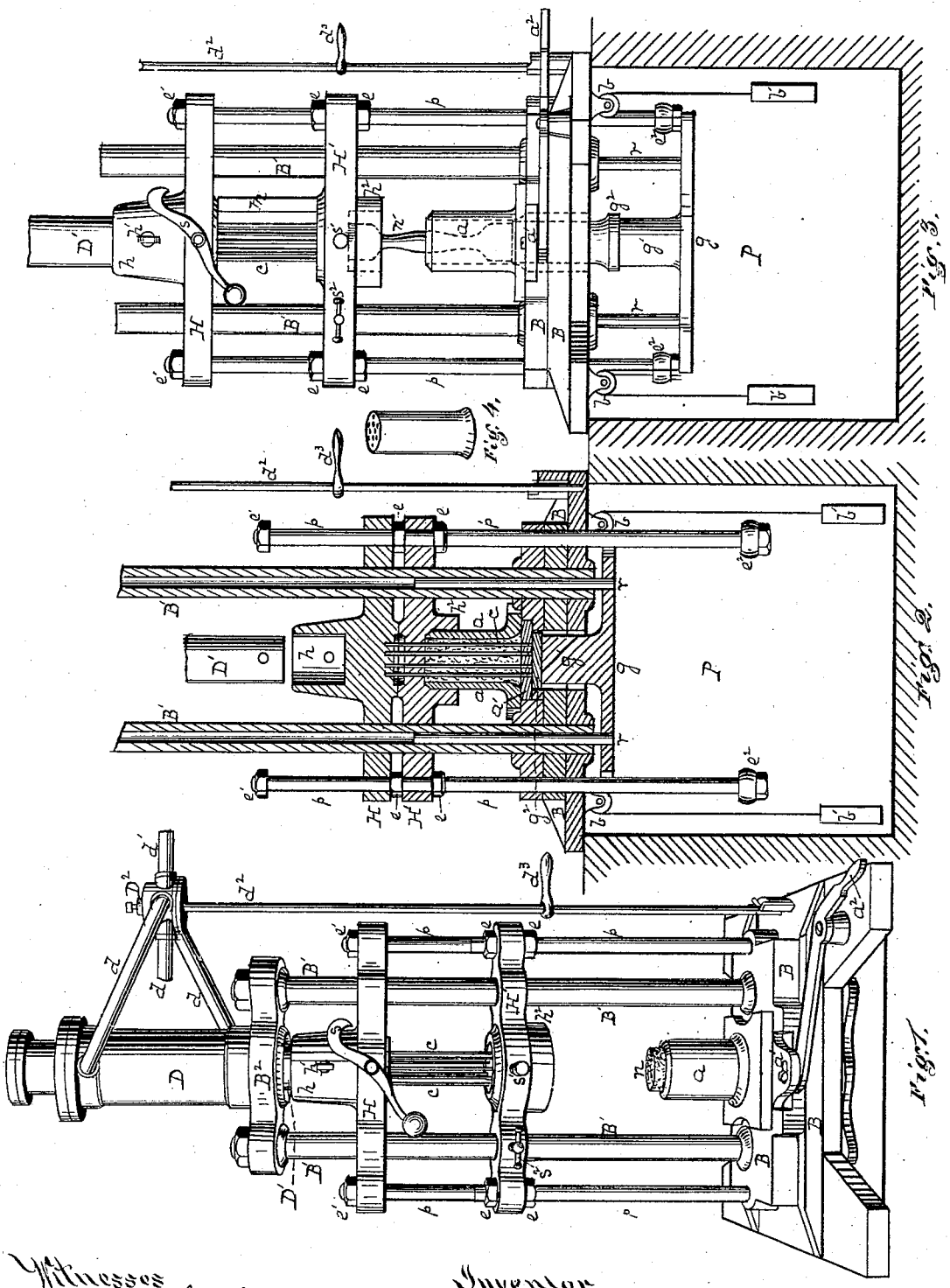
E. J. MILDREN.

Machine for Making Tuyeres.

No. 167,850. Patented Sept. 21, 1875.



Witnesses
Claudius L. Parker.
J. E. Boggs.

Inventor
Edward J. Mildren,
by Geroe N. Christy,
his Attorney.

UNITED STATES PATENT OFFICE.

EDWARD J. MILDREN, OF JOHNSTOWN, PENNSYLVANIA.

IMPROVEMENT IN MACHINES FOR MAKING TUYERES.

Specification forming part of Letters Patent No. **167,850**, dated September 21, 1875; application filed August 16, 1875.

To all whom it may concern:

Be it known that I, EDWARD J. MILDREN, of Johnstown, county of Cambria, State of Pennsylvania, have invented or discovered a new and useful Improvement in Tuyere-Machine; and I do hereby declare the following to be a full, clear, concise, and exact description thereof, reference being had to the accompanying drawing making a part of this specification, in which—like letters indicating like parts—

Figure 1 is a front view, in perspective, of my improved machine. Fig. 2 is a vertical sectional view of the lower operative part thereof. Fig. 3 is a front elevation of the parts shown in Fig. 2; and Fig. 4 is a perspective view of a tuyere, as produced by the machine.

My invention relates particularly to a machine for making tuyeres for Bessemer converters by hammering the plastic earthy material which forms the tuyere, while suitably inclosed, so as, while it is shaped and perforated, it is also compressed, condensed, or solidified to an extent which, I believe, has not heretofore been attained; and as the durability of such tuyere depends, in part, on the density of the material which composes it, I secure, in addition to advantages due to an improved construction of machine, the further advantage of a more durable product, which, to the extent of its increased durability, cheapens and facilitates the Bessemer processes of making steel. My improvement, with modifications such as the skilled mechanic will suggest, may be adapted to the manufacture of other kindred articles of plastic material, which, in their manufacture, require, or may be improved by, a like treatment.

In the drawing, B represents the base-plate, pedestal, or foundation of my machine. For convenience, I prefer to build it over a pit or basement, P. The frame-work consists of upright posts or supports B^1, and a cross-head, B^2, on which latter I arrange a double-acting steam-cylinder, D, furnished with steam supply and exhaust pipes *d*, communicating with the steam-pipe d^1 from the boiler through a four-way cock, D^2. By means of a valve-stem, d^2, and arm d^3 the operation of the steam-cylinder is put within reach of the operator; but as these pipes, ports, cocks, and reversing-gear form no part of my present invention, they may be varied at pleasure. The steam-cylinder D is fitted with the usual steam-piston, the stem D^1 of which, either itself or by an interposed device or devices, constitutes the ram to perforate, hammer, and discharge the tuyere, and also a carrier to raise and lower certain devices, as presently to be described. On the base B, and in the axial line of the piston-stroke, I arrange the tuyere-mold *a*, it having a cavity of the size and shape of the tuyere to be made. This mold is made open at both ends, with the flaring end downward, (if it have any flare,) and the base B has an opening immediately beneath for the downward discharge of the tuyere, when finished; but to close the lower open end of the mold *a*, while the tuyere is being made, I employ a sliding or movable plate, a^1, which is moved in and out between suitable guides in the base B by means of a pivoted lever, a^2, or in other suitable way. On the posts B^1 I arrange two vertically-moving cross-heads, H H′. The upper one H has a socket, *h*, on its upper face, into which the piston-stem D^1 enters, so as to be secured thereto, when desired, by means of a pin, h^1, though other means of connecting and disconnecting the two may be substituted.

To the lower side of this cross-head H I attach the perforators *c* in any desired number and arrangement, such as will give the desired air-holes in the tuyere. The lower cross-head H′ is made with a cup-shaped cavity or mold-cap, h^2, on its lower face, of such size and shape as will slide neatly over and onto the upper end of the mold *a*, as illustrated in Fig. 2. The perforators *c* pass through holes properly arranged in the bottom of this cavity, so that, passing through the same, they may enter and perforate the tuyere-blank longitudinally; and in order that they may make complete perforations through the entire tuyere-blank a corresponding arrangement of holes is made in the slide a^1, which closes the bottom of the mold. Parallel with the posts B^1 are two lifting-rods, *p p*, which pass through the projecting ends of the cross-heads H H′ and, extending down through the base B, enter the

pit P. The lower cross-head H′ is by set-screws or stop-nuts *e* fixed on the rods *p*, so that they all must move together. The other or upper cross-head H moves freely on the rods *p* through a distance such that when it rises and engages the stop-nuts e^1 the lower ends of the perforators *c* will be withdrawn from the cavity of the mold-cap h^2. As the cross-head then continues its upward motion it will carry up with it the lower cross-head H′, the lifting-rods *p*, at the same time, sliding up through the base B, till, having arrived at the proper point, the stop-nuts e^2 prevent further upward motion. In the pit P, by weights and pulleys *b b′*, I suspend a table, *g*, with a column, g^1, rising therefrom into the opening through the base B directly under the cavity of the mold *a*. On the removal of the slide a^1 the finished tuyere is forced down onto this column, and both being depressed together the tuyere is brought into the pit, whence it is removed by hand. The guide-rods *r* of the table *g* play in the tubular cavities of the posts P, they being made hollow for that purpose. By means of a weighted hook, *s*, and lug s^1 the cross-heads H H′ may be connected together when desired, and, for purposes presently to be explained, set-screws s^2 may be added to the cross-head H′.

The operation is as follows: By hand, or any suitable means, a tuyere-blank, *n*, is roughly shaped to fit approximately into the cavity of the mold *a*, and for the sake of great accuracy the material may be weighed.

As I compress the blank somewhat by hammering, the blank *n* should be made a little longer than the mold-cavity, so that, after all the material is compressed or driven into the mold *a* and is perforated, the tuyere so formed will have the desired density or solidity, and all the tuyeres produced will be of a uniform length. The devices being in the position shown in Fig. 1, the tuyere-blank *n* thus prepared is dropped into the mold *a*. By the appropriate movement of the steam cock or valve the piston-stem D^1 receives a downstroke, which results first in the lowering of the lower cross-head H′ till its cap h^2 covers the upper end of the mold *a*, and the bottom of its cavity rests on the top of the tuyere-blank. As this cross-head H′ is made of cast-iron it is quite heavy, and will by its weight partially compress the material of the blank into the cavity of the mold *a*.

The next result of the downward stroke of the piston D^1 is that the perforators *c* are driven down lengthwise of and through the tuyere-blank, and with their points in the holes in the bottom slide a^1. I then remove the pin h^1, and, using the piston D^1 as a ram or hammer, impart a series of rapid and powerful blows to the cross-head H, and through it to the cap h^2 of the cross-head H′, so as to force into the cavity of the mold D any material which may still be above the level of its upper end, and in this way I impart to it the density desired. The weights *b′* of the table *g* are heavy enough to bring or hold the column g^1 in the cavity of the base B below the slide a^1. The position of these devices at this stage of the operation is shown in Fig. 2.

The next step is to withdraw the perforators *c* from the tuyere. If the cross-head H′ is heavy enough to maintain its position while the perforators *c* are drawn out, it will act as a stripper to hold the tuyere in place, and prevent the breakage of its upper end; otherwise I fasten it in that position by the set-screws s^2 till the perforators *c* are entirely withdrawn from the tuyere, and this is done by connecting the piston-stem D^1 with the upper cross-head H, as above described, and giving the piston an upstroke. As soon as the perforators *c* are clear of tuyere the set-screws s^2 (if used) are loosened, and the cross-head H engaging the upper stop-nuts e^1 on the lifting-rods *p*, the cross-head H′ is lifted to the position shown in Fig. 1.

In order, now, to discharge the tuyere, I draw out the slide a^1, insert a post, *m*, Fig. 3, between the cross-heads H H′, and place a ram, *n′*, on top of the tuyere, its lower end being preferably of the diameter of the mold-cavity, or slightly less. I then give a downstroke to the piston-stem D^1, so as to bring the bottom of the cavity of the mold-cap h^2 against the top of the ram *n′*, and, by continuing the stroke, drive the tuyere out of the lower open end of the mold and make it clear the base B. It will then rest on top of the depressed column g^1, or on a lifting-board, g^2, placed thereon, so that a workman, taking hold of the board, may carry it off to the drying-room or kiln. The devices then being brought back to the position shown in Fig. 1, the operation is repeated.

In the construction of the apparatus many modifications may be introduced, such as an open-and-shut mold, secured to the base B when in use, instead of an unjointed mold permanently attached to the base. The mold may be either tapering or straight-sided, and a pivoted instead of sliding bottom *a′* may be employed. Also, the steam-hammer may be caused to act against a plunger, which shall enter the mold-cavity. These and other like modifications may be introduced without a substantial departure from the scope of the invention.

I claim herein as my invention—

1. The combination of a steam-actuated piston-stem and tuyere-mold, substantially as and for the purposes set forth.

2. A cross-head, H′, carrying a mold-cap, h^2, in combination with a mold, *a*, substantially as and for the purposes set forth.

3. A cross-head, H, as a carrier for the perforators *c*, having a detachable connection with a steam hammer, ram, or piston-stem, and in combination therewith, substantially as described, whereby the tuyere-blank may be perforated and hammered, and the perforators withdrawn through the action of the piston-stem.

4. The combination of the cross-head H carrying perforators *c*, cross-head H′ carrying mold-cap h^2, and mold *a* having a perforated bottom, substantially as and for the purposes set forth.

5. As a means of discharging the finished tuyere, the piston-stem D^1, acting directly or indirectly against the end of the tuyere, in combination with a movable bottom, a^1, a fixed unjointed mold, *a*, and counterweighted column g^1, relatively arranged, substantially as set forth.

6. The cross-heads H H′, playing on the posts B^1, in combination with the lifting-rods *p* and piston-stem D^1, substantially as set forth.

7. The combination of steam-actuated piston-stem, a perforating cross-head, a compressing cross-head, and mold, substantially as and for the purposes set forth.

8. The combination of steam-actuated piston-stem, a perforated cross-head, a compressing cross-head, and mold with a removable perforated mold-bottom, substantially as set forth.

In testimony whereof I have hereunto set my hand.

EDWARD J. MILDREN.

Witnesses:

DAVID BRAUM,

MCCON MOORE.