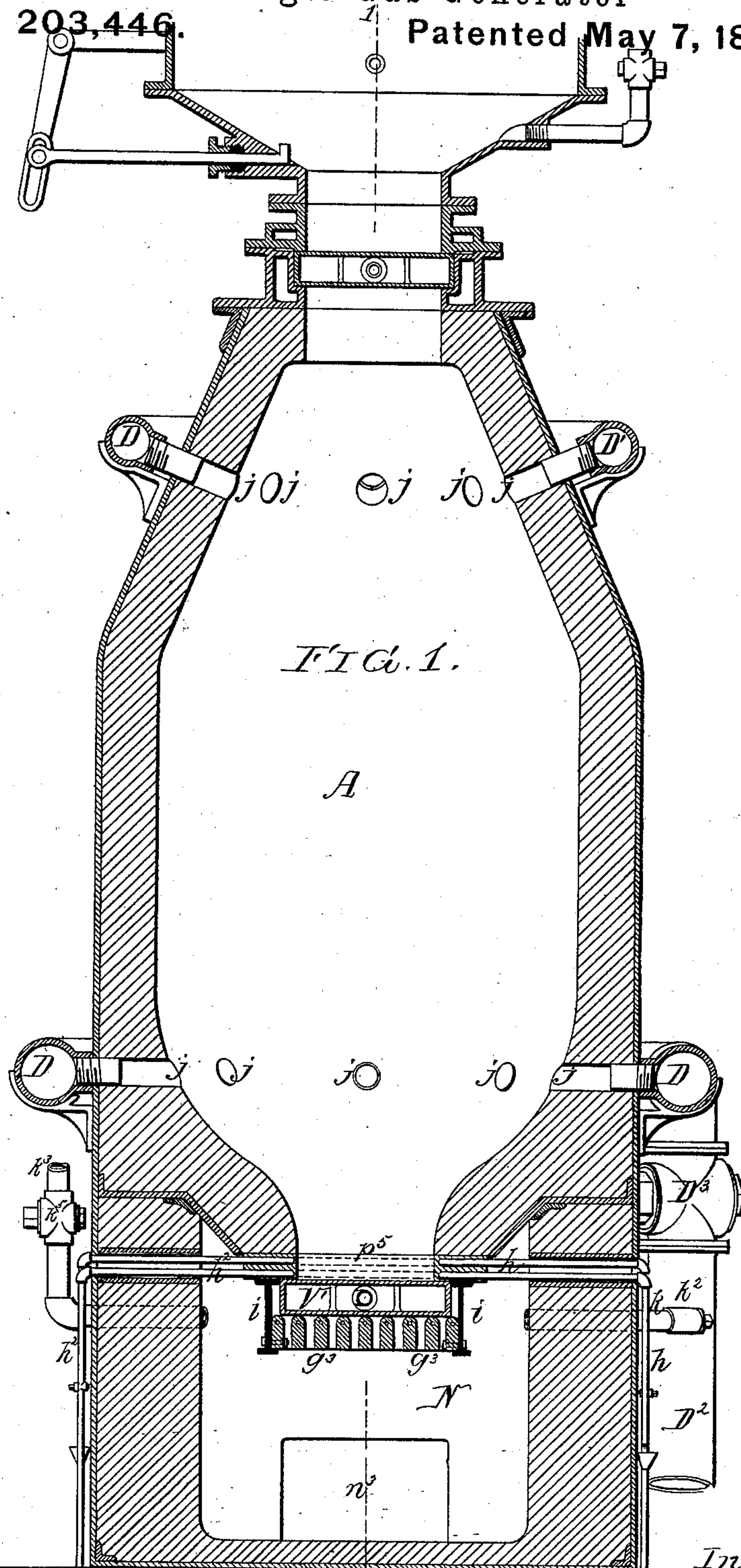


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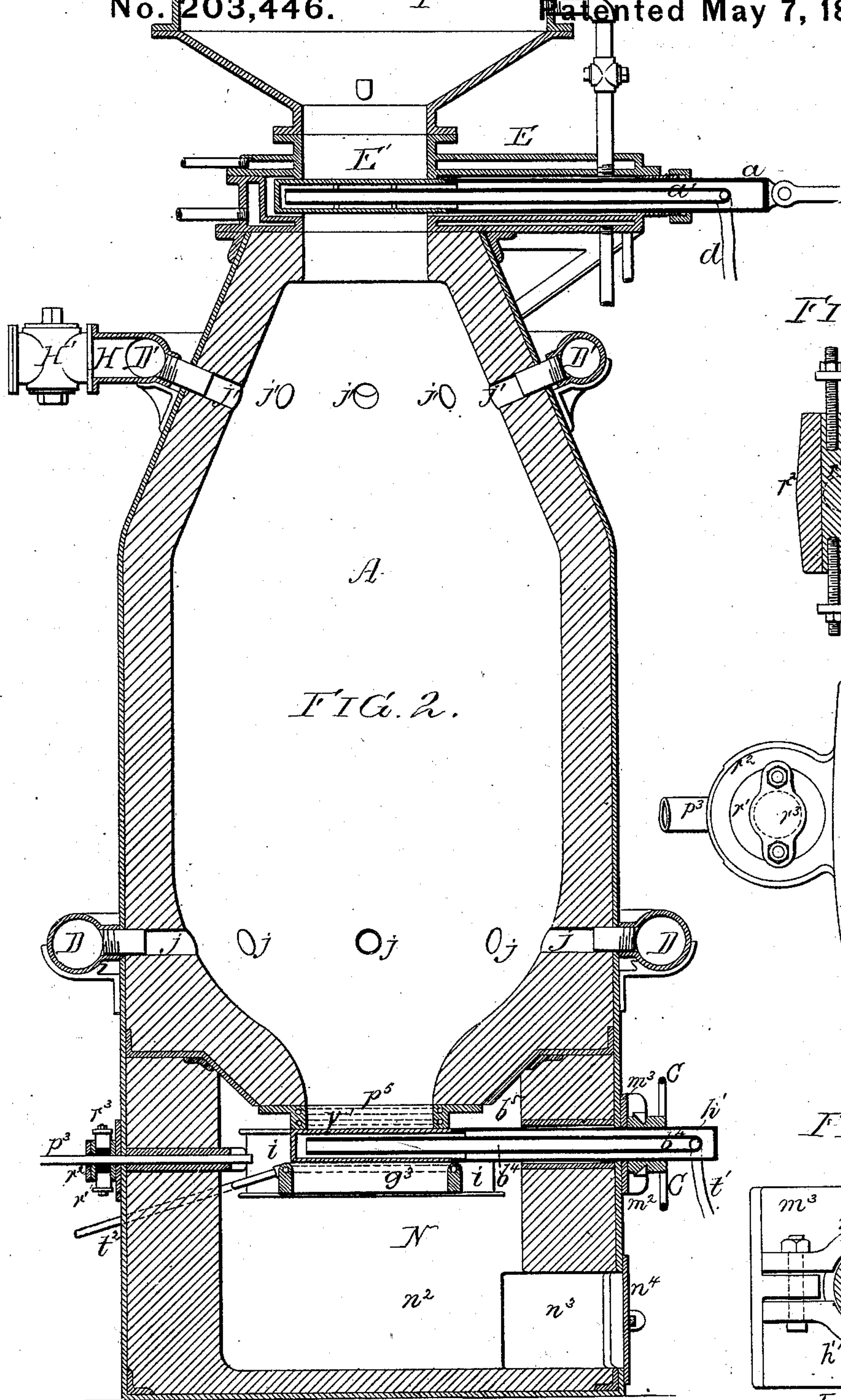


FIG. 3.

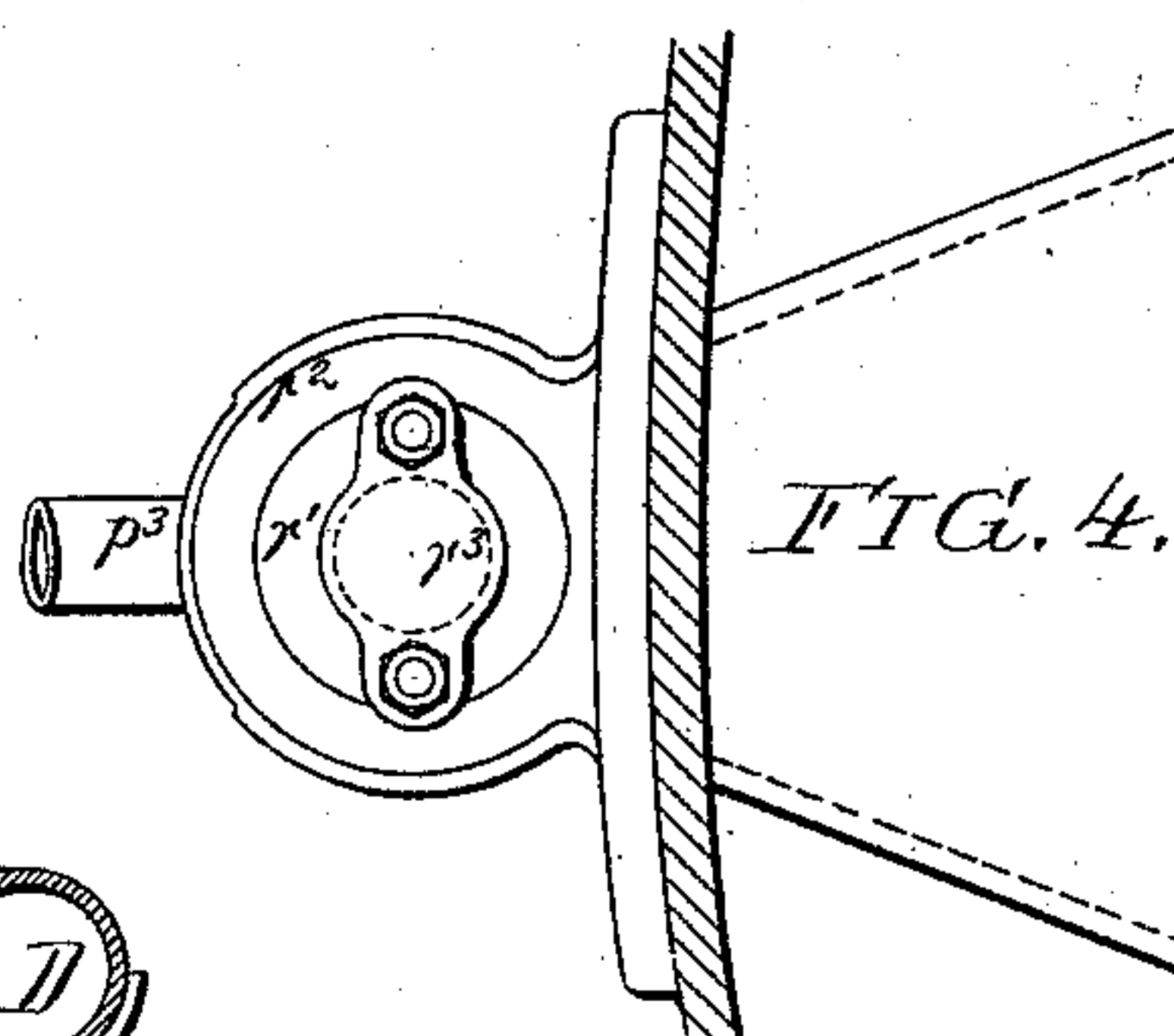
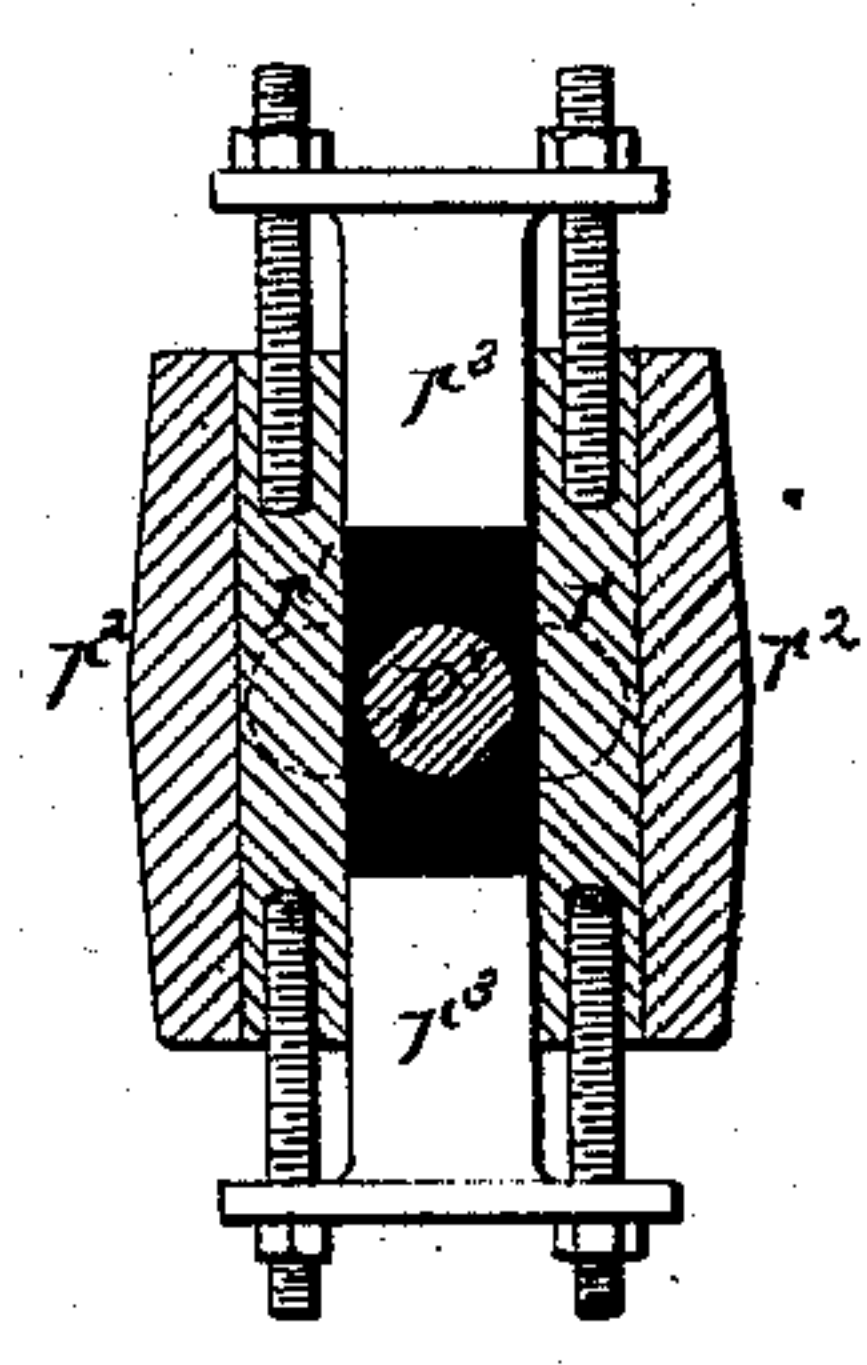
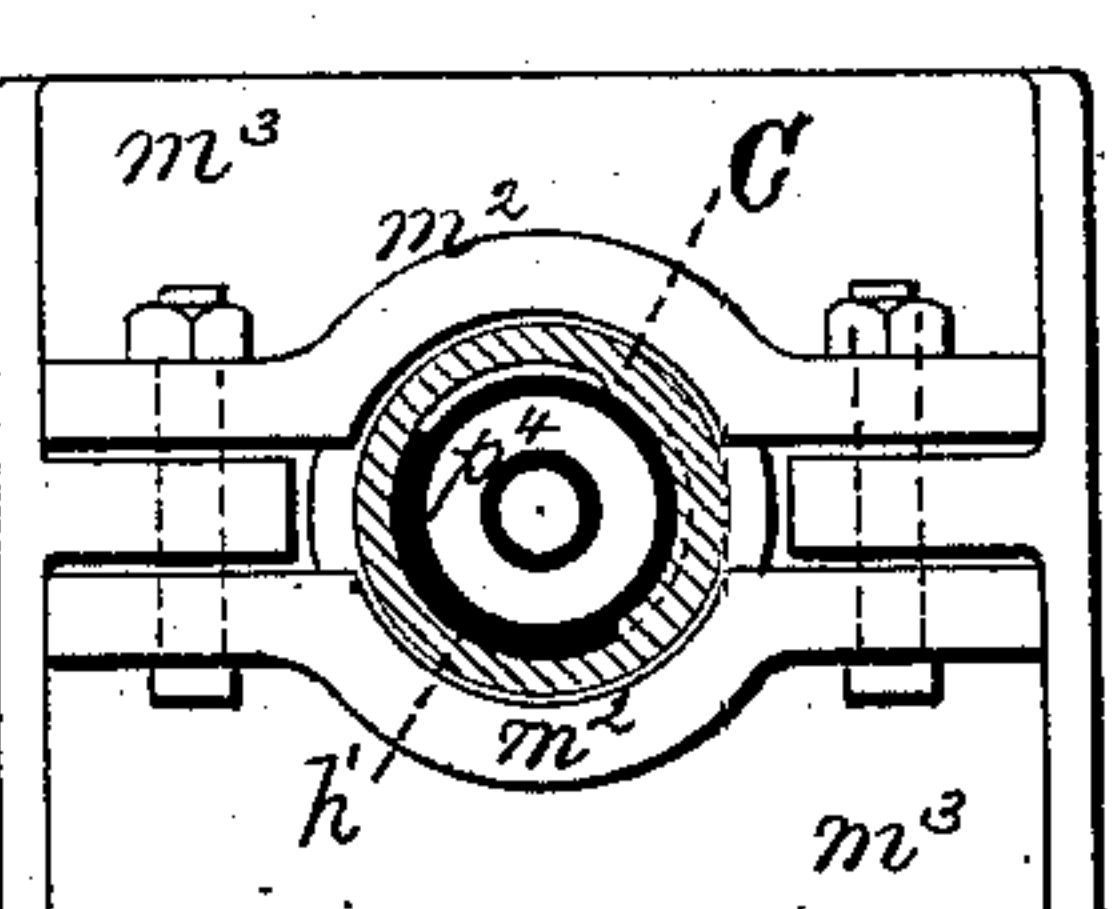


FIG. 4.

FIG. 5.



Witnesses,  
Thomas M. Swan  
John A. Reimer.

Inventor,  
Mark John Hamilton  
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Howson and Son



# UNITED STATES PATENT OFFICE.

MARK J. HAMILTON, OF WHITEMARSH, PENNSYLVANIA.

## IMPROVEMENT IN METALLURGIC GAS-GENERATORS.

Specification forming part of Letters Patent No. **203,446**, dated May 7, 1878; application filed January 26, 1878.

*To all whom it may concern:*

Be it known that I, MARK JOHN HAMILTON, formerly of St. Louis, Missouri, but now of Whitemarsh, Montgomery county, Pennsylvania, have invented a new and useful Improvement in Metallurgical Gas-Generators, of which the following is a specification:

My invention relates to certain improvements in the apparatus for manufacturing steel for which Letters Patent No. 195,891 were granted to me October 9, 1877; the main objects of my improvements being to protect the valves of the generator from the destructive effects of the heat to which they are subjected.

In the accompanying drawings, Figure 1, Sheet 1, is a vertical section of the gas-generator with my improvements; Fig. 2, Sheet 2, a vertical section of the generator on the line 1 2, Fig. 1; Figs. 3, 4, and 5, detached views of parts appertaining to the generator.

In Sheets 1 and 2, A is the generator, consisting of a vessel formed substantially as shown in the drawing, and having an exterior casing of wrought-iron plates and lined with fire-brick, N being the ash-pit.

On the top of the vessel is a feeding device, the main features of which are fully described in my aforesaid patent.

The valve E' is contained within a valve-box, E, and this has a double top, bottom, sides, and ends, forming spaces, through which water can circulate freely, in order to protect the surfaces of the valve and its seat from the injurious effects of heat imparted by the ignited fuel in the generator.

Water may be supplied to these spaces from an elevated reservoir, and may be discharged from the said spaces through suitable pipes, so that the valve-box may always be in a comparatively cool condition.

The valve E' is hollow, as is also the valve-rod *a*, which passes through a stuffing-box, and is connected to any suitable device for operating the valve.

A cold-water pipe, *a'*, extends through the tubular valve-rod *a* to within a few inches of the end of the valve, and an elastic pipe, *d*, connects with the pipe *a'* through the side of the hollow valve-rod, and conveys cold water to the valve E'. The water, after cooling this

valve, passes through the spaces between the external surface of the pipe *a'* and the internal surface of the hollow valve-rod, and is discharged through a suitable elastic tube, *b'*.

The interior of the generator, instead of communicating with the purifier through a single pipe, as in my former patent, communicates through a number of openings, *j'*, with an annular pipe, D', supported by brackets on the exterior casing, and this annular pipe communicates through a pipe, H, with the purifier when the cock H' is open.

D is the annular blast-pipe, similar to that described in my said patent, and communicates with the interior of the generator through tuyeres *j*, the blast being communicated through a pipe, D<sup>2</sup>, furnished with a suitable cock, D<sup>3</sup>.

A pipe, *k*, furnished with a cock, *k*<sup>2</sup>, forms a communication between the blast-pipe D<sup>2</sup> and the ash-pit when the said cock is open, and *k*<sup>3</sup> is a pipe leading from the ash-pit to the open air, and having a cock, *k*<sup>5</sup>.

A cast-iron chambered ring, *p*<sup>5</sup>, situated at the discharge-opening at the bottom of the generating-chamber, has two cold-water supply-pipes, *h h*, and two hot-water discharge-pipes, *h*<sup>2</sup> *h*<sup>2</sup>, as shown, in order that the said ring may be maintained in a comparatively cool condition by the circulation of water through it. This ring is supported by the girders *i i*, which rest on the brick lining of the ash-pit; and, if desired, these girders may be made hollow, and have a stream of cold water passed through them. The hollow grate-bars *g*<sup>3</sup> are also supported by these girders, and are supplied with streams of cold water through the pipe *t*<sup>2</sup>.

V' is a valve fitted to the ring *p*<sup>5</sup>, and, with the exception that it is slightly wedge-shaped, is similar in every respect to the valve E' hereinbefore described, having a cold-water tube, *b*<sup>4</sup>, supplied through the elastic tube *t*<sup>1</sup>, and a warm-water space, *b*<sup>5</sup>, connected with a suitable elastic discharge-tube, *t*<sup>4</sup>.

The hollow valve-rod *h*<sup>1</sup> has a screw-thread cut on its external surface, and adapted to the threaded interior of the hub of the wheel C, which is tight against the bracket-plate *m*<sup>3</sup>, and is kept firmly in its place by the clamping-bars *m*<sup>2</sup>, as shown in Fig. 5.



By revolving the wheel C the valve-rod  $h^1$  will be moved horizontally in the required direction and the valve  $V'$  shut or opened, as desired.

This valve is always open, except when it is found necessary to clean out the ash-pit. As pieces of incombustible material may be too large to fall through the grate-bars, a poker,  $p^3$ , is employed to remove them. This poker passes horizontally through a hollow vertical stopper,  $r'$ , which is made slightly conical, and is arranged to turn on its vertical axis in the outer portion of the case  $r''$ , the latter being riveted to the casing of the generator, and its inner portion  $r^4$  passing through the wall of the ash-pit. The entrance to the outer portion of the case for the admission of the poker is elongated horizontally, as shown by dotted lines in Fig. 3, and the inner portion of the case, which passes through the wall, is made flaring, so that the poker can be vibrated laterally, the stopper oscillating in its bearings as the poker is vibrated.

The poker, where it passes through the stopper, is surrounded by a packing of asbestos, which is confined within the cylindrical opening of the stopper by two followers,  $r^3$ .

The incombustible material which falls through the grate-bars is removed from the ash-pit N.

The operation of my improvement is as follows: After the lining in the generator has been dried, the cocks  $k^2$  and  $D^3$  are closed; but the valves  $E'$  and  $V'$  remain open, as well as the door  $n^4$  of the ash-pit. The lower part of the generator A is filled up to about the level of the tuyeres  $j$  with small pieces of thoroughly-dried wood through the aperture in the feeding-cylinder. Coke or charcoal is then charged onto the wood through the same aperture until the generator is filled, after which the fire is lighted at the grate-bars  $g^3$ , and fed by an air-draft through the opening  $n^3$ . As soon as the fuel has been properly ignited, the grate-bars and ash-pit are cleaned out and the aperture  $n^3$  closed. The valve  $E'$  is now closed, as are also the cocks  $H'$  and  $k^5$ , so as to make the generator gas-tight. The cock  $D^3$  is then partially opened, and a gentle air-blast allowed to enter the fire through the pipe D and the tuyeres  $j$  until the gases in the generator have attained their maximum pressure, after which the cock  $D^3$  is fully opened.

After the gases in the generator have attained their maximum pressure, fuel is fed to it in the manner described in the aforesaid

patent, the said fuel being either coke, coal, charcoal, or thoroughly-dried wood.

When it is necessary to remove the ashes from the ash-pit N, the wedge-shaped slide-valve  $V'$  is pushed forward by turning the wheel C until it is tightly pressed against the ring  $p^5$  by being jammed between it and the grate-bars  $g^3$ . The cock  $k^5$  is now opened, and the gases in the ash-pit allowed to flow into the open air until the pressure inside and out is the same, or nearly so. The cock  $k^2$  is then opened, and the remainder of the gas removed by the atmospheric air flowing through the pipe  $k$ , and thence through the pipe  $k^3$ .

Care must be taken to remove all the gases from the ash-pit N before opening the door  $n^4$ , so as to avoid the explosion that might take place if any ignited matter chanced to be in the ash-pit with the gases at the time of opening the door  $n^4$ .

As soon as all the gases are thus removed, the cock  $k^2$  is closed, the door  $n^4$  opened, and the ash-pit cleaned out, after which the cock  $k^5$  is closed and the door replaced, as before.

If the tuyeres enter below instead of above the grate-bars  $g^3$ , the pipe  $k$  will be dispensed with and the door  $n^4$  removed as soon as the valve  $V'$  is closed and the pressure lowered to that of the atmosphere by opening the cock  $k^5$ .

I claim as my invention—

1. The combination of the generator and the grate at the bottom of the same with a water-cooler valve between the generator and grate, all substantially as set forth.

2. The combination of the hollow wedge-shaped valve  $V'$  with the ring  $p^5$  and the grate.

3. The combination of the valve  $V'$  and its hollow spindle, threaded externally, with the wheel C, having an internally-threaded hub adapted to the said spindle, the bracket-plate  $m^3$ , and clamping-bars  $m^2$ , for confining the said hub to the bracket, all substantially as set forth.

4. The combination of the ash-pit N and grate  $g^3$  with the case  $r''$ , secured to the casing of the generator, the poker  $p^3$ , and the packed vertical stopper  $r'$ , through which the poker passes, and which permits the lateral vibration of the said poker, all as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

M. J. HAMILTON.

Witnesses:

JOHN M. DEEMER,  
HARRY SMITH.