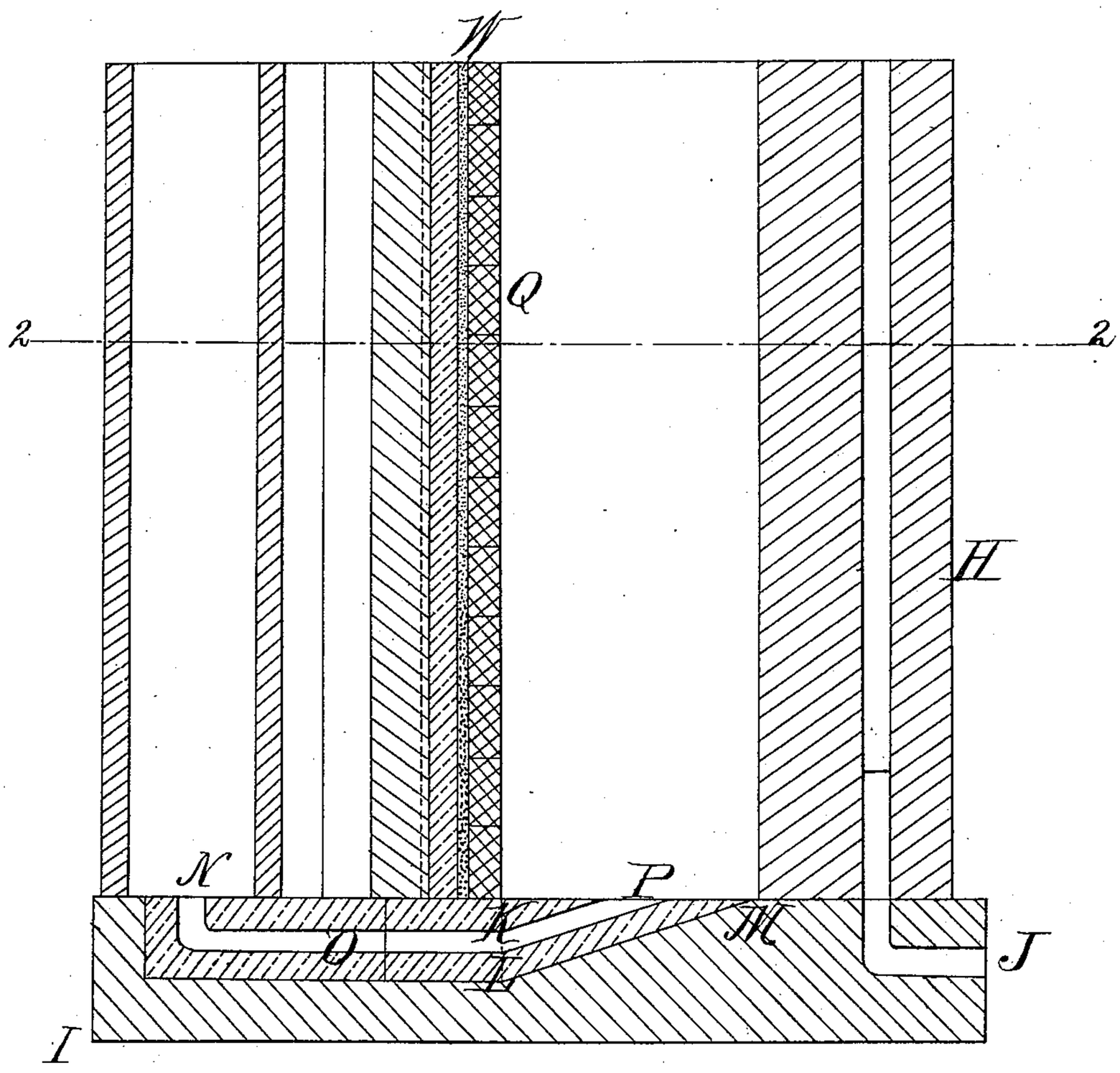
(No Model.) 3 Sheets—Sheet 1.

V. E. L. DEMENGE.

APPARATUS FOR MANUFACTURING ARMOR PLATES OR THE LIKE.

No. 564,053. Patented July 14, 1896.

Fig. 1.



Witnesses
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(No Model.) 3 Sheets—Sheet 2.

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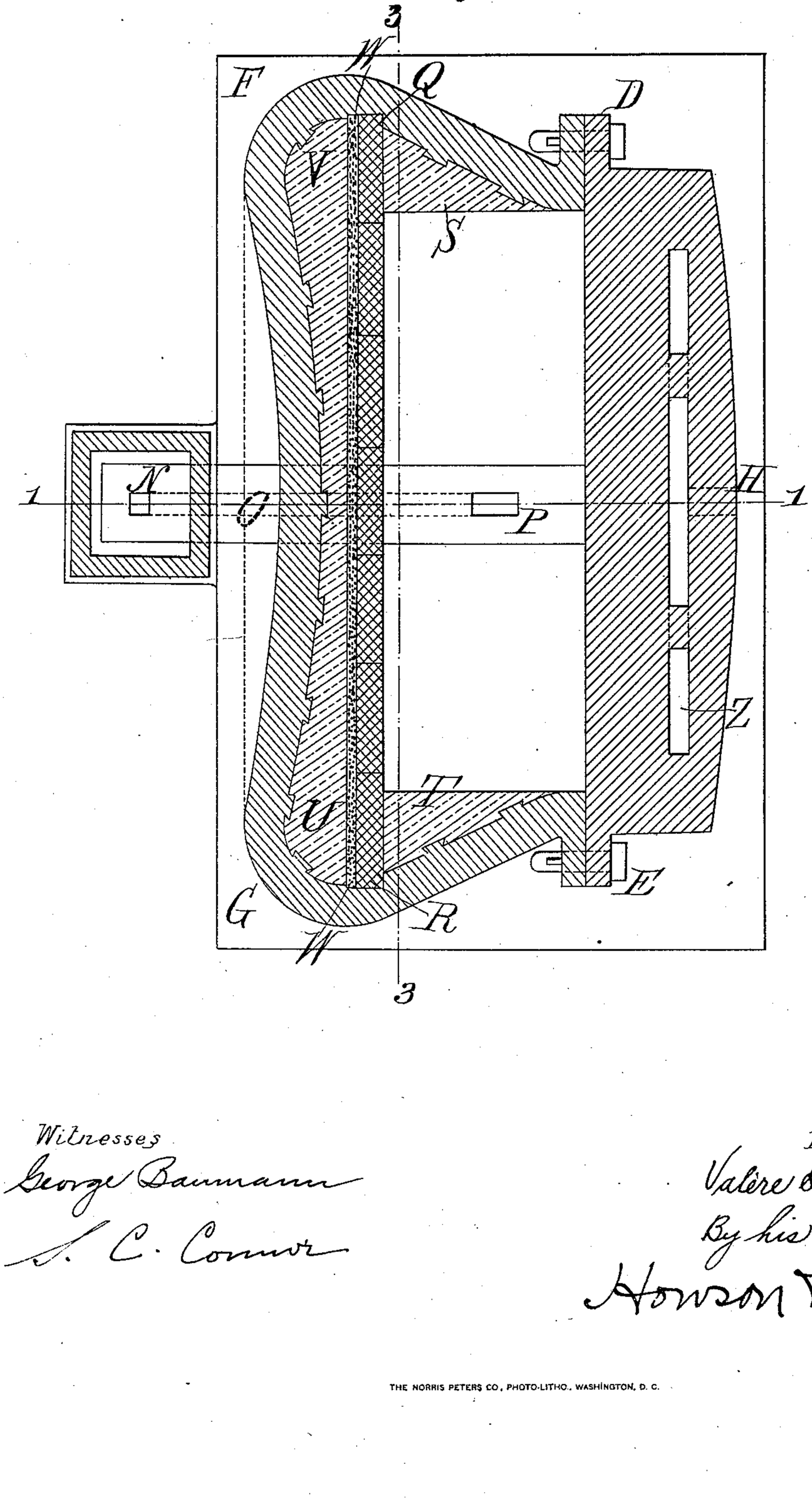
Fig. 2.



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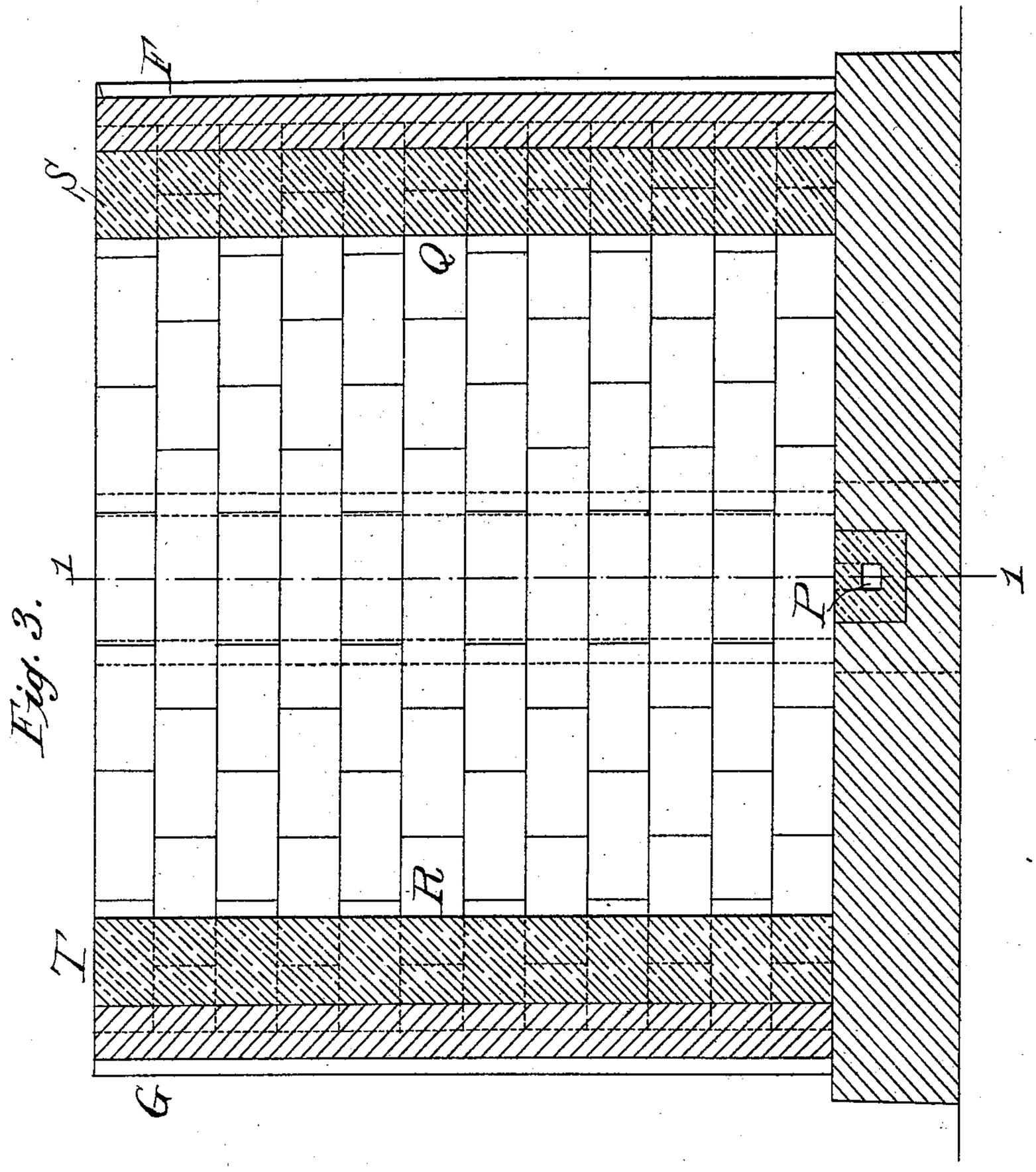

Fig. 3.

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UNITED STATES PATENT OFFICE.

VALÈRE EMILE LÉON DEMENGE, OF PARIS, FRANCE.

APPARATUS FOR MANUFACTURING ARMOR-PLATES OR THE LIKE.

SPECIFICATION forming part of Letters Patent No. 564,053, dated July 14, 1896.

Application filed May 1, 1894. Serial No. 509,628. (No model.) Patented in England April 9, 1894, No. 7,061.

To all whom it may concern:

Be it known that I, VALÈRE EMILE LÉON DEMENGE, a citizen of the Republic of France, residing in Paris, France, have invented certain new and useful Improvements in Apparatus for the Manufacture of Armor-Plates or the Like, (for which I have obtained Letters Patent in Great Britain, No. 7,061, dated April 9, 1894,) of which the following is a specification.

My invention relates to apparatus for the manufacture of armor-plates and the like.

The process carried out in this apparatus is to effect the decreasing cementation of armor-plates, not upon the plate after the forging of the same, but upon the ingot, which will be transformed into a plate and during the casting of the ingot; not upon the metal in the solid and hammered state, but upon the metal prior to its solidification. I utilize the property of carbon of being incorporated with the metal and of hardening it much more easily and rapidly when the metal is liquid than when it is solid. In the casting I obtain ingots which are very much carburized upon one face and in which the proportion of carbon decreases with the distance from this face and with the approach to the opposite face. For attaining this result it is needful to combine two conditions: first, to cover one of the sides of the ingot-mold (that corresponding to the face of the ingot which is to be cemented) with a sufficiently thick layer of carburizing materials which may or may not be united by any agglomerating agent; second, to regulate the solidification of the ingot, so that it will take place very rapidly upon one of the faces of the ingot, (that which is designed to absorb the least carbon possible,) next successively from this face to the opposite face, (that which has to be hardened,) and then as slowly as possible on the side of this latter face.

The carburizing materials employed, (pulverized wood, charcoal, coke, anthracite, or the like,) agglomerated by tar, molasses, or other materials, may be applied to the side of the ingot-mold by any suitable means, either by being molded or packed in place or in the form of blocks. Various devices may likewise be used for effecting the rapid cooling of one of the sides of the ingot-mold and for preserving its heat at the opposite side on which the carburizing material is provided. For instance, I utilize for this purpose the differences in the conductibility of materials which constitute the sides of the ingot-mold, whose emitting powers may also be varied as regards the outer surfaces. Moreover, I take account of the conditions of cooling by radiation and give my ingot-mold the outer form, which is best adapted for obviating too rapid a cooling at the extreme parts and at the corners of the mold. I may also change the conditions of cooling in the various parts of the ingot-mold by causing currents of fluids at various temperatures to circulate therein.

The casting of the metal is effected in such a manner that destruction or partial destruction of the carbureted side cannot take place.

In the accompanying drawings I have represented by way of example an ingot-mold according to my invention.

Figure 1 is a vertical section on the line 1 1 of Figs. 2 and 3. Fig. 2 is a horizontal section on line 2 2 of Fig. 1, and Fig. 3 is a vertical section on line 3 3 of Fig. 2.

The ingot-mold is composed of two parts, which are connected together at E and D. One of the parts, D F G E, forms three vertical sides concave toward the exterior, and is made of cast-iron. The other part, D H E, constitutes a slab or metallic plate well finished interiorly. Its thickness is greater in the middle H, and it is convex toward the exterior. This part may be made either of cast iron or steel or of an alloy of cast-iron and another metal which is a better conductor than iron, such as copper. The bottom of the ingot-mold is made of cast-iron, but it is of a certain thickness, and a prismatic recess K L M is provided therein throughout its width, so as to enable fire-bricks formed with a bevel to be sunk therein. In the middle brick is the conduit N O P for conveying the metal against the foot of the slab of the ingot-mold.

A wall Q R, made of blocks of carbon, is sunk into masonry S T U V of fire-bricks, filling the corners of the ingot-mold. The blocks of carbon have a thickness of at least forty millimeters. The carbon employed is wood charcoal, anthracite, or coke, deprived of ashes as much as possible. According as it is desired to facilitate or diminish the absorp-

tion of carbon the thickness of the grains varies from one to four millimeters sidewise. The agglomeration is obtained by means of tar freed from its water and from its light oils, or by means of molasses. The blocks are subjected to a strong compression in a very regular mold and then freed from the greatest quantity possible of the volatile materials which they contain by any known process of drying or distillation. The process which appears to succeed best in practice consists in heating the blocks of coal to a red heat in a closed vessel, so as to free them completely from the volatile materials which they contain. However, in order that the blocks thus treated may possess a sufficient strength the size of the grains of coal should be about four millimeters. The small faces of the blocks should be very regular, they should rest directly one upon the other without interposition of clay-grout, no scratch should be produced at the corners, and the blocks should be strong enough to be handled without fear. The wall, consisting of blocks of coal, is constructed in such a manner that the joints cross each other. Moreover, each block of coal rests upon a bed of clay W, covering the masonry U V of fire-bricks which lines the metallic side of the first part of the ingot-mold. The parts S T, built of fire-bricks, must terminate in a point, in order to obtain a continuous decrease in the conductibility of the sides, and the space into which the metal is cast constitutes a rectangle. It is easy to obtain the adherence of this masonry to the metal of the ingot-mold by providing in the interior side of the latter dovetail grooves.

The thickness of the layer of masonry V U, made of fire-bricks placed between the metal of the ingot-mold and the wall consisting of blocks of coal, may be varied according to the slowness with which the part of the ingot directly in contact with the coal is to cool. In like manner the thicknesses of the slab D H E and of the lateral linings S T may be varied according to circumstances. When this masonry has been built up, I subject this first part of the ingot-mold to a drying operation in the stove, which operation must be conducted slowly and with the greatest care.

Before the casting I arrange the ingot-mold in the pit, taking care to remove from the slab all the sources of heat which might injuriously affect the conditions of rapid heating. In certain cases I may use on this side still more active means, such as currents of any fluid, passed through conduits Z for rapidly absorbing the heat developed. On the contrary, the arrangement on the side of the part built of masonry is such that the heat will be retained as long as possible.

The metal should be derived as far as practicable from pure raw materials, well deoxidized by appropriate additions of manganese, and should contain very little carbon, (say from 0.10 to 0.15 per cent.) The temperature for the casting should not be too high.

In certain cases it is advantageous to coat the outer surface of the blocks of coal on the side where the metal will be cast with a grout of molasses mixed with clay or other inert material, for this thin layer will prevent any kind of diffusion at the commencement of the pouring, while disappearing after a certain time for enabling the absorption to take place. Such diffusion or mixing of detached particles of carbon with the mass of metal being cast would result in an effervescence which would agitate the metal and might cause an indiscriminate carburizing throughout the mass.

The ingot removed from the mold presents on one face a layer of coal adhering to a layer of cast-iron, first very graphitous, then cleaner and cleaner, which in turn adheres to the layer of hard steel. This face must be carefully chipped off with a chisel to remove the layer of carbon. Next the ingot is placed in a reheating-furnace and heated to the usual temperature for the forging. The stamp on the press acting upon the sides of the ingot frees it very quickly from the parasitic crust, which falls as easily as ordinary oxid. The ingot is then treated like a homogeneous ingot and transformed into a plate either by forging or by rolling. Next the plate is subjected to any suitable process of hardening, for example, either to a hardening with water or with oil, or even to a variable hardening, the hard face being hardened with water and the soft face with oil, these hardening operations being effected by immersion or by sprinkling, according to the hardness which it is desired to obtain on each of the faces.

What I claim is—

1. A mold for casting metal plates, the said mold having one wall of carburizing material, and the wall opposite thereto of metal, and refractory walls of varying thickness back of the carburizing-wall and at the sides, tapering from the carburizing side to the metal side, substantially as and for the purposes set forth.

2. A mold for casting metal plates, having one wall provided with an inner face of carburizing material, and being of less heat-conducting capacity than the opposite wall, substantially as described.

3. A mold for casting metal plates, having its inlet for the fluid metal at the bottom and having the wall provided with an inner face of carburizing material and being of less heat-conducting capacity than the opposite wall, substantially as and for the purposes set forth.

4. A mold for casting metal plates, the said mold being in two parts adapted to be easily joined together or detached, one of the parts being completely metallic and of variable thickness, the greatest thickness existing in the transverse vertical plane which passes through the middle of the ingot-mold, the other part consisting of a cast-iron envelop

lined with a refractory masonry of variable thickness, and further lined, on the part next the side of the ingot to be hardened with a wall of carburizing material, the form of the iron envelop being such that the refractory lining is smaller in the transverse vertical plane passing through the center of the mold and thicker at the parts corresponding to the edges of the ingot at the side to be carburized, whereby the swiftness of cooling by radiation is uniform in all points of each layer of metal parallel to the carburizing-wall.

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

VALÈRE EMILE LÉON DEMENGE.

Witnesses:
LÉON FRANCKENS,
CLYDE SHROPSHIRE.