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R. BERG.

BLAST FURNACE.

APPLICATION FILED OCT. 2, 1902.

NO MODEL.

Fig. 1.

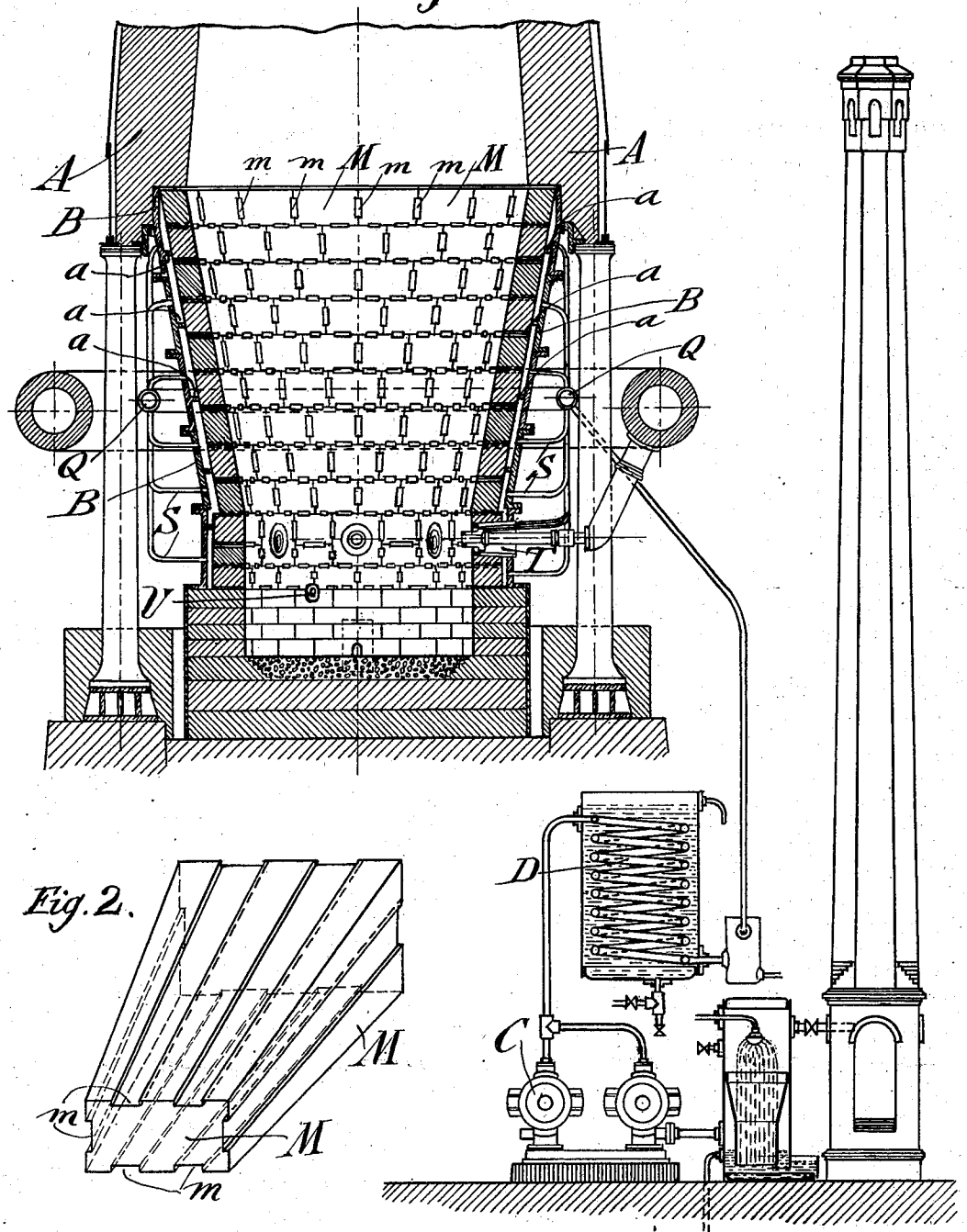


Fig. 2.

WITNESSES:

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BLAST-FURNACE.

SPECIFICATION forming part of Letters Patent No. 721,417, dated February 24, 1903.

Application filed October 2, 1902. Serial No. 125,613. (No model.)

To all whom it may concern:

Be it known that I, RUDOLF BERG, a citizen of the United States, residing in Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Blast-Furnaces, of which the following is a specification.

This invention relates to improvements in blast-furnaces, and more specifically to such improvements in blast-furnaces by which the cooling of the boshes and twyers is effected by means of compressed and cooled air in place of water and by which the objectionable and oftentimes dangerous explosions commonly known as "center" and "lower" explosions are successfully prevented.

The boshes and twyers of blast-furnaces are usually cooled, so as to protect them against the corrosive action of the charge melted in the furnace, by means of so-called "water-boshes," which are lined at their inner faces by means of fire-bricks that are replaced from time to time when burned out. The water-boshes and twyers are fixed in the walls of the lower part of the furnace, and their surfaces are subjected to the extremely-high temperature of the molten metal and slag. It is due to the lack of regularly substituting new coolers, twyers, and cinder-notch coolers, together with the corrosion of the water-boshes by the influence of the high temperature at the interior of the furnace and their contact with the molten mass of metal and slag, that water will enter the hottest part of the blast-furnace and cause the quick formation of steam in considerable quantities, which gives rise to violent explosions known as "lower" explosions. Another kind of explosions—the so-called "center" explosions—are formed at the center of the lower part of the blast-furnace and are caused partly by this rapid steam generation and partly by the caving in of the obstructions technically known as "scaffolds," which occur frequently in the working of blast-furnaces and which arise from various causes, such as the agglomeration of part of the charge to the unequally-eroded lining and also the faulty distribution of the charge, whereby its proper and regular descent is prevented, so that while the charge below the scaffold is working down the mass above is left with a diminished support beneath it until the weight of the superincumbent material is such that on the addition of a new charge the scaffold breaks down and descends with considerable force to the hearth. These slips are generally known as "center" explosions and usually occur, from their nature, at the same time with the top explosions that take place at the upper part or throat of the furnace. When the top and center explosions take place simultaneously, a serious combined explosion is induced, which frequently causes great injury to life and property. Heretofore when the formation of a scaffold was discovered it was necessary to reduce the blast, so as to get the scaffold down without a sudden rush. This, however, takes up valuable time. Scaffolds also lead to erosions in the lining of the furnace, making the furnace work slowly and causing thereby a diminished yield of metal. Lastly, the scaffolds, besides preventing the regular descent of the charge, obstruct the free passage of the blast and the escape of the furnace-gases, as well as cool down the furnace and thicken the slags.

The object of this invention is to obviate the objections incidental to the water-cooling of the boshes and twyers of blast-furnaces and the consequent dangerous center and lower explosions due to the same, and for this purpose the invention consists of a blast-furnace in which the boshes and twyers are cooled by means of compressed and cooled air supplied to the same by means of main and branch supply-pipes from suitable air-compressors.

The invention consists, further, of certain details of construction and combination of parts, which will be fully described hereinafter and finally pointed out in the claims.

In the accompanying drawings, Figure 1 shows the lower part of a blast-furnace in vertical central section and the main and branch pipes from suitable compressors connected thereto, showing my improved system of air-cooling as applied to the boshes and twyers of the same; and Fig. 2 shows an individual brick, which is provided with grooves at its sides, so as to form channels with the grooves of the adjacent bricks.

Referring to the drawings, A represents a blast-furnace the bosh-shell of which is provided at its inner faces with horizontal ribs *a*. Between these ribs, which encircle the lower part of the bosh-shell B, is arranged a lining of fire-bricks, the individual bricks of which are provided at the rear, sides, and ends with grooves, so as to form channels with the faces of the bosh-shells and twyers. The bosh-shell is provided between the ribs with holes, which are connected by branch pipes S with a main pipe Q, which encircles the lower part of the blast-furnace, said main pipe being also connected with the twyers T, tap-hole U, and cinder-notch coolers. Each of these branch pipes S is preferably provided with a stop-cock, so as to turn on or cut off the supply of compressed air. The circular main or supply pipe Q is connected with an air-compressor C, from which the air is passed through a suitable cooler D, which compressor forces the highly-compressed and cooled air into the main and branch pipes Q and S and from the same channels *m*, formed by the grooves of the bricks M of the boshes, twyers, cinder-notch coolers, &c. When the blast-furnace is in operation, the compressed and cooled air is continually forced with uniform pressure to the boshes, twyers, &c., so that the same in passing through the grooves of the fire-bricks composing the lining enters the lower part of the furnace and causes a uniform and sufficient draft in the lower part of the same, cooling the boshes and twyers and inducing a uniform and constant combustion of the charge at the inner surface of the fire-brick lining of the boshes and hearth. By this equal and complete combustion no obstructions, such as scaffolds, can be formed at the interior of the furnace, as the mass of coke and ore in their different stages descends gradually from the throat of the furnace over the lining of the boshes and delivers the molten metal into the hearth of the furnace.

My improved construction of blast-furnace produces a uniform and effective cooling of the boshes and twyers, so as to do away with the erosion of the water-boshes and the consequences incidental thereto, keeps the fire-brick lining in conical shape, so as to insure the uniform gradual descent of the charge over the same, whence the formation of scaffolds in the interior of the furnace is obviated, and neutralizes thereby the source of the center explosions, requiring fewer renewals of the bricks and less-frequent interruptions of the plant, and, lastly, produces the more efficient working of the blast-furnace, and thereby an increased yield and a better quality of metal. In view of the continuous supply of compressed air forced through the channel between the bosh-shell and fire-bricks a less quantity of hot-blast air is needed. Thus the size of the hot-blast stoves, blowing-engines, and steam-generating plants may be proportionately diminished and the efficiency of the plant correspondingly increased.

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

1. In a blast-furnace, the combination with the boshes and twyers of the same, of means for supplying compressed and cooled air to the boshes and twyers, and through the same to the interior of the blast-furnace, substantially as set forth.

2. In a blast-furnace, the combination, with the bosh-shell and twyers of the same, of a fire-brick lining for the boshes and twyers, channels formed between the bosh-shell and lining, and means for supplying compressed and cooled air to said boshes and twyers, and through the same to the interior of the blast-furnace, substantially as set forth.

3. In a blast-furnace, the combination with the bosh-shell and twyers, said bosh-shell being provided with interior horizontal ribs, of a fire-brick lining supported between said ribs and provided with channels, a main pipe for compressed air, and branch pipes connecting said main pipe with the bosh-shell and twyers, substantially as set forth.

4. In a blast-furnace, the combination, with a bosh-shell at the lower part of the furnace provided with openings, of horizontal ribs at the interior of said shell, a fire-brick lining supported between said ribs and provided with channels, a main pipe encircling the lower part of the furnace and connected with a source of compressed and cooled air, and valved branch pipes connecting said main pipes with the openings in said bosh-shell so as to supply compressed and cooled air to the same and to the interior of the furnace, substantially as set forth.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

RUDOLF BERG.

Witnesses:
S. J. TOOLE,
P. F. TOOLE.