

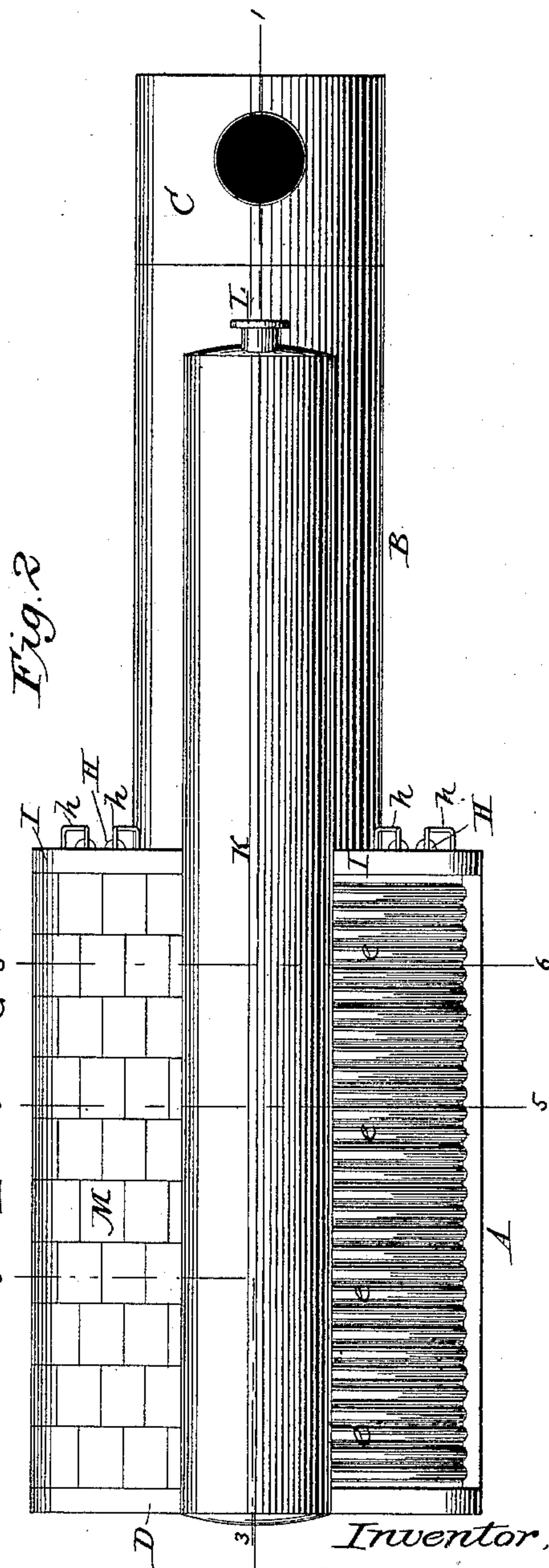
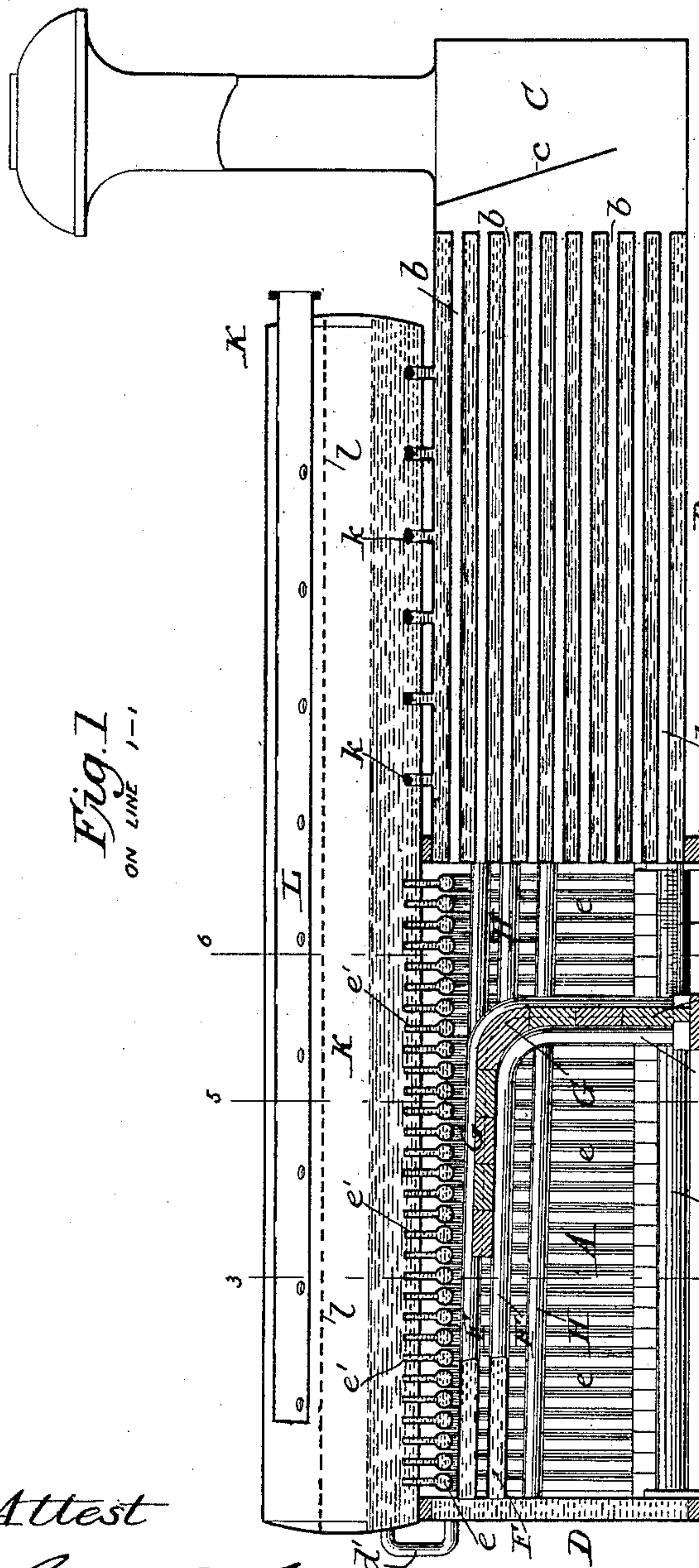
(No Model.)

2 Sheets—Sheet 1.

J. BAIRD.
STEAM BOILER.

No. 434,973.

Patented Aug. 26, 1890.



Attest
Sidney P. Hollingsworth
W. H. Smith.

Inventor,
John Baird
by his attorneys
Goldwin Davidson & Wright.

(No Model.)

2 Sheets—Sheet 2.

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Fig. 3.

ON LINE 3-3

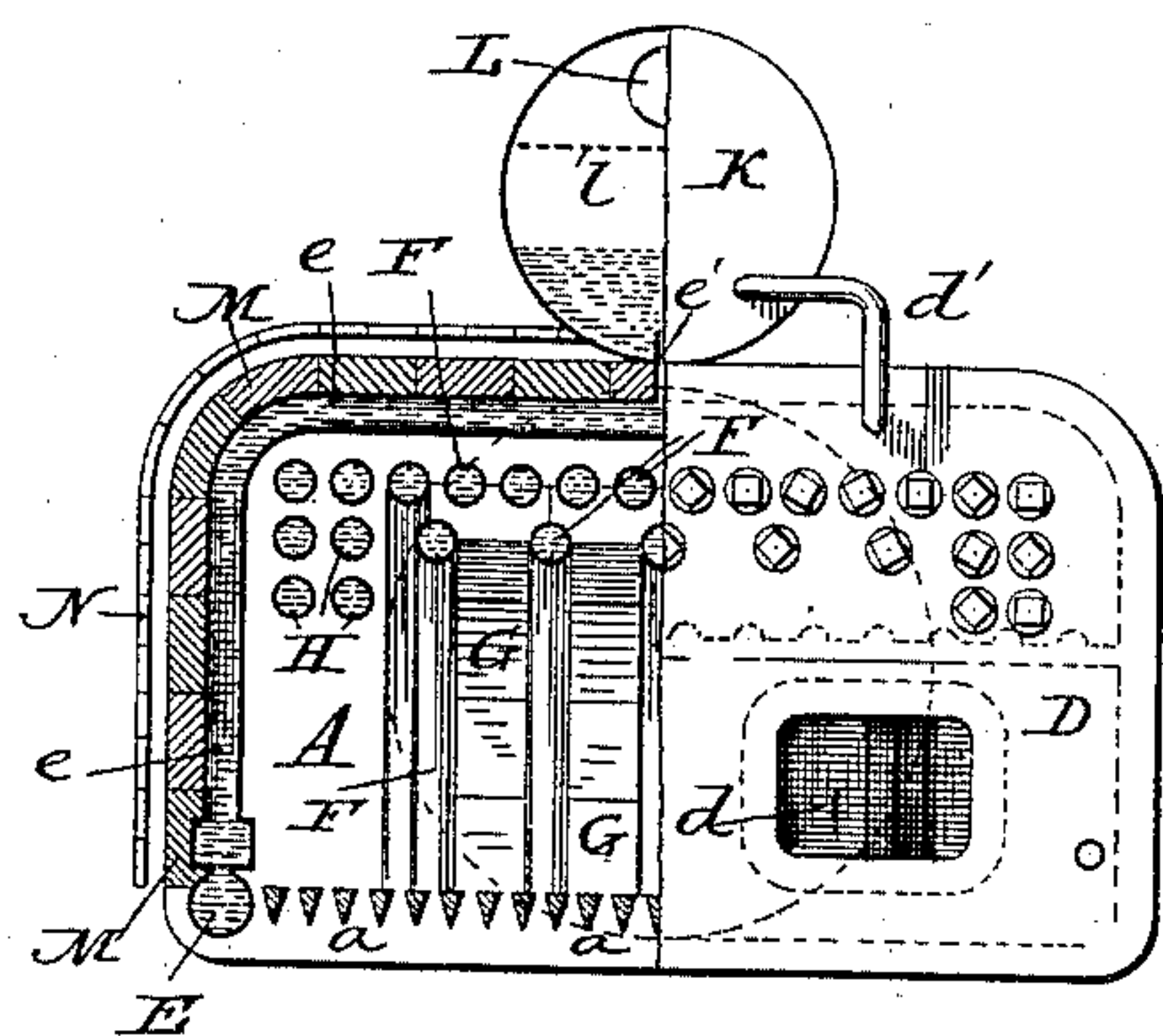


Fig. 4.

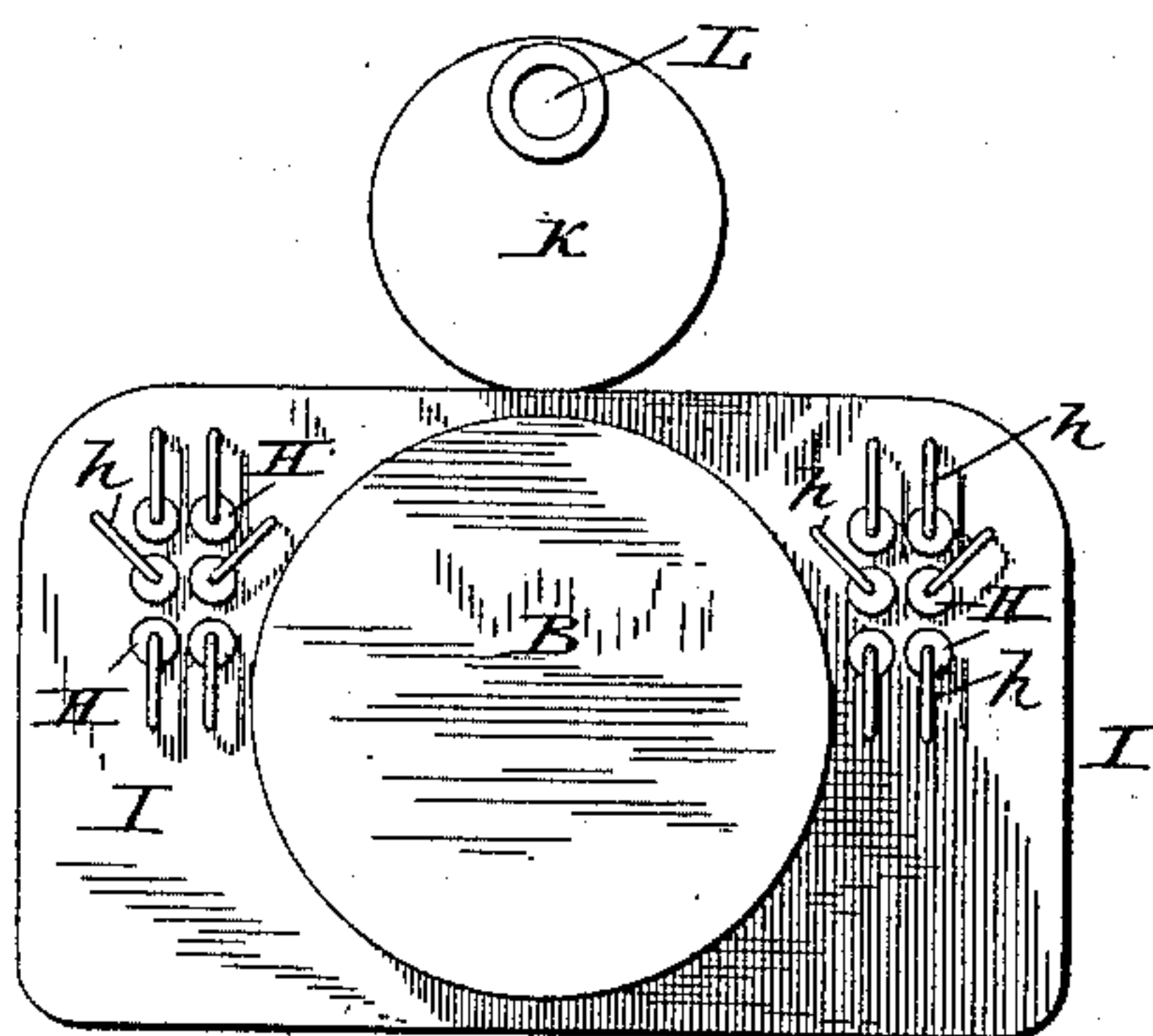


Fig. 5.

ON LINE 5-5

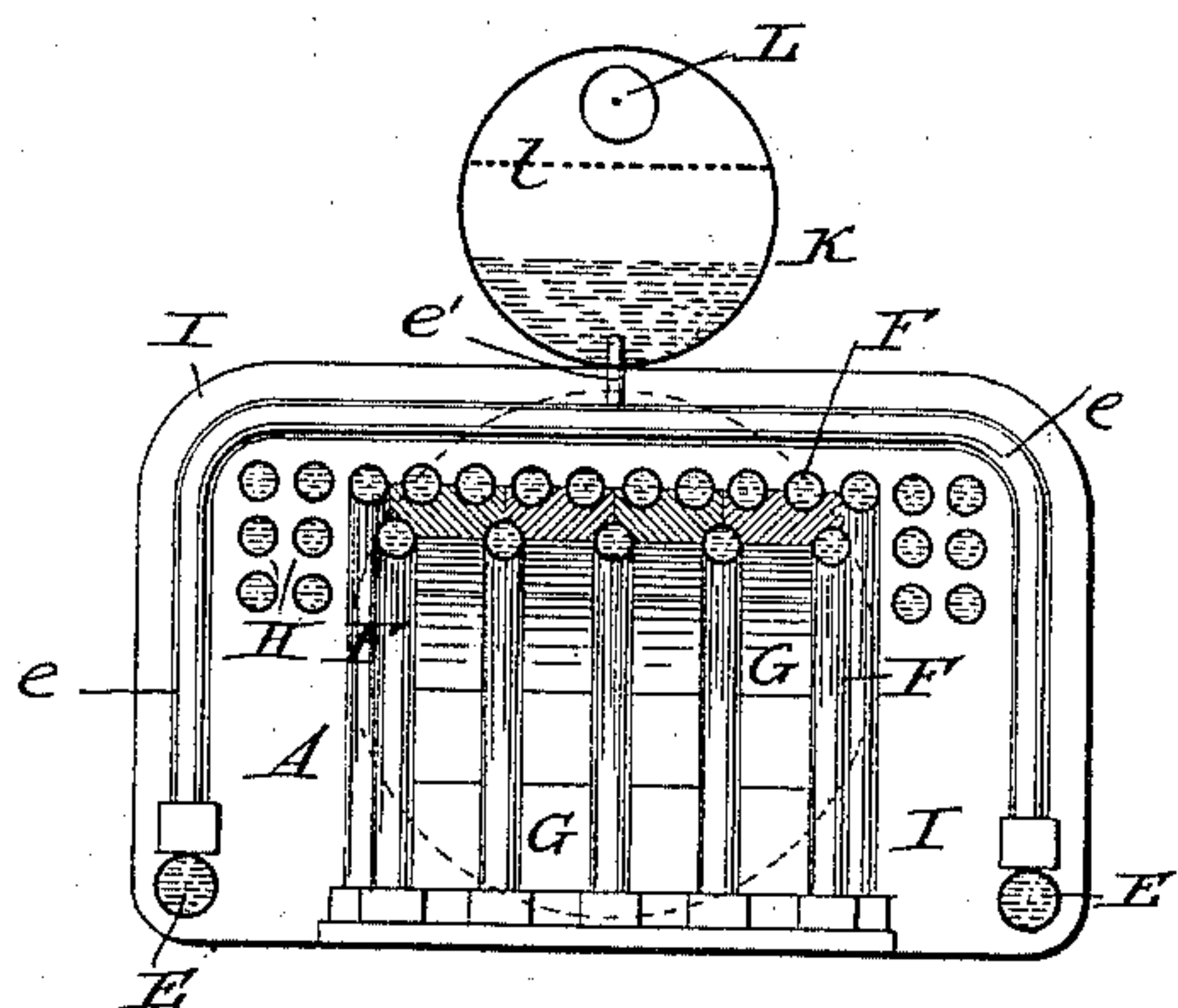


Fig. 6.

ON LINE 6-6

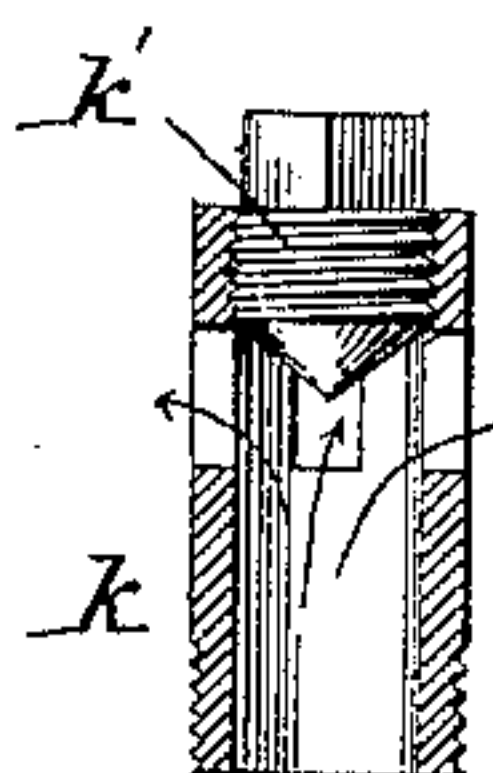
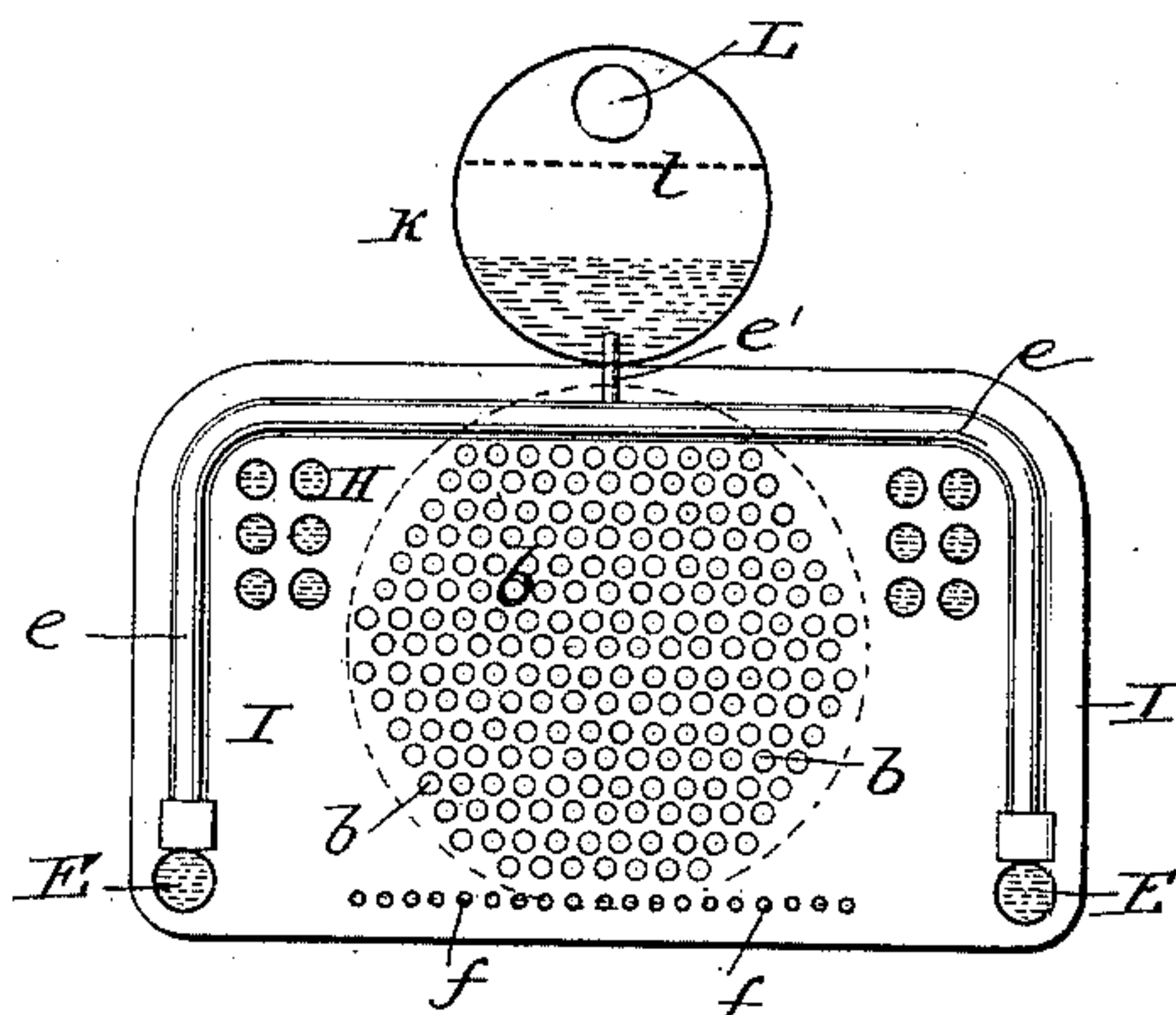


Fig. 7.

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UNITED STATES PATENT OFFICE.

JOHN BAIRD, OF NEW YORK, N. Y.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 434,973, dated August 26, 1890.

Application filed April 24, 1890. Serial No. 349,257. (No model.)

To all whom it may concern:

Be it known that I, JOHN BAIRD, mechanical engineer, a citizen of the United States, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

My invention more especially relates to locomotive-boilers, but may, however, advantageously be used in stationary or marine boilers, and constitutes an improvement upon the boiler shown in United States Letters Patent heretofore granted to me as No. 402,127, dated April 30, 1889, and No. 415,135, dated November 12, 1889. The former of these patents shows two boiler-shells, the upper one overlying the lower, as well as a fire-box containing vertical water-tubes, both at its sides and front end, and transverse horizontal tubes constituting the roof of the fire-box, these tubes being covered on their upper and outer sides by fire-brick.

The objects of my present invention are to secure a large water-heating surface, an advantageous application of heat directly to the water-tubes, an active water-circulation, and efficient means of drying the steam, and other incidental advantages in construction and operation.

To these ends my improvements consist in certain constructions, combinations, and organizations of instrumentalities specified in the claims at the close of this specification. Unless otherwise specified, the parts are of usual well-known construction.

In the accompanying drawings, which represent so much of a locomotive embodying my improvements as is necessary to illustrate the subject-matter claimed herein, Figure 1 represents a vertical longitudinal section on the line 1 1 of Fig. 2; Fig. 2, a plan or top view; Fig. 3, a view, partly in front elevation and partly in vertical transverse section, on the line 3 3 of Figs. 1 and 2; Fig. 4, an end view of the rear or smoke-stack end of the boiler; Fig. 5, a vertical transverse section on the line 5 5 of Figs. 1 and 2; Fig. 6, a similar view on the line 6 6 of the same figures; and Fig. 7, a detail view showing a vertical section through one of the deflecting-tubes connecting the upper shell with the lower water-spaces of the boiler.

A fire-box A, provided with grate-bars *a*, is

shown as connected by a back head I with the front tube-sheet of the lower shell B, through the fire-tubes *b* of which the products of combustion pass out through a smoke-box C, shown as provided with a deflector *c*.

The front or feed-door end of the boiler is composed of two parallel sheets of metal constituting a front head or water-space D provided with fire-doors *d*.

The sides and top of the fire-box consist of a series of transverse arched water-tubes *e*, placed closely together side by side and extending from the front to the back head, their lower ends being united to longitudinal side tubes E, connecting the front head with the lower shell. A series of longitudinal water-tubes connected with the front head extend horizontally backward to a point, say, about three-fourths of the distance between the front and back heads, where they are bent downward, reaching to the bottom of the fire-box, their lower ends being connected by small pipes *f* to the water-leg at the bottom of the tube-sheet. Consequently the heated water and steam pass from the bottom of these water-pipes upward and forward over the fire-box to the front head, where they are exposed to the direct action of the fire. These longitudinal tubes, it will be observed, do not extend entirely across the fire-box, but are arranged centrally therein, as shown in Figs. 3 and 5, so as to leave sufficient room on each side to afford access to the front connection at the tube-sheet. The longitudinal tubes are also shown as arranged in two parallel rows F F', leaving a space between them which is filled with fire-brick or pottery G.

As shown in Figs. 3 and 5, the upper set of these tubes is arranged more closely together than the lower one, the advantage of which is that the flame impinges upon the fire-brick between the inner or lower set of tubes, and thus thoroughly heats it, and communicates its heat in turn to the upper or outer set, the increased number of which gives additional heating-surface. I prefer to fill this space with fire-brick, not only to the full height of the tubes, but to extend it forward over the rear part of the fire-box—say half-way to the front head. This arrangement leaves sufficient space for the escape of the products of combustion, both over the top of the fire-

bricks, between the longitudinal tubes F and the transverse arched tubes *e*, and also at the sides between the vertical parts of these same tubes. These tubes F F' are also shown
 5 as arranged directly in front of and in line with the lower shell, directly between the furnace and the fire-tubes, consequently deflecting the products of combustion around these tubes as they pass to the front end of
 10 the lower shell. I utilize also the upper portion of the space left, as before described, on each side of the longitudinal tubes, by inserting longitudinal water-tubes H therein, connecting the front head with the tube-
 15 sheet of the lower shell. These tubes, it will be observed, are exposed throughout their whole length to the direct action of the fire. These tubes are preferably fastened to the inner sheet of the front head, and pass
 20 through packed water-tight sleeves at one end in a manner shown in Letters Patent No. 425,970, granted to me April 22, 1890, thus leaving them free to slide endwise in the sleeves as they expand or contract. These
 25 tubes are supplied with water from the rear head I by small tubes *h* fitted to their ends.

An upper shell K is shown as extending over the entire length of the fire-box and over the greater portion, if not the whole, of the
 30 lower shell. It is connected with the front head by suitable pipes *d'* for the passage of mingled steam and water, with the lateral arched tubes *e* by small pipes or tubes *e'*, and with the lower shell by vertical tubes *k*. The
 35 water preferably normally stands in the upper shell at a level equal to about one-third of the shell, so as to cover all the connecting-pipes *d'*, *e'*, and *k*, above mentioned, so that all the tubes in the fire-box and lower shell
 40 are below the water-level. The steam consequently has to rise through the water in the upper shell.

In order to prevent any rush of water or steam from the lower shell or fire-box tubes,
 45 the upper ends of the connecting-tubes are closed with conical plugs *k'*, beneath which the tubes are perforated laterally, so as to deflect the uprising steam and water laterally. (See Fig. 7.) This device is shown in my patent,
 50 No. 425,970, of April 22, 1890, above mentioned. The priming of the boiler is further prevented by a horizontal perforated plate or diaphragm *l*, extending across the upper part of the upper shell K. A perforated steam-
 55 pipe L, between this diaphragm and the top of the upper shell, conducts the steam from the boiler. As before remarked, the upper shell extends nearly the full length of the fire-box and lower shell, thus affording a large
 60 surface at the water-level. This construction, in combination with the deflectors in the connecting-pipes, the perforated plate, and perforated steam-pipe, insures the delivery of
 65 great part of the waste incident to using in

locomotives steam excessively saturated with water, which is the principal source of the great condensation of steam in such engines.

The arched tubes constituting the roof and sides of the fire-box are covered with asbestos or fire-brick M, and this in turn is enclosed in a casing N.

I claim herein as new and as of my own invention—

1. The combination, substantially as here- 75
 inbefore set forth, of a fire-box, a boiler-shell, fire-tubes therein directly back of the fire-box, and longitudinal water-tubes arranged centrally and transversely in the fire-box directly in front of the fire-tubes connected with
 80 the front head and extending downward at their rear ends across the rear portion of the fire-box in the path of the flame which passes beneath and around them to the fire-tubes.

2. The combination, substantially as here- 85
 inbefore set forth, of a fire-box and a double series of longitudinal water-tubes arranged centrally and transversely in the upper part thereof, connected with the front head, bent
 90 downward at their rear ends, and connected at their lower ends by small pipes to a water-leg at the back end of the fire-box.

3. The combination, substantially as here- 95
 inbefore set forth, of a fire-box arranged in two substantially parallel rows and longitudinal water-tubes therein bent downward at their rear ends, with fire-brick interposed between both the vertical and horizontal portions of the tubes.

4. The combination, substantially as here- 100
 inbefore set forth, of a fire-box, a double row or set of central longitudinal water-tubes therein bent down at their rear ends, fire-brick interposed between the rows, and supplementary longitudinal water-tubes between
 105 the central water-tubes and the sides of the fire-box.

5. The combination, substantially as here- 110
 inbefore set forth, of a front head, a back head, transverse arched water-tubes in the fire-box, central longitudinal water-tubes therein, bent down at their rear ends, and supplementary upper lateral longitudinal water-tubes intermediate of the transverse and longitudinal tubes. 115

6. The combination, substantially as here-
 inbefore set forth, of a fire-box, a lower shell, a front head, an upper shell overlying the fire-box and lower shell, deflecting-pipes connecting them below the water-level, a perforated diaphragm above the water-level in the
 120 upper shell, and a perforated steam-pipe between this diaphragm and the top of the upper shell.

In testimony whereof I have hereunto subscribed my name. 125

JOHN BAIRD.

Witnesses:

ADDISON W. BAIRD,
 HUBERT HOOPER.