

(No Model.)

2 Sheets—Sheet 1.

H. HACKNEY.
STEAM BOILER.

No. 387,511.

Patented Aug. 7, 1888.

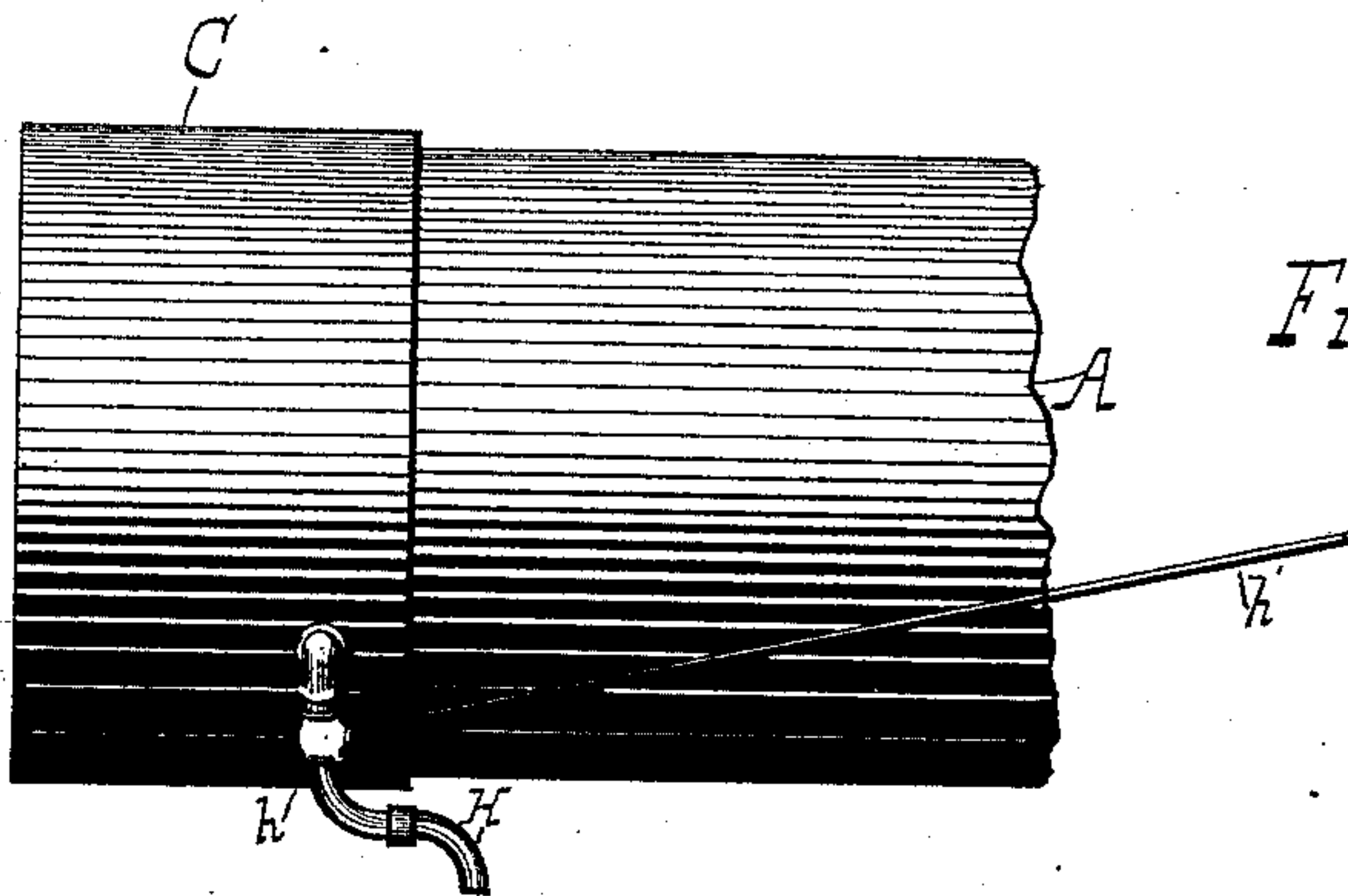
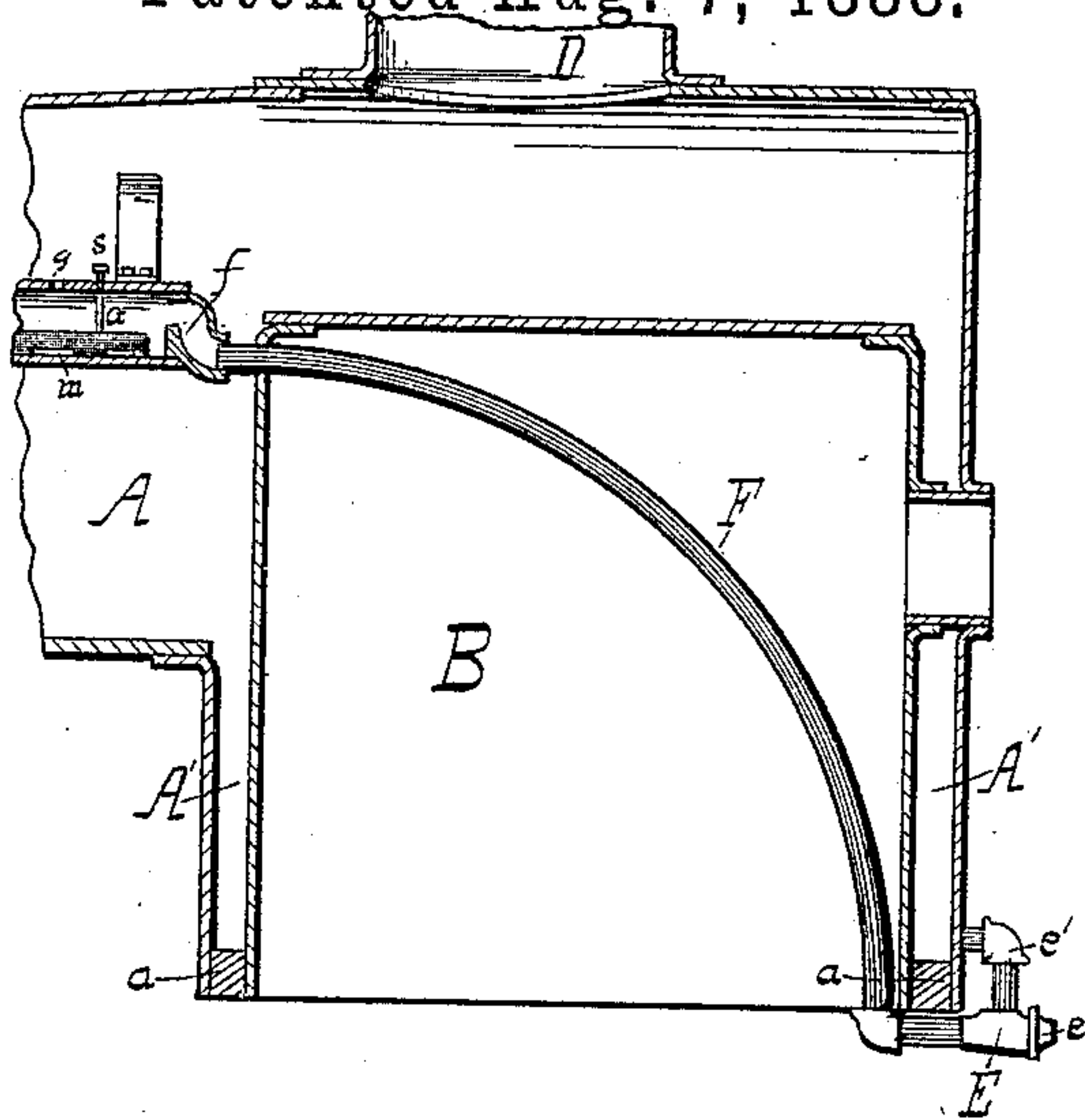
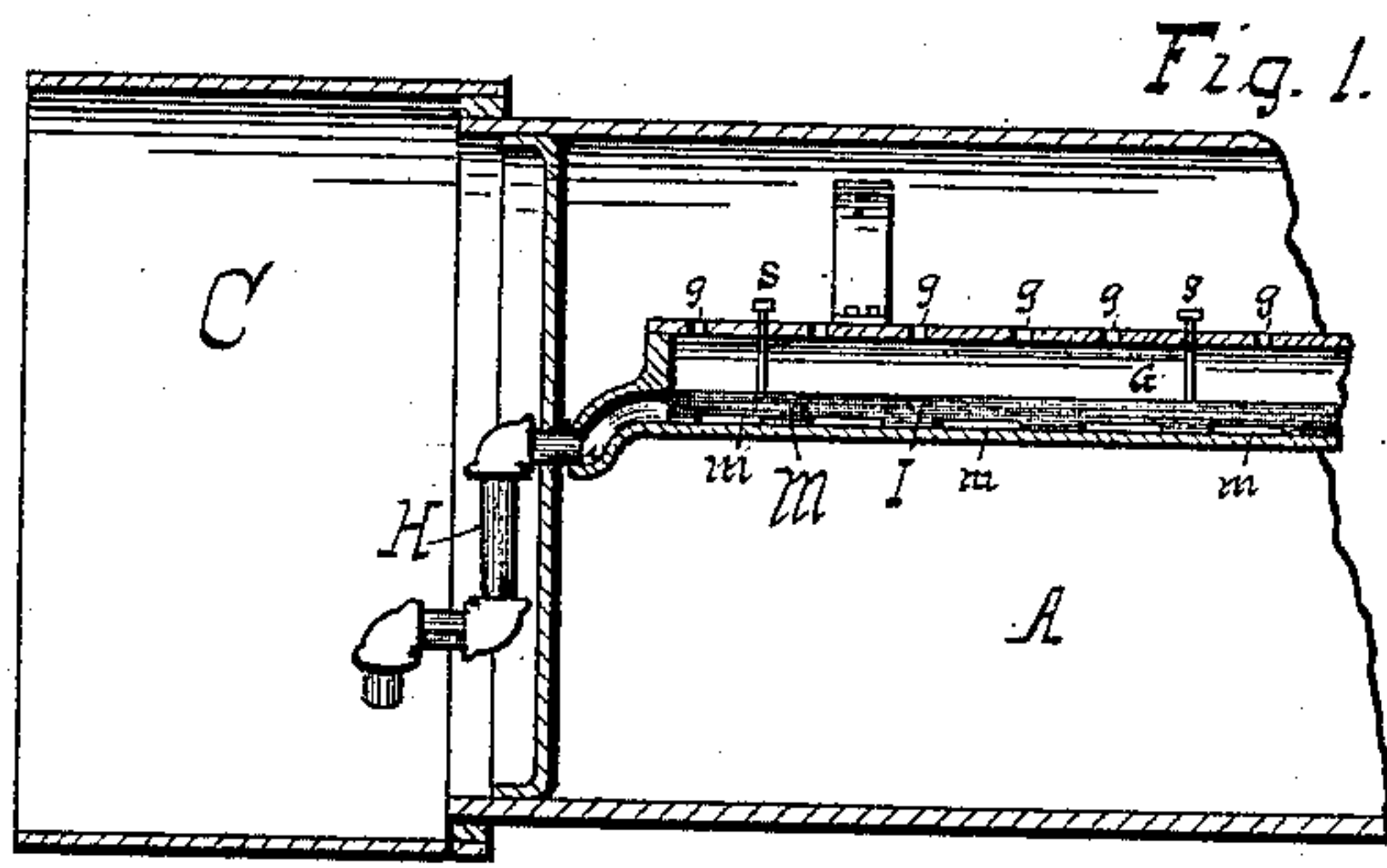
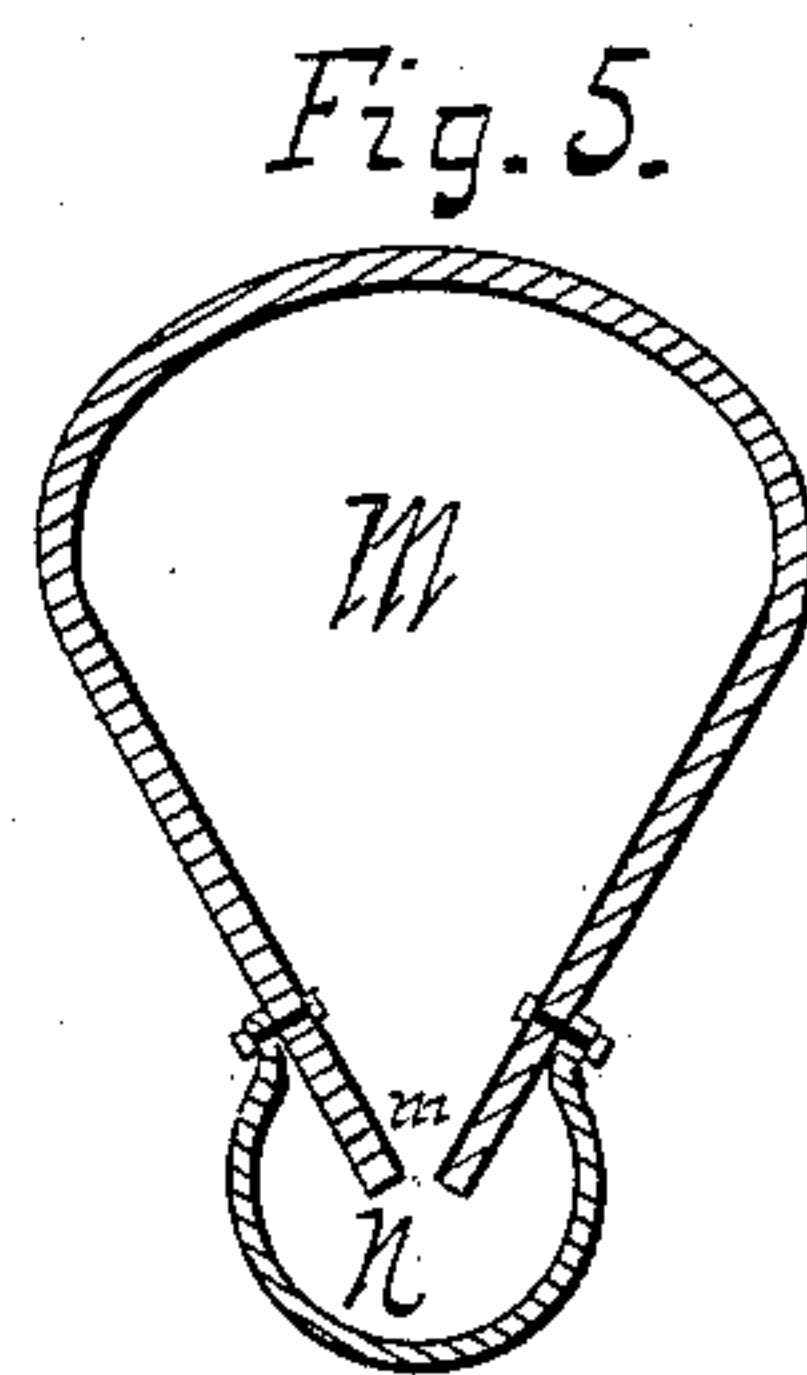
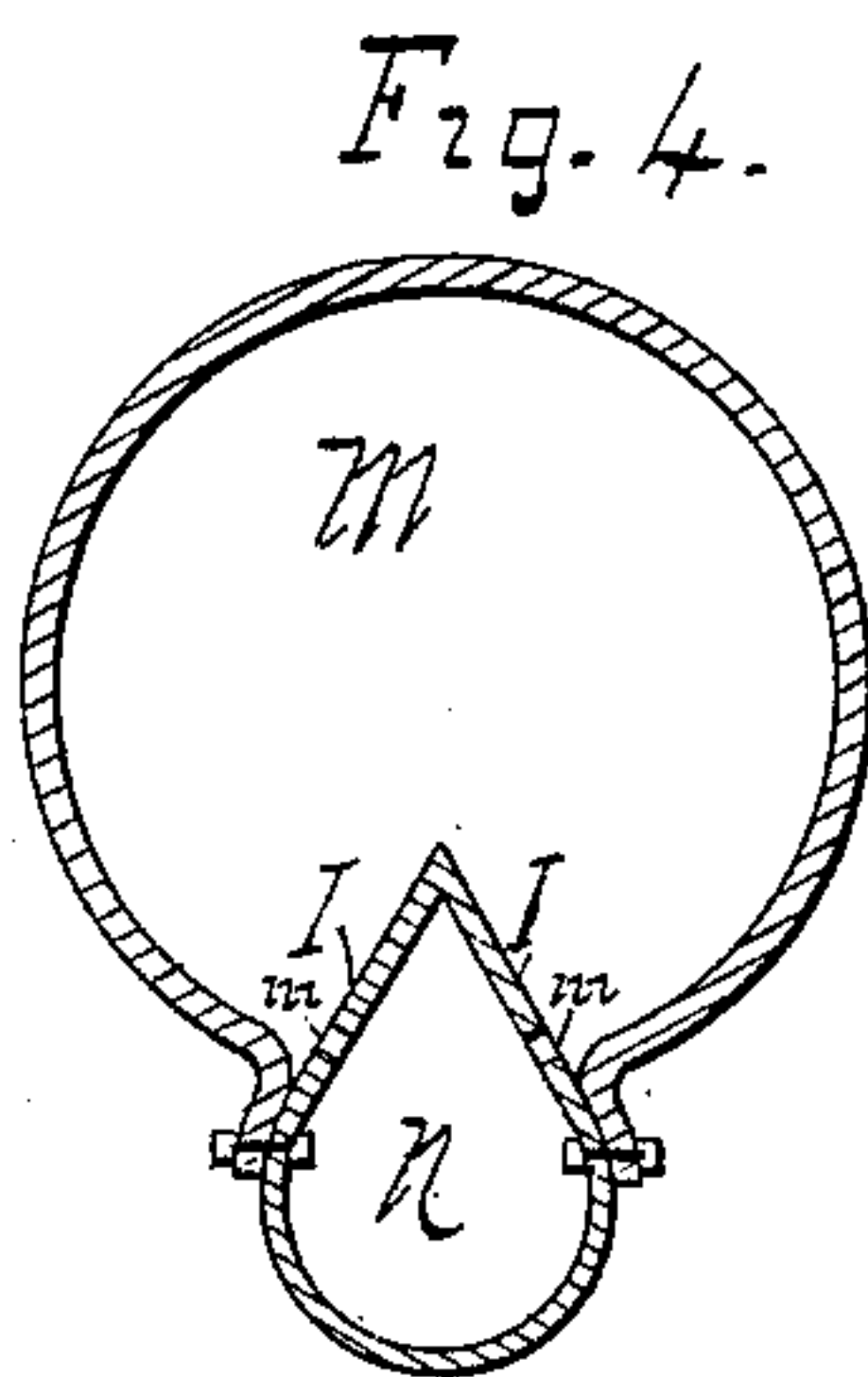
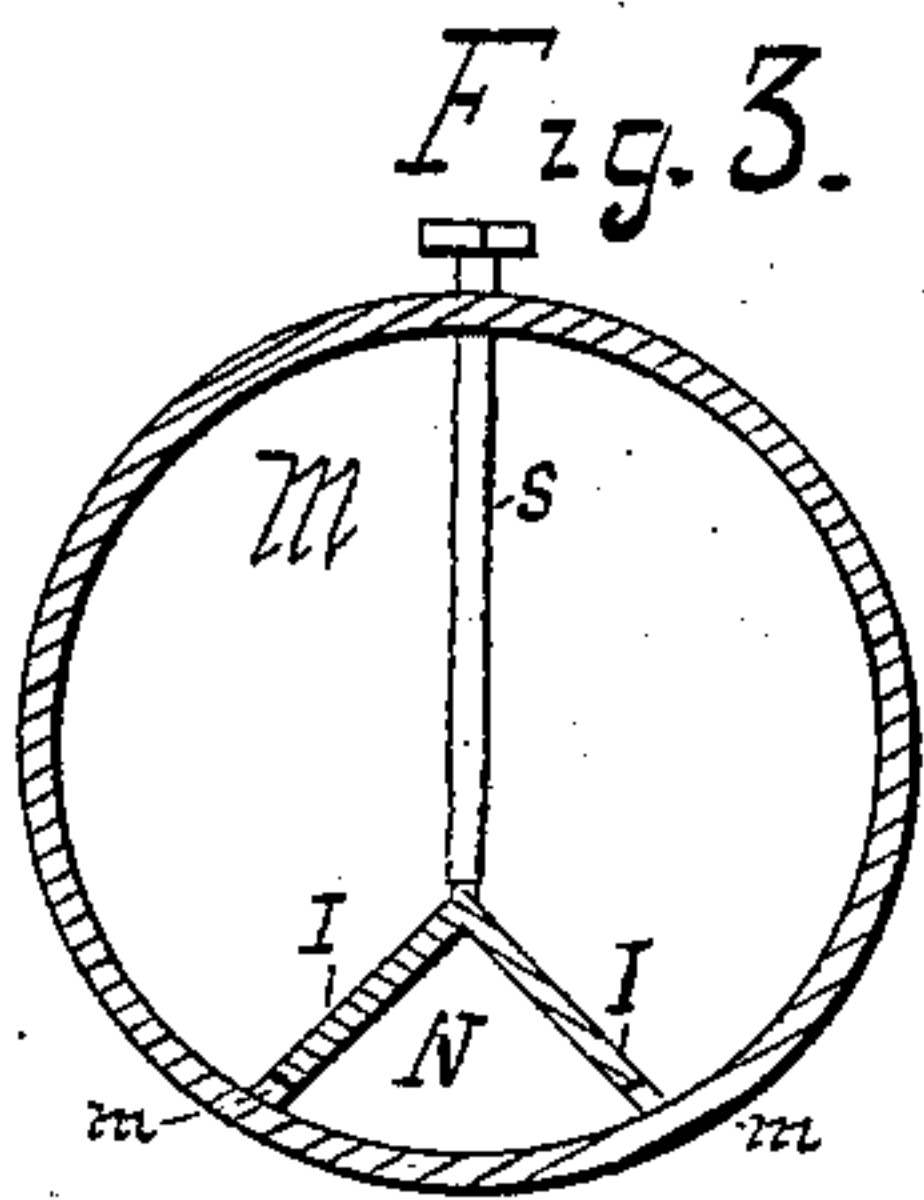
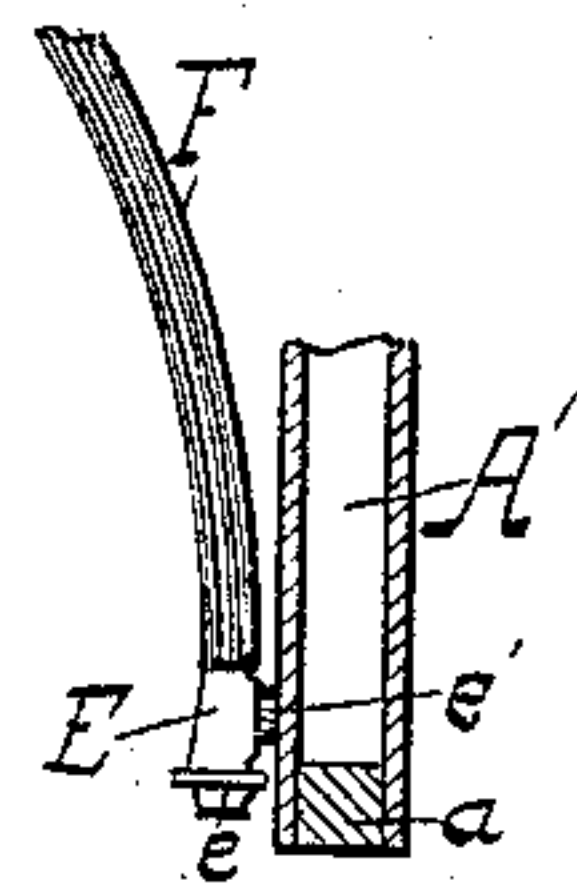


Fig. 2.



Witnesses,
Harry Burton,
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Inventor,
Herbert Hackney.

By his Attorneys,
Hill & Dixon.

(No Model.)

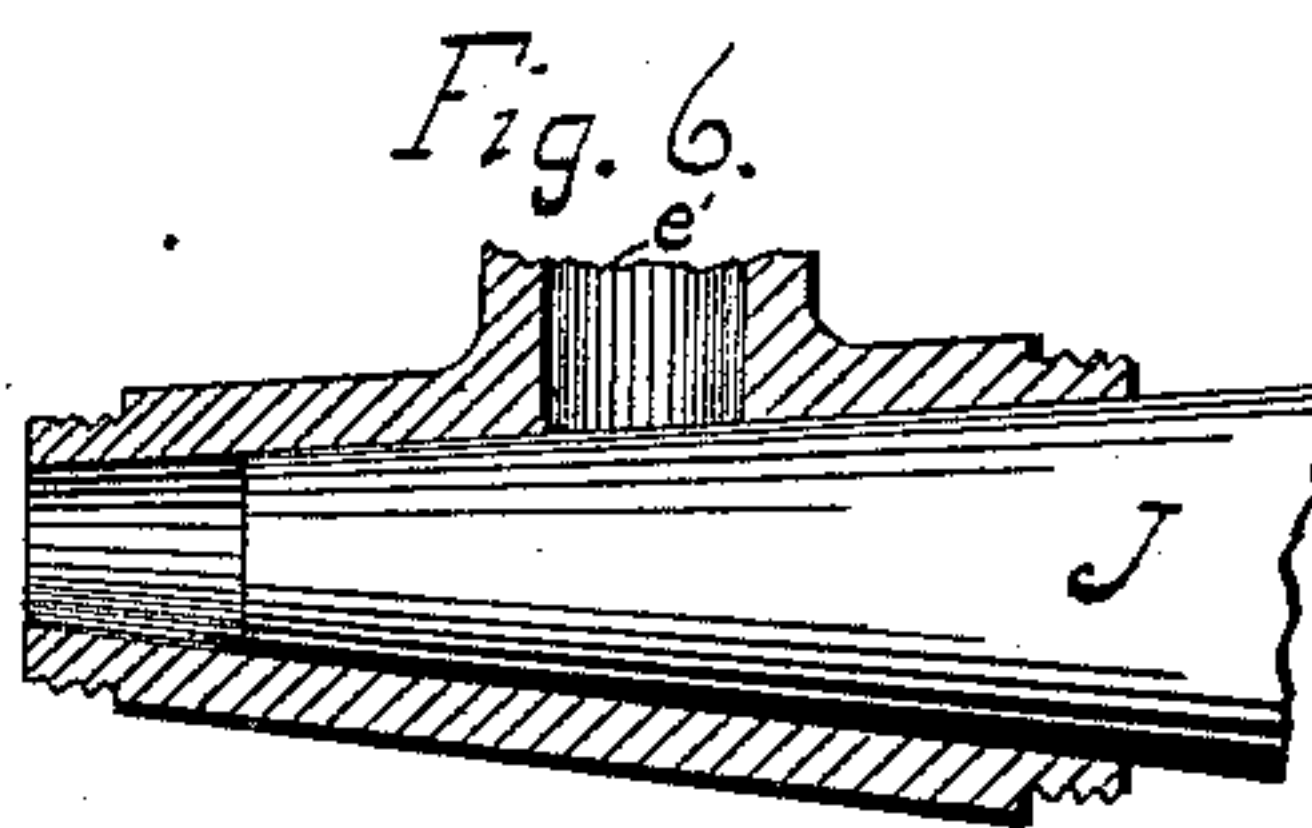
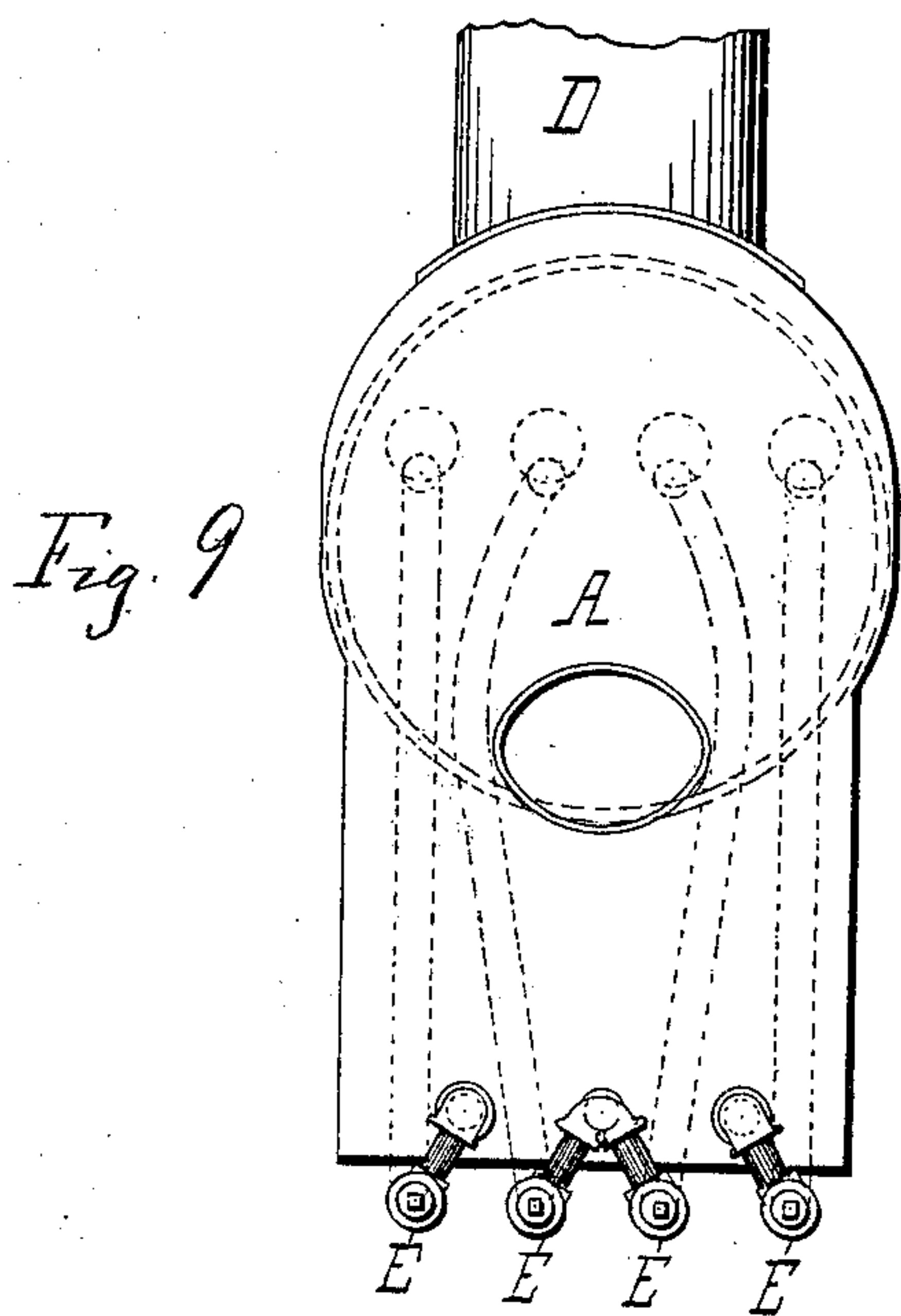
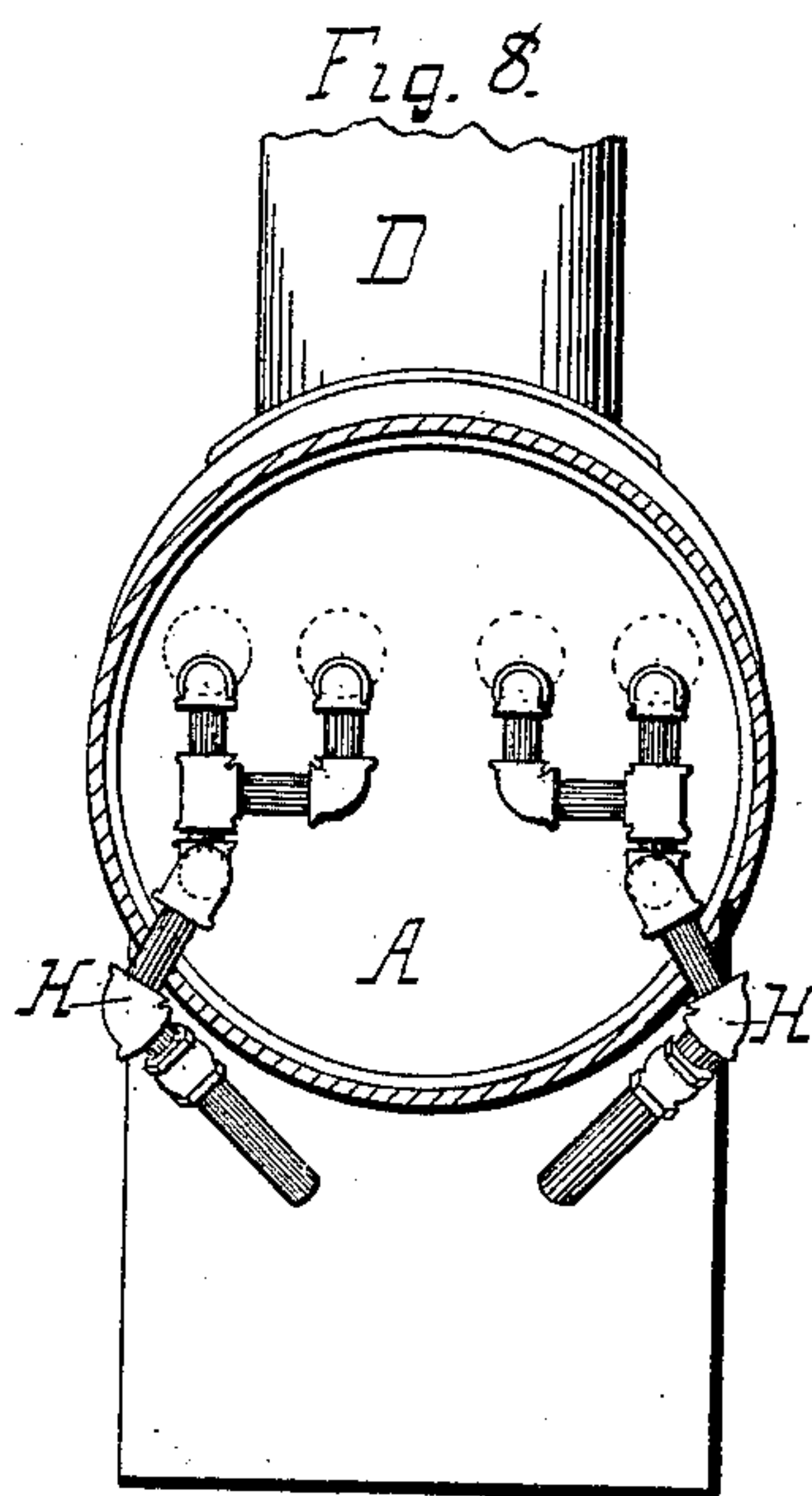
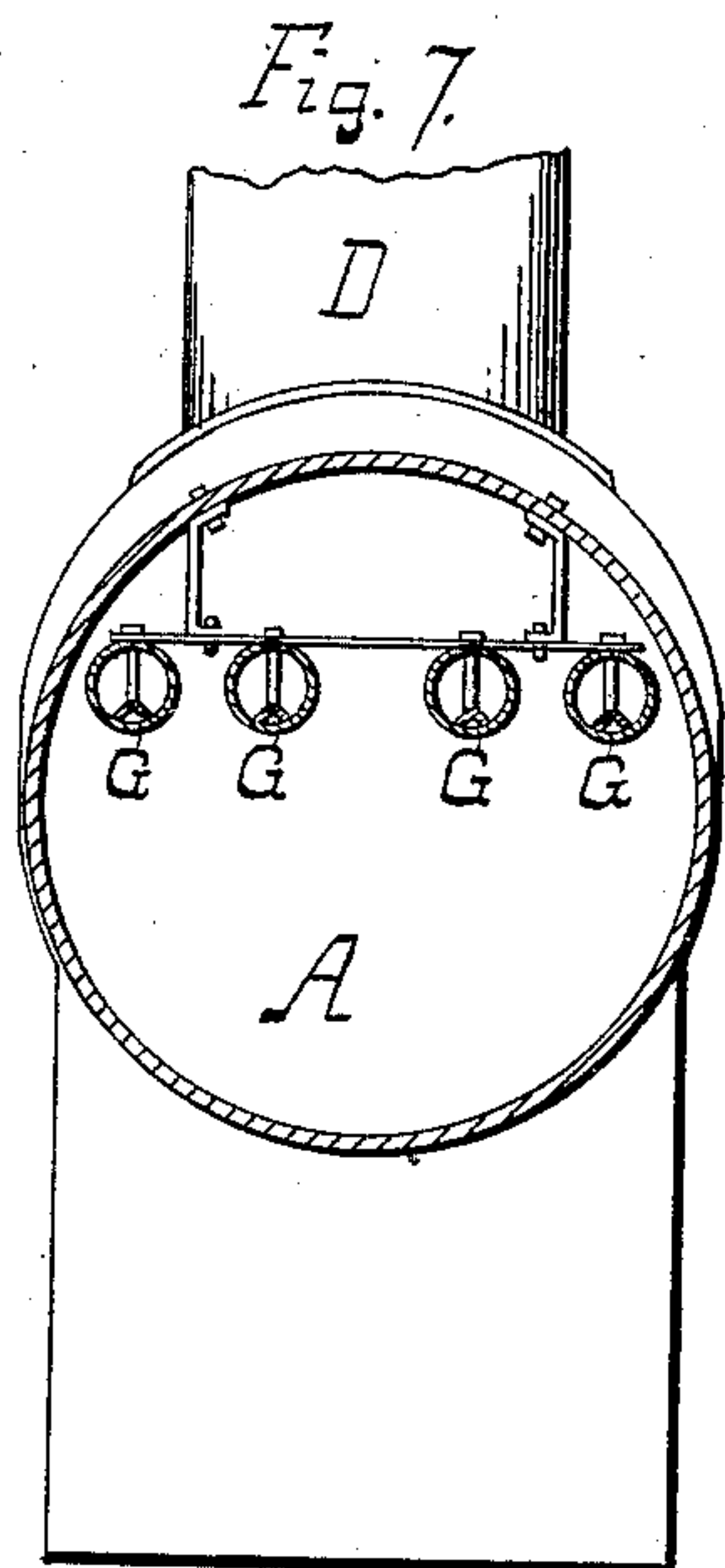
2 Sheets—Sheet 2

H. HACKNEY.

STEAM BOILER.

No. 387,511.

Patented Aug. 7, 1888.



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UNITED STATES PATENT OFFICE.

HERBERT HACKNEY, OF TOPEKA, KANSAS.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 387,511, dated August 7, 1888.

Application filed May 10, 1888. Serial No. 273,515. (No model.)

To all whom it may concern:

Be it known that I, HERBERT HACKNEY, a citizen of the United States of America, residing at Topeka, in the county of Shawnee and State of Kansas, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

In the drawings, Figure 1 is a longitudinal vertical section of a locomotive-boiler with my improvements attached. Fig. 2 is a side elevation of the same, showing a portion in section, with the mode of attachment slightly modified. Figs. 3, 4, and 5 are cross-sections of the mud-drum, showing different forms of construction. Fig. 6 is a longitudinal section of the coupling E. Fig. 7 is a cross section of the boiler, and Figs. 8 and 9 are opposite end elevations of the boiler.

Similar reference-letters indicate the same or corresponding parts.

The object of my invention is primarily to collect and remove from the boiler-water by mechanical means the various impurities which are liable to form incrustations and sediments, and, secondarily, to equalize, so far as possible, the temperature of the water and thus prevent strains resulting from unequal expansion and contraction of the different parts of the boiler. Some of the impurities which are found in boiler-water are so light as to float at or near the surface, while others are so heavy as to sink to the bottom; and one object of my invention is to enable both of the classes of foreign substances to be simultaneously discharged from the boiler.

The principle of my invention, broadly considered, consists in forcing a water-circulation from the lower part of the water-space (by means of a circulation-pipe exposed to the direct action of the fire or its heated products of combustion) into and through a mud-drum submerged in a higher part of the water-space and isolated from the direct action of the fire, from which mud-drum the circulation-water, after depositing its sediment, passes into the water-space, while the mud is removed from time to time by opening a discharge-cock.

The invention consists in the means by which this principle is applied and utilized and in the several improved devices and combinations of devices employed therewith, all

of which are more specifically pointed out and distinguished from each other in the following specification and in the several claims thereto appended.

Referring to the accompanying drawings, A indicates a locomotive-boiler, (the flues of which are not shown, because immaterial to this invention;) B, the boiler-furnace; C, the smoke-arch; D, the steam-dome; A', the "water-leg" of the boiler, and *a* the "mud-ring."

From the lower part of the water-leg (the nearer the mud-ring the better) I extend a circulation-pipe, F, up through some portion of the space occupied or traversed by the fire or its heated volatile products of combustion, (preferably the fire-box itself,) and thence into a more elevated portion of the water-space, so that the action of the heat directly upon the pipe will force a circulation of water through the pipe from the lower part of the water-space, where the cooler water tends to settle, to a higher portion of said water-space, where the water is at a higher temperature, and thus promote the equalization of the temperature throughout the boiler. At its upper end the pipe F discharges the circulating-water into a larger horizontal pipe or mud-drum, G, submerged in the water of the boiler and therefore not in direct contact with the fire, and provided with a series of holes, *g g*, along its top, through which the water slowly percolates back into the water-space, after having deposited its sediment along in the lower part of the mud-drum. The water from pipe F is preferably directed into the upper part of the mud-drum by means of a deflecting-wall, *f*, so as not to disturb the depositing sediment.

The mud-drum is provided with an eduction-pipe, H, and discharge-cock *h*, controlled by a rod, *h'*, which extends to the cab. Upon opening the cock *h*, when steam is up, the steam-pressure will force boiler-water simultaneously through pipe F and openings *g* into the mud-drum, and thence out through the discharge-pipe, thus thoroughly cleaning and washing out the mud-drum. By arranging the drum near the normal water-level, the impure water at the surface, (charged with light floating foreign substances,) and the equally impure water at the lower end of the water-

leg, (charged with the heavier mineral substances,) will be simultaneously expelled from the boiler in the process of cleaning out the drum, as above described, while the intermediate purer water will be retained by seasonably closing the cock.

Having thus described my main invention, I will now proceed to set forth certain special and independent improvements thereon, designed to secure additional advantages in its practical application and use.

The first of these improvements consists in combining with the boiler the automatic circulation-pipe exposed to the direct action of the fire and the submerged mud-drum isolated from the direct action of the fire, a perforated partition or diaphragm, I, which divides the mud-drum into two chambers or compartments, M N, the upper and larger of which communicates at one end with the pipe F and along its top with the water-space of the boiler, and the lower and smaller of which communicates at the opposite end with the discharge-pipe II and along the line of its perforations with the upper chamber. The object of this device is to cause the mud which is brought by the pipe F into the larger chamber to settle in the neighborhood of the perforations *m*, through which the two chambers communicate with each other, and then be swept into and through said perforations and through the small chamber N to the discharge-pipe, by the violent rush of the water through said perforations when the cock *h* is opened, whereby the sediment will be removed more quickly and with less waste of boiler-water than when the mud-drum is constructed with a single chamber.

Another special improvement consists in forming the diaphragm or wall that divides the two chambers M N with inclined and substantially flat faces to receive the muddy deposit, and with the perforations *m* arranged along the lower edge or edges of said inclined faces, so that the rush of the water will be aided by gravity in cleaning the mud from its supporting-surfaces and forcing it into the lower chamber. This may be accomplished in various ways, of which three are shown in Figs. 3, 4, 5, respectively.

In Figs. 1, 3 the diaphragm is represented as composed of a long strip of angle-iron confined in the tubular mud-drum by screws *s*, and provided with notches *m* along its lower edges, through which communication is effected between the two chambers.

In Figs. 4, 5 the upper and lower chambers are formed of two tubes, one of which is flattened to a V shape on one side, as seen in the cross-section, and the V-shaped edge is then introduced into a slot formed along the other tube, after which the two tubes are fastened together in a suitable manner. The perforations are arranged at the lower edge or edges of the inclined surfaces which receive the mud. In this case, as with the form shown in Fig. 3,

that portion of the mud which does not settle through the perforations *m* into the chamber N lodges mainly upon the inclined faces I I immediately above said perforations, and is easily swept into the lower chamber when the discharge-cock is opened.

Another special improvement consists in adapting the automatic circulation-pipe F to be employed for washing out the mud-drum when the boiler is empty, or when steam is not up, by attaching a pump-hose to its lower end, opening the cock *h*, and forcing water through the hose into the pipe and mud-drum. To this end the pipe F is connected at its lower end to the water-leg by means of a coupling, E, the inner end of which is attached to said pipe, the outer end provided with a screw-cap, *e*, and admitting of the attachment or application of the hose when the screw-cap is removed, and the side of which is tapped to permit it to be connected to the water-leg by a short pipe, *e'*, as shown in Figs. 1, 2.

Certain advantages result from forming the coupling E with a funnel-shaped bore sufficiently large to permit the end of the hose J to be inserted in beyond the point where the lateral pipe *e'* is attached, as shown in Fig. 6. This construction obviates the necessity for a cock in pipe *e'* to prevent the water from passing from the hose through pipe *e'* into the empty boiler, inasmuch as the end of the hose, when forced into the coupling beyond the pipe *e'*, will close the passage to pipe *e'* and cause all the water to be forced through pipe F.

Further advantages result from arranging the pipe F within the furnace in a curved form and position, as shown in Fig. 1, so that it will be substantially parallel to the line of draft from the fire-bed to the heating-flues. Experience shows that the flying cinders in a fire-box subject to strong draft soon abrade and cut out metal surfaces opposed to their line of movement, but have little injurious effect upon similar surfaces substantially parallel to said line. In a locomotive-furnace their line of movement is a curve rising from the fire-bed and bending back to the boiler-flues; and I accordingly connect the lower end of the pipe F to the rear lower edge of the water-leg, and curve it upward and forward to and through the upper edge of the rear flue-sheet, as shown, thereby conforming its position to the line of movement of the flying sharp particles from the fire-bed, and saving it from abrasion thereby, besides causing the furnace-heat to act more uniformly upon it throughout its exposed surface.

The whole apparatus is so arranged as not to be in the way when cleaning, repairing, or plugging the flues or firing the engine, and it occupies no space available for other purposes and requires no special construction of boiler or furnace. I have described it in connection with a locomotive-boiler; but it can obviously be applied to a stationary boiler as well, and as many sets of the apparatus may

be used with a single boiler as the judgment of the constructor may approve.

Experience has shown that the automatic circulation-pipes, combined with the mud-drums and means for cleaning the same, as herein described, effect a very great economy in the consumption of fuel by preventing the accumulation of mud and scale on the heating-surfaces, and keeping the boiler clean with its water uniformly heated, and also by utilizing the additional heat communicated to the pipe F, besides conducing to the durability of the boiler by preventing unequal expansion and contraction and by purifying the water from deleterious substances, which are liable to deposit and cause the boiler to burn out.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination of the boiler with a submerged mud-drum isolated from the direct action of the fire, and an automatic circulation-pipe exposed to the direct action of the fire or the heated volatile products of combustion, and adapted to continuously circulate the water from the lower part of the boiler into the mud-drum and thence into the upper part of the boiler, substantially as described.

2. The combination of the boiler with a submerged mud-drum isolated from the direct

action of the fire, and communicating along its upper edge with the water-space of the boiler, and the automatic circulation-pipe exposed to the direct action of the fire or the heated volatile products of combustion, and adapted to continuously circulate the water from the lower part of the boiler into the mud-drum and thence into the upper part of the boiler, substantially as described.

3. The combination of the boiler, the automatic circulation-pipe exposed to the direct action of the fire or the heated volatile products of combustion, and the submerged and isolated mud-drum, divided into two compartments, M N, the former of which communicates with the circulation-pipe and the water-space and the latter with the discharge-pipe and the compartment M, substantially as described.

4. The combination of the boiler, the mud-drum and means for discharging the same, and the automatic circulation-pipe F, with the coupling E, provided with a removable cap to adapt the apparatus to the application of a hose for cleaning purposes, substantially as described.

HERBERT HACKNEY.

Witnesses:

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HARRY BITNER.