

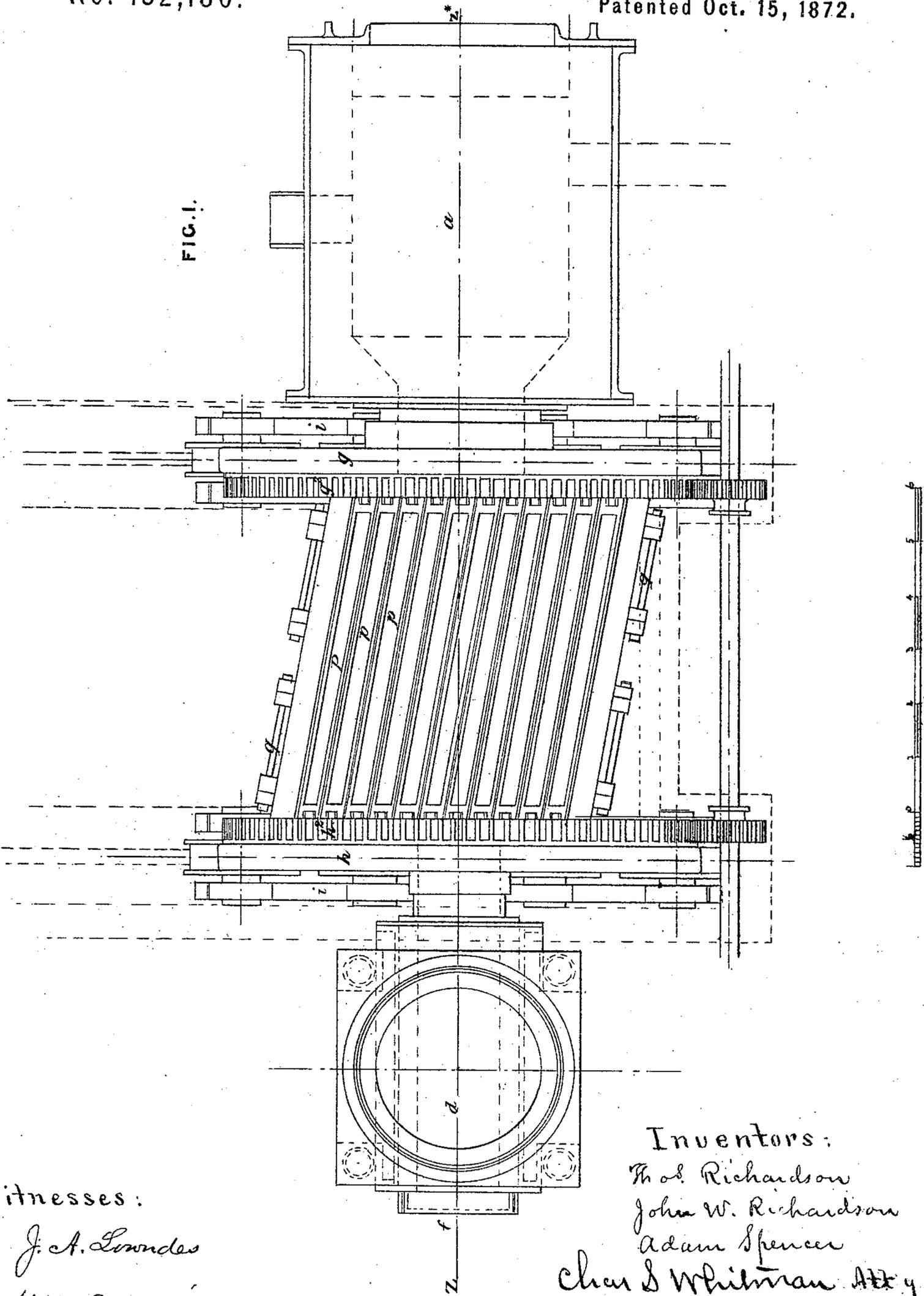
RICHARDSON, RICHARDSON & SPENCER.

Improvement in Rotary Puddling Furnaces.

No. 132,180.

Patented Oct. 15, 1872.

FIG. 1.



Witnesses:

J. A. Lowndes

H. A. Daniels

Inventors:

Thos. Richardson

John W. Richardson

Adam Spencer

Chas S Whitman Atty

RICHARDSON, RICHARDSON & SPENCER.

Improvement in Rotary Puddling Furnaces.

No. 132,180.

Patented Oct. 15, 1872.

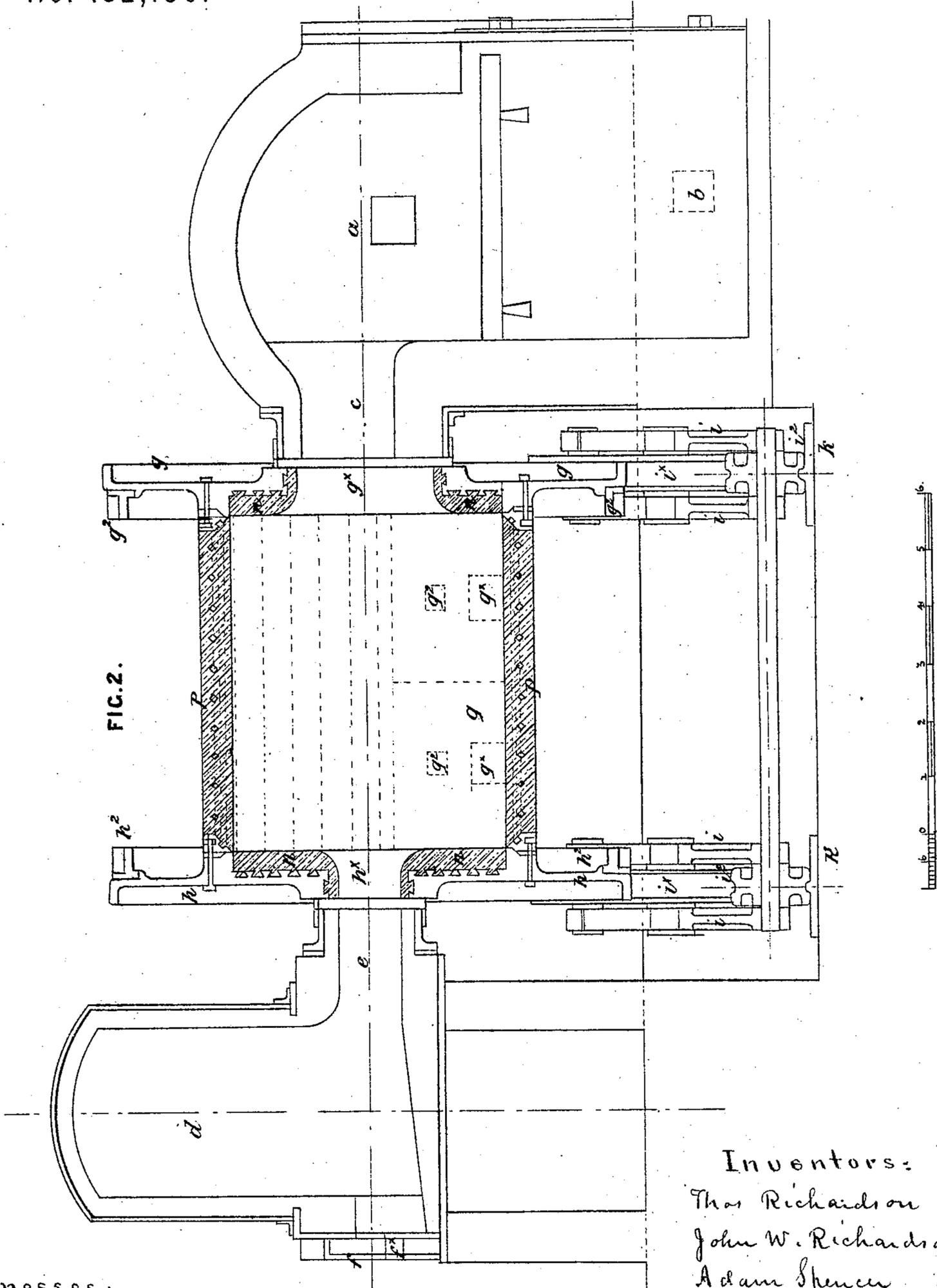


FIG. 2.

Inventors:
 Thos Richardson
 John W. Richardson
 Adam Spencer
 C. S. Whitman Atty

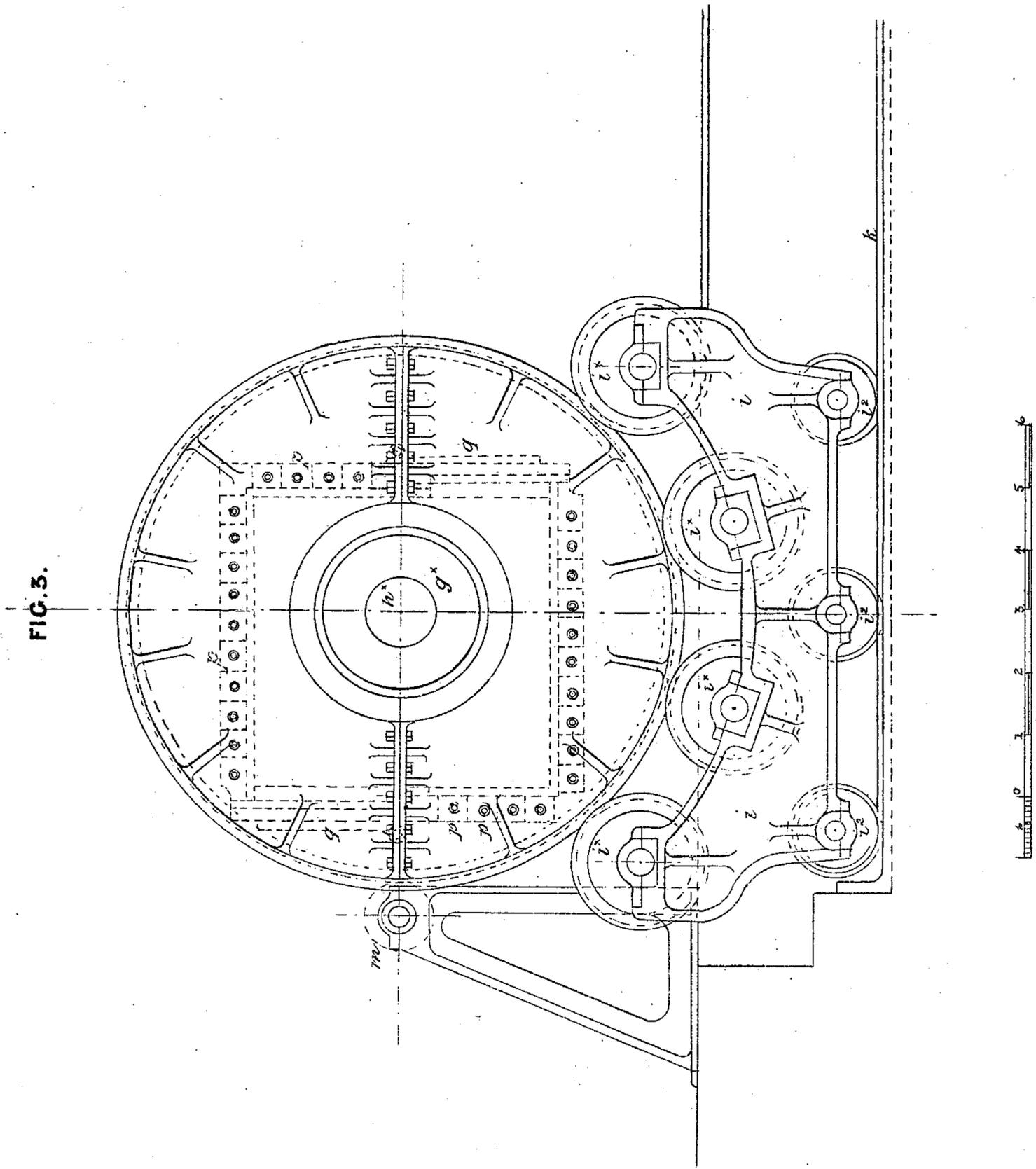
Witnesses:
 J. A. Lovandes
 H. A. Daniels

RICHARDSON, RICHARDSON & SPENCER.

Improvement in Rotary Puddling Furnaces.

No. 132,180.

Patented Oct. 15, 1872.



Witnesses:

J. A. Liondes
H. A. Daniels

Inventors:

Thomas Richardson
John W. Richardson
Adam Spencer
charl whitman Atty

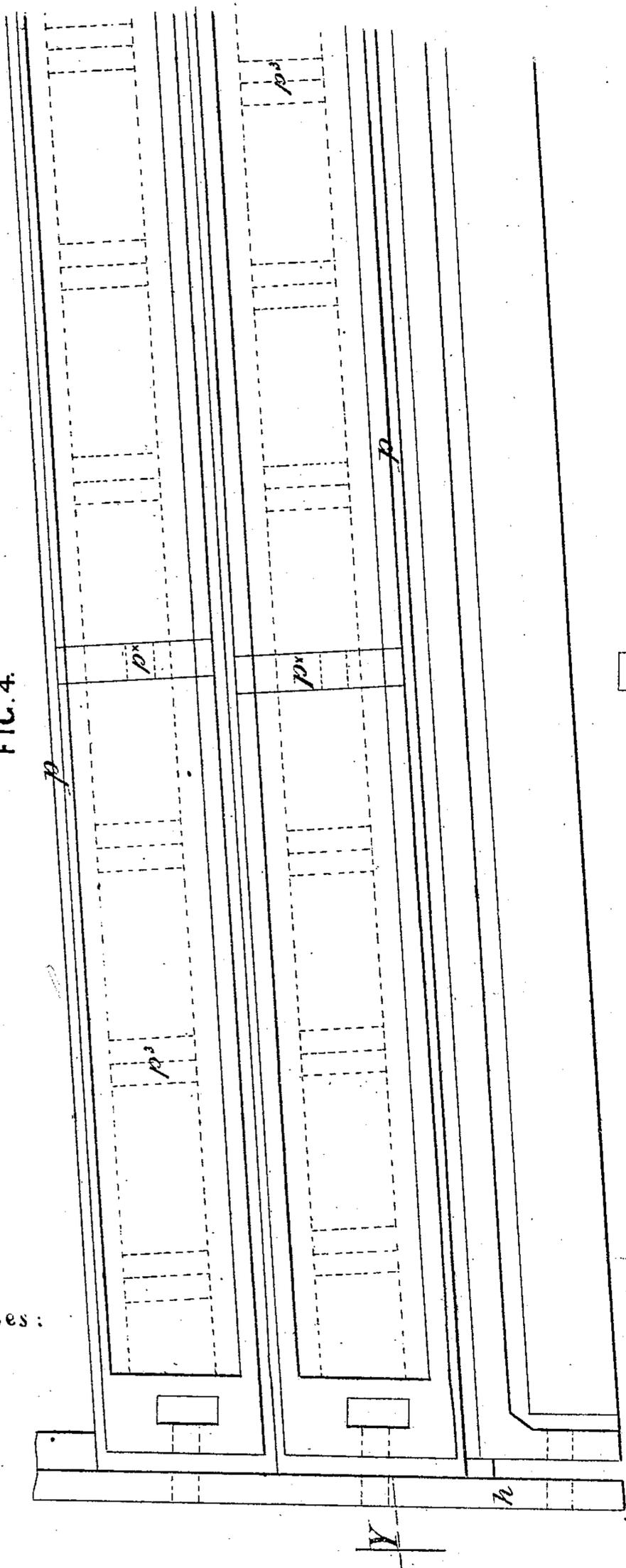
RICHARDSON, RICHARDSON & SPENCER.

Improvement in Rotary Puddling Furnaces.

No. 132,180.

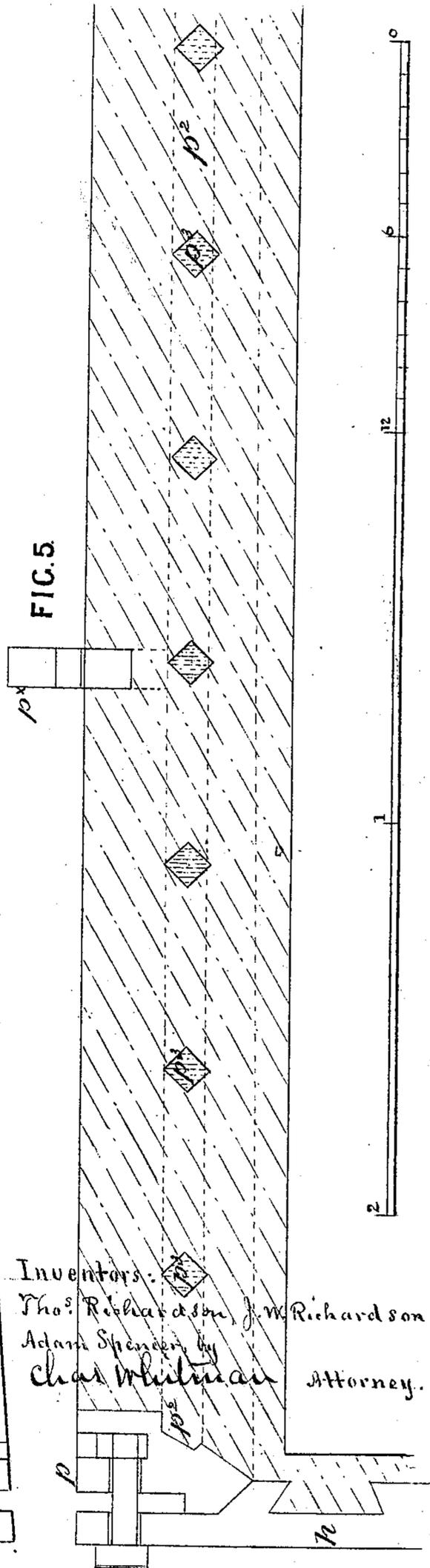
Patented Oct. 15, 1872.

FIG. 4.



Witnesses:

FIG. 5.



Inventors: *Thos. Richardson, J. M. Richardson*
Adam Spencer, by
Char. Whitman Attorney.

RICHARDSON, RICHARDSON & SPENCER. Improvement in Rotary Puddling Furnaces.

No. 132,180.

Patented Oct. 15, 1872.

FIG. 8.

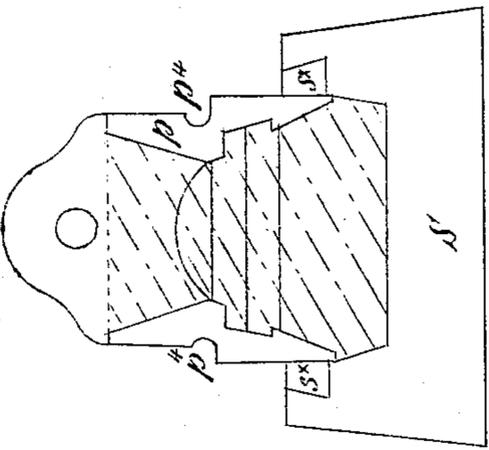


FIG. 7.

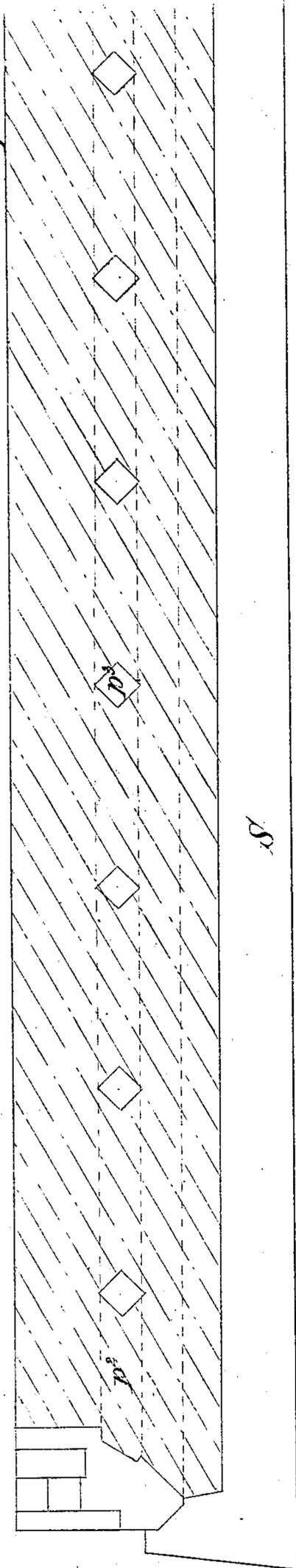
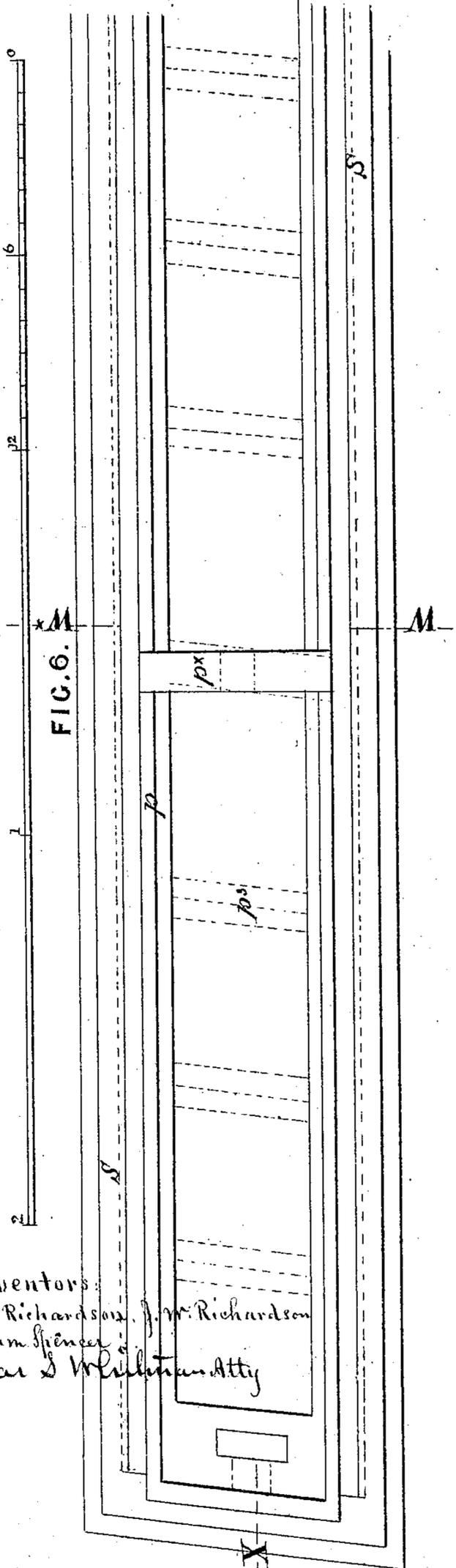


FIG. 6.



Witnesses :

Inventors:
 Tho: Richardson, J. W. Richardson
 Adam Spencer
 Char S. Whitman Atty

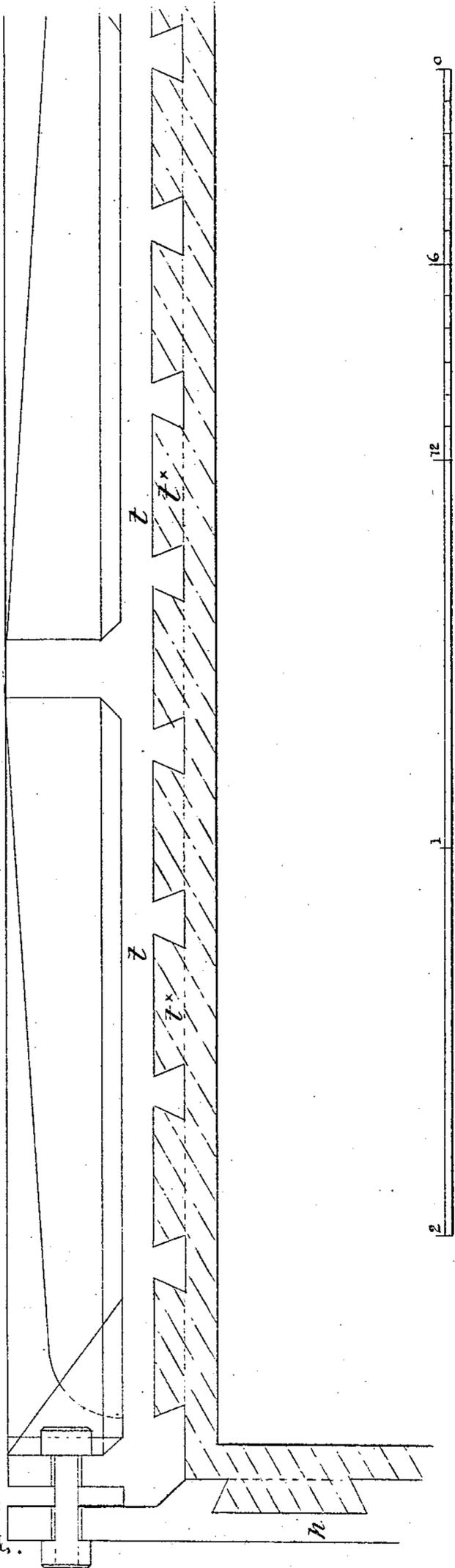
RICHARDSON, RICHARDSON & SPENCER.

Improvement in Rotary Puddling Furnaces.

No. 132,180.

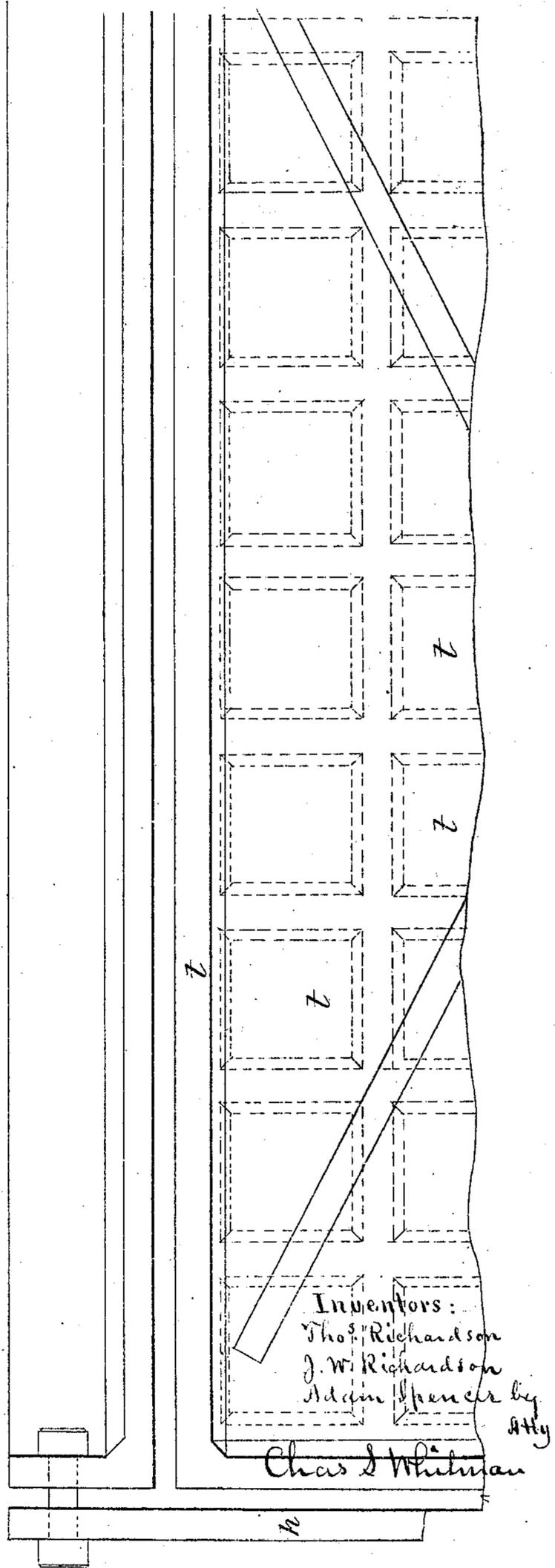
Patented Oct. 15, 1872:

FIG. 10.



Witnesses:
H. C. Daniels.

FIG. 9.



Inventors:
Thos. Richardson
J. W. Richardson
Adam Spencer by
Atty

Chas. J. Whitman

UNITED STATES PATENT OFFICE.

THOMAS RICHARDSON, JOHN W. RICHARDSON, AND ADAM SPENCER, OF
WEST HARTLEPOOL, GREAT BRITAIN.

IMPROVEMENT IN ROTARY PUDDLING-FURNACES.

Specification forming part of Letters Patent No. 132,180, dated October 15, 1872.

To all whom it may concern:

Be it known that we, THOMAS RICHARDSON, JOHN WILLIAM RICHARDSON, and ADAM SPENCER, all of West Hartlepool, in the county of Durham and Kingdom of Great Britain, iron-masters, have invented certain Improvements in Revolving Puddling-Furnaces, of which the following is a specification:

The invention consists, first, in constructing the interior of revolving puddling-furnaces with surfaces arranged in the form of a regular or irregular figure presenting various flat surfaces for securing the more effectual disturbance and agitation of the liquid metal; secondly, in lining revolving puddling-furnaces with a lining introduced by pouring it in in a molten state from the outside; thirdly, in constructing the sides or surfaces of such furnaces of a honey-combed or cellular character, or with trays open to the outside, for the more effectually holding the lining; fourthly, in lining the sides or surfaces of revolving polygonal furnaces, when of the character lastly above set forth, or otherwise, with oxide of iron, which has been run into molds of such a shape that the oxide, when cold, shall fit the said sides or surfaces; and, lastly, in the application, in revolving puddling-furnaces, of "mill-furnace cinder," or "ball-furnace tap," or the same material prepared for the purpose in any furnace or cupola as the special material to be used as and for the purpose of the lining or fettling, when applied in combination with or in pursuance of any of our improvements herein specified.

The above-mentioned several features of the invention are intended to be performed in manner as follows: The furnace is to be built up of flanged plates bolted together into a rhomboidal or other approved form, skeleton trays or boxes, (in the form of bars or otherwise,) after being filled with the lining in a molten state, or, as otherwise herein stated, being sometimes substituted for the side plates which are intended to be bolted at their ends to the end plates of the furnace. The improved process of lining by pouring in the molten material will be better understood by contrasting it with the process commonly employed for lining the bottom plates of ordinary puddling-furnaces—namely, placing a quantity

of wrought-iron scrap on the said plates, (which are plain,) then urging the fire to melt as much as possible of the scrap into an oxide of iron, allowing the oxide to settle down onto the bottom plates—and thus to form the lining, from which any unmelted scrap is carefully removed. (The sides, ends, and roof are not thus lined, but bricks or other well-known materials are employed.) A revolving furnace cannot be lined in accordance with this process, as the top and sides would melt down before the wrought-iron scrap would be melted on the bottom. Now, by our invention, this difficulty is obviated by melting down the oxide in a cupola, reverberatory, or air furnace, and while in the molten state running it into the revolving furnace to fettle the interior, and allowing it to set upon either side or end, as may for the time be necessary, and accordingly as such side or end—first one, then another, and so on in succession—is presented for the purpose. The improved cellular, or other than plain character of the sides or surfaces is to be produced by casting or otherwise forming them with the dovetailed, honey-combed, or undercut cavities, sinkings, or grooves to be employed to key in or hold the fettling or lining. The lining is sometimes to be applied by pouring in, as above described, and sometimes by previously molding to fit the side or other plates, trays, boxes, bars, or parts.

In further illustration of the manner in which the invention is to be performed, we have appended the accompanying drawing.

Figure 1, Sheet 1, is a general plan view of fire-grate and stack, with the improved converter or revolving portion of the furnace between them. Fig. 2, Sheet 2, a longitudinal vertical section of these taken through the line Z Z* on plan; and Fig. 3, Sheet 3, an end elevation of the improved revolving converter on its roller-carriage, hereinafter referred to.

a is the fire-grate, similar in construction to the ordinary fire-grates of puddling-furnaces, and provided, as usual, with pipe or culvert *b*, for introducing blast when required. The bridge end of the grate terminates in a cylindrical orifice, *c*, opening into the converter. The chimney or stack *d* also has a cylindrical orifice, neck, or throat, *e*, leading thereto out

of or away from the converter. Near the bottom of the stack is a door, f , with spy-hole f^x for observing the operation of conversion. It will be noted, particularly, from an inspection of the dotted lines in Fig. 3, that the interior of the improved revolving converter has four sides or surfaces arranged in the form of a regular square, and has also two ends. Instead of a square, however, a figure of three or more sides may be substituted, and the figure need not, of necessity, be a regular figure; and although we prefer the rhomboidal or skew disposition of the sides with relation to the longitudinal axis of rotation on line $Z Z^*$ in Fig. 1, shown in that figure, this disposition, excepting in combination with the form or forms herein otherwise described, does not constitute a feature of the invention.

The construction of the converter is as follows: It is a box-like vessel, with circular openings $g^x h^x$ in its ends $g h$, corresponding and communicating with the circular openings c and e from fire-grate and into the stack, respectively. The ends $g h$ are circular vertical plates of cast-iron, with rims, flanges, and ribs, &c., thereon, and the openings $g^x h^x$ are cast or formed in the said ends. The outer flanges or rims of the ends enable them to be supported by and to rest and revolve upon the rollers i^x of the roller-carriage i , which, by means of its wheels i^2 , is free to be easily moved upon the rail-plates k , and with the converter thereon bodily conveyed away from the normal position of the carriage and converter (represented in the figures) for the purpose of fettling or repairs when required. $g^2 h^2$ are large spur-wheels secured to the end plates g and h , respectively, for giving the revolving motion to the converter from pinions, as at m in Fig. 3, or from any convenient gearing, and which may be driven from a steam-engine or otherwise. The surfaces of the plates $g h$ within the body of the converter are cast with dovetailed honey-combings or cells for holding the fettling n . (See Fig. 2.) The sides of the converter consist of skeleton cells, trays, or boxes p , lined with fettling and bolted to the ends $g h$, and constructed as shown more clearly in detail in the Figs. 4, 5, 6, 7, 8, hereinafter described. On two opposite sides of the converter are hinged honey-combed doors q , having in them charging-holes q^x and spy-holes q^2 , and which (doors) may be opened singly or together, for the purpose of withdrawing the charge. Fig. 4, Sheet 4, is a plan showing the skeleton trays or boxes p in position with regard to the end plates $g h$ of converter. Fig. 5, Sheet 4, is a section of one of these through the line $Y Y^x$ in Fig. 4. Fig. 6, Sheet 5, is a plan showing one of the trays or boxes p as placed in or on a mold, s , and filled with the fettling cast into it while the two are together. Figs. 7 and 8, Sheet 5, longitudinal and transverse section of same through the lines $X X^*$ and $W W^*$ in Fig. 6, respectively. In these figures p is the frame or body of the tray; p^x , handle to same; p^2 ,

groove for keying in or holding the fettling; p^3 , bars of wrought-iron for the same purpose, riveted through the sides of the body p . s is the mold, and $s^x s^x$, in Fig. 8, grooves filled with fire-clay to prevent the fettling from leaking while filling; $p^4 p^4$, also in Fig. 8, grooves for the purpose of introducing luting between the trays when in position on the converter. The trays p , after being filled in the molds s , and after being allowed to cool, are to be secured by bolting to the ends $g h$ of the converter. Fig. 9 is a plan, and Fig. 10, Sheet 6, a section, of honey-combed plates t , which may be substituted in place of the trays p , represented in position with regard to the end plates $g h$ of converter, and exhibiting (by dotted lines in the plan) the general arrangement of the undercut or dovetailed cells t^x , cast in or upon them for holding the fettling; but instead of the cells, cavities, sinkings, or grooves being produced by casting, as described, they may be produced by cutting into the body of the plate, or by affixing pieces thereto. The fettling is represented in position in the section, Fig. 10. The end plates $g h$ of the converter are to be fettled by means of bricks made of the same fettling material, cast in suitable molds, of a wedge or key like form, so as to fit and lock into the ends $g h$; and further to secure the whole of these bricks, molten fettling is to be run in behind them, filling the dovetailed cells in the said ends, laying hold of the bricks and solidifying the whole firmly together. The "mill-furnace cinder" or "ball-furnace tap" above mentioned, and which we consider to be a material specially suitable to be used as and for the purpose of the fettling or lining when applied in combination with or in pursuance of any of our said improvements, is a well-known oxide of iron, being the waste cinder or meltings of wrought-iron when subjected to the heat of a reverberatory or other furnace, care being taken that the bottom of such furnace upon which such wrought-iron is placed shall be made of cast-iron plates lined as customary, and avoiding all silicious matter. The mode of using the improved furnaces, though not constituting a part of the invention, may be briefly appended. The iron to be treated is to be introduced into the converter in a molten state, the charging-holes q^x to be closed, and the converter to be revolved, when, by means of the flat sides, the iron will be thoroughly agitated, and after the required time, which may be ascertained through the spy-hole, it will assume the granular form, and commence to ball. The doors are then to be opened and the ball or balls withdrawn and conveyed to the hammer.

What we claim is—

1. The constructing the interior of revolving puddling-furnaces with surfaces arranged in the form of a regular or irregular figure presenting various flat surfaces, for securing the more effectual disturbance and agitation of the liquid material.
2. The lining revolving puddling-furnaces

with a lining introduced by pouring it in in a molten state from the outside.

3. The constructing the sides or surfaces of such furnaces of a honey-combed or cellular character, or with trays open to the outside, for the more effectually holding the lining.

4. The lining the sides or surfaces of revolving polygonal furnaces, when of the character lastly above set forth, or otherwise, with oxide of iron which has been run into molds of such a shape that the oxide, when cold, shall fit the said sides or surfaces.

5. In the application in revolving puddling-furnaces of "mill-furnace cinder" or "ball-furnace tap," or the same material prepared

for the purpose in any furnace or cupola, as the special material to be used as and for the purpose of the lining or fettling, when applied in combination with or in pursuance of any of our improvements herein specified.

THOMAS RICHARDSON.

JOHN WILLIAM RICHARDSON.

ADAM SPENCER.

Witnesses:

JOHN WOOD,

76 Scarborough street, West Hartlepool.

JOSEPH FREEK,

28 Archer street, West Hartlepool, Kingdom of Great Britain, town of West Hartlepool, in the county of Durham.