(No Model.) 3 Sheets—Sheet 1.

J. GIERS.

MANUFACTURE OF STEEL.

No. 283,735. Patented Aug. 21, 1883.

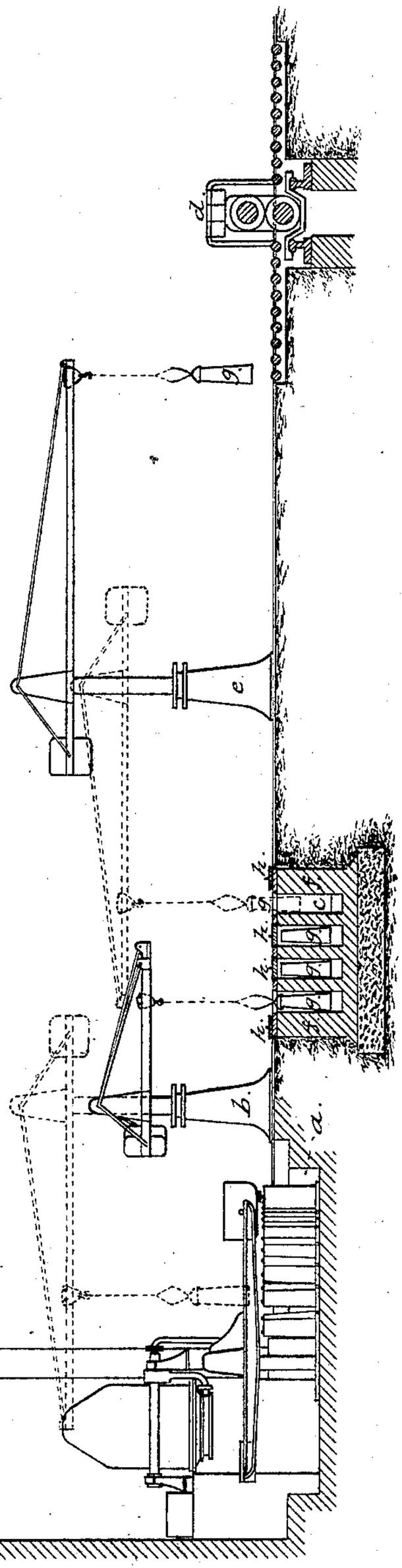

Fig. 1.

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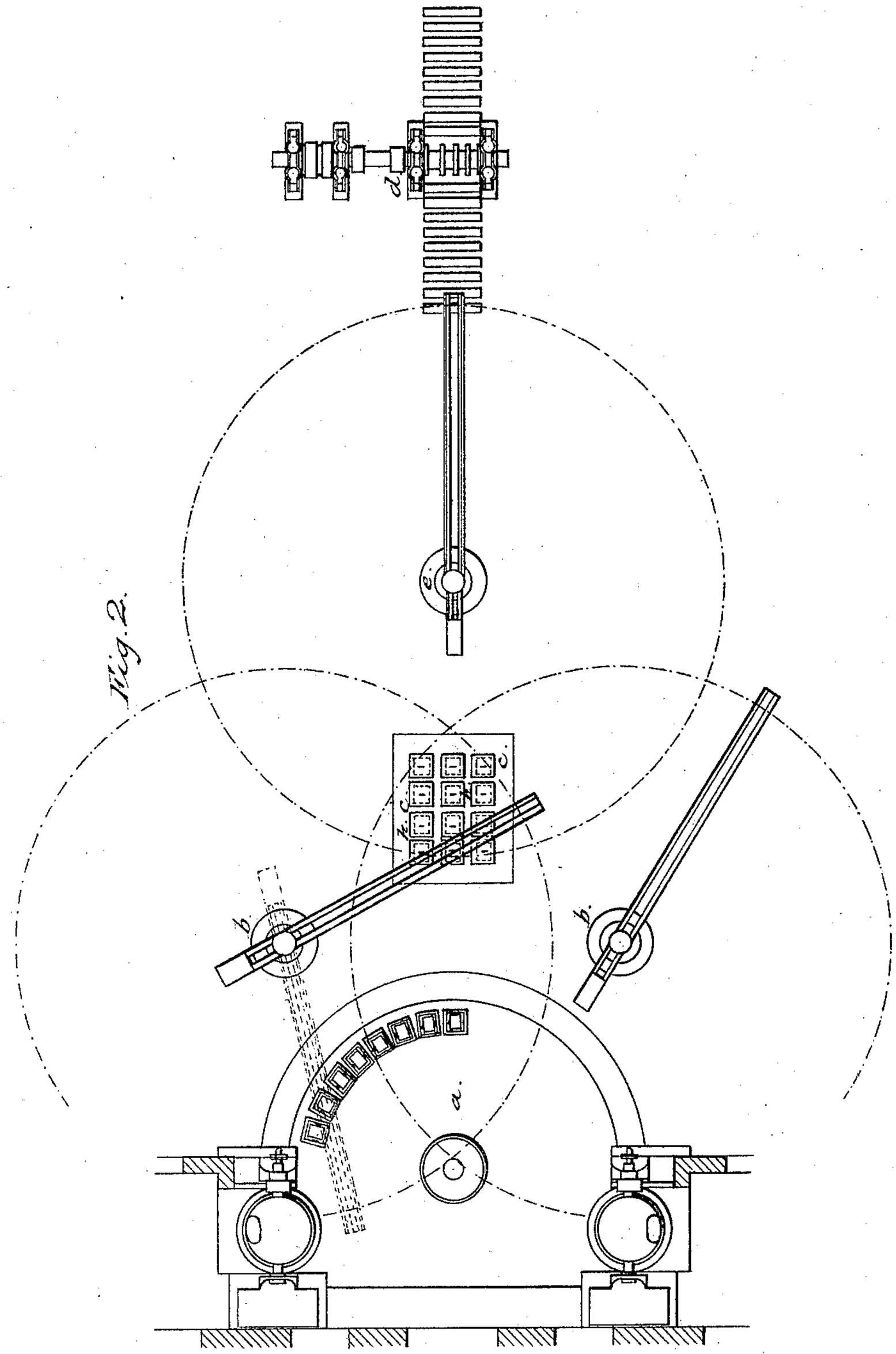

Fig. 2.

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Fig. 4.

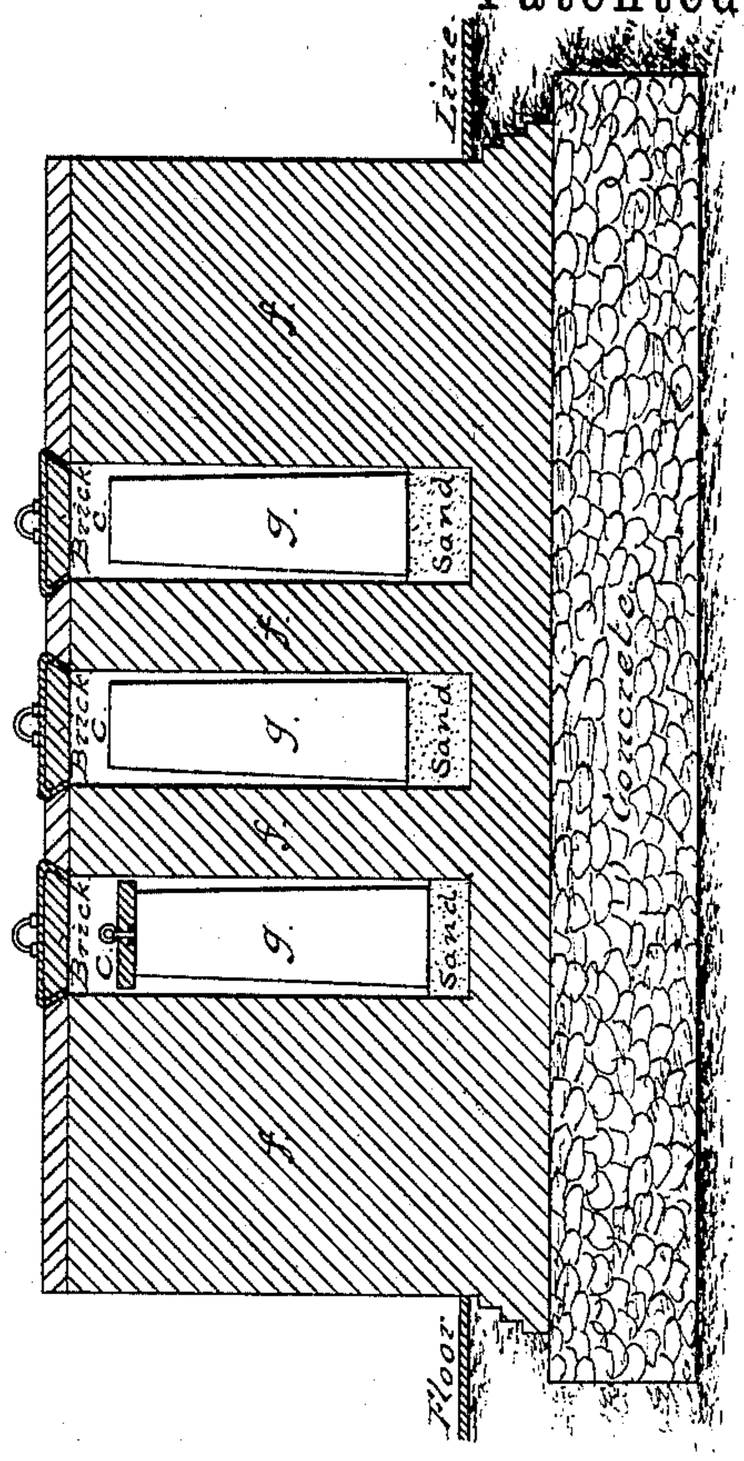
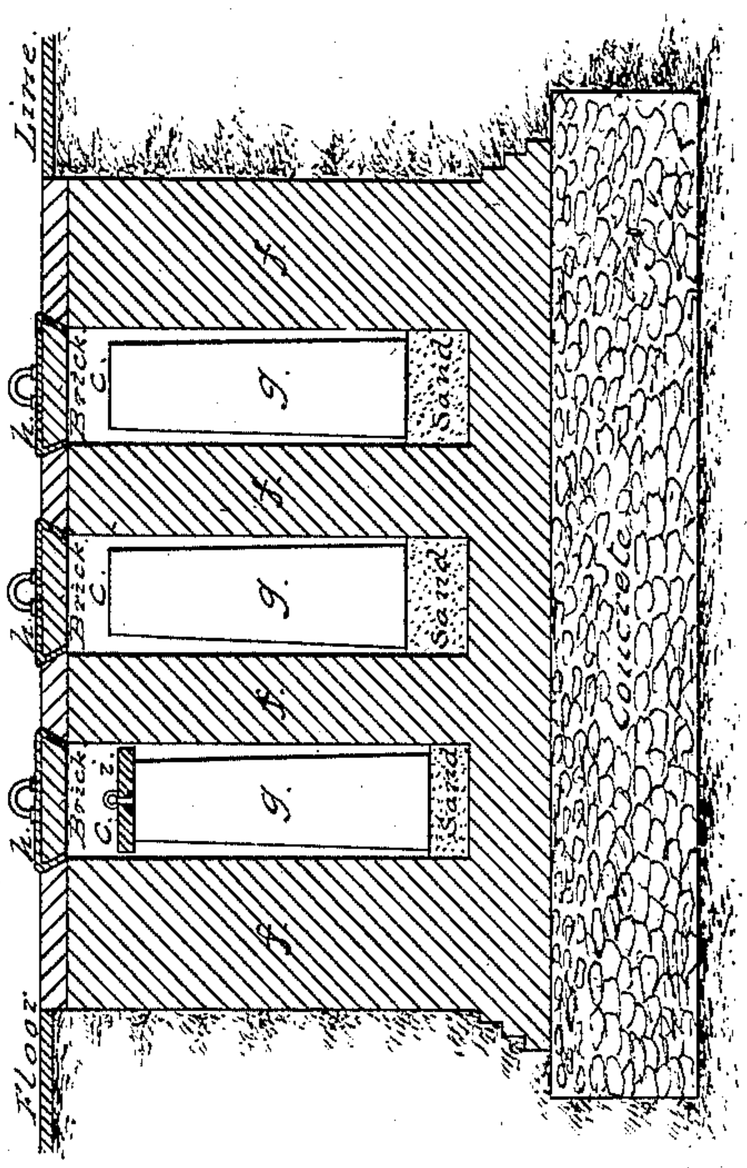


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN GIERS, OF MIDDLESBROUGH-ON-TEES, COUNTY OF YORK, ENGLAND.

MANUFACTURE OF STEEL.

SPECIFICATION forming part of Letters Patent No. 283,735, dated August 21, 1883.

Application filed April 18, 1882. (No model.) Patented in England March 7, 1882, No. 1,089; in France May 8, 1882, No. 148,829; in Germany May 9, 1882, No. 21,716; in Belgium May 12, 1882, No. 57,891, and in Austria April 7, 1883, No. 27,037.

To all whom it may concern:

Be it known that I, JOHN GIERS, a subject of the Queen of Great Britain and Ireland, residing at Middlesbrough-on-Tees, in the North Riding of county of York, England, have invented a certain new and useful Improvement in the Manufacture of Steel; 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.

Hitherto, when a steel ingot has been cast, either by the Bessemer, the open-hearth, or other process, it has in practice usually been taken, while yet hot, to a heating-furnace, and therein brought to a sufficient and even heat, preparatory to being rolled down into a bloom or into a finished article. This has been done at considerable expense in skilled labor, in fuel, in loss of yield, and in the building and maintaining of costly heating-furnaces. In some isolated cases it has been experimentally attempted to obviate the above-described inconvenience and loss by rolling down ingots immediately after they have been stripped from the mold and without the application of any heat other than their initial heat or that derived from the fluid metal of which they were formed; but in practice it has been found impossible to carry this out, since every ingot could not be taken to the rolls at once, while, moreover, as is well known, the heat of an ingot is unequally distributed—that is to say, an ingot, when stripped quickly, is in the interior too hot for rolling, (sometimes it is even in a fluid or partially fluid state,) and if kept long enough for the interior to be reduced to the proper heat the exterior becomes, from radiation, too cold for rolling. The practice has also been described, and been followed to some extent, of placing hoods or shields lined with refractory material over the ingots after they are stripped and before being conveyed to the rolls, to prevent unequal cooling, or to put them in portable chambers so lined, in which they are conveyed to the blooming-rolls; also, of packing them for a while before rolling in pulverized charcoal, or an equivalent pulverized material, in portable boxes or chambers above ground or in pits, and commanded by cranes to lift them from the molds to the chambers or pits, and from thence to the blooming-rolls; but I have found, by trial, all these plans defective, for the reason, mainly, that the exterior of the ingot becomes suddenly cooled or too greatly cooled to admit of proper development and uniform distribution of the heat throughout the ingot, and that these methods are also cumbersome and impracticable.

Now, my invention consists in constructing a series of stationary vertical soaking pits or chambers—preferably under ground and near the blooming-rolls, and provided with thick walls of refractory material—these underground chambers to be previously heated by the first charge of the ingots, and their temperature maintained by the successive charges, the use of any pulverized material or the employment of portable chambers or hoods to be entirely dispensed with. I employ, also, suitable cranes to carry the ingots quickly from the molds to the pits, and from thence to the rolls. By these means the surface heat of the ingot is maintained or even increased from what it is when it leaves the mold, the interior heat reduced, its uniform distribution secured, and the whole process shortened and improved.

My invention, in a convenient form, is illustrated in the accompanying drawings, in which Figure 1 is an elevation and part vertical section; Fig. 2, a plan. Fig. 3 is a view in cross-section of the "soaking-pits," and Fig. 4 a similar view of a modification thereof.

Referring to the drawings, *a* is a Bessemer casting-pit. *b b* are cranes commanding the same, and *c c* are soaking-pits, shown arranged in a block of four rows, but which may be otherwise arranged—as, for example, concentrically to the crane. *d* is a blooming-mill, and *e* is a crane for transferring the heated ingots from the soaking-pits to the rolls. The soaking-pits *c* are constructed in a mass of refractory material, *f*—such as fire-brick—which will absorb a large amount of heat while in use.

h is a cover or lid, lined also with refractory material, with which the pits *c* are covered after the ingots are deposited therein. I also prefer to use a second or false cover slightly smaller in cross-section than the pit, consisting of a slab or block of fire-brick, which is placed on top of the ingot inside of the pit

before the outside cover is put on, as shown at *i*, Fig. 3. This is especially desirable when the ingot is much shorter than the pit.

Fig. 4 represents a pit constructed partly above and partly below ground; but in such case the wall of refractory material should be made thicker than when the chambers are entirely below ground, so as to render them practically under ground.

When the ground is wet, or for other reasons an under-ground pit is undesirable, the the soaking-pits may be built entirely above ground; but in such cases, as just stated, the exterior wall should be made thicker, so as to set over the heat.

As the practical success of my improvement depends, not upon a slow cooling of the ingots, but upon returning to the surface of the ingots the heat radiated therefrom while in the soaking-pit, it becomes necessary that the surrounding walls of the pit should be of sufficient thickness to receive and accumulate a large store of heat with as little loss from external radiation as possible. For this purpose, if good fire-brick be used, a thickness of wall eighteen inches will ordinarily suffice, although walls of somewhat less thickness might perhaps secure the desired result.

Each soaking-pit *c* is of a cross-section slightly larger than that of the ingot, and of a depth slightly deeper than the length of the ingot. In practice I find it advantageous to make the pit of a cross-section exceeding that of the ingot by as little as is compatible with the ready insertion and withdrawal of the ingots; but in order to allow for those cases in which the ingots have fins or excrescences, I should usually make my pits about three inches larger in cross-section than the big end of the ordinary ingot to be treated.

The depth of the pit I make about twelve inches greater than the length of the longest ingot the pit is designed to receive, and the level of the pit's bottom is raised by putting in sand to form a floor to the pit, so that when an ingot is under treatment in the pit its upper end may be only about six inches below the mouth of the pit. Into such a pit each ingot, after being stripped, is promptly placed and covered over at once with the lid. Before the operation of rolling is commenced the soaking-pits are heated by the first charge of ingots, which are inserted solely for that purpose. By the successive charges of the ingots the brick-work of the soaking-pit is heated and maintained to about a certain temperature, so that if by any delay an ingot is received short of heat its temperature is raised by the heat from the walls of the pit itself. Thus the refractory mass of which the pits are formed acts as an accumulator and regulator of heat, giving and absorbing the same as is required to carry on in a practical continuous manner the operation of preparing the ingots for rolling.

The period during which the ingot is to be left in the pit varies with the size of the ingot and respective temperatures of pit and ingot at the time of the insertion of the ingots in the pit. With ingots about twelve inches average thickness I have found about thirty minutes sufficient. After a sufficient time has been allowed to elapse the surface heat of the ingot is increased, assumes about the same temperature as the interior, and a proper and uniform temperature acquired, which fits the ingots for the operation of the blooming-rolls.

The feature of my improvement which distinguishes it from attempts which have been heretofore made to prepare newly-cast steel ingots for rolling without subjecting them to the action of furnace heat consists in what I term a "soaking process," as distinguished from a process of slow or retarded cooling. By a soaking process I mean treating newly-cast ingots, while the steel is in a fluid or semi-fluid condition at the center and while sufficiently solid at the surface of the ingot, in a pit surrounded by walls of refractory non-conducting material capable of being highly heated by the absorption of heat from successive charges of ingots treated therein, and of sufficient thickness to prevent any material loss of heat by radiation from the exterior, so that when the newly-cast ingots are placed in such heated pit the heat radiated therefrom is continually returned to the surface of the ingot, thereby allowing the interior of the ingot to part with its excess of heat, while the exterior gradually rises in temperature until the whole mass acquires a uniform temperature suitable for rolling or hammering.

If the ingot were surrounded with a considerable air-space or with powdered charcoal or similar substance, interposed between the walls of the pit and the ingot, a process of slow or retarded cooling would be the result, and the exterior of the ingot would always remain materially cooler than the interior, until the entire mass becomes too cold to be worked. If, however, more ingots should be cast or taken from the molds and placed in such soaking-pits simultaneously and treated as above, substantially the same results might possibly be obtained, in which case the process would be the same as above described and herein claimed; but I prefer treating each ingot singly and separately.

It will also be seen that the above process might be followed with the ingots placed in the pits in a horizontal position; but I prefer to arrange them vertically, as already described.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The process hereinbefore described of preparing newly-cast steel ingots for rolling or hammering by subjecting them for a short time to a heat-equalizing treatment in previously-heated soaking-pits composed of or lined with a sufficient thickness of fire-brick or similar refractory non-conductive material, whereby the heat radiated from the ingots is returned thereto by the walls of the pit until a substan-

tially uniform temperature of the ingot is attained, substantially as and for the purpose hereinbefore described.

2. As an improvement in apparatus for treating newly-cast steel ingots preparatory to rolling or hammering, vertical soaking-pits constructed of or lined with a sufficient thickness of fire-brick or other suitable non-conducting refractory material to serve as an accumulator and radiator of heat given out from the ingots placed therein, each such pit having a separate lid or cover, substantially as and for the purpose described.

3. As an improvement in apparatus for treating newly-cast steel ingots preparatory to working, vertical soaking-pits constructed of or lined with fire-brick or similar material of sufficient thickness substantially to prevent the external radiation of heat, each such soaking-pit being furnished with a separate outer lid or cover and an inner or false cover to be laid on top of the ingot within the pit, substantially as and for the purpose described.

JOHN GIERS.

Witnesses:
W. COOPER,
EDGAR OUTHWAITE,
Both of Middlesbrough-on-Tees.