No. 658,653. Patented Sept. 25, 1900.

S. P. KETTERING.

PUDDLING FURNACE.

(Application filed Nov. 13, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

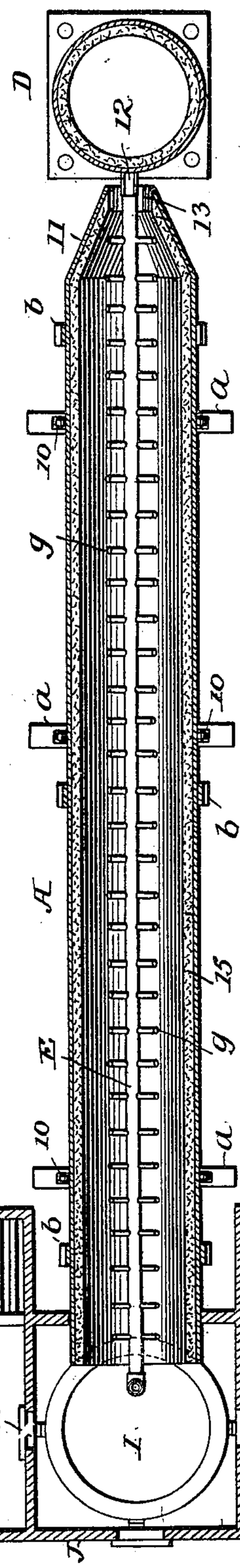

Fig. 2.

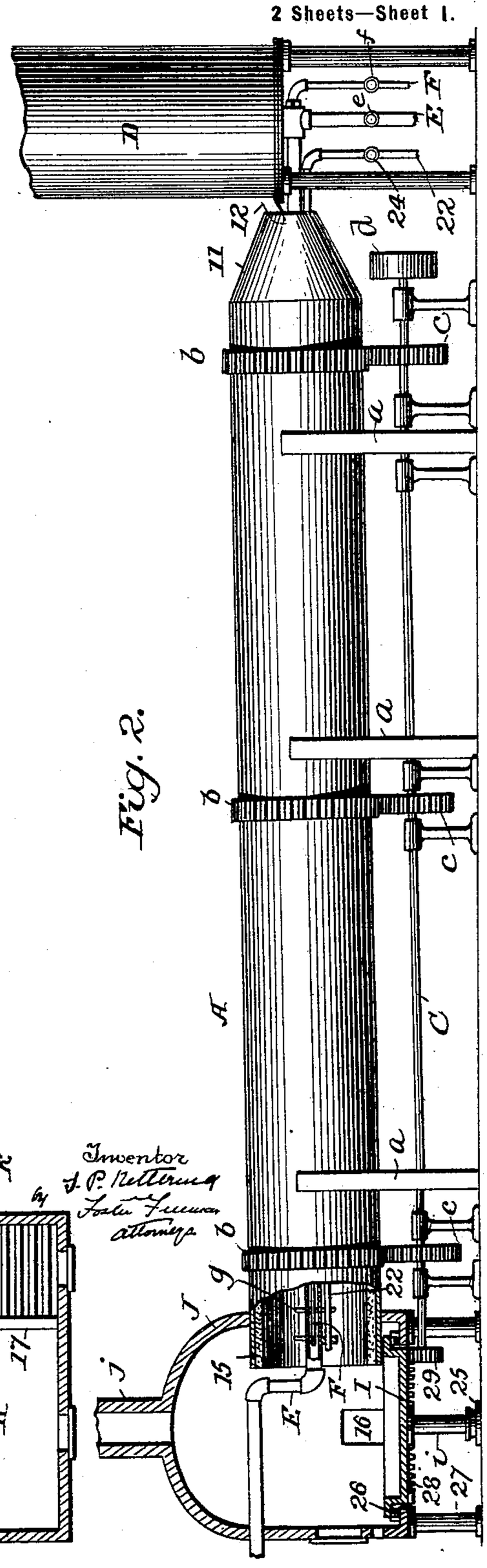

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Fig. 3.

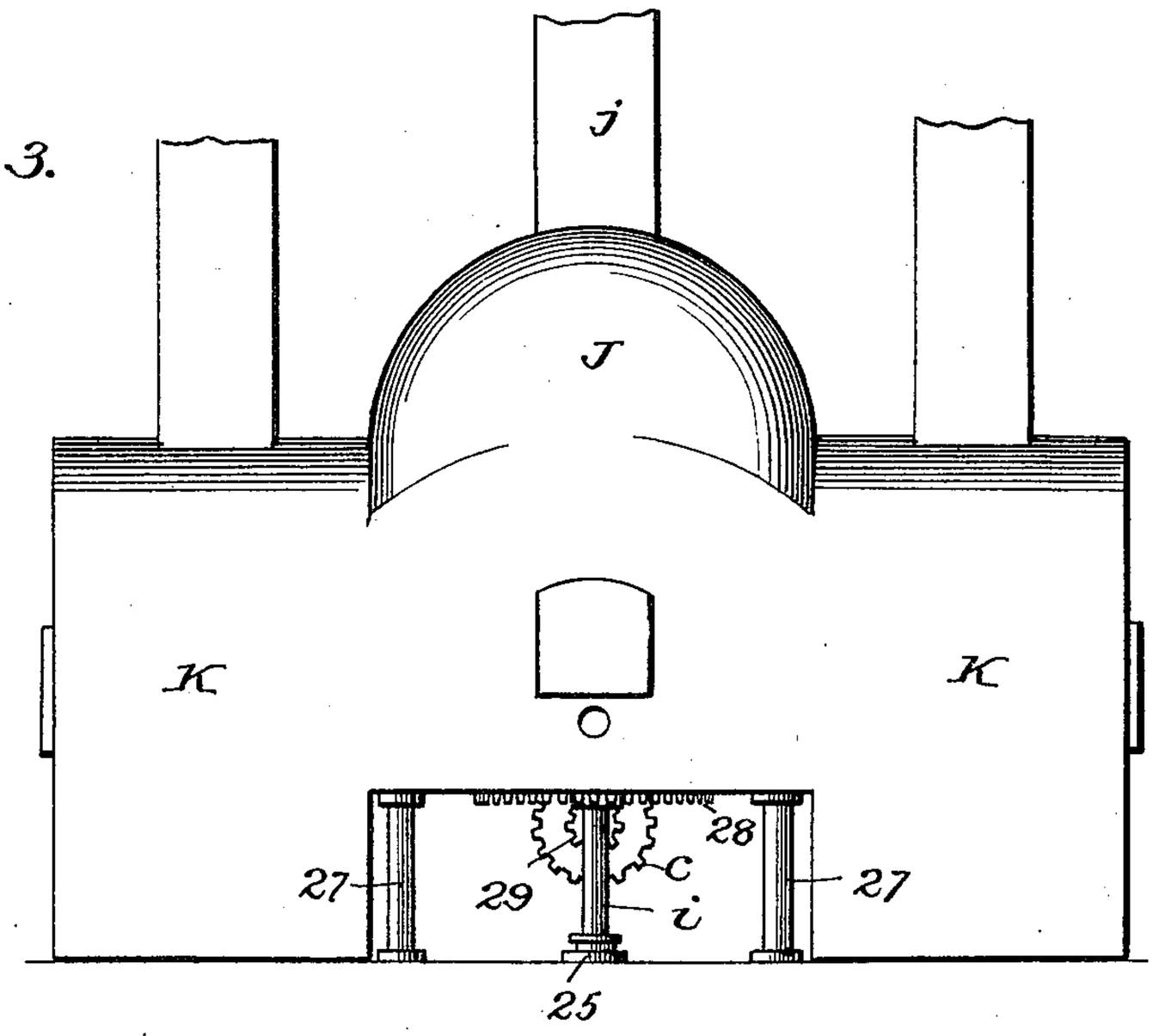

Fig. 4.

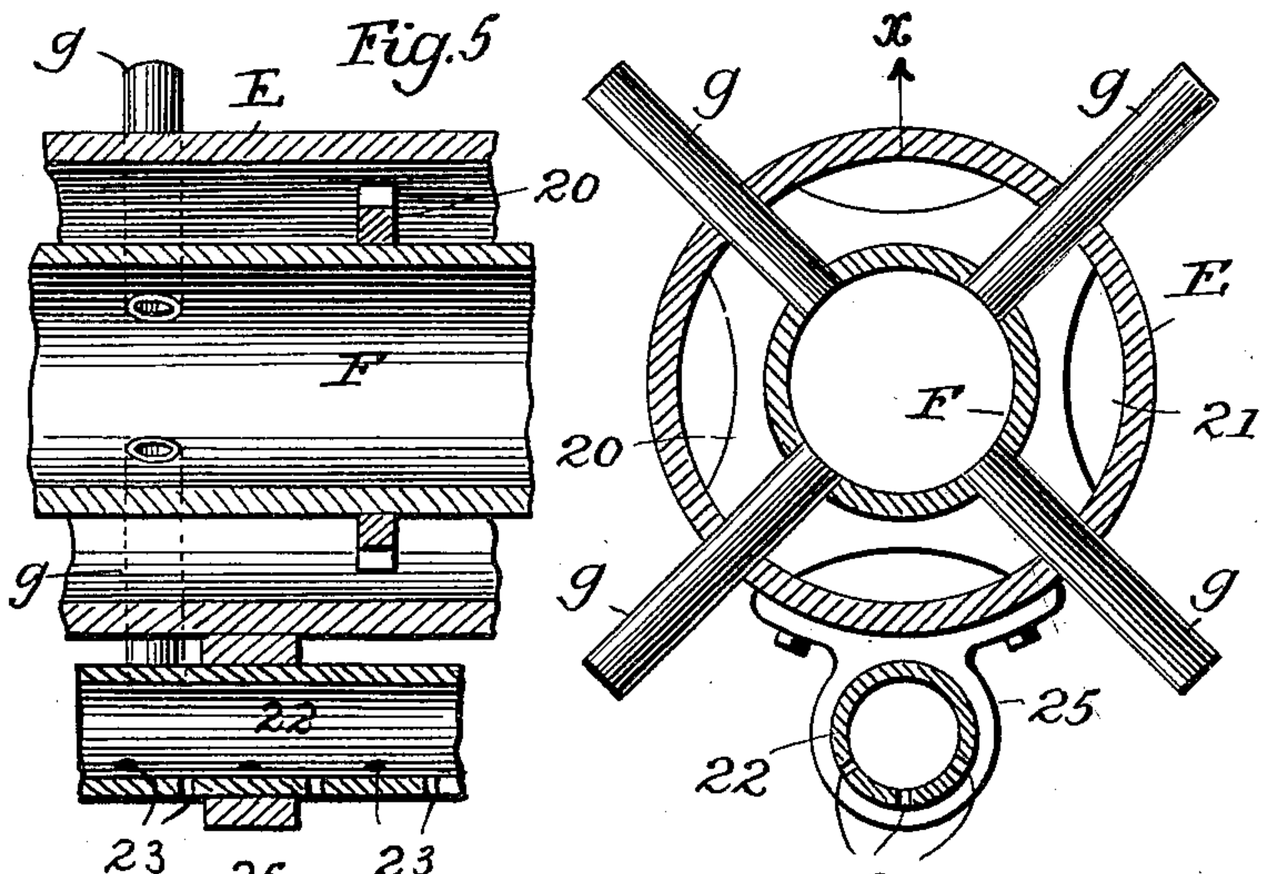

Fig. 5

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UNITED STATES PATENT OFFICE.

SIMON PETER KETTERING, OF SHARON, PENNSYLVANIA.

PUDDLING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 658,653, dated September 25, 1900.

Application filed November 13, 1899. Serial No. 736,868. (No model.)

To all whom it may concern:

Be it known that I, SIMON PETER KETTERING, a citizen of the United States, residing at Sharon, in the county of Mercer and State of Pennsylvania, have invented certain new and useful Improvements in Puddling-Furnaces, of which the following is a specification.

This invention relates to improvements in apparatus for the manufacture of wrought-iron, its object being to provide an apparatus for this purpose by which the operation of converting pig-iron into wrought-iron may be substantially continuous and by means of which much manual labor will be saved and the output be increased.

The invention will be fully described hereinafter, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional plan view of an apparatus constructed in accordance with my invention. Fig. 2 is a side elevation partly in section and partly broken away. Fig. 3 is an elevation of the rear or delivery end of the apparatus. Fig. 4 is a transverse section through the fuel and water supply pipes. Fig. 5 is a longitudinal section through a section of the fuel and water pipes on the line *x x* of Fig. 4.

In carrying out my invention I employ a long cylinder A, which is supported to rotate about its axis in bearings (indicated by *a*) and which may, if preferred, be provided with antifriction devices, (indicated by 10.) Some means must be provided to rotate the cylinder, and, as shown, it is provided with a series of toothed circumferential rings *b*, with which engage gears *c* on a shaft C, the latter being provided with a belt-pulley *d*, by means of which it is driven from a source of power. (Not shown.) The receiving end of the cylinder is tapered, as indicated at 11, and a spout or trough 12 projects through the opening 13 at this end, said spout being supported by any suitable means so as to not interfere with the rotation of the cylinder. The function of this spout is to convey the molten metal to the cylinder from the melting-furnace D.

Preferably the cylinder will incline downwardly from its receiving end to its delivery end in order that the metal introduced therein may naturally tend to move toward the delivery end.

Extending longitudinally through the cylinder A is a pipe E, connected to a source of water-supply (not shown) and provided with a valve *e* for controlling the flow of water through the pipe. Within the pipe E is another pipe F, which is connected to a source of oil or gas supply (not shown) and provided with a controlling-valve *f*. A series of nipples *g* are fitted in the pipe F and extend through the pipe E, such nipples forming passages for the escape of the oil or gas to be burned within the cylinder. These nipples radiate from the pipe and are so disposed that they will heat the cylinder uniformly.

A series of rings 20 are shrunk on the pipe F, preferably about two feet apart, and these rings are of a diameter to fit snugly within the pipe E, and thus firmly support the pipe F centrally of the pipe E. In order to permit the water to circulate through the pipe E, the rings are provided with recesses or openings 21. Another advantage of this construction is that it greatly adds to the strength and rigidity of the pipe E, which will not be as liable to sag or bend in the cylinder, and it will only be necessary to properly support it outside of the cylinder A.

Sometimes it may be necessary to lower the temperature of the metal within the cylinder, and in order to do this I provide another pipe 22, extending into the cylinder through the receiving end and having a series of spray-orifices 23. The pipe 22 is connected to a source of water or steam supply and is provided with a valve 24, and it will preferably be supported from the pipe E by hangers 25.

The cylinder A is lined with fire-brick or other suitable material, (indicated by 15.) At the delivery end of the cylinder is a rotary pan I, into which the metal from the cylinder A is delivered. The pan may be supported in any convenient manner to permit of its rotation—as, for instance, by a central downwardly-extending pin *i*, supported in a step-bearing 25—and a series of antifriction-rollers 26 may be provided to maintain the pan in a horizontal position. The upper edge of the pan works within the lower edge of a hood or covering J, from which extends a

stack *j* and through which the products of combustion from the cylinder escape. These products pass over the pan I and tend to keep the metal therein at a suitable temperature for further treatment. The hood or covering may be supported in a stationary position in any suitable manner—as, for instance, by pillars 27—and it is provided with an opening through which the delivery end of the cylinder extends. In order to impart rotary movement to the pan I, it may be provided with a circular rack 28 on its under surface and a gear 29, carried by the shaft C, may engage the rack, suitable means being provided to rotate the shaft.

Preferably the iron will be balled in the pan I, the hood J being provided with suitable openings for the insertion of the implements necessary for this operation and also to permit the balls to be taken out. Sometimes, however, it may be desirable to use the pan I only to work the metal until it is in the right condition for balling and then to remove it from said pan to a balling-furnace. For this purpose I have shown a balling-furnace K on each side of the hood J and which communicates with it through openings 16, and when the balling is to be done in these furnaces K an attendant will with a proper implement work the metal in the pan I until it is in the right condition for balling and then toss it through one of the openings 16 into one of the furnaces K, where it will be balled in the usual manner ready for the squeezers. Each furnace K is provided with a fire-box *k* and a bridge 17 between the fire-box and furnace and a flue 18, through which products of combustion escape. Instead of the balling-furnaces shown rotary balling-furnaces of any well-known type may be employed.

Having described the mechanical features of the apparatus, I will now describe the operation. Pig-iron is introduced into the melting-furnace D as fast as is necessary to keep up a supply of molten metal to the cylinder A. This cylinder, which is in effect a converter or purifier, is rotated at a uniform speed and the metal introduced is thereby constantly agitated and shifted from one position to another, and thus every particle of the mass is subjected to the action of the flame from the nipples *g* and will gradually work down to the delivery end of the cylinder. Air can enter freely at the receiving end of the cylinder to supply the necessary oxygen, and by the time the metal reaches the delivery end of the cylinder most of its carbon and other impurities will have been eliminated and the metal will be at "nature," or nearly so.

It may sometimes be necessary to reduce the temperature of the metal at certain stages of its treatment in the cylinder, and this may be accomplished by spraying water on it through the orifices 23 of the pipe 22. The water is of course vaporized and passes off in the form of steam with the products of combustion out through the delivery end of the cylinder and stack *j*. The metal when it enters the pan I will be in a spongy condition, but not balled, and the products of combustion passing over the pan to the stack will keep the metal at the proper temperature to enable the attendant to work it and toss it through the openings 16 to the furnaces K, where it will be balled in the ordinary manner or it may be balled in the pan I, as before stated.

The advantages arising from the use of my improved apparatus are that the operation may be practically continuous and carried on with much less manual labor than is at present necessary when the output is considered. The flow of metal into the converter may be continuous, except at such times as it may be necessary to suspend operations to repair the apparatus, and of course the delivery to the pan I and the operation of balling will also be continuous. Heretofore, so far as I am aware, converters have received a certain charge of iron, either melted or unmelted, and after being treated the entire charge of purified metal is discharged from the converter to be balled and another charge put into the converter. To save time in charging and discharging the converter, heavy charges have been used, and this necessitated considerable time to eliminate the impurities. By my improved apparatus the metal is fed slowly but continuously to the converter, and in moving toward the delivery end of the converter it is in a comparatively-thin film on the interior of the converter from end to end thereof, and this results in a more rapid exposure of every particle of the metal to the action of the heat and flame in the converter and the impurities are more rapidly eliminated.

My invention is not limited to the use of the specific forms of melting and balling furnaces shown nor to other specific details of construction illustrated and described, as these may be modified or changed in many ways and still be within the scope of my claims.

Having described my invention, I claim—

1. In an apparatus for the manufacture of wrought-iron, the combination of an open-ended cylinder supported to rotate about its axis, means to rotate it, means to deliver molten metal into one end, means to supply fuel to the interior of the cylinder, a covered rotary pan into which the cylinder discharges the metal, and a stack leading from the cover of the pan through which the products of combustion pass from the cylinder, substantially as set forth.

2. In an apparatus for the manufacture of wrought-iron, the combination of an open-ended cylinder supported at an inclination to rotate about its axis, means to rotate it, means to deliver molten metal to the highest end of the cylinder in a substantially continuous and uniform flow, means to supply fuel to the in-

terior of the cylinder, a covered rotary pan into which the cylinder discharges the metal, and a stack leading from the cover of the pan through which the products of combustion pass from the cylinder, substantially as set forth.

3. In an apparatus for the manufacture of wrought-iron, the combination of an open-ended cylinder supported to rotate about its axis, means to rotate it, means to deliver molten metal into one end, means to supply fuel to the interior of the cylinder, a covered pan into which the cylinder discharges the metal, a stack leading from the cover of the pan through which the products of combustion pass from the cylinder, and a balling-furnace adjacent to and communicating with said pan, substantially as set forth.

4. In an apparatus for the manufacture of wrought-iron, the combination of an open-ended cylinder supported to turn about its axis, means to turn it, means to deliver molten metal into one end of the cylinder, a water-pipe extending through the cylinder, a fuel-pipe within the water-pipe, discharge-nipples radiating from the fuel-pipe and projecting through the water-pipe, a covered rotary pan into which the cylinder discharges the metal, and a stack leading from the cover of the pan through which the products of combustion pass from the cylinder, substantially as set forth.

5. In an apparatus for the manufacture of wrought-iron, the combination of an open-ended cylinder supported at an inclination to turn about its axis, means to turn it, means to deliver molten metal into the highest end of the cylinder, means to deliver fuel to the interior of the cylinder, means to spray water onto the metal within the cylinder, a covered rotary pan at the lower end of the cylinder into which the latter discharges the metal, and a stack leading from the cover of the pan through which the products of combustion pass from the cylinder, and a balling-furnace adjacent to and communicating with the rotary pan, substantially as set forth.

6. In an apparatus for the manufacture of wrought-iron, the combination of an open-ended cylinder supported to rotate about its axis, means to rotate it, means to deliver molten metal into one end, a pan to receive the metal from the other end, and a fuel-supply pipe within the cylinder about which the cylinder rotates, said pipe having radiating discharge-nipples, substantially as set forth.

7. In an apparatus for the manufacture of wrought-iron, the combination of an open-ended cylinder supported to rotate about its axis, means to rotate it, means to deliver molten metal into one end, a pan to receive the metal from the other end, a fuel-supply pipe within the cylinder about which the cylinder rotates, said pipe having radiating discharge-nipples, and means to spray water upon the metal within the cylinder, substantially as set forth.

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

SIMON PETER KETTERING.

Witnesses:

A. McDOWELL,

J. T. McDOWELL.