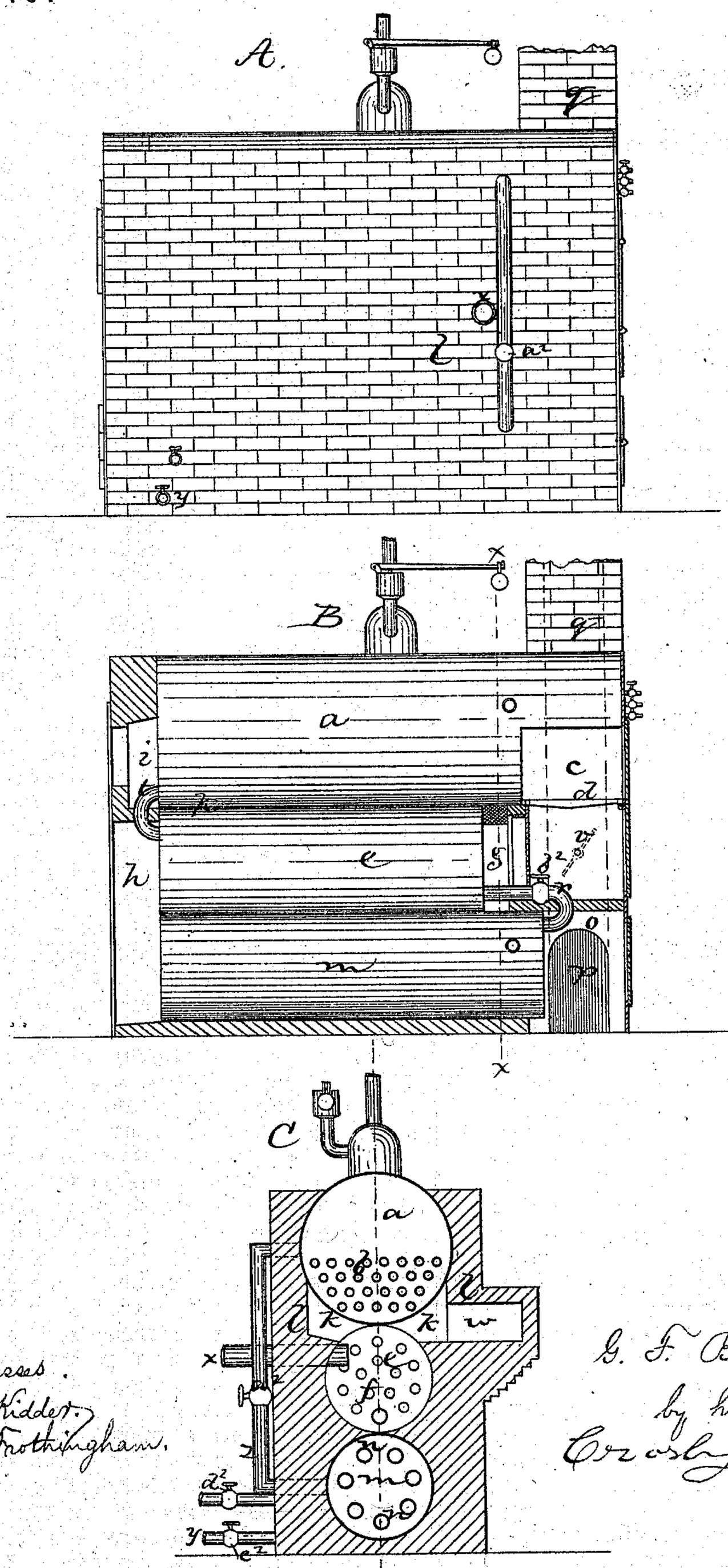
[72.] G. F. BURKHARDT. Improvement in Steam Generators.

No. 119,310. Patented Sep. 26, 1871.



Witnesses.
S. B. Kidder.
M. W. Frothingham.

G. F. Burkhardt,
by his attys.
Crosby & Gould.

UNITED STATES PATENT OFFICE.

GOTTLIEB F. BURKHARDT, OF BOSTON HIGHLANDS, MASSACHUSETTS.

IMPROVEMENT IN STEAM-GENERATORS.

Specification forming part of Letters Patent No. 119,310, dated September 26, 1871.

To all whom it may concern:

Be it known that I, GOTTLIEB F. BURKHARDT, of Boston Highlands, in the State of Massachusetts, have invented certain Improvements in Steam-Generators; and I do hereby declare that the following, taken in connection with the drawing which accompanies and forms part of this specification, is a description of my invention, sufficient to enable those skilled in the art to practice it.

My invention relates to certain improvements in steam-generators, having reference to the relative arrangement of the flue and water-spaces thereof. The invention consists, first, in the arrangement of three horizontal tubular boilers in a vertical series, with a fire-pot or furnace at the front of the upper boiler, with the flue-tubes of said boiler opening at their rear ends into a flue or fire-space between the upper boiler and the next below it, which flue-space, at its front end, communicates with the flue-tubes of the second or center boiler, through which flue-tubes the fire and volatile products of combustion pass into the flue-tubes of the lower boiler, passing through which they escape into the chimney at the front end of the boiler, the flue-spaces being so arranged and having dampers so arranged that the fire, &c., may be drawn from the furnace through the flues of the upper boiler back through the return flue-space between the two uppermost boilers into the chimney, without passing through the flue-pipes of the middle boiler or those of the lower boiler. The invention further consists in opening the exhaust into the space at the front of the second series of flue-tubes so as to urge and quicken the draught at a point about midway between the furnace and the escape-flue of the lower boiler. The invention further consists in the arrangement of the water-supply pipes and blow-off pipes, by which the lower boiler may be freed from water and blown off by the pressure of the steam from the upper boiler, the sediment and deposits which tend to settle in the lower boiler from the whole series being thereby driven off, and enabling the whole boiler to be kept clean and free from salts and other deposits, without stopping the fire or cessation of the steam-generating operation.

The drawing represents a boiler or series of boilers embodying my improvements.

A shows the boiler in side elevation of the masonry; B, a side elevation of the boiler, the masonry being removed; C, a section on the line *x x*. *a* denotes the main boiler, having horizontal flue-tubes *b* in its lower part, and a steam-space or chamber in the upper part thereof, the safety-valve and exhaust being arranged with respect to this main or upper boiler in the ordinary manner. At the front of this boiler is the furnace *c*, having an ordinary grate, *d*, the arrangement of the furnace of the flue-tubes and tube-sheets being similar to what is found in ordinary horizontal boilers. Under the boiler *a* is a second and secondary boiler, *e*, having horizontal flue-tubes *f*, which open from a flue-space, *g*, at the front of said boiler, and into a vertical flue-space, *h*, at the rear thereof. The flue-pipes *b* of the main boiler open into a flue-space, *i*, at the rear end thereof, and this space *i* opens into a horizontal flue-space, *k*, between the two boilers *a e*, said flue-space *k* being formed by the bottom surface of the upper boiler, the upper surface of the boiler *e*, and the adjacent surfaces of the side walls of the masonry *l*. The rear flue-space *h* is common to the boiler *e* and a lower auxiliary boiler, *m*, the horizontal flue-pipes *n* of which extend from the space *h*, through the boiler *m*, into a front flue-space, *o*, which, by a flue-opening, *p*, communicates with the chimney *q*. The flue-tubes *n f* of the boilers *m e* are surrounded by water-spaces, occupying all the room not occupied by the flue-pipes, and the water-space of the lower boiler communicates with the water-space of the next by a connecting-pipe, *r*, leading from the top of the lower boiler into the bottom of the next one, while the water-space of the second communicates with the water-space of the main boiler by a pipe or tube, *t*, connecting the top of the center boiler with the bottom of the main boiler, the three boilers being charged with water from the pump through the supply-tube *u*.

When the fire in the furnace is well established the flames and heat from it first pass directly through the flues of the main boiler, generating steam from the water surrounding such flues, from which flues the flame, smoke, &c., pass between and in contact with the outer surfaces of the main boiler and the center boiler, heating said surfaces, and passing thence through the flues of the center boiler into the flue-space *h* at the rear thereof, and thence forward through the tubes of the lower boiler, into the front flue-space *o*, from which

they escape into the chimney, after having, by long and tortuous passage, imparted all their caloric to the surfaces against which they have passed and the water back of such surfaces.

In starting the fire this tortuous passage is objectionable, and I therefore arrange a damper, *v*, in the chimney, this damper when thrown down, opening a flue-passage, *w*, leading from the flue-space into the chimney, and closing communication with the flue-passage *o* leading from the lower flue-space into the chimney, the flames then escaping into the chimney without passing through the flue-pipes *n*, flue *h*, and flue-pipes *f*. When the fire is established the damper is closed against the flue-passage *w*, thus opening the flue-passage *p*, when the flame, smoke, and other volatile products of combustion will pass through all the flue-tubes and spaces, as before described.

The exhaust-pipe from the engine leads into a pipe, *x*, which extends through the masonry and debouches into the flue-space *g* at the front of the second or center boiler, and the pressure of the exhaust steam urges and quickens the draught or acts as a blower, as will be readily understood. The exhaust may be provided with a two-way cock, or with two cocks, so that the engine may be made to exhaust either into the atmosphere or into the flues of the boiler, as may be desirable. Leading from the bottom of the lower boiler is a blow-off pipe, *y*, provided with a suitable stop-cock, and leading into the top of the lower boiler is a pipe, *z*, which extends from the steam-space at the top of the upper boiler, this pipe being provided with a suitable stop-cock, a^2. In the supply-pipe *r*, connecting the lower boiler and the one above it, is another stop-cock, b^2. When communication is open between all the boilers all sediment and deposits tend to settle into the lower boiler, and by shutting the supply-cock b^2, opening the blow-off cock c^2, shutting the water-supply-cock d^2, and opening the steam-cock a^2, the water will be driven from the lower boiler, and the pressure of the steam will carry with it all the dirt and other sediment and deposits. Previous to thus blowing off the flue-opening *p* may be closed, shutting off the heat of the furnace from the lower boiler. After the lower boiler is thus blown off the supply-cocks b^2 d^2 may be opened and all the water-tubes exposed to the action of the fire.

By the arrangement of the flues, flue-tubes, and water-spaces, the water is gradually heated before it rises into the upper or steam-generating boiler, and all the caloric generated in the furnace is utilized in heating the water and converting it into steam and in urging the draught.

I claim—

1. The arrangement of the main steam-generator boiler *a*, secondary boiler *e*, and auxiliary boiler *m* with the furnace *c*, flue-tubes *b f n*, and flue-spaces *i g h k*, substantially as shown and described.

2. In combination with the boilers and flues, arranged as described, the exhaust-pipe *x* opening into the flue *g*, substantially as shown and described.

3. In combination with the boilers and flues, arranged as shown and described, the flue-openings *p w* and damper *v*, arranged substantially as shown and described.

4. In combination with the boilers, arranged as shown and described, the stop-cock b^2 and blow-off pipes, arranged to operate substantially as described.

GOTTLIEB F. BURKHARDT.

Witnesses:
FRANCIS GOULD,
M. W. FROTHINGHAM. (72)