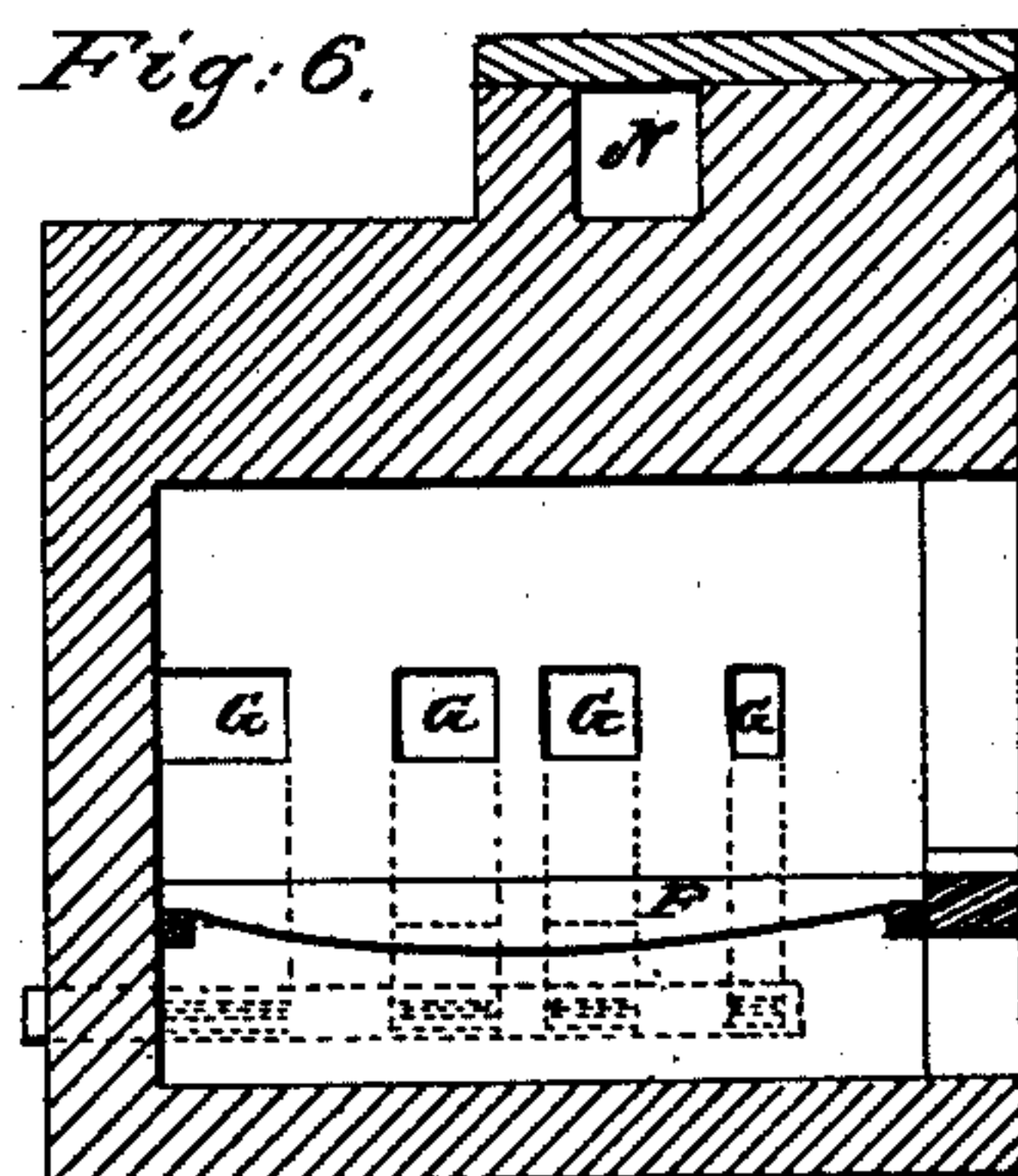
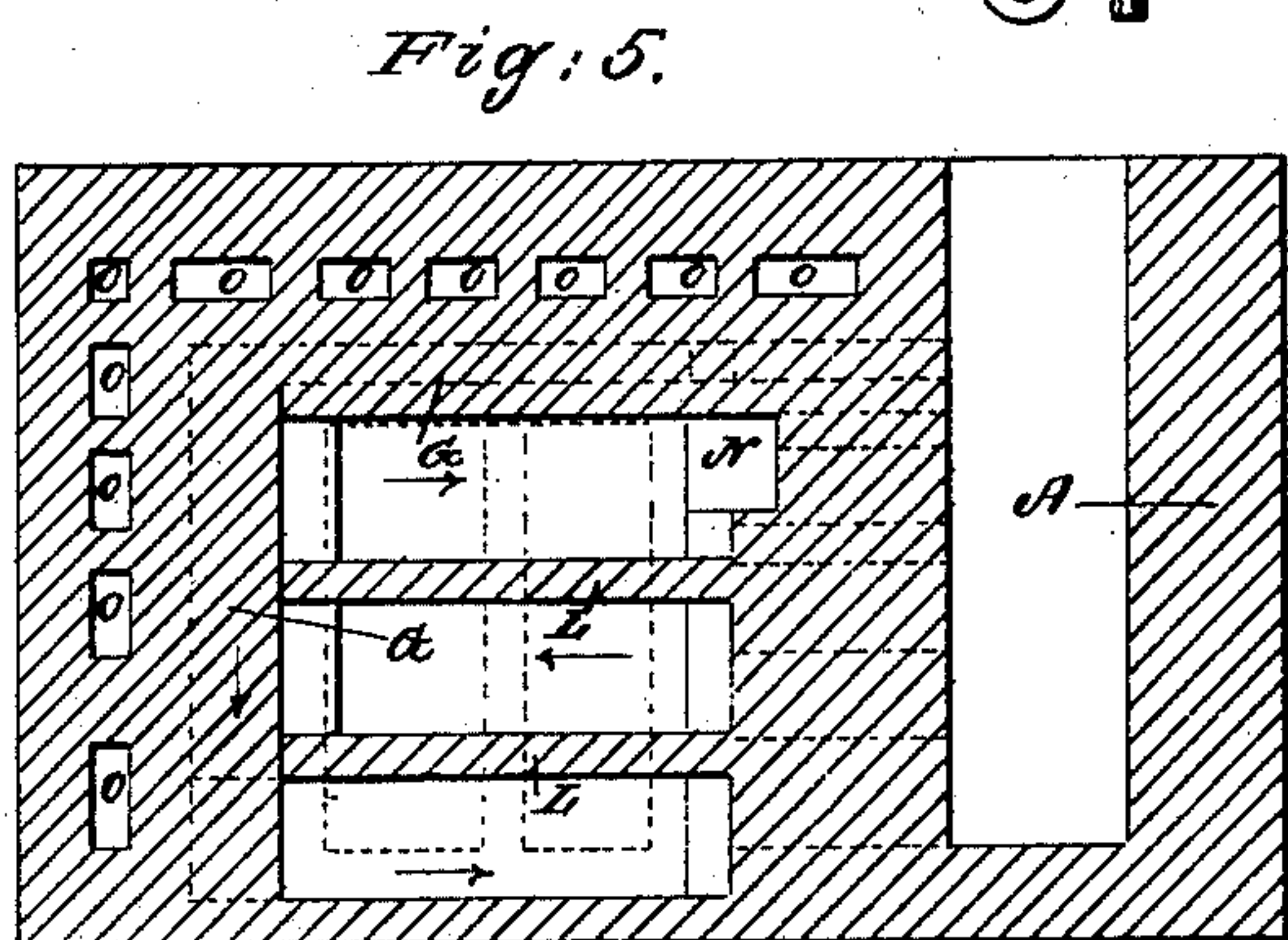
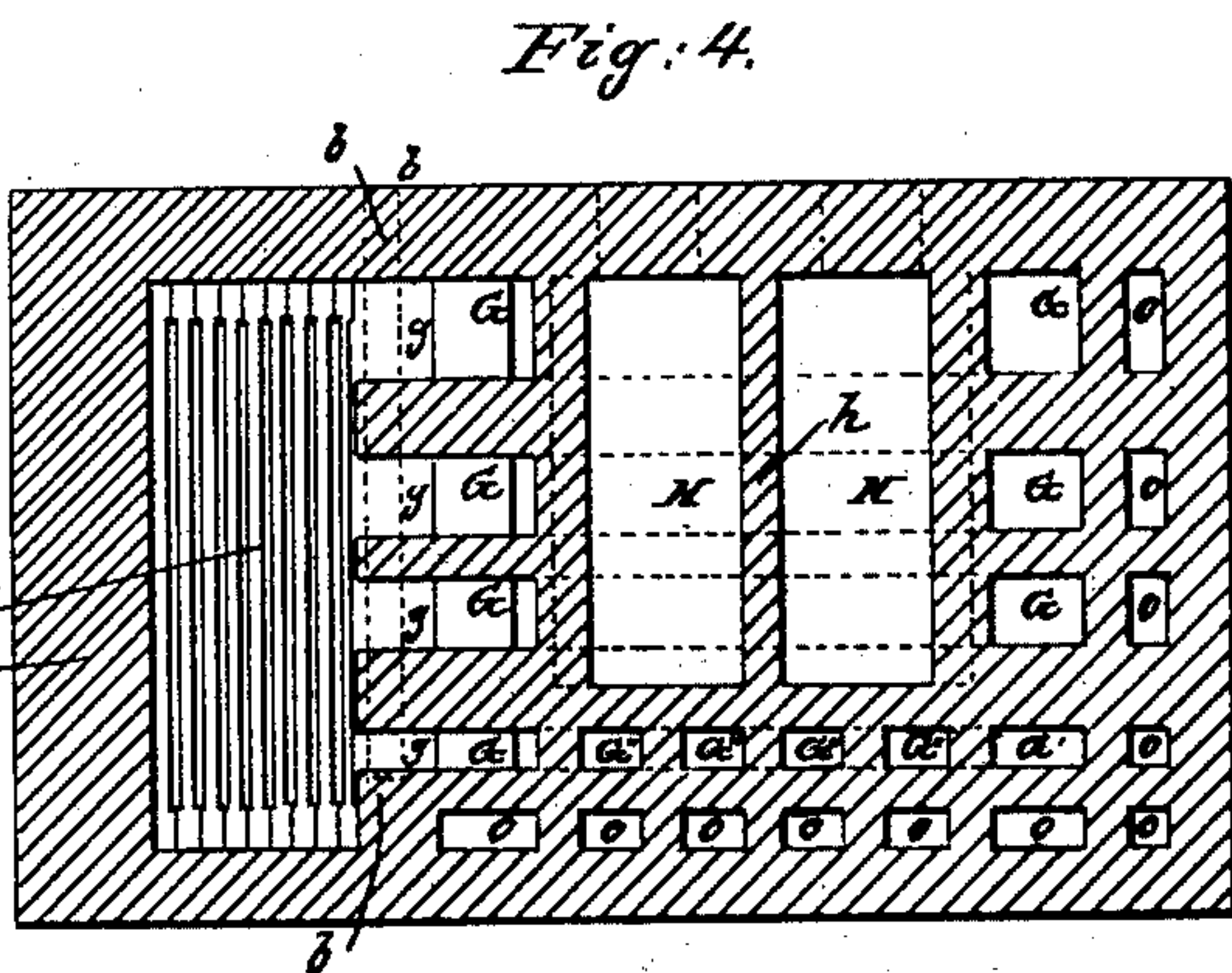
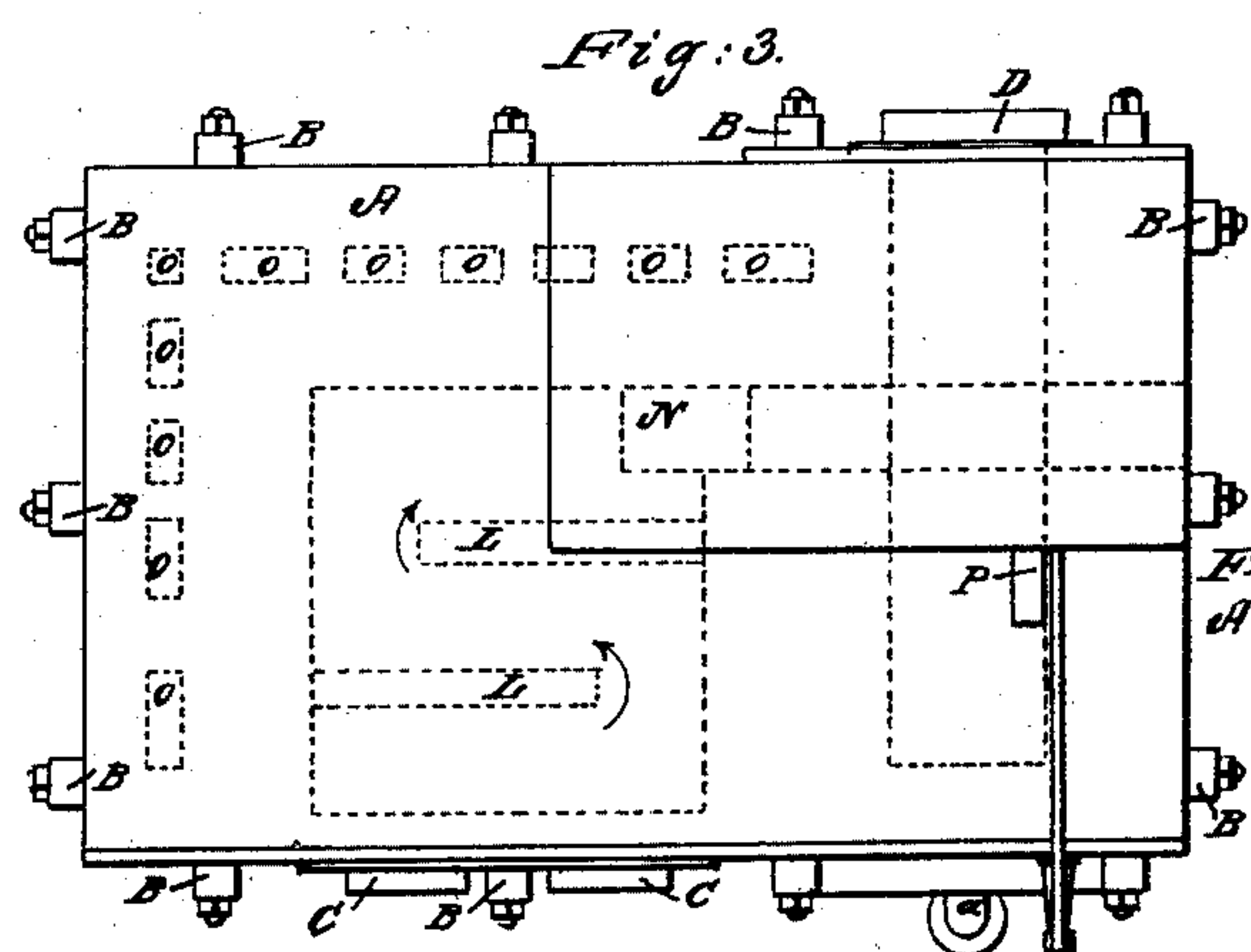
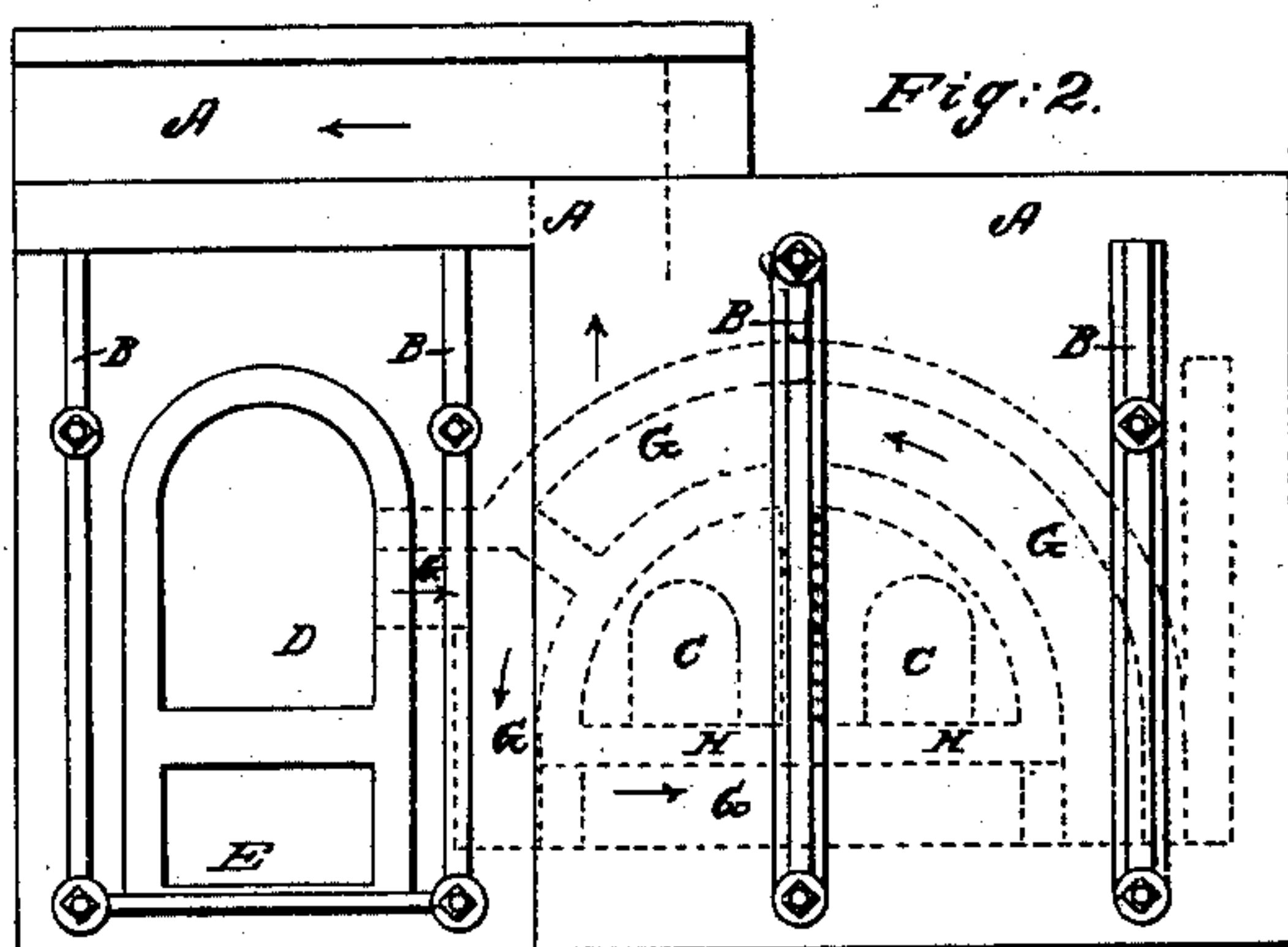
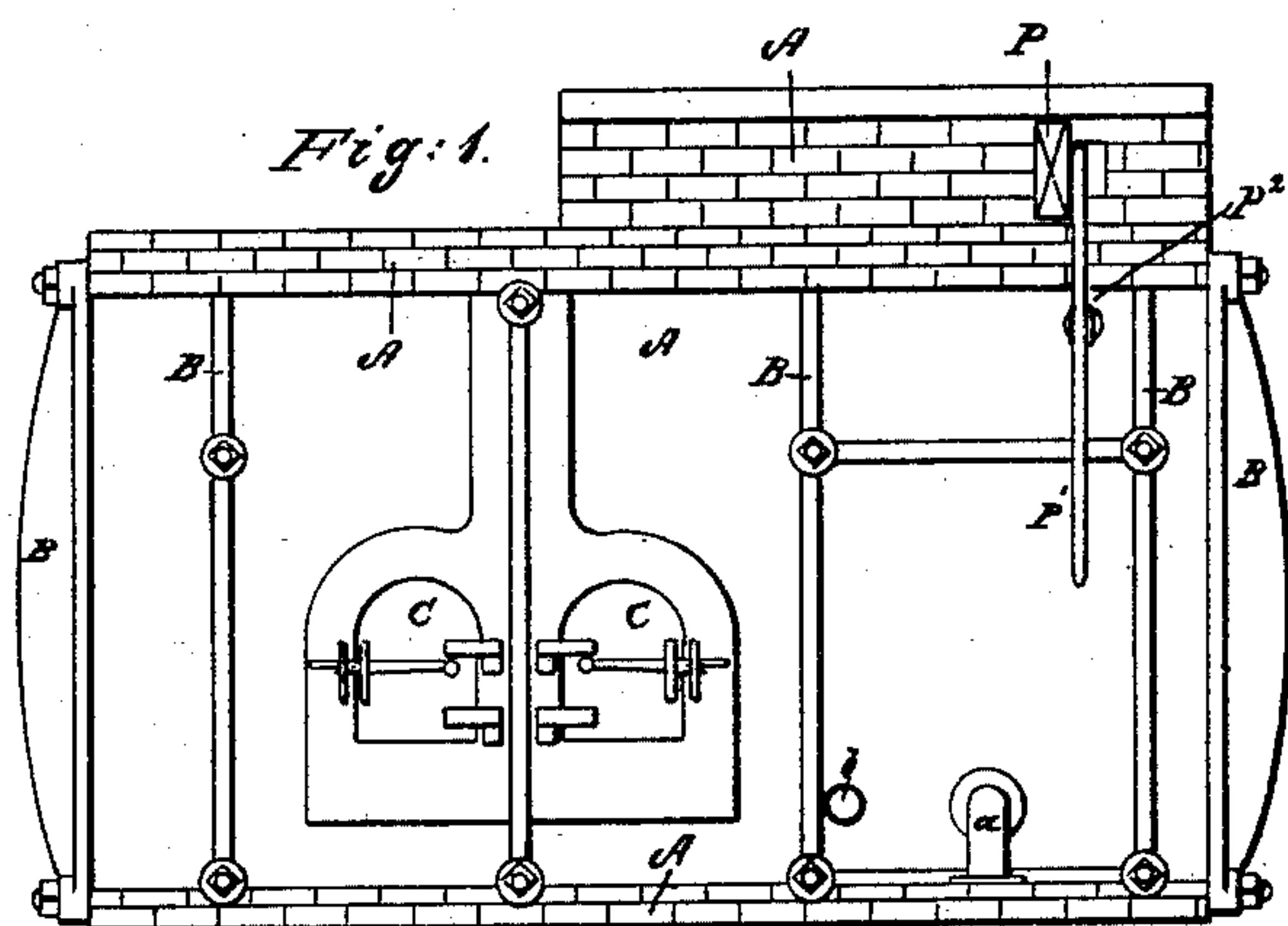


P. G. GARDINER.
Tempering Furnace.

No. 21,828.

Patented Oct. 19, 1858.



Witnesses:
J. B. Hapley
George W. Fox.

Inventor:
P. G. Gardiner.

UNITED STATES PATENT OFFICE.

PERRY G. GARDINER, OF NEW YORK, N. Y.

FURNACE FOR TEMPERING STEEL.

Specification of Letters Patent No. 21,828, dated October 19, 1858.

To all whom it may concern:

Be it known that I, PERRY G. GARDINER, of the city, county, and State of New York, mechanical engineer, have invented a new and useful Improvement in Furnaces for Reheating Steel for the Purposes of Hardening, Tempering, or Annealing; and that the following is a full and exact description of my said furnace, reference being had to the drawings accompanying and making part of this specification.

In the drawings Figure I is a front elevation of the exterior. Fig. II is a front elevation showing the interior part of the fire chamber, and the dotted lines representing the heating ovens and also the flues and direction of the heat and flame. Fig. III is a horizontal section across the furnace, showing the division walls over the heating ovens, and the main flue, also the air spaces around the shell of the furnace. This section is just above the section of Fig. V. Fig. IV is a horizontal section showing the grate bars, the mouths of the flues for conducting the heat first under the ovens; and the red dotted lines representing an air pipe for supplying fresh air to consume the smoke, &c., and make combustion the more perfect. Fig. V is a horizontal section across the furnace over the heating ovens showing the bases of the division walls over the arch of the oven for conducting the heat back and forth, and the entrance place for the heat over the ovens. Fig. VI is a vertical cross section through the furnace showing the openings in the fire place, also the grate bars; and the dotted lines showing the air pipe perforated; the vertical flues; and the continuation of the inner flue outward to the chimney or vent.

In all the figures the same letters represent the same parts.

In the reheating of steel for the purposes of hardening, or tempering or annealing, it has heretofore been done by reverberatory furnaces, in which the flame and heat came in direct contact with the metal above or below; in some instances ovens have been constructed so as to have the heat and flame pass under the floor of the heating oven so as not to come in contact at first with the metal itself, and the heat and flame have then passed above the metal but in the same chamber with the metal. The difficulty with all such methods of reheating steel arises from the fact that the steel being ex-

posed to the flame and atmosphere from the furnace, contracts impurities that impair its qualities; the carbon in the steel becomes oxidated by the oxygen of the atmosphere; and one part being more heated than another part the steel loses its uniformity of texture and is harder in one part than another, and it also loses its homogenousness of quality. The uniformity of texture in the steel which is so desirable, and which is more or less imperfectly obtained by melting sufficient pieces together as in cast steel, is to some extent destroyed, and always unfavorably effected by heating the steel with the flame and atmosphere in contact with the metal itself.

The object and nature of my invention consists in so arranging the furnace as to have the flame and heat act upon a closed oven or chamber in which the metal to be operated upon is placed, in such a manner as to heat the oven below and around and above, and to communicate a powerful and steady heat to the oven, while the interior of the oven and its contents, have no communication with the flame or flues of the furnace, and as little as possible with the external atmosphere. To attain this object and the advantages to the steel which thereby result I construct and arrange my furnace in the following manner.

The general shape of my furnace is rectangular and oblong as shown in the horizontal sections of the drawings.

Fig. I is a front elevation, in which A A are the brick walls and structure continued above the body of the stack in reduced size for the exit-flue and damper.

B, B, are iron clamps with rods with nuts and screws for securing the brick work together.

C, C, are the doors of the heating oven, (divided into two.)

a, is the curved part of the blast pipe communicating with the fire place and to be used only occasionally when the fire is first started.

b is the end of an air tube or pipe, which runs only at the bottom and back of the vertical flues hereinafter described.

The grate bars and the furnace and the floor of the heating ovens are placed nearly upon the same plane, the oven floor being a little lower than the grate bars. The grate bars and chamber of fuel being at one end of the furnace extending across the body of

the furnace and parallel with the oven. The door of the fire place is in the back of the furnace upon the side opposite to that on which the doors of the oven are placed, and is seen at D, (Fig. II.)

Underneath the grate bars is the ash pit and chamber E. The grate bars are seen in the plan section Fig. VI at F. Behind the bridge-wall of the fire place which extends along the whole length of the fire chamber are the four vertical flues shown in Fig. IV at G, G, G, G', and through which all the heat and flame from the fire passes. The bridge-wall being lower than the sides of the flues in order to leave the horizontal openings into the flues as shown at g, g, g, g, Fig. IV. The four vertical flues G, G, G, G', are continued downward until they are at a point sufficiently below the floor of the oven, when they are turned at right angles and run horizontally along the furnace until they reach beyond the floor of the heating oven. The floor of this oven is constructed of tiles made of fire clay, and the tiles must reach across the apartments, and be laid so as to be tight and not to admit the flame or external air. The sides and top of the oven are arched, and must be built of fire brick, and made tight so as to exclude the flame and external air. The floor of the ovens are seen in Fig. IV at H, H, the heating apartment being divided into the two ovens by the division wall h, extending from top to bottom.

The form of the oven is shown in the dotted lines in Fig. II, the dotted lines at c, c, representing the doors of the ovens in the opposite side of the furnace. The depth of the oven is a little less than the depth of the fire chamber as shown in Fig. IV. All the flues G, G, G, G', are made to pass under the floor of the heating oven, the top of the flues being part of the floor of the oven, except the flue G', which runs a little behind the back wall of the oven so as to communicate its heat to the back of the oven through the openings G'', G'', G'', Fig. IV. The flues after passing under the oven ascend vertically and the flames and heat are thus carried into the extended heating flues or spaces shown by the dotted lines in Fig. V at G' and G, at right angles to each other. By means of these spaces or extended fire-flues the upper portions of the back and of the side of the oven farthest from the fire chamber are exposed to the heat like the other parts. The heat and flame are then carried up vertically through the opening at the end of the horizontal flue G last described. This vertical flue ascends to the level of the exterior of the roof of the oven. It is then continued from the front to the back of the roof of the oven, as shown in Fig. III, by dividing walls L, L, extending part way across so that the

heat and flame are conducted in a circuitous direction back and forth over the roof of the oven before ascending into the exit flue or chimney. The direction of the flue and of the flame and heat are shown by the arrows in Fig. III, and the exit of the flame and heat into the chimney is by the vertical flue at the opposite side of the top of the oven from that of the entrance flue before described. The vertical ascending flue is shown at N, Figs. II, III, V.

The flue at the top is provided with a sliding damper to close or open the flue at the top. This is shown at P, Fig. I, and is adjusted by means of an arm p' turning upon a pin in the center, upon a projecting bracket p^2 , the upper end of the arm p being fast to the damper P. The openings o, o seen in the horizontal sections of the drawings are constructed in the walls of the furnace for admission of air to keep the exterior of the furnace from being too highly heated. At the foot of the vertical descending flues G, G, G, G', I place the air tube b, the exterior end of which is seen in Fig. I, and is shown by the red dotted lines at b, b, Figs. IV and VI. This tube is of metal and extends along the whole length of the grate bars on the opposite side of the bridge wall. Where the tube crosses the descending flues, it is pierced with many holes, so as to admit the external air freely to the products of the fuel from the fire chamber, and thus by a supply of fresh air contributes to make the combustion the more perfect. I do not claim this particular result, however, as part of my invention. The steel to be reheated is placed within the ovens upon fire brick trestles or supports slightly elevated from the floor. The doors should be tightly closed and kept tight except when the steel is being taken out or put in. The arrangement of the oven into two distinct parts is convenient for having a constant supply of the perfectly heated metal. The ovens thus constructed and heated if kept closed, will retain their heat a very long time, and the heat can be graduated to the degree desired with ease and accuracy. The blast through the blast pipe will rarely be required, and only at the first starting of the fires. After the steel has been heated to the desired degree, it is to be submitted to the process of hardening, tempering or annealing; for some purposes the longer the steel is subjected to the heat of the oven, the better it will be.

Having thus described the construction and arrangement of the reheating furnace and oven according to my improvements and invention what I claim therein and desire to secure by Letters Patent is:

1. The heating of steel for the purposes of preparation for hardening tempering or annealing in a closed chamber or oven of

fire brick or other suitable material impervious to the flame, smoke and gases of combustion, the smoke, flame and gases of combustion being distributed over the exterior
5 surface of the floor, roof and rear of the heating oven by means of vertical and return or reverberatory flues between the fire chamber and chimney as described.

2. I claim the perforated air tube *b* placed

at the foot of the vertical descending flues 10 on the side of the bridge wall opposite the fire place in combination with the fire chamber and flues and between the fire chamber and oven operating in the manner set forth.

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Witnesses:

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G. W. Fox.