the swinging yokes F, F′, pivoted to the furnace-jacket on each side of the notch-opening; and devices, such as keys, f^2, f^3, whereby said door is detachably secured on each side to said yokes, substantially as set forth.

4. The combination, with the iron-notch, of the gun M, having a curved muzzle adapted to reach said notch; the lateral stays J; the lug *m′*, adapted to freely engage with said stays; and a swinging support for said gun, whereby the same may be lowered into position and quickly secured, substantially as set forth.

5. The combination with the tubular, pistonless gun having a curved muzzle and adapted to contain a large mass of plastic clay stopping; of an inlet-nozzle for the admission of fluid under pressure to the interior of said gun, said nozzle being arranged at the lower side of the gun's bore near the rear end thereof and opening in the direction of the muzzle, substantially as set forth.

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