

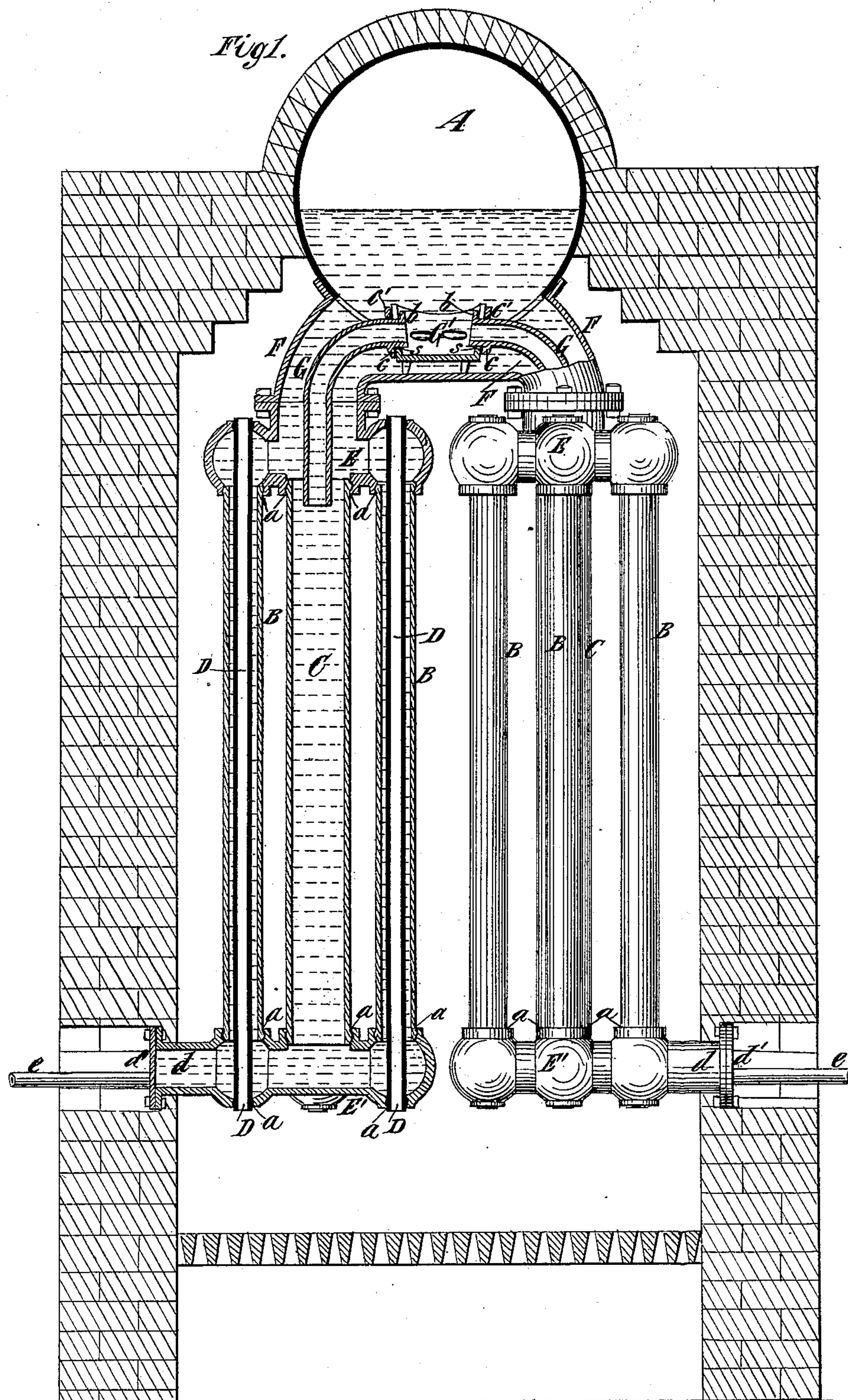
(No Model.)

2 Sheets—Sheet 1.

W. E. KELLY.
STEAM GENERATOR.

No. 246,787.

Patented Sept. 6, 1881.



Witnesses { *Thos Hays*
Ed Glatzmaier

Inventor: *Wm E Kelly*
by his Attorneys
Brown & Brown

(No Model.)

2 Sheets—Sheet 2.

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Fig 2.

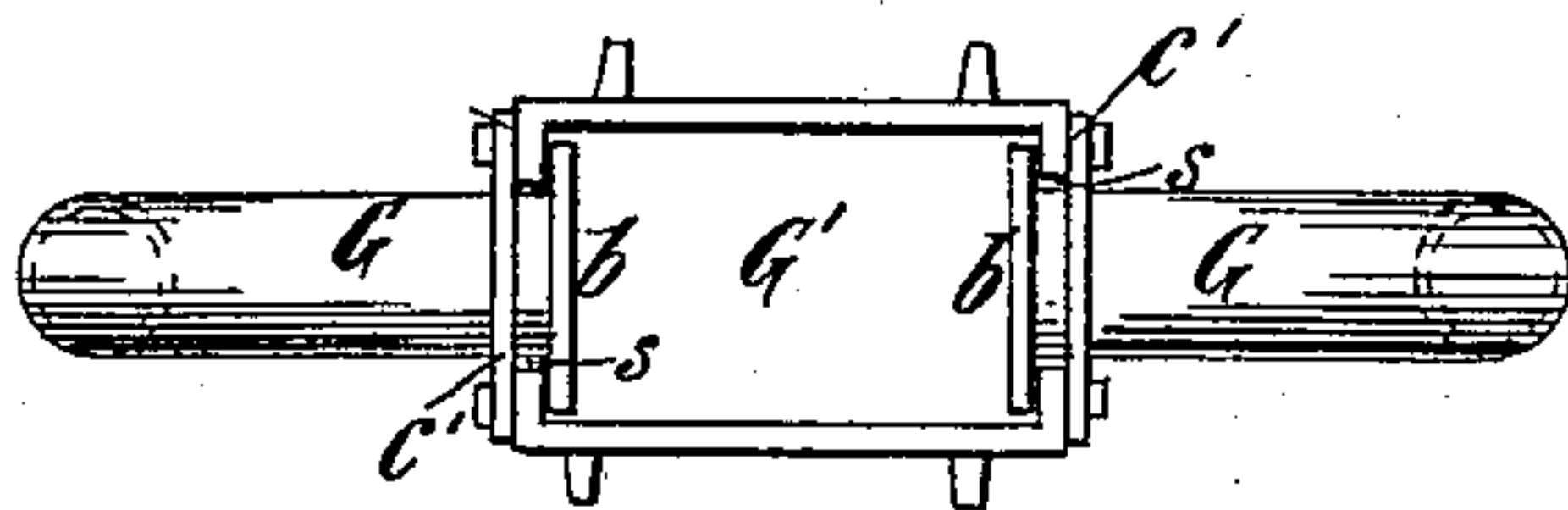


Fig 3.

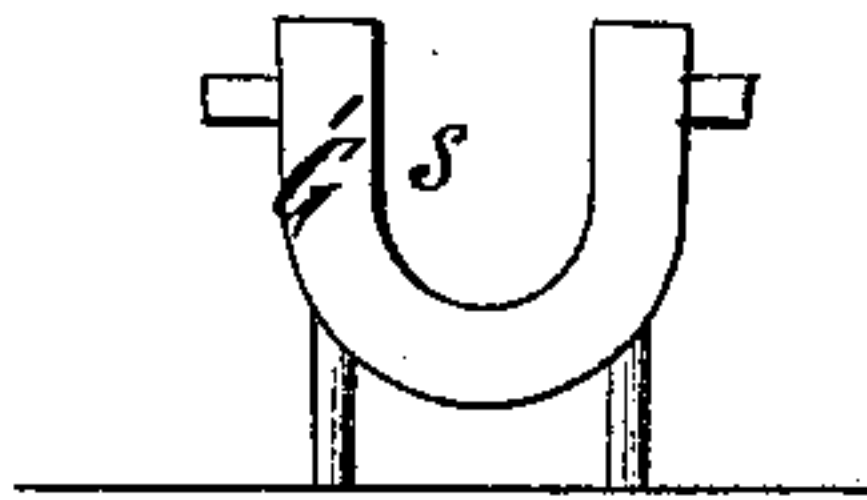


Fig 4.

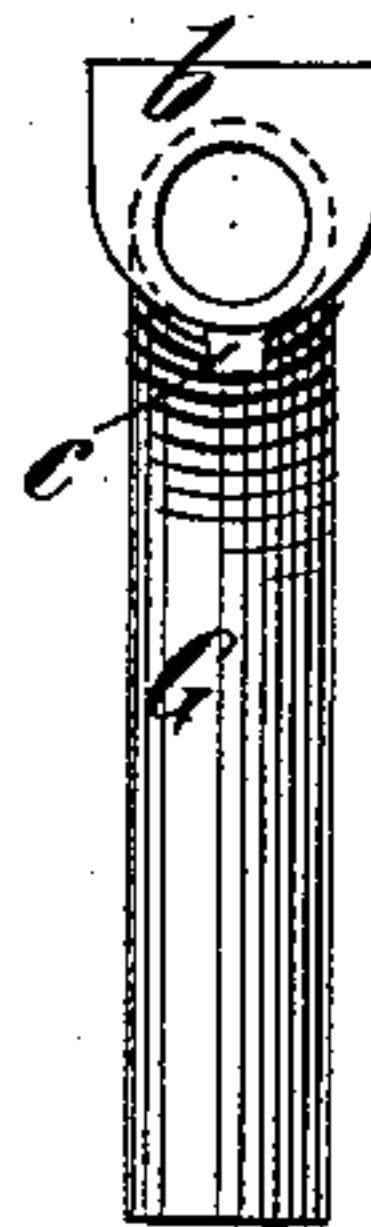


Fig 5.

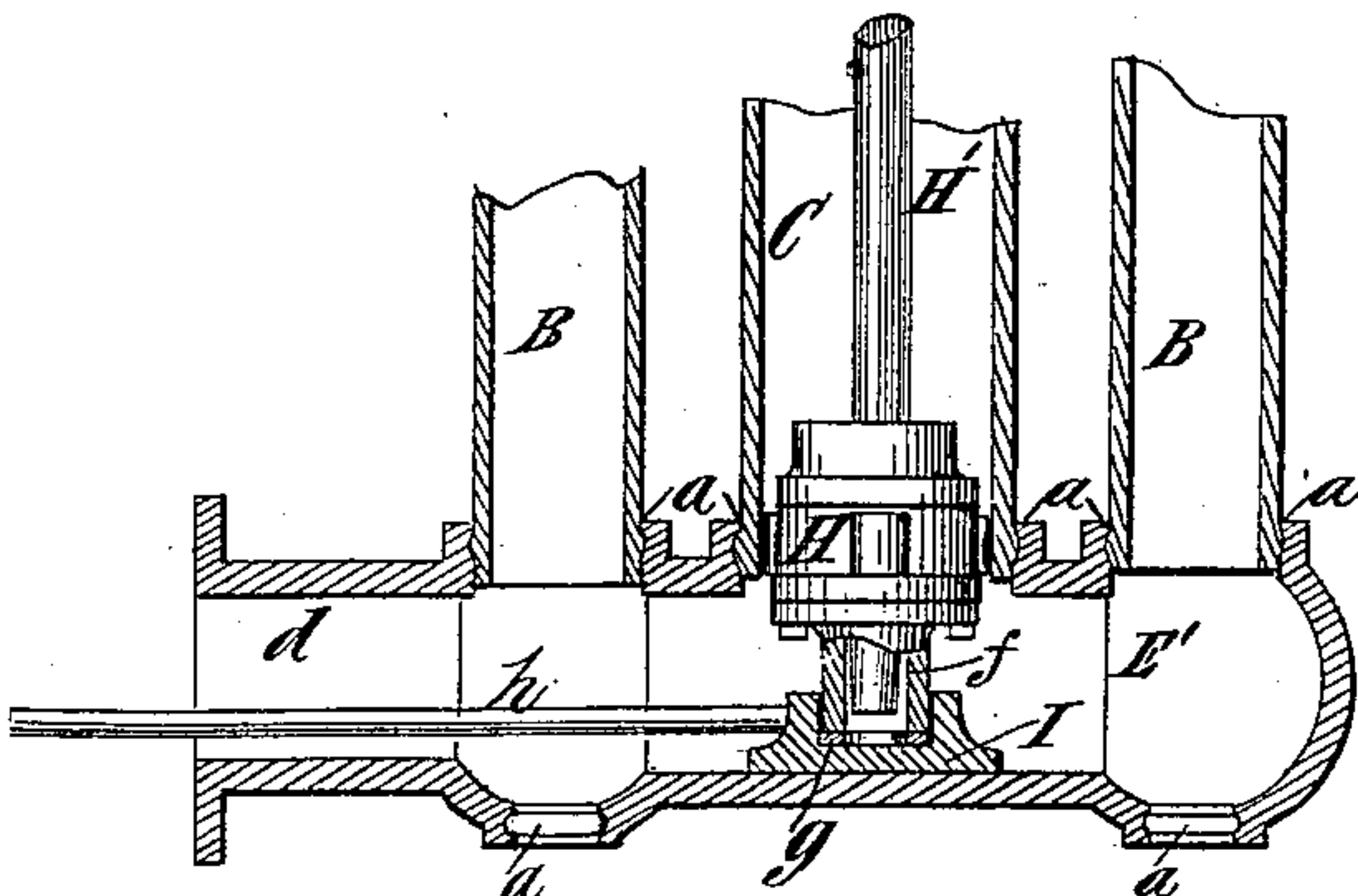


Fig 6.

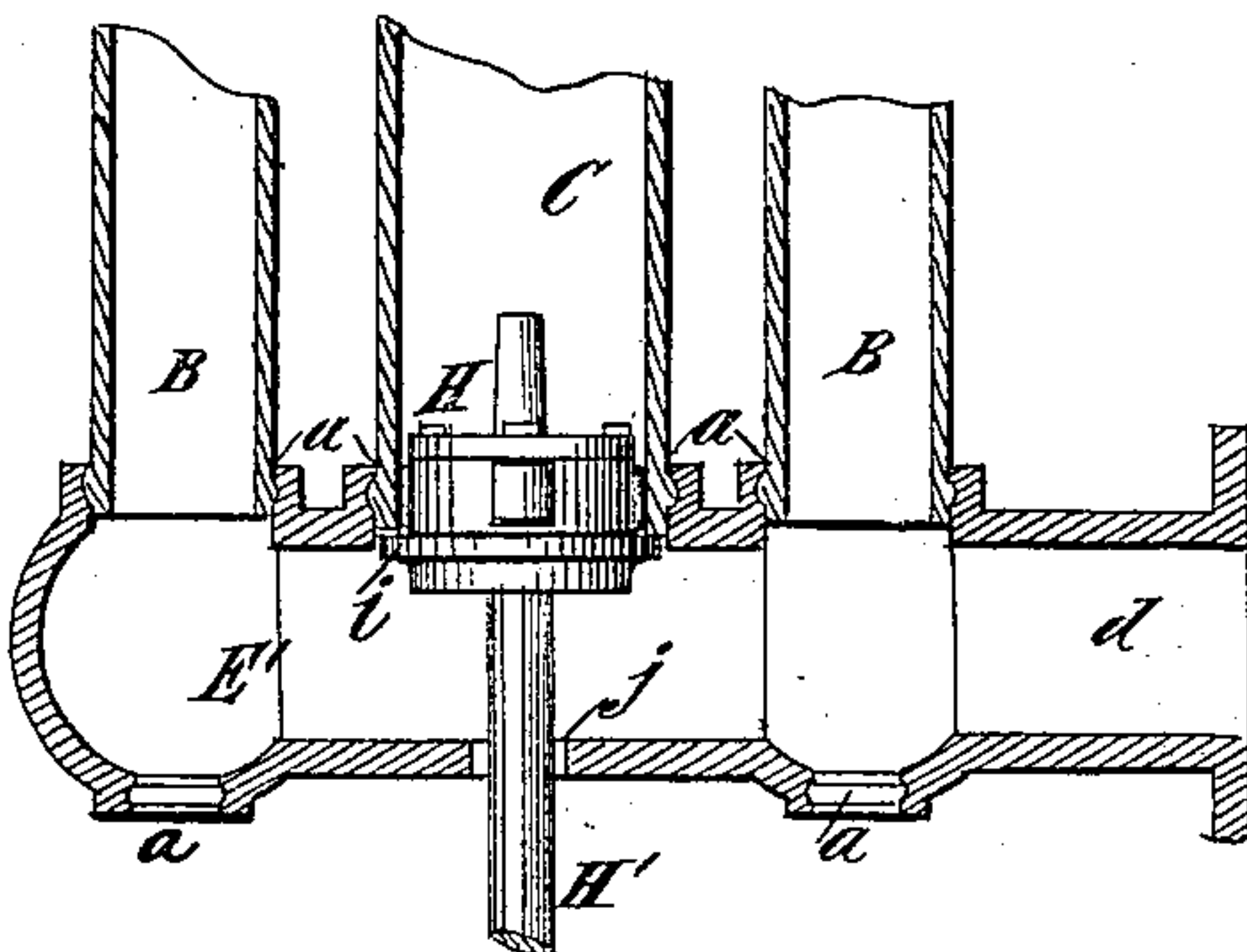


Fig 9.

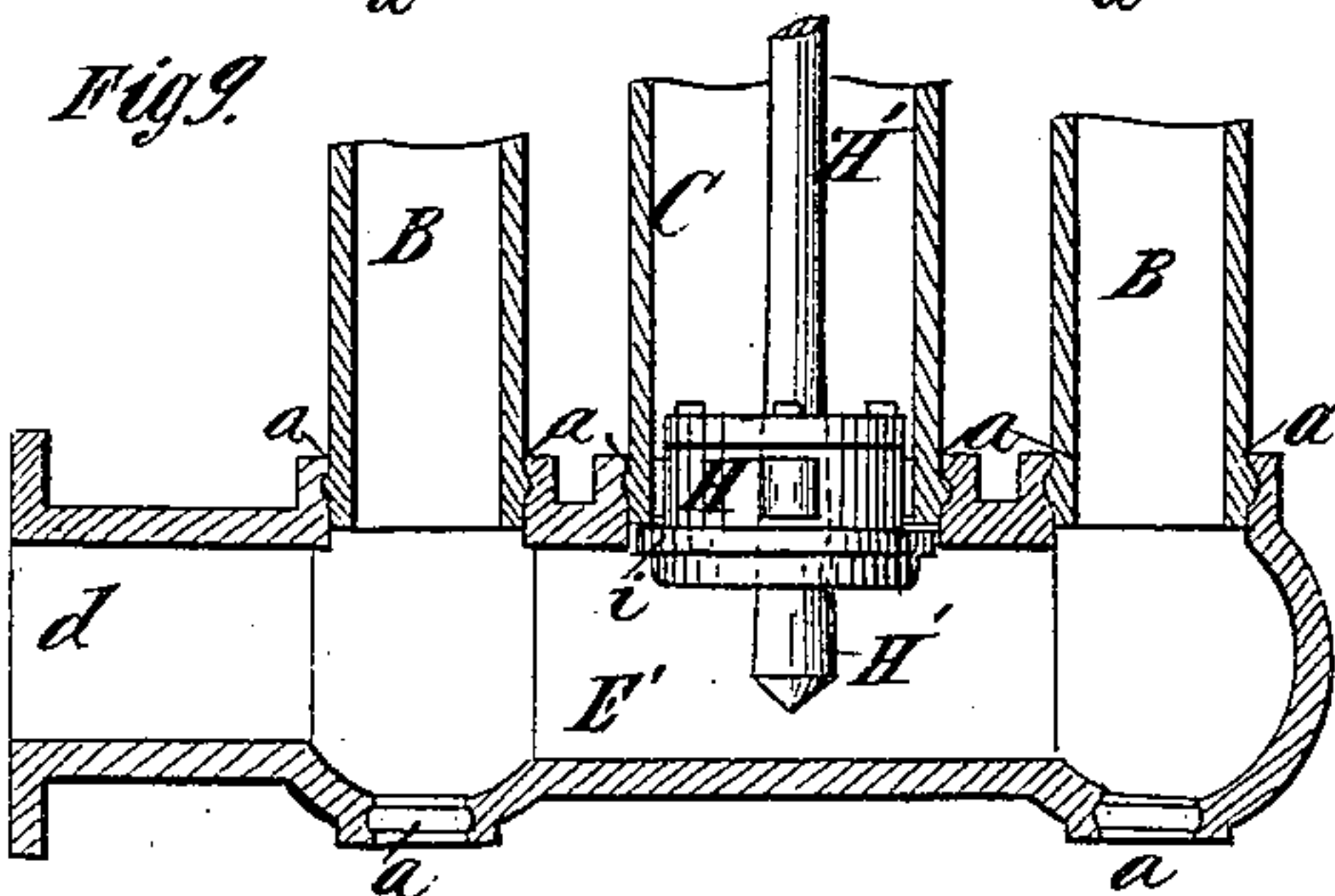


Fig 7.



Fig 8.



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Fred Hayner
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UNITED STATES PATENT OFFICE.

WILLIAM E. KELLY, OF NEW BRUNSWICK, NEW JERSEY.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 246,787, dated September 6, 1881.

Application filed March 16, 1881. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM E. KELLY, of New Brunswick, in the county of Middlesex and State of New Jersey, have invented certain new and useful Improvements in Steam-Generators, of which the following is a specification.

My invention relates, principally, to generators in which separate sections, each composed of upright pipes or tubes connected at their upper and lower ends by connecting pieces or chambers and arranged to provide for an upward and downward circulation, are combined with a common horizontal steam and water drum from which the water circulates down through certain of the pipes or tubes, and thence upward through other pipes or tubes to the drum. Frequently these sections are arranged in pairs, and those of each pair are connected with the drum by throats which lead one from each section and communicate with a single opening in the drum; and one feature of my invention consists in the combination, with a drum and a pair of sections, each connected therewith by a throat, of a circulating-pipe arranged within each throat, to provide for a circulation of the colder water down through the said pipe and a circulation of the warmer water upward around the said pipe, and a novel means of connecting and supporting the two circulating-pipes, which enables them to be readily inserted and held in proper position within the two throats. As the lower connecting pieces or chambers of some of the sections of each generator are directly exposed to the hottest part of the fire it is very desirable that all the pipes or tubes should be expanded into the tube-holes, and also that there should be no joints, or at least no flanged joints, upon their under sides; but heretofore it has been customary to make a hole in the bottom of each of the lower connecting pieces or chambers large enough to permit of a tube-expander being inserted through it, to be used in expanding the tubes in the tube-holes, and afterward to close such holes by means of blank flanges secured by bolts, which are almost certain to burn off and cause the joints to leak. This necessitates such careful attention and frequent repairs as to cause great prejudice against such generators.

The object of other features of my invention is to obviate the necessity of forming this flanged joint upon the bottom of the aforesaid lower connecting pieces or chambers; and to this end my invention consists in the combination, in a section of a steam-generator of the kind above described, with one or more of the straight pipes or tubes comprised therein, of a lower connecting piece or chamber having its lower side, which is above and exposed to the fire, closed and integral with its other parts, and an opening in its side adapted to be located within the wall of the generator, whereby an expander and appurtenances may be inserted into said piece or chamber and the expander-mandrel introduced through and operated in said tube. If a step is inserted through said side opening with the expander the latter may be supported by said step while the expander-mandrel is driven and turned from above; but if a hole be made in the bottom of the connecting piece or chamber opposite any tube or pipe the expander alone may be inserted through the side opening and the expander-mandrel driven through said hole, and the hole afterward closed by a screw-plug or a safety end. By this means I obviate the necessity of any flanged joint which will immediately come in contact with the fire and be apt to entail leakage.

In the accompanying drawings, Figure 1 represents a transverse vertical section of a generator-drum and a pair of sections depending therefrom, and one of which is shown in section. Fig. 2 represents a plan of the two circulating-pipes between the drum and sections and the means whereby they are connected and supported. Fig. 3 represents an end view of the piece with which said pipes are connected. Fig. 4 represents an end view of one of the circulating-pipes. Fig. 5 represents a vertical section through a lower connecting piece or chamber upon a larger scale, and also representing an expander, which is used to expand the pipes or tubes. Fig. 6 represents a similar section, showing another way in which an expander may be worked. Figs. 7 and 8 represent two different ways of closing a small hole in the connecting pipe or chamber when the expander-mandrel is withdrawn through the bottom of the connecting

piece or chamber; and Fig. 9 represents a view similar to Figs. 5 and 6, showing still another way of working an expander.

Similar letters of reference designate corresponding parts in all the figures.

A designates a horizontally-arranged steam and water drum, from which depend separate sections, arranged in pairs, and each composed of pipes or tubes B C, fire-tubes D, and upper and lower connecting pieces or chambers, E E'. The pipes or tubes B are shown as somewhat smaller than the pipe or tube C, and are arranged in a group or series around the latter, and both the pipes or tubes B and C are expanded into tube-holes *a* in the lower side of the upper connecting piece or chamber, E, and the upper side of the lower piece or chamber, E', and all communicate with each other through said connecting pieces or chambers. The fire-tubes extend through the pipes or tubes B and also through both connecting pieces or chambers, and are expanded into tube-holes in the latter. It is obvious that the water in the tubes B will be more affected by heat than that in the tube C, and consequently an upward circulation will take place through the tubes B and a downward circulation through the tube C. Each section communicates with the drum A by a throat, F, and, as here shown, both throats are formed in a single casting, and both communicate with a common hole or opening in the drum.

While the generator is in operation a constant current of cold water downward through each throat F is taking place, and also a constant upward current of warmer water; and to prevent the two currents from conflicting, and thus producing a violent agitation, which causes the generator to prime or make wet steam, I arrange a circulating-pipe, G, in each throat F, through which the downward circulation will take place, while the upward circulation takes place around it.

In order to provide for conveniently placing the two pipes in position, and also for supporting them, I employ a box or trough, G', which has an open top and stands or rests upon the casting in which are the two throats, as seen in Fig. 1. Both circulating-pipes G are detachably connected with the box or trough G' in a manner clearly shown in Figs. 1 to 4, and as they balance each other neither they nor the box or trough need any other support. In each end of the box or trough G' is a U-shaped recess or opening, *s*, and the pipe F fits loosely therein, and is provided with a flange, *b*, which fits inside the box or trough and prevents the circulating-pipe from outward movement, and also with a lip, lug, or stop, *c*, which bears upon the outside of the box or trough and keeps the pipes from tilting. In order to hold the pipes F more securely I may arrange a bar, *c'*, above each pipe F and bolt said bar to the box or trough.

As shown in Fig. 1, but more clearly in Figs. 5 and 6, the tube-holes *a* in the connecting

pieces or chambers E E' have in them annular grooves or concave depressions, into which the tubes are forced by the action of the tube-expander, thus forming an annular enlargement or bead upon the tube. This enables the tubes to serve the purpose of stay-bolts, strengthening the sections and resisting the pressure of the steam in opposite directions upon the pieces or chambers E E', which would otherwise tend to force them apart. When the tubes are expanded into such annular grooves or recesses the longitudinal expansion of one of the tubes more than another cannot cause a leak, because by such expansion the bead or enlargement upon the tube will be forced more tightly against one side of the groove or recess, while a strain from contraction will cause the bead or enlargement to bear tightly upon the other side of the groove or recess.

In order to permit of an expander being introduced into the lower connecting piece or chamber, E', for expanding the lower end of the tube C into its tube-hole, it has been usual to form the said piece or chamber with a hole in its bottom or under side large enough to permit the expander to pass through, and after the tubes are expanded to close said hole by a blank flange bolted on. This flanged joint is, in many of the sections of each generator, directly over the hottest of the fire, and the bolt-heads soon burn off and cause the joint to leak, requiring constant attention and frequent repair.

In Figs. 5 and 6 I have represented two modes of operating the expander, which avoid the necessity of a flange-joint in the connecting piece or chamber, and which I will now describe. In each case the lower connecting piece or chamber has an opening and an elongated horizontal neck, *d*, upon its outer side, which is sufficiently long to extend into the brick-work, as seen in Fig. 1, where it will be out of reach of the fire, and which is closed by a blank flange, *d'*, through which may be inserted the feed-pipes *e*, or pipes connecting the several sections of a generator.

In the mode of operation shown in Fig. 5 the expander H is inserted through the neck of the upper connecting piece or chamber, E, and is passed down through the tube C, and the expander-mandrel H' is likewise driven in and turned from the upper end of the tube. In order to hold the expander H in the proper vertical position to enable its rollers to act at the proper point in the tube, I employ a step-bearing, I, which receives a sleeve, *f*, bolted to the lower side of the expander, and contains a loose washer, *g*, which receives the thrust of the expander-mandrel, and upon which the sleeve *f* and expander turn. The step I may be attached to a handle, *h*, and is inserted and withdrawn through the open neck *d*, and may be considered as one of the appurtenances of the expander. In this example of my invention no opening whatever is necessary opposite the tube C, and the bottom or under side of the

piece or chamber E' is closed and integral with the other parts thereof.

In Fig. 6 the expander H is itself inserted through the open neck *d*, and is provided with the usual collar, *i*, which bears against the end of the tube and holds the expander in position. In this instance there is a small hole, *j*, opposite the tube C, through which the expander-mandrel H' is inserted, and after completing the operation of expanding the tube said hole may be tightly and permanently closed by a screw-plug, *k*, as shown in Fig. 7, or by a safety end, *l*, expanded into the hole, as shown in Fig. 8.

By constructing the lower connecting-piece, E', with the large opening in its side, which is entirely out of reach of the fire, and through which either the expander itself or its supporting-step may be inserted, I remove one of the great objections which has hitherto existed in boilers of this class, and increase the durability and reliability of the boiler. The opening *d* may with advantage be oval, with its major axis in a horizontal plane to readily receive the expander or its step-bearing. The opening *d* also provides for examining the interior of the lower connecting-pieces and for thoroughly cleaning them out.

Fig. 9 represents a lower connecting piece or chamber, E', exactly like that shown in Fig. 5, and the object in this case is to dispense with the step-bearing I, (shown in Fig. 5.) To effect this I make the expander-mandrel H' with a reverse taper, or tapering upward from its lower end, and the expander-rollers are forced out by drawing the expander-mandrel upward instead of forcing it downward. The expander itself in this case is inserted through the open neck *d*, and the mandrel H' is thrust down the tube C and passed entirely through the expander. The expander is then raised and inserted into the end of the tube, and by a screw or other means the mandrel is drawn up to force the rollers outward and expand the tube.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a steam-generator, the combination, with a drum and a pair of sections, each connected therewith by a throat, and comprising

tubes or pipes providing for an upward and downward circulation, of a circulating-pipe arranged within each throat, and an open-top box or trough in said drum, with the opposite ends of which said circulating-pipes are connected, substantially as and for the purpose specified.

2. The combination of the box or trough G', having U-shaped recesses *s* in its ends, and the circulating-pipes G, having flanges *b* and stops *c*, substantially as specified.

3. The combination, in a steam-generator, of the chamber E' and the straight pipe or tube C, the chamber E' having its lower side, which is above and exposed to the fire, closed and integral with its other parts, and an opening in its side adapted to be located within the wall of the generator, whereby an expander and appurtenances may be introduced into said chamber and the expander-mandrel introduced through and operated in said tube, substantially as specified.

4. The combination, in a steam-generator, of the chamber E', the straight pipe or tube C, and the chamber E, the chamber E' having its lower side, which is above and exposed to the fire, closed and integral with the other parts, and an opening in its side adapted to be located within the wall of the generator, whereby provision is afforded for introducing an expander and appurtenances and operating the expander by a mandrel introduced through said pipe or tube, and the chamber E having an opening in its top, through which the expander-mandrel may be inserted and operated, substantially as specified.

5. The combination, in a section of a steam-generator, of pipes or tubes providing for an upward and downward circulation, and a connecting piece or chamber having an opening in its side of sufficient size to permit of the introduction of a tube-expander, and having in its bottom or under side a hole for the insertion of an expander-mandrel, substantially as and for the purpose specified.

WILLIAM E. KELLY.

Witnesses:

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ED. GLATZMAYER.