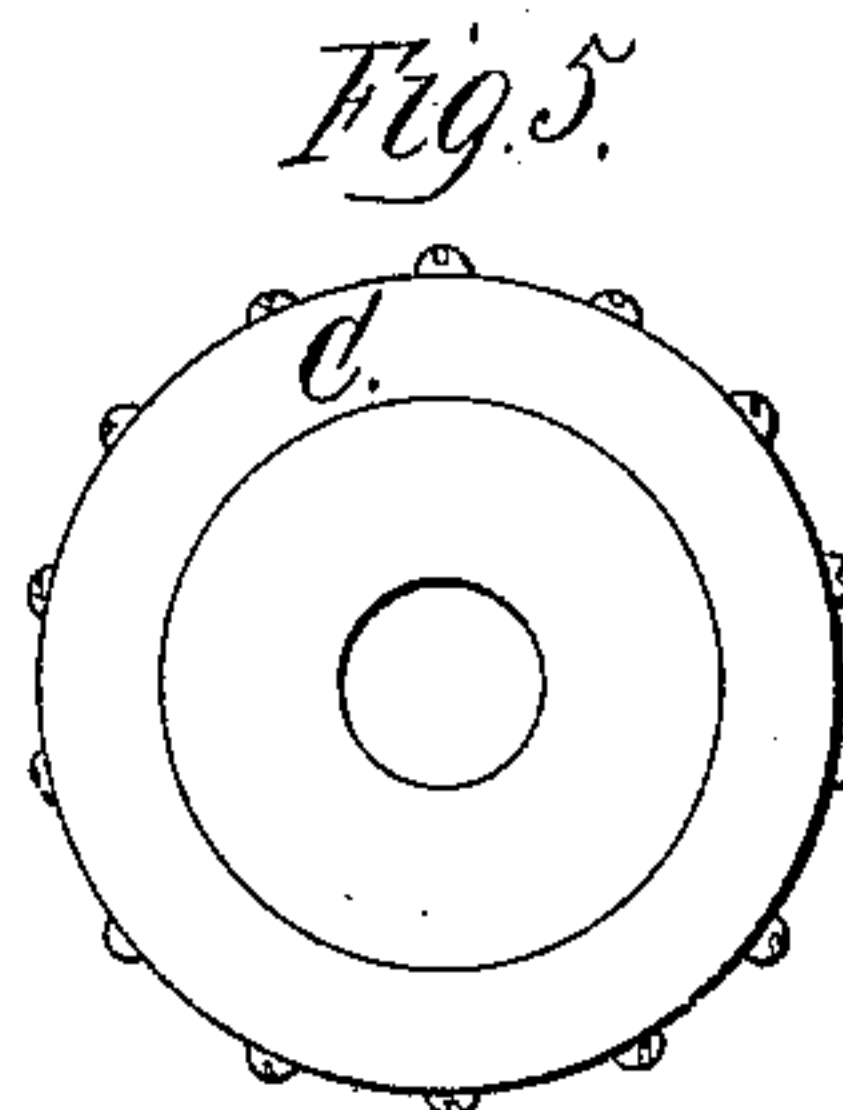
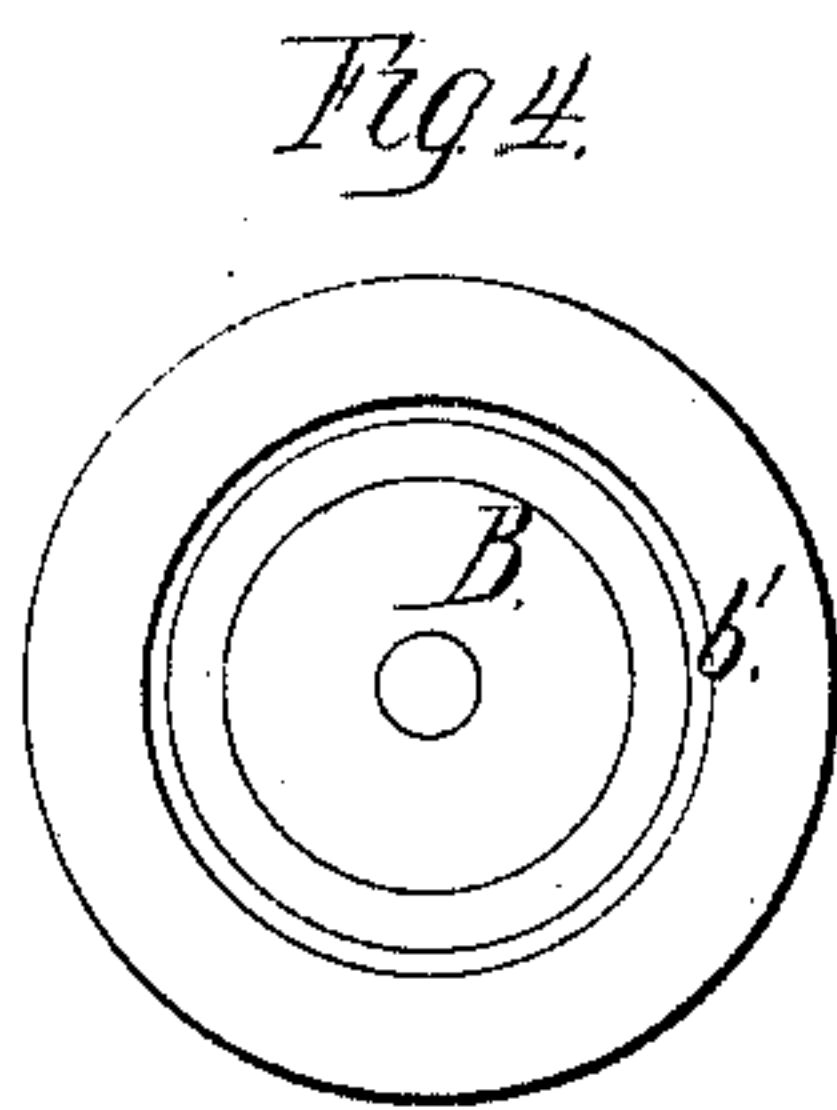
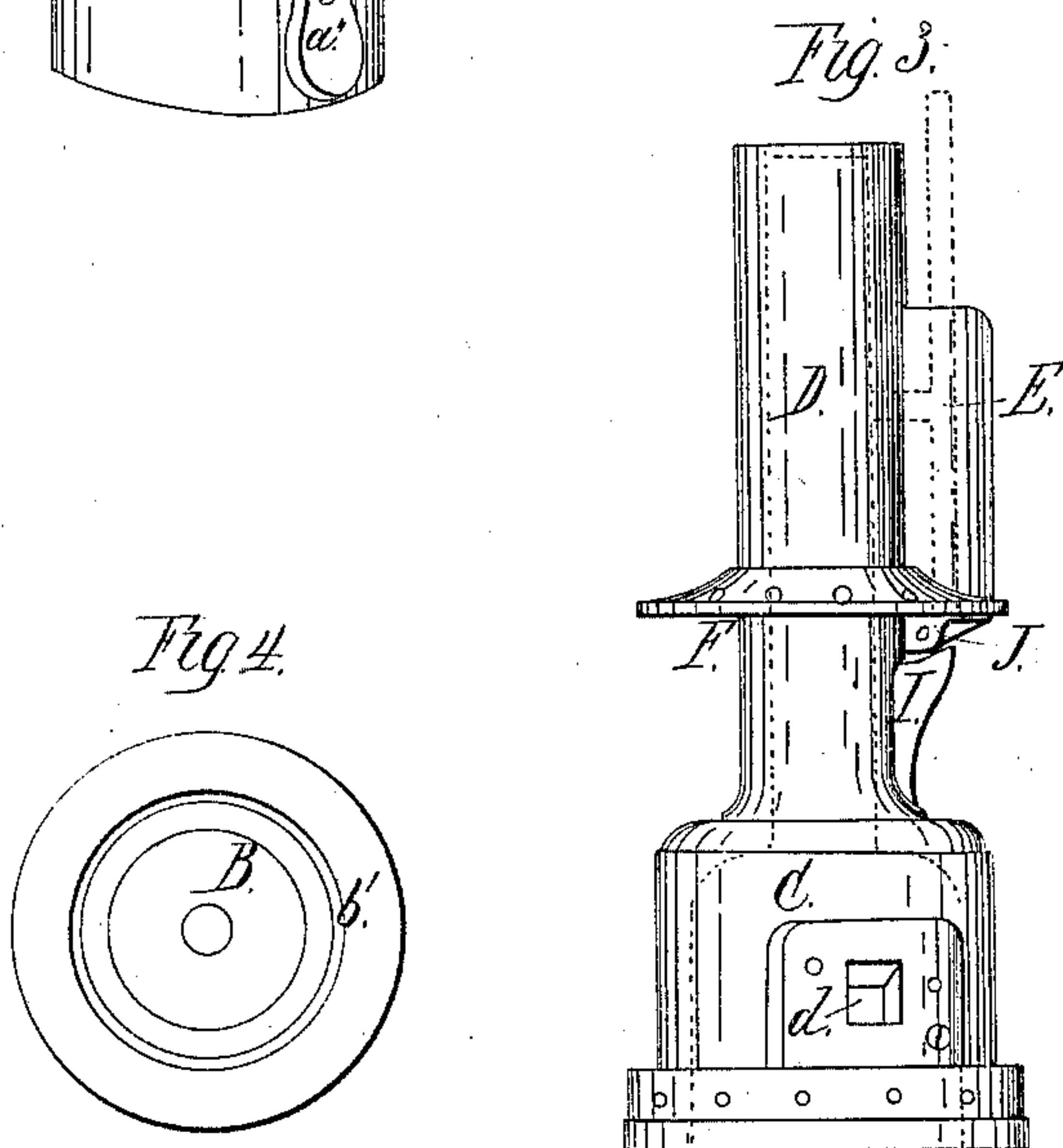
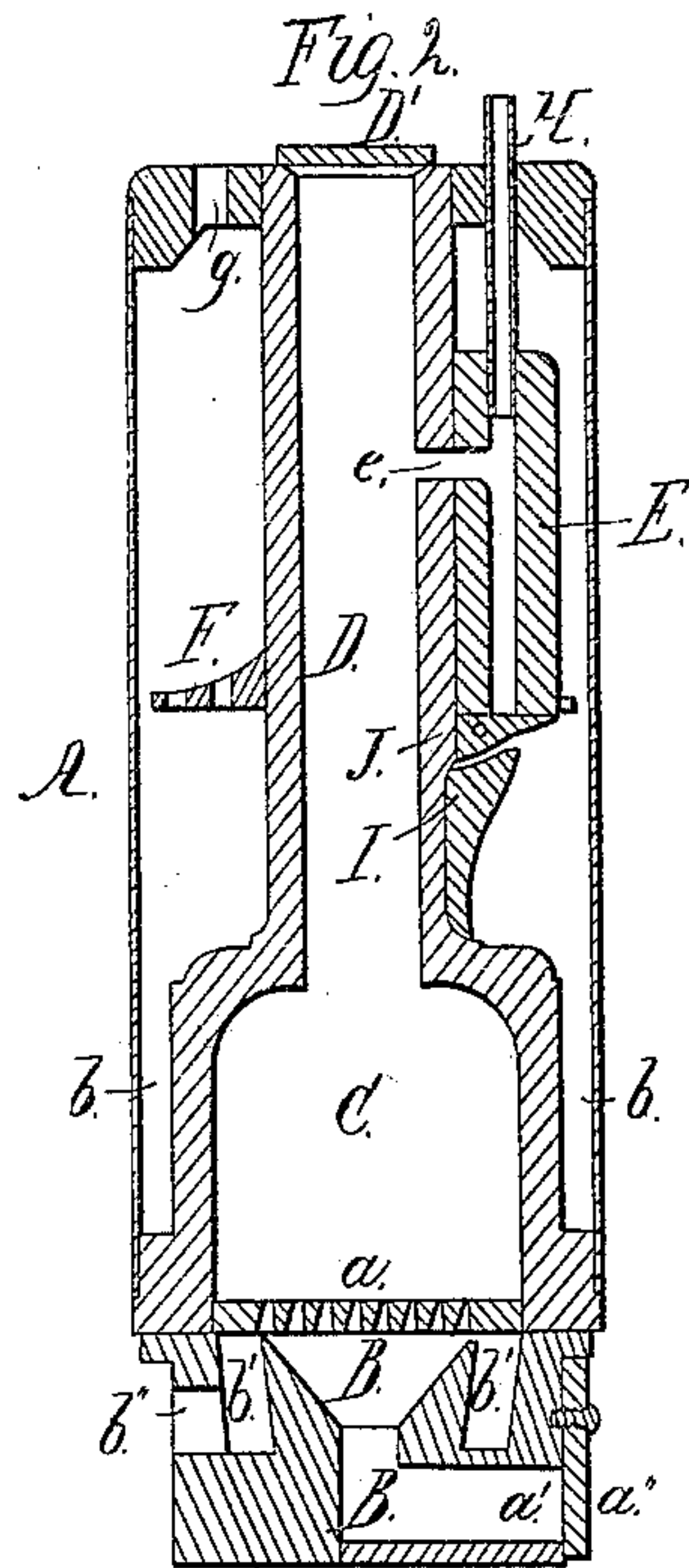
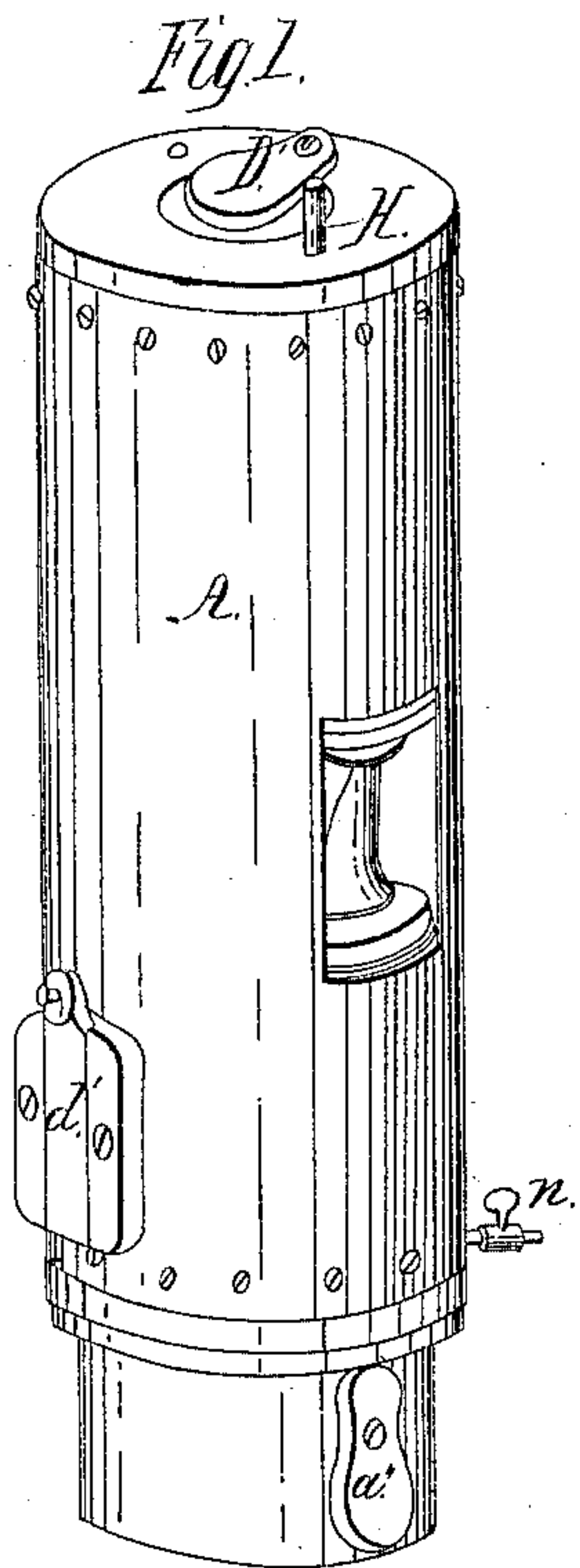


Craig & Madden,
Steam-Boiler Furnace,
No. 15,025. Patented Nov. 15, 1864.



Witnesses:
W. H. Burroughs,
A. M. Gleason

Inventor:
Isaac Craig
John Madden

UNITED STATES PATENT OFFICE.

ISAAC E. CRAIG AND JOHN MADDEN, OF CLEVELAND, OHIO.

IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. 45,025, dated November 15, 1864.

To all whom it may concern:

Be it known that we, I. E. CRAIG and J. MADDEN, of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Steam-Boilers; and we do hereby declare that the following is a full and complete description of the construction and operation of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 is a perspective view of the boiler. Fig. 2 is a vertical section. Figs. 3, 4, and 5 represent detached sections that will be referred to in the description.

Similar letters of reference denote like parts in the several views.

Our improvement relates to constructing a steam-boiler so that all the caloric eliminated from the fuel in its combustion will be devoted to the generation of steam by conveying the heat and products of combustion through the water, leaving all the heat which would otherwise pass off with the gases in the water, it being no part of the object to obtain force by working off the products of combustion at a higher heat than that which the air has from compression when it first flows from the pump into the boiler.

Fig. 1 represents the boiler, the interior construction of which is shown in Figs. 2 and 3, consisting of an ash-pit, B, furnace or fire chamber C, with the flue-pipe D, that communicates with a side pipe, E; and F is a diaphragm around the pipe about the center of the boiler. The furnace, with the pipes D E and diaphragm, is represented detached from the boiler in Fig. 3, being readily removed from below. The furnace fits into the boiler close at the lower end, with a space, *b*, above around the furnace, as shown in Fig. 2.

d, Fig. 3, is an opening through which the furnace is supplied with fuel, being closed or opened by a door, *d'*, Fig. 1, on the outside of the boiler.

a is a grate between the furnace and ash-pit B, the ashes being removed through an opening, *a'*, by means of the adjustable gates *a''*.

b' is an annular chamber, which communicates with the furnace through the grate *a*, and at one side of this chamber there is an opening, *b''*, for the purpose of introducing a

forced draft or blast from bellows, air-pump, or other mechanical means into the furnace through the chamber *b'*.

Fig. 4 represents the ash-pit and chamber *b'* detached from the boiler, and Fig. 5 is a view of the under side of the boiler when the ash-pit is thus detached.

The flue-pipe D from the furnace extends to the top of the boiler, and is closed by the valve D'.

g is an exhaust-opening for the attachment of a steam-pipe, and on the opposite side is a water-pipe, H, that extends down and fits into the side pipe, E, as represented, by which the water is conveyed into the boiler through the side pipe, E, and valve J underneath. The flue-pipe D communicates with the side pipe through an opening or transverse throat, *e*, and around the pipe D. Above the valve J is the perforated diaphragm F, extending round close to the inside of the cylinder A of the boiler.

The manner of operating this boiler as constructed, so as to appropriate all the products of combustion directly to the generation of steam, is as follows: When the fire is first kindled in the furnace, the flue-pipe may be uncovered to allow the smoke to pass off at first, and, until a sufficient amount of steam is generated, to work the engine, when it is again covered, and the furnace being supplied with fuel, the door *d'* is closed, and by operating the bellows or other arrangement connected with the furnace, as described, a draft is produced, which carries the eliminated heat from the combustion of the fuel up in the flue-pipe, through the throat *e*, down into the side pipe, opening the valve J, where it enters the water in the boiler and is forced through it. Thus all the products of heat from the furnace are brought in direct contact with the water, to which they communicate all their radiant caloric; and if there is an excess of heat that is not taken up by the water its effect will be to superheat the steam and act as an agent in increasing the energy or force of the steam. The valve J as it is opened comes against a rest, I, underneath. This valve is continually open as long as the forced draft is in operation, and as the products of heat are carried down through the side pipe the water from the supply-pipe H mingles with the caloric and passes down into the boiler with it.

When the forced draft ceases, the pressure of steam in the boiler will close the valve, preventing the escape of steam or water through the side pipe. Any ashes or cinders that might be carried into the boiler with the smoke and heat will fall to the bottom, where they can be blown out through the faucet *n*, Fig. 1. The perforated diaphragm *F* across the boiler, surrounding the flue-pipe, is designed to distribute the ebullitions caused by the injection of the caloric into the boiler, so as to prevent foaming, as the products of combustion are forced into the boiler below the surface of the water, the ordinary height of the water being above the diaphragm, and the end of the pipe *L* below it.

What we claim as our improvement, and desire to secure by Letters Patent, is—

1. The arrangement of the opening *b''*, furnace *C*, and flue *D*, in combination with throat

e and valve *D'*, substantially as and for the purpose set forth.

2. The pipe *E* and pipe *H*, in combination with the flue *D*, substantially as and for the purpose set forth.

3. The valve *J* and diaphragm *F*, in combination with the pipe *E*, flue *D*, and boiler, when arranged substantially as and for the purpose set forth.

4. The annular chamber *b'* and ash-box *B*, in combination with the fuel-throat *e* and boiler, when arranged substantially as and for the purpose set forth.

ISAAC E. CRAIG.
JOHN MADDEN.

Witnesses:

W. H. BURRIDGE,
A. W. McCLELLAND.