

(No Model.)

2 Sheets—Sheet 1.

J. M. HARTMAN.

TUYERE FOR BLAST FURNACES.

No. 248,462.

Patented Oct. 18, 1881.

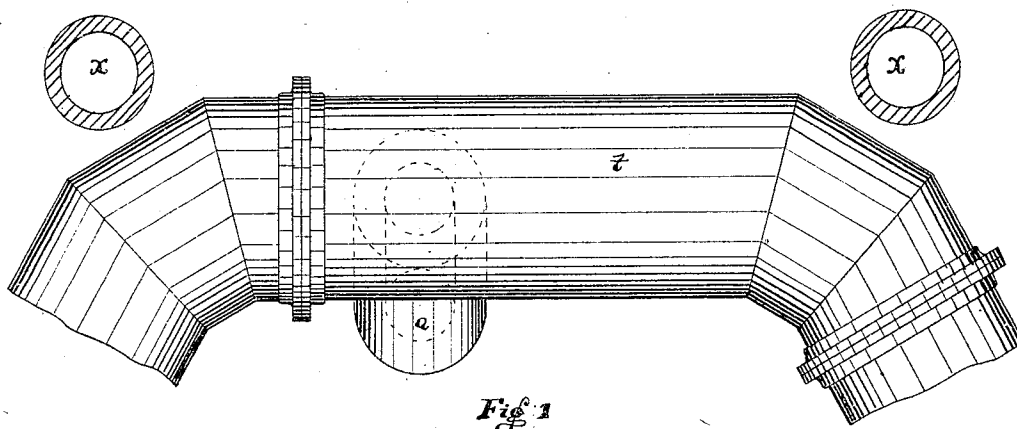


Fig. 1

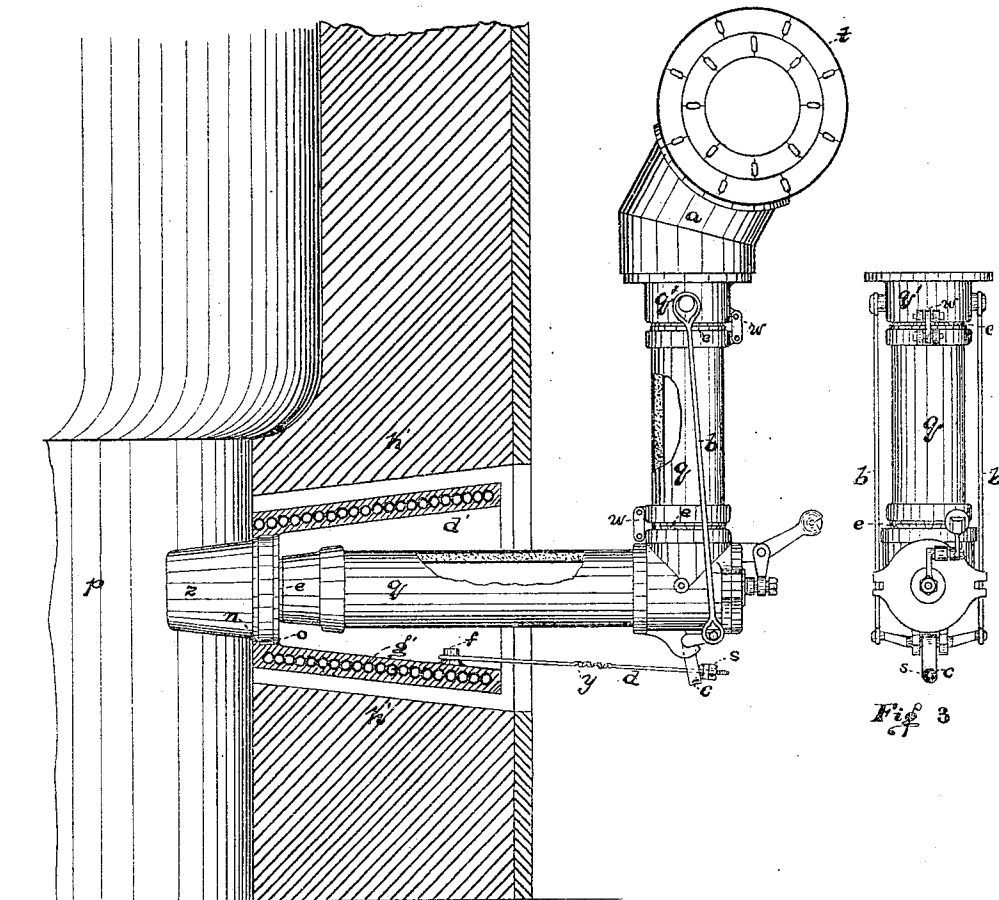


Fig. 2

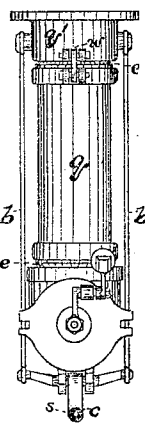


Fig. 3

Witnesses
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Robert K. Gray

Inventor
John M. Hartman

(No Model.)

2 Sheets—Sheet 2.

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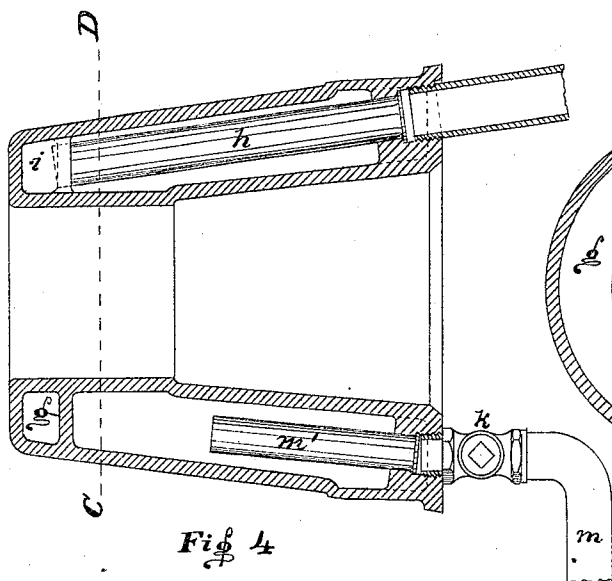


Fig 4

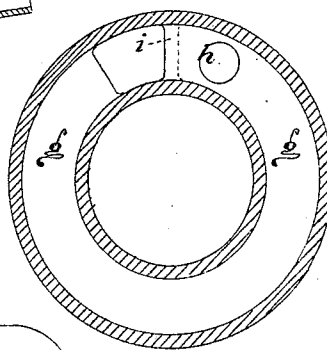


Fig 5

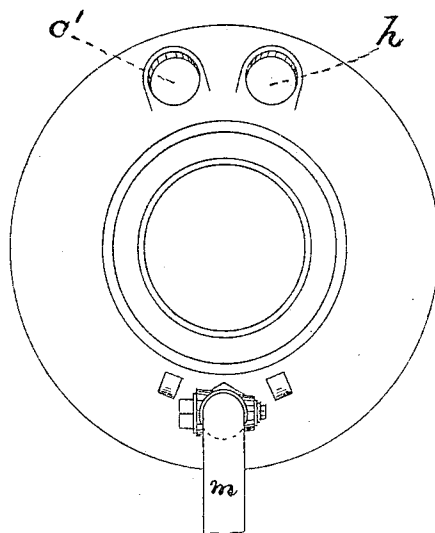


Fig 6

Witnesses

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TUYERE FOR BLAST-FURNACES.

SPECIFICATION forming part of Letters Patent No. 248,462, dated October 18, 1881.

Application filed May 14, 1881. (No model.)

To all whom it may concern:

Be it known that I, JOHN M. HARTMAN, a citizen of the United States, residing at the city of Philadelphia, State of Pennsylvania, have invented new and useful Improvements in Blast-Furnaces for Metallurgical Purposes, of which the following is a specification.

My invention relates to improvements on the pipes and connections for delivering the air or blast to the furnace; and the objects of my improvements are, first, to cheapen the distributing tuyere-pipe; second, to make the tuyere-pipe flexible in all its parts and dispense with clay or other packed joints; third, to increase the circulation of the water at the nose of the tuyere; fourth, to remove the deposition or mud from the tuyere; fifth, to form a metallic joint between the tuyere and the tuyere-breast; sixth, to increase the length of the tuyere-breast, and thereby protect the walls of the hearth. I attain these objects by the means illustrated in the accompanying drawings, in which—

Figure 1 is a plan of the distributing or circular tuyere-pipe. Fig. 2 is an elevation of the circular pipe, tuyere-pipe, tuyere, tuyere-breast, and section of the furnace-hearth. Fig. 3 is an end elevation of the tuyere-pipe. Fig. 4 is a sectional elevation of the tuyere. Fig. 5 is a cross-sectional elevation of the tuyere on line C D. Fig. 6 is an end elevation of the tuyere.

Similar letters refer to similar parts throughout the several views.

The circular pipe *t*, Fig. 1, surrounding the furnace, receives the blast heated to about 1,200°, and distributes the blast through the tuyere-pipe and tuyeres *z* to the furnace-hearth *p* at different points. To the circular pipe are attached two or more branches, *a*, which deliver the blast into the tuyere-pipe. The tuyere-pipe *q q q'* is composed of two or more parts, with globe-joints on the end of each part, so that any irregularities in the position of the pipe may be accommodated and a tight joint produced. The links *b b*, the bell-crank *c*, and the link *d*, with spring *y* and nut *s*, are to hold the tuyere-pipe together and exert a yielding pressure on the joints of the pipe. The tuyere has on its butt-end a globe-face, *e*, to which the tuyere-pipe is attached. The tuyere *z* has

an internal water circulation secured by the pipe *h*, the divisions *i* and *g*, and the discharge *c'*. The tuyere is cleaned from the muddy deposition of the water by washing the mud out with a current of water passing through the pipe *m* and cock *k*. The tuyere-breast *d'* has in the small end the annular taper surfaces *n o*, which receive the butt-end of the tuyere and form a metallic joint. In the large end of the tuyere-breast is a lug, *f*, to which the link *d* of the tuyere-pipe is attached. The breast has an internal circulation of water through the coil *g'*.

An annular water-space can be used in the tuyere-breast, same as in the tuyere, for cooling the tuyere-breast. The water circulating through the tuyere-breast abstracts the heat from the walls *h'* of the hearth and prevents them from melting by the intense heat in the hearth.

Heretofore the circular distributing tuyere-pipe surrounding the furnace and supplying it with hot blast has been made in one piece, forming a complete circle, or it has been made in sections and bolted together at the columns supporting the furnace. The branches *a*, leading to the tuyeres from this circular pipe, are lined with fire-brick to prevent radiation. To line this branch is difficult, owing to the small diameter of the pipe—usually about fifteen inches—and the long distance from the end of the pipe through which the material has to be passed to line the pipe. The workman lining the pipe has to lie down to do his work, which renders the work costly and difficult. When the joints are placed at the columns the space between the columns and the furnace is so contracted that difficulty is experienced in getting the flange in the space and in getting at the joint-bolts. By making this distributing-pipe with a bend at each column, as shown in Fig. 1, *x x*, and using a straight pipe from bend to bend, with the flanges placed close to the bend, they can be lined quicker and better. This dispenses at the columns with the bevel-flanges, which are difficult to fit up and adjust. Flanges at right angles to the pipe are quickly fitted up and adjusted.

Tuyere-pipes, as heretofore made, have their globe-joints held by bolts and nuts. The heat of the blast conducted through the tuyere-

pipe causes the bolts and nuts to rust, which frequently requires the bolts to be cut off before the pipe can be taken apart. The faces of the joints in the tuyere-pipe are iron, and they rust rapidly. This rusting of the joints and the rigid hold of the bolts cause the breakage of the tuyere-pipe by the expansion of the pipe from the high heats now obtained in regenerative furnaces. If the bolts are not screwed up tight enough, the joints leak. With the higher pressures and higher temperatures of blast now used joints that will yield and remain tight are an absolute necessity. In Patent No. 205,744, July 9, 1878, granted me, a yielding tension on the horizontal tuyere-pipe joints is shown. As part of the joints are on the horizontal pipe and part on the vertical pipe, this yielding tension must be exerted in two directions to hold the tuyere-pipe together and to the tuyere. By attaching two links, *b*, Fig. 2, to the upper or stationary part of the pipe *g*, and attaching the lower end of these links to a right-angle lever, *c*, under the pipe, then attaching a link, *d*, with a spring, to the second end of the lever, and attaching the other end of the link *d* to the water or tuyere breast, two lines of yielding tension are got in one system, and all bolts are dispensed with. The joints *e e e* are metallic globe-faces. By unscrewing the nut *s* on link *d* the pipe can be taken apart. The small links *w*, Fig. 3, are to hold the pipe temporarily while coupling it together with the main links.

I do not confine myself to a particular position for the spring.

The nut on the link *d* is made of copper and tin, and not being in contact with the hot pipe, it does not rust or stick.

The object in having the tuyere-pipe in two parts at right angles is to allow for the expansion of the tuyere-pipe and distributing hot-blast pipe. It is not necessary to have the pipes at right angles, as they will work if the angle is greater or less. By placing a lug or projection, *f*, Fig. 2, in the end of the tuyere-breast and attaching the link *d* to the lug, the tuyere-pipe is forced against the tuyere and holds the latter firmly in the breast. A weight and lever can be substituted for the spring.

With the high pressures of blast now used—from eight to thirteen pounds per square inch—tuyeres have heretofore frequently blown out and endangered the lives of the workmen. The tuyere-pipe being made with an inner and outer shell, the space between the two shells is driven up solid with asbestos, which prevents conduction of heat, and by its firmly supporting the inner shell the shell is prevented from warping by the high heat of the blast.

Heretofore two forms of tuyeres have been used—first, the double-shell tuyere, having an annular water-space; second, the coil-tuyere, with a positive circulation of water through the whole length of it. Tuyeres are nearly always burned off or destroyed at the small end. As their liability to burn off is decreased

by a rapid circulation of water at the nose, I place in the annular tuyere a transverse division, *g*, Fig. 4, and the pipe *h*, which induces a circulation at the nose and prevents it from burning off. The pipe *h*, delivering the cold water directly at the nose of the tuyere, and the longitudinal partition *i*, in combination with the annular division *g*, induces a rapid circulation around the nose, and thereby prevents the tuyere being destroyed.

Annular tuyeres, as heretofore used, become filled with deposition from the water, which, being a non-conductor, often causes a tuyere to be burned off. By attaching a cock or valve, *k*, to the butt-end of the tuyere at the bottom and forcing a current of water through the pipe *m*, the mud deposited in the bottom of the tuyere is washed out through the discharge-pipe of the tuyere.

I disclaim the use of a cock on the discharge-pipe of a tuyere for cleaning the tuyere, as the discharge-pipe must be in all cases at the top of the tuyere to make the proper circulation and get rid of the air. With the cock and separate attachment there is no danger of the tuyere burning by interfering with the constant circulation of water. With a cock on the discharge-pipe the circulation of water is interfered with and the tuyere is rendered liable to be burned. Heretofore the tuyere-breasts have been made in length about three-eighths of the thickness of the walls where they are inserted.

In practice, when the furnace works irregularly, the walls melt away over the outer end of the tuyere-breast and cause the furnace to go out of blast. To obviate this I increase the length of the breasts to not less than three-fourths the thickness of the walls where the breasts are inserted, and the coil is continued to the end of the breast. The pipe heretofore used in the tuyere water-breast has been three-fourths or one inch in diameter inside, and the coils are not wound close together.

I prefer making the coil of one and one-fourth inch pipe, wound close together, especially at the nose. This gives a larger cooling-surface and a larger body of water to do the cooling, whereby the walls are better protected and the breasts made less liable to be burned.

Tuyere-breasts, as heretofore made, have a separate ring in the small end. This ring is bored out taper to receive the tuyere, and is made separate for convenience of boring. I dispense with the separate ring, and form in the nose of the tuyere-breast two annular taper surfaces, *n o*, to receive the taper on the butt-end of the tuyere. The taper part of the tuyere-breast, in which the tuyere fits, has to be of some length to hold the tuyere firmly. This taper surface being large, the tuyere jams in it and gives trouble to get it out. By forming the annular taper surfaces *n o*, Fig. 2, the taper bearing is decreased and the tuyere is taken out without difficulty.

The large end of the water or tuyere breast

can be secured by lugs to the jacket surrounding the furnace, which would prevent the breasts from being pushed into the furnace in event of a slip of the stock from a scaffold.

5 Heretofore there has been used a combination of a tuyere-breast with a tuyere inserted in it, having the joint between the tuyere and breast made of clay. There has been used, also, a tuyere-breast with a separate ring in
10 the nose, into which the tuyere fitted, forming a metallic joint. There has been used, also, a tuyere with a tuyere-pipe, having a clay joint between them. These clay joints are formed by driving, with a tool, clay in the space where
15 the joint is to be made.

Clay joints are difficult to make, and take a long time to get them perfect. They frequently blow out from the high pressure now used, as the clay becomes brittle when the moisture
20 evaporates from it.

The combination of a tuyere-breast forming a metallic joint direct with a tuyere, and a tuyere with a metallic oscillating joint to attach the tuyere-pipe to, and a flexible tuyere-
25 pipe has not heretofore been used.

I do not broadly claim a yielding tension in claim 2.

I disclaim the use of a cock on the discharge-pipe of a tuyere for the purpose of washing out
30 the mud.

I do not confine myself to the direction of the water-current in pipe *m*, Fig. 4.

I do not confine myself strictly to a metallic joint in claim 7, as a thin washing of clay becomes necessary if the joint-surfaces are not
35 perfectly round.

I do not claim the use of a current of water through the supply-pipe of a tuyere for cleaning the deposit out of it. Neither do I claim
40 the use of a current of water forced backward through the discharge-pipe of a tuyere for removing the deposit. The pipe *m'* in a short tuyere of, say, six inches long can be omitted, as the current would be sharp enough to remove the deposit in that space.

I claim—

1. The combination, with the tuyere-pipe and tuyere of a blast-furnace, of a distributing-pipe made of segments and bends, with flanges at the branches, to which the tuyere-pipe connects, as and for purposes herein described. 50

2. An oscillating joint on the pipe *q'*, and an oscillating joint on the tuyere *z*, with the tuyere-pipe *q q*, held together, to the tuyere, and to the pipe *q'* by a link or links, in combination with
55 a spring or its equivalent, for purposes herein set forth.

3. In combination with a tuyere having an annular water-space, the pipe *h*, the transverse division *g*, extending nearly around the nose of
60 the tuyere, and the longitudinal partition *i*, to induce a rapid circulation of water at the nose of the tuyere, for purposes herein described.

4. In combination with an annular tuyere having a supply and discharge water-pipe, a
65 separate pipe, *m'*, placed in the butt-end of the tuyere at the bottom, a cock, *k*, and a pipe, *m*, through which a current of water is forced to remove the deposit, the said current being operated by opening or closing the cock *k*. 70

5. The combination of an oscillating tuyere-pipe, a tuyere having metallic joints, and a tuyere-breast whose length is not less than three-fourths of the thickness of the walls
75 where the breast is inserted.

6. In combination with a tuyere-breast, the lug *f* and link *d*, to hold the tuyere-pipe together and the tuyere in the tuyere-breast, as herein described.

7. The combination of a tuyere-breast and
80 a tuyere, with the joints between them formed by the annular taper surfaces *n o*, as herein described.

8. The combination of a circular tuyere-breast, a tuyere, and a flexible tuyere-pipe, each
85 having metallic surfaces to form the joints between them, substantially as set forth.

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Witnesses:

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J. H. FRIES.