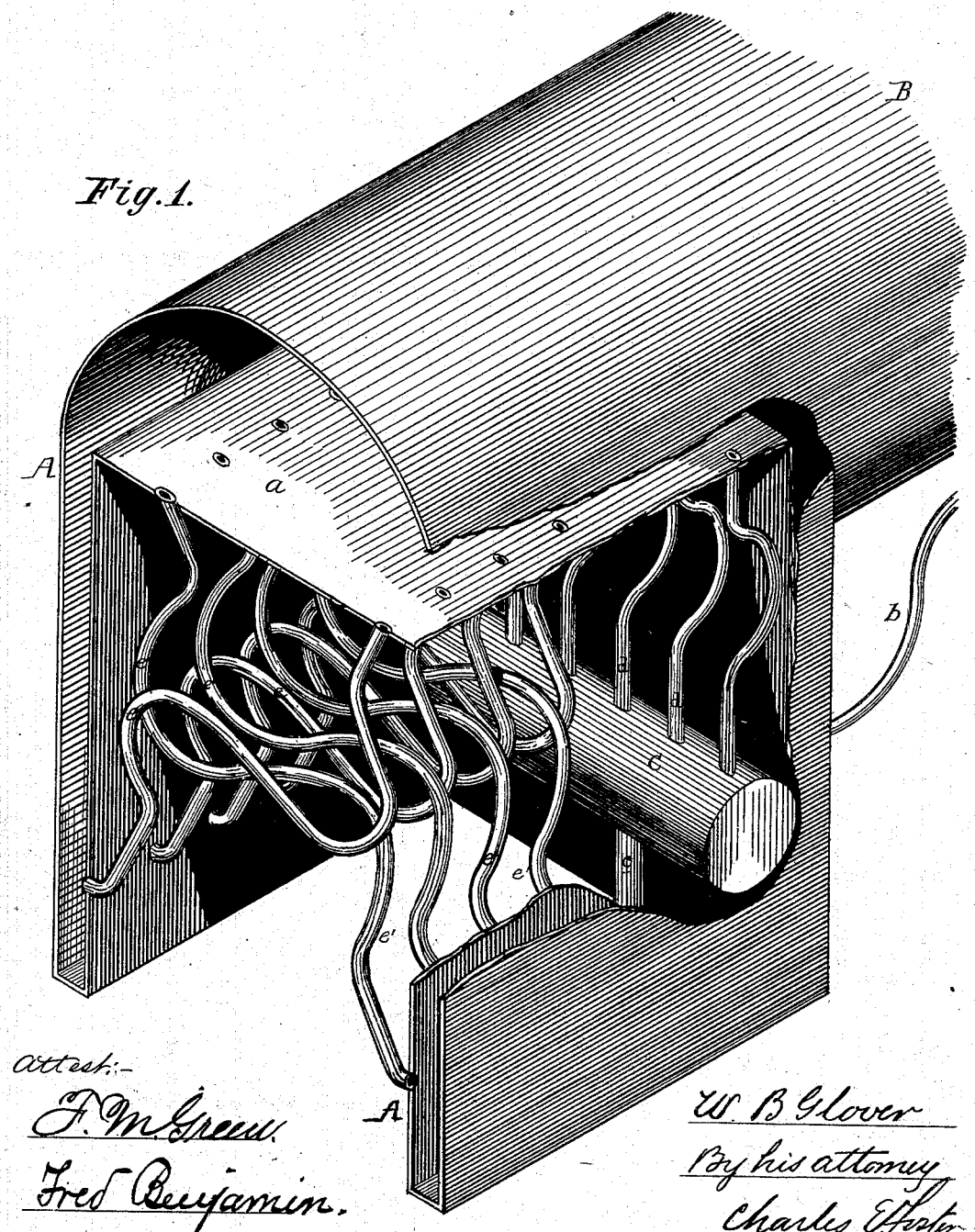
2 Sheets—Sheet 1.

W. B. GLOVER.

WATER TUBE AND CIRCULATING STEAM-BOILERS.

No. 186,472. Patented Jan. 23, 1877.

Fig. 1.



attest:-

F. M. Greene

Fred Benjamin.

W. B. Glover

By his attorney

Charles E. Foster

2 Sheets—Sheet 2.

W. B. GLOVER.

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Fig. 2.

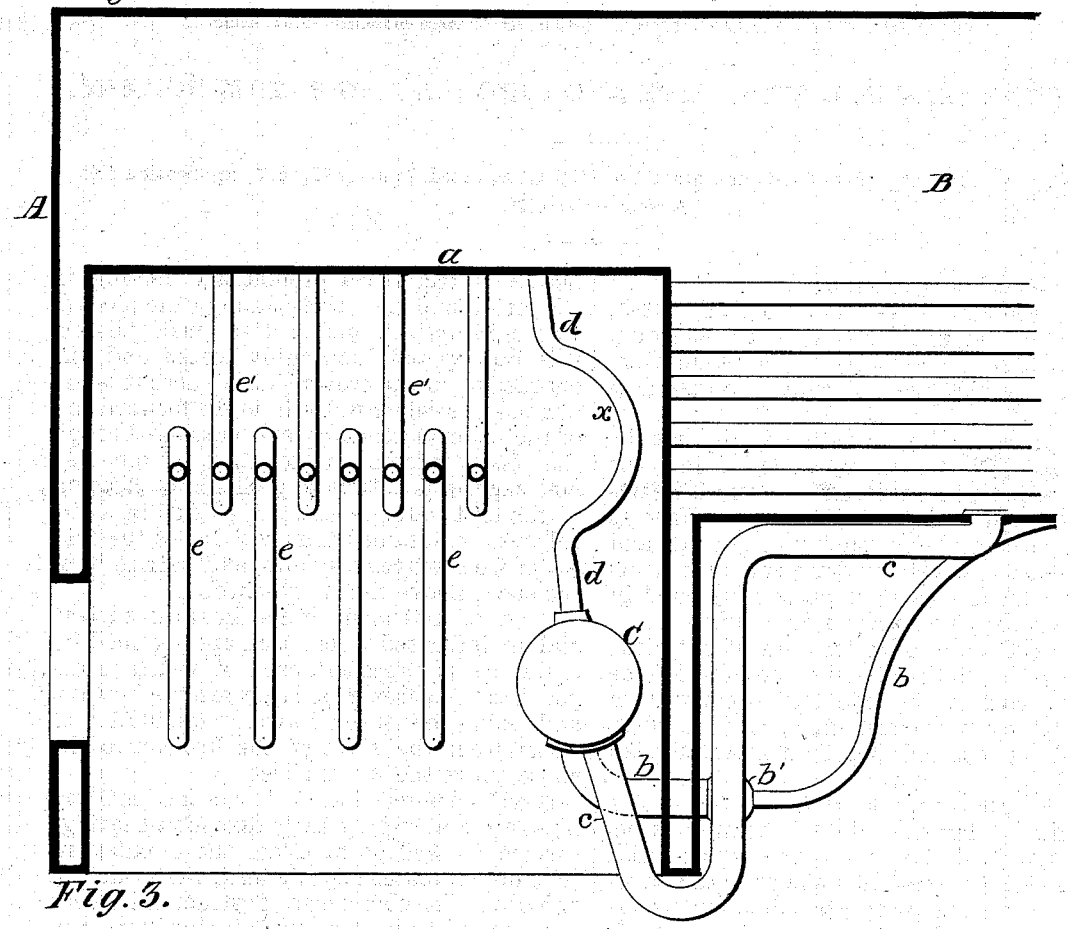
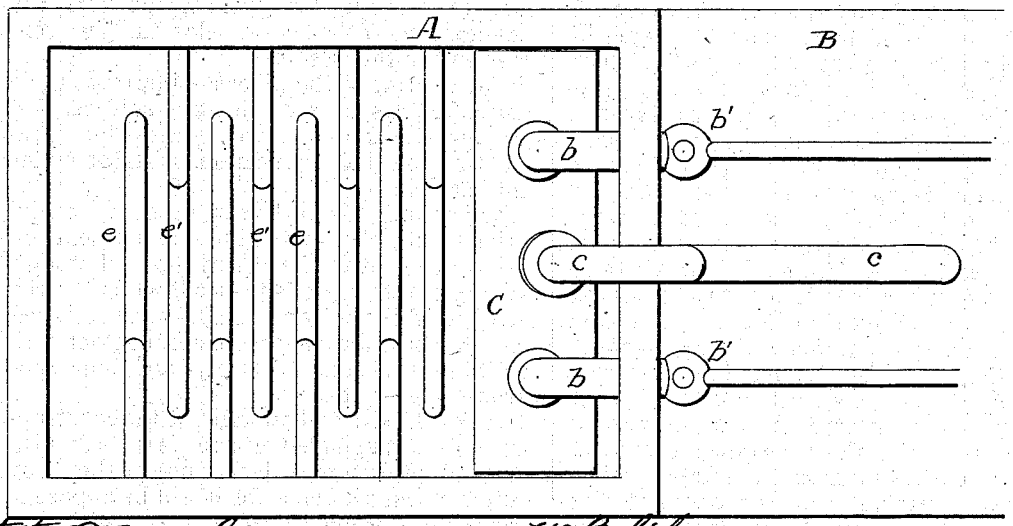


Fig. 3.



attest F. M. Green.
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W. B. Glover
By his attorney Charles E. Foster

UNITED STATES PATENT OFFICE.

WINSLOW B. GLOVER, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN WATER-TUBE AND CIRCULATING STEAM-BOILERS.

Specification forming part of Letters Patent No. **186,472**, dated January 23, 1877; application filed November 20, 1876.

To all whom it may concern:

Be it known that I, WINSLOW B. GLOVER, of Boston, Suffolk county, Massachusetts, have invented Improvements in Steam-Generators, of which the following is a specification:

The object of my invention is to heat the feed-water prior to its introduction into the boiler, to insure a rapid circulation of the water, and such an extended heating-surface as will cause steam to be quickly generated; and these objects I obtain by the peculiar construction and arrangement of parts illustrated in the accompanying drawing, in which—

Figure 1 is a perspective view of sufficient portion of a cylindrical boiler and fire-box (the end and part of the side being removed) to illustrate my improvements. Fig. 2 is a longitudinal section, and Fig. 3 an inverted plan view.

A is the fire-box, and B the cylinder, of a horizontal boiler, the sides of the fire-box being double, and the crown-sheet *a* being flat or curved. The grate (not shown in the drawing) is of the usual construction, and is arranged in the ordinary manner, and above the same, at the rear of the fire-chamber, is placed a horizontal heating-drum, C, supported in any suitable manner. Two inlet-pipes, *b b*, provided with check-valves *b' b'*, extend through the rear wall of the fire-box, and communicate with the heating-drum, and a circulating pipe, *c*, extends from the bottom of the latter, under the lower edge of the said rear wall, upward and forward, and communicates with the water-space of the cylinder B. A series of pipes, *d d*, each of which is bent to a bow shape at *x*, form a communication between the heater C and the water-space above the crown-sheet. Within the fire-box are arranged two alternate series of pipes, *e e'*, each communicating with the water-chamber between the double side walls, at a point a short distance above the grate, and extending across the fire-chamber, and communicating near the opposite side with the space above the crown-sheet, each pipe approximating an **S** shape, one end entering the side wall and the other the crown-sheet.

The water, forced by a pump or injector through the inlet pipe or pipes *b* into the heater C, receives a preliminary heating in the latter, and then rises through the pipes *d*, where, being in a comparative small volume, it is rapidly and thoroughly heated and discharged upon the crown-sheet, where it is vaporized, the colder water from the forward end of the boiler descending and passing through the pipe *c* into the heater C, to be reheated and vaporized. Thus a preliminary heating of the feed-water is effected, as well as a circulation maintained that withdraws the cold water from extreme points, and carries it to the space above the crown-sheet.

A great extension of the heating-surface and an increased circulation are obtained by the series of pipes *e e'*, each of which is exposed to the gases where they are the hottest, and serves to insure an upward circulation of water from the sides of the fire-box to the space above the crown-sheet.

It will be noted that while the heater C and pipes *d e e'* afford a greatly-extended heating-surface, as well as facilitate the circulation, they do not materially diminish the available size of the fire-chamber or obstruct the direct passage of the heated gases to the flues, the arrangement of the heater below the flues contributing to this result.

The bending of the pipes *d e* increases their length, affords a greater heating-surface, and also permits expansion and contraction without straining their connections with the boiler and heater.

By bending the pipes *e e'*, so that the central positions shall extend nearly horizontally transversely over the fire, a more thorough heating of the pipes is insured, while the circulation of the water is sufficiently retarded to maintain it for a short time in contact with the highly-heated surfaces, and impart a greater degree of heat.

One of the chief advantages of the construction and arrangement above described is its ready adaptation to boilers of any of the most ordinary constructions, for it will be apparent that the heater and pipes may be readily applied, as described, within any of the usual square boxes, without in any way altering the construction of the boiler.

I claim—

1. The combination of the heater C, arranged

within a fire-place of a steam-generator, below the flues, its inlets *b*, the pipes *c*, communicating with the heater, and with the forward end of the boiler, and the series of bent pipes *d*, extending from the heater to the crown-sheet, as set forth.

2. The arrangement of two series of S-shaped pipes, *e e'*, intermediately and transversely within the fire-place, crossing each other, and each communicating with the side water-leg on one side, and the crown-sheet on the opposite side, whereby the heating-surface is increased, and a circulation of the water from the hottest to the coolest part of the fire-place is effected, all as set forth.

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

WINSLOW B. GLOVER.

Witnesses:

JOHN MAY,

EPHRAIM K. BOSTON.