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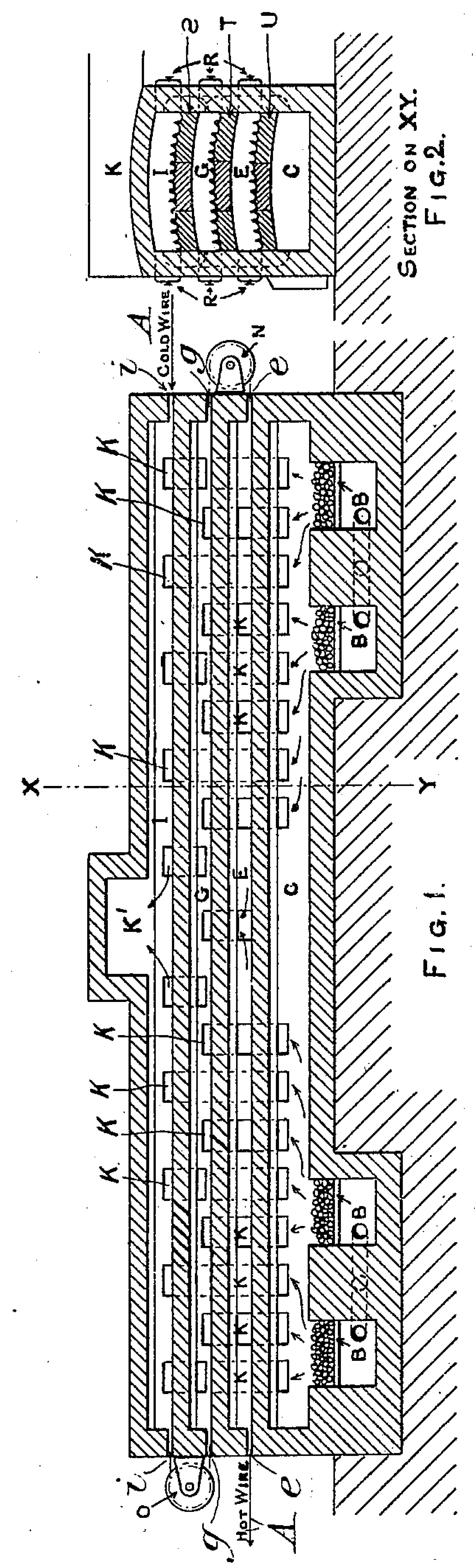
F. H. DANIELS.

FURNACE FOR ANNEALING WIRE.

(Application filed Apr. 9, 1902.)

(No Model.)



Section on XY.
Fig. 2.

Fig. 1.

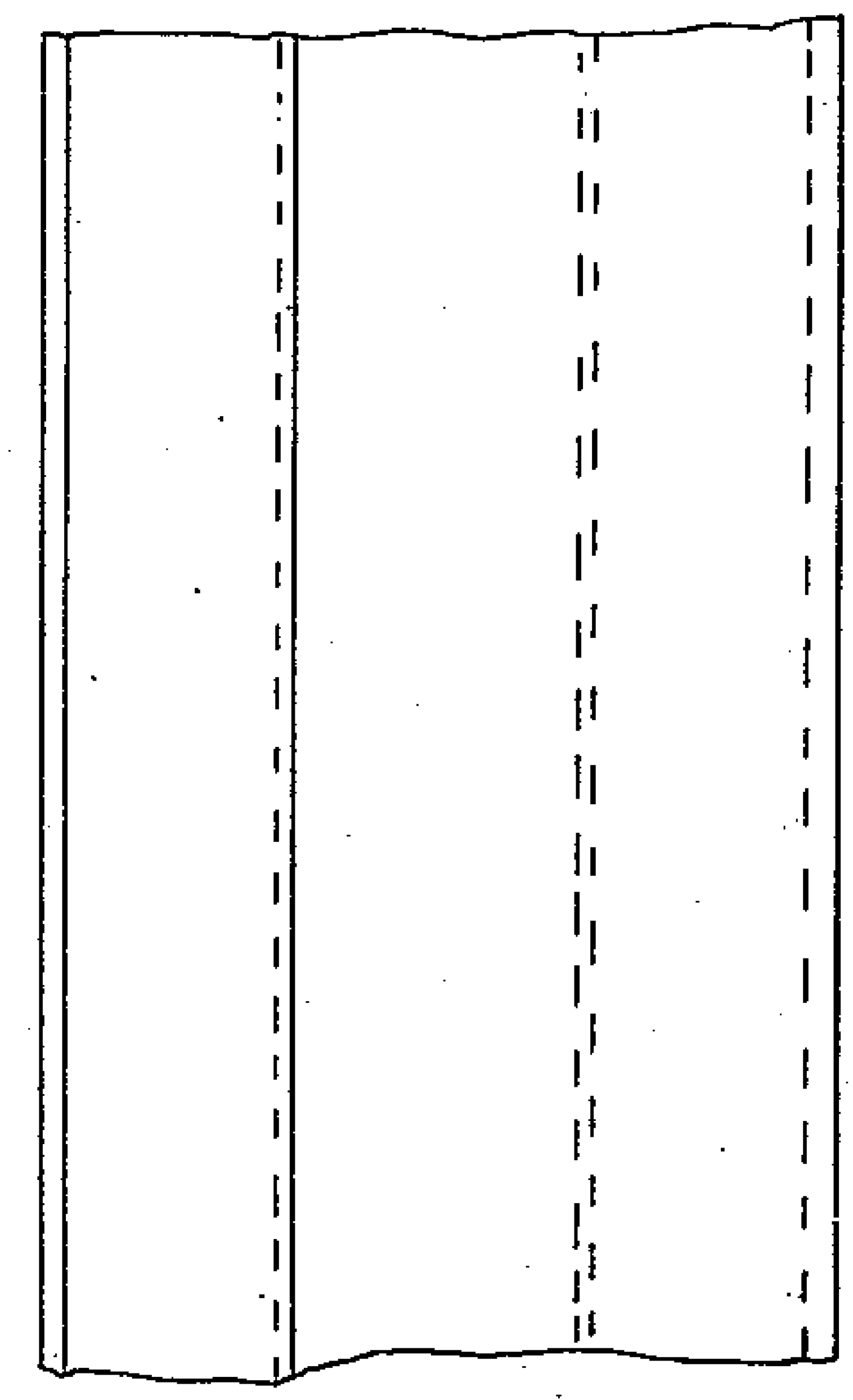


Fig. 4.

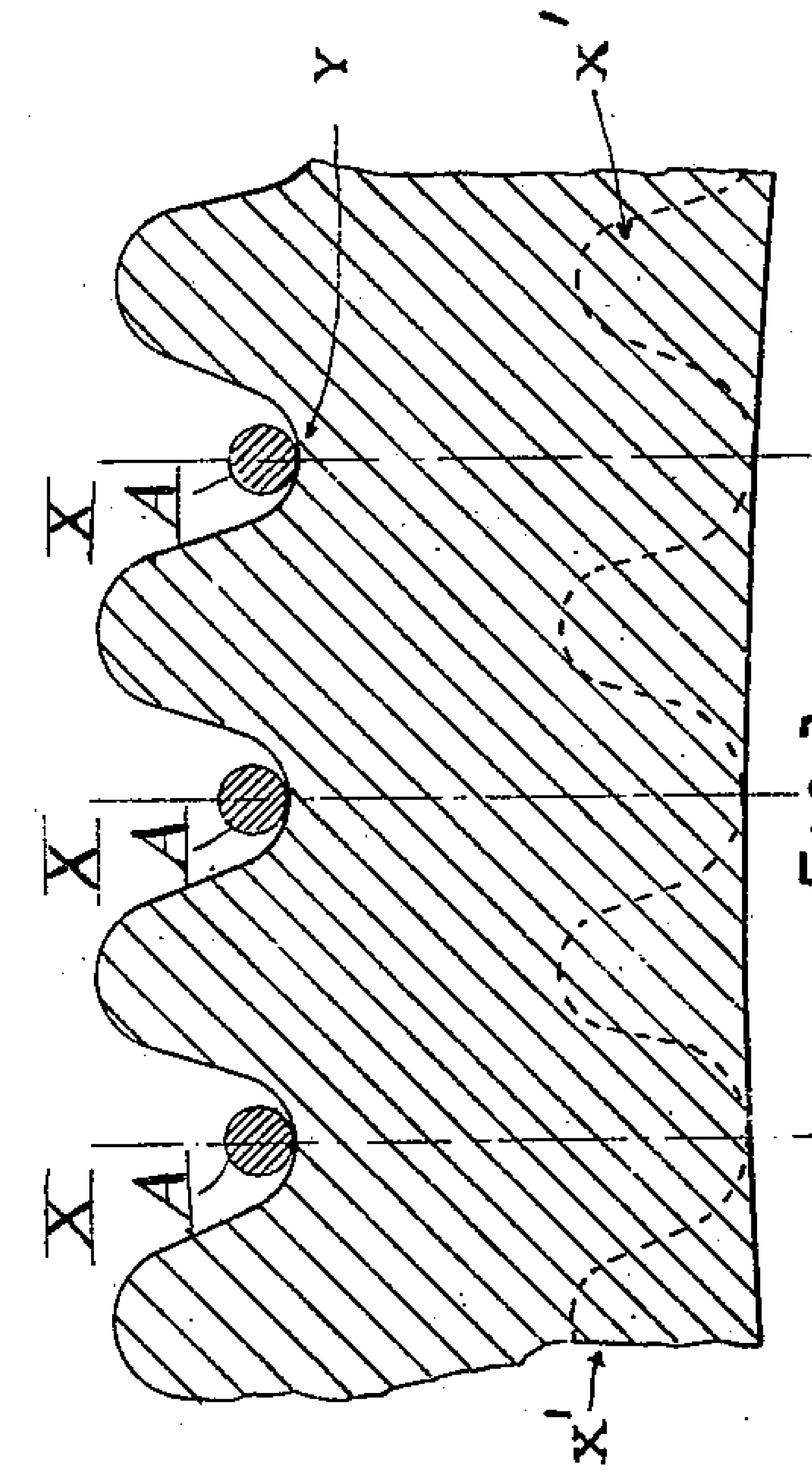


Fig. 3.

Witnesses:
E. M. Olmsted
Chas. J. O'Neill

Inventor:
F. H. Daniels
By his attys
Pierce & Greasborough

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

FRED H. DANIELS, OF WORCESTER, MASSACHUSETTS.

FURNACE FOR ANNEALING WIRE.

SPECIFICATION forming part of Letters Patent No. 706,031, dated August 5, 1902.

Application filed April 9, 1902. Serial No. 101,991. (No model.)

To all whom it may concern:

Be it known that I, FRED H. DANIELS, a citizen of the United States, residing at Worcester, county of Worcester, State of Massachusetts, have invented certain new and useful Improvements in Annealing-Furnaces; 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.

The invention relates more especially to furnaces for annealing wire, though it is adapted also for the similar treatment of other elongated metal shapes. It is not new in this class of furnaces to pass the wire consecutively through different heating chambers or passages. These passages have heretofore usually been formed by properly-centered holes in special key-shaped tiles that are built up to form an arch. The products of combustion of the furnace pass around and outside of these tiles and do not go through the passages occupied by the wires, the object of this arrangement being to prevent direct access of the combustion products to the surface of the metal on account of the injurious oxidation and scaling of the product that is consequent upon the combination of the products with the incoming fresh air.

The perforated tiles above mentioned while capable of resisting considerable heat for long periods of time are poor conductors of heat. Hence high furnace temperatures must be maintained, with consequent high coal consumption. Moreover, the tiles are high in first cost and are also the part of the furnace most subjected to repairs. For although excellent heat-resisting material can be obtained such material resists very poorly the abrasion caused by drawing the wires continuously through the holes above mentioned. Consequently the wires continuously cut their way downward, and a point is soon reached when expensive repairs are necessary. Again, temporary repairs are difficult to make. It often happens that holes develop between the joints of the various tiles, through which the products of combustion obtain access to the tubes. The only method of stopping this trouble, except by shutting down the furnace and tearing out the tilework, is by introducing clay solutions through a long tube from one end of the furnace, making a very difficult and uncertain job, and the poor heat-conducting power of the tiles and their tendency to abrasion, as mentioned above, limit the speed at which it is economical to run these furnaces.

It is characteristic of the present invention that the above-described perforated tiles are dispensed with and that the wire is led through chambers or passages that are internally heated by the passage through them of the products of combustion from the furnace. The bare wire is led through these passages in direct contact with the products, and a further characteristic feature of the invention lies in the fact that a pressure slightly greater than that of the atmosphere is maintained in these annealing-passages and atmospheric air excluded therefrom by the employment of forced draft in the ash-pit instead of relying upon the usual furnace-stack.

In the accompanying drawings what is technically known as a "three-pass" furnace is shown; but the invention is equally well adapted to furnaces with any number of passes. The drawings also show a coal-fired furnace; but I do not intend to limit myself to this method of heating, as oil or gas may be employed, if desired.

Figure 1 is a longitudinal section of a furnace constructed in accordance with the invention. Fig. 2 is a cross-section at X Y. Fig. 3 is an enlarged cross-section of the floor of the annealing-passages, and Fig. 4 is a side view of the same.

Referring to Fig. 1, B B B B indicate the fire boxes and grates, and K′ the ultimate outlet for the products to the stack or chimney. In the present construction there are preferably two fire-boxes at each end of the furnace structure, and the stack-outlet is in the middle. Any other arrangement may, however, be adopted.

The letters E, G, and I denote the annealing chambers or passages, extending from end to end of the furnace. These passages all communicate by means of flues K K, &c., with a chamber C, which is in direct communication with the fire-boxes, so that the products of combustion from the grates pass into and through all the chambers and passages on their way to the stack.

The chambers E, G, and I are provided with

openings or perforations *e*, *g*, and *i*, respectively, at each end near the floor to admit the wire, which preferably is led first into the chamber I and after passing through this chamber is run over a sheave O and led back in the reverse direction through the intermediate chamber G. After it issues from this chamber it passes around a roller N and enters the final chamber E, from which it issues at the opposite end, being pulled through by any suitable winding apparatus. The course of the wire through the chambers is clearly indicated in Fig. 1 of the drawings, and it is to be noted that it passes first into and through the chambers of lowest temperature and finally issues from the chamber where the temperature is highest.

As shown in Fig. 2, all the chambers preferably extend clear across the furnace-structure and are provided with ports or side doors R for the introduction of tools or instruments to effect repairs or to adjust the wires should occasion require. The floors S, T, and U of these chambers are preferably arched, as shown in the second figure, and are constructed of tiles made in the form shown in detail in Figs. 3 and 4—that is to say, each is formed of tiles having longitudinal corrugations X, forming guide channels or gutters to receive the wire A and keep its several plies separate and straight. The tiles are preferably corrugated only on their upper sides and are flat on their under sides, as shown in full lines in Fig. 3. If preferred, however, they may be corrugated on both sides, as indicated by dotted lines X′, and in this event the under-side corrugations should preferably be arranged to alternate in position with those on the upper side, so as to secure the maximum strength and maintain an equal distribution of heat throughout the life of the tiles, which, as will be understood, are gradually worn away by the weight and friction of the wire resting and moving in the grooves.

It is to be noted that the plies of the wire pass through the several annealing-chambers E, G, and I, resting, as shown in Fig. 3, in the bottoms of the channels or gutters formed by the corrugations and in direct contact with the products of combustion passing through the chambers on their way to the stack. It is also to be noted that the ridges between the corrugations act as reservoirs of heat on the floors of the chambers and that where the double corrugated form is employed the corrugations on the under side of the tiles act as collectors of the heat in the chamber below, thereby greatly tending to the maintenance of an even temperature and heating of the wire.

It is necessary, as is well known, in order to prevent the oxidation and scaling of the wire by the action of the products of combustion, that the outside air should be excluded from the annealing-chambers. This is because red-hot iron or steel will not oxidize in the presence of CO or CO_2 or hydrocarbon gases. If less oxygen is admitted than is necessary to burn these gases, or even if only so much be admitted as will be absorbed by the gases, there will be no oxygen left to effect oxidation. I therefore provide for maintaining a pressure throughout the chambers slightly above that of the atmosphere by the employment of forced draft in the ash-pits of the furnace. Steam or air jets may be utilized for this purpose and may be arranged as denoted at *b b*, &c., in Fig. 1 or in any other preferred manner. With this provision the superior pressure within the annealing-chambers prevents the entrance of outside air through the openings at the end of the furnace, by means of which the wires enter and leave the chambers.

The construction and operation of the improved furnace being as thus described, the method of working with it will be understood without further description. It may be observed, however, that as the fresh air is excluded from the annealing-chambers the furnace is particularly adapted for burning the cheaper forms of anthracite slack in connection with steam-blasts under the ash-pits.

Although I have herein shown the corrugated tiles as extending the entire length of the chambers E, G, and I, I contemplate in some cases, especially where very heavy wire is being treated, to employ the old form of perforated tiles in connection therewith for part of the length of the chambers, this being more especially for the purpose of confining the plies of the wire and preventing the possibility of their jumping the grooves of the corrugated tiles before they become thoroughly heated.

Having thus described my invention, what I claim is—

1. In a wire-annealing furnace, a chamber through which the wire is drawn, said chamber having a floor adapted to support the wire, said floor being constructed of tiles having longitudinal corrugations formed therein to constitute channels or gutters to separate and guide the plies of the wire.

2. In a wire-annealing furnace, a chamber through which the wire is drawn, said chamber having a floor adapted to support the wire, and having longitudinal corrugations to form channels or gutters to separate and guide the plies of the wire, said floor having also similar corrugations on its under side alternating in position with those on the upper side.

3. In a wire-annealing furnace having a plurality of superposed chambers through which the wire is drawn consecutively, said chambers having floors formed of longitudinally-corrugated tiles to form channels or gutters to separate and guide the plies of the wire, and the under sides of the tiles having similar corrugations to form collectors for the heat in the chamber below.

4. In a wire-annealing furnace having a

fire-box in stack, the combination with a chamber or chambers through which the products of combustion pass and through which the wire is drawn in direct contact with said products, of a floor adapted to support the wire and having open longitudinal channels or gutters to separate and guide the plies of the wire, and means for maintaining a pressure in said chambers above that of the atmosphere, said means consisting of a blast of air or steam in the ash-pit of the furnace.

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

FRED H. DANIELS.

Witnesses:
W. H. MORSE,
THOS. MACDUFF.