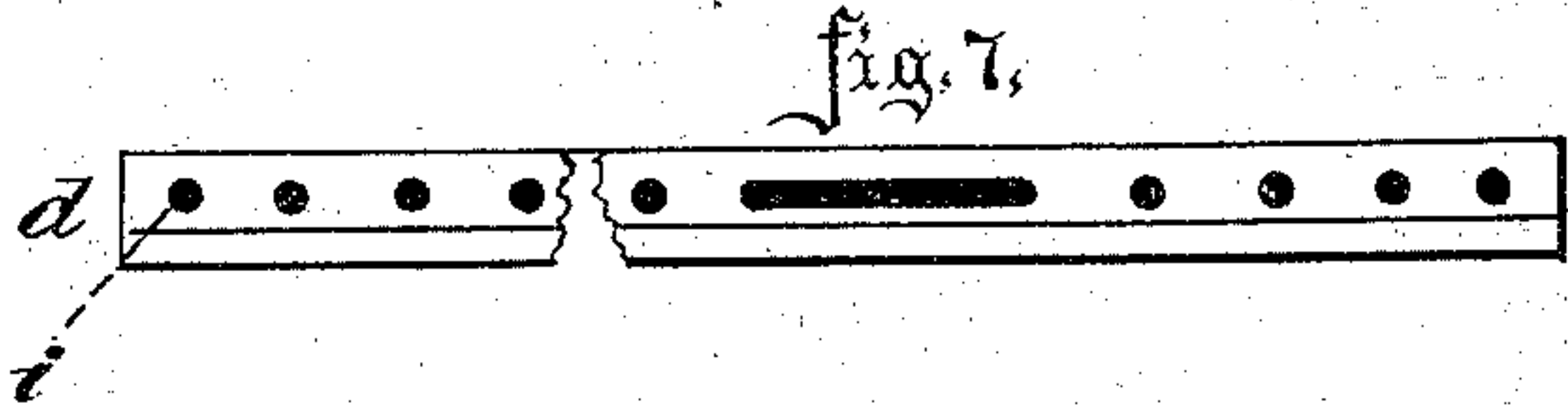
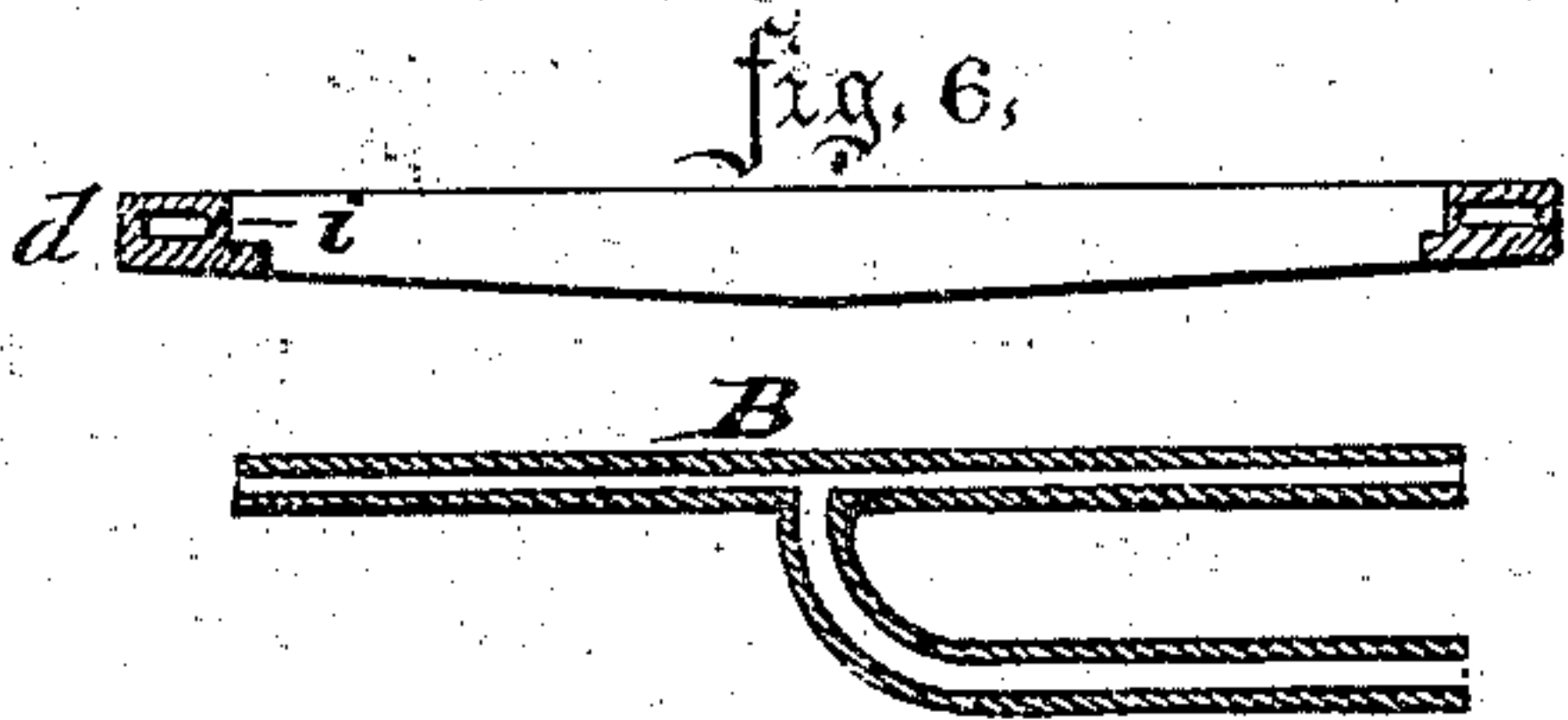
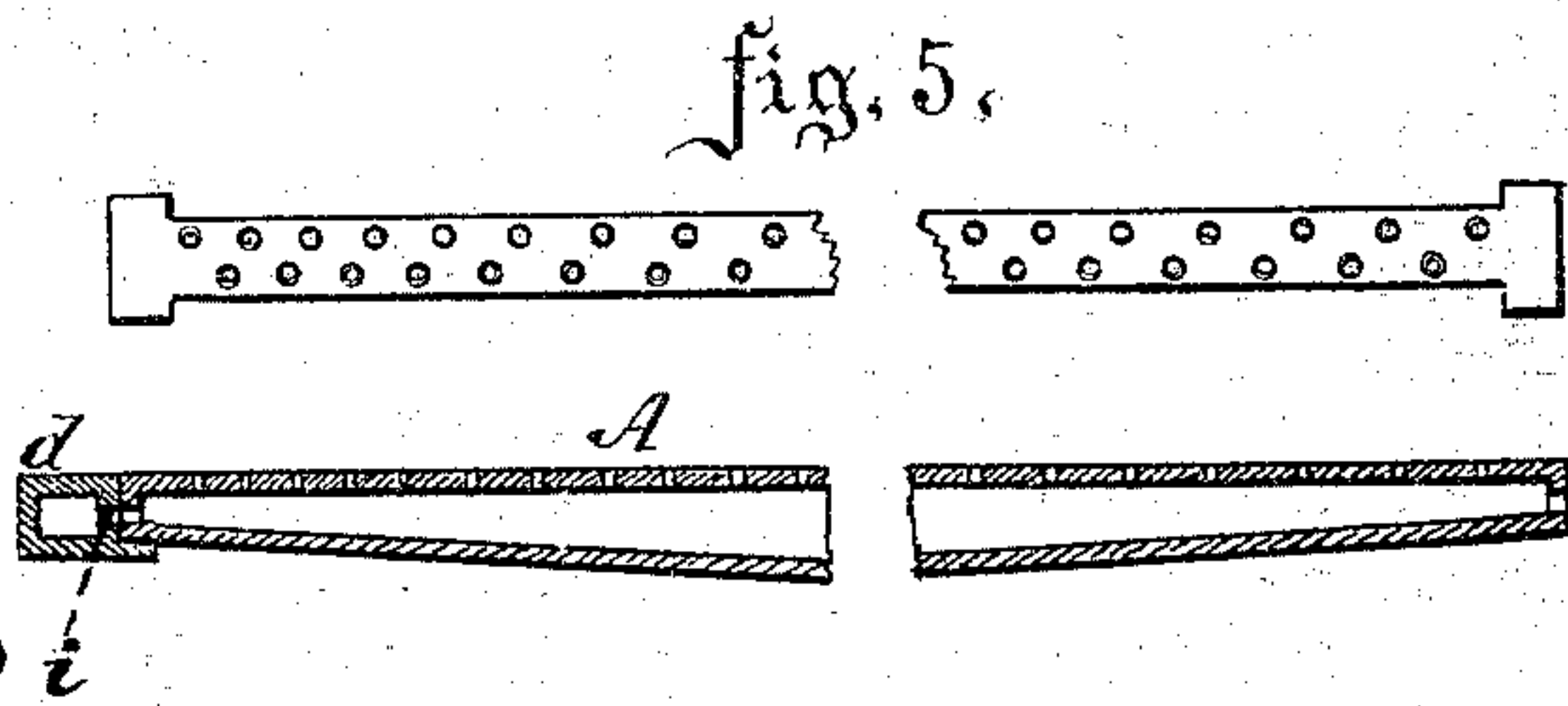
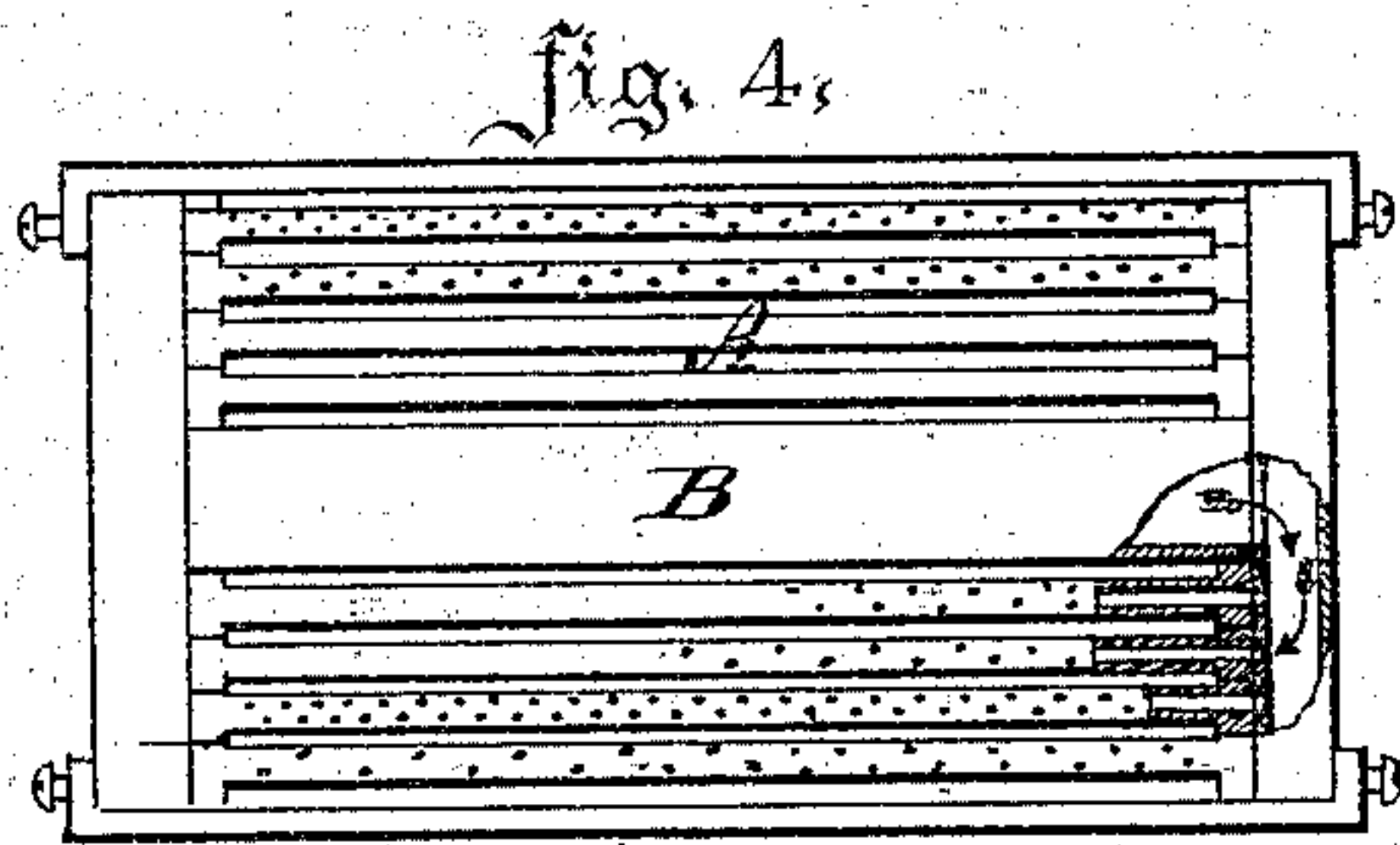
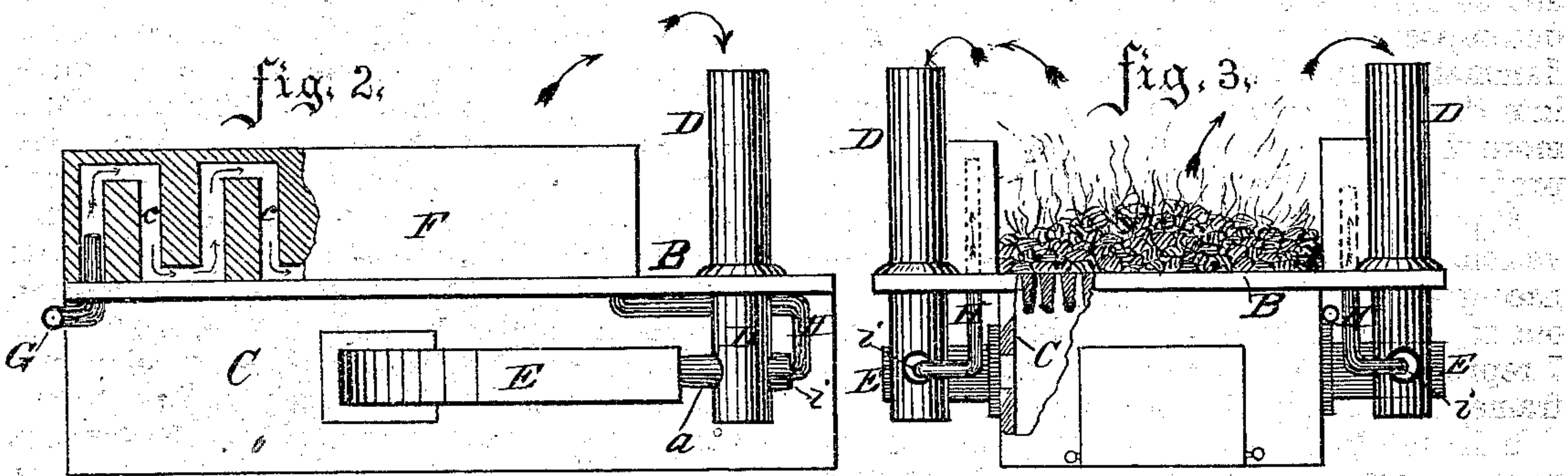
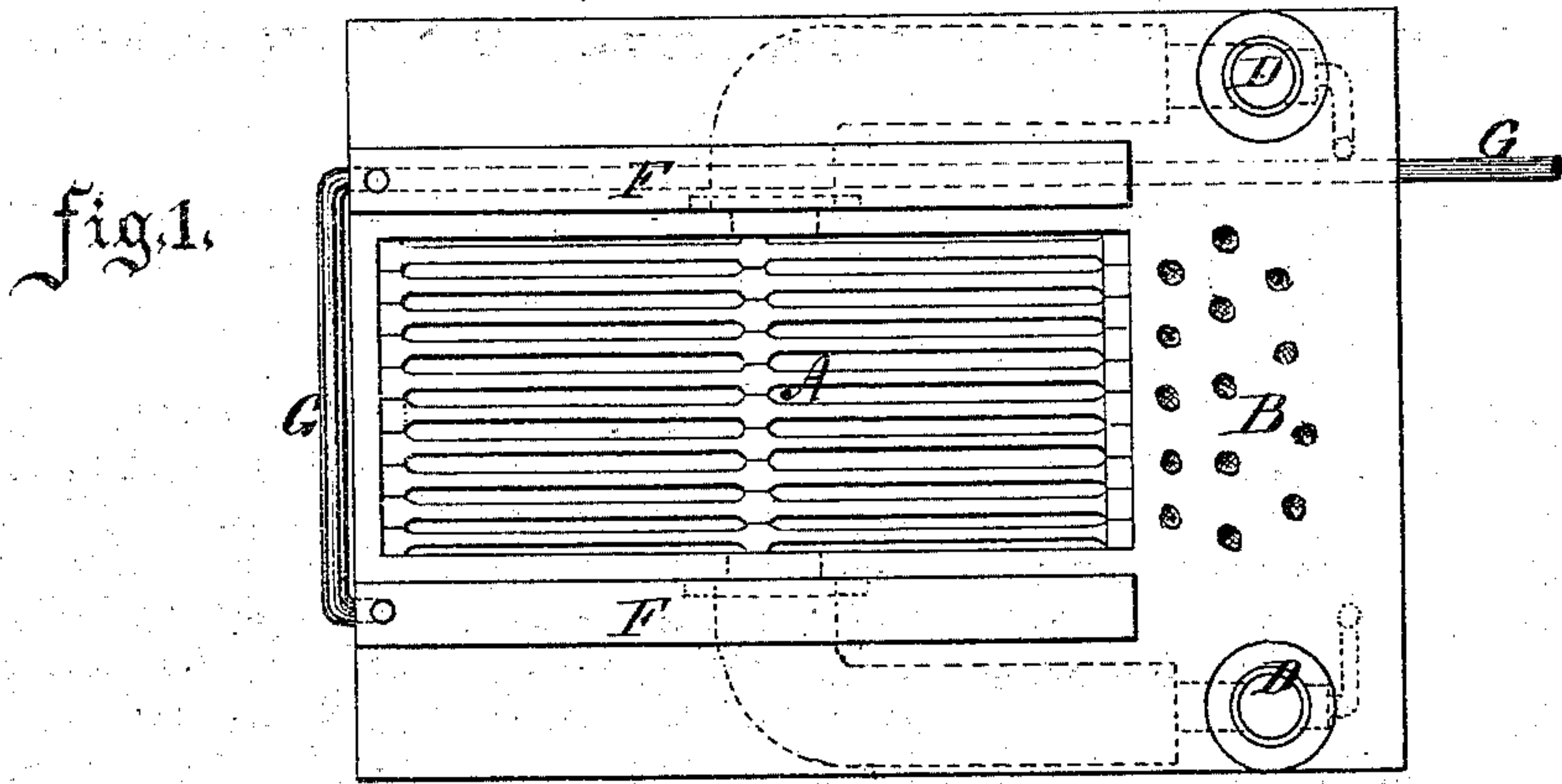


L. STEVENS.

Apparatus for Burning Coal in Boiler-Furnaces.

No. 153,990.

Patented Aug. 11, 1874.



Attest

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UNITED STATES PATENT OFFICE.

LEVI STEVENS, OF WASHINGTON, DISTRICT OF COLUMBIA.

IMPROVEMENT IN APPARATUS FOR BURNING COAL IN BOILER-FURNACES.

Specification forming part of Letters Patent No. **153,990**, dated August 11, 1874; application filed July 15, 1873.

To all whom it may concern:

Be it known that I, LEVI STEVENS, of Washington, in the county of Washington and District of Columbia, have invented certain Improvements in Apparatus for Burning Coal in Boiler-Furnaces, &c., of which the following is a specification:

My invention relates to the utilization of fuel in boiler-furnaces; and it consists in taking from the fire-chamber a portion of the gases produced by combustion of the fuel therein, and so combining the same with steam as to decompose the latter, thus producing an inflammable gas, which with air is then injected into the fire-chamber, and thereby effecting a more thorough utilization of the fuel and its products, as hereinafter more fully described.

Figure 1 is a top-plan view, Fig 2 a side elevation, and Fig. 3 a front end view, of a furnace-grate with devices applied for carrying out my method or process. Figs. 4, 5, 6, and 7 represent hollow perforated grate-bars and frame, which may also be used.

It is well known that the fuel used in furnaces is not fully utilized, the best practical results yet attained falling far short of the theoretical results, due from the amount of fuel used in any given case. Many plans have been devised to obviate this waste of fuel, but as yet without accomplishing the desired result. After many experiments I have devised a method or plan by which I am enabled to produce greatly improved results in this direction. My method, briefly stated, is to take direct from the fire-chamber of a furnace a portion of the gases of combustion at a high heat, and mingle them with steam also highly heated, so as to decompose the steam, and thereby form an inflammable gas, and then to inject this gas, together with atmospheric air, back into the fire-chamber, where it will come in contact with the fuel on the grate, so as to produce a more perfect combustion of the same, and also of the escaping gases. As is obvious there are many ways in which this may be done. I will, however, proceed to describe one means of carrying out the process.

In the accompanying drawings, A represents an ordinary furnace-grate, with a roasting or coking hearth, B, at its front end, though this latter is not essential. At each side of the ash-

pit, under the grate, is arranged a vertical plate, C, Figs. 2 and 3, which forms a narrow chamber or space, extending from the front along each side of the ash-pit to the rear, within which I locate a tube, E, the rear end of which opens through the plate C under the grate, about midway of its length, as shown in Fig. 2, and by the dotted lines in Fig. 1. At the front of the grate, near each corner, I place a vertical tube, D, the upper end being left open for the entrance of the hot gases from the fire, these tubes extending through the hearth B into the chambers alongside of the ash-pit below, as shown in Figs. 2 and 3, and having a smaller tube or nozzle, *a*, extending from their rear sides into the open mouths of the side tubes E. Steam is taken from the boiler (not shown) by a pipe, G, which conducts it into the rear end of superheaters F, arranged one along each side of the grate, and from whence it passes in a highly-heated state through pipes H at the front end, these pipes H being carried down into the side chambers, and terminating each with a nozzle, *i*, that enters the tube D in line with the tube *a* and the larger tube E, as shown in Fig. 2, there being an open space left around the nozzle *i* for the entrance of air into tube D, as shown in Fig. 3. In like manner a space is left around the tube or nozzle *a*, where it enters the mouth of tube E, for the admission of still more air.

With this arrangement of devices, which can be easily applied to existing furnaces, the operation is as follows: The fire is started in the usual manner, and as soon as steam is generated in the boiler it enters or is admitted to the superheaters, and as it escapes through the nozzles *i* into the tubes E it creates a vacuum in the tubes D, thereby drawing the gases from the burning fuel into them, where said gases, at a temperature of about 1,000° Fahrenheit, are brought into direct contact with the steam, at a temperature of about 600°. By the union of these at this high temperature the steam is decomposed, and an inflammable gas is produced, which being injected under the grate passes up through the fuel thereon, and materially assists in its combustion, and also of the gases which pass from the fire-chamber back under the boiler. As previously explained, air is drawn in by the steam-jet, and

mingled with the steam and gases from the fire-chamber to aid in combustion; and, if desired, air may also be admitted into the ash-pit at the front, as usual, though I generally keep it closed. The steam-jet creates a strong blast, and does away with the necessity of blowers; and when everything is perfectly arranged the combustion is rendered so perfect that there is but little, if any, smoke or gases escaping from the furnace, and hence there is but little, if any, necessity for a smoke-stack.

By using the hollow perforated grate-bars and frame represented in the drawings, and passing the inflammable gas into and through them, it can be applied very uniformly over the entire surface of the grate, and thus brought more intimately into contact with the fuel and gases in the fire-chamber.

While the foregoing is one plan of device, and a very simple and efficient one, of carrying out and applying my method of utilizing fuel, more especially as applied to furnaces already built, I would remark that the devices may be modified or changed in many ways without affecting the principle. It is not absolutely necessary to pass the steam through superheaters, provided the gases taken from the fire-chamber are at a sufficiently high temperature when brought into contact with the steam to decompose the latter and produce the inflammable gas.

I am aware that smoke and the escaping products of combustion have been taken from the smoke-stack or from chambers at the rear end of a boiler, and by means of steam-jets carried back with air into the ash-pit, or into

chambers connected therewith; but such devices or plans were intended to consume the smoke and escaping products of combustion, or prevent the escape of noxious gases into the surrounding atmosphere. I do not claim any such plan or devices; nor will such accomplish the results attained by my method, for the reason that the temperature of the smoke and escaping products is too low to decompose the steam. My method differs from all such in this, that I take the gases direct from the fire-chamber at a high temperature, and bring them at once into contact with steam also at a high temperature, so as to decompose the steam and produce an inflammable gas, which, being injected into the fire-chamber, materially aids in the combustion of the fuel and its products.

Having thus described my invention, what I claim is—

1. The herein-described method of utilizing fuel in furnaces—that is to say, by taking direct from the fire-chamber more or less of the highly-heated gases of combustion, mingling them with steam at a high temperature, and then injecting these commingled gases or their resulting product into the furnace, substantially as described.

2. The combination, with a furnace, of the tubes D, steam-pipes H, provided with nozzles *i*, and the tubes E, constructed and arranged to operate substantially as and for the purpose set forth.

LEVI STEVENS.

Witnesses:

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