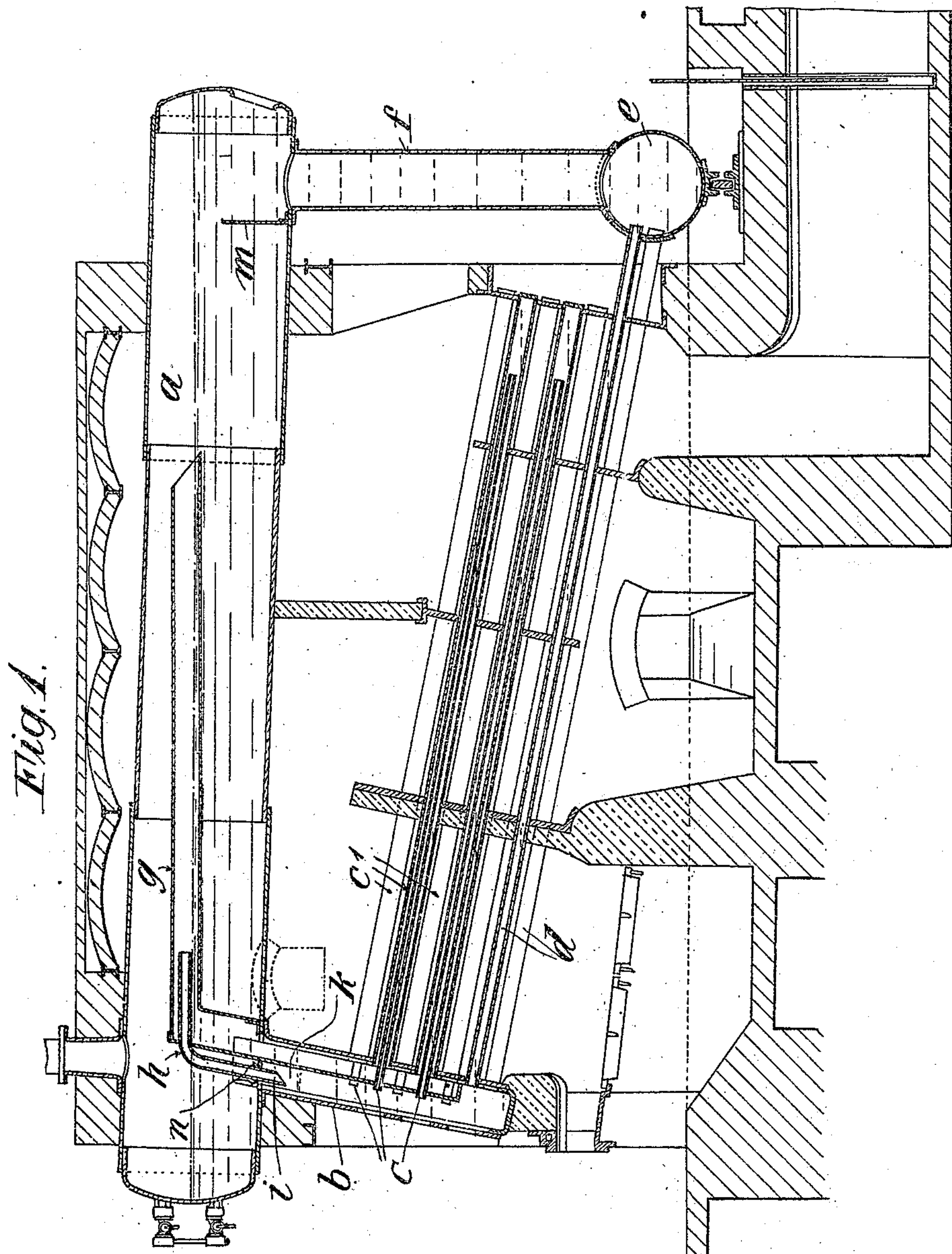


C. MAHLKE.
WATER TUBE BOILER.
APPLICATION FILED JUNE 16, 1909.

956,388.

Patented Apr. 26, 1910.

3 SHEETS—SHEET 1.



Witnesses:

M. H. Darg.
L. W. Price

Inventor:

Carl Mahlke
by J. E. Boulter
his Attorney

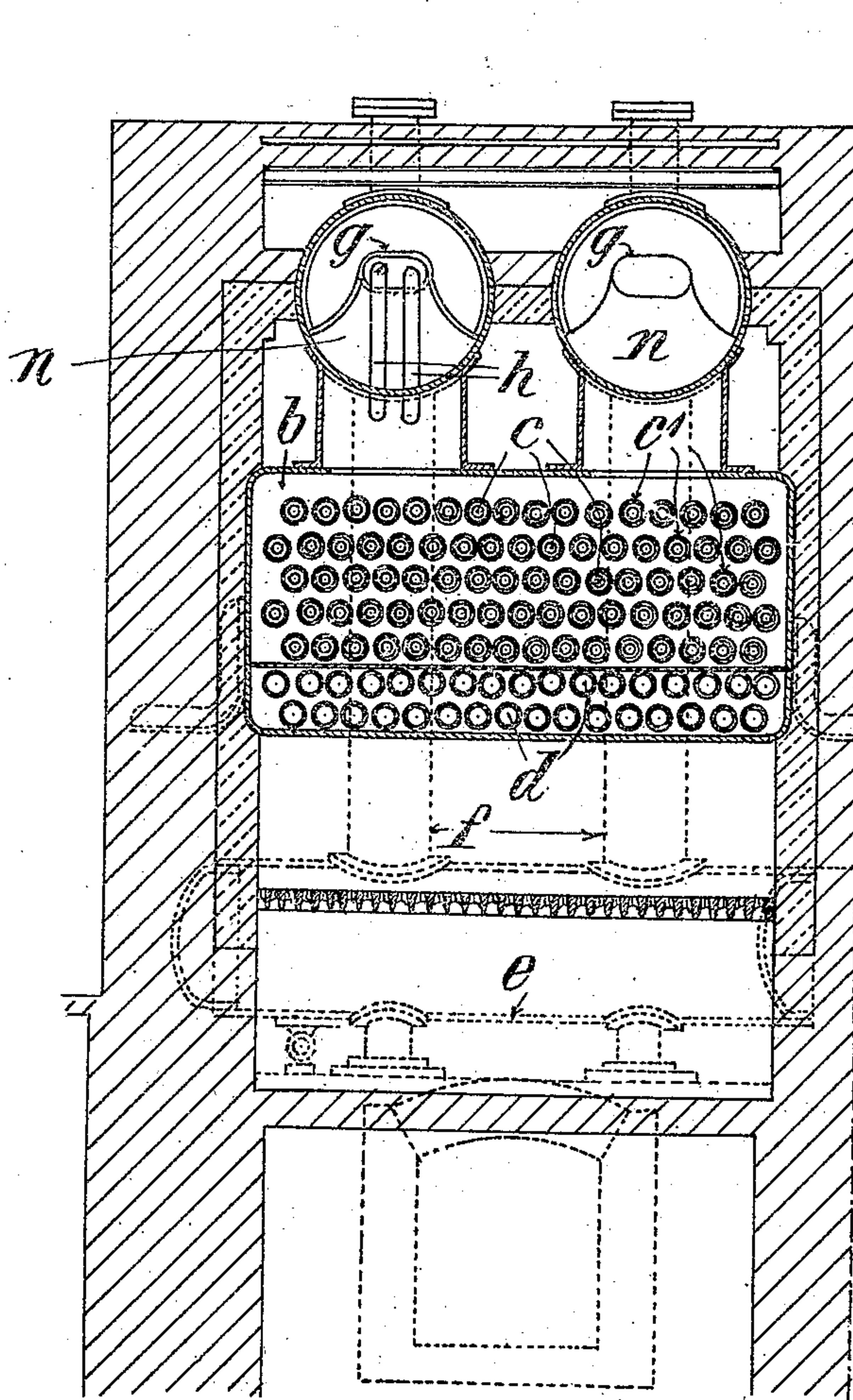
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Fig. 2.



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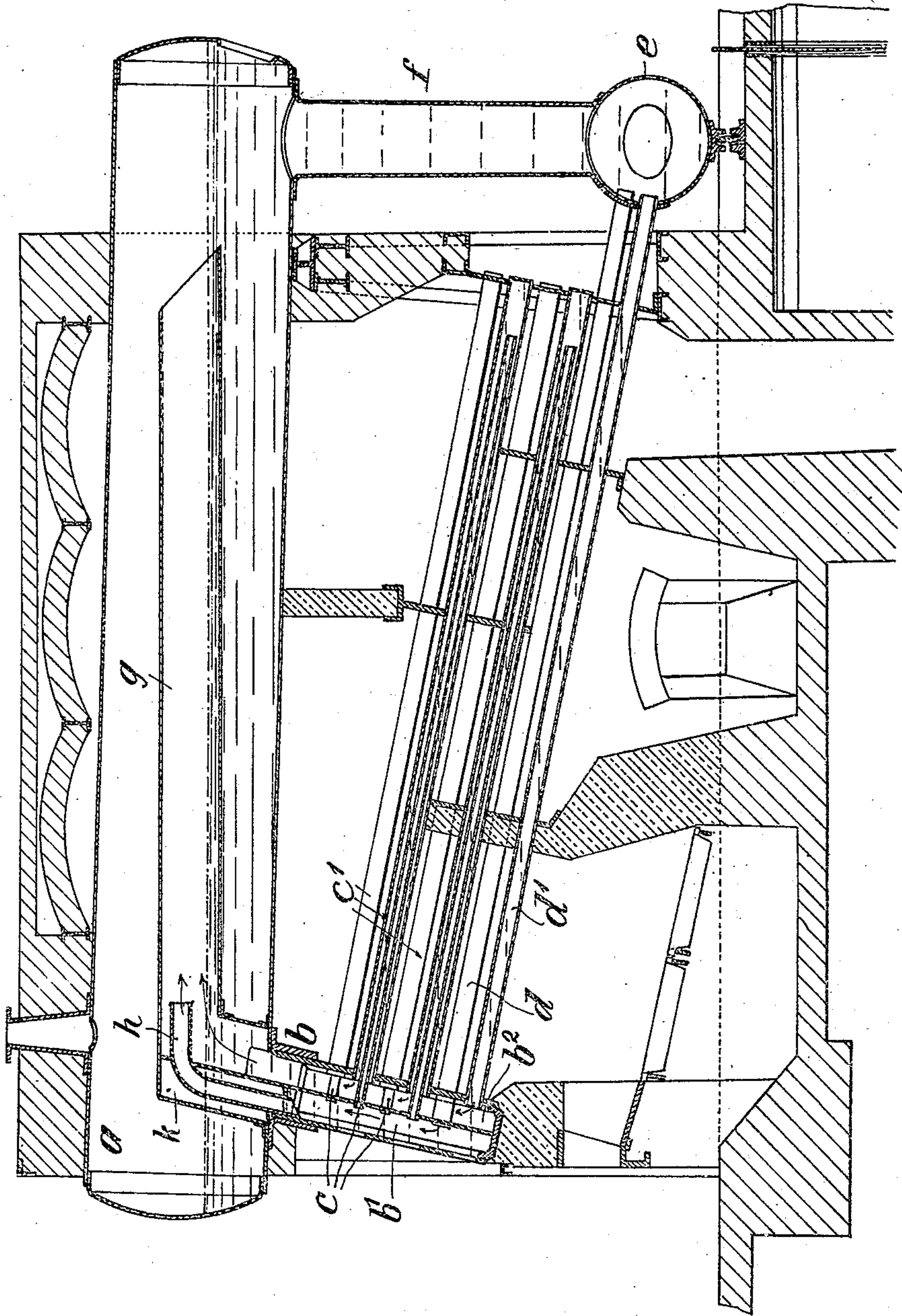
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3 SHEETS—SHEET 3.

Fig. 3.



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UNITED STATES PATENT OFFICE.

CARL MAHLKE, OF MÖDLING, NEAR VIENNA, AUSTRIA-HUNGARY, ASSIGNOR TO THE FIRM, RÖHRENKESSELFABRIK MÖDLING, VORMALS DÜRR, GEHRE & CO., AKTIENGESELLSCHAFT, OF MÖDLING, AUSTRIA-HUNGARY.

WATER-TUBE BOILER.

956,388.

Specification of Letters Patent. Patented Apr. 26, 1910.

Application filed June 16, 1909. Serial No. 502,553.

To all whom it may concern:

Be it known that I, CARL MAHLKE, a citizen of Austria-Hungary, and resident of Mödling, near Vienna, Austria-Hungary, have invented a certain new and useful Improvement in Water-Tube Boilers, of which the following is a specification.

Some previously known single header water tube boilers consist mainly of one or more steam drums, a suitably divided water chamber and a system of Field tubes, the upper ends of which are fixed in the water space, while the lower ends are freely mounted in such a manner as to be capable of expansion and are closed by means of separate obturators. The feed water, which is always admitted to the steam drum, descends through the front half of the water chamber and the inner Field tubes into the lowest rear ends of the water tubes which are heated throughout their entire length, and it then ascends through the annular passage of the Field tubes toward the rear half of the water chamber and reaches the steam drum as a mixture of steam and water, where the steam separates from the water. The steam ascends to the point where the steam is drawn off while the water circulates again as already described. In such cases it may happen, especially when the boiler is run with an exceptionally forced draft, that the scale and mud forming constituents contained in the water, which owing to their greater specific gravity naturally become deposited in the lowest rows of tubes, block the annular passage between the Field tubes and impede the circulation of the water, which may result in bending and burning of the lowest water tubes.

Now the present invention has for its object to increase the water circulation positively in such a manner that the scale and mud forming constituents are prevented from settling in the tubes and in addition the evaporating capacity of the boiler is increased. These objects are attained owing to the fact that one or more rows of ordinary water tubes are arranged in front of the system of Field tubes, or the tubes of the lower nests of tubes are composed of ordinary water tubes and so connected with the water chamber and mud drum directly communicating by a downcomer with the rear end of the steam drum, that a double

flow of water is produced. With this double flow of water, the whole of the feed water for the boiler is first of all forced by the cross box through the system of ordinary water tubes located near the fire into the front half of the chamber which is completely shut off from the steam drum, after which it is distributed in the system of Field tubes in the usual manner, and conducted to the steam drum through the rear half of the chamber. If a part of the water forced by the mud drum into the ordinary lower water tubes be allowed to issue into the rear half of the chamber, in which, passing by the mouths of the outer tubes of the Field tube system and exerting suction upon them, it ascends into the steam drum, then in addition to the double circulation a further flow is provided which by the suction effect described considerably assists the water circulation in the Field tube system.

The two forms of the water tube boiler mentioned above are illustrated in the accompanying drawing, in which,

Figure 1 shows the complete installation consisting of a single chamber water tube boiler with double water circulation, in longitudinal section. Fig. 2 is a corresponding vertical section, and Fig. 3 is a longitudinal section of the construction with the double and additional water circulation.

In both embodiments of the invention one or more nests of ordinary water tubes d and d' are arranged in front of the Field tube system or the tubes of the lowest or of some of the lowest rows of Field tubes are replaced by ordinary water tubes and these water tubes d or d' are extended rearward and open into a mud drum e which communicates with the rear end of the steam drum a by means of a downcomer f .

In the construction illustrated in Figs. 1 and 2, the front half b' of the water chamber b is shut off from the water space of the steam drum by means of a suitable partition n and the rear half of the water chamber b^2 terminates immediately below the system of Field tubes c, c' , so that the ordinary water tubes d connect the mud drum e with the front half b' of the water chamber. This front half of the chamber is in communication, by means of one or more tubes h opening into the collecting pipe g with the steam space of the steam drum and its or their

mount *i* is located so far below the partition *n* that a steam space is formed in the front half *b'* of the chamber. By means of this arrangement the whole of the water of the boiler is forced to descend through the downcomer *f* into the mud drum *e*, to flow through the water tubes *d* into the front half of the chamber *b'* and then, as direct ascent into the upper boiler is prevented by the wall *n*, to flow through the system of Field tubes and then finally to pass through the rear half *b²* of the water chamber and the collecting pipe *g* into the steam drum *a*. The steam formed in flowing through the water tubes *d* is carried by the steam tube *h* directly into the collecting pipe *g*. By this means the double water circulation already referred to is formed, as the water must flow twice through the entire length of tubing. Owing to the speedy evaporation which takes place, especially in the tubes *d*, the flow is rendered much more vigorous so that the scale and mud forming constituents of the water have no time for settling in the tubes.

In the embodiment of the invention illustrated in Fig. 3, some of the water tubes *d'* arranged in front of the Field tubes open into the rear half *b²* of the water chamber *b*. The water supplied from the mud drum *e* to these tubes *d'* in which it is speedily heated and even evaporated to a great extent ascends through the rear half of the water chamber to the steam drum as a mixture of steam and water. As in doing so it must pass in front of the outlets of the Field tubes between the middle wall of the chamber and the rear wall of the chamber, owing to its rapid flow it produces a suction effect upon the latter and carries with it the water contained in the annular passages formed in the system of Field tubes, thereby largely increasing the water circulation in this system of tubes *e, c'*. This vigorous circulation is still further assisted owing to the fact that the ascent of the mixture of steam and water formed in the lowest nest of tubes *d'* is not merely facilitated by the rising of the hot water and of the steam bubbles but also by the weight of the descending column of water in the downcomer *f*. In this manner the double water flow obtained in the tubular system in accordance with Figs. 1 and 2 is largely increased by means of the additional water circulation produced by the tubes *d'* and thereby the object aimed at, which is the very rapid circulation of water

and vigorous evaporation, is greatly facilitated.

If two or more steam drums are provided in the boiler plant installation a corresponding number of connecting downcomers for the mud drum *e* are provided and also the necessary connections between the water chamber and the steam drums.

Having described my invention what I claim and desire to secure by Letters Patent of the United States is:—

1. A single header water tube boiler comprising in combination, a divided water chamber, a system of Field tubes, the inner tubes of said system extending into the front half of said divided water chamber and the outer tubes of said system extending into the rear half of said divided water chamber, a steam drum, a mud drum, a downcomer connecting said steam drum with said mud drum, a nest of the usual water tubes, one end of the latter entering the said mud drum and the other end of said last mentioned water tubes entering the front half of said water chamber, said front half being closed off from the steam drum, and one or more tubes adapted to connect the steam space in said steam drum with the front half of said divided water chamber.

2. A single header water tube boiler comprising, in combination a divided water chamber, a system of Field tubes, the inner tubes of said system extending into the front half of said divided water chamber and the outer tubes of said system extending into the rear half of said divided water chamber, a steam drum, a mud drum, a downcomer connecting said steam drum with said mud drum and a nest of the usual water tubes, the whole of said last-mentioned tubes extending at their rear ends from the mud drum, a number of said tubes extending with their front ends into the front half of said divided water chamber, said water chamber being closed off from the said steam drum, and the rest of the said tubes extending with their front ends into the rear half of said divided water chamber.

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

CARL MAHLKE.

Witnesses:

WILHELM BERGER,
ROBERT W. HEINGARTNER.