

(No Model.)

3 Sheets—Sheet 1.

E. K. JONES & T. N. WILSON.
FEED WATER HEATING APPARATUS.

No. 581,212.

Patented Apr. 20, 1897.

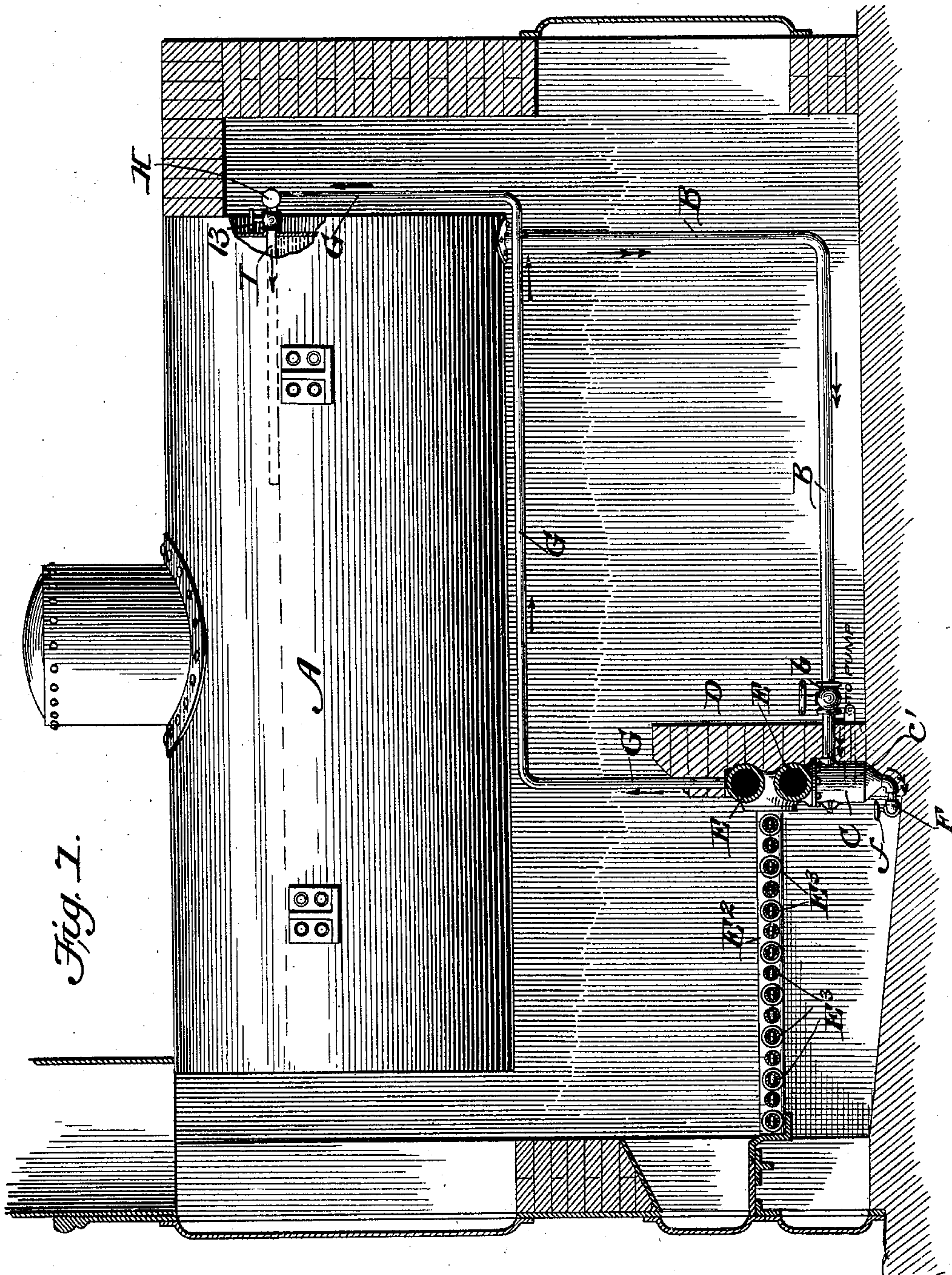


Fig. 1.

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ATTORNEYS.

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Fig. 2.

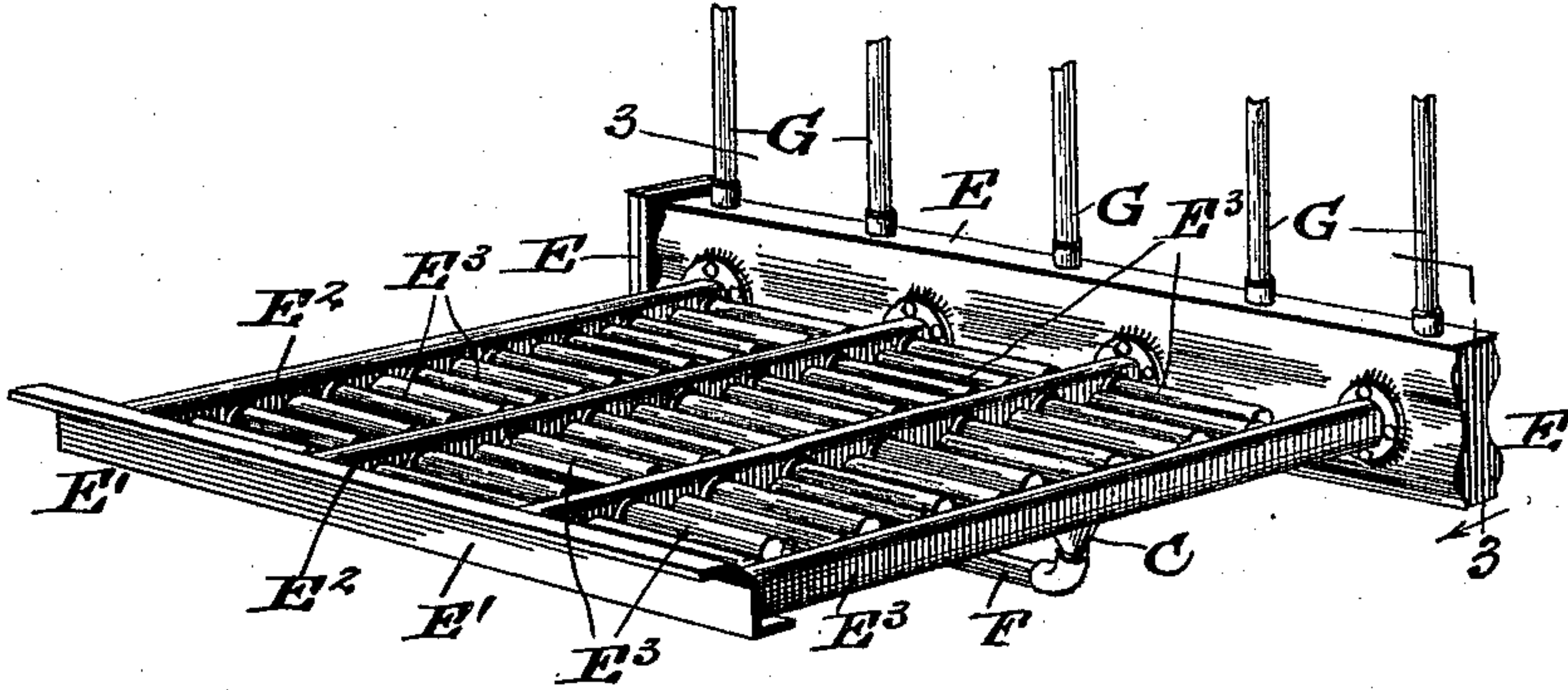


Fig. 3.

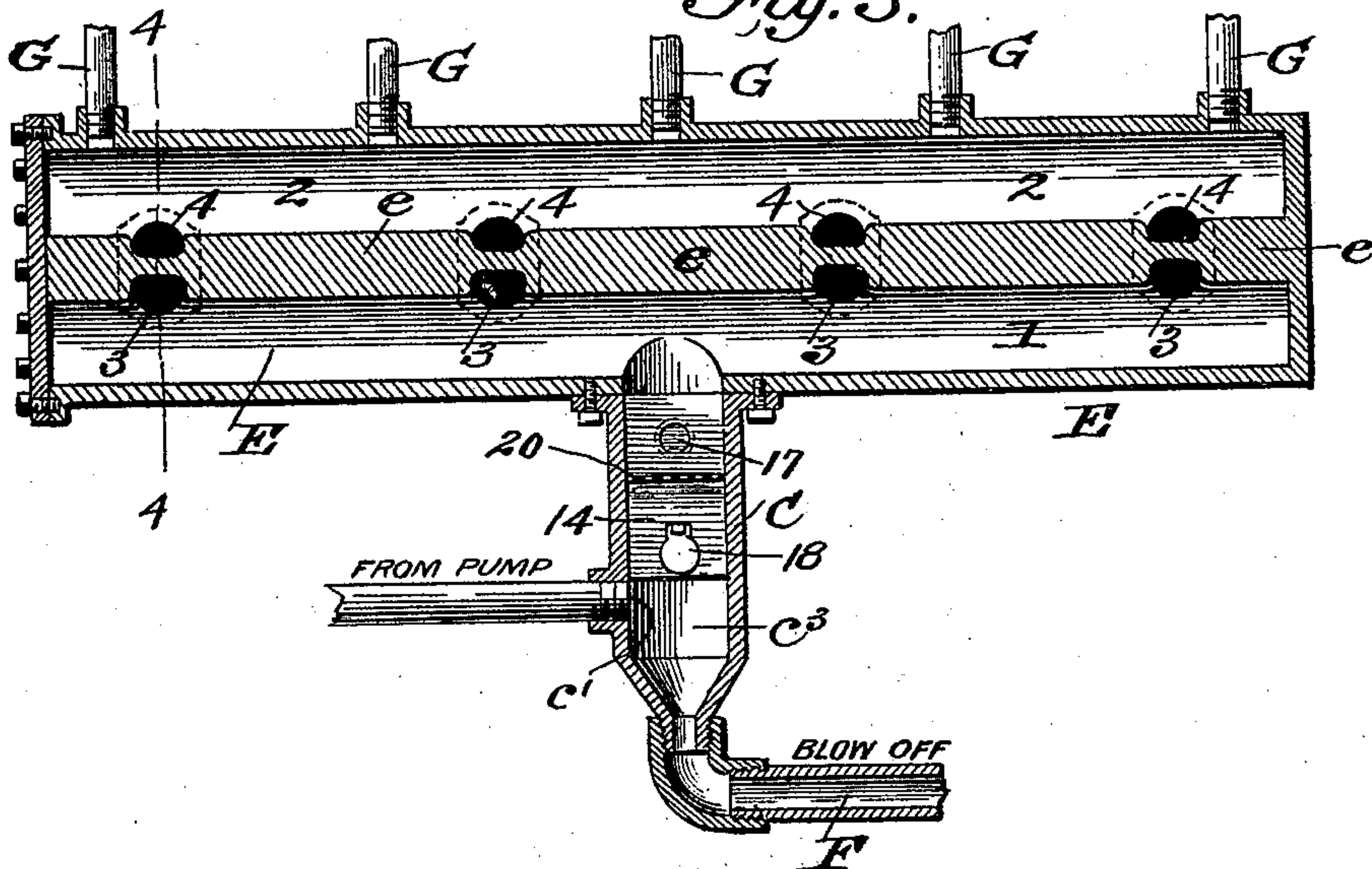
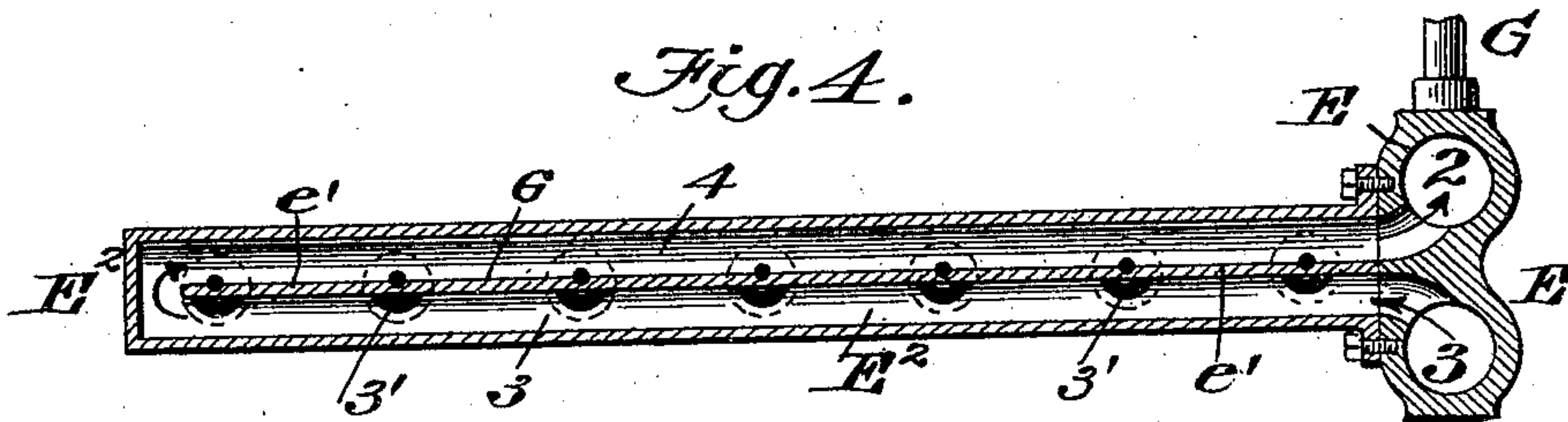


Fig. 4.



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Fig. 5

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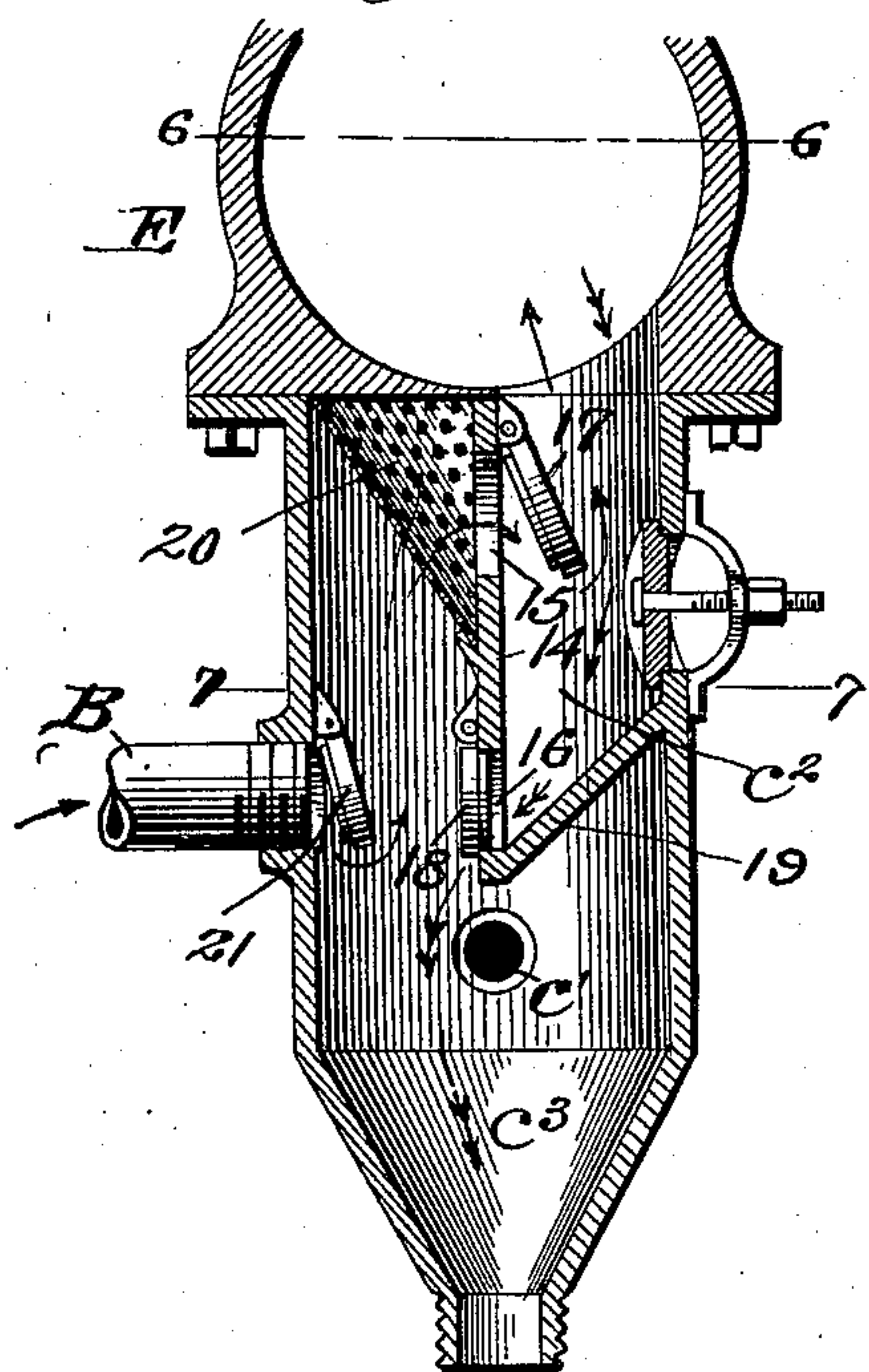


Fig. 6

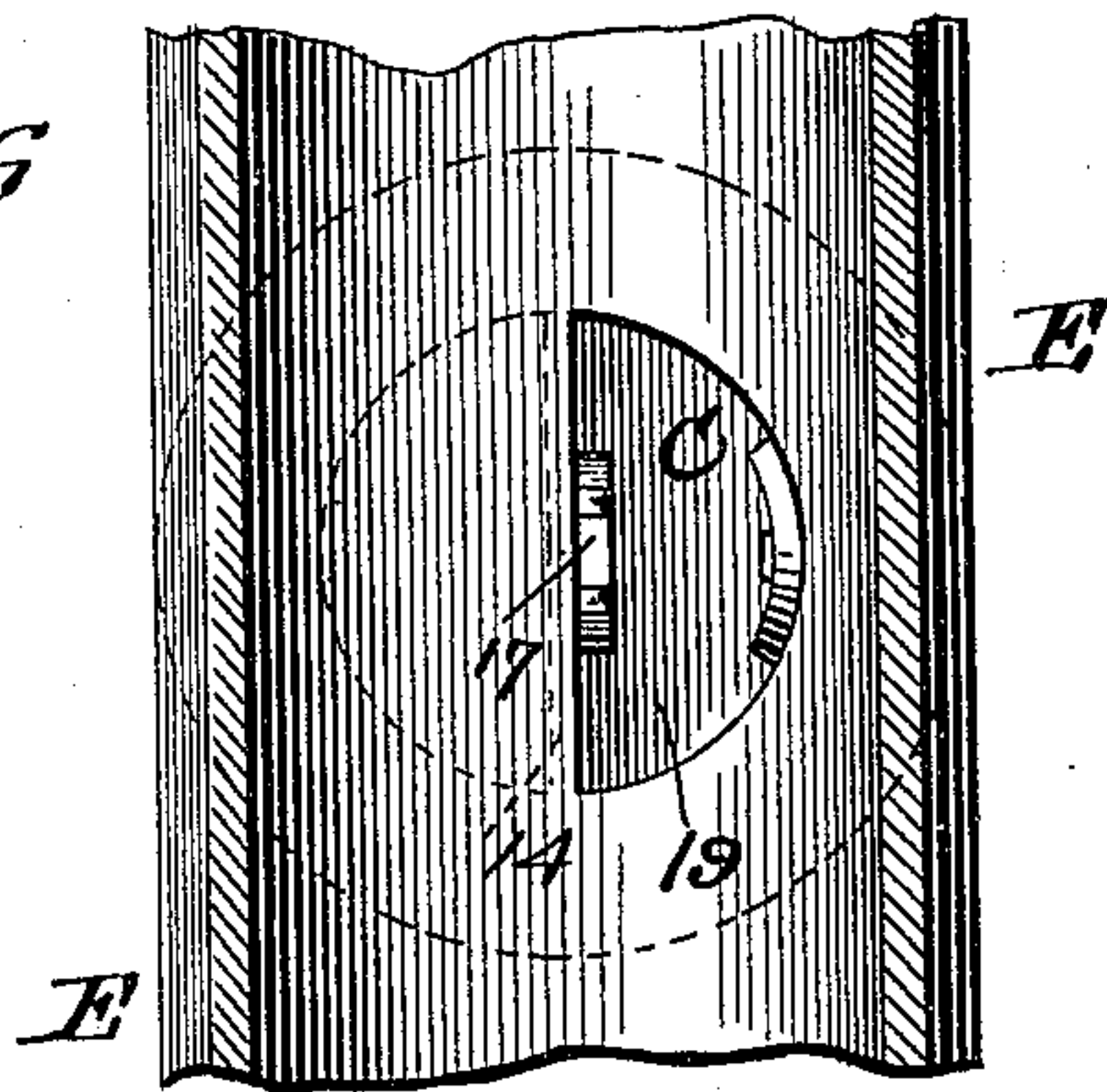


Fig. 7

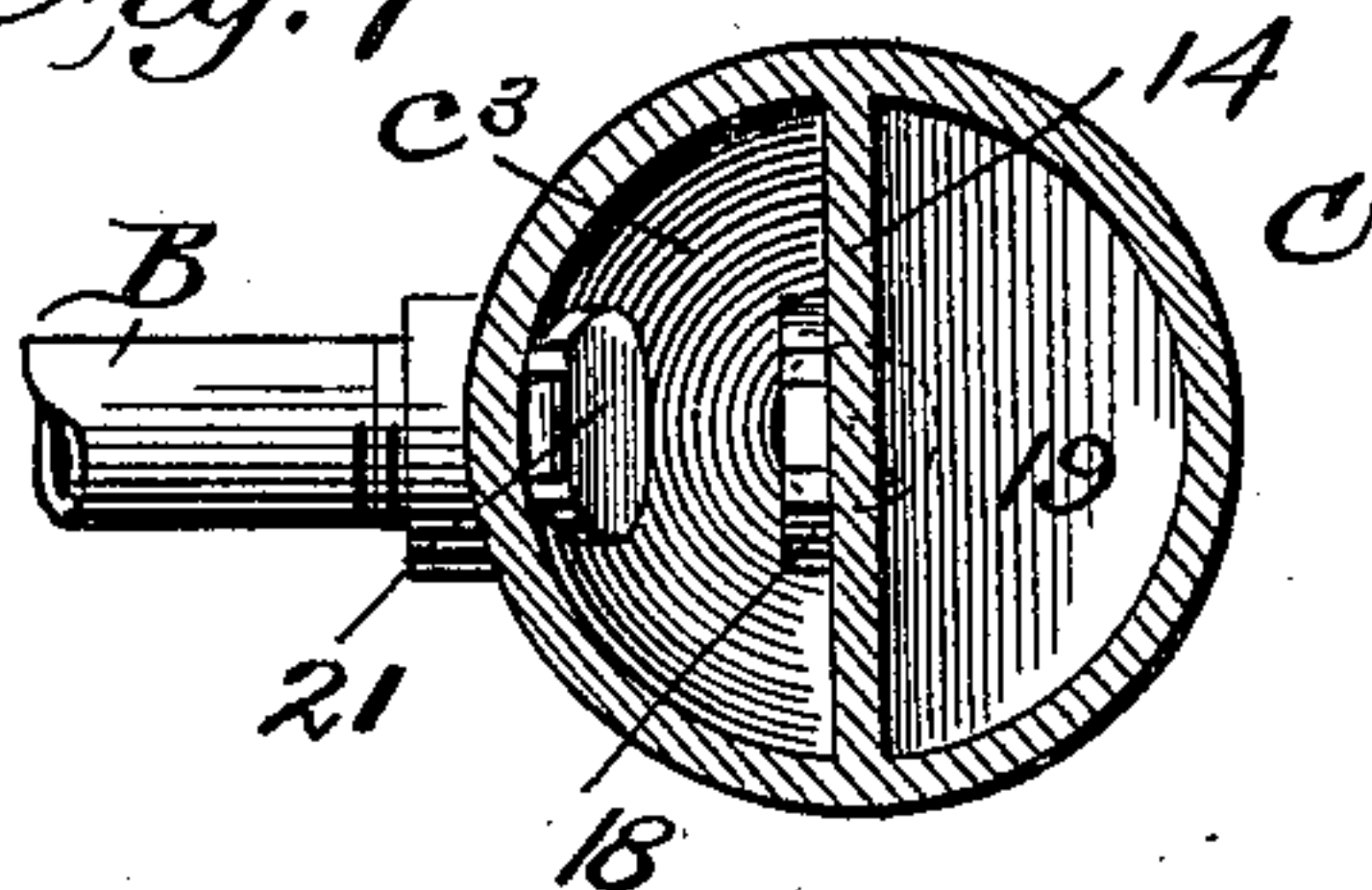


Fig. 8.

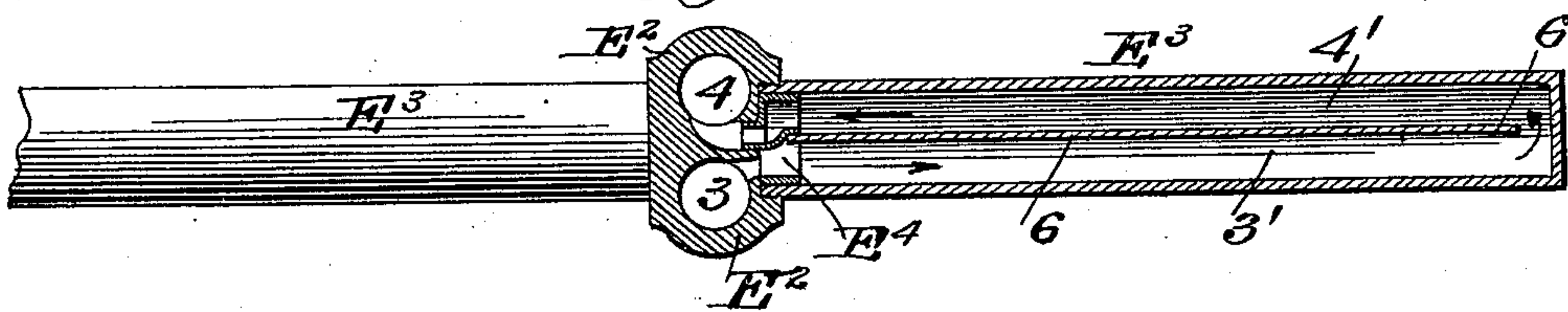


Fig. 9.

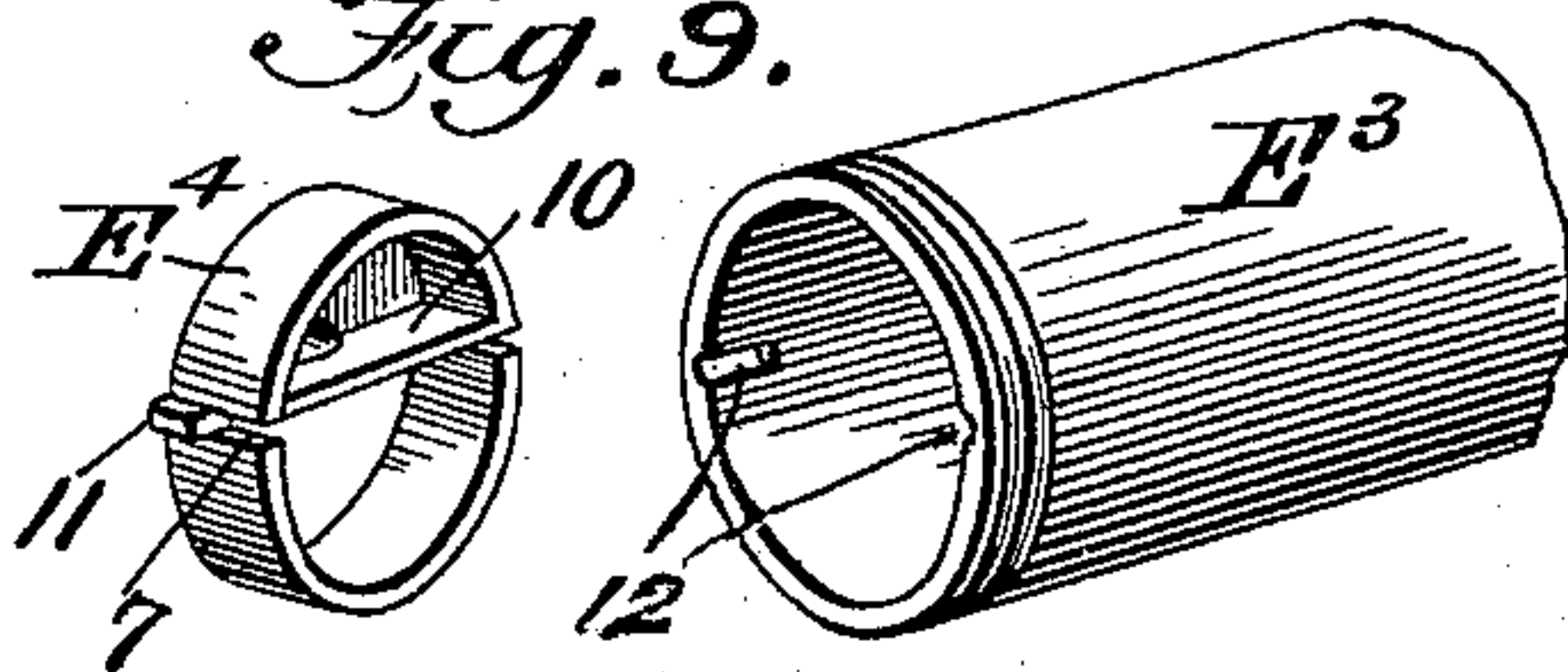
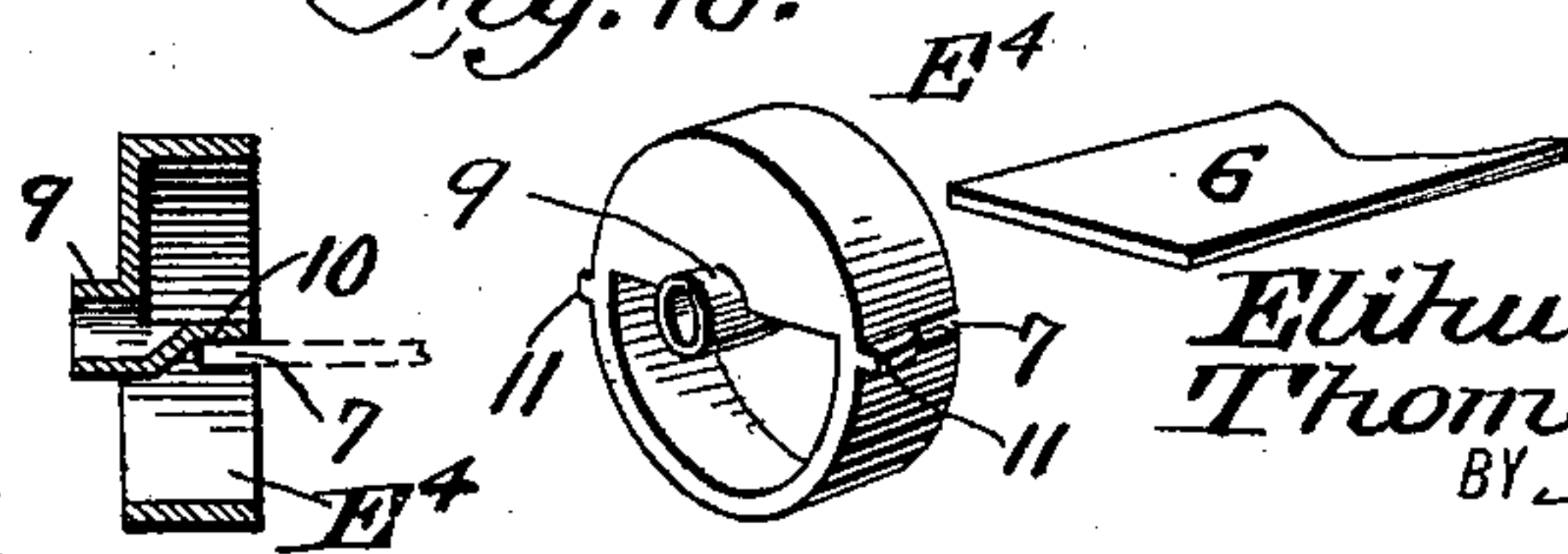


Fig. 10.



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UNITED STATES PATENT OFFICE.

ELIHU K. JONES AND THOMAS N. WILSON, OF FULTON, OREGON.

FEED-WATER-HEATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 581,212, dated April 20, 1897.

Application filed August 5, 1896. Serial No. 601,768. (No model.)

To all whom it may concern:

Be it known that we, ELIHU K. JONES and THOMAS N. WILSON, of Fulton, in the county of Multnomah and State of Oregon, have invented a new and Improved Feed-Water-Heating and Scale-Removing Apparatus for Steam-Boilers, of which the following is a specification.

Our invention is an improvement in the class of feed-water heaters in which the water is forced through hollow grate-bars on its way to the boiler. We have devised several improvements in the construction and arrangement of parts constituting such apparatus, as hereinafter described, and shown in the accompanying drawings, (three sheets,) in which—

Figure 1 is a vertical section of a boiler-furnace provided with our apparatus. Fig. 2, Sheet 2, is a perspective view of the grate. Fig. 3 is an enlarged vertical longitudinal section of the main grate-bar and the mud drum or separator attached thereto on line 3 3 of Fig. 2, looking in the direction of the arrow. Fig. 4 is a sectional view on line 4 4, Fig. 3, of the main grate-bar and one of the tubes extending from it at a right angle. Fig. 5, Sheet 3, is an enlarged vertical central section of the mud drum or separator. Fig. 6 is a horizontal section of the main hollow grate-bar on line 6 6 of Fig. 5. Fig. 7 is a horizontal section of the separator on line 7 7 of Fig. 5. Fig. 8 is a sectional view showing two of the hollow arms attached to a grate-tube, one being in longitudinal section and the other in side view. Figs. 9 and 10 are perspective views of details hereinafter referred to.

A indicates a stationary tubular steam-boiler arranged horizontally in brickwork in the usual way. A large water-circulating pipe B, having a stop-cock *b* and check-valve 21, connects the rear end and lower side of said boiler with a vertical mud drum or separator C, which is located in the bridge-wall D and attached to the under side of the rear hollow main bar E of the grate, which is also partly embedded in the front side of said bridge-wall.

A feed-pump (not shown) is connected with the drum or separator C at *c'*, Fig. 5, and the

feed-water passes thence into and through the hollow grate, and then through the small pipes G to the boiler A.

The construction of the grate is as follows: The principal parts of the grate are the large hollow main bar E, (see Figs. 1 and 2,) arranged in and flush with the front side of the bridge-wall D, the angular dead-plate E', at the front end of the grate, a series of hollow lengthwise tubes or main grate-bars E², and a series of hollow or tubular arms E³, that project horizontally from such cross-tubes E² at right angles thereto. The several arms E³ of each tube E² alternate, as shown, with the like arms E³ of a parallel and adjacent tube E².

The main cast-iron tube E, Fig. 3, has a central lengthwise horizontal partition *e*, forming the channels or passages 1 and 2, one above the other, and each of these channels has as many side openings as there are longitudinal tubes E² attached to bar E. Said tubes E² have also a partition *e'*, and thus two longitudinal passages 3 and 4, one above the other. They are secured to the main tube E by means of bolts 4 passing through the flanged heads of tubes E², which are seated on flat surfaces, as shown. The front ends of tubes E² rest on the ledge of the dead-plate E'. The tubular arms E³ (see Fig. 8) screw into threaded sockets formed in the sides of tubes E². Each arm has a central horizontal division plate or partition 6, which is, however, of less length than the chamber of the arm, so that a space is left at the outer or free end of the latter for passage of water from the lower channel or passage 3' to the upper one 4'. In the inner end of each arm E³ is a hollow cylindrical head E⁴, having a diametrical slot 7, Fig. 10, on one side to receive the partition 6, and on the other a nozzle or central tubular projection 9, that enters and fits snugly in an opening or socket formed in the side of tube E and communicating with the upper channel 4 of the same. The partition 6 fits closely in the slot 7 and is thereby held or supported in due position. The circular head has also a transverse division plate or diaphragm 10, Figs. 9 and 10, corresponding to and in alignment with the partition 8 and forming practically a continuation of the latter. The

heads E^1 are provided exteriorly with lateral lugs 11, which fit in corresponding notches 12, Fig. 9, in the tubular arm E^3 and serve to prevent rotation of said heads and the partitions 6, attached to them.

The small pipes G, Figs. 1 and 2, attached to the upper side of the main grate-tube E, extend upward and connect with a common head H, located at the rear end of the boiler near the top of the same and consisting of a horizontal tube. The pipes I extend from it through the end of the boiler A, near the center of the latter, and are provided with stop cocks or valves 13.

The body of the mud drum or separator C is cylindrical and tapered at the lower end, to which an escape or blow-off pipe F, having a stop cock or valve f , is attached. The separator is arranged vertically and bolted to and suspended from the under side of the main grate-bar E, Figs. 1, 3, and 5. A central partition 14, Fig. 5, extends down about half the length of the separator and is provided with two openings 15 and 16, having hinged pendant check-valves 17 and 18, that open in opposite directions. An inclined imperforate partition 19 joins the lower end of such vertical partition 14 with the side of the body of the separator. These partitions 14 19 form virtually one and divide the chamber of the separator into two compartments c^2 and c^3 . A perforated plate or screen 20 is arranged in an inclined position to cover the upper valved opening 15. The pipe leading to the pump (not shown) is attached below the partition 14 and the mouth of pipe B, that leads to the lower rear side of the boiler A, is provided with a hinged check-valve 21.

It is apparent that if the valve b of pipe B is closed and valve 13 of pipe I opened then water entering the separator C from the pump-pipe will pass, as indicated by single-headed arrows, through the perforated screen-plate 20, through the valved opening 15 in partition 14, and thus into the lower passage 1 of grate-bar E, and, passing thence through the grate-tubes E^2 and their lateral arms E^3 , will return heated to the upper passage 4 of said grate-bar E and through pipe G, head H, and pipes I into the boiler A. It will also be noted that in this case the valves 17 and 18, respectively, open and close automatically.

The screen 20 strains the water passing through it and some foreign matters are collected in the lower end of the separator. Some scale or other sediment is also deposited in the pocket or compartment c^2 and collects on the inclined partition 19, on which it slides down to the valved opening 16.

Upon opening cock 13 of pipe I and valves b and f of pipes B and F water will discharge from the boiler through the separator C and pipe F, as indicated by double-headed arrows. In this case the valve 17 closes and valve 18 opens automatically, and the scale or sediment in pocket c^2 is blown through opening

16 into the lower portion or compartment c^3 of the separator, whence it passes out into pipe F.

When the valve f of blow-off F is closed and valves b and 13 of pipes B and I are opened, water will pass from the boiler through pipe B, the separator C, the grate, and pipes G I, so that steam may be generated quickly and in large amount. In this case the check-valve b in separator C comes into action.

It will be perceived that a practically equal distribution and circulation of water in all portions of the grate are assured, and since normally all the water from the pump passes through the grate before entering the boiler it is delivered to the latter highly heated or partly converted into steam. The arrangement is also such that the circulation is upward and the water enters and leaves the hottest part of the grate. The grate-bar E, tubes E^2 , and arms E^3 , being provided with lengthwise partitions practically converts them into double tubes, which economizes material and space.

What we claim is—

1. The combination with a steam-boiler of feed-water-heating apparatus composed of a main grate-bar having parallel lengthwise passages, a series of minor grate-bars, having like passages and joined to the main grate-bar as shown whereby the respective passages communicate, a series of pipes connecting said main grate-bar with the upper portion of the boiler, and a pipe connecting the lower portion of the boiler with the grate, substantially as shown and described.

2. The combination with a steam-boiler of a feed-water-heating apparatus, composed of a main grate-bar having separated longitudinal passages, a mud drum or separator connected with the lower passage of the same, and having a blow-off attachment, a series of minor grate-bars having parallel longitudinal passages, that communicate with the respective passages of said main grate-bar, pipes leading from the upper portion of the latter into the upper part of the boiler, and a pipe leading from the lower part of boiler to the separator, as shown and described.

3. In a feed-water-heating apparatus, the combination with a series of grate-bars, having longitudinal passages, of a series of tubular arms having a partition, or diaphragm, that is separated from the free end of the arm proper, whereby the latter is provided with upper and lower passages that communicate respectively with the upper and lower passages of said grate-bars, as shown and described.

4. In a feed-water-heating apparatus, the combination with the grate-bars having parallel, longitudinal, separated passages, of lateral tubular arms attached to the same, and having a partition forming upper and lower communicating passages, and a hollow, ap-

ertured head, arranged in the inner end of each arm and serving as a support for the partition or diaphragm which divides the arm longitudinally, substantially as shown and described.

5. In a feed-water-heating apparatus, the combination with grate-bar having parallel, separated, longitudinal passages, and lateral, tubular arms, partition-plates or diaphragms that divide the arms into upper and lower passages, a hollow apertured head arranged in the inner end of said arms, and having a slot or recess in which such partition-plates are inserted, whereby the said head serves to support the partitions as shown and described.

6. In a feed-water-heating apparatus, the combination with the grate-bars having separated upper and lower longitudinal passages, of lateral tubular arms which are attached to said bars, a hollow apertured head arranged in the inner end of an arm, and having on its inner side a tubular projection that communicates with the upper passage of the grate-bar, and in its other side a horizontal slot, a

horizontal partition-plate, or diaphragm, that is inserted and held in said slot, and lugs formed on said head and entering recesses in the arm proper, as shown and described.

7. In a feed-water-heating apparatus, the combination with the hollow grate-bar of a mud drum or separator and pendent from the latter, and having an annular partition that divides its chamber and is provided with openings and automatic check-valves seating in opposite directions, substantially as shown and described.

8. In a feed-water-heating apparatus, the combination with the boiler, a hollow grate and pipes G, connecting the latter with the boiler, of the pipe B, and separator C, having an apertured and valved partition, and pump and blow-off pipes provided with valves, as shown and described to operate as specified.

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