No. 724,549. PATENTED APR. 7, 1903.

F. H. DANIELS & S. T. & C. H. WELLMAN.

INGOT HEATING FURNACE.

APPLICATION FILED MAY 13, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

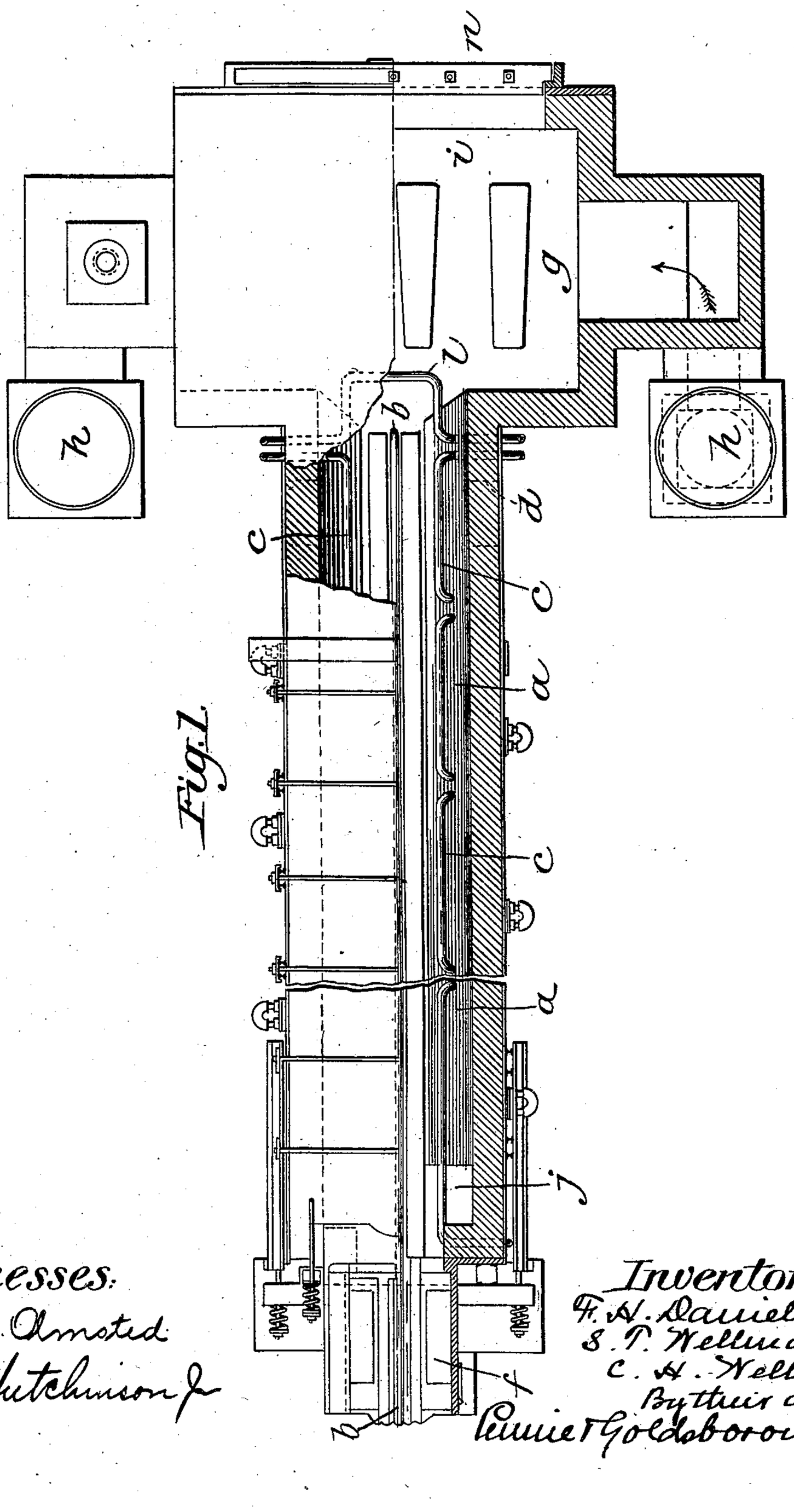


Fig. 1.

Witnesses:
E. M. Arnold
J. E. Hutchinson Jr

Inventors.
F. H. Daniels,
S. T. Wellman &
C. H. Wellman
By their attys.,
Lemuel Goldsborough

No. 724,549. PATENTED APR. 7, 1903.

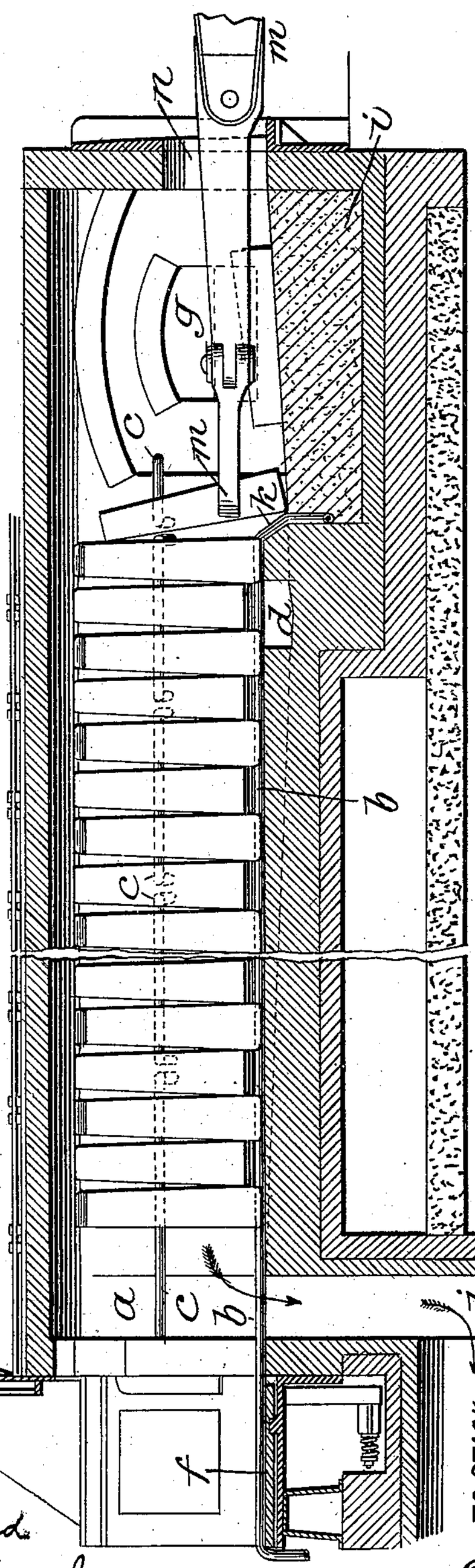
F. H. DANIELS & S. T. & C. H. WELLMAN.

INGOT HEATING FURNACE.

APPLICATION FILED MAY 13, 1902.

NO MODEL. 3 SHEETS—SHEET 2.

Fig. 2.



Witnesses:
E. M. Olmsted
J. E. Hutchinson Jr

Inventors.
F. H. Daniels,
S. T. Wellman &
By C. H. Wellman
Pennie Goldsborough attys

No. 724,549. PATENTED APR. 7, 1903.

F. H. DANIELS & S. T. & C. H. WELLMAN.

INGOT HEATING FURNACE.

APPLICATION FILED MAY 13, 1902.

NO MODEL. 3 SHEETS—SHEET 3.

Fig. 3.

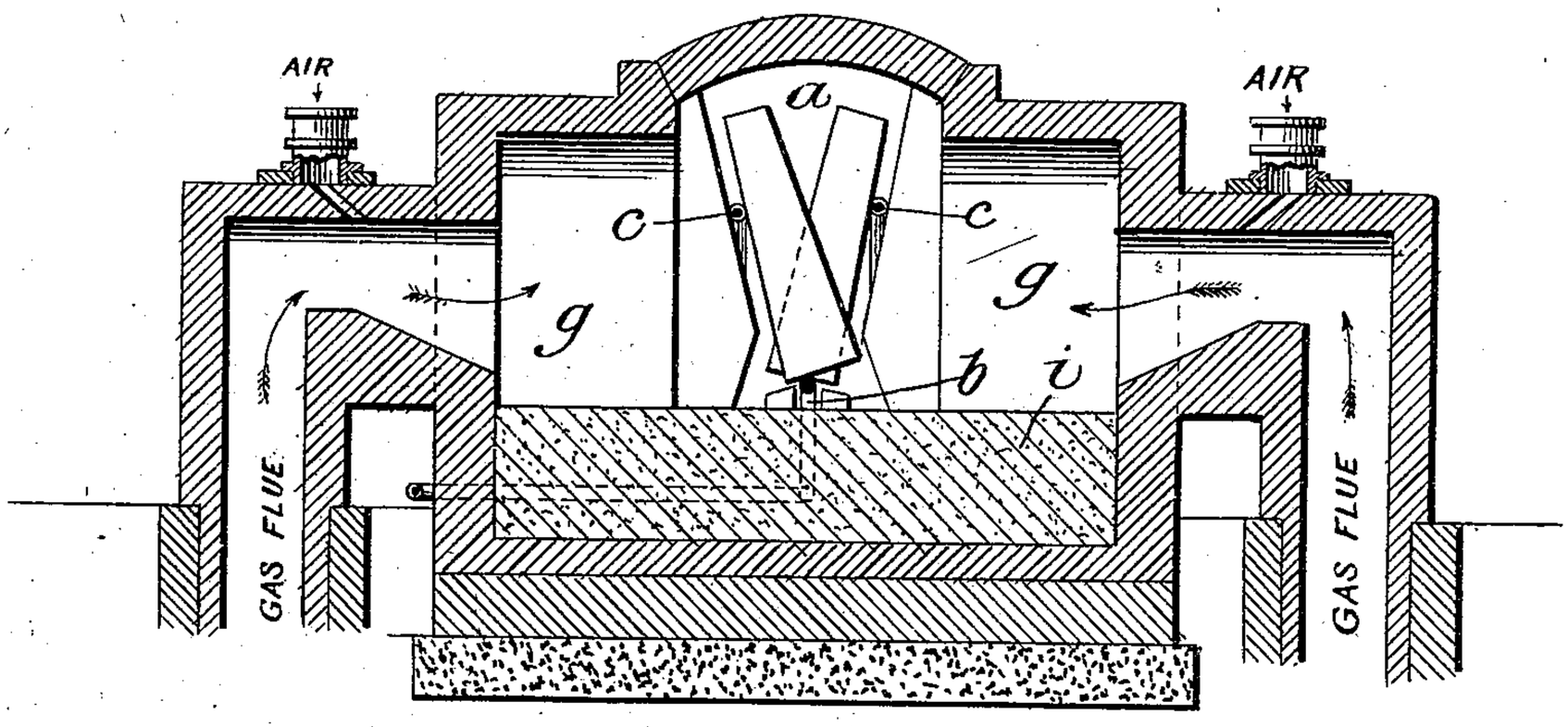
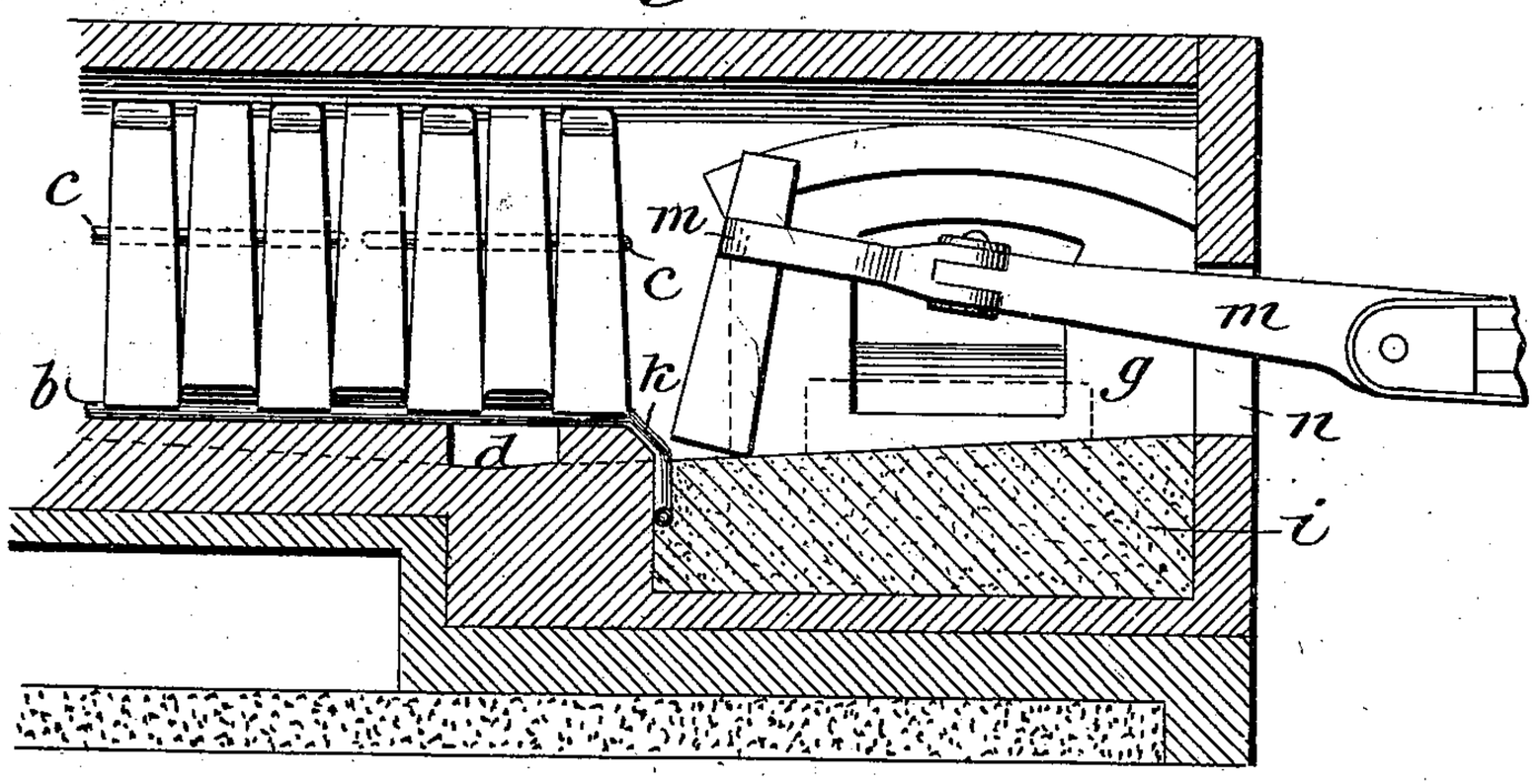


Fig. 4.



Witnesses:
E. M. Olmsted
J. E. Hutchinson Jr

Inventors.
F. H. Daniels,
S. T. Wellman &
C. H. Wellman, by
Pennie & Goldsborough attys

UNITED STATES PATENT OFFICE.

FRED H. DANIELS, OF WORCESTER, MASSACHUSETTS, AND SAMUEL T. WELLMAN AND CHARLES H. WELLMAN, OF CLEVELAND, OHIO; SAID WELLMAN AND WELLMAN ASSIGNORS TO THE WELLMAN-SEAVER-MORGAN ENGINEERING COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

INGOT-HEATING FURNACE.

SPECIFICATION forming part of Letters Patent No. 724,549, dated April 7, 1903.

Application filed May 13, 1902. Serial No. 107,143. (No model.)

To all whom it may concern.

Be it known that we, FRED H. DANIELS, residing at Worcester, county of Worcester, State of Massachusetts, and SAMUEL T. WELLMAN and CHARLES H. WELLMAN, residing at Cleveland, county of Cuyahoga, State of Ohio, all citizens of the United States, have invented certain new and useful Improvements in Ingot-Heating Furnaces; and we 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.

The invention relates more particularly to furnaces of the continuous type—that is to say, having elongated heating-chambers and where the ingots are introduced one at a time into one end and pushed through to the discharge end in opposition to the passage of the products of combustion. In the operation of these furnaces it has not heretofore been practicable to bring the ingots to a sufficiently high heat to effect the finishing process, and it has been customary to take them out of the furnaces and transfer them to finishing-chambers, or "soaking-pits," as they are called, where the ingots are subjected to the finishing heat, which is a necessary preparation for the action of the mill-rolls. These soaking-pits are separate from the furnaces, and as they are independently fired and require the maintenance of reheaters or regenerators they are very expensive in the matter of fuel consumption. Moreover, in order to maintain in the furnaces a suitable discharge heat for the ingots it is necessary to keep the fire-boxes so hot that considerable heat is lost up the stack unless the furnaces are constructed in abnormal lengths, which for many reasons is not feasible.

In the present invention the principal object in view is to economize in the cost of maintenance by eliminating the expense of the reheaters or regenerators for the soaking-pits and by minimizing the loss of heat up the furnace-stack, and the characteristic features of the invention are the enlargement of the discharge end of the furnace into a finishing-chamber, which is kept at a high heat and which performs the office of the usual soaking-pit, and the maintenance of a moderate heat in the furnace proper, which is made of the usual length. As thus constructed each furnace comprises in its structure two communicating chambers, into one of which the ingots are introduced and gradually raised to the highest temperature which it is feasible to raise them without wasting heat up the stack, which temperature, however, is not sufficient to prepare the ingots for rolling down, and to the other of which they pass immediately and are subjected to that high degree of heat necessary for the finishing operation, both chambers deriving their heat from the same source and the finishing-chamber acting as a storing-reservoir for supplying heat to the heating-chamber, into and through which the products of combustion pass from the finishing-chamber.

The invention is applicable to any form of the continuous type of heating-furnace. We have shown it herein as applied to the narrow vertical form illustrated and described in our patent of March 13, 1900, No. 645,305; but we do not intend to be limited to any particular construction either of the heating-chamber or the finishing-chamber or to any particular arrangement or connection of these chambers, provided it be such that the products of combustion from the finishing-chamber may pass freely into and through the heating-chamber and the ingots from the latter chamber may be transferred to the finishing-chamber, whence they are taken to the rolling-mill.

One form of furnace embodying the present invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a plan view, one-half the furnace being shown in section. Fig. 2 is a vertical longitudinal section; Fig. 3, a cross-section of the finishing-chamber; and Fig. 4 is a view similar to Fig. 2, illustrating a slightly-modified arrangement.

Referring to the views, *a* denotes the heating-chamber of the furnace. Its general construction is substantially like the corresponding chamber of our patent above referred to; but the interior arrangements for supporting the ingots are slightly different, as described and claimed in our application filed June 19, 1902, Serial No. 112,322; but as the means for supporting the ingots form no part of the present invention no further description thereof is deemed necessary herein except to say that the bottom of the chamber *a* has a central water-pipe *b*, on which the ingots rest, and lines of water-pipes *c* are arranged along the side walls for the ingots to lean against. The water-pipe *b* is preferably supported somewhat above the floor of the heating-chamber, as best shown in Fig. 3, and on each side of the pipe the floor of the chamber slopes gradually downward to a transverse slag-discharge *d* near the junction of the heating and finishing chambers.

The ingots are introduced into the furnace at the end where there is an ordinary door for closing the heating-chamber after the introduction of each ingot. The water-pipe *b* extends through this door onto a platform *f*, where the ingots are received and positioned ready to be pushed one at a time into the furnace.

At the discharge end of the furnace an enlarged chamber *g* is provided. Preferably it extends transversely across the end of the heating-chamber and is in open communication with it, as shown in all the figures of the drawings. This constitutes the finishing-chamber before referred to. It is preferably fired from both ends by generators *h* for gaseous fuel or furnaces of any kind for solid fuel. The capacity of this finishing-chamber is preferably such that a considerable number of ingots may be under treatment simultaneously, though the invention is not limited to any particular size, shape, or capacity.

In Figs. 2 and 3, *i* denotes the floor of the finishing-chamber. It is preferably made of sand and is sloped, as best shown in Fig. 2, toward the slag-discharge *d*, with an opposite inclination to the floor of the heating-chamber.

The products of combustion pass from the generators *h* into the finishing-chamber and thence directly into and through the heating-chamber and to the stack through the passage *j* at the feeding end.

The ingots are introduced into and passed through the heating-chamber by a pusher in the manner described in our patent before referred to. They are supported on end, as best shown in Fig. 3 herein, and slide along the water-pipe *b* in a manner now well understood. They lean alternately to one side and the other of the heating-chamber, and their upper portions rest against the side pipes *c*. As before described, the ingots are introduced one at a time, and as fast as they are raised to the proper temperature a new one is introduced, and the whole line is pushed forward until the whole length of the chamber is filled, as shown in Fig. 2, when the ones nearest the discharge end are ready to be transferred to the finishing-chamber. This transfer may be effected according to the present invention in either of two ways, one of which is indicated in Fig. 2 and the other in Fig. 4. As shown in both these figures, the water-pipe *c* is bent downwardly from the discharge end of the heating-chamber to the bed of the finishing-chamber on an inclination of about forty-five degrees, as shown at *k*. The object of this inclination of the pipe is to permit the ingots to slide from their support in the heating-chamber onto the floor of the finishing-chamber with as little jar and concussion as possible. In Figs. 1 and 2 the end section of the side line of pipes *c* is shown continued across the path of the ingots to the other side of the chamber *a* and projects slightly into the finishing-chamber, as at *l*; but in Fig. 4 this end section of the pipes *c* is omitted. In either arrangement the ingots are pulled from the heating-chamber into the finishing-chamber by power-tongs *m*, which are introduced through a door *n* in the side of the finishing-chamber opposite and in line with the heating-chamber *a*, through which door they are also removed, when the finishing operation is complete. These tongs may seize the ingots near their upper ends and pull them over head foremost onto the sand bed of the finishing-chamber, or they may seize them lower down and pull them butt foremost, as shown in Fig. 2. When the former method is used, the upper ends of the ingots require no support, and the cross-pipe *l* of the end section of the side pipes is omitted; but when the ingots are pulled butt foremost it is necessary to arrange the pipe as shown in Fig. 2 in order to prevent the ingots from tipping over forward. By either method the ingots are laid upon the floor of the finishing-chamber, as indicated in Fig. 1, and the door *n* of this chamber is preferably as wide as the chamber itself in order to facilitate the easy withdrawal of the ingots.

Such being the construction of our improved furnace, it is to be noted that as both the heating and finishing chambers derive their heat from the same source the expense of maintaining separate heaters is dispensed with; also, that the arrangement provides for the maintenance of an intense heat in the finishing-chamber and a moderate heat in the heating-chamber. No loss of heat results from the high temperature in the finishing-chamber, and as it forms a storage-reservoir for the heating-chamber it enables us to keep the latter at a more uniform temperature than was before possible and at the same time secures practically the same result with a lesser degree of heat, and consequently

minimizes the waste of heat by enabling us to utilize practically the whole volume of useful heat before the products pass to the stack.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. An ingot-heating furnace comprising two communicating chambers in combination, viz., a continuous chamber adapted to receive the ingots at one end and to have them advanced therethrough standing on end in opposition to the passage of the products of combustion, and a finishing-chamber at the discharge end of the continuous chamber, said continuous chamber being heated by the products of combustion passing into and through it from the finishing-chamber, and the latter chamber communicating with the continuous chamber so as to receive the ingots directly therefrom, said finishing-chamber having a door in line with the continuous chamber for the introduction of a tool to withdraw the ingots end foremost from the continuous chamber onto the bed of the finishing-chamber.

2. An ingot-heating furnace, comprising a heating-chamber into one end of which the ingots are introduced and through which they are progressively advanced, and a finishing-chamber communicating with the heating-chamber at its discharge end, said two chambers having their floors inclined in opposite directions toward a common slag-discharge.

3. An ingot-heating furnace, comprising a heating-chamber into one end of which the ingots are introduced and through which they are progressively advanced, and a finishing-chamber communicating with the heating-chamber at its discharge end, so as to permit the ingots to be transferred directly from the heating-chamber onto the floor of the finishing-chamber, and a support extending across the discharge end of the heating-chamber to prevent the ingots from falling forward and permit them to be drawn butt-end foremost.

4. An ingot-heating furnace, comprising a heating-chamber into one end of which the ingots are introduced and through which they are progressively advanced, a water-pipe in the floor of said chamber to support the ingots on end, said pipe being elevated above the floor of the chamber, and a finishing-chamber communicating with the heating-chamber and having a sand floor or bed the receiving end of which is below the level of the water-pipe, and an ingot-support extending across the end of the heating-chamber, said pipe being inclined as described at the discharge end to permit the ingots to slide easily onto the bed of the finishing-chamber, and the ingot-support acting to prevent them from falling over in case their upper ends are pulled forward.

In testimony whereof we affix our signatures in the presence of witnesses.

FRED H. DANIELS.
SAMUEL T. WELLMAN.
CHARLES H. WELLMAN.

Witnesses as to Fred H. Daniels:
W. E. SNYDER,
JAMES W. SMITH.

Witnesses as to Samuel T. and Charles H. Wellman:
C. W. COMSTOCK,
W. S. WELLMAN.