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Patented May 28, 1901.

E. D. WASSELL.

METHOD OF MANUFACTURING WROUGHT IRON.

(Application filed Dec. 20, 1899. Renewed Nov. 8, 1900.)

(No Model.)

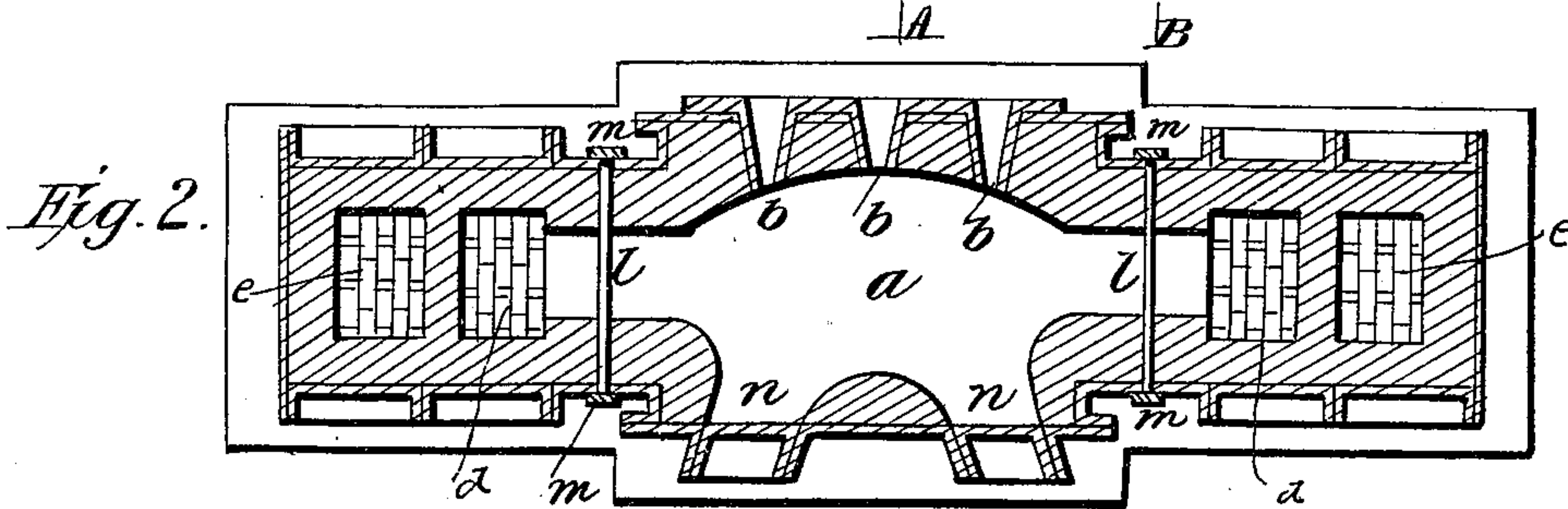
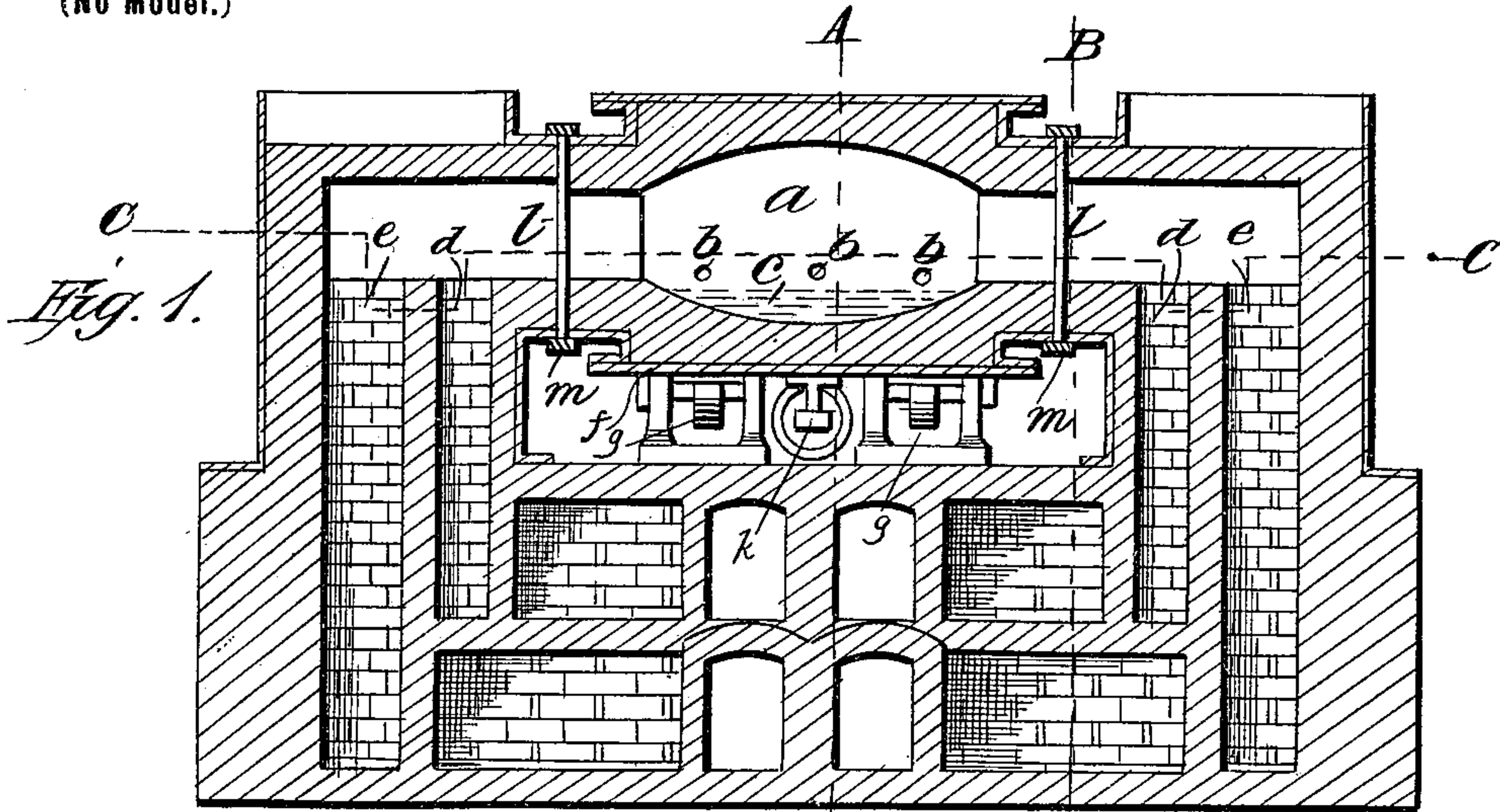


Fig. 3.

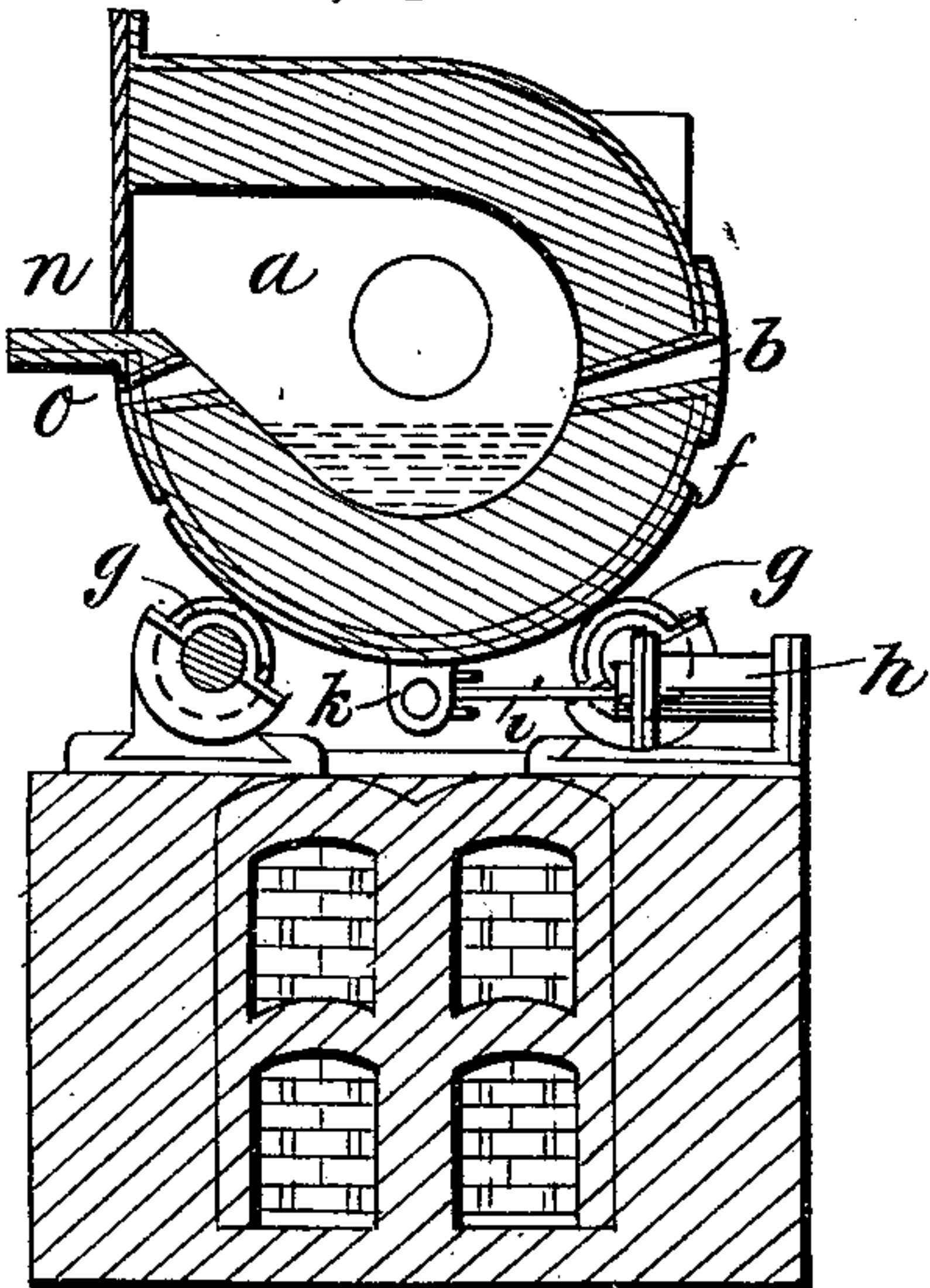
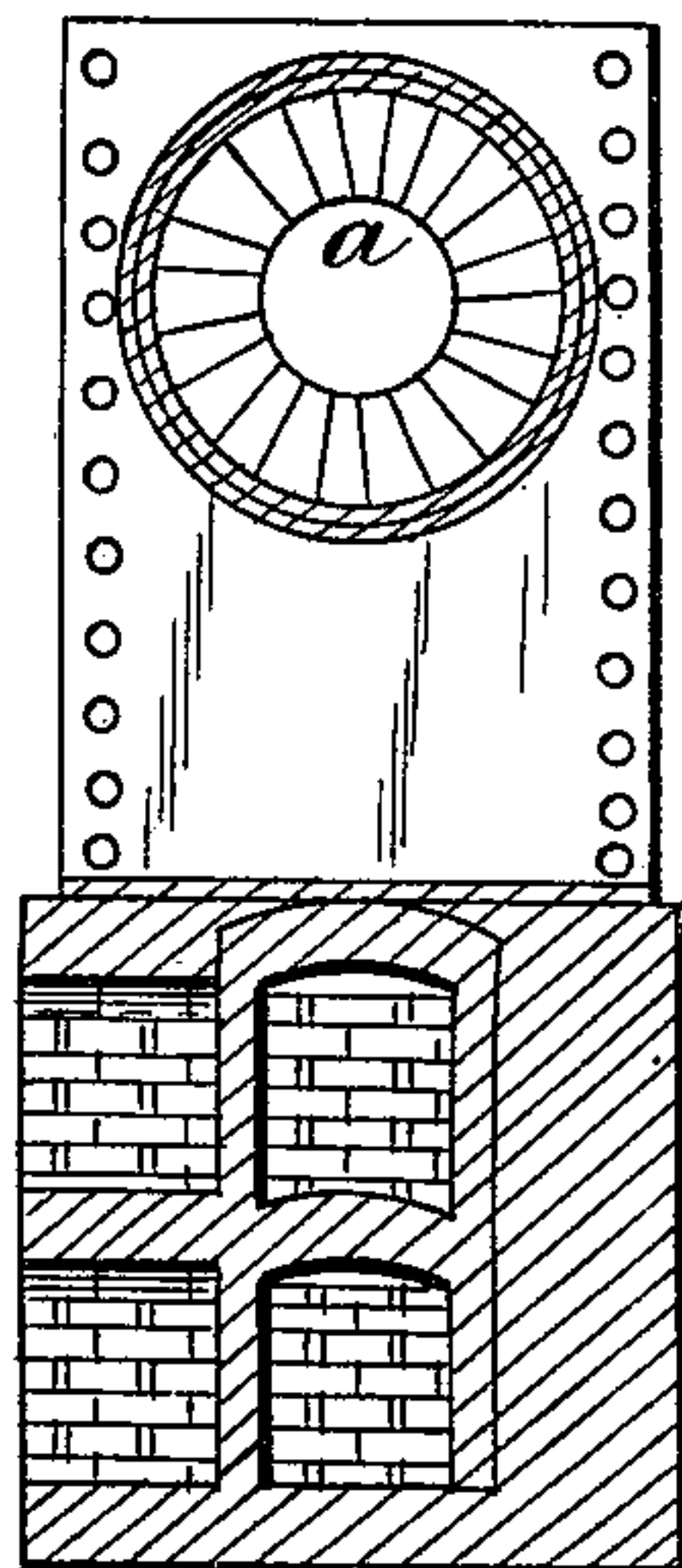


Fig. 4.



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METHOD OF MANUFACTURING WROUGHT-IRON.

SPECIFICATION forming part of Letters Patent No. 675,120, dated May 28, 1901.

Application filed December 20, 1899. Renewed November 6, 1900. Serial No. 35,664. (No specimens.)

To all whom it may concern:

Be it known that I, EDWIN D. WASSELL, a citizen of the United States, residing at Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Methods of Manufacturing Wrought-Iron; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to the metallurgic art, has especial reference to the manufacture of what is known to the trade as "puddled iron," has for its object economy in fuel and labor and increased production, and consists in certain improvements in the method of treating molten pig or cast iron, which will be fully disclosed in the following specification and claims.

In the accompanying drawings, which form part of this specification, Figure 1 represents a vertical longitudinal section of a furnace constructed to manufacture iron by my method; Fig. 2, a horizontal section on line C C; Fig. 3, a transverse section on line A A, Fig. 1; and Fig. 4, a like section on line B B.

Reference being had to the drawings and the letters thereon, *a* indicates the working chamber of a regenerative furnace provided with twyer-holes *b*, through which air under pressure is conducted and directed into the molten bath of metal *c* with such force as to penetrate the metal and agitate and impart a gyratory motion thereto, and *d* and *e* indicate the air and gas chambers. That part of the furnace which contains the working chamber *a* is supported upon a cradle *f*, which rests upon rollers *g g* and is oscillated by a hydraulic cylinder *h*, whose piston-rod *i* is connected to a lug *k* on the cradle, so that the bath of molten metal can be shifted from one side of the working chamber to the other to change the angle of its surface and the angle of the currents of air entering the working chamber through the twyers *b*, and that part of the furnace which contains the air and gas chambers *d* and *e* is stationary, and to prevent the ingress of cold air or the escape of the hot gases or smoke through the joints *l l* in the necks of the furnace they are surrounded by an expansible and contractible

band or ring of iron *m*, and the working chamber is provided with charging-openings *n n*, which are closed by suitable doors (not shown) after the furnace has been charged with pig or cast iron, and a slag-discharge opening *o*. The working chamber *a* having been supplied with its charge of pig or cast iron, the charge is reduced to a liquid form by the heat of the furnace in the ordinary way preparatory to blowing or applying air under pressure to the molten bath. At this stage of the operation the blast of air is turned on while the working chamber is in its normal position; but immediately after the blast is turned on the adjustable part of the furnace is moved to the left, which by reason of the circular form of the working chamber will cause the liquid to flow to the right and above the twyers *b b* and until the blast is made to enter the working chamber on the straight line or level with the bottom thereof, and the pressure of the blast should be sufficient to prevent the metal entering the twyers and produce agitation, ebullition, and a gyratory motion of the metal to eliminate the carbon and other impurities contained in the metal. During the blowing and while the liquid metal is in a state of ebullition small quantities of lime or limestone must be charged into the furnace, which will mix with the metal by reason of the agitation taking place and form a dephosphorizing slag, by which the phosphorus will be eliminated from the liquid metal. The blowing must be continued until the carbon and other metalloids have been eliminated to a point where iron and not steel is assured; but during the time the metal is being blown the pressure of the blast should be varied at intervals to suit the conditions of the metal at different stages of the operation to prevent excessive oxidation and consequent waste of the liquid metal, and it is also essential that the blast shall be so regulated that the temperature in the metal shall not be raised too high at any time by the too-rapid oxidation of the metalloids, as a too-high temperature would interfere with the passage of the phosphorus into the slag. A neutral flame is maintained during this period. It is essential that the agitation of the liquid metal by the air-blast be maintained as long as possible, or until the metal assumes

a granular form and the granules form a pasty mass. When the metal has been blown to a point where it begins to lose its fluidity and assumes the granular or pasty condition, the blowing of the metal must cease, as this condition would indicate the carbon to have reached the minimum point and that further blowing of the metal would result in excessive oxidation of the metal itself. Before shutting off the blast the converting-chamber must be shifted back to the right until the twyers and the twyer-holes are above the surface of the metal. The continuation and completion of the process must now be dependent upon the heat generated by the furnace, which heat is maintained and may be regulated to suit the conditions of the metal under process of conversion to wrought-iron by the skilful operator in charge. After the converting-chamber has been shifted back and the air-blast shut off, as above stated, the accumulated slag or scoria must be tapped from the furnace through the outlet *o*, after which the air-blast may again be utilized to oxidize a portion of the surface metal, or a pure oxid of iron, such as tap-cinder from a heating-furnace, or oxidized wrought-iron made for the purpose, or black oxid of iron in granular form or in small lumps may be charged into the furnace and upon the surface of the granular or semiliquid iron and reduced to a liquid by the heat of the furnace and the metal. Whether the oxid of iron is charged or formed by oxidation of the surface iron it is absolutely essential that the iron be thoroughly rabbled by the operator in charge of the furnace, so as to commingle and bring the oxid of iron in contact with all the granules of the iron. A reducing-flame is maintained during this period. The molten oxid of iron being thoroughly commingled

with the iron by the constant rabbling finishes the oxidation and removal of the metal-loids and also furnishes the necessary slag. The metal is then balled in the usual way. 45

Having thus fully described my invention, what I claim is—

1. The method of treating iron, which consists in subjecting liquid pig or cast iron to currents of air until the metal partly loses its fluidity and forms a pasty mass, removing the impurities from the surface of the mass, then supplying oxid of iron upon said surface, and applying sufficient heat to melt the oxid, and finally agitating the pasty mass of iron and the layer of molten oxid thereon and thereby commingling the oxid and the iron for the further elimination of impurities from the iron, and finally balling the iron. 55

2. The method of treating iron, which consists in subjecting liquid pig or cast iron to currents of air so regulated during the first blowing period as to create a gentle ebullition of the metal and maintaining a degree of heat in the metal sufficiently low to effect a partial removal of the impurities and continuing the air-currents until the liquid metal partly loses its fluidity and forms a pasty mass, removing the slag or scoria from the surface of the semiliquid metal, supplying oxid of iron upon the surface of the semiliquid metal and applying sufficient heat to melt the oxid, and finally commingling the oxid of iron with the semiliquid metal by stirring and disintegration for the further and complete elimination of the impurities, and finally balling the iron. 65 70 75

In testimony whereof I affix my signature in presence of two witnesses.

EDWIN D. WASSELL.

Witnesses:

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