

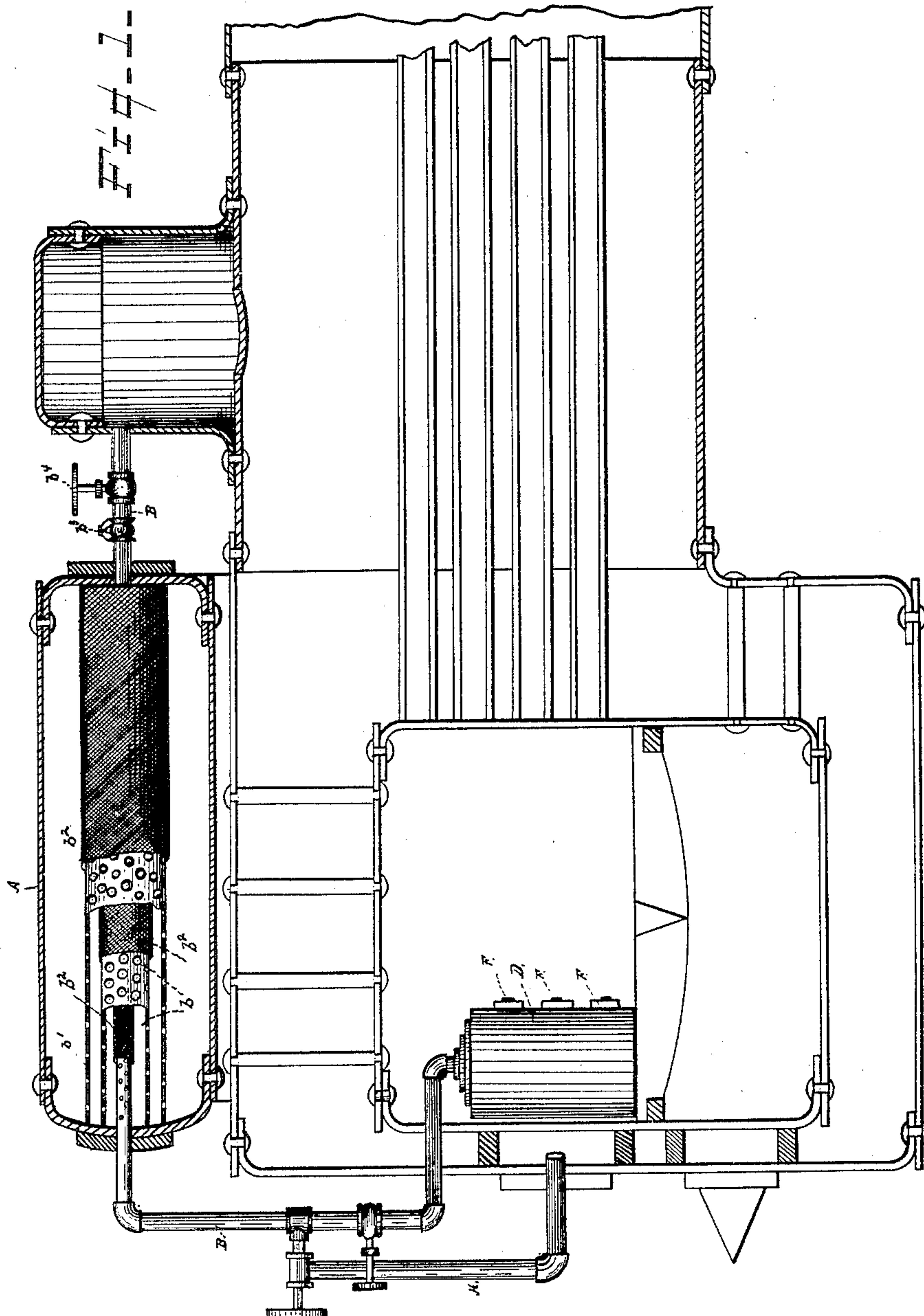
(No Model.)

2 Sheets—Sheet 1.

J. LIVINGSTONE.  
SUPERHEATER AND BURNER.

No. 399,541.

Patented Mar. 12, 1889.



Witnesses  
H. B. Hyatt,  
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John Livingstone Inventor,  
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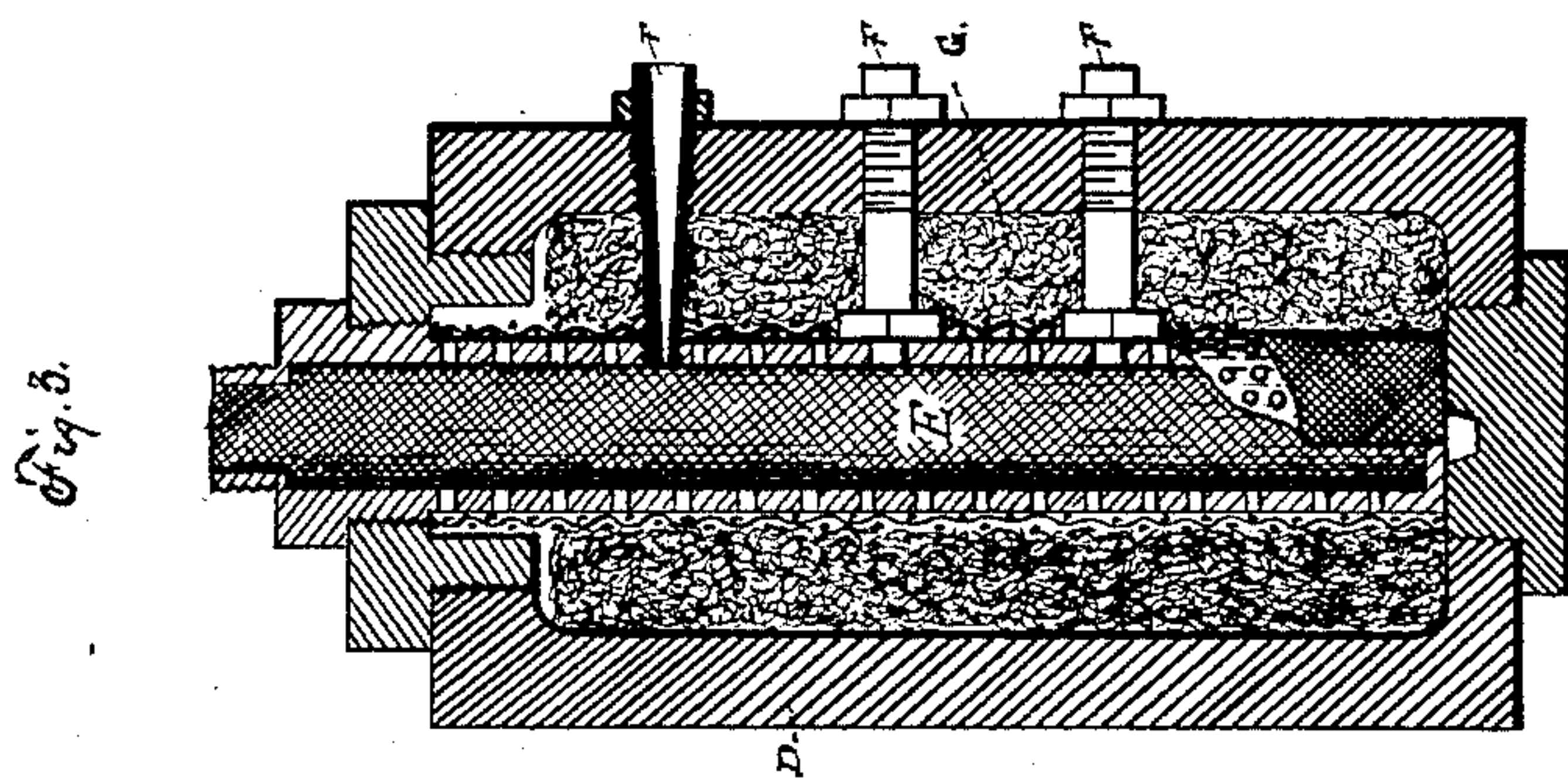
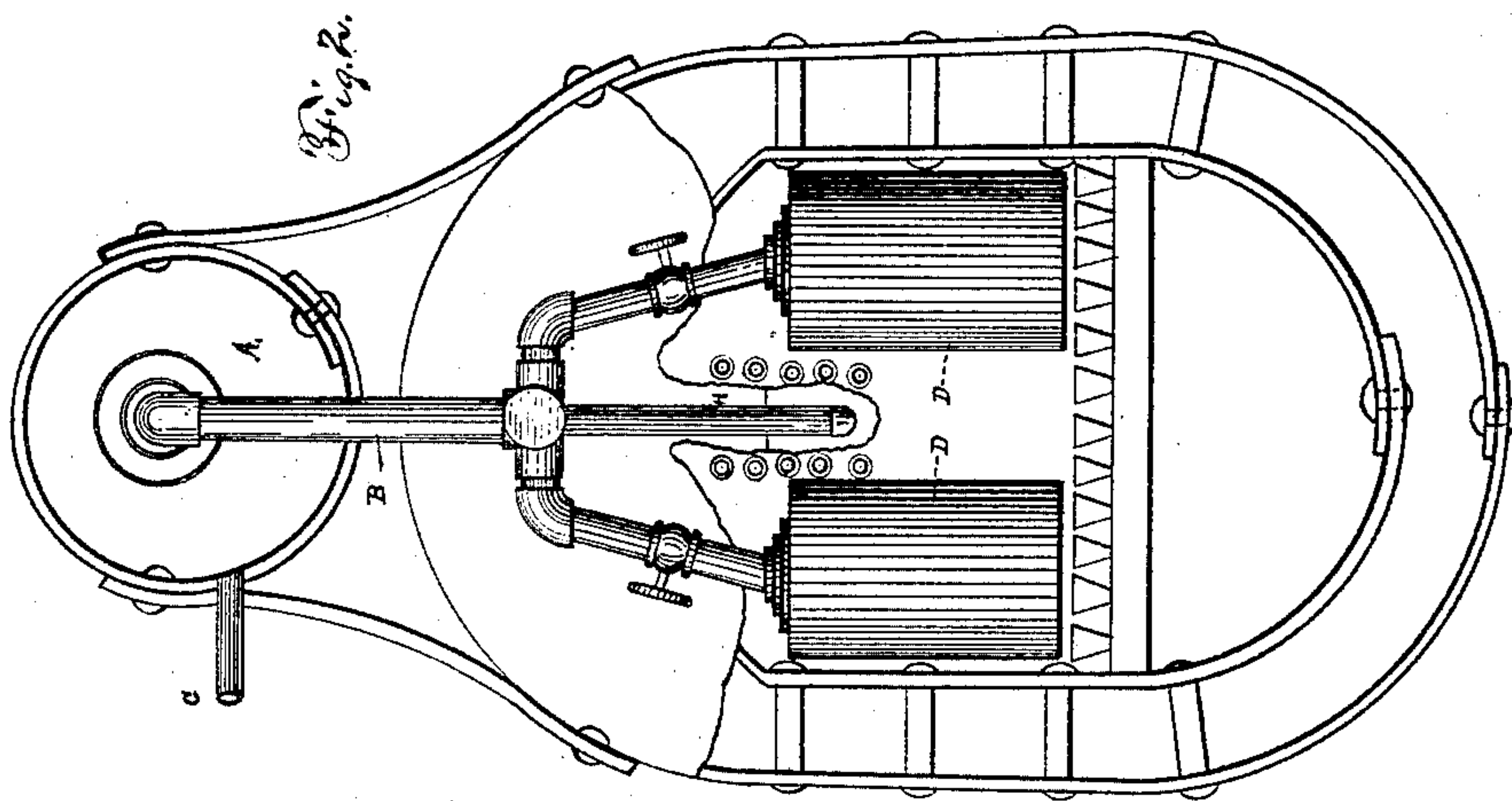
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# UNITED STATES PATENT OFFICE.

JOHN LIVINGSTONE, OF TORONTO, ONTARIO, CANADA.

## SUPERHEATER AND BURNER.

SPECIFICATION forming part of Letters Patent No. 399,541, dated March 12, 1889.

Original application filed April 25, 1888, Serial No. 271,797. Divided and this application filed December 1, 1888. Serial No. 292,396. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN LIVINGSTONE, a subject of the Queen of Great Britain, residing at Toronto, in the county of York and Province of Ontario, Canada, have invented certain new and useful Improvements in Superheaters and Burners; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to that class of devices in which steam is introduced into the furnace to aid combustion. It is for use as an attachment to furnaces of every kind, for the purpose of increasing the efficiency of the furnace and the perfect combustion of the fuel.

The form of the device is of necessity varied as to shape according to the size and kind of each furnace or boiler, according to the room-space available, and where available on a boiler or in a furnace or in close proximity thereto for any part of the device.

The nature of my invention will more fully appear from the subjoined description, and the novelty will be pointed out in the claims, reference being had to the accompanying drawings of one form, in which it is made to apply to a portable boiler of the locomotive type.

Figure 1 is a longitudinal section showing the furnace and my apparatus connected thereto. Fig. 2 is a transverse view, with the front plates of the boiler removed so as to show inside of furnace. Fig. 3 is an enlarged section of the superheaters D D.

A is a vessel, made of boiler-plate or similar material of strength to resist the internal pressure equal to that in the same boiler to which it is attached.

B is a steam-pipe from the boiler entering A and passing through it. The portion inside of A is surrounded by one or more tubes, tunnels, or pipes, *b b'*, of iron or brass or other suitable metal, with holes in the said portion of B inside of A and in the surrounding pipes *b b'*. The said portion of B and the surrounding pipes *b b'* may be each incased in close-fitting sleeves made of fine woven wire-cloth; or the sleeves may be made of flannel, cot-

ton, or other woven material, *b<sup>2</sup>*. The sleeves may be made fast to the said portion of the pipe B, and the sleeves for each of the said pipes *b b'* may be made fast by sewing each sleeve, according to its size or pipe, to each respective pipe with fine wire of brass or other metal through the holes in the said portion of the pipe B, and through the holes in the surrounding pipes *b b'* within the vessel A. Between A and the boiler the pipe B is fitted with a check-valve, *b<sup>3</sup>*, and a shut-off valve, *b<sup>4</sup>*.

C is a pipe connected to A, by which oil may be put into the vessel A by hand or by any mechanical device. A glass gage may be used to show the level of oil in the vessel A, and a hand-hole, with secure-joint, may be in any part of the said vessel A to remove sediment or refuse matter.

D D represent superheaters of any desired shape or form. I prefer the cylindrical form, of a size corresponding to the available room-space in the furnace, and they may be from seven to nine inches in diameter, placed in the preferred part, the part preferred being on each side of the door at the front inside, standing on end, resting upon the floor of the furnace, and passing up through the grate-bars or standing upon the grate-bars or supported by any suitable means, and of such height as may be suitable for the furnace. D D may be made of cast-iron or suitable metal, which may be protected from too rapid oxidation by a coating of lamp-black or refractory substance, and must be of sufficient strength to withstand pressure at least equal to that in the boiler.

Inside the casings of D D, tubes E E, of brass or bronze or other suitable material, pass through the upper end to the bottom of the inside. The bottoms both of the casing of D and the tubes E E are closed and steam-tight.

The inner tubes, E E, are about one-third of the diameter of the outer shells, D D, and have a number of holes in parallel rows drilled through the sides of each about half an inch apart.

Around E E and close fitted thereto are sleeves of fine woven brass-wire cloth sewed to said tubes E E, with brass wire stitched



through the holes in E E to the sleeves in which E E are incased, and within E E is also a lining of fine woven brass-wire cloth, also stitched to E E with brass wire through the

5 holes in E E.

From the inner linings in the tubes E E, but not passing through the said linings, one or more small tubes or nozzles, F F F, F F F, are made to project through from the linings

10 within E E, through E E and outer linings of E E, and through the superheaters D D, exposing to the fire short blunt points.

The inner end of each of the nozzles or tubes F F F, F F F for about half an inch

15 may be about one thirty-second of an inch in diameter or less, increased by tapering the hole in each nozzle to the outer end—say, to the extent of one-sixteenth or three thirty-seconds of an inch in diameter at furnace end

20 or point, for the purpose of blowing through the nozzles any grit or sediment that may pass to the nozzles.

The nozzles or tubes F F F, F F F in superheaters D D are made to project, as stated,

25 by being screwed through the casing of D D and E E.

Within the space G G, between the brass woven wire-cloth lining to E E and the casing D D, there are loosely placed pieces of iron

30 or steel, such as iron filings and turnings from an iron-turning lathe.

The nozzles F F F, F F F in each of the superheaters D D are placed one above the other, the lowest being about ten inches above

35 the grate-bars, so as to be a little above the level of the top of the fuel when coal is used, and I place the others each about four inches above the other.

The nozzles F F F, F F F are adjusted

40 to point diagonally across the furnace; but the particular angle is not essential, neither is the height at which they are placed, as both may be varied to suit conditions required by the shape and size of the furnace or kind of

45 fuel used. H is a movable pipe, so arranged that when necessary it may be used to increase the draft or to prevent any excess of volume in the the gases escaping through the door.

50 The operation of the device is as follows; After the steam has been raised to a certain pressure in the boiler, it is passed through the pipe B to the vessel A, and from A by the pipe B to the brass tubes E E within the

55 superheaters D D. The steam, acting upon

the heated iron turnings, filings, or pieces of iron and steel in the space G, between the lining of E E and casing of D D and upon the superheaters D D, becomes decomposed into its component parts and forces its way through

60 the nozzles F F F, F F F into the furnace in the form of combustible gas. When desirable, and by preference at low temperatures, the vessel A is partially filled with oil; by preference crude petroleum, which, acted upon

65 by the heat from the steam passing through B, gives off a vapor that in smallest measure passing through the woven wire or other sleeve-lining around the pipes *bb'* and that portion of the pipe B within A, saturates the steam

70 from the boiler, insuring the combustion of the steam after passing through the nozzles F F F, F F F into the furnace in the form of a gas, and in the saturation counteracting the aqueous properties of the steam at the lower

75 temperatures.

The ejection of the steam through the nozzles F F F, F F F in the form of combustible gases, as mechanically devised in this my invention, brings the gases of combustion

80 into the requisite density of furnace-air for their perfect natural union in increased motion with great heat among the particles and causes thorough combustion, the only residue being a slight vapor through the smoke-stack

85 and fine ashes that drop through the grate-bars into the ash-pan.

What I claim as new is—

1. The superheater and burner consisting of an outer casing, a perforated tube within

90 the outer casing, forming a space between it and the casing, iron or steel filings or pieces filling said space, and nozzles connecting the inner tube and outer casing, substantially as described.

2. The superheater and burner consisting of an outer casing, a perforated tube within the outer casing and forming a space between it and the casing, wire-cloth surrounding the perforated tube, iron or steel filings or pieces

95 filling said space, and nozzles connecting the tube and outer casing, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN LIVINGSTONE.

Witnesses:

GEO. R. BYINGTON,  
M. F. HALLECK.