

C. H. BAKER.

Improvement in Tuyeres for Bessemer Converters.

No. 129,512.

Patented July 16, 1872.

Fig. 1.

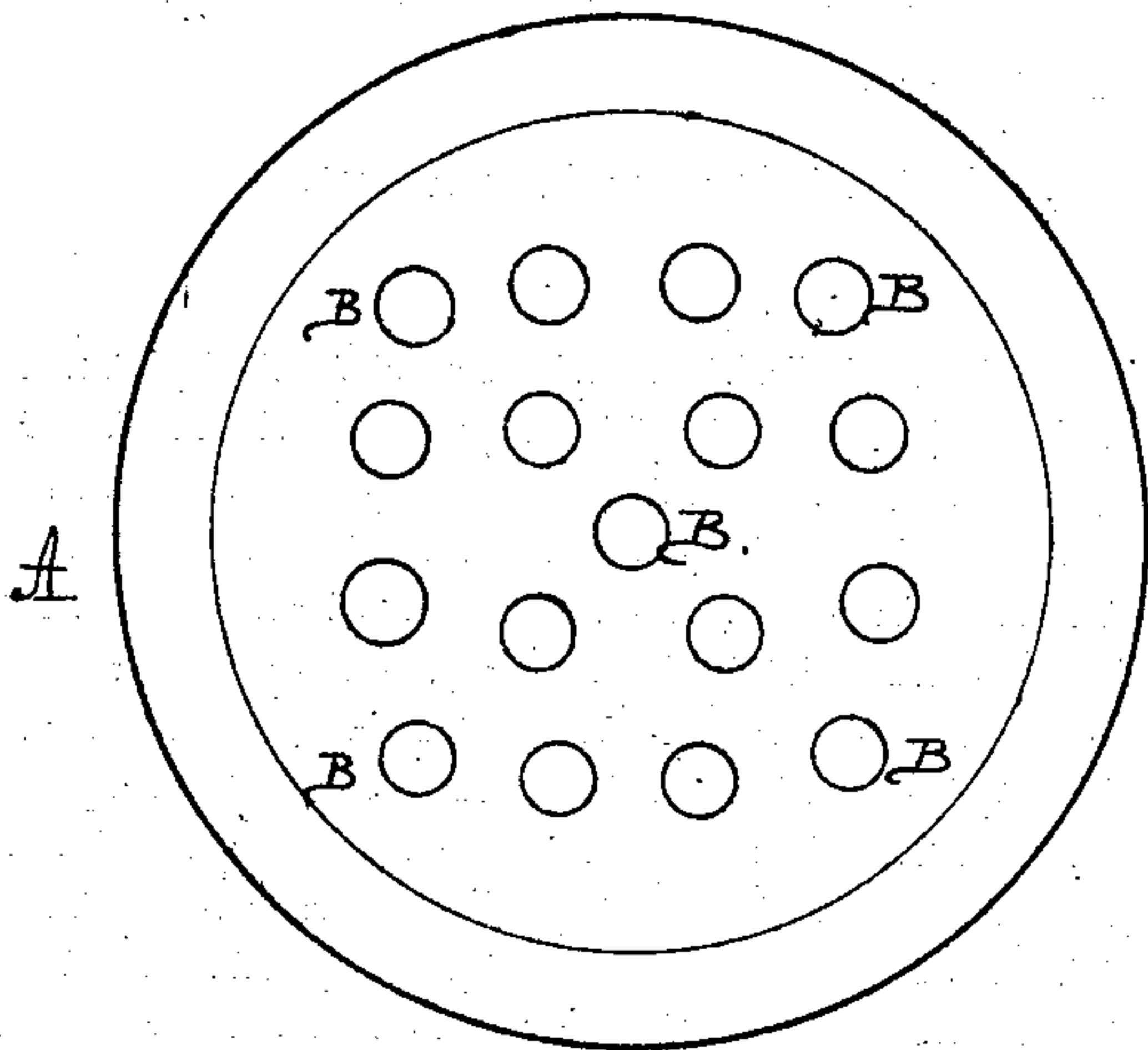


Fig. 2.

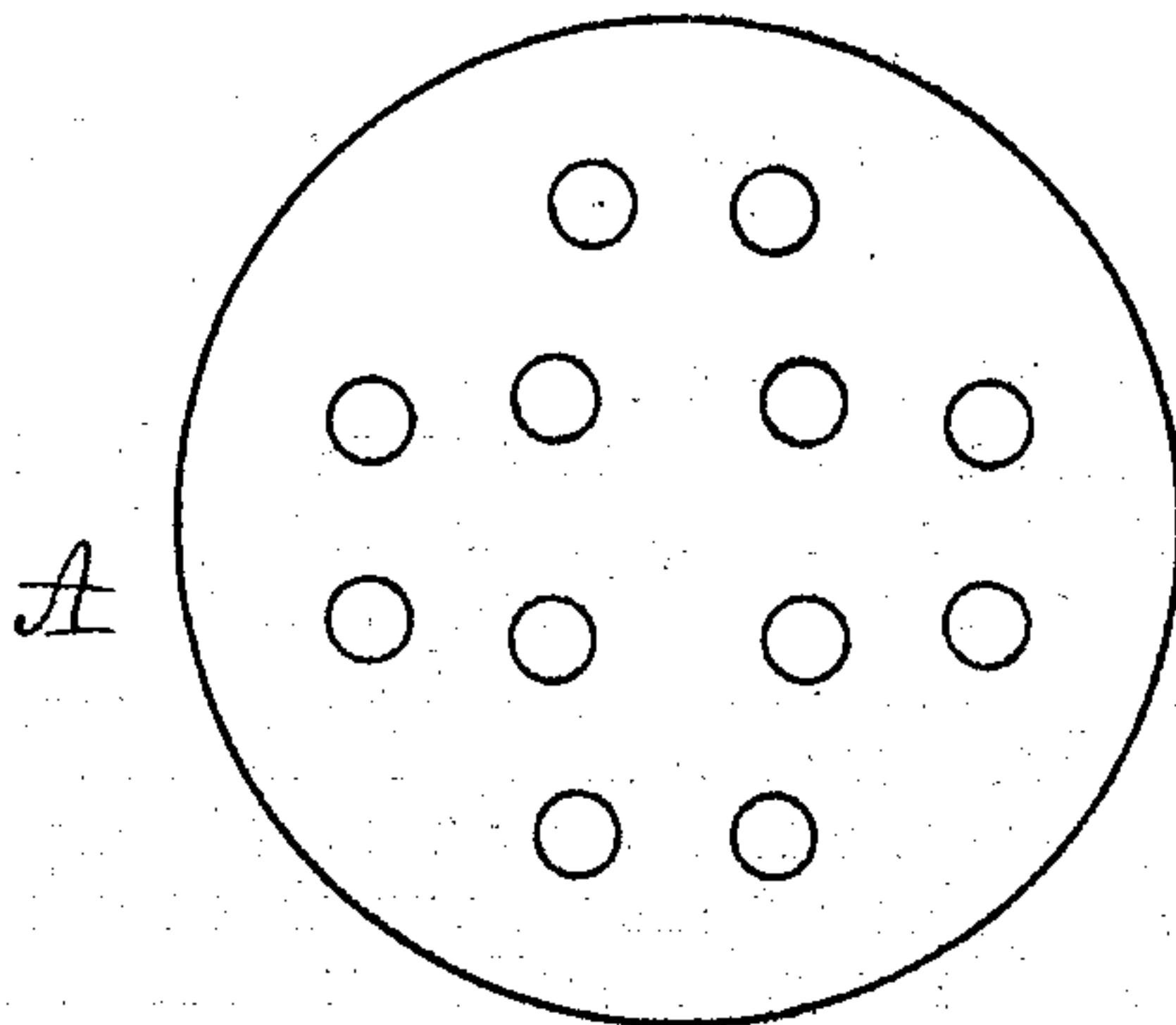


Fig. 3.

A

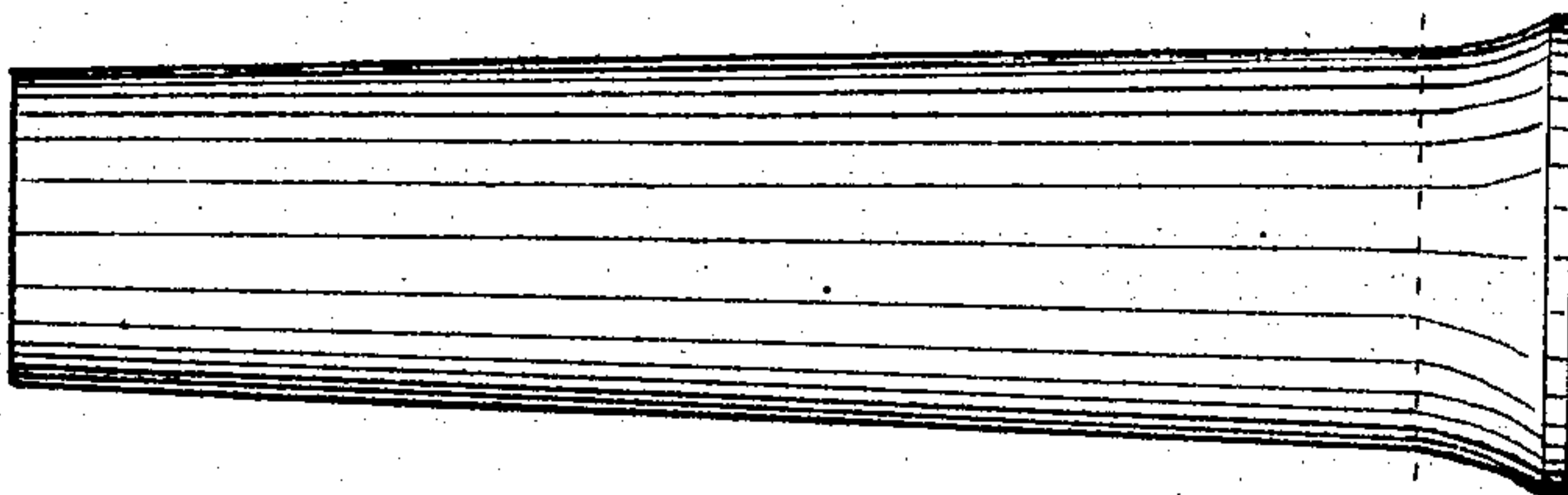
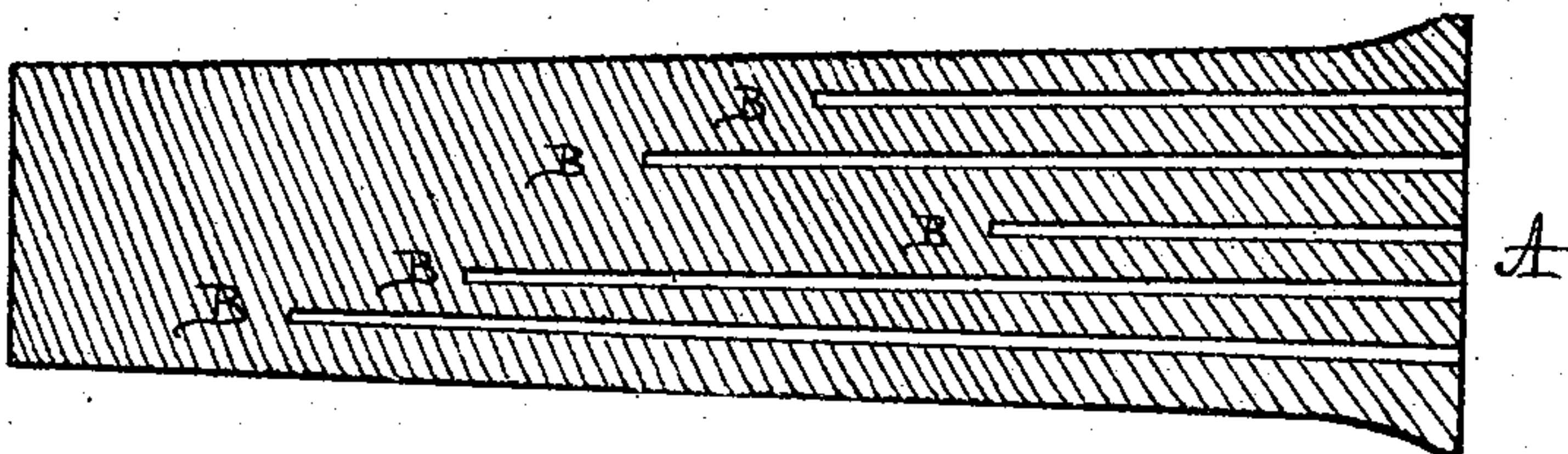


Fig. 4.



Witnesses:

Jacob E. Schiedt.  
Alfred C. Savidge

Inventor:

Charles H. Baker,  
by John C. Diederichs  
Atty.



# UNITED STATES PATENT OFFICE.

CHARLES H. BAKER, OF PHILADELPHIA, PENNSYLVANIA.

## IMPROVEMENT IN TUYERES FOR BESSEMER CONVERTERS.

Specification forming part of Letters Patent No. 129,512, dated July 16, 1872.

*To all whom it may concern:*

Be it known that I, CHARLES H. BAKER, of the city and county of Philadelphia and State of Pennsylvania, have invented a new and useful Improvement in Tuyeres for the Bessemer Process of Making Steel; and I do hereby declare the following to be a clear and exact description of the nature thereof sufficient to enable others skilled in the art to which my invention appertains to fully understand and use the same, reference being had to the accompanying drawing making part of this specification, in which—

Figure 1 is a bottom view of the device illustrating my invention. Fig. 2 is a top or plan view thereof. Fig. 3 is a side view thereof. Fig. 4 is a vertical section, the constant or ordinary openings not being shown.

The Bessemer process of making steel is sufficiently known not to require a description at this time. In that process, however, there is employed a strong vessel of peculiar form, which is known as a converter, having a movable bottom and trunnions, on which it turns. It is also lined with a silicious mixture to resist the heat. The air is forced in at the bottom of the vessel and enters through perforations in cylinders of fire-brick denominated tuyeres. These tuyeres pass through an iron plate, which keeps them in position. They are then built into a "bottom" by ramming around them a mixture of crushed stone and fire-clay slightly wet and rammed solid. The bottom is then baked and becomes as hard as stone. Thus the tuyeres are firmly embedded in the mixture, together forming almost a homogeneous mass, and offering by their perforations the only means of entrance for air. The bottom is held in position in the vessel by bolts, so that its surface touches the silicious lining of the inside, and on this bottom the melted iron rests in actual contact with the tops of the tuyeres and crushed stone, &c., of which it is constructed. The bottom has to sustain the whole weight of the melted iron. As an example, six tons of this iron are made into steel at one operation or charge, and as the air is forced in and the chemical action progresses the whole charge of melted metal is violently agitated. This agitation, the weight of the charge, and the heat of the melted metal

all unite to wear away the refractory materials composing the "bottom," so that its surface is gradually lowered, especially in the center, and naturally the tuyere becomes shortened. The bottom is worn away with greater or less rapidity and not at all regularly. One bottom will resist the hurtful influences of from one charge to nine or ten charges, during which operation the tuyeres are shortened from twenty inches in length to nine, eight, or even six inches, but it is not usually safe to use the bottoms if the tuyeres have become as short as nine inches, so that their lengths afford means of judging of the endurance of the bottoms and of determining how soon a new one must be substituted in order that the work may go on. It is the business of a man to ascertain the status of the bottom and measure the tuyeres with a wire run through the perforations. After a charge of iron has been converted into steel in the vessel by the action of air, as described, the liquid metal is poured into a ladle and the requisite castings are made. When the vessel has been emptied it is partially inverted and the workman or "vessel-man" looks upward at the bottom through the opening in the vessel and there sees in the surface of the bottom the tops of the tuyeres, which are embedded in it.

My invention is designed to dispense with this mechanical measurement and form convenient means of ascertaining the state or alteration of the tuyere. To this end the invention consists in a self-gauging tuyere; and it also consists, in connection with the "constant" openings, in introducing in the tuyere a number of indicators running partially through the tuyere which shall open successively or present themselves as the tuyere is shortened by use, which indicators will be open or visible at a known distance from the top of the tuyere so that the mere appearance of an opening or exposition of an indicator in any tuyere during its use will indicate at a glance to the vessel-man or workman that the length has been altered by the known distance. It also consists in making the indicators of any desirable cross-section to attract notice with greater certainty. It further consists in grouping the indicators so that they open or present themselves according to any desirable plan or pattern. It



finally consists in arranging the indicators so as to open or present themselves in any desired succession.

Referring to the drawing, A represents a tuyere for the purposes of making steel by the process set forth. In this tuyere will be formed the constant openings for the air as usual. B represent the indicators, which may consist of holes or openings, rods of some refractory material or colored stripes in the tuyere, or any other characteristics which will run partially through the tuyere in such a manner and of such differing lengths that one shall open or present itself every time a known length of the material of the tuyere has been removed during its use. These indicators present themselves to the observer by inspecting the bottom of the converter, and the consequent reduction of the length of the tuyere will be noticed and appreciated. The indicators may be arranged to present themselves in an order, progressing from left to right, round the tuyere "against the sun," (a mechanical expression;) and also, as an additional warning, I may place the shortest indicator in the most conspicuous place as of importance to attract attention. It is well that the outer holes are disposed in groups, so that those in the four different groups—say, of three holes each—approach each other until their centers are one inch instead of one and a quarter inch apart, making the minimum distance between the holes themselves at the bottom one-half inch, which is thick enough to answer the purpose. The thickness is something of a consideration, since the air passing through the holes is at a pressure of twenty to twenty-five pounds per square inch, and the tuyeres sometimes break short across and blow out. After this change in the constant holes, if I use blind holes or openings, I insert the

outer holes, so that, accordingly, at the bottom of the tuyere the least thickness between the holes will be one-half inch. A variation is made in the central blind-hole, which is but three-eighths of an inch from the other; but this is of little or no use for admitting air, since the tuyere seldom becomes much shorter during use than the length this central hole indicates. The indicators may be made round, square, rectangular, polygonal, or irregular in cross-section, that they may more readily attract attention. The indicators may be grouped, so that by their opening or exposition, according to any regular or irregular plan of pattern, they may the more readily challenge notice.

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

1. A self-gauging tuyere, substantially as and for the purpose described.

2. A tuyere rendered self-gauging by causing its appearance while in use to indicate its length, substantially as set forth.

3. In a tuyere, indicators, which extend partially therethrough, substantially as and for the purpose described.

4. The indicators in a tuyere, grouped so that their opening will the more readily attract attention, or arranged so as to open in any desired succession, substantially as described.

5. The combination, with the constant air-holes in a tuyere, of blind-holes or other indicators, which shall become visible as the tuyere is worn down, substantially as described.

The above signed by me this 23d day of January, 1872.

CHARLES H. BAKER.

Witnesses:

JAMES BUTLER,  
JOSEPH WOOD.