

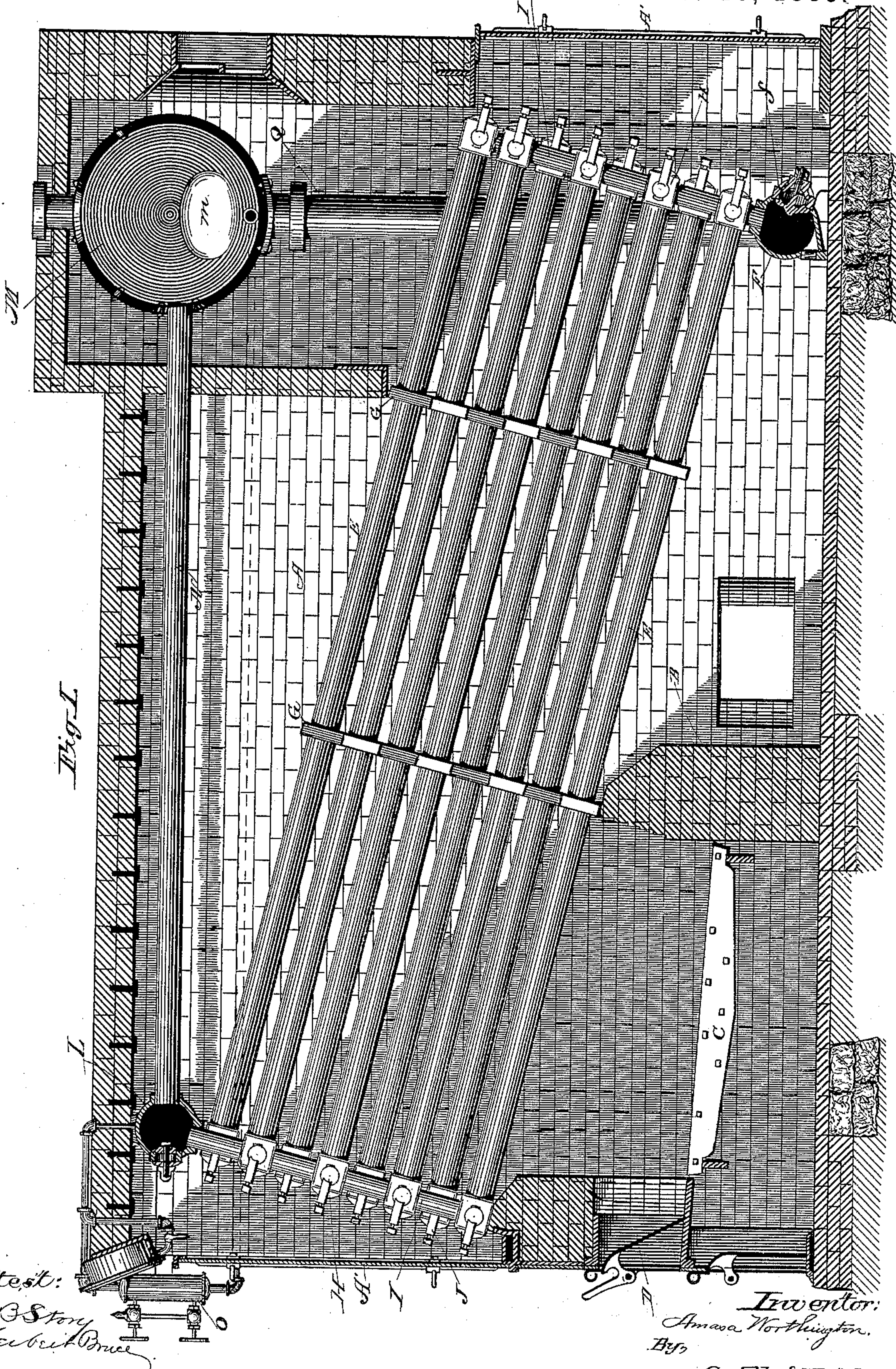
(No Model.)

4 Sheets—Sheet 1.

A. WORTHINGTON.
SECTIONAL STEAM BOILER.

No. 330,359.

Patented Nov. 10, 1885.



Attest:
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Notary Public

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(No Model.)

4 Sheets—Sheet 2.

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Fig. 2.

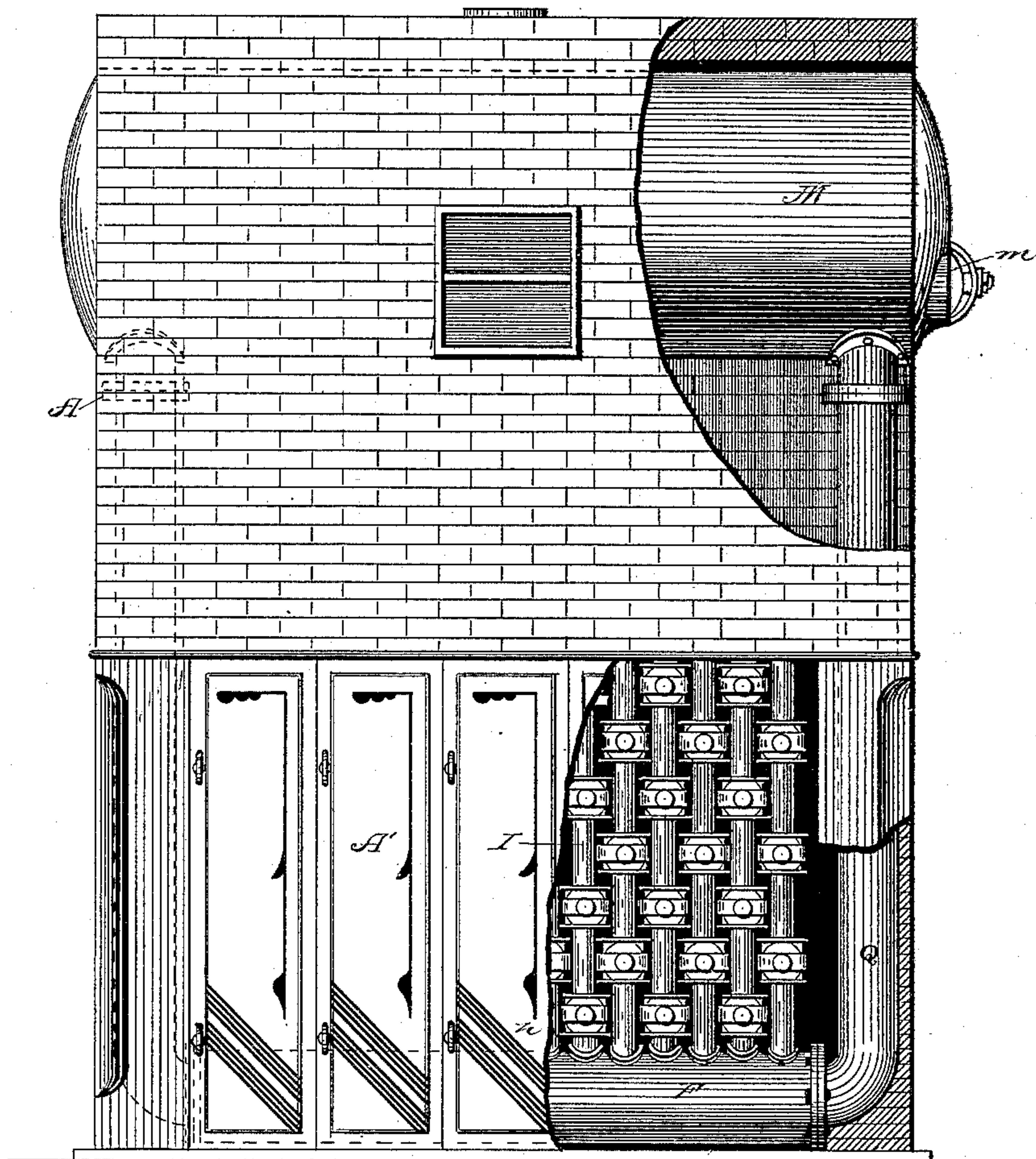


Fig. 5.

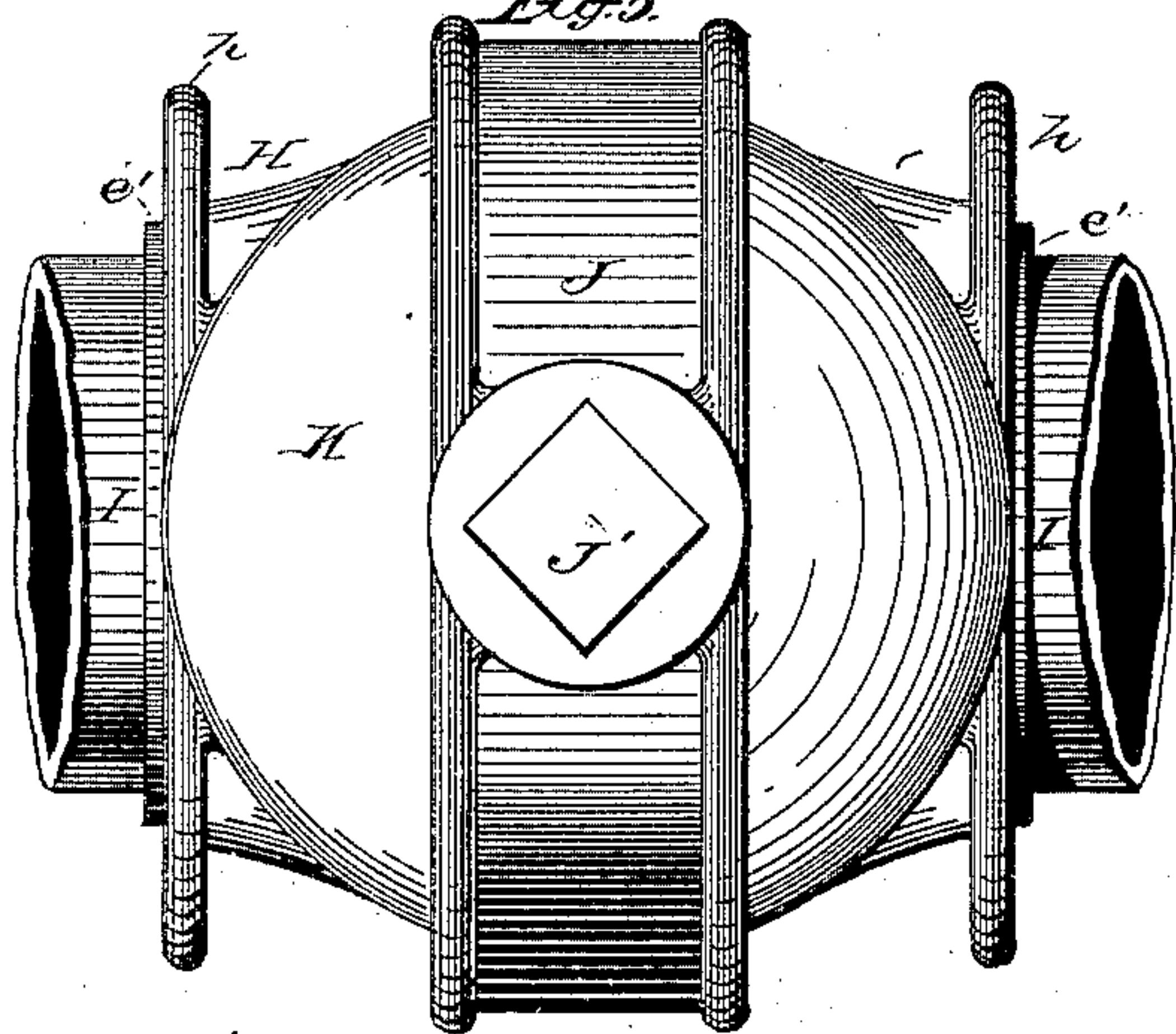
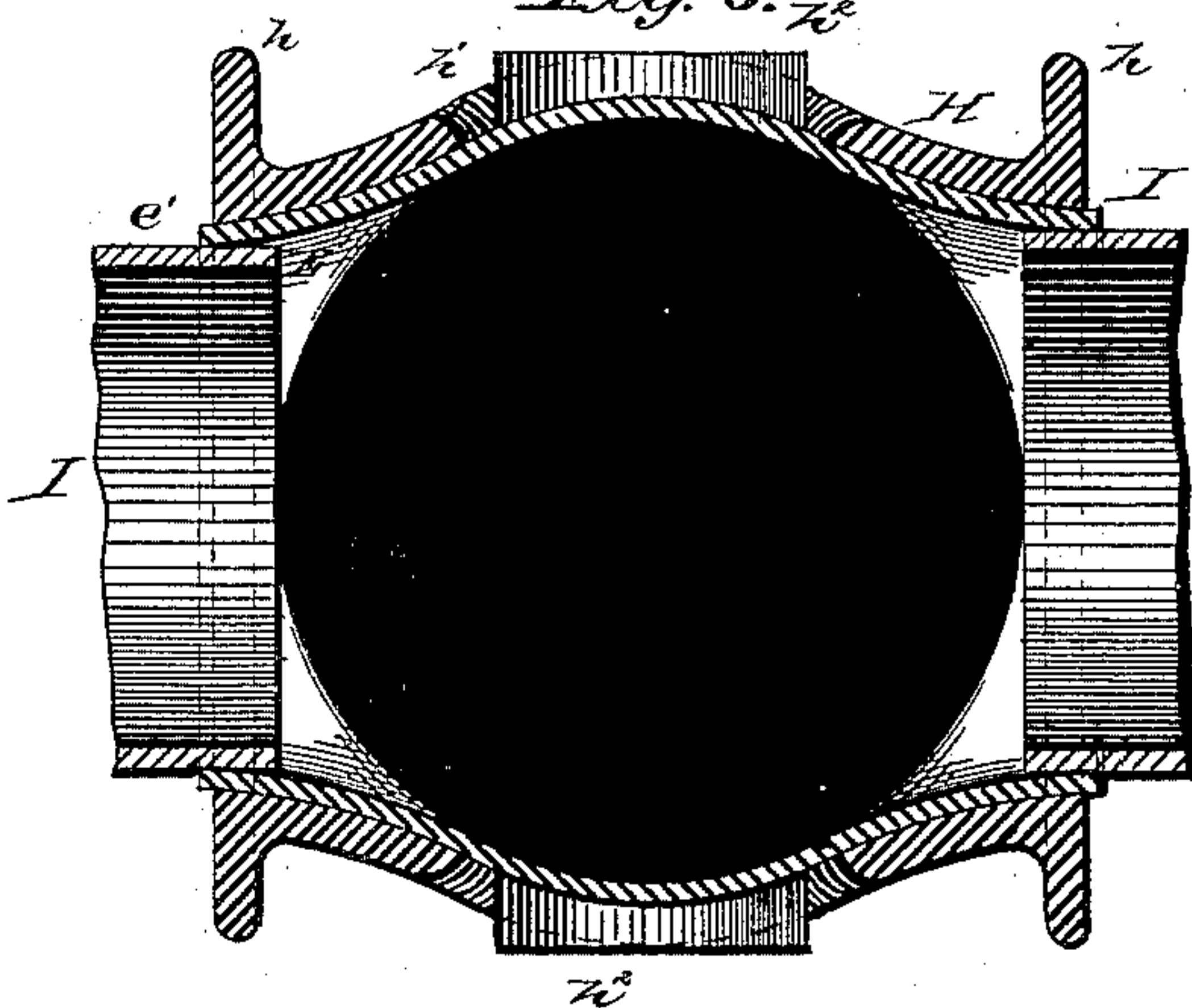


Fig. 6.



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Fig. 3.

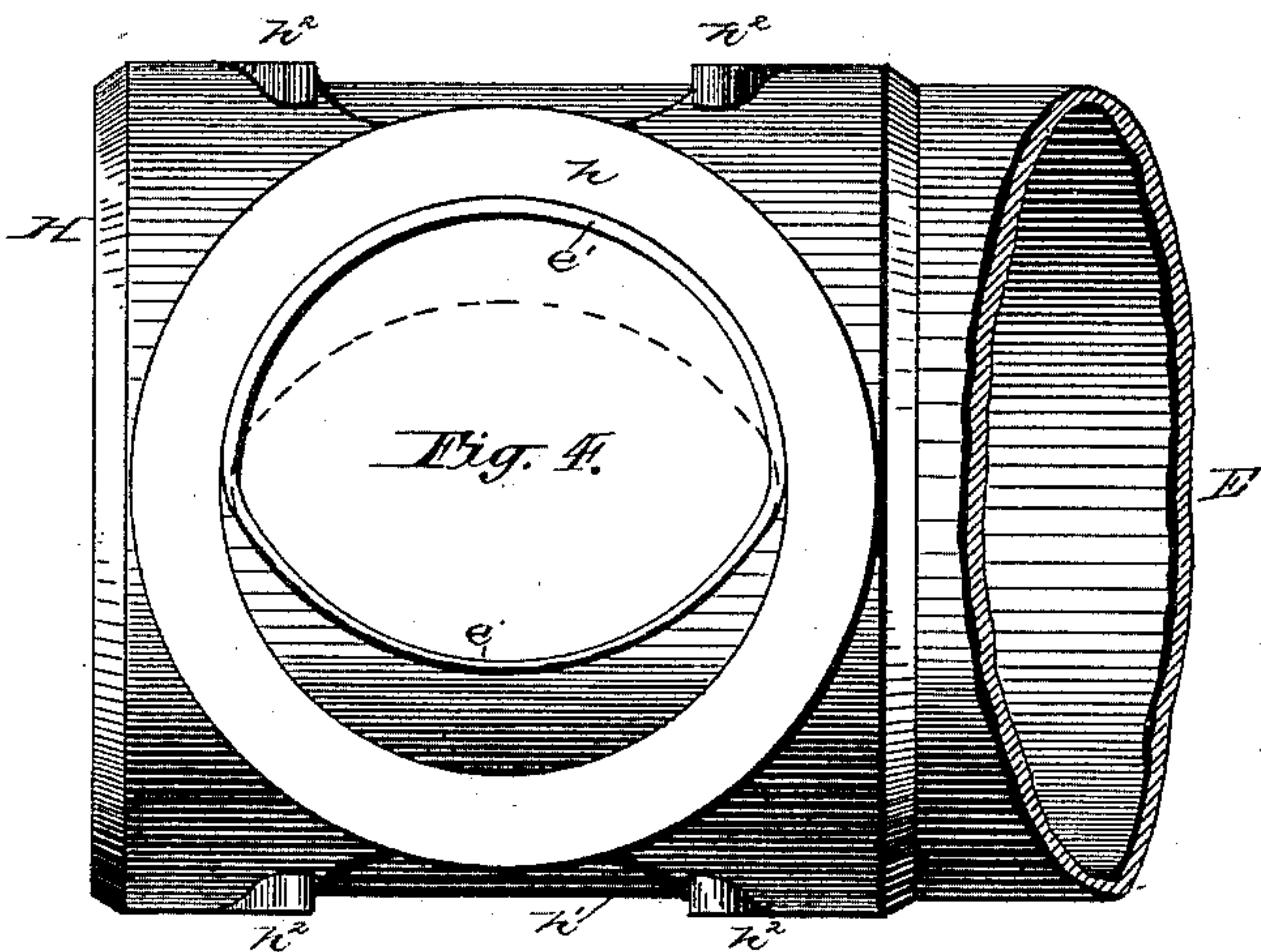
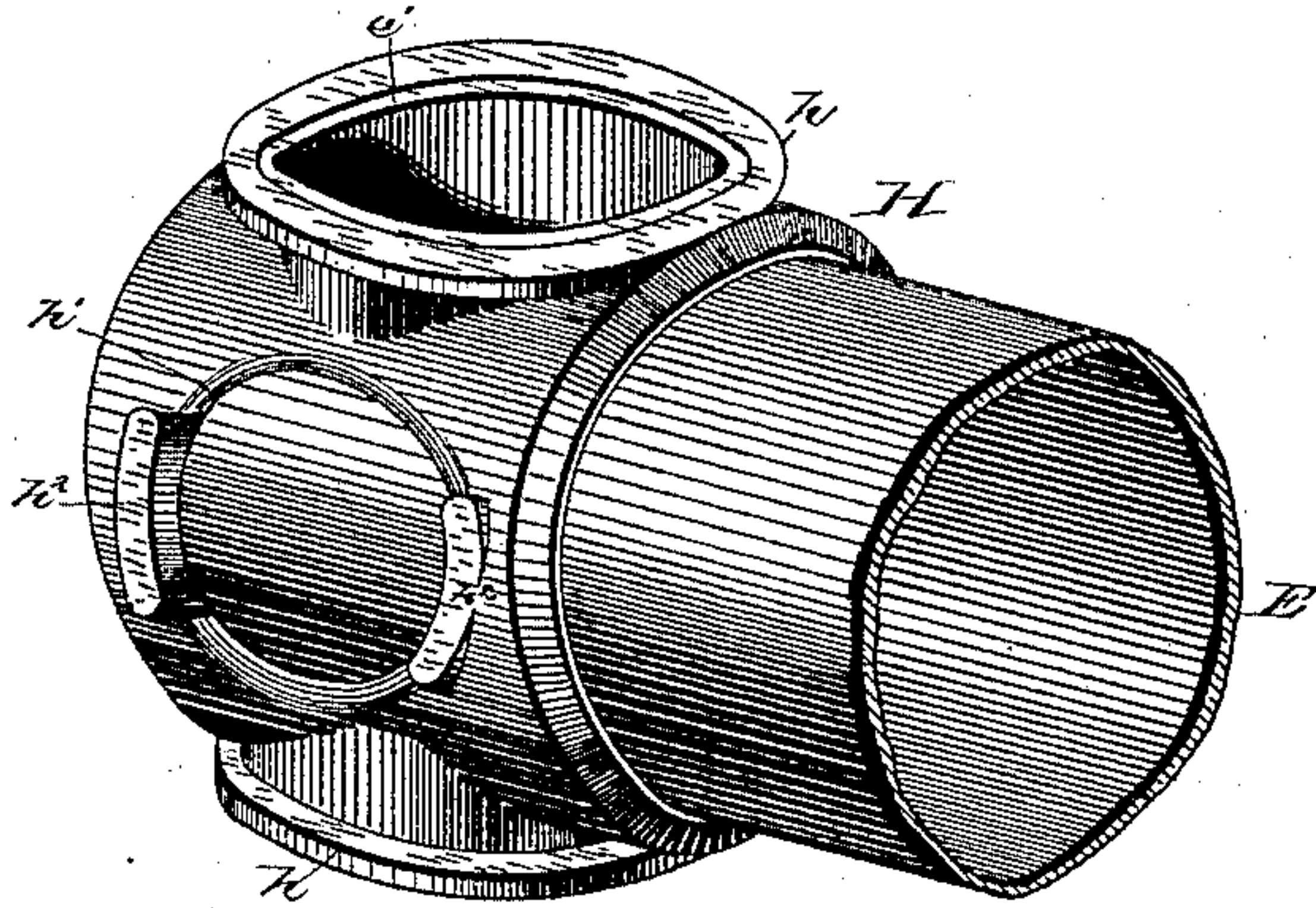


Fig. 9.

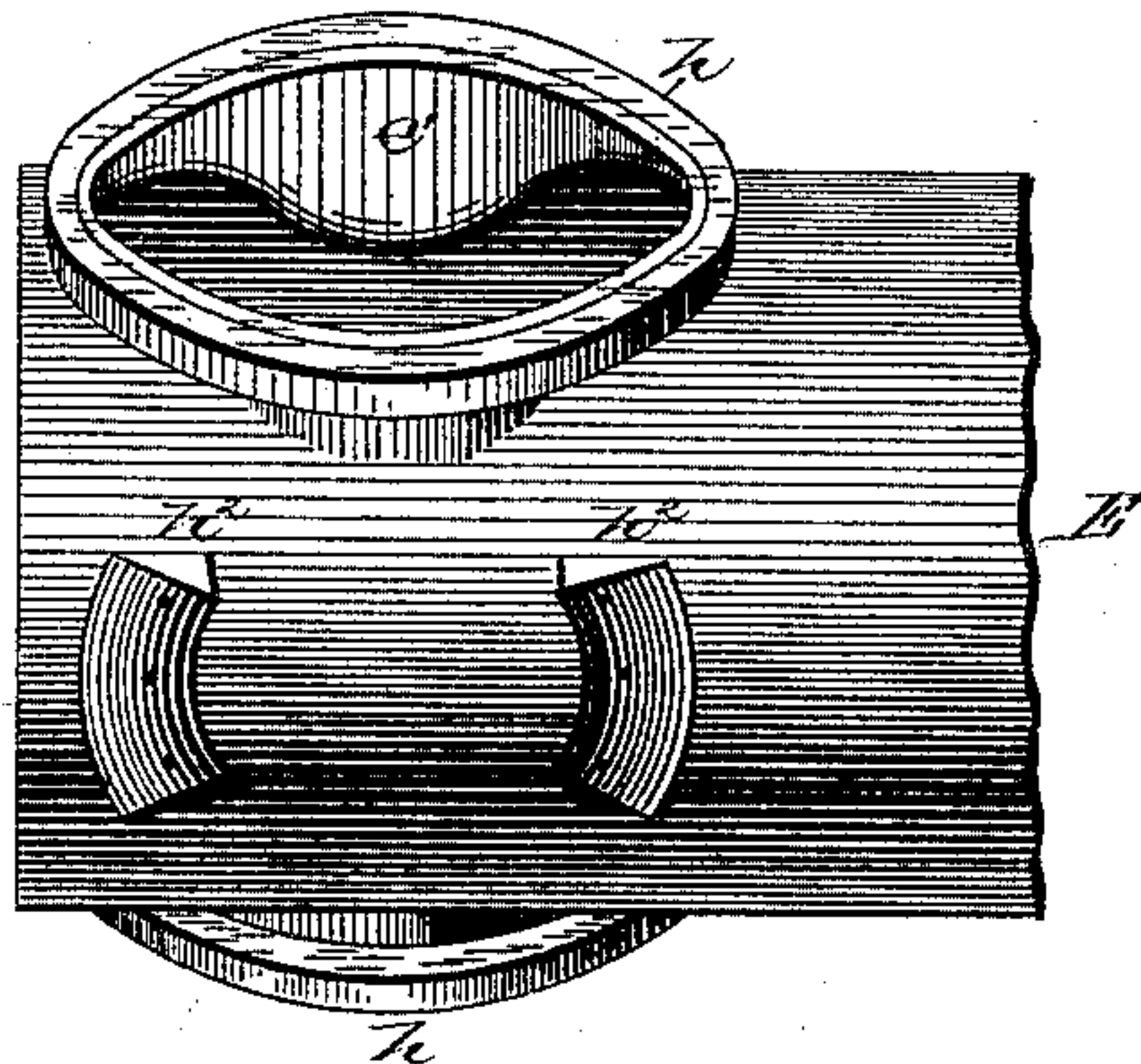


Fig. 10.

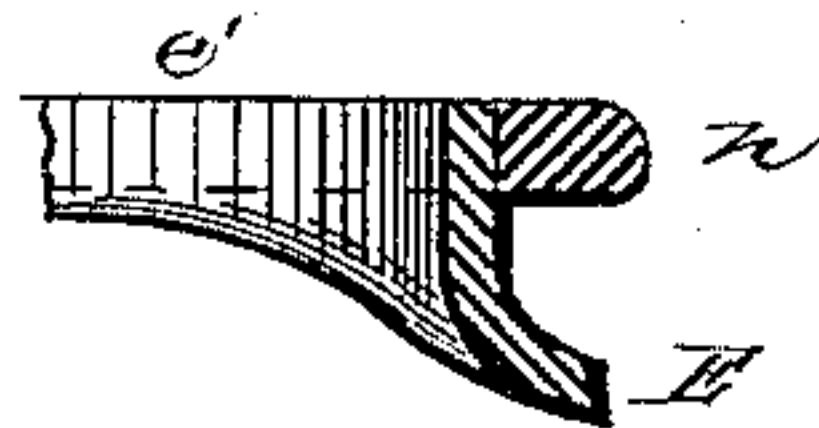


Fig. 11.

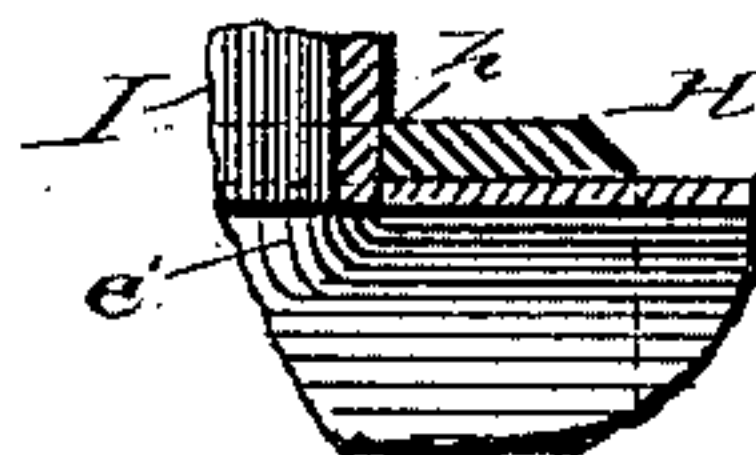
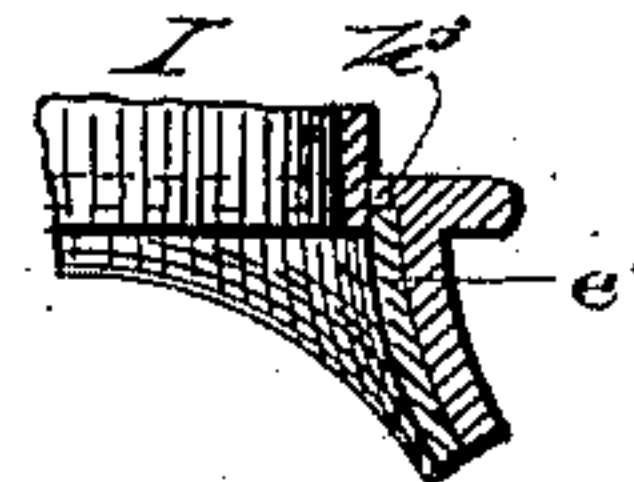


Fig. 12.



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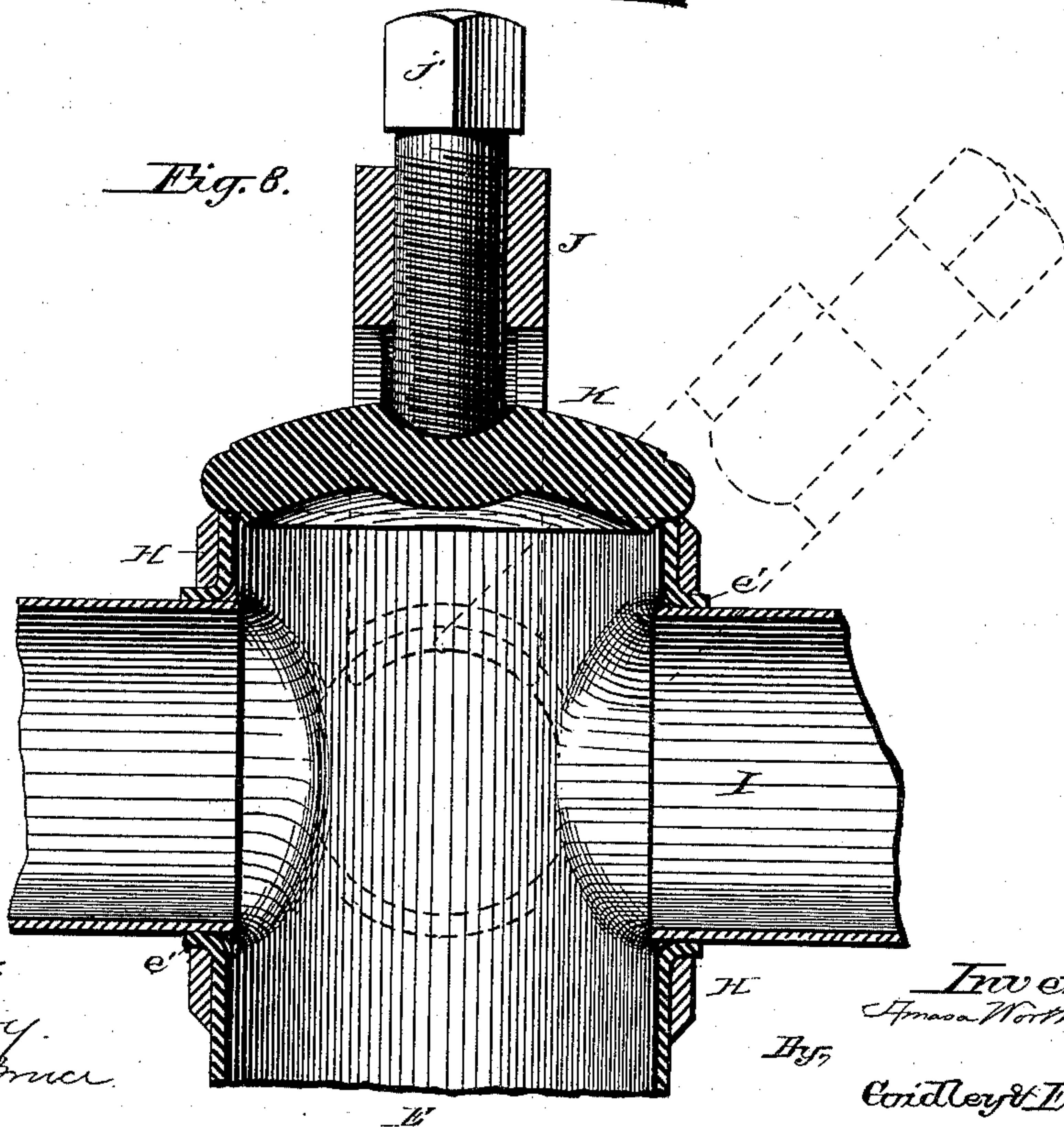
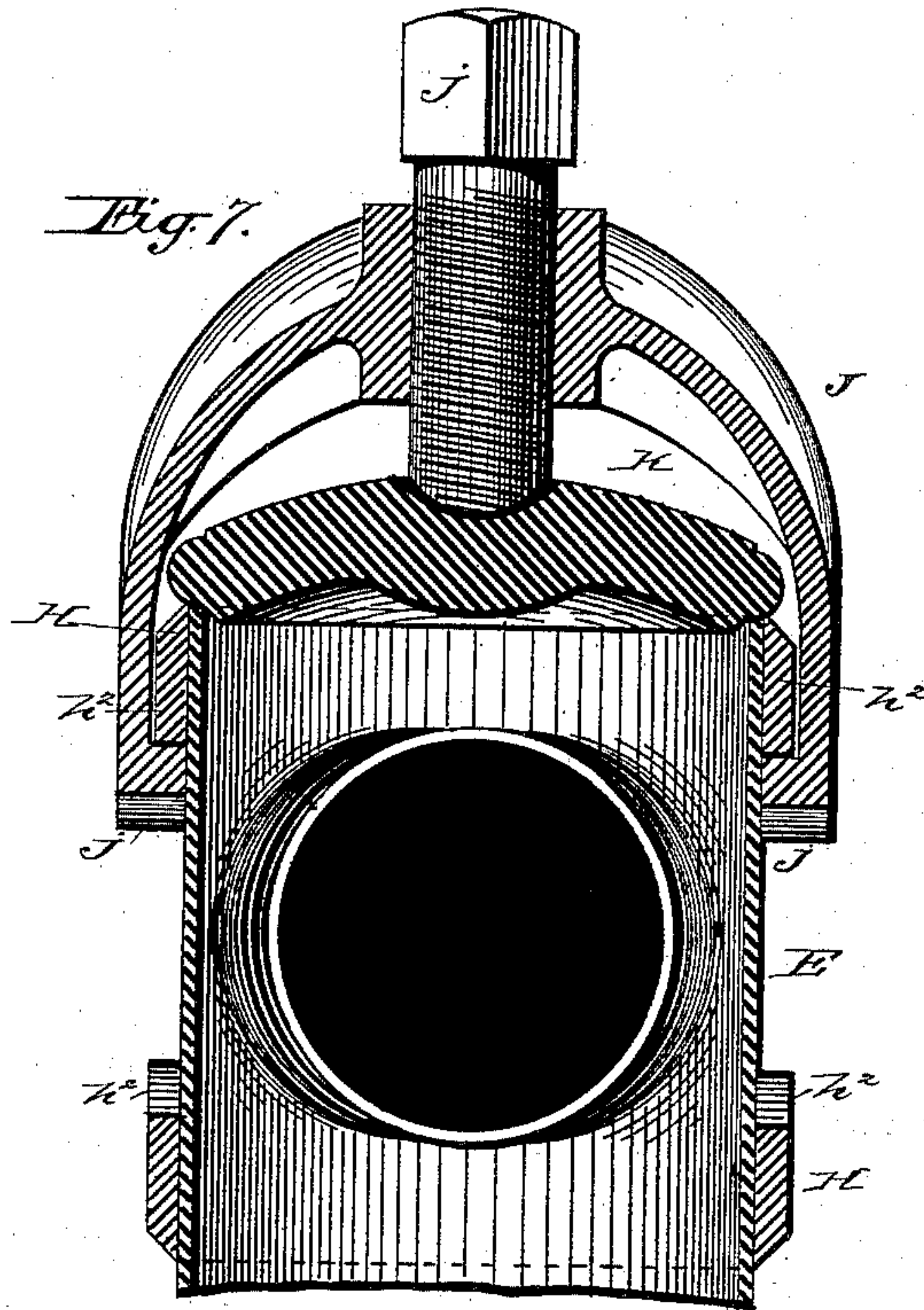
(No Model.)

4 Sheets—Sheet 4.

A. WORTHINGTON.
SECTIONAL STEAM BOILER.

No. 330,359.

Patented Nov. 10, 1885.



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UNITED STATES PATENT OFFICE.

AMASA WORTHINGTON, OF CHICAGO, ILLINOIS.

SECTIONAL STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 330,359, dated November 10, 1885.

Application filed January 30, 1885. Serial No. 154,412. (No model.)

To all whom it may concern:

Be it known that I, AMASA WORTHINGTON, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Sectional Steam-Boilers, of which the following is a description, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of said boiler. Fig. 2 is a rear elevation of the same. Fig. 3 is a perspective view of my improved re-enforcing jacket with a tube formed therein. Fig. 4 is a plan view of the same, showing said pipe or tube partially formed therein. Fig. 5 is an end view showing a cap for inclosing the same. Fig. 6 is a central transverse vertical sectional view thereof. Fig. 7 is a central horizontal sectional view in plan of said jacket with said tube formed therein. Fig. 8 is a vertical longitudinal sectional view of the same, with portions of the connecting-pipes. Fig. 9 illustrates a modification thereof, being one of the main pipes or tubes formed in like manner, with re-enforcing rings in lieu of said complete jacket. Fig. 10 is a detail view showing a portion of said ring and tube in section. Fig. 11 is a sectional view in detail showing a modification of the construction indicated in Fig. 8, and Fig. 12 is a detail view of the same in plan.

Like letters of reference indicate like parts in the different figures.

The object of my invention is primarily to provide a sectional boiler in which shall be combined lightness, simplicity, strength, and elasticity, whereby the respective parts may accommodate themselves to the varying expansion and contraction of the tubes and connecting parts peculiar to that class of boilers without injury to the joints and the production of leakage thereat. A further object is to so construct said boiler that the greatest freedom of circulation may be maintained directly with those tubes in which the largest amount of evaporation is produced, thus obviating the danger of overheating said pipes, while "priming" is prevented by reason of the more steady and even circulation, which is thereby maintained.

Heretofore in boilers of this class castings of various forms termed "headers" have been used to form the connections of the main tubes

with each other. These headers, owing to the unequal and varying expansion and contraction of the main tubes, caused by the uneven distribution of heat, are necessarily made of great weight in order to obtain the requisite strength; but in addition to the extra cost and extreme weight thus added to the boiler the very rigidity thus produced is an objection, in that while the header itself may not break the connection therewith soon becomes so impaired as to cause leakage. Moreover, the headers themselves cannot be relied upon in point of strength, but are often broken. A further objection is that several, if not all, the tubes are connected to one header, thus rendering it impossible to transport the parts separately. These objections and that of imperfect circulation above referred to I overcome in the following manner:

First. I preferably surround the main tubes at the ends with strengthening-jackets, and cause perforations to be made in the bottom and top of said tubes, respectively, at either end, said perforations being so formed as to enable said tubes to be formed or drawn to conform to the interior of said jacket, and at the same time to receive the ends of the connecting-pipes, which may be expanded therein, the ends of said main tubes being closed by means of detachable plates or caps, as hereinafter described. This arrangement enables me to dispense with the usual headers, and to form a complete series of pipe-connections, or what might be regarded as one continuous pipe, by inserting the connecting-pipes within the main tubes after forming the latter as above mentioned for such connection; and, moreover, the connections with each tube being separate, the tubes may be transported separately, which is often a great advantage.

Second. Instead of connecting the main steam and water drum with the top of the rear end of the main tubes by means of a series of small pipes, I connect said steam and water drum directly with the mud-drum by means of two large pipes extending down upon either side of said boiler, and connecting with the respective ends of the mud-drum, thus serving as columns or supports for the steam and water drum, while at the same time they permit an unrestricted flow of water directly from the source of supply to the hottest tubes, where it

is most needed, all of which will be hereinafter more particularly described, and definitely pointed out in the claims.

In the drawings, A represents the casing or brick-work surrounding the boiler in the usual way, while A' A' are iron doors or removable panels secured to the front and rear thereof to give access to the ends of the tubes.

B is the bridge-wall of the furnace, C the grate, and D the furnace-door.

E represents the main tubes of the boiler, which are inclined in the usual way, the upper ends being supported upon a ledge in the wall A, the middle by the bridge-wall B, while the opposite ends are attached to and rest upon the mud-drum F. Midway between the ends are placed one or more "flame-walls," G G, Fig. 7, constructed in the usual way, which serve to support each pipe independently of its fellows, and to separate them from each other.

The pipes E are connected with each other at the respective ends in the following manner: I prefer, first, to surround the respective ends of each pipe with a re-enforcing or strengthening jacket, A, (better shown in Figs. 3 and 4,) which may be constructed of steel or malleable iron, and is provided with openings at the bottom and top to receive the connecting-pipes therein in addition to the thickness of metal of the main tube, which is pressed or formed around and within said opening. Flanges or rings h h are formed around each of the openings in said jacket, which serve to support or re-enforce the connecting-joint, as hereinafter shown. After placing said jacket H in position as indicated, oblong or elliptical perforations are made in the pipe E through the openings in said jacket, as indicated partly in full and partly in dotted line, in Fig. 4, said opening being so formed that upon drawing up that portion of said tube E to conform to the inner surface of said jacket, the edges of the pipe-opening so made may be even with the outer or flat surface of the opening in said jacket. This can be accurately determined only by actual test, as much depends upon the thickness of the metal and the extent to which the same is drawn. The contour of said opening may be assumed to be about as shown at e , Fig. 4, which shows one half of an ellipse, the remainder being indicated in dotted lines. The part shown at e indicates the perforation in the tube E before being drawn, while e' shows a part of the same pressed or formed against the wall of the jacket. Figs. 3, 5, and 6 illustrate the interior of said neck or part e' as it appears when fully drawn up and formed. This molding or conformation of the pipe E attaches the jacket H firmly thereto and prevents the latter from moving in any direction. After expanding or forming those portions above mentioned of the tubes E into said jackets H, I connect said tubes E by means of short sections or nipples I, of smaller pipe, which are preferably inserted a short distance within the parts e' , as clearly shown in Figs. 5, 6, and

8, when they may be expanded in position by means of a mandrel, thus forming a complete series of connections of the pipes themselves without any other medium, said jackets serving merely as a re-enforcement to the parts e' , which are rendered somewhat thinner by being so drawn, as well as a support to expand said metal against, while at the same time said jacket may be utilized in a simple manner for securing the cap over the end of the tube, which is accomplished as follows: Lateral openings h h (better shown in Figs. 3, 4, and 6) are made in said jackets, upon opposite sides of which, as best illustrated in Figs. 3 and 4, are formed lugs h^2 h^2 h^2 h^2 , which serve as abutments or shoulders for the lugs j j of a crab or clamp, J, Figs. 5, 7, and 8, to be secured thereto. The cap K (shown in said last-named figures) is preferably fitted to the end of the tube E, and secured in position by means of a set-screw, j' , in connection with the crab J. To place said crab in position, the set-screw is loosened sufficiently to permit it to pass freely over the plate. The arms are then projected over the jacket, as indicated in dotted lines in Fig. 8, and moved laterally, the lugs j j being passed beneath the lugs h^2 h^2 until the set-screw is in line with the tube E, when, upon being screwed up, it passes into a suitable depression in the cap K and holds the latter securely against the end of said tube.

As a modification in the construction of said jacket, the rim h may be provided with an inner projecting flange, h^3 , Figs. 11 and 12, of even thickness with the part e' , so that the latter, instead of being pressed outwardly, so as to be flush with the outer surface of said rim, may be made shorter, the pipe I, Fig. 11, having its main bearing-surface against the flange h^3 .

I do not confine myself to the use of the jacket H, as above described, as the same may be dispensed with without altering the contour of the tubes E at their connecting-points. Such a construction is shown in Figs. 9 and 10, in which the pipe E is first perforated as above set forth, after which a re-enforcing ring, h , may be placed over the neck e' , which is first formed in a suitable die, when the expansion of the nipple within said neck firmly fixes the ring in place, said ring being the equivalent of the flange h shown in the other figures. In this construction lugs h^2 h^2 may be riveted upon the pipe E in lieu of those formed upon the jacket, or portions of said pipe may be pressed inwardly to form abutments for engaging the lugs of the crab J.

After connecting the tubes E with the pipes I at their respective ends, the upper ends of the latter, at the front of the boiler, are united in like manner to a large horizontal cross pipe or drum, L, Fig. 1, which in turn is connected with the steam and water drum M by a series of long horizontal pipes, N, thereby furnishing a large separating-surface before reaching the drum M, and thus producing dry steam at the latter point, said pipes N

being intended to form the water-line of said boiler, and having a water-gage, O, Fig. 7, connected with the pipe L to indicate the the height of water in said tubes. The steam
5 and water drum M is in turn connected with the mud-drum F, Figs. 1 and 2, by means of two large pipes, Q Q, one of which is shown in said last-named figures, which form columns for the support of the former.

10 Each of the larger pipes or drums L, M, and F is provided with suitable hand-holes, *l m f*, respectively, Fig. 1, to give access thereto. A feed-pipe, R, is placed in the drum M, while an opening, S, is provided in
15 the drum F for blowing off the steam.

It is obvious that by interposing the large pipes Q Q between the drums M and F the water is more freely supplied to the lower tubes which perform the greater service, than if con-
20 nected directly with the top service of tubes.

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

1. A water-tube boiler in which the main and connecting pipes are directly united by 25 means of necks formed upon the respective ends of the former into which the connecting-pipes are expanded, said necks being surrounded by re-enforcing jackets, substantially as described, and for the purposes specified. 30

2. The combination, with the tubes E, having necks or flanges *e'* formed thereon, of the connecting-pipes I, jackets H, and caps K, with means for detachably securing the latter to the ends of said tubes, substantially as and 35 for the purposes specified.

3. In combination with the main pipes of a water-tube boiler, the jackets H, constructed substantially as and for the purposes set forth.

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Witnesses:

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