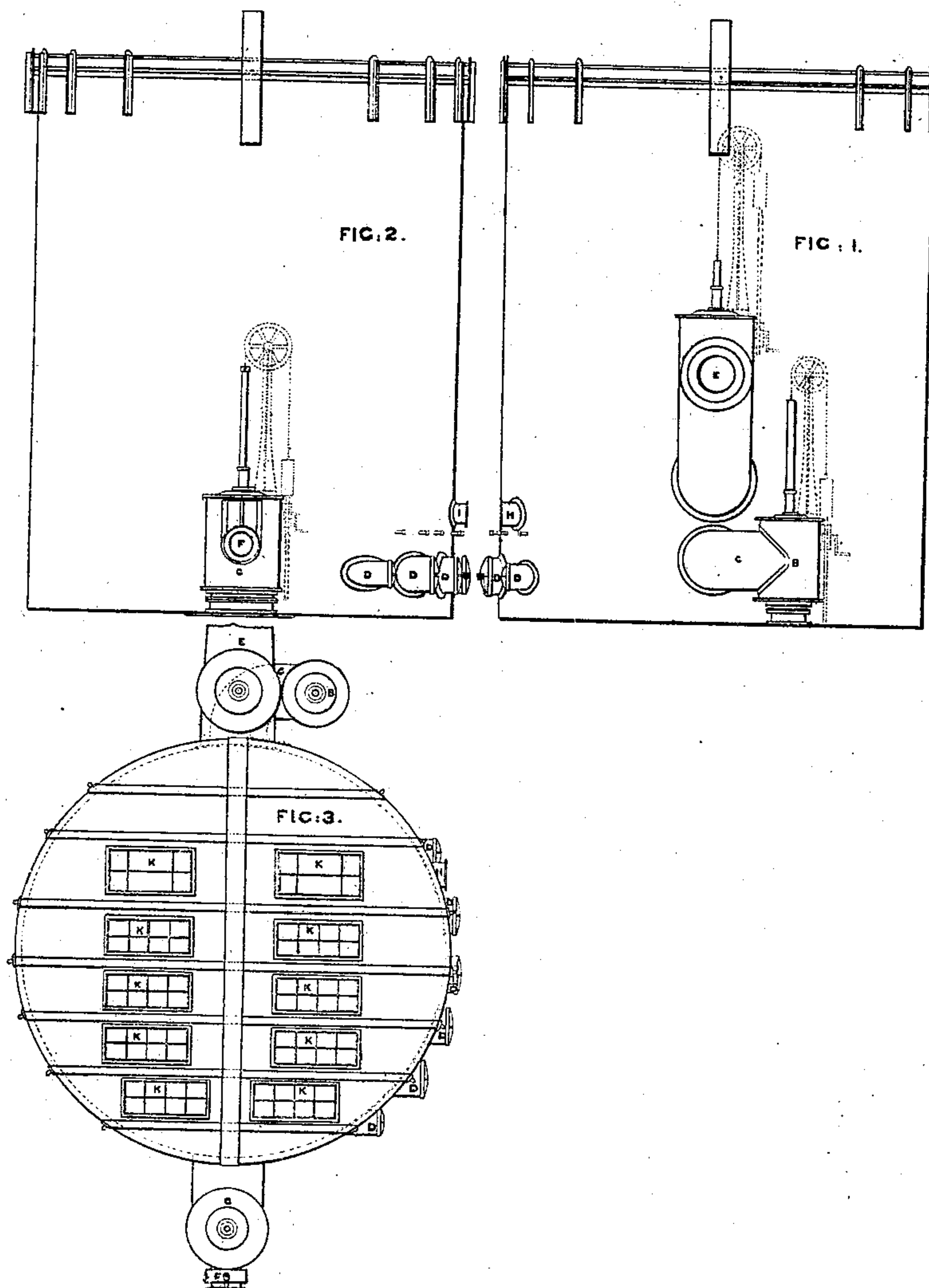


T. WHITWELL.

Improvement in Hot Blast-Ovens for Metallurgic-Furnaces.

No. 130,885.

Patented Aug. 27, 1872.



Witnesses.

Benjamin Ford
Joseph E. Brooks

Inventor.

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FIG 1

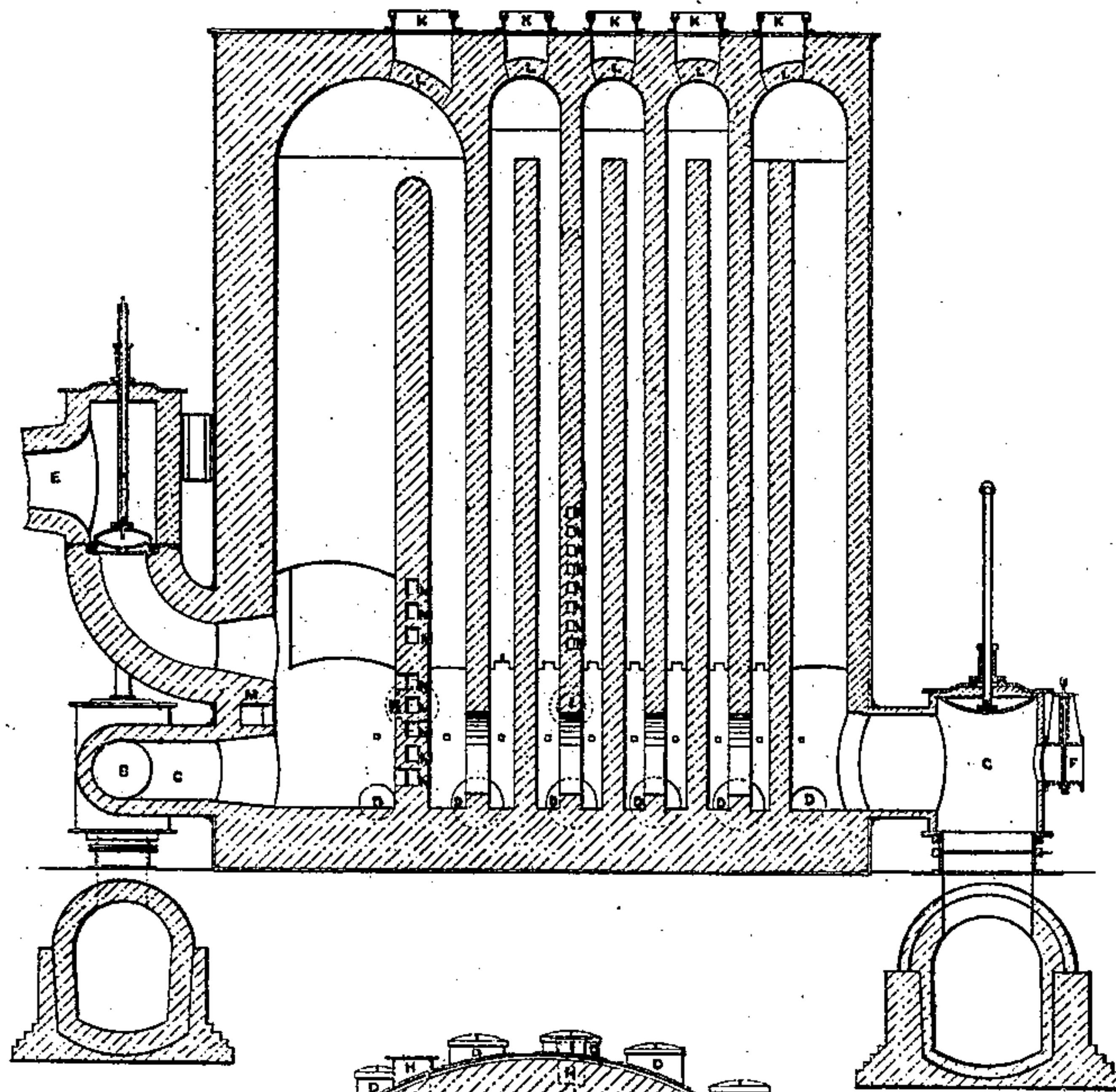
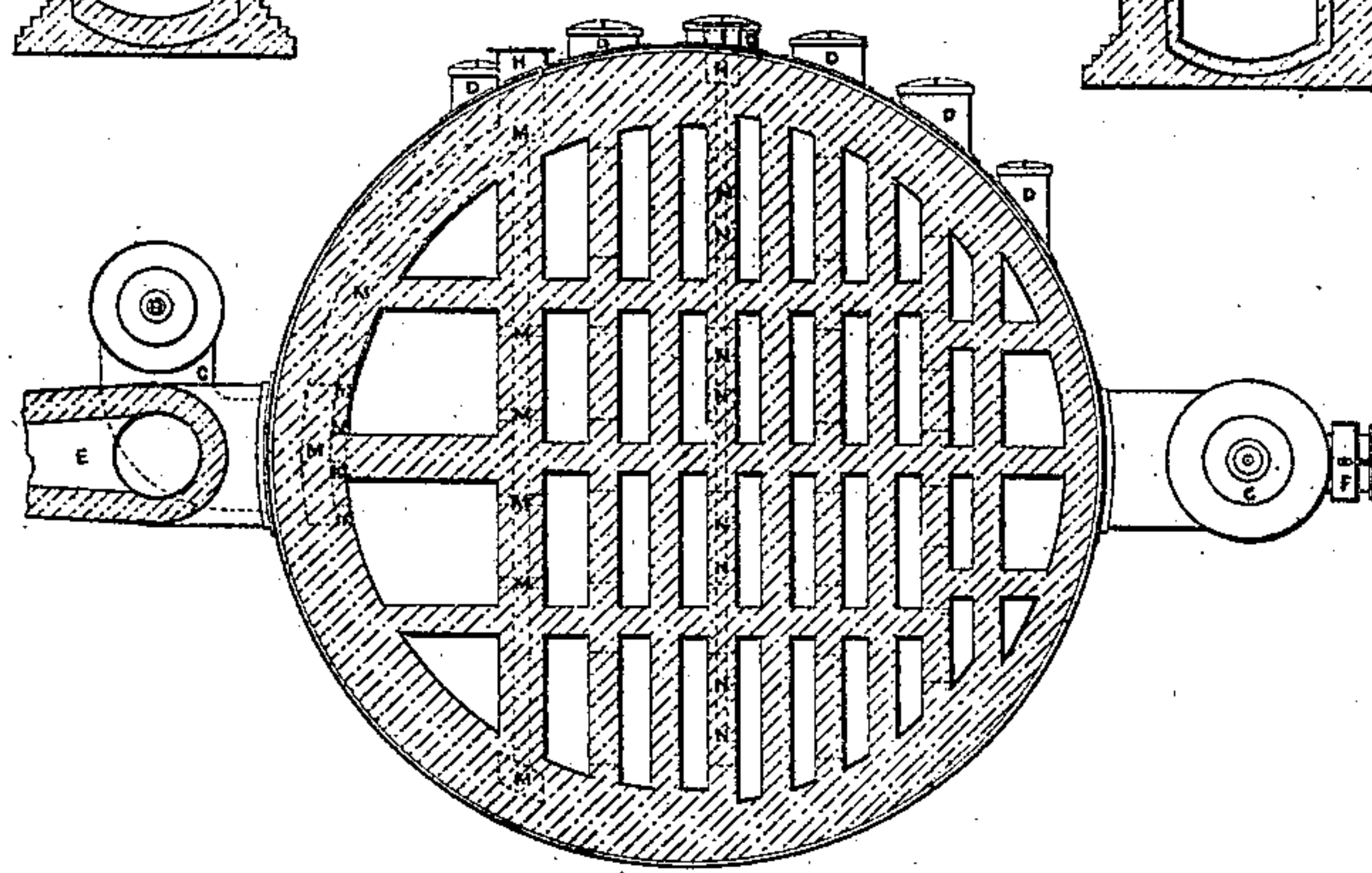


FIG 2



Witnesses.

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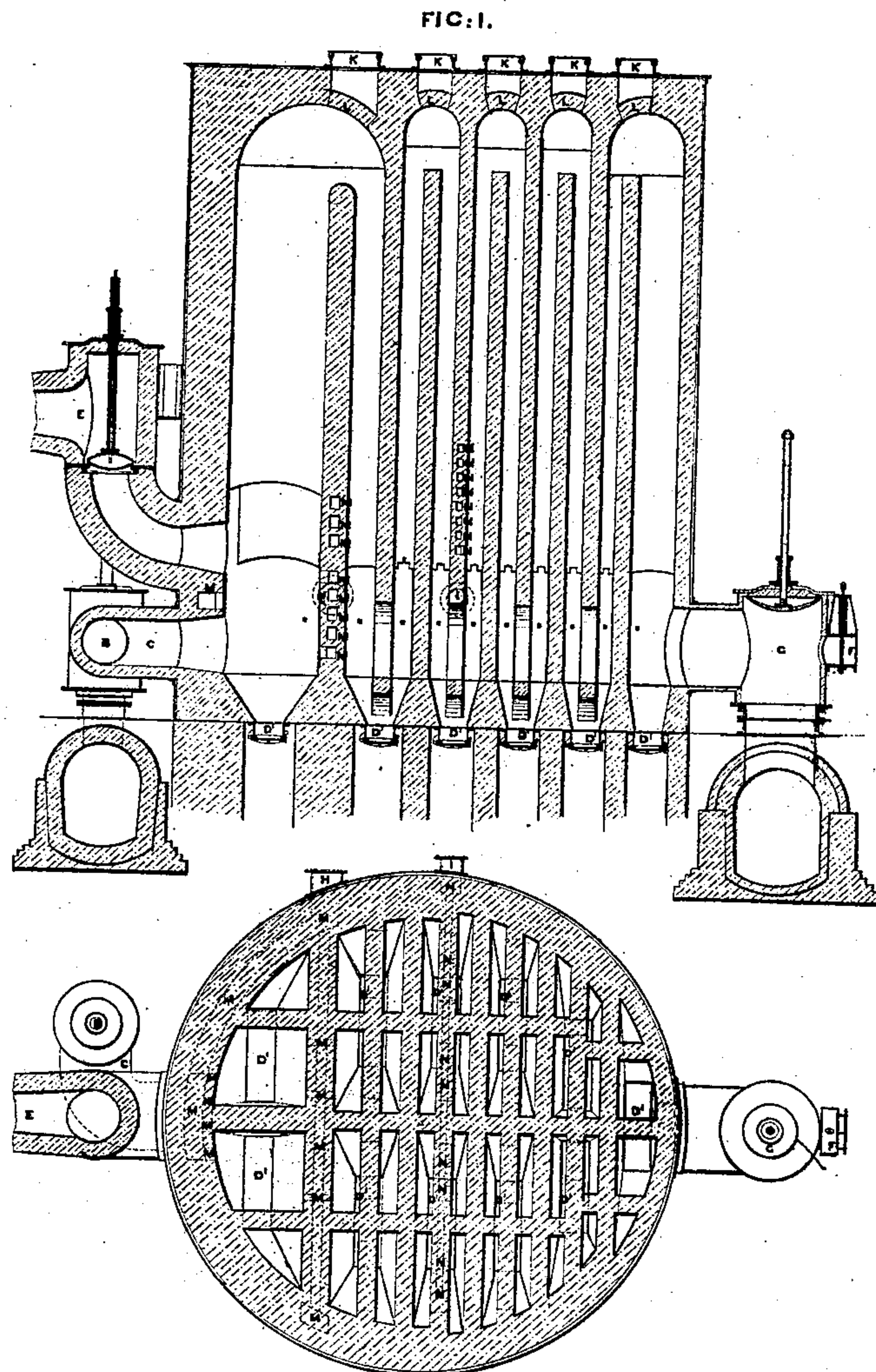


FIG. 2.

Witnesses.

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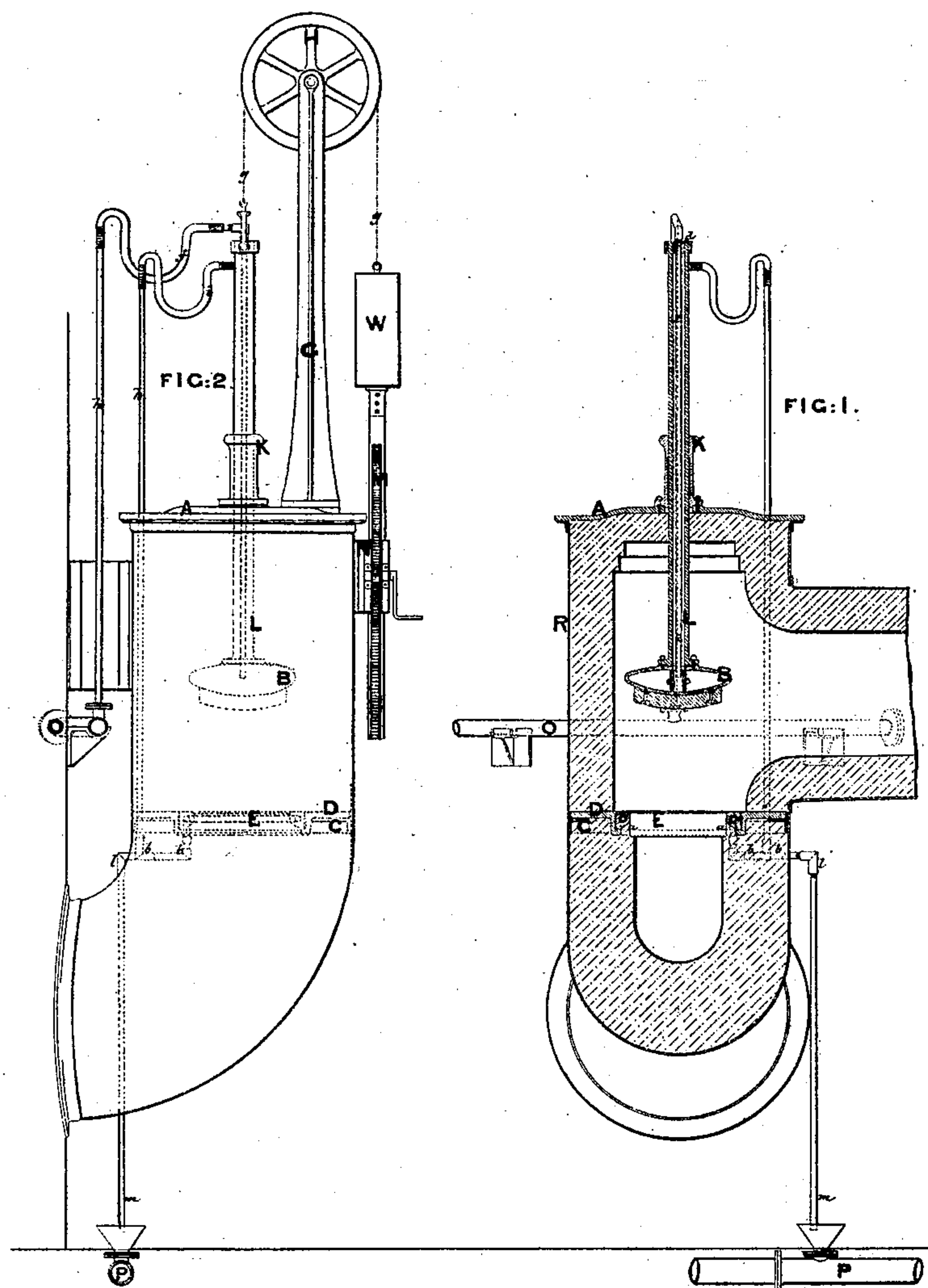
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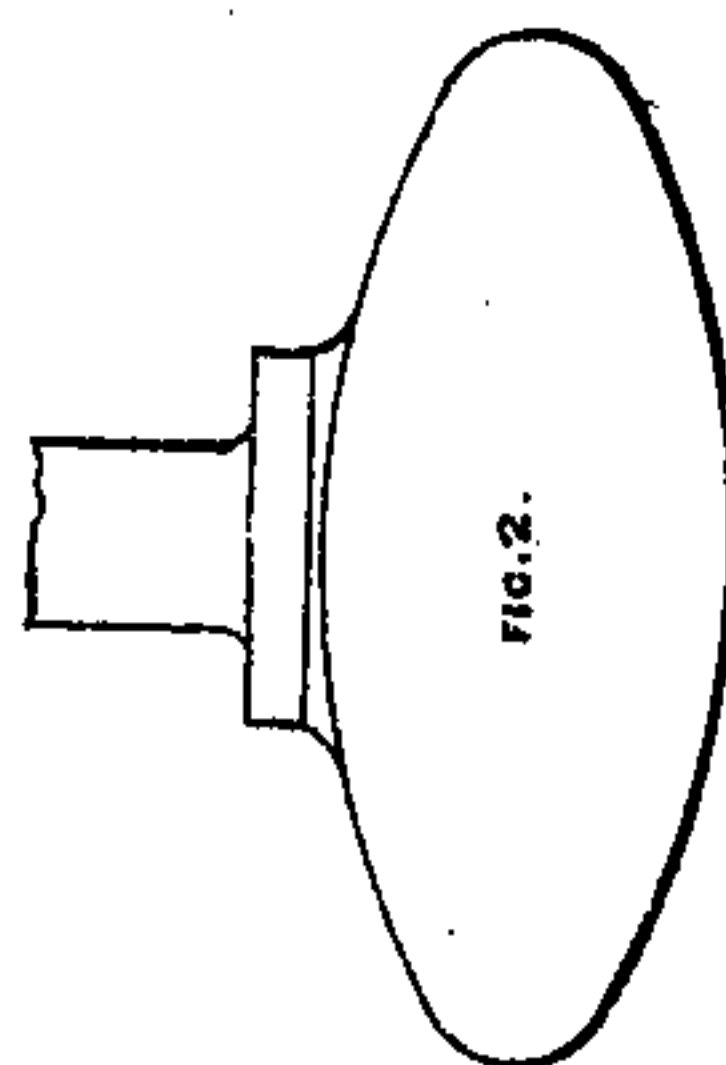
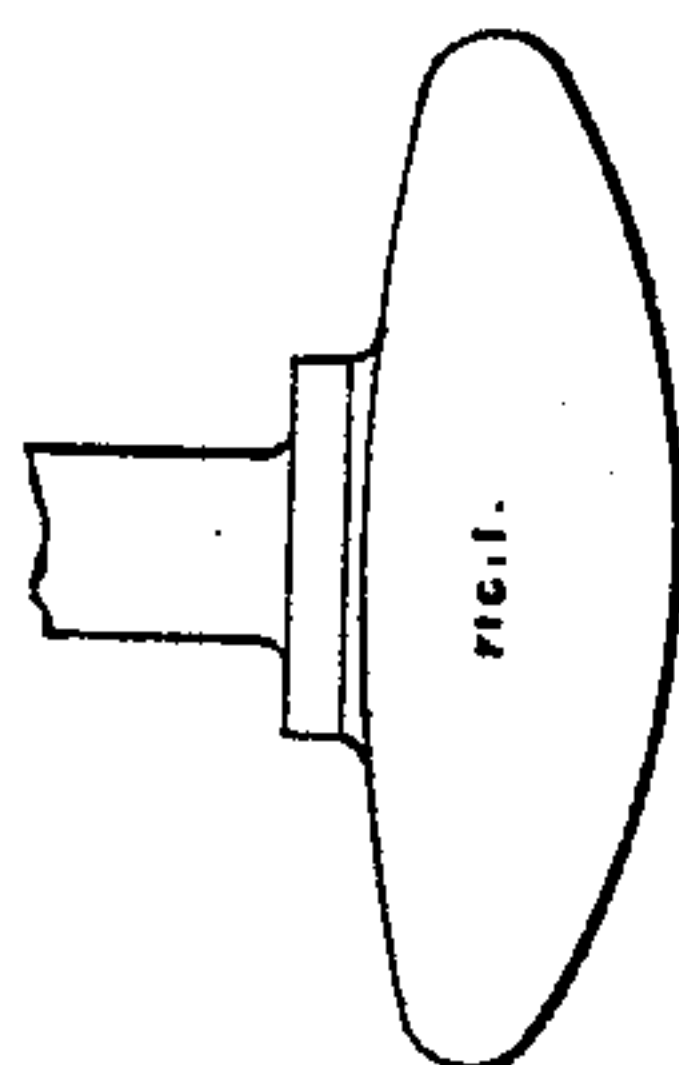
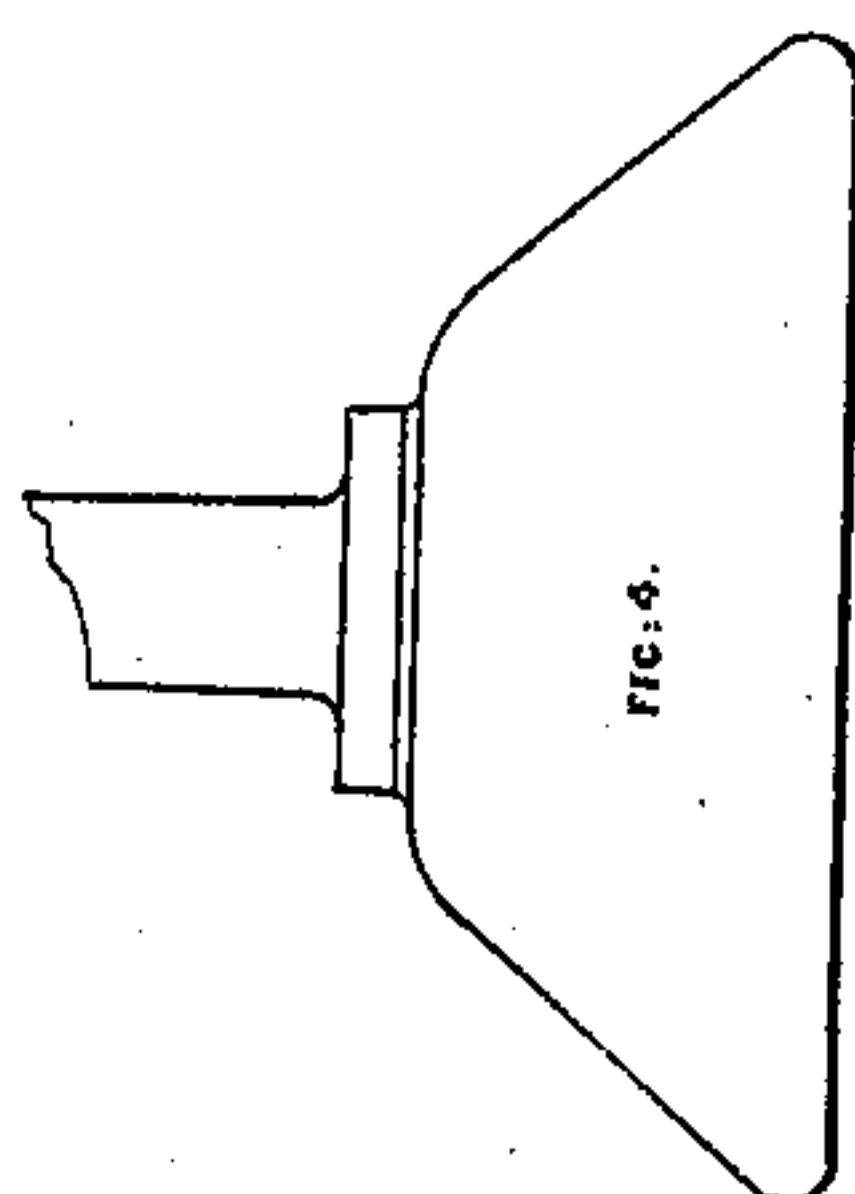
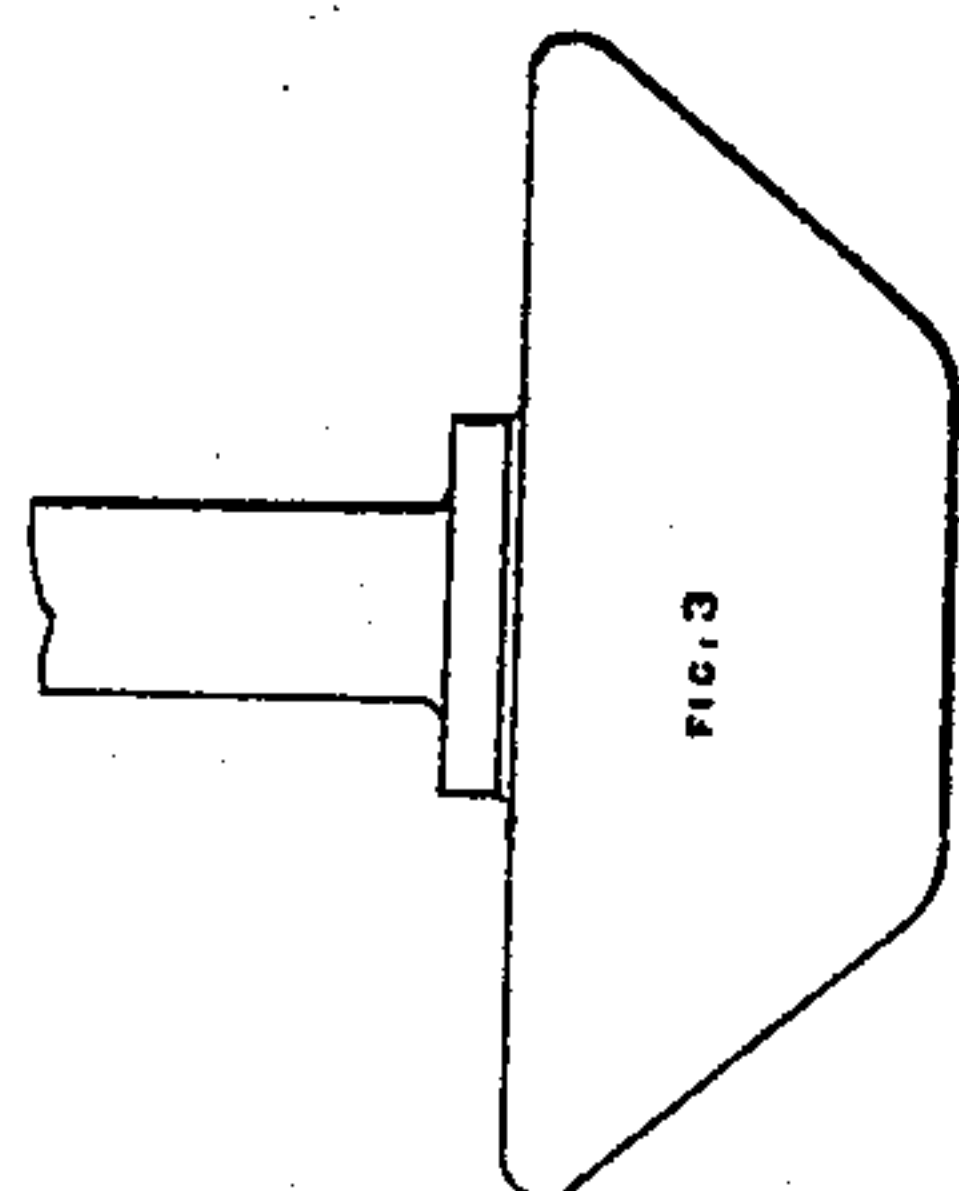
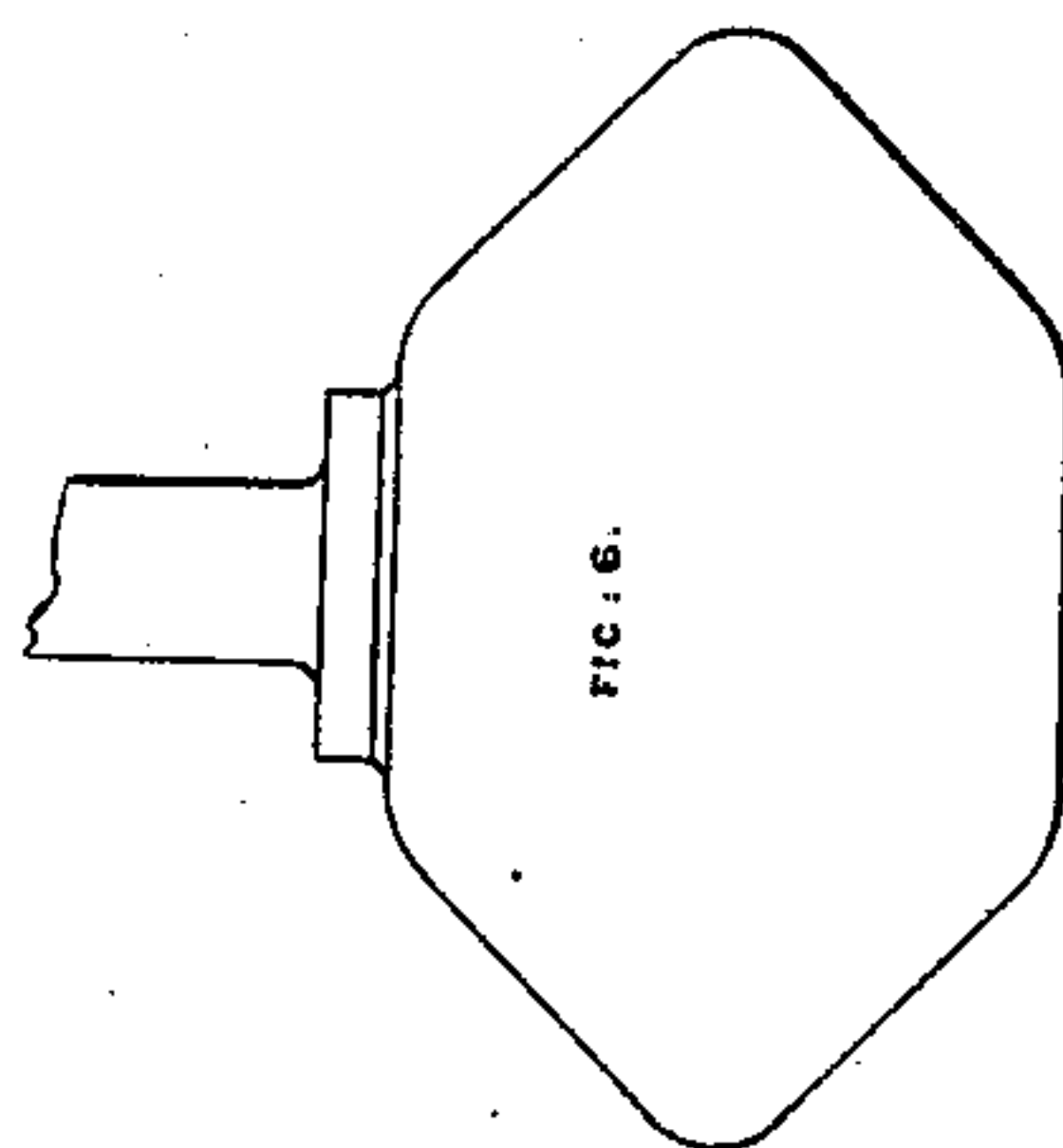
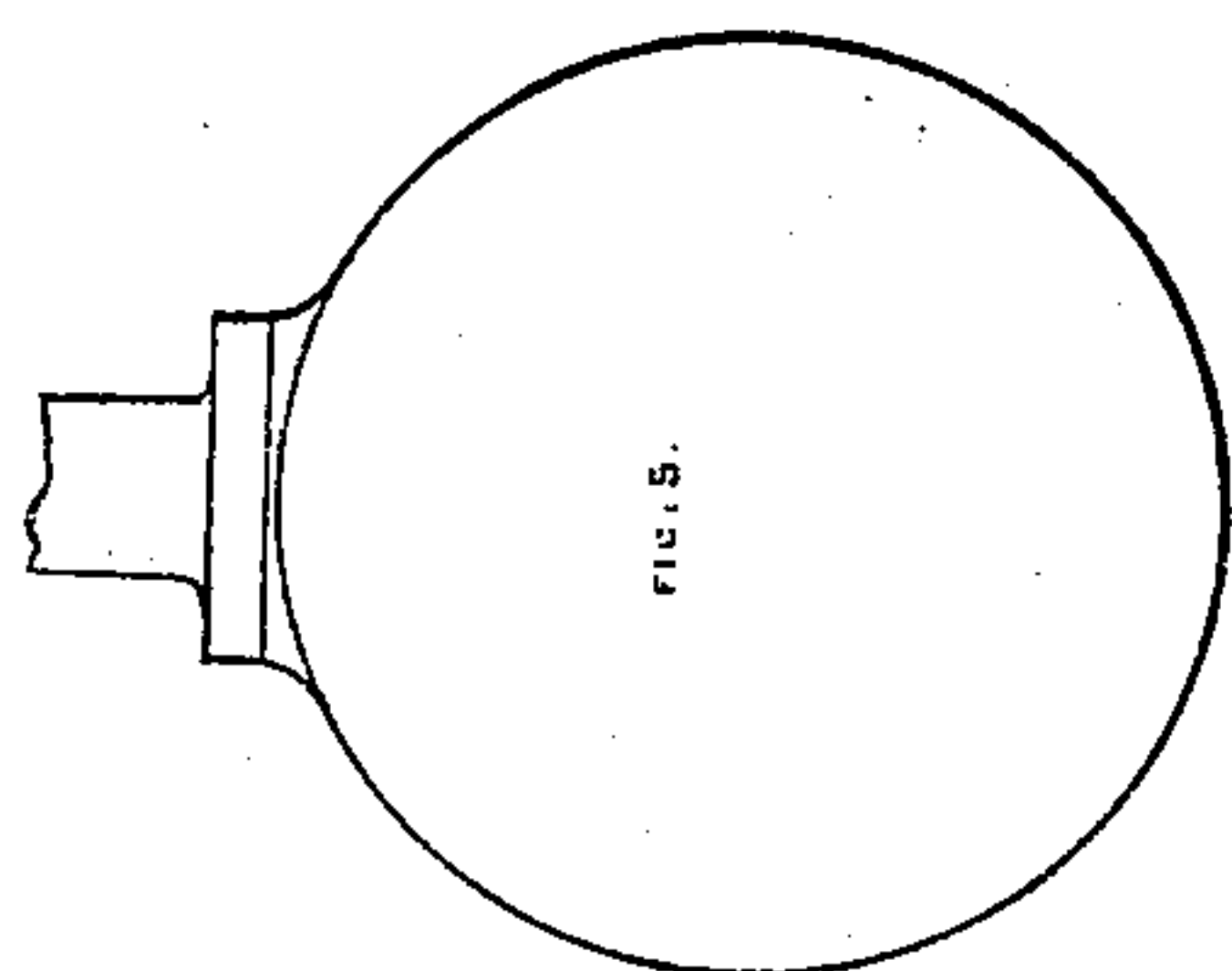
Inventor:
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Witnesses.

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Joseph E. Brooks

Inventor.

Thomas Whitwell

UNITED STATES PATENT OFFICE.

THOMAS WHITWELL, OF STOCKTON-UPON-TEES, ENGLAND.

IMPROVEMENT IN HOT-BLAST OVENS FOR METALLURGIC FURNACES.

Specification forming part of Letters Patent No. 130,885, dated August 27, 1872.

To all to whom it may concern:

Be it known that I, THOMAS WHITWELL, of the Thornaby iron-works, Stockton-upon-Tees, in the county of Durham, England, a subject of the Queen of Great Britain, have invented or discovered new and useful Improvements in Furnaces and Apparatus used in Heating Airs or Gases for the Supply of Blast-Furnaces and for other purposes; and I, the said THOMAS WHITWELL, do hereby declare the nature of the said invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement thereof; that is to say—

This invention has for its object improvements in furnaces and apparatus used in heating airs or gases for the supply of blast-furnaces and for other purposes. Two or more similar ovens or heating-chambers are employed, which are alternately heated by burning therein gas supplied from any suitable source, and the airs or gases to be heated are alternately directed into and caused to pass through these two or more ovens or chambers. Each oven or heating-chamber is inclosed by a wall, by preference of a circular form, and is divided by upright parallel partitions or walls, stayed by cross-walls, into several compartments. These walls are formed of fire-brick, ganister fire-stone, or other refractory material. The top and bottom of each oven or chamber may be formed similarly to the walls. These walls are alternately constructed with openings at top and bottom, so that the airs or gases in passing through an oven or chamber pass alternately under and over the succeeding walls or partitions. I form such furnaces, ovens, or heating-chambers with openings in their tops, sides, and bottoms for facilitating the cleaning of the interior surfaces of their walls from the dust deposited by the gas burned therein during the heating of such ovens or heating-chambers. For this purpose I form the top of each furnace, oven, or heating-chamber with an opening or openings above each of the vertical walls, which do not ascend to the top; and I make the opening of proper size and dimensions to enable a workman to introduce a convenient instrument and use it for the purpose of detaching the dust from the surfaces of the vertical walls at each side of the same. At the lower

part of such furnace, oven, or heating-chamber I form suitable openings closed by plugs or lumps of refractory material, for the purpose of removing such dust from the furnace, oven, or heating-chamber, as may have been detached from the vertical walls. I also, in positions where it may not be convenient to construct the opening, as above described, prefer to make the same in the bottom of the stove in such position as may be suitable or convenient for the purpose of removing the dust deposited on the walls by the gas above mentioned. I prefer to cover the exterior of the oven or heating-chamber with iron. I form other openings closed by suitable doors or valves, for the purpose of admitting the air necessary for the combustion of the burning gas in heating the furnace, oven, or heating-chamber; and I construct the brickwork in such manner as to heat the air, as aforesaid, for the promoting of a better combustion and for regulating the temperature of the furnace, oven, or heating-chamber.

At the opposite side of each furnace, oven, or heating-chamber are suitable openings for supplying gas to the furnace, oven, or chamber for the heating of the same, and for allowing the products of combustion to pass from each oven or chamber to the chimney.

Suitable pipes are constructed for conducting airs or gases into the oven or chamber; but when the airs or gases are passing through the furnace, oven, or heating-chamber they are caused to flow in the opposite direction to that in which the burning gas has been previously caused to flow through the oven or chamber when heating it, and this is caused by the valves aforesaid, which are worked in such manner as to cause the airs or gases to be heated to enter at the side or end of the furnace, oven, or heating-chamber where it is connected to the chimney, and to cause the airs or gases, when heated, to pass off by the pipe provided for the purpose at a high degree of temperature.

By the construction of these furnaces, ovens, or heating-chambers, the airs or gases to be heated are caused to pass over the identical surfaces previously traversed by the burning gas in heating the oven or chamber. The air necessary for the combustion of the burning gas employed in heating the furnace, oven, or

heating-chamber is by the means herein set forth caused to be heated previous to mixing with the burning gas, whereby the intensity of the combustion is increased. The air is also introduced at one or more suitable places, whereby the furnace, oven, or heating-chamber may be heated to one uniform temperature, as may be desired. The valves which I employ are made hollow and with hollow spindles, so that water may circulate through both the valve and the spindle. The bottom of the valve is convex downward, (by preference, or it might be flat,) so as to remove any liability to deposit around the periphery of the valve where it fits against its seat.

Having thus stated the nature of my said invention, I will proceed more fully to describe the manner of performing the same.

Description of the Drawing.

Figure 1, Sheet 1, is a side elevation of apparatus constructed and combined according to my invention, showing the burning-gas inlet, and the outlet for the heated airs or gases. Fig. 2, Sheet 1, is a side elevation of apparatus, showing the burning-gas outlet and inlet for the airs or gases to be heated. Fig. 3, Sheet 1, shows a plan of one of the furnaces or heating-chambers. Fig. 1, Sheet 2, is a vertical section of a furnace or heating-chamber, and Fig. 2, Sheet 2, is a sectional plan of the same.

In each of these figures the same letters of reference are used to indicate the same parts.

The apparatus consists of two or more similar furnaces, ovens, or heating-chambers, whereof one only is shown. The furnace, oven, or heating-chamber consists of an air-tight shell of iron inclosing a circular wall constructed of fire-brick or other material suited to the temperature it will have to bear. The furnace, oven, or heating-chamber is divided by several transverse walls at varying distances from each other, which are crossed at right angles by longitudinal walls for the more perfect support of the same, the whole being properly bonded together. The alternate transverse walls are open at top and bottom, so that the airs or gases to be heated entering at the chimney end of the furnace, oven, or heating-chamber are, by the construction of the walls, caused to ascend, then to descend, then to ascend, and so on until the heated airs or gases leave the furnace, oven, or heating-chamber at the opposite end of the furnace to that at which they entered. At the top of each furnace, oven, or heating-chamber are iron doors K K, which are protected by fire-plugs or lumps L L, which fit the openings on the top of the furnace, oven, or heating-chamber. These openings on the top of the furnace, oven, or heating-chamber are by preference formed over the walls, which do not come to the top of the furnace, oven, or heating-chamber, by which means the surfaces of the walls situated below the opening can be cleaned with facility. These openings, when the airs or gases

to be heated are passing through the furnace, oven, or heating-chamber, are kept closed. In the section shown there are nine of these transverse walls, but the number and also height of the same may be varied according to the extent of surface over which it is desired that the airs or gases to be heated shall pass. At the lower part of the walls, which ascend to the tops of the furnace, oven, or heating-chamber, there are openings for the passage of the airs or gases to be heated. Two or more furnaces, ovens, or heating-chambers are used in combination, in order to maintain a regular stream of heated airs or gases. Gas from any suitable source is supplied to one furnace, oven, or heating-chamber, while the airs or gases to be heated are passing through another furnace, oven, or heating-chamber, and the arrangement of the passages and valves in connection with the furnaces, ovens, or heating-chambers is such that the airs or gases to be heated pass through the furnace, oven, or heating-chamber in the opposite direction, and over the identical surfaces of the brick walls previously traversed by the burning gases, or heating the furnace, oven, or heating-chamber, by these means the airs or gases to be heated absorb heat from the walls in ascending or descending, and thus become of the same or nearly the same heat as the walls of the furnace, oven, or heating-chamber prior to leaving the same. The dust carried by the burning gas employed in heating the furnace, oven, or heating-chamber accumulates on the walls, and requires to be scraped or removed from time to time. The scraping or removal from the walls is performed by proper tools introduced through the top openings K K, as above described, and the dust is removed from the bottom of each chamber or oven, through the openings closed by the doors D D, by means of convenient tools.

I will now describe the process of the heating of the furnace, oven, or heating-chamber. The gas from any suitable source is made to enter by the gas-inlet valve B, whence it is conducted to the furnace, oven, or heating-chamber by the pipe C. The hot-outlet E is closed, and also the cold-inlet F, while the chimney-valve G is opened, as also the air-inlet valves H and I, for assisting in the combustion of the burning gas. By this means the walls of the furnace, oven, or heating-chamber are made red-hot to a proper proportion of the whole furnace, oven, or heating-chamber, during which time the airs or gases to be heated have been traversing other furnaces, ovens, or heated chambers, heated previously in a similar manner.

The air admitted at H and I for assisting in the combustion of the burning gas is conducted to and fro by long air-passages M N, formed in the thickness of the vertical walls in such way that the air becomes red hot before it meets the burning gas, and hence the combustion is made more intense.

I will now describe the heating of the air or

gases. The furnace, oven, or heating-chamber having been made red-hot, as above described, the burning-gas inlet B is closed, as also the air-inlets H and I. The chimney-valve G is also closed. The hot-outlet E, which is lined with refractory material, is now opened; also the cold-inlet F; by which means the airs or gases to be heated are made to enter the furnace, oven, or heating-chamber at the coldest end, and by the construction of the furnace, oven, or heating-chamber the airs or gases to be heated ascend and descend the walls in rotation till they attain to the required temperature, and issue from the furnace, oven, or heating-chamber by means of the hot outlet E. After a proper interval of time—that is to say, before the airs or gases to be heated cease to be sufficiently heated—they are shut off from the furnace, oven, or heating-chamber, and made to pass through another similar furnace, oven, or heating-chamber previously heated, by which means a constant current of heated airs or gases is maintained.

Fig. 1, Sheet 3, is a vertical section, and Fig. 2, Sheet 3, is a sectional plan, of a furnace, oven, or heating-chamber, differing slightly from that shown on Sheet 2, in that, in place of the cleaning openings and doors D, at the lower part of the side, openings and doors D', at the bottom of the furnace, oven, or heating-chamber, are employed, in which case passages are provided beneath the structure.

The construction of such of the valves as are exposed to a high heat is shown in detail on Sheet 4. Fig. 1 is a section through the valve-casing, guide-spindle, and valve. Fig. 2 is an elevation, showing the water-connections and arrangements for lifting and lowering the valve.

R is a circular wrought-iron casing with a fire-brick lining, containing the valve B and its seat. The upper part of the casing is closed with a metal cover, A. Riveted to the inside of the casing is an angle-iron ring, C, faced on the upper side, and set perfectly level. Bolted to this ring, with a faced joint, is a circular false seat, D. This false seat is recessed so as to carry the water-seat E with an air-tight faced joint, *a*, and having a pipe cast in and fitted with tube connections and couplings *b b*. The valve B is cast hollow, the sides being connected by means of stays *c c* cast in one piece therewith. That part of the valve where it rests upon the seat is faced and ground into the seat. To the valve B is connected the spindle L, which is turned throughout its length. The upper end of the spindle is closed by means of a plug, *d*, through which the water-tube *e e* rises. This tube is connected by a flexible coupling, *f*, or in other convenient way, to the water-supply, and the tube passes down the interior of the spindle L to the valve B, which it supplies with water. The spindle L passes air-tight through the guide K, which is bored to fit the spindle. The use of this guide is to keep the valve B and spindle L true to the center of

the seat E. The spindle L and valve B are counterbalanced by a metal weight, W, of proper size, and connected to them by a chain, *g*, passing over a sheave, H, carried by the standard G, which is bolted to the cover A. Attached to the chain *g*, carrying the counterbalance W, is a rack, M, which is actuated by a pinion carried by a bracket, N, fastened to the casing R for the purpose of raising or lowering the valve B. The water required for protecting the valve B is conveyed from the supply-pipe O by the pipe *h* and the flexible connection *f* and the pipe *e e* to the valve. It is returned by the annular space between the pipe *e e* and the inside of the spindle L, and thence, by means of the flexible or other connection *i*, to the pipe K, which pipe carries the water, by the couplings *b b*, to the pipe cast in the interior of the seat E from the valve-seat. It is returned by the connections *l* and *m* to the waste-water pipe P.

The valve B may be protected from the action of high temperature by a covering of brick or other refractory material, fixed by any suitable means on the exposed side of the valve.

The drawing on Sheet 5 shows forms which may be given to the valves. Fig. 1 is the double-convex-lens shape, cast hollow, which form I prefer. Fig. 2 is the hollow elliptical form. Fig. 3 is in the form of a truncated cone or conical valve, cast hollow. Fig. 4 is a truncated cone inverted, cast hollow. Fig. 5 is a hollow spherical valve. Fig. 6 is a double truncated conical valve, cast hollow.

Having thus described the nature of my invention, I would have it understood that I claim—

1. The blast-heating furnace, constructed in circular form, with upright walls stayed by cross-walls, and with openings in the top and at the bottom of the furnace to permit of the cleaning of the spaces between said walls, substantially as before set forth.

2. I also claim the admission of heated air, substantially as described, for the combustion of gas in the furnace, oven, or heating-chamber.

3. I also claim the furnace, constructed with cross-walls and with cleaning-openings in its bottom, to permit the dust to drop from the furnace, as hereinbefore described.

4. I also claim the construction of the hollow metal valves of the furnaces, ovens, or heating-chambers, substantially as described, and of such form as to avoid the deposition of mud or other foreign matter by the water, and to insure the effectual cooling of the part of the valve which comes in contact with the seat.

THOMAS WHITWELL.

Witnesses:

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Stockton-on-Tees, Gentleman.

WILLM. SHARP,
Attorney's Clerk, Stockton-on-Tees.