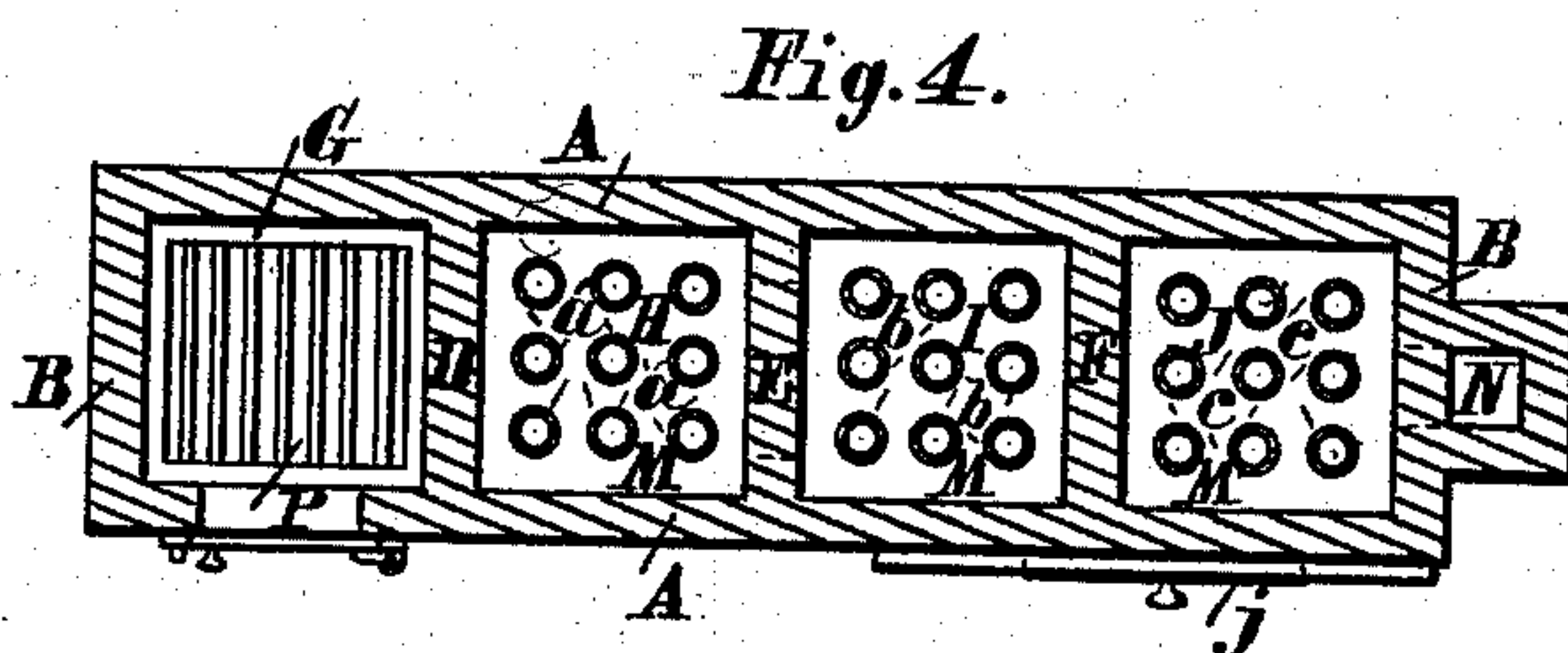
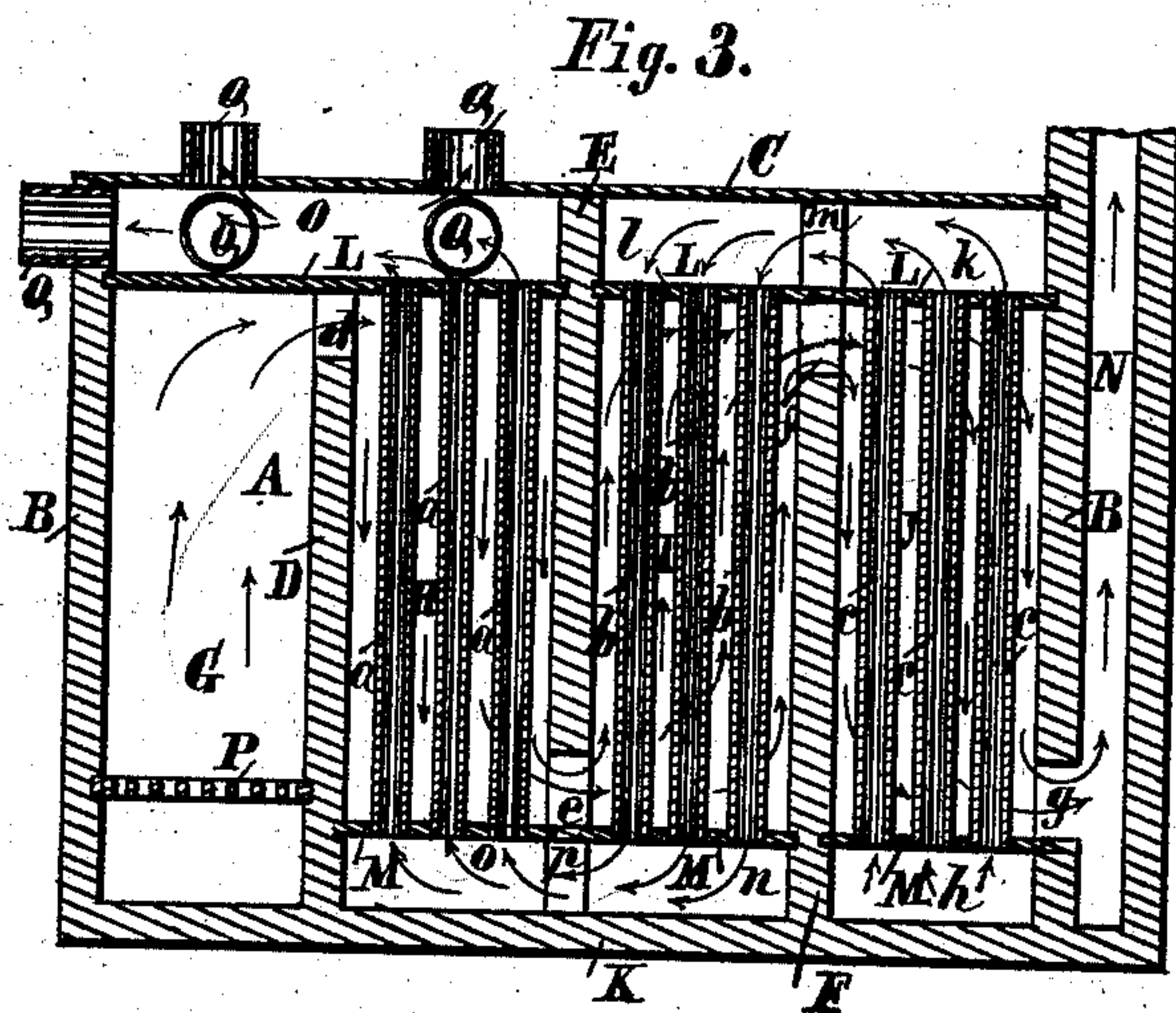
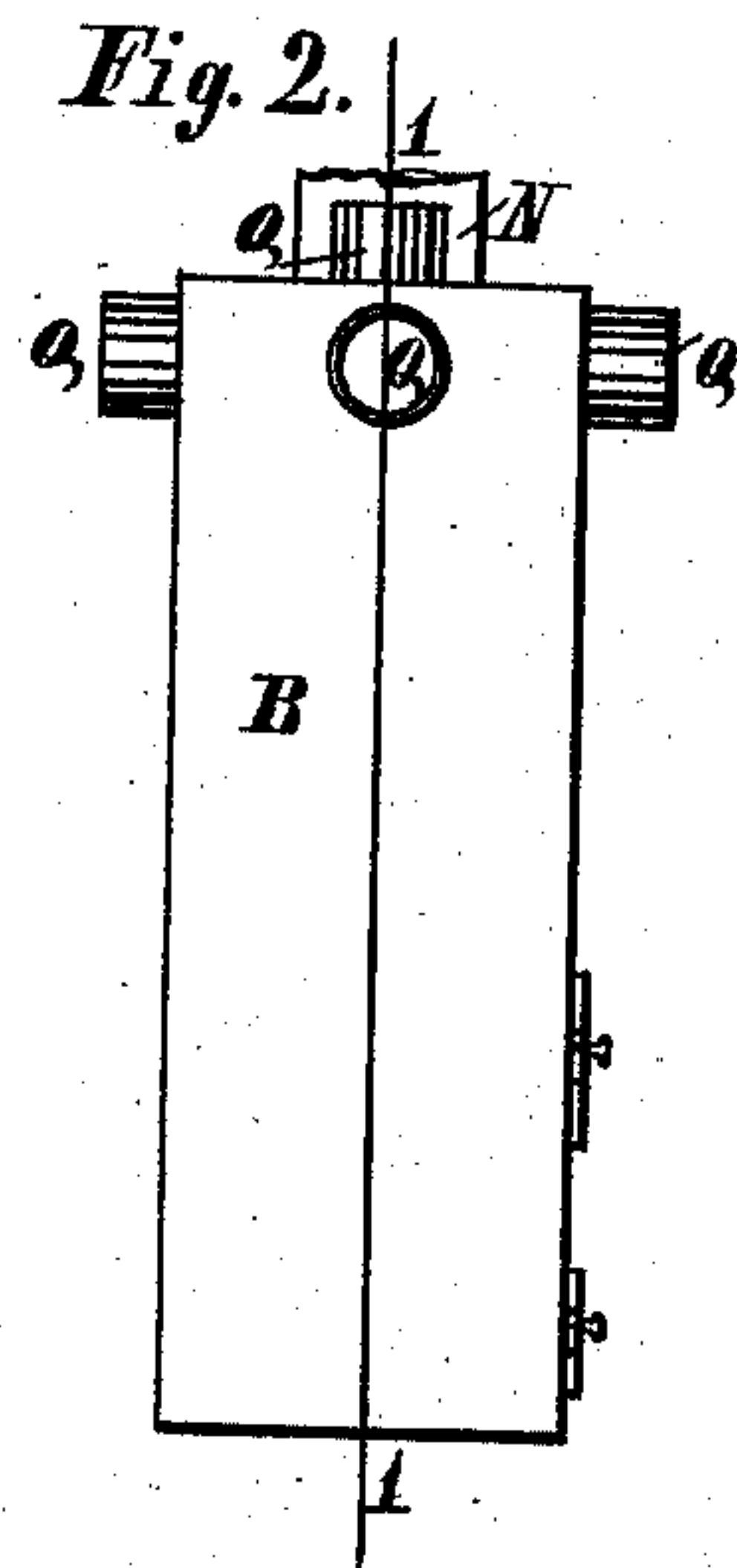
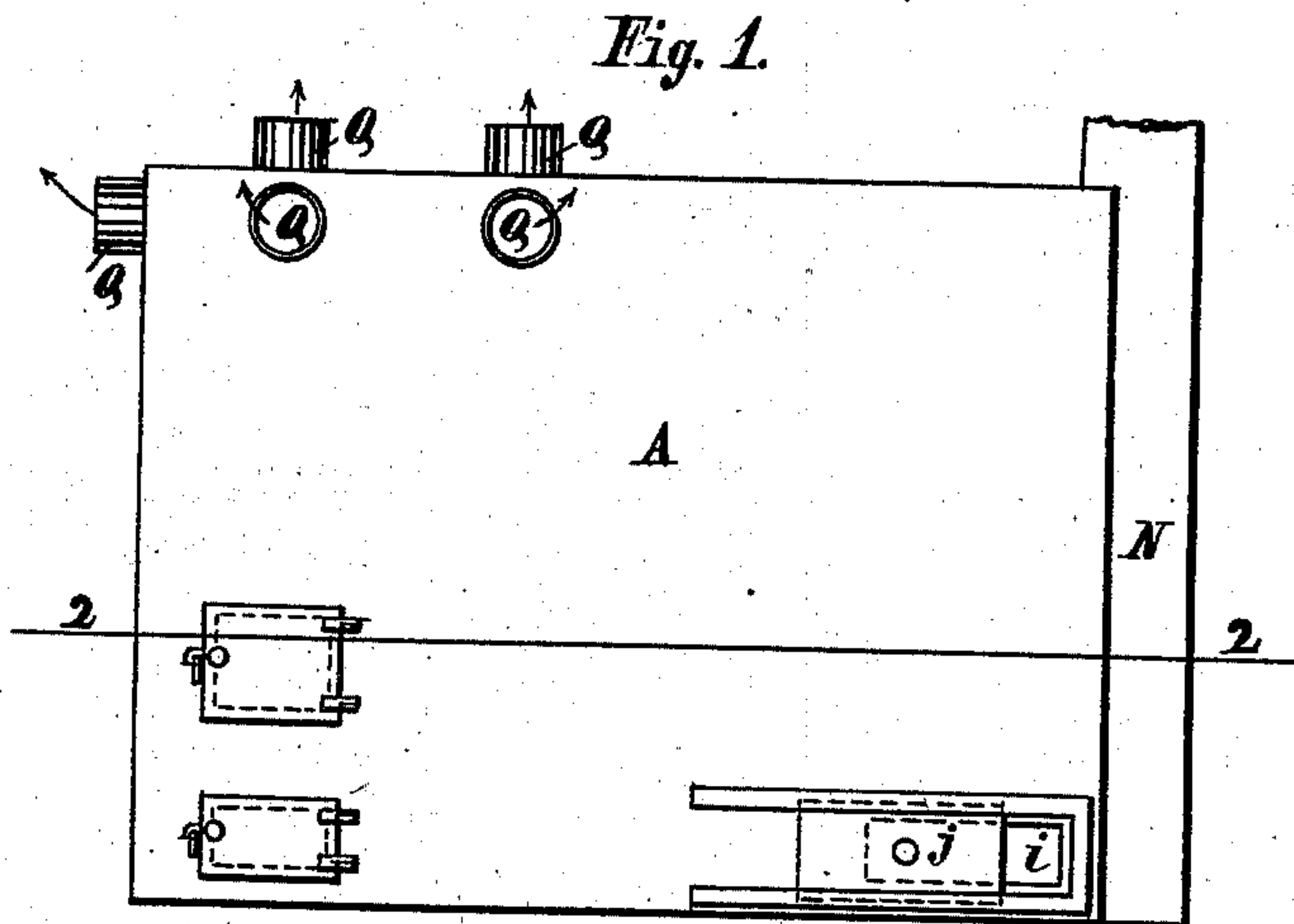


(No Model.)

G. F. BURKHARDT.
FURNACE.

No. 284,181.

Patented Sept. 4, 1883.



Attest;
Louis Cohen,
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Inventor;
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per Edw. Dummer, Atty.

UNITED STATES PATENT OFFICE.

GOTTLIEB F. BURKHARDT, OF BOSTON, MASSACHUSETTS.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 284,181, dated September 4, 1883.

Application filed March 9, 1883. (No model.)

To all whom it may concern:

Be it known that I, GOTTLIEB F. BURKHARDT, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Furnaces, of which the following is a specification, reference being had to the accompanying drawings.

My invention relates to a hot-air furnace; and it consists in the combination of a combustion-chamber with two or more flues having vertical tubes therein, said flues being for the passage of the smoke and gases from the fire, and said vertical tubes for the passage of the air to be heated, in the manner hereinafter set forth.

My invention also consists in such further details of construction as are hereinafter described, and specifically pointed out in the claims.

In the drawings, Figure 1 is an elevation, and Fig. 2 an end view, of a furnace embodying my invention. Fig. 3 is a vertical section taken on line 1 1 in Fig. 2, and Fig. 4 is a horizontal section and plan taken on and below line 2 2 in Fig. 1.

I prefer to construct the outer walls, A A and B B, of brick. A plate, C, forms the top or cap of the furnace. The space inclosed by the outer walls is divided by the vertical walls D, E, and F, which I also prefer to construct of brick, though they may be of other material. Thus are formed the combustion-chamber G and the vertical flues H, I, and J, the division-walls E and F also extending from the bottom K of the furnace to the top plate, C. While I have shown the combustion-chamber and the vertical flues of about the same size, and have shown three of these flues, yet they may vary in size with reference to each other, and there may be only two, or may be more, flues. Above the combustion-chamber is a plate, L, which forms the top of said chamber, and extended forms the top of the flue H. For each of the flues H I J there is a plate, L, to form the top thereof, and a plate, M, to form the bottom thereof. Between the plates L and the plate C there are spaces, and between the plates M and the bottom of the furnace K there are spaces, as shown. In flue H there are vertical tubes *a*, extending from plate M to plate L, in flue I tubes *b*, and in flue J

like vertical tubes, *c*. These vertical tubes open into the spaces below the plates M and into the spaces above the plates L, as shown. 55

The furnace is suitably located with reference to a chimney, N, which may, when convenient, be built with the furnace, so that one wall, B, of the furnace may form part of a wall of the chimney. 60

At the upper end of the combustion-chamber G and of the flue H is an opening, *d*, leading from the combustion-chamber to this flue. At the bottom of the flues H and I there is an opening, *e*, leading from one to the other of these flues. At the upper end of the flues I and J is an opening, *f*, leading from one flue to the other. At the lower end of the flue J there is an opening, *g*, leading from this flue to the chimney N. 70

To the space *h* below the tubes *c* an opening, *i*, leads from the space outside of the furnace or from a cold-air conduit. This opening *i* may be regulated as to size by means of a slide, *j*, or other suitable contrivance. From the space *k* above the tubes *c* to the space *l* above the tubes *b* is an opening or passage, *m*, in the wall F, and from the space *n* below the tubes *b* to the space *o* below the tubes *a* is an opening or passage, *p*, in the wall E. The space above the tubes *a* and that above the combustion-chamber form one hot-air chamber, O. 80

The flame, smoke, or gases from the fire on the grate P pass up the combustion-chamber G, through the opening *d*, down the flue H, through the opening *e*, up the flue I, through the opening *f*, down the flue J, and through the opening *g* into the chimney N, around and in contact with the outside of the tubes *a*, *b*, and *c*. The cold air enters the opening *i*, passes up the tubes *c*, through the opening *m*, down the tubes *b*, through the opening *p*, up the tubes *a* into the hot-air chamber O. From this hot-air chamber lead as many pipes Q, for conducting the hot air, as may be required. These hot-air pipes may connect with the hot-air chamber at the top or sides thereof, according as the location of the rooms to be heated may require. 100

As the result of the arrangement of the flues and tubes in my furnace, all the heat capable of producing any useful effect may be taken up by the air from the smoke and gases, since

thus time is given for such absorption of heat by the air. The air is also most effectually heated by being first acted on by the smoke and gases as they pass from the furnace, and hence while they are at a comparatively low temperature, and thereafter acted on by them while at their highest temperature, when they leave the fire.

Great economy of heat is secured by means of my furnace, while it is simple and may be constructed with a comparatively small cost.

I claim as my invention—

1. In a furnace, the combination of these elements, namely: a combustion-chamber, two or more vertical flues for the passage of the smoke and gases, an opening from the combustion-chamber to one of said flues, and openings from flue to flue at or near the top and bottom of the flues, alternating as set forth, vertical tubes in said flues for the passage of air, and air-spaces below and above said tubes, whereby the air is directed up and down the tubes alternately, substantially as specified.

2. A furnace having exterior walls, A A

and B B, divided by two or more walls, and having a top plate, C, and plates L and M, whereby a combustion-chamber is formed, two or more vertical flues for the passage of the smoke and gases, and air-spaces above and below said flues, vertical tubes connecting said air-spaces, substantially as specified.

3. In a furnace, the combination of the combustion-chamber G, vertical flues H, I, and J, vertical tubes *a*, *b*, and *c*, air-spaces above and below said tubes, and hot-air chamber O, substantially as specified.

4. The combination of the combustion-chamber G, vertical flues H I J, vertical tubes *a* *b* *c*, openings *d e f g* in the division-walls, for the passage of the smoke and gases, openings *i m p*, for the passage of air into the furnace and through the walls, spaces *h k l n o*, for the air, and the hot-air chamber O, substantially as described.

GOTTLIEB F. BURKHARDT.

Witnesses:

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EDW. DUMMER.