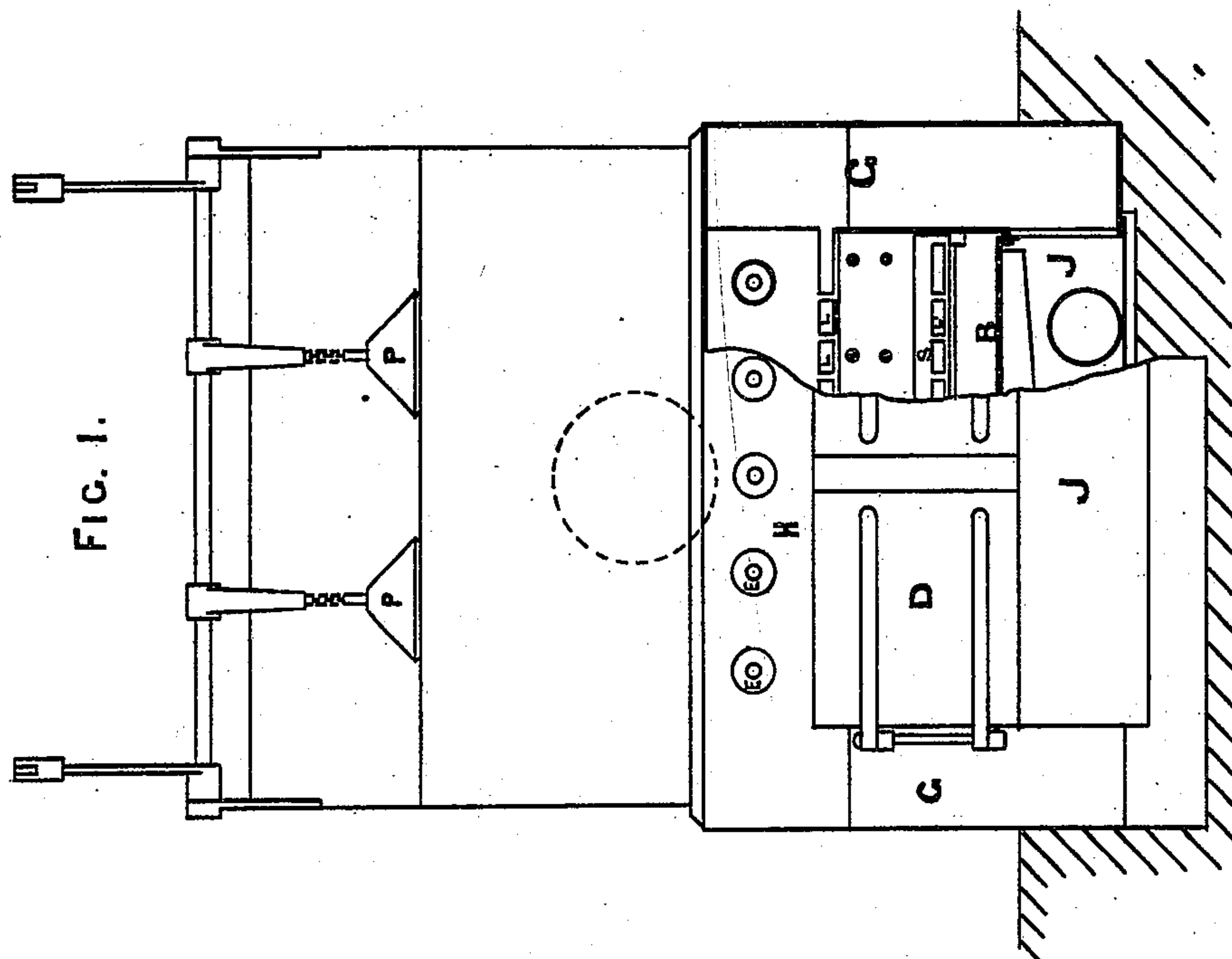


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Furnace.

No. 230,104.

Patented July 20, 1880.



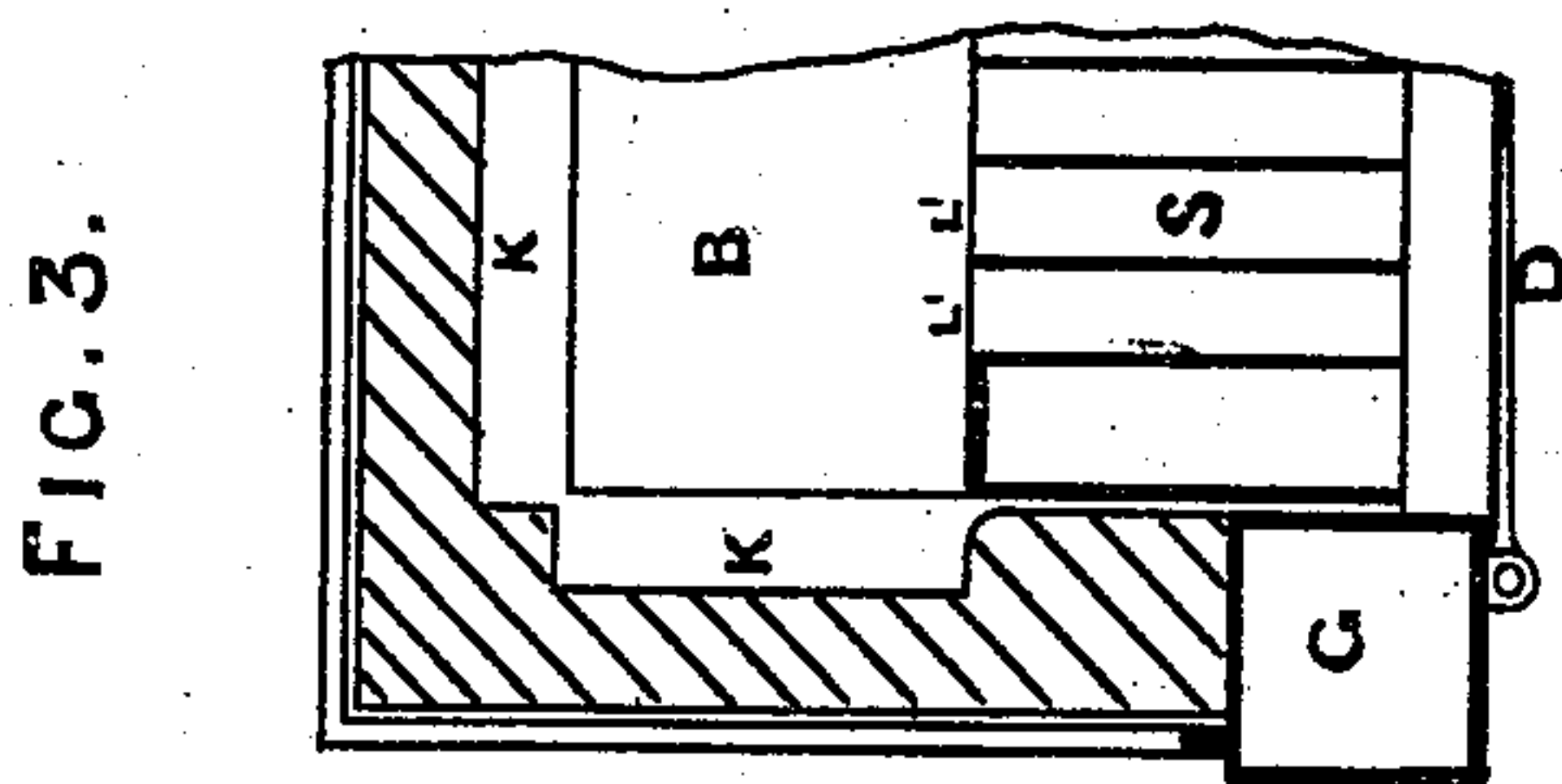
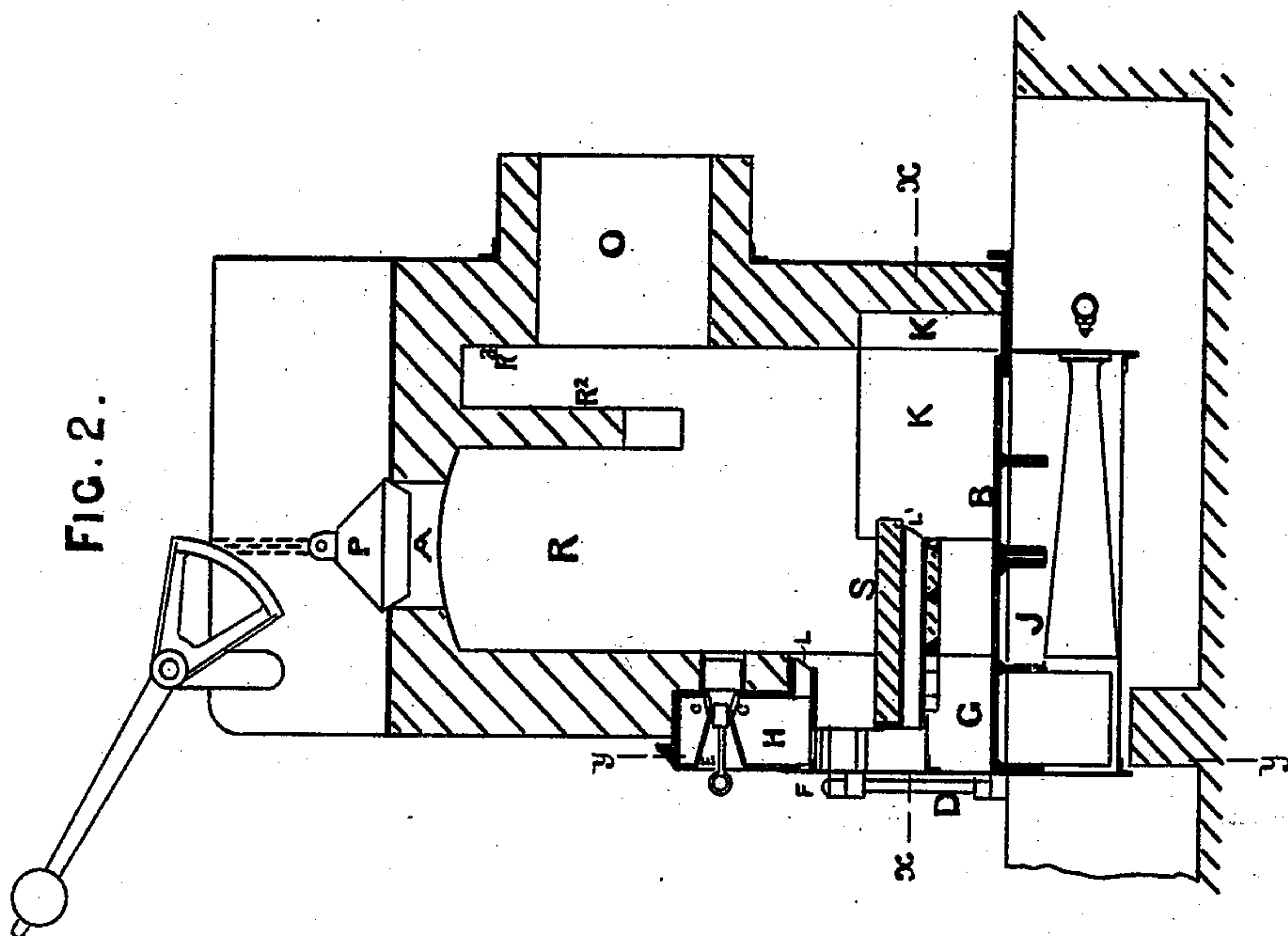
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# UNITED STATES PATENT OFFICE.

EDWARD BROOK, OF BRADFORD, GREAT BRITAIN, ASSIGNOR TO HENRY ARTHUR GADSDEN, OF LONDON, ENGLAND.

## FURNACE.

SPECIFICATION forming part of Letters Patent No. 230,104, dated July 20, 1880.

Application filed February 16, 1880. Patented in England July 16, 1879.

*To all whom it may concern:*

Be it known that I, EDWARD BROOK, of Bradford, in the county of York, Kingdom of Great Britain and Ireland, have invented new and useful Improvements in Furnaces, of which the following is a specification.

This invention relates to furnaces for the combustion of fuel, applicable to the manufacture of iron, chemicals, glass, the production of gas, heating of steam-boilers, and such like purposes, and particularly to furnaces of the class wherein, as usually constructed, a round, square, or rectangular chamber of considerable depth, built of fire-brick, with solid hearth and no grate-bars, has at the top a retort or receptacle, into which the fuel is fed, and which is open at the bottom, around, or partly around, which the escaping gases and flame circulate on their way to the outlet, the ashes and fire resting on the hearth, and one or more doorways or openings being provided in the walls for removal of ashes, also openings or tuyeres above the floor for admitting air to the fire, and the whole being cased outside with iron or bound together by stays and rods.

According to my invention, I apply to such furnaces an improved step-grate, and construct them with an improved arrangement of bottom or lower part, as hereinafter described.

In carrying out my invention I build the furnaces, as previously described, square or rectangular in plan; but I recess the back and part of the two end walls somewhat on the inside at the bottom, and provide a hollow casting to carry the front wall, which casting I arrange at some distance above the floor, thus leaving an opening or doorway underneath, through which the ashes and clinkers are removed. At the bottom of the furnace I provide a floor of iron plates, and underneath this floor an air-tight chamber, into which the necessary air is forced by means of one or more steam-jet blowers, and from whence it is led by passages up the sides of the doorway into the hollow casting over the doorway. This hollow casting over the doorway, supporting the front wall, is perforated along its inner face for passing a portion of the air and steam into the fire at this point, and it is also perforated along its under side for passing the remainder of the

air and steam into passages formed in an iron door, closing the aforesaid doorway when the furnace is at work. The passages in this iron door lead downward a little distance to the outer edge of a casting acting the part of what is commonly known as a "step-grate." This casting or step-grate, instead of being formed of one flat plate or bar, as is customary, is composed of two plates a little distance apart, connected together by ribs, thus forming passages therein, through which the greater part of the air and steam coming down the passages in the door is passed into the fire. This step-grate is considerably broader than usual, and is protected, where necessary, by refractory material. It rests on supports at each end of the furnace, about half-way up the doorway, thus leaving a space above and underneath it, through which spaces the ashes and clinkers are easy of access and removal. The front part of the fire being held up by this step-grate gives ready access to the ashes, &c., collecting at the back part of the furnace.

In the drawings, Figure 1 is a front elevation, with part in section on the line *y y* in Fig. 2, and Fig. 2 a transverse sectional elevation, showing a furnace according to my invention. Fig. 3 is a part horizontal section in the line *x x* of Fig. 2.

The same letters are used in all the views to denote like parts.

R R is the retort or receptacle, open at the bottom. It is formed by building an arch,  $R^2$ , across at a little distance from the back wall,  $R^3$ . This retort is kept filled, or nearly so, with fuel fed through the opening or openings A, closed by a plug or plugs, P, lined with fire-clay, and each fitting into a hole in an iron plate laid on the top.

B is the solid hearth of iron plates, ribbed underneath, upon which part of the ashes and clinkers rests. O is the outlet for the flame and gas. D is the door closing the opening for withdrawal of ashes and clinkers. This door has plates secured to it, so as to form passages for conveying air or air and steam to the step-grate and lower part of the fire.

S is the step-grate, resting on supports at each end of the furnace, and protected by refractory materials, as shown. Its principal ob-



ject is to support the front portion of the fire, thus giving great facility for access to and withdrawal of ashes and clinkers that collect at the back part.

5 In practice it is desirable the space underneath the step-grate should be not less than about seven inches deep.

H is the hollow casting, which is arranged to support the front wall over the doorway and  
10 convey air to the various apertures for admission to the fire, and has stoking-holes E cast with it, to admit of breaking up the fire, the holes being closed by small movable plugs.

*c c* are small perforations having an aggregate area slightly larger than the openings closed by the small plugs. Through these  
15 openings *c c* air passes into the fire, thus preventing flame from issuing when the small plugs are withdrawn from the stoking-holes.  
20 There are other perforations (marked F) in this casting, to admit of the insertion of bars when necessary to support the fire while withdrawing ashes and clinkers from the top of the step-grate.

25 G G are castings for conveying the air and steam from the steam-jet blowers up the sides of the doorway to the hollow casting H. J is the air-tight chamber containing the steam-jet blowers. K K are the recesses in the back and  
30 part of the two end walls, for preventing clinker adhering to the walls at these parts. The openings L L', where the air or air and steam issue into the fire, should not extend to the end walls within about nine inches.

35 The furnace is shown in the drawings as a gas-producer cased with iron, which is carried up some distance above the top, to retain the coal when it is thrown thereon and to carry the shaft and levers for working the plug or  
40 plugs P; but in some cases, where the furnace can be placed close to the object to be heated, and where the chimney-draft is capable of drawing sufficient air through the fire without the aid of the steam-jet blowers, the air-tight chamber J and the steam-jet blowers may be omitted.  
45

In applying the furnace to the various purposes enumerated it is to be placed as close as convenient to the object to be heated, and the outlet O connected thereto by a fire-brick flue,

and the gas burned at the point where the heat  
is required, on any of the well-known systems. 50

In some applications, where the furnace can be placed close to the object to be heated—as, for instance, when applied to a large puddling-furnace or to a steam-boiler with two flues—I  
55 provide two outlets for the gas and flame.

What I claim is—

1. In a furnace such as hereinbefore referred to, a step-grate composed of two plates a little distance apart, connected together by ribs  
60 forming passages therein, through which the greater part of the air and steam coming down the passages in the door is passed into the fire, all constructed and arranged substantially as described. 65

2. In a furnace such as hereinbefore referred to, a hollow casting, H, having stoking-holes, air-holes, and passages formed therein, the whole being constructed and arranged for operation substantially as hereinbefore described  
70 and shown, and for the purposes specified.

3. In a furnace such as hereinbefore referred to, the combined arrangement of apparatus whereby air or air and steam is or are caused to pass through the hollow casting H, formed  
75 with stoking-holes E, and which supports the front wall over the doorway, and thence to the interior of the furnace, partly in a direct manner through openings L and partly through passages in the door D, all substantially as hereinabove described and illustrated. 80

4. The combination of parts constituting the improved furnace, consisting of the retort R, arch R<sup>2</sup>, back wall, R<sup>3</sup>, opening or openings A, plug or plugs P, solid hearth B of iron plates  
85 ribbed underneath, outlet O, door D, step-grate S, hollow casting H, with stoking-holes E and movable plugs and perforations *c c* and F F, castings G, air-tight chamber J, recessed back and end walls, the whole constructed, arranged, and operating substantially as described and shown. 90

EDWARD BROOK.

Witnesses:

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