

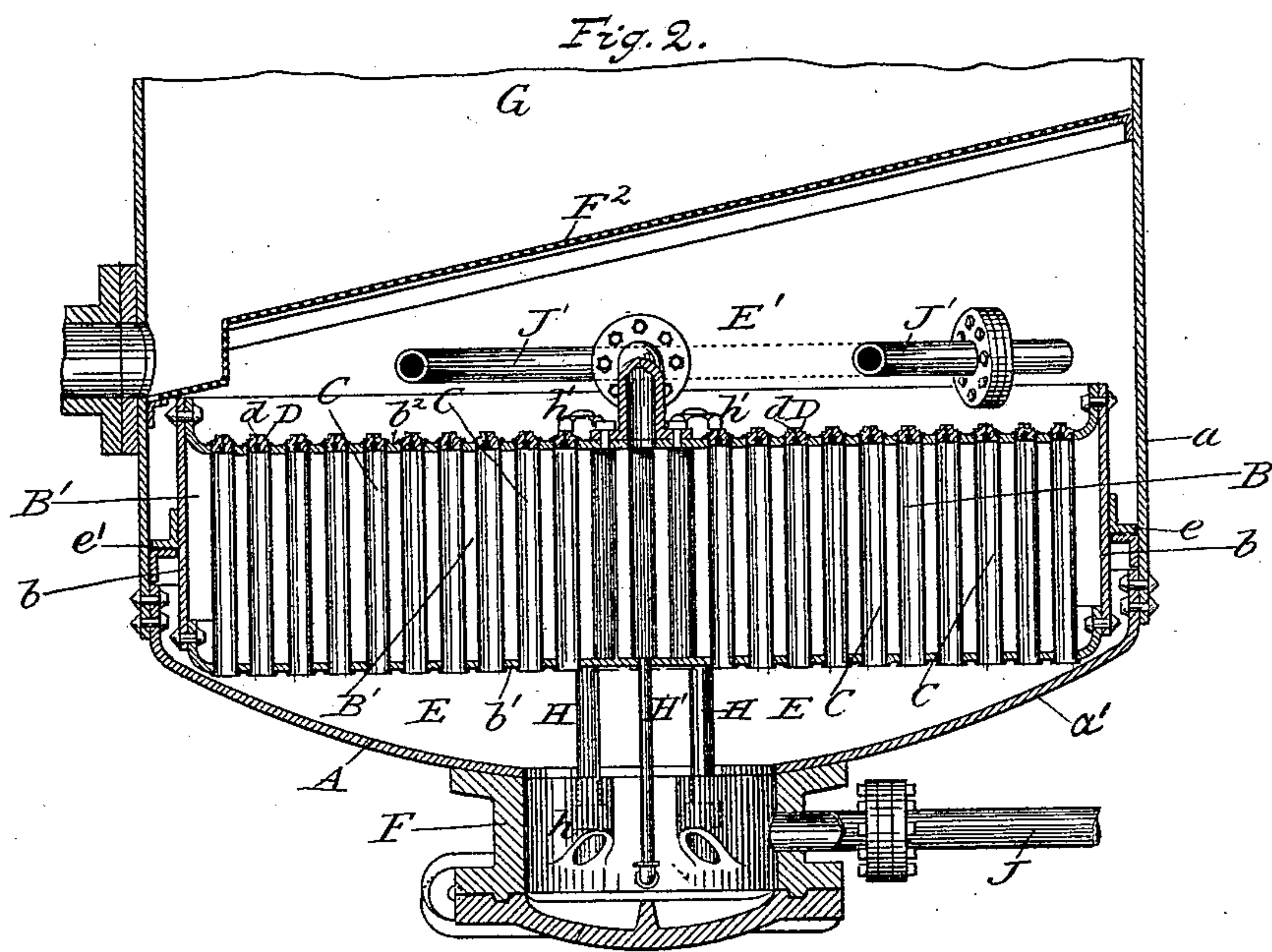
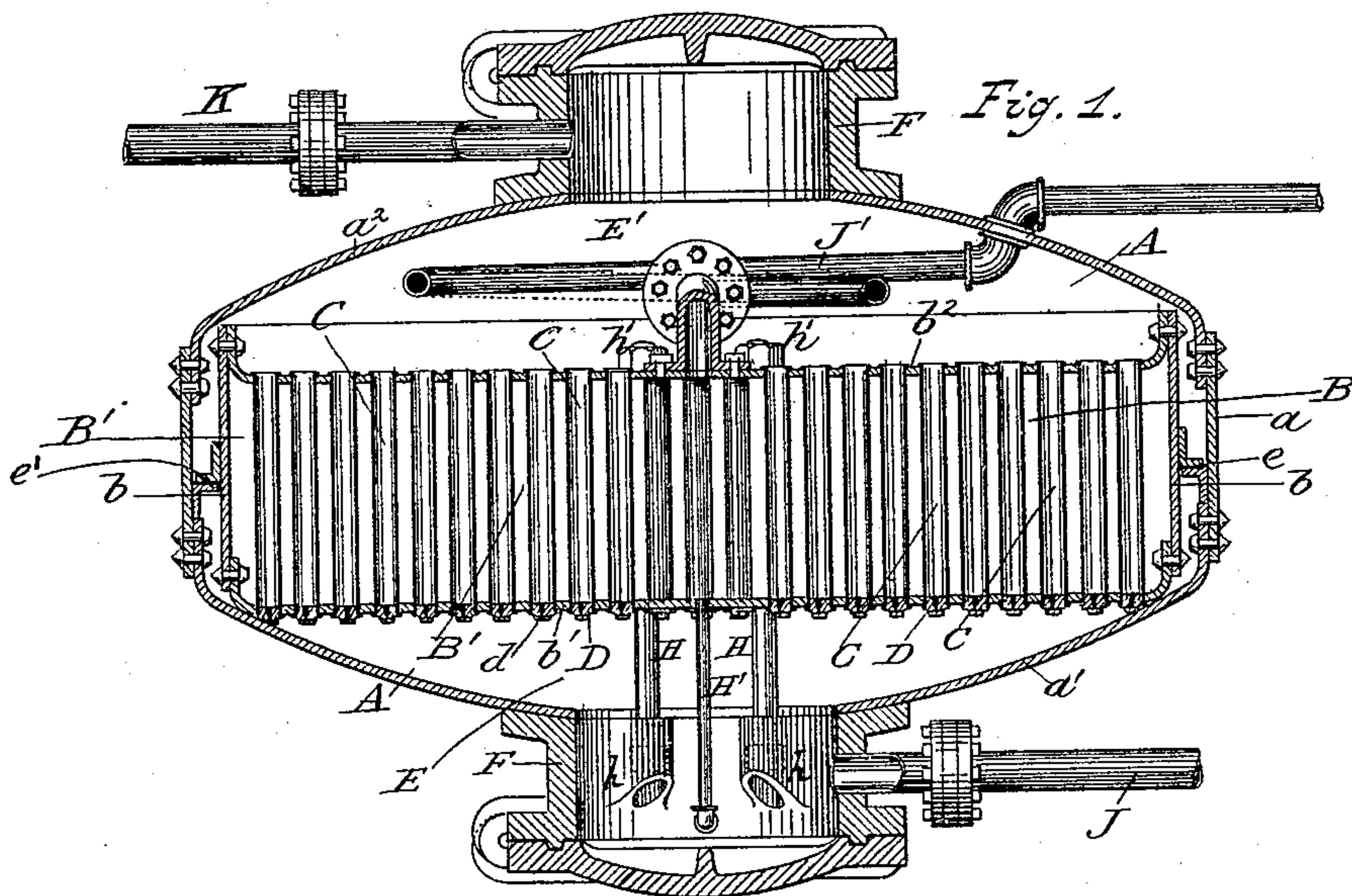
(No Model.)

2 Sheets—Sheet 1.

A. SELKIRK.
DEVICE FOR HEATING LIQUIDS.

No. 481,151.

Patented Aug. 16, 1892.



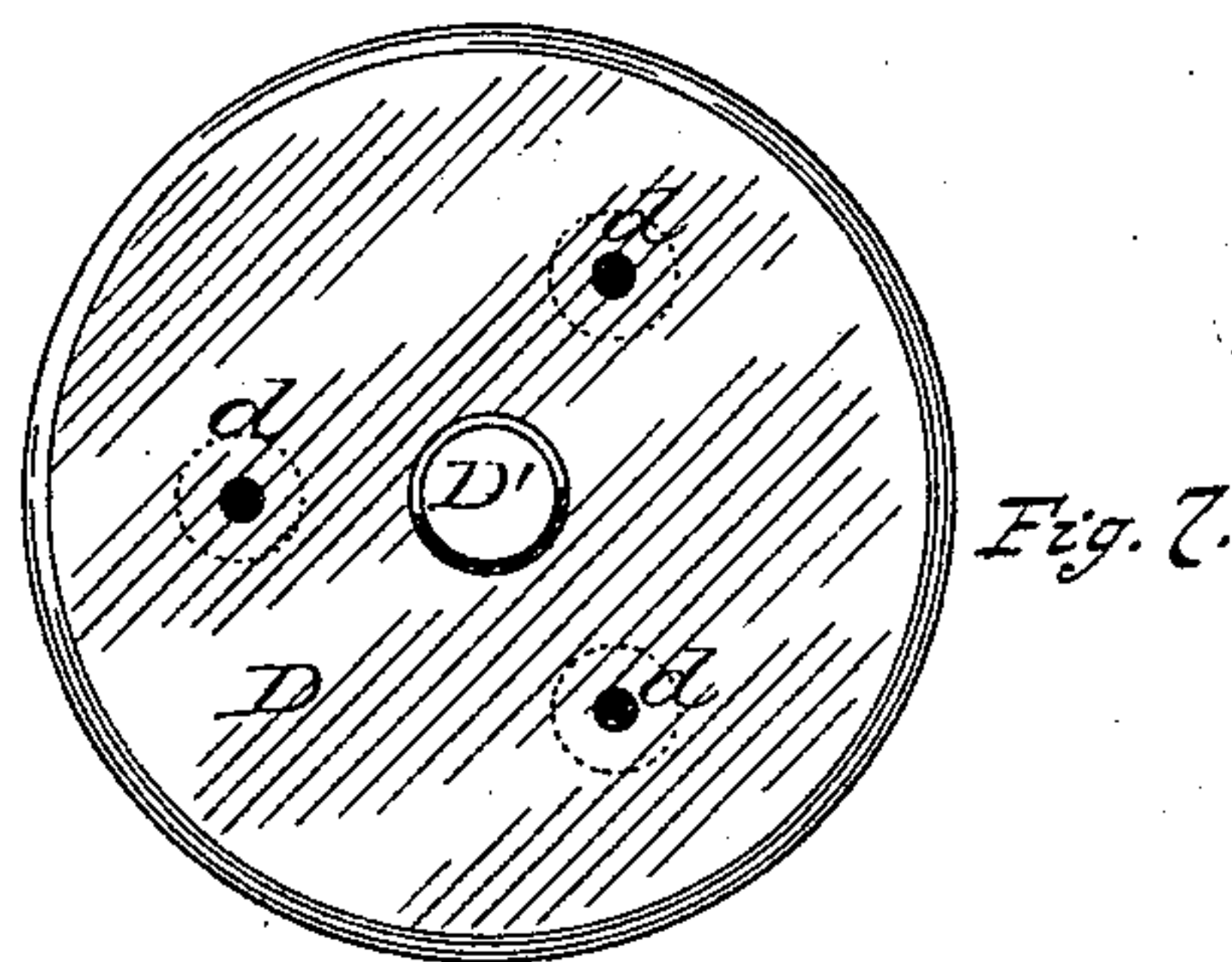
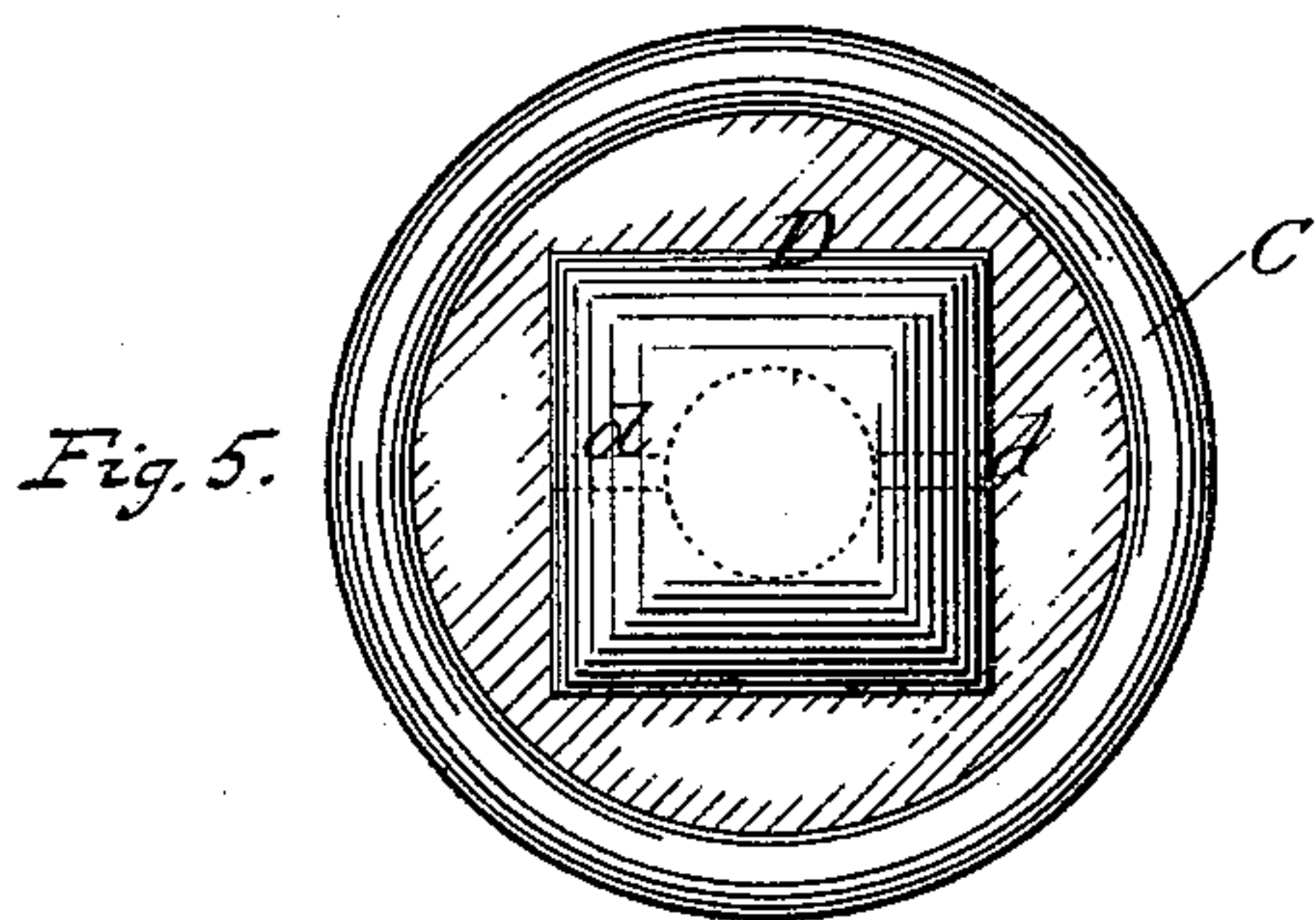
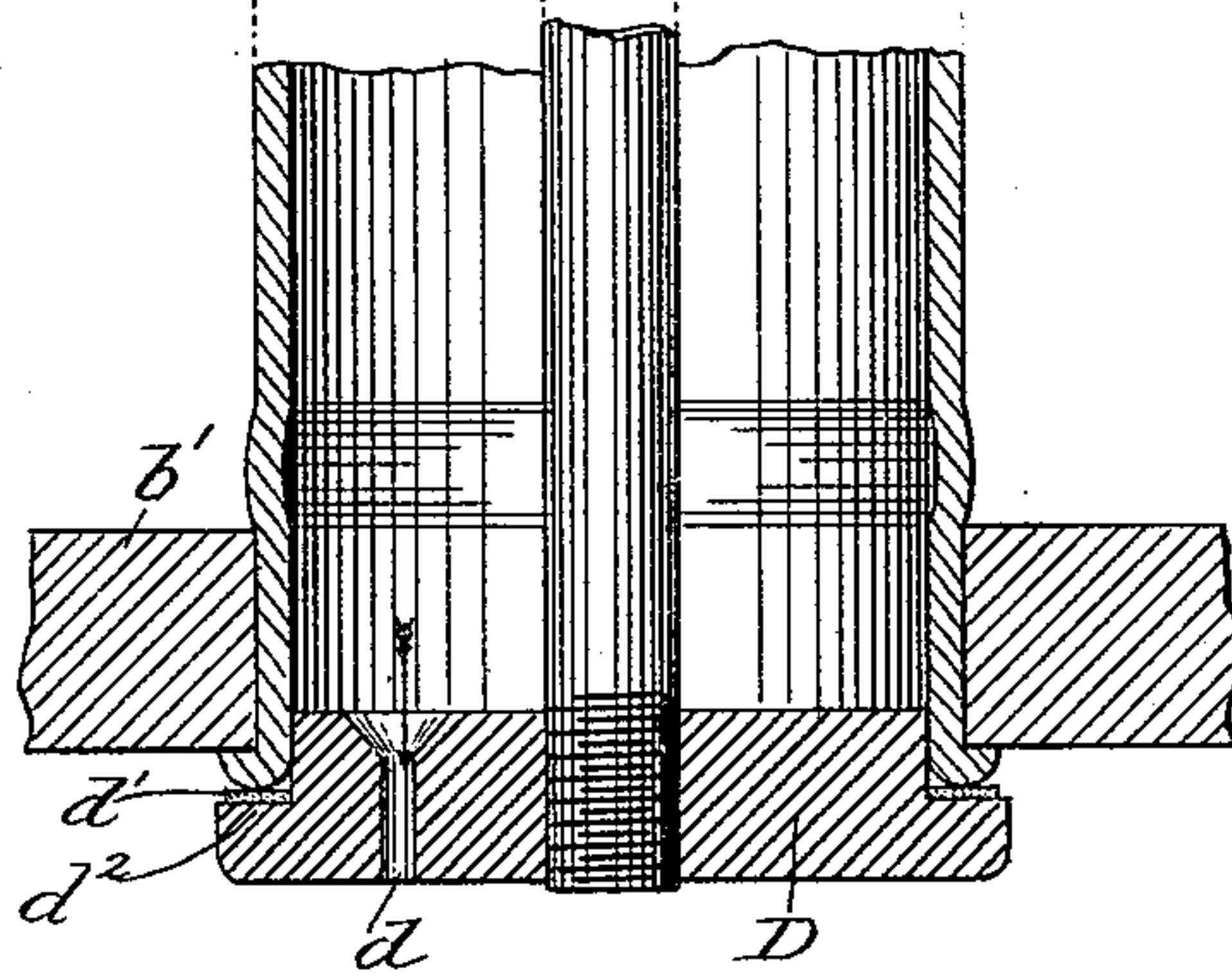
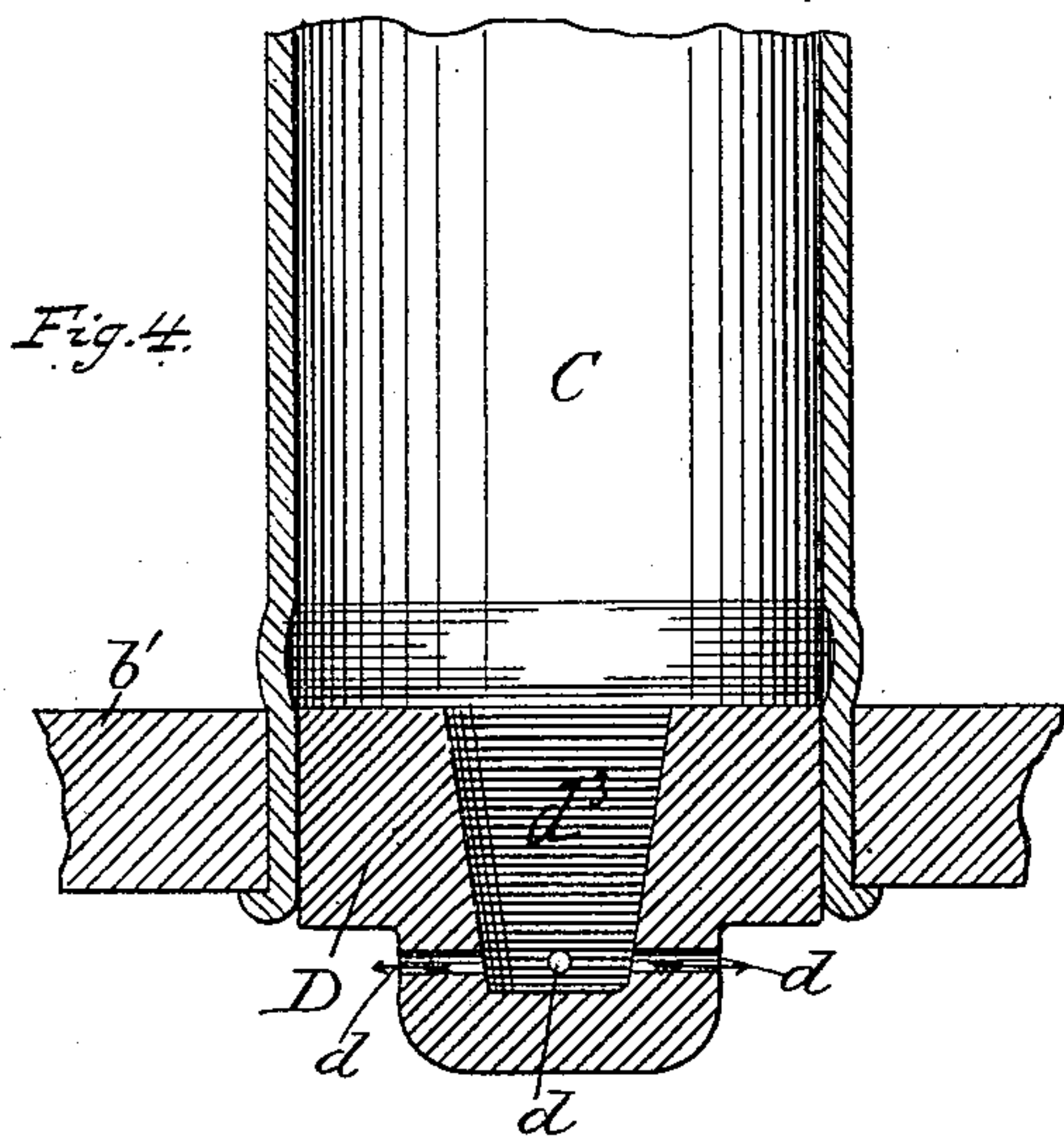
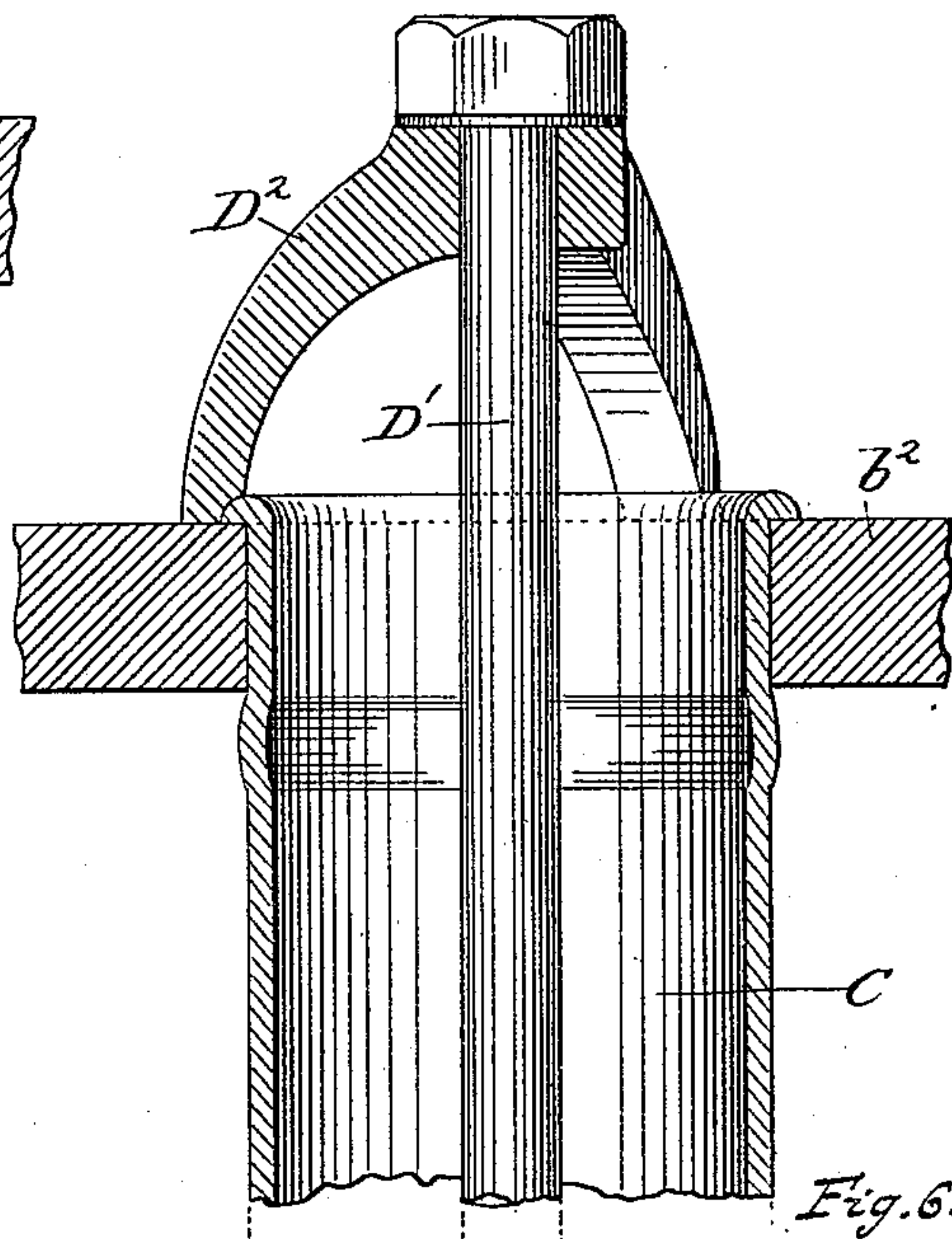
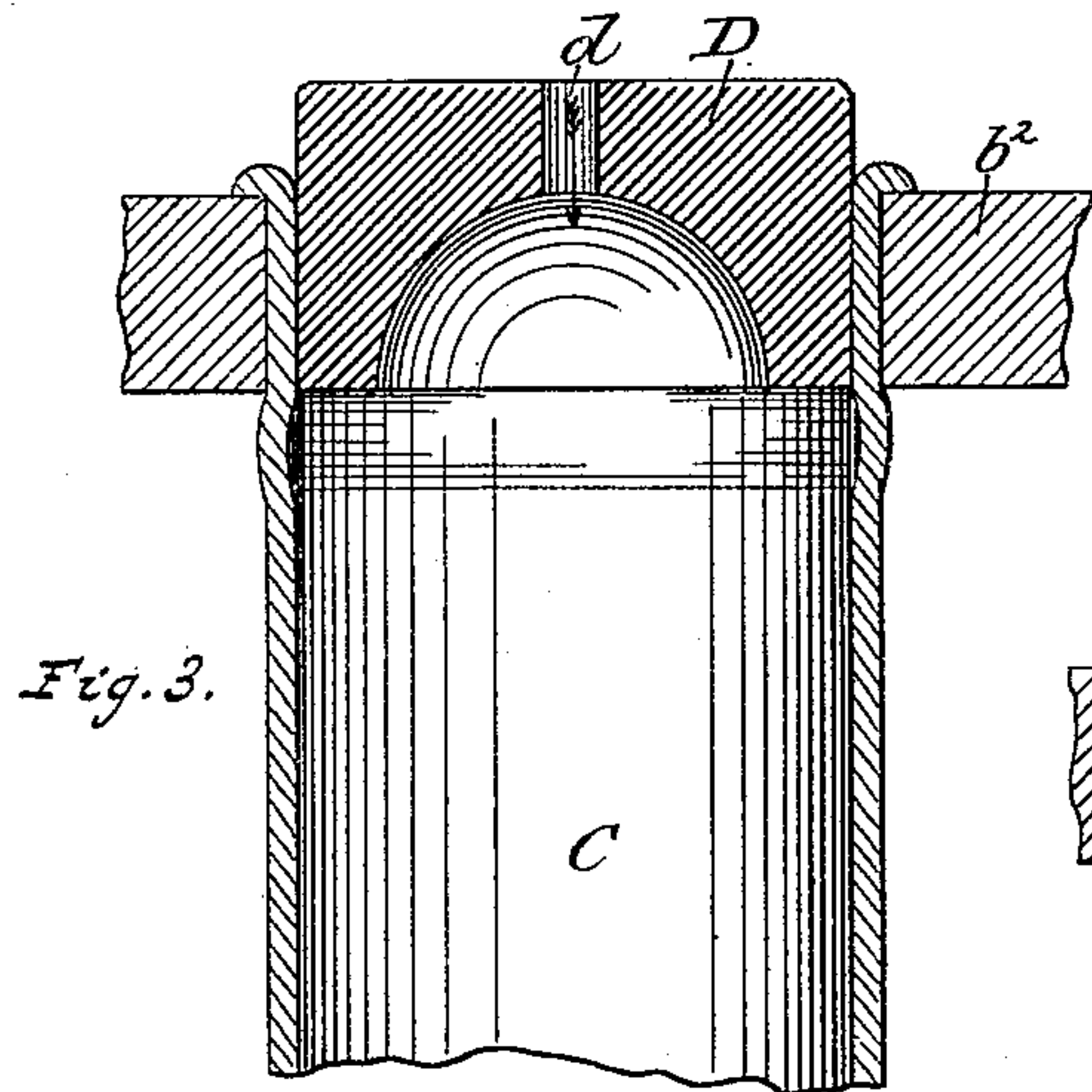
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Inventor.

UNITED STATES PATENT OFFICE.

ALEXANDER SELKIRK, OF ALBANY, ASSIGNOR, BY MESNE ASSIGNMENTS, TO
ROBERT WHITEHILL AND DANIEL WARING, OF NEWBURG, NEW YORK.

DEVICE FOR HEATING LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 481,151, dated August 16, 1892.

Application filed May 31, 1889. Renewed January 28, 1892. Serial No. 419,544. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER SELKIRK, a citizen of the United States, residing at Albany, in the county of Albany and State of New York, have invented certain new and useful Improvements in Devices for Heating Liquids, of which the following is a specification.

My invention relates to devices for heating and reheating water and liquids, and, although adapted for general use, is especially intended for use in connection with digesting apparatus, and particularly as described in application, Serial No. 312,750, filed even date herewith, and shown in application, Serial No. 301,877, filed March 5, 1889; and it consists of the combinations of devices or elements hereinafter particularly described, and specifically set forth in the claims.

The object of this invention is to provide, in a liquid-heating device having tubes for the passage of liquids and which are heated by steam or other agent, means for producing in said liquor-tubes, without lessening the areas of their heating-surfaces, suitably-reduced passage-ways which will operate to induce a uniform distribution of the water or liquid to be heated to all of the said tubes, so that a like volume of liquid will have passage through each tube and the time of passage of the liquid through each tube will be the same as that of the passage of the liquid through the others, thereby causing the heating device to be more effective than under the form of construction heretofore had, and in which the tubes, acting as heating devices and receiving and discharging the liquids, are free passage-ways of capacity corresponding with their bores, which latter in most of the older constructions are of capacity as large or nearly as large as either the inlet or outlet pipes of the liquid-heating device, and, further, to provide combinations of devices and parts by which my invention can be carried into practice.

In the accompanying drawings, forming a part of this specification, Figure 1 represents a sectional elevation of a liquid-heating device embodying my improvements and provided with means for access to the liquid-chambers of the device and for the delivery

of liquid into the heater and its withdrawal therefrom. Fig. 2 is a sectional elevation of the liquid-heating device and illustrating it to be contained within the lower end of a digesting-vessel. Fig. 3 is a sectional elevation of an upper end portion of a liquor-circulating tube and illustrating a perforated plug applied thereto. Fig. 4 is a sectional elevation illustrating a modification of the perforated plug and its application to the lower end of the tube. Fig. 5 is an end view of the perforated plug shown in Fig. 4. Fig. 6 is a sectional elevation of the liquor-circulating tube having a modified form of the perforated plug and device for holding the same in place. Fig. 7 is an end view of the perforated plug shown in Fig. 6.

The same letters of reference refer to like parts throughout the several views.

In the drawings, A represents any suitable shell-form receptacle (which can be made of iron, steel, or other suitable material) having its parts secured together in a steam and liquor tight manner and with strength sufficient to resist the internal pressure to which the heater may be subjected. In Fig. 1 this receptacle is shown to be formed of the cylindrical wall a and end walls or heads a' and a^2 and provided with covered manholes F for access to the interior either from above or below, as may be required, for effecting repairs of parts or other purposes. These covered manholes can be made with any suitable form of construction and are applied and secured to the heads a' a^2 in a steam and water tight manner. In Fig. 2 the cylindrical wall a and lower head or end wall a' are shown to be formed by the lower end portion of the cylindrical wall and the lower end head of a digester of the class illustrated and described in the applications hereinbefore referred to. In this figure there is substituted for the solid end wall or head a^2 (shown in Fig. 1) the perforated plate F, Fig. 2, forming the bottom of the digesting-chamber of the digester, which perforated plate forms, with walls a and a' , a suitable receptacle for containing the steam heating-vessel B when constructed as a separate vessel.

Within the receptacle A are heads b' b^2 , which may be securely joined by rivets in a

steam-tight manner with the cylindrical wall a , but as shown are secured to a separate cylinder b by rivets. These heads $b' b^2$, together with the cylinder they are secured to, form a vessel containing the steam or other well-known heating agent used for heating liquids, and, as shown, the heads $b' b^2$ and cylinder b together form the vessel B, separate from the receptacle formed of the cylinder a and end walls $a' a^2$ or plate F, as illustrated, respectively, in Figs. 1 and 2.

C C are tubes of such diameter and length as may be preferred or found to be necessary to be used to furnish a sufficient heating-surface through which the heating agent may act for heating the water or liquid in its passage through said tubes. These tubes are employed in a group or series arranged at intervals, but as closely together as the metal of the heads $b' b^2$ will permit and yet retain sufficient strength to resist the pressure to which they may be subjected, and they are secured in place by having their end portions, after passing through nicely-fitting perforations made, respectively, in said heads, expanded, as is generally practiced to produce strong and steam-tight joints of tubes with heads.

The vessel B, formed of the cylinder b , heads $b' b^2$, and the group of tubes C C, is shown in Figs. 1 and 2 to be supported within the receptacle A (formed in each case as above described) from the cylindrical wall a by means of the flanged rings e' and e , suitably secured one to the cylinder a and the other to cylinder b , with the horizontal flange of ring e resting on that of the ring e' and having, preferably, a suitable gasket or packing between them, and although these rings $e e'$ operate as a means for supporting the vessel B within its receptacle A, yet they operate together to stop all communication between the liquor-chambers E E', except through the tubes C. When the heads $b' b^2$, having in them the tubes C, are securely joined, as they may be, with the cylindrical wall a instead of to the cylinder b , (as is frequently done in the construction of feed-water heaters,) the use of these rings $e e'$ will be obviated and no communication between the liquor-chambers E and E' will be had, except through the tubes C C.

J and K, Fig. 1, are respectively inlet and outlet pipes for leading the water or liquids to be heated into and from this liquid-heating apparatus.

D is a perforated plug, which is applied to each one of the many tubes C for producing in each a reduced passage-way through which the water or liquid can escape or press from one liquid-chamber E to the other E'. These perforated plugs can be made of any suitable metal and nicely fit the bores of the said tubes. The perforations d in these plugs D are substantially of like size and of such smaller area in proportion to the area of the inlet or outlet pipes J and K, respectively, that the aggregate areas of the whole number of per-

forations d in said plugs D will be about equal to the area of one of said pipes J and K and cause the liquid as it is received into this liquid-heating device to have a continuously-uniform distribution to the tubes C C, and thereby prevent only a small number of the tubes from delivering the liquid rapidly from one liquid-chamber to the other. When this liquid-heating device is used in connection with a digester or analogous vessel and is contained within such vessel, as illustrated in Fig. 2, these plugs D, perforated, as described, for producing in the liquid-heating tubes C the reduced passage-ways d , can be inserted in the said tubes from either end, but are preferably used seated in their upper ends, as shown in that figure. When the device is used as shown in said figure, the liquor is passed upwardly from chamber E through said tubes to the chamber E', between the upper side of the steam-heating vessel B and the perforated plate F, through which plate the heated liquor will have passage into the digesting-chamber G above, instead of through an outlet-pipe, when this liquor-heating device is exterior to the vessel it is intended to be used with.

When the liquid-heating device shown in Fig. 1 is located exterior to a vessel in connection with which it is to be used, either the pipe J may serve as an inlet-pipe for the passage of the liquid to be heated and the pipe K as a discharge-pipe for conveying the liquid after being heated into the vessel where it is to be used or, if desired, the pipe K may be used as the inlet-pipe, in which event the pipe J will operate as the discharge-pipe.

When employing this device in connection with another vessel for heating liquids to be circulated through such vessel, (as in the case of my application, Serial No. 312,750, filed on an even date with this application and hereinbefore referred to,) a pump may be connected with the pipe J if the pipe K is to be used as the inlet-pipe of the heating device or with the pipe K if the pipe J is to be used as the inlet-pipe, as above indicated, so as to induce a draft of the water or other liquid from said vessel through said heating device, and thence to the pump, to be returned to the said vessel from which it was drawn; or, instead of causing a flow of the liquid through the heating device by induction, the pump can be so interposed between the latter and the vessel as to draw the liquid from said vessel and then force it through whichever of the pipes J or K as may be used as the inlet-pipe into said heating device, and thence into the vessel again from which it was drawn, thereby producing a circulation through the heating device in a direction the reverse of that had by the induced draft of the liquid through it.

As before stated, the perforated plugs D can be set in either end of the tubes C, as preferred, the drawings showing them in Fig. 1 to be seated in the lower ends of the tubes,

with provision for the passage of the water or liquor into this heating device from either direction. In Fig. 2 these perforated plugs are shown to be seated in the upper ends of the tubes, with provision for the passage of the liquid in an upwardly direction only; but it is to be understood that I do not confine myself to any particular place or situation of these perforated plugs in these tubes C, but would apply them to the same from either end, accordingly as the nature of the operations of the liquid to be heated may require for producing advantageous results. When the volume of water or liquor to be heated is very considerable and is to have an upward movement through this heating device into a chamber above, as into chamber G in Fig. 2, I prefer to set these perforated plugs into the upper ends of the tubes C; but when the volume of liquor to be heated is comparatively small and its passage through the device is comparatively slow I prefer to apply these perforated plugs to the lower ends of the tubes C, as illustrated in Fig. 1.

In Fig. 3 the perforated plug is shown to be applied in the upper end of the tube C, as in Fig. 2, where it is intended the water or liquid is to be forced upwardly, as before described. In this situation the perforated plug is effective to produce a diffusive circulation of the liquid through all the tubes C in the heater when the volume to be heated is large and is forced under pressure in direction of arrow 1 in Fig. 3 to have a passage into the vessel intended to receive the heated liquid. In this situation of the perforated plug D in the upper end of tube C (when the direction of the passage is downwardly through the perforation d , as indicated by arrow 1 in Fig. 3) the liquid is forced by the draft or pressure of the pump or its equivalent liquid-forcing means to pass from the upper liquor-chamber in the form of small streams through the many small perforations d into the said tubes C, and after laterally spreading against the heated side walls of the tubes the liquid will press downwardly through the latter and have its temperature raised to about that of the walls of the same before its entrance into the lower liquor-chamber.

In Fig. 4 is shown a tube having in its lower end a plug D, provided with several perforations d , which are in directions transversely to the direction of length of tubes C.

In Figs. 6 and 7 is shown a plug provided with several perforations made in direction of the length of the tube. When the plug is provided with several perforations, as illustrated in Figs. 4, 5, 6, and 7, such perforations will each be made of a size less than those in plugs having only one perforation each; but their aggregate capacity as passageways for the liquid is to be about equal to the capacity of a single perforation for passing the same quantity of liquid. These plugs D may be secured in their respective tubes by being tightly driven in the same, or they

may be held in place by a suitable bolt D' and screwing into the plug, as shown in Fig. 6, in which case a gasket d' may be employed between a shoulder made with the plug and the end edge of the tube.

In Figs. 1 and 2 are shown bolts H H, holding by their head ends with recessed sockets h , made with the manhole-seats, and passing up through a corresponding number of tubes and preferably through tubes similar to tubes C in the heating device and secured by nuts h' h' to hold said heating device in place and from shifting within receptacle A.

Steam is supplied to the steam-chamber B' of this heating device through any suitable live-steam-supply pipe connecting with a suitable steam-generator or other source of supply. When the heads b' b^2 are securely joined with cylinder a instead of cylinder b , this steam-supply pipe can be made to have communication directly with the steam-chamber B' by the steam-supply pipe being connected directly with the said chamber through the cylindrical wall of the same; but when the heads b' b^2 are joined with cylinder b and the vessel B is contained in the receptacle A, as illustrated, the steam-supply pipe, as pipe J', will lead from the source of steam through one of the heads of said receptacle into one of the liquid-chambers E or E' and by means of a bowed form of a portion thereof connect with vessel B at about the center of one of its heads and so as to communicate with the chamber B'. The bowed form of this pipe J' within the liquid-chambers permits a variety of degrees of expansion and contraction of the parts without materially affecting the parts of the apparatus at its joints.

H' is an exhaust-steam pipe leading from the lower side of the steam-chamber B to the outside of the apparatus to a suitable steam-trap or other place of discharge.

This liquid-heating device can be made with any preferred length and with any suitable diameter and can be arranged, relatively, in a horizontal position for use, as well as vertically.

I am aware that it is not new to employ a series of liquor-circulating tubes in connection with a steam-chamber for heating said tubes or with oppositely-located water or liquor chambers for leading water or liquids to be heated in said tubes from one such chamber to the other, and therefore such a combination of devices is not broadly claimed by me as my invention.

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

1. In a device for heating liquids, the combination, with a receptacle or vessel for containing steam or other known heating agent, of two or more tubes or pipes contained within the chamber of said steam-receptacle and connecting with oppositely-located liquor-chambers, which are situated exterior to said receptacle and provided with inlet and outlet

pipes or openings, and the plugs D, provided each with perforations d and secured in said tubes, substantially as and for the purposes set forth.

- 5 2. In a device for heating liquids, the combination, with the heads a' and b' , having a liquor-chamber between, heads a^2 and b^2 , also having between them a liquor-chamber, a cylinder which, together with heads b' and b^2 ,
10 forms a steam-chamber which has provision for receiving steam, and a series of tubes con-

tained within the said steam-chamber and having their opposite ends communicating with said liquor-chambers, of the plugs D, having in them perforations d and secured 15 within said tubes, and provision for the inlet and discharge of liquor, substantially as and for the purpose set forth.

ALEXANDER SELKIRK.

Witnesses:

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CHARLES SELKIRK.