(No Model.)

J. REESE.

REGENERATOR FOR SECURING A UNIFORM TEMPERATURE IN STEEL INGOTS.

No. 270,249. Patented Jan. 9, 1883.

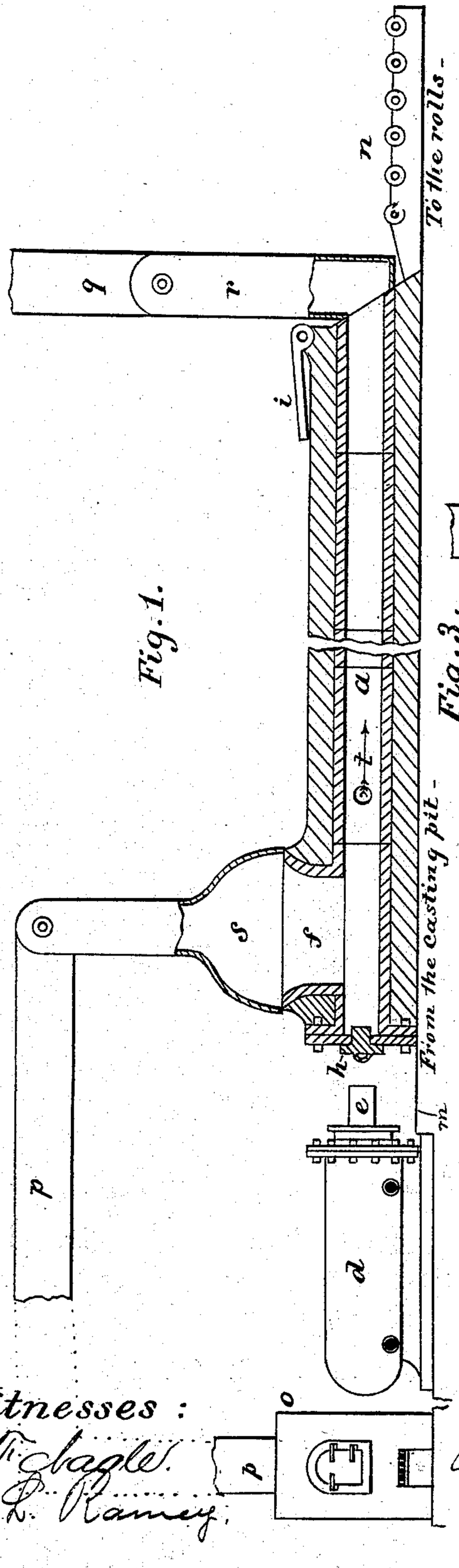

Fig. 1.

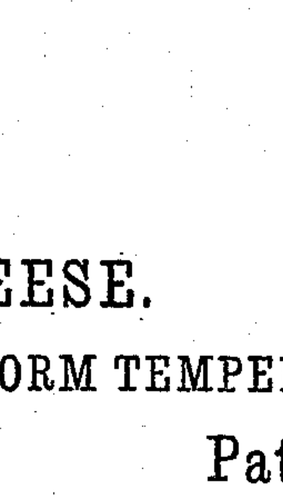

Fig. 3.

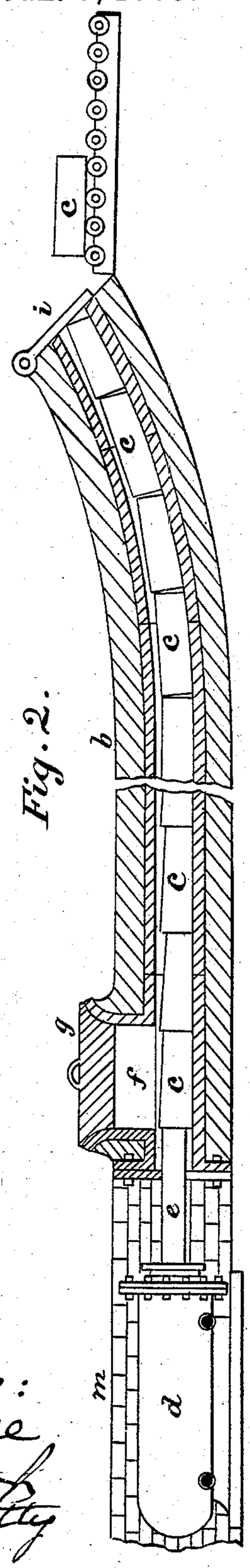

Fig. 2.

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UNITED STATES PATENT OFFICE.

JACOB REESE, OF PITTSBURG, PENNSYLVANIA.

REGENERATOR FOR SECURING A UNIFORM TEMPERATURE IN STEEL INGOTS.

SPECIFICATION forming part of Letters Patent No. 270,249, dated January 9, 1883.

Application filed October 20, 1882. (No model.)

To all whom it may concern:

Be it known that I, JACOB REESE, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Regenerators for Securing a Uniform and Desirable Temperature in Steel Ingots; and I hereby declare the following to be a full, clear, and exact description thereof, reference being had to the drawings forming a part thereof.

I use the term "regenerator" to indicate the device for the reason that the heat of the chamber is maintained by the heat given off from the ingot. Another term which may be used is "equalizing-tunnel."

The object in view is to facilitate and cheapen the blooming of steel ingots; and to this end I transfer the ingot, after having stripped it of the mold, from the casting-pit to a regenerator or equalizing-tunnel, in its passage through which the temperature is preserved in the shell or outer part of the ingot until the center has solidified and the whole ingot has acquired a uniform solidity and temperature, so that when the ingot escapes from the equalizing-tunnel or regenerator it is in condition to pass to the blooming-mill, all as will hereinafter more fully appear.

Figure 1 is a side view of my improved ingot-regenerator plant, part in section, when placed above ground. Fig. 2 is a side view of my ingot-regenerator plant, part in section, when placed under ground. Fig. 3 is a view of my false ingot.

Like letters refer to like parts where they occur.

I will now proceed to describe my invention more specifically, so that others skilled in the art to which it appertains may apply the same.

In the drawings, *a* is the inner metal walls of the regenerator or equalizing-tunnel. *b* is the outer non-conducting lining. *c* are the ingots in transit through the regenerator or equalizing-tunnel. *d* is the hydraulic ram. *e* is the ram-piston. *f* is the hopper, through which the ingots are inserted into the regenerator or equalizing-tunnel. *g* is the hopper-lid. *h* is a stopper for closing the end of the regenerator or equalizing-tunnel when the ram-piston is withdrawn. *i* is the lid, covering the end of the regenerator or equalizing-tunnel, through which the ingots are delivered. *m* is the floor-line. *n* is the blooming-mill table. *o* is the furnace for the initial heating of the regenerator or equalizing-tunnel. *p* is the flue leading from the furnace to the regenerator or equalizing-tunnel. *q* is the stack, with the adjustable flue *r*, for taking away the gases from the regenerator or equalizing-tunnel during its initial heating.

In the practice of this improvement in a Bessemer-steel plant, having a capacity to produce six hundred tons of rails per day of twenty-four hours, when three-rail ingots are made the ingots will be about twelve inches square and nearly five feet long, eighty ingots per hour will be produced, and as it is necessary that the ingots should remain in the regenerator or equalizing-tunnel from twenty to thirty minutes for such a plant, I construct the regenerator or equalizing-tunnel of sufficient capacity to hold forty ingots, and as each ingot is five feet long the length of the regenerator or equalizing-tunnel will be five by forty, or two hundred feet in length, and of sufficient internal cross-section to permit the ingots to pass freely through it. Where the passage is straight it need not be more than one inch larger than the ingot; but where it deflects, sufficient room should be provided to allow the ingots to pass forward freely.

The regenerator or equalizing-tunnel may be constructed of any suitable material; but I prefer to construct its internal shell of steel, with walls of about two inches thick. This shell should be surrounded by a wall of fire-brick, fire-clay, or some other good non-conductor of heat, and the whole protected from rain or dampness from any source. These non-conducting outside walls may be made of fire-brick, asbestus, or mineral wool; but in any case they should be made of sufficient thickness, so as to prevent the heat from escaping as far as possible.

At the converting-house end of the regenerator or equalizing-tunnel a furnace should be connected with it in such a manner that the products of combustion may be forced from the furnace through the entire length of the regenerator or equalizing-tunnel, in order to raise its temperature to the proper degree before charging. At the other end of the regenerator or equalizing-tunnel it is provided with a door, a stack, and gas-flue for carrying

off the waste gases. At the converting-house end of the regenerator or equalizing-tunnel it is provided with a hydraulic ram for pushing the ingots through, and near this end is placed a hopper, having an opening of sufficient size to drop the ingots down into the regenerator or equalizing-tunnel. When this hopper is not used for dropping the ingots in, it is tightly closed with a door or cap.

When this ingot regenerator or equalizing-tunnel is so constructed, with its front end within reach of the converting-house ingot-crane, and its rear end reaching to the blooming-mill table, the lid *i* is thrown back, the gas-flue *r* is placed over the regenerator, the furnace *o* is fired up, and the products of combustion are forced through the regenerator until it is properly heated. The gas-flue *r* is then detached, and the lid *i* is lowered, the blowing of the furnace is discontinued, the furnace-flue *s* detached, and the regenerator is ready for work.

A heat of metal having been blown and cast into ten or more ingots, the ingots, after being stripped of the mold, are taken immediately after casting and dropped into the hopper, with their small end fronting the blooming-mill. The hydraulic ram is then caused to push the ingot one length forward, the ram is drawn back and another ingot dropped in and pushed forward, and in this manner the ten ingots are dropped and pushed forward in the regenerator. The lid or cap of the hopper is then put on and the regenerator kept closed until the next heat has been cast, when the operation before described is again practiced, and so is the practice continued at intervals until the regenerator is fully charged. When the regenerator is fully charged and the ingots appear at the front end ready for rolling, the roller telegraphs to the engineer in charge of the hydraulic ram for an ingot. If an ingot is ready to be dropped in, it is so done, and by pushing it forward all the ingots in the regenerator are pushed one length ahead, and in doing so an ingot is pushed out of the front end. In passing out it raises the cap and escapes forward on the rollers. The cap *i* closes and the ingot enters the blooming-rolls and is bloomed in the usual manner. When this is done the roller telegraphs for another ingot, and does so whenever he wants one. When the roller telegraphs for an ingot, and the engineer at the other end has no ingot to put in, he then drops in a false ingot, such as shown in Fig. 3, and by pushing this false ingot forward the hot ingot is delivered at the other end. By this means the ingots may be delivered to the blooming-mill in regularity as required. When a false ingot escapes from the regenerator or equalizing-tunnel at the blooming-mill it is drawn aside and placed on a truck and returned to the charging end.

The false ingots may be made by riveting two plates on the ends of four bars, or they may be made as hollow steel ingots. The skeleton form of the ingot permits the passage past it and free circulation of the non-oxidizing gases employed to protect the ingots from oxidation.

Should the blooming-mill not take the ingots as fast as they are made and taken from the pit, the hopper may be made so as to retain ten or more ingots one above the other, and by this means the ram may push the bottom ingot forward at such intervals as required, while the ingots may be dropped in as fast as they can be taken from the pit.

When the ingots are taken from the mold in which they are cast the outside has been hardened and cooled by coming in contact with the cold ingot-mold, but the metal on the inside of the ingot is still in a molten state. Now, if the outside temperature is 1,000° Fahrenheit to the depth of half an inch, and the remainder is 4,000° Fahrenheit, a twelve-inch-square ingot weighing eighteen hundred pounds would contain more than sufficient heat, if properly distributed, to possess a uniform temperature of 2,500° Fahrenheit, so that when the ingots are placed in the regenerator or equalizing-tunnel the outside abstracts heat from the walls of the regenerator and from the highly-heated air, and as the center solidifies the heat thus set free in passing out also heats up the outside shell of the ingots, as well as the air which conveys the excess heat to the walls of the regenerator, so that within thirty minutes from the time an ingot is placed in the regenerator or equalizing-tunnel it has assumed a uniform temperature throughout its entire body and is in proper condition for blooming without the use of any fuel for reheating. When a temperature not exceeding 1,500° Fahrenheit is required in the ingots for blooming, cast-iron will be suitable for the inner walls, but when the temperature of the ingot is required to exceed that degree the inner walls should be made of steel, low in carbon, which will resist a temperature of 2,500° to 3,000° Fahrenheit without injury.

In the ordinary practice of reheating ingots there is a loss by oxidation of two and a half per cent. When the ingots cost forty (40) dollars per ton this waste amounts to one dollar per ton. By the use of my ingot-regenerator the greater part of this loss is avoided; and in order to prevent the loss of oxidation altogether, I force the vapor of petroleum, carbonic oxide, or other carbonated vapor into the regenerator, so as to keep it continuously charged with a non-oxidizing gas. By this means the oxidation of the metal is entirely prevented, and the loss from oxidation avoided.

In order that the metal may be more perfectly protected from oxidation, a carbonated vapor—such as petroleum or other hydrocarbon or carbonic oxide—is forced into the regenerator through the opening marked *t*, and by this means a non-oxidizing atmosphere may be constantly secured within the regenerator.

Having described my invention, what I claim

as new and useful, and desire to secure by Letters Patent, is—

1. In a plant for casting, transferring, and blooming ingots, the combination of a casting-pit, a blooming-mill, and an interposed ingot transfer-tunnel provided with devices, substantially as described, for forcing the ingots in succession from the pit to the rolls, substantially as and for the purpose specified.

2. In a plant for casting, transferring, and blooming ingots, the combination of a casting-pit, a blooming-mill, and an interposed ingot-transfer and equalizing tunnel composed of an iron or steel chamber surrounded by a non-conducting covering, and provided with devices, substantially as described, for forcing the ingots in succession from the pit to the rolls, substantially as and for the purpose specified.

3. An ingot-regenerator or equalizing-tunnel having openings for receiving and discharging the ingots, and provided with a gas inlet, substantially as and for the purpose specified.

4. The combination, with an equalizing-tunnel having a non-conducting covering or shell, and an inlet and outlet, of a furnace detachably connected therewith, substantially as and for the purpose specified.

5. The combination, with an equalizing-tunnel or regenerator having a non-conducting covering or shell, of a furnace detachably connected therewith, and a hydraulic ram, arranged at the furnace end of the tunnel.

6. A false ingot of skeleton form, substantially as and for the purpose specified.

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Witnesses:

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