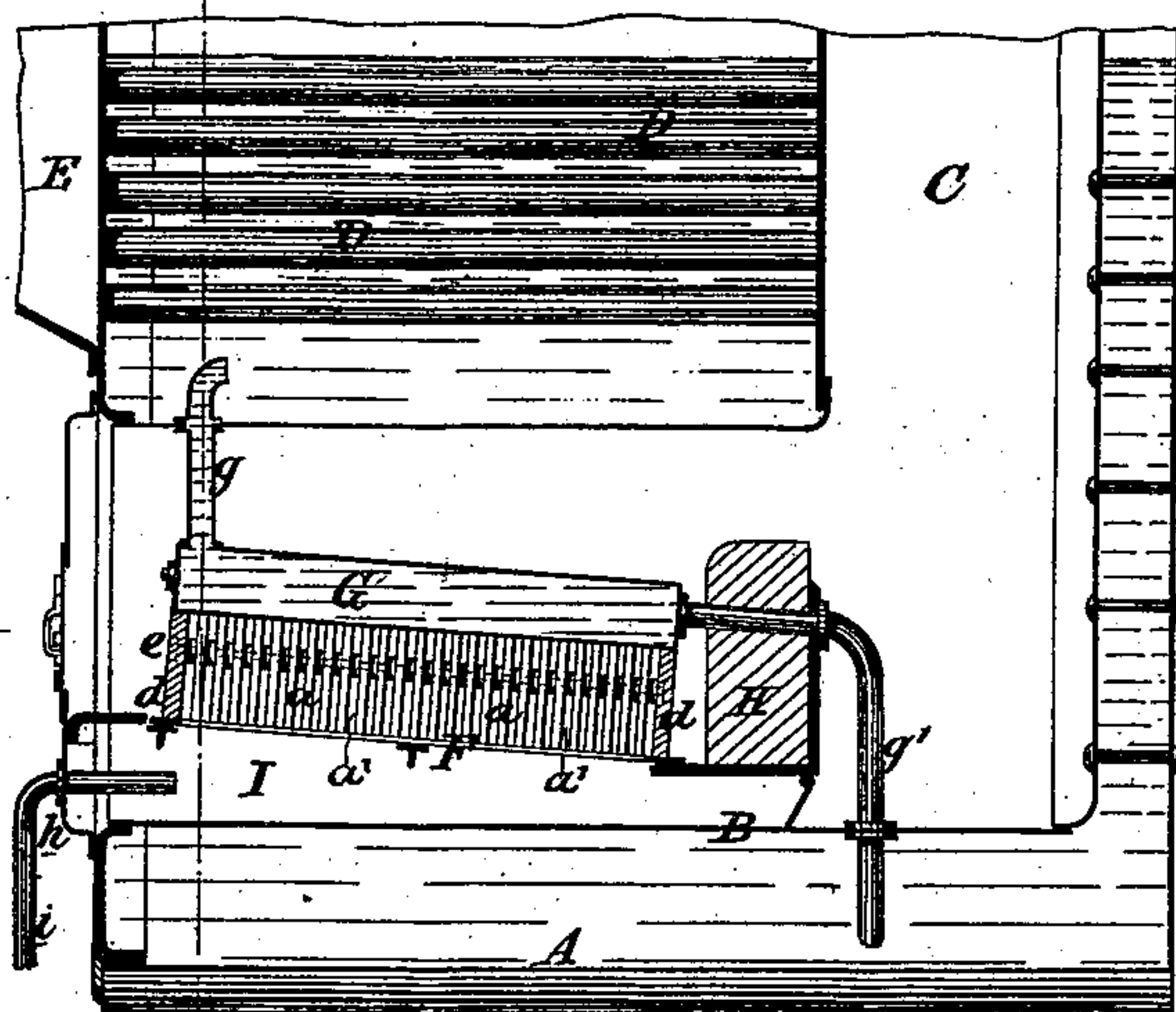
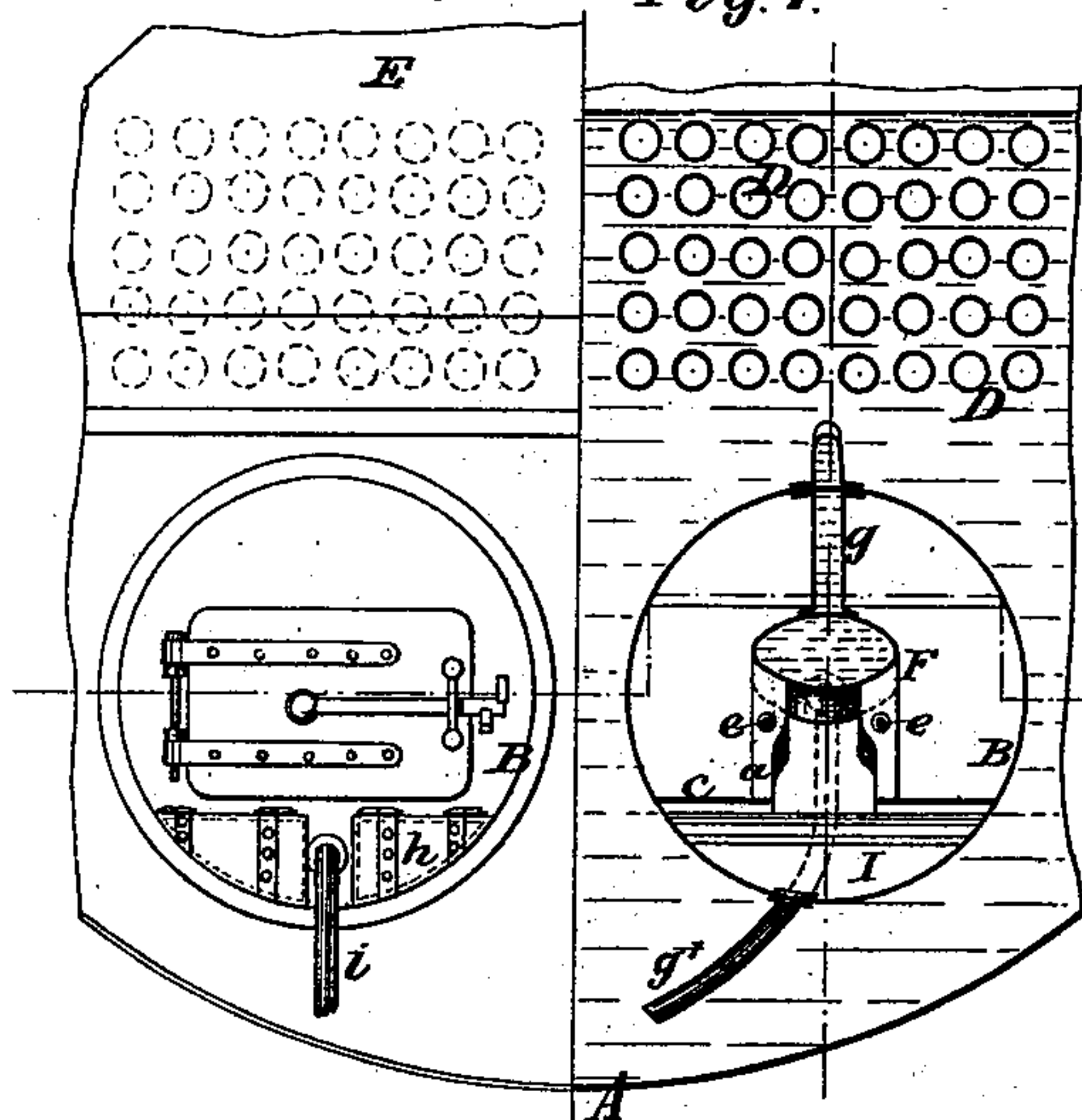


(No Model.)

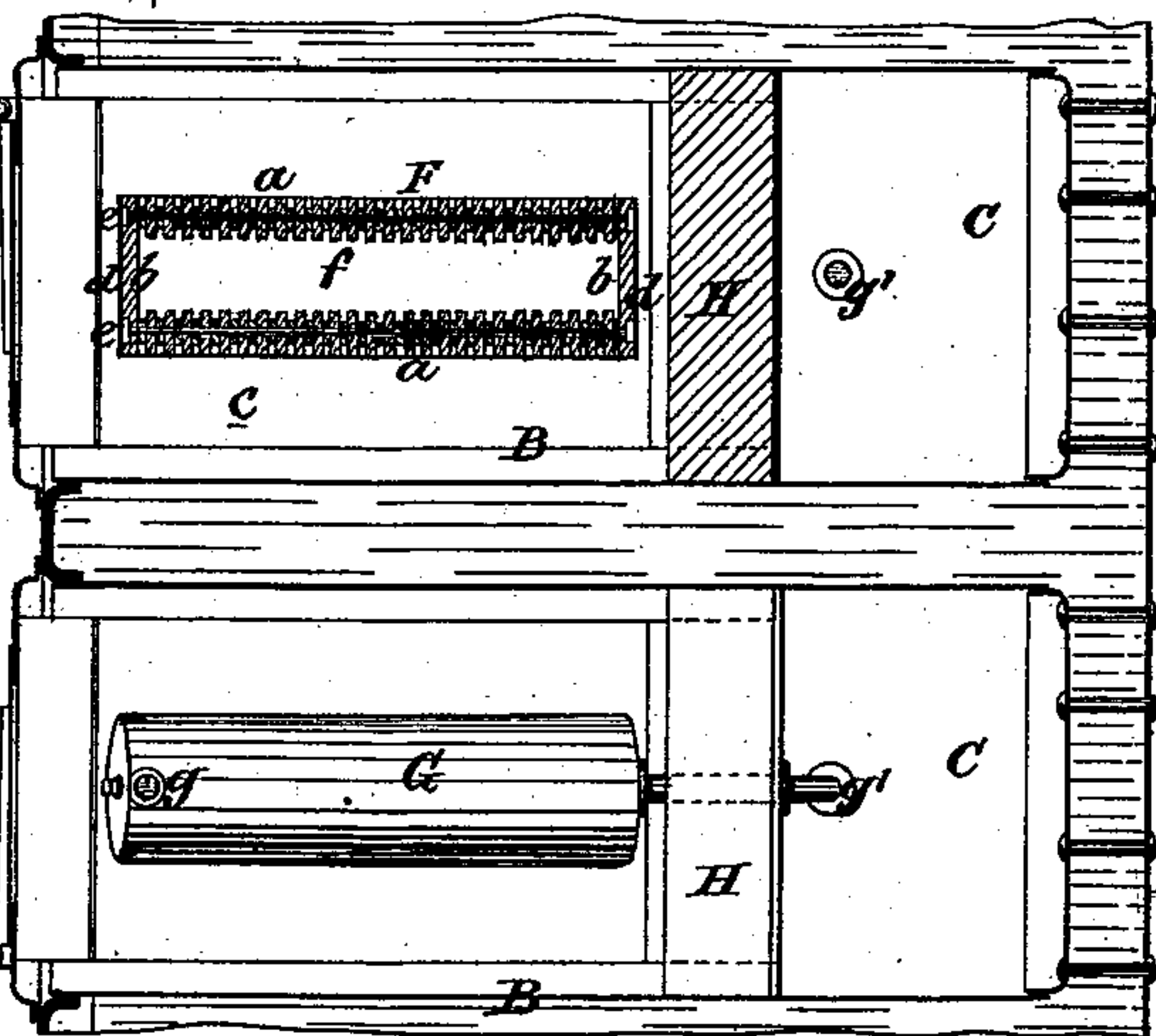
J. WAVISH.  
Steam Boiler Furnace.

No. 230,373. *Fig. 1.*

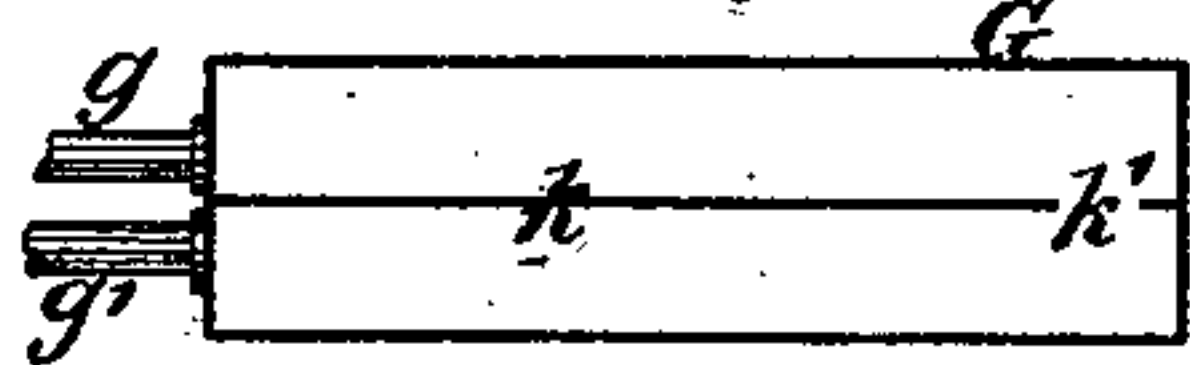
Patented July 20, 1880.



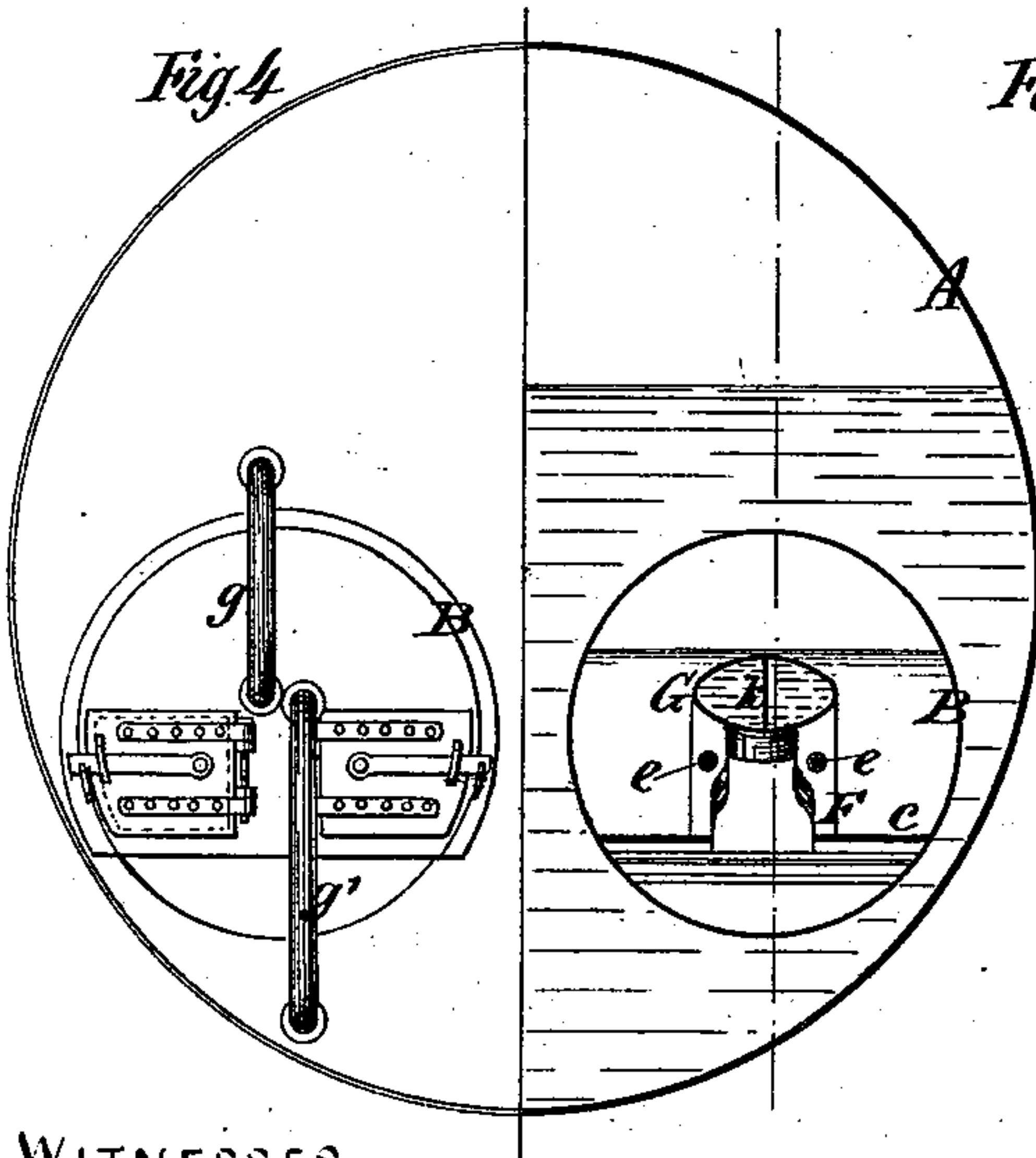
*Fig. 3.*



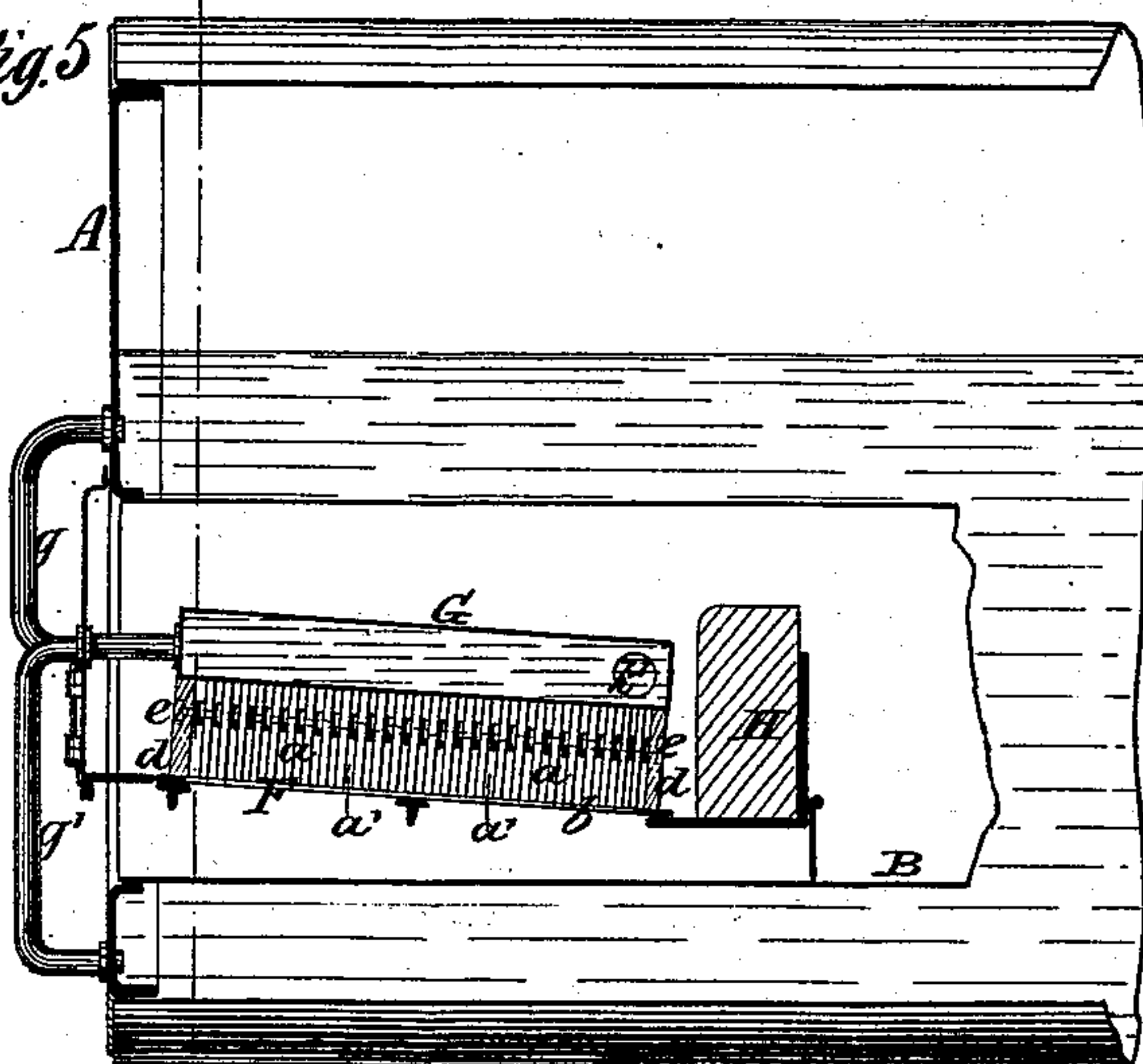
*Fig. 6.*



*Fig. 4.*



*Fig. 5.*



WITNESSES

*John W. Deemer*  
*Henry Howson*

INVENTOR.

*James Wavish*  
*by his Attorneys*  
*Howson and Son*



# UNITED STATES PATENT OFFICE.

JAMES WAVISH, OF LEYTONSTONE, ENGLAND.

## STEAM-BOILER FURNACE.

SPECIFICATION forming part of Letters Patent No. 230,373, dated July 20, 1880.

Application filed April 15, 1880. (No model.) Patented in England June 19, 1879.

*To all whom it may concern:*

Be it known that I, JAMES WAVISH, a subject of the Queen of Great Britain and Ireland, and residing at Leytonstone, county of Essex, England, have invented certain Improvements in or applicable to Locomotive, Marine, and other Steam-Boilers, for the purpose of promoting the combustion of fuel and obtaining increased evaporating power, for which I have obtained a patent in Great Britain, (No. 2,448, 19th June, 1879,) and of which the following is a specification.

My invention relates to the apparatus for facilitating the proper combustion of fuel, constructed upon what is known as "Wavish's system."

In applying the said apparatus to steam-boilers it has been customary to construct it in the form of a series of vertical bars, which surround an elongated opening in a plate constituting the bottom of the grate, and are surmounted by another plate, which forms a cover to the chamber thus constituted, a space being left between each two consecutive bars, so as to form outlets into and among the fuel for the air introduced through the said opening.

It has been found in practice that the said cover becomes rapidly deteriorated and destroyed under the action of the heat to which it is subjected, and requires frequent renewal.

Now my present invention has for its object counteracting this tendency to rapid deterioration of the cover, and at the same time increasing the evaporating power of the boiler; and it consists, for that purpose, in constructing the cover hollow and connecting it with the water-space in the boiler in such a manner that the water shall be caused to enter and fill and constantly circulate through the cover, thus protecting it from injury from the action of the heat at its exterior, and also contributing to the available heating-surface of the boiler.

My present invention is particularly adapted for use in locomotive and marine steam-boilers, but it is also applicable to steam-boilers of other descriptions.

And in order that my said invention may be fully understood, I shall now proceed more particularly to describe the same, and for that purpose shall refer to the several figures on

the annexed sheet of drawings, the same letters of reference indicating corresponding parts in all the figures.

Figure 1 of my drawings represents a half end elevation and half transverse vertical section of a portion of a marine boiler having applied thereto the improvements which form the subject of my said invention. Fig. 2 is a longitudinal section, and Fig. 3 a horizontal section, of the same, both corresponding to Fig. 1. Figs. 4, 5, and 6 illustrate the application of my said invention to a Cornish boiler, Fig. 4 being a half end elevation and half transverse vertical section of the boiler; Fig. 5, a longitudinal section of a portion of the same; and Fig. 6, a detail of one of the water-chambers hereinbefore referred to and hereinafter more fully described.

Referring to Figs. 1, 2, and 3, A is the shell of a marine boiler. B B are the fire-boxes, C the smoke-boxes, D the fire-tubes, and E the chimneys, all of which may be generally arranged in any usual or suitable manner. F are the grates, which, as constructed upon the principle of what is known as "Wavish's system," each consist of vertical bars *a*, arranged at opposite sides of an elongated opening, *b*, in a plate, *c*, constituting the bottom of the grate. The bars are secured together and to end plates, *d d*, by bolts *e*, and are surmounted by a cover, so as to form a chamber, *f*, into which the air for supporting combustion is introduced through the opening *b*, the said air thence passing through spaces *a'* left between the bars into and among the burning fuel in the grate.

Now my present invention relates, chiefly, to the construction and arrangement of the covers surmounting the said bars; and it consists in constructing them hollow, so as to form water spaces or chambers, as shown at G, and connecting them with the water-space in the boiler, in order to maintain a circulation of water through the boiler and the said chambers. The connection of the chambers G with the boiler water-space may be made in various ways. In the example illustrated in Figs. 1, 2, and 3 a pipe, *g*, at the fire-door end of each chamber G is carried upward into the upper part of the boiler water-space, and another pipe, *g'*, at the opposite end is passed through



the fire-bridge H and extended downward into the lower part of the boiler water-space. The water is thus caused to enter and fill and constantly circulate through the chambers or hollow covers G, thereby protecting them from injury from the action of the external heat, and at the same time contributing to the available heating-surface of the boiler and equalizing the expansion of the boiler-plates.

In carrying out my present invention, and in particular in the application of the same to marine boilers, it is found advantageous to close the ash-pits at *h*, thus forming air-chambers I, and to supply air thereto for the purpose of supporting combustion by means of pipes *i* and a fan or blower from the external atmosphere, in lieu of the necessary air being drawn from the stoke-hole, as in the ordinary manner.

I make no claim, however, to the use of closed ash-pits and a forced draft as forming any part of my present invention.

Figs. 4, 5, and 6 illustrate the application of my invention to a double-flued Cornish boiler, BB being the flues containing the grates F, constructed in the manner hereinbefore described. In this example the pipes *g g'*, communicating, respectively, with the upper and lower parts of the boiler water-space, are carried out at the front of the boiler, and a partition, *k*, (see detail, Fig. 6,) having an aperture, *k'*, is provided in each of the water-chambers G, in order to further promote the circulation of the water throughout the extent of the said chambers.

Although, however, I have shown different arrangements of the pipes *g g'* in the examples of marine boiler and Cornish boiler illustrated, I wish it to be understood that the said arrangements of pipes may be used indiscriminately for either type of boiler; also that the partition in the water-chambers may be used or omitted in either arrangement; and, further, that the pipes and chambers may be otherwise modified according to circumstances.

By means of my present invention the advantages of my system in facilitating the proper combustion of fuel are retained, while at the same time the apparatus is rendered more durable and an augmentation of the evaporating power of the boiler and an equalization in the expansion of the boiler-plates are secured.

I claim as my invention—

In a steam-boiler furnace, the combination of the bottom plate of the grate, having an opening, *b*, with vertical grate-bars *a*, and a hollow cover surmounting said grate-bars, and having pipes communicating with the water-space of the boiler, all substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES WAVISH.

Witnesses:

CHARLES MILLS,

JOHN JAMES,

Both of 47 Lincoln's Inn Fields, London.