(No Model.) 3 Sheets--Sheet 1.

H. HEINE.

Sectional Steam Generator.

No. 233,094. **Patented Oct. 12, 1880.**

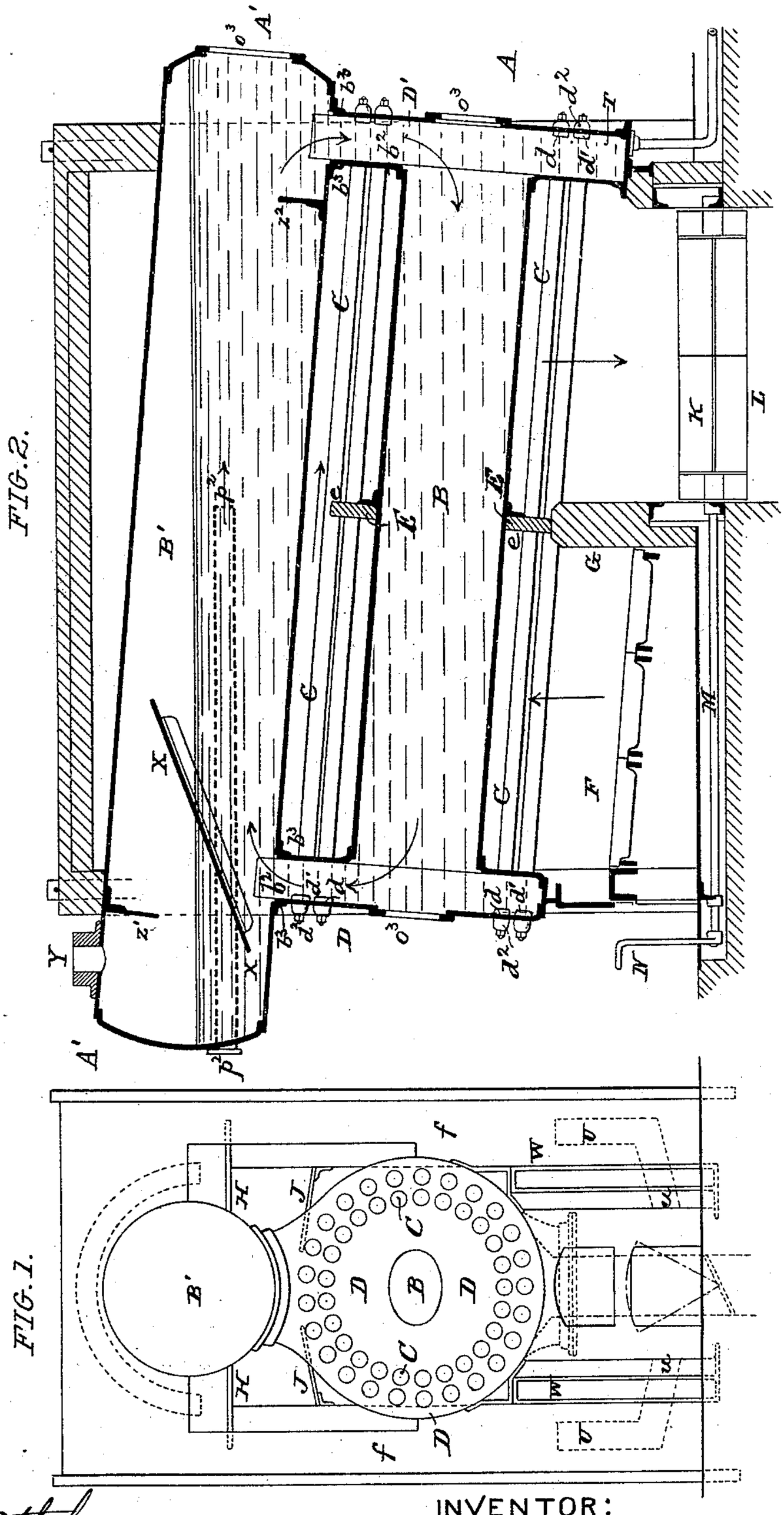


FIG. 2.

FIG. 1.

ATTEST:
John W. Herthel
Robert Burns

INVENTOR:
Hermann Heine
per Herthel & Co
Atty's

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

(No Model.)

3 Sheets—Sheet 2.

H. HEINE.

Sectional Steam Generator.

No. 233,094. Patented Oct. 12, 1880.

FIG. 4.

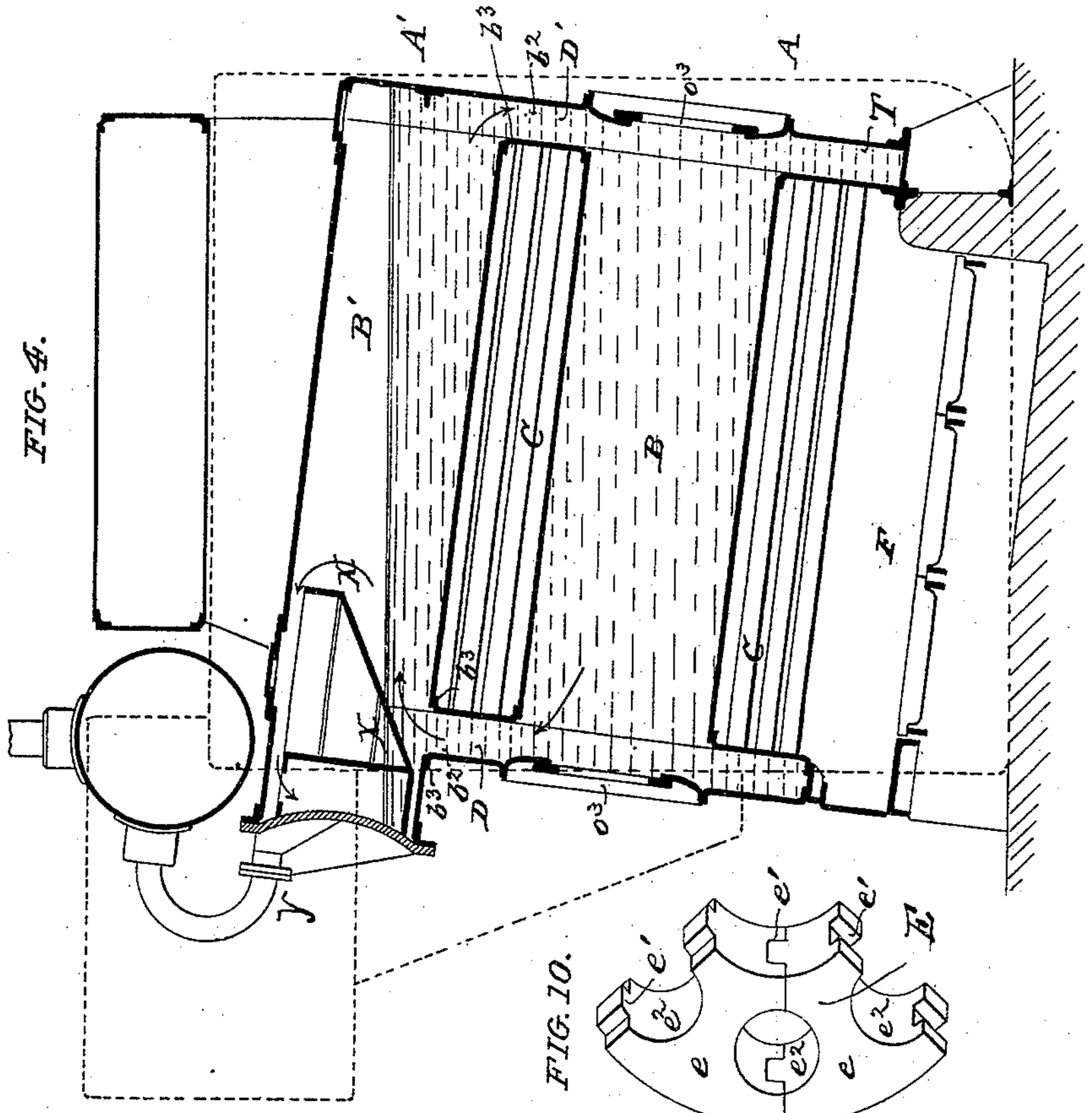
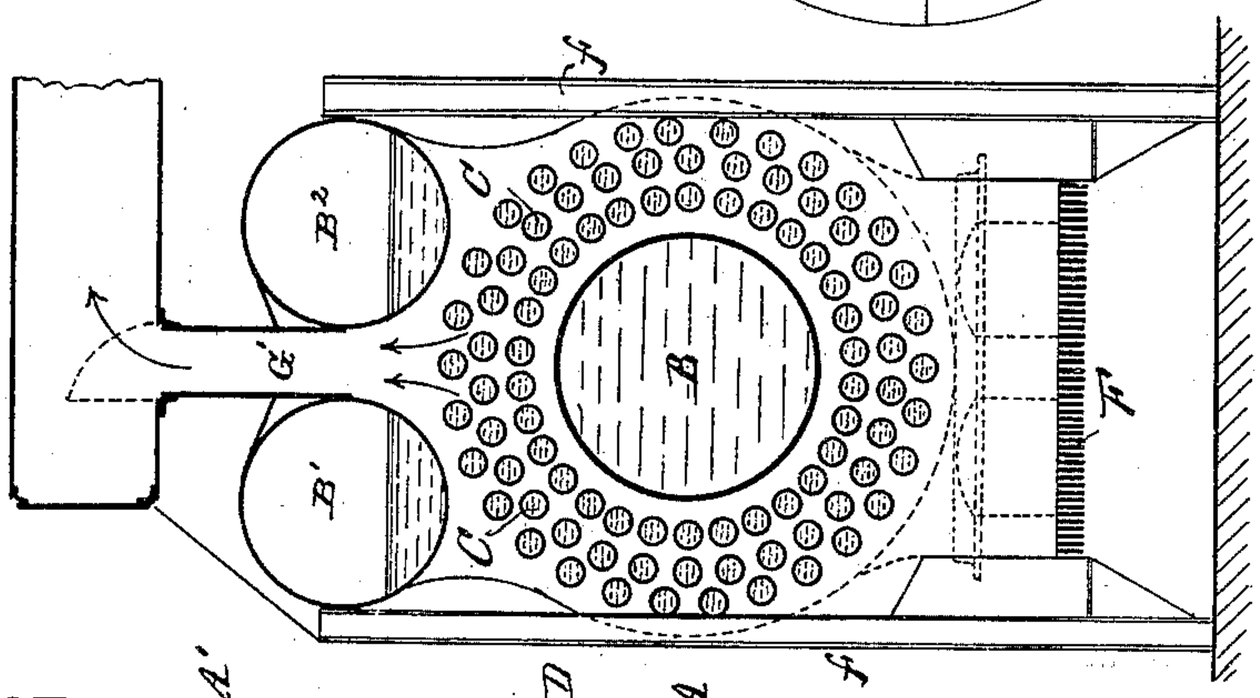


FIG. 10.

FIG. 3.



ATTEST:

John. W. Herthel.

Robert Burns

INVENTOR:

Hermann Heine

per Herthel & Co

Attys

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

(No Model.)

3 Sheets—Sheet 3.

H. HEINE.

Sectional Steam Generator.

No. 233,094. Patented Oct. 12, 1880.

FIG 6.

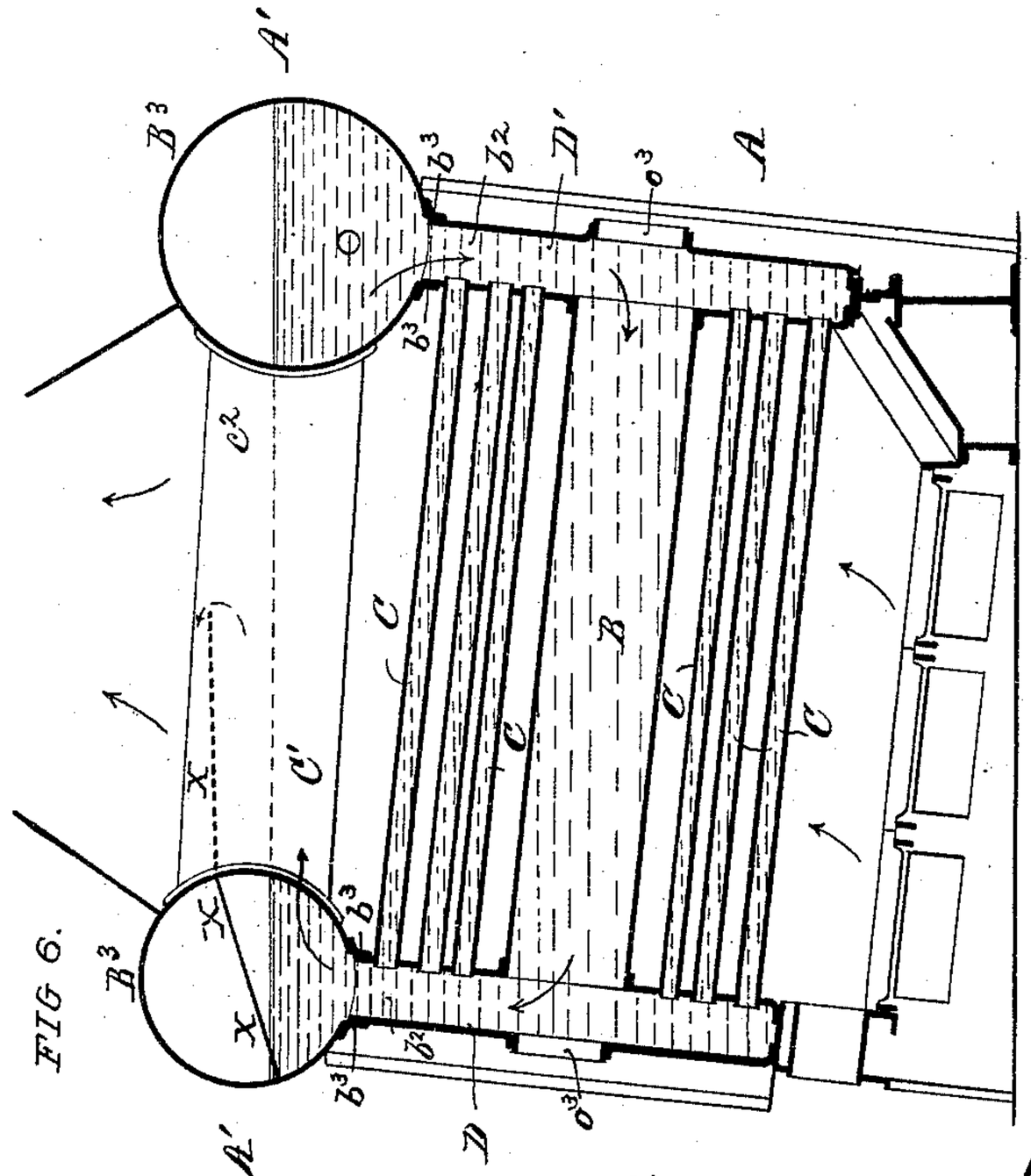


FIG. 8.

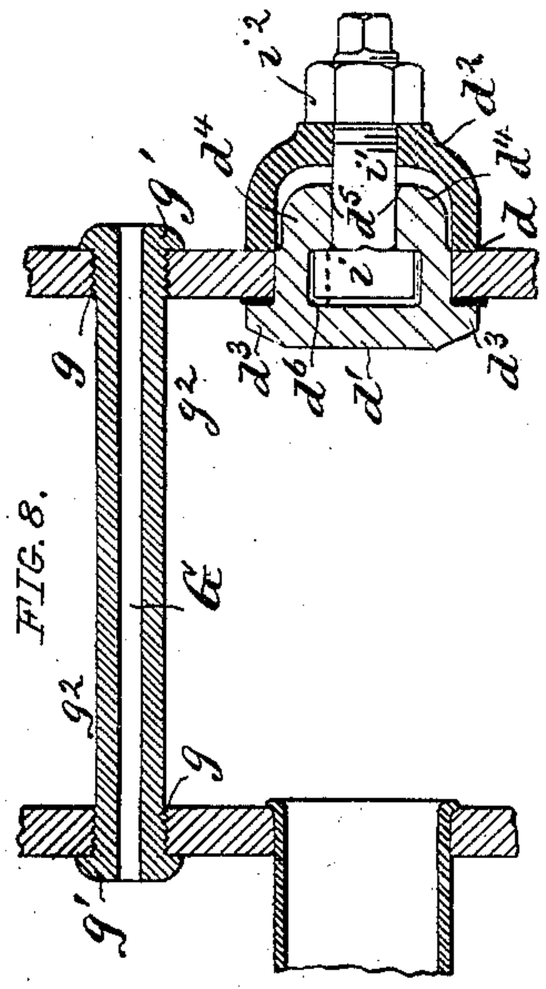


FIG. 7.

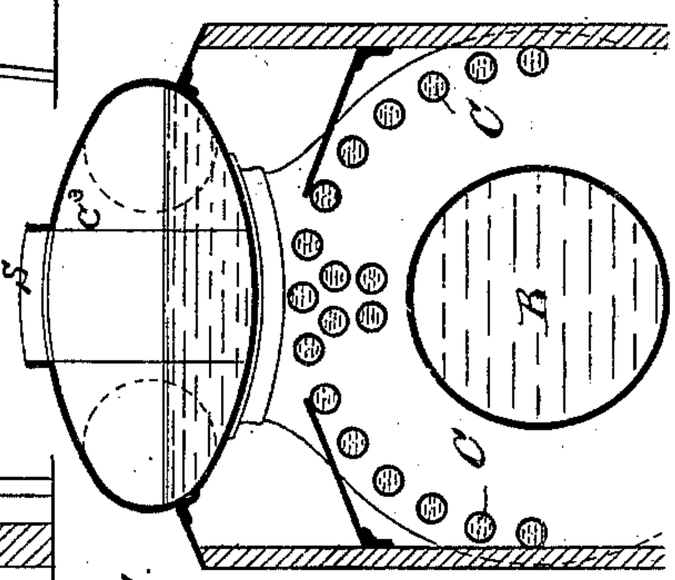


FIG. 5.

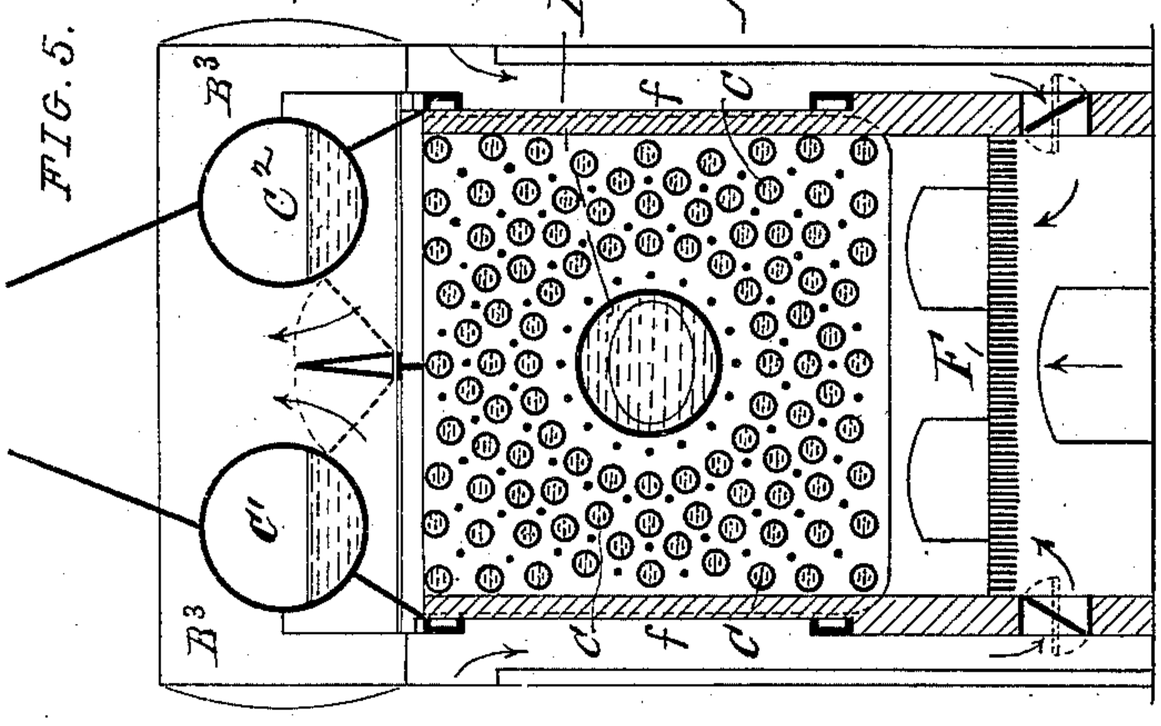
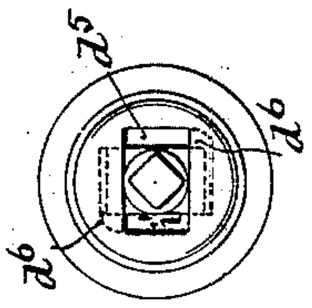


FIG. 9.



ATTEST:
John W. Herthel,
Robert Burns

INVENTOR:
Hermann Heine
per Henthel & Co
Attys

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

HERMANN HEINE, OF BERLIN, PRUSSIA, ASSIGNOR TO ADOLPHUS MEIER & CO., OF ST. LOUIS, MISSOURI.

SECTIONAL STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 233,094, dated October 12, 1880.

Application filed May 3, 1880. (No model.) Patented in Germany August 16, 1877, December 10, 1877, June 6, 1878, January 12, 1879, and June 22, 1879; in England October 9, 1877; in Belgium March 6, 1878; in France March 9, 1878; in Austria June 26, 1878, and in Russia December 31, 1878.

To all whom it may concern:

Be it known that I, HERMANN HEINE, of the city of Berlin, Prussia, have invented a new and useful Steam-Generator, (for which I have obtained patents in the German Empire, No. 751, bearing date August 16, 1877, and No. 2,258, bearing date December 18, 1877,) of which the following is a specification.

My invention relates more especially to further essential improvements of the sectional steam-generator for which Letters Patent were granted me in the United States February 12, 1878, No. 200,294; and my present improvements (like said patent) are also designed for and to be applied to stationary, marine, and other boilers.

As these improvements differ somewhat in shape, and are modified to suit the particular boiler to which they are to be applied, I therefore have illustrated in the accompanying drawings, in Sheet I, the improvements for a stationary boiler, Figure 1 being a front elevation; Fig. 2, a longitudinal sectional elevation.

Sheets II and III show my improvements applied in modified ways to a marine boiler, Figs. 3, 5, and 7 being respective front elevations of said modifications; Figs. 4 and 6, respective longitudinal sectional elevations; Figs. 8, 9, enlarged detail views, showing manner of connecting inside and outside covers to the hand-hole plates; also, in said Fig. 8 is shown the tube-stay and how its ends are joined. Fig. 10 is an enlarged detail perspective, showing the construction and joining of the sections composing the diaphragm.

Similar letters refer to similar parts throughout the several views.

I will first fully describe the improvements as applied to stationary boilers.

A is the lower section; A′, the upper section. The lower section consists of a waist or central boiler, B, having the concentrically-arranged series of water-tubes C. The upper section simply consists of the boiler B′, and preferably said upper boiler is placed parallel with the lower one. Both sections A A′ (upper and lower boilers) communicate with each other by the front and rear chambers or heads, D D′, and said heads are sufficiently larger in diameter than the waists or boiler B to admit of the connection of the outer ends of each water-tube with the inner sheets or head-plates of D and D′, and all shown in my former patent, and here indicated in Figs. 1, 2.

I prefer to provide the hind heads or chambers, D′, with the same parts as the front head or chamber, D—that is, the said front chamber, as shown in my former patent, has its outer end plate (or that part of it opposite the rows of the water-tubes) provided with a series of hand-holes at *d*, fitted with inside covers, *d′*, for the purposes of facilitating the cleaning and tightening of said water-tubes. (See Figs. 2 and 8.) Hence the rear chamber, D′, will also have its outer end plate so duplicated with hand-holes *d* and inside covers, *d′*. (See Fig. 2.) In the present case, I, however, improve this part of the invention by providing outside covers, d^2, for the hand-holes *d*, (for both front and rear chambers,) and in addition to the just-named inside covers, *d′*, of my former patent, both said covers being peculiarly constructed and connected together, as follows: The cover *d′* consists of a cap-plate, d^3, and forming part of it is a cylinder-projection, d^4, the body of which has a rectangular opening at d^5, and this latter feature is made or recessed to have the shape shown in dotted lines, and thus forming the internal locking-corners at d^6. (All shown in Figs. 8 and 9.) Into the openings d^5 d^6 of the inside cover the rectangular head *i* of a bolt or screw, *i′*, is passed and locked. (See Figs. 8 and 9.) This done, there is placed upon the bolt the outside cover, d^2, having its annular face resting against the lateral portions of the head or outer end plate, and against which said cover is tightened by a nut, i^2, on the bolt, as shown in Figs. 8, 9. The inside and outside covers are by this means held firmly up to close the hand-holes. The said covers *d′* d^2, forming a perfect joint, are unlocked by unscrewing the nut i^2 only so much as to be able to turn the bolt *i′* for a quarter of a turn to the left within the recess above mentioned. The bolt *i′*, coupled by its

nut i^2 to the cover d^2, can then be withdrawn at once. The necessity of having a bolt-hole and the use of guards and additional joints, with necessary steam-joint, &c., is thus prevented, and a perfect joint of the parts is had, affording sufficient facilities to clear out the tubes. The stays G, I also employ here for the purposes shown in my prior patent. The outer stays (those that are positioned between the water-tubes) I prefer to make hollow or to consist of and be hydraulic tubing. (See Fig. 8.) To join the ends of the tube-stays G, these are made screw-threaded at g, to screw into head plates or sheets of the chambers D D′, while the projecting ends of said tube-stays I rivet or weld over the said head-plates, as shown at g'. (See Fig. 8.) Further, between the sheets or plates of the chambers D D′ the external diameter of the tube-stay G is cut down (see g^2) to a size corresponding to the bottom of the thread on the ends, and all as shown in Fig. 8. The further advantages and results derived from this construction of the tube-stays are, that, besides acting as safety-stays proper, they also show at a glance any rupture by a leakage of water or steam. Further, the operator is enabled to introduce steam-jets to pass through said stays, for cleansing and other purposes.

The inner stays, if there be any, are riveted to the inside of the waist or boiler B, or pass through the same from end to end, being tapped or bolted to the outer end sheets of the head-chambers D D′. The lower portion of the rear head-chamber, D′, is extended to form a pocket, T, for collecting the mud or sediment from the water, and from which it may be blown off in the usual manner.

The end sheets and tube-sheets of both front and rear head-chambers, D D′, of the lower boiler are extended upward (see b^2) to form similar head-chambers (or drums) for the upper boiler; or, where this is a plain cylindrical shell, as in Figs. 1, 2, the said extensions of the head-chambers may be simply flanged outward or receive angle-irons, as shown at b^3, Figs. 2, 4, 6, to rivet to the lower portion of the upper boiler, and as shown.

I supply the feed-water through a pipe, p^2. (See Fig. 2.) This feed-pipe p^2 passes through the front head of the upper boiler, and is made to extend for about half the length of the same. The front end of this feed-pipe is properly controlled by a cover, screw-cap, or plug, all as indicated in Fig. 2. By means of so feeding the supply-water the same is made to take part in and increase the natural circulation of the water in the boiler.

To further aid the circulation, and to prevent priming, I place an inclined sheet or plate, X X, across the upper boiler or drum, B′, and above the opening of the upper extension, b^2, of each head-chamber D. (See Figs. 2, 4, 6.) By means of this inclined plate X X the water is deflected toward the rear of the boiler, and the steam is compelled to travel back and under said inclined plate before passing over it to the front.

Z′ is a drip-plate, riveted at a right angle to near the forward end and inside of the upper boiler. (See Fig. 2.) Said plate is for the purpose of catching, arresting, or collecting any moisture remaining in the steam.

Z^2 is a check-plate, secured vertically to the inner face of the upper boiler, near the rear end thereof, and said plate is for checking or catching the sediment in said boiler, and which can then be removed through man-hole, or may be made to be blown off by a pipe entering the upper boiler from the rear and joining the plate Z^2 at its bottom.

O^3 represents the respective man-holes for front and rear head-chambers; also, for upper boilers.

E is a diaphragm. (See Figs. 2 and 10.) It is composed of duplicate sections or members e, constructed in the shape shown in Fig. 10, having the tongue-and-groove joint at e' and the circular openings at e^2, when said duplicates are joined together, and as clearly shown in said Fig. 10. By the opening e^2 each section of the diaphragm is slipped on the water-tube. By their tongue and groove said sections are joined, and thus the entire diaphragm E is made to surround the central waist, boiler, or tube B, as shown. The heated gases, flames, &c., are, by means of this diaphragm E, (and of which there can be more than one,) forced to ascend to the upper boiler, and then, behind said diaphragm, down again toward the flue.

The side walls, f, are brought close to the outermost tubes, and plates or tiles J, (see Figs. 1, 5, 7,) projecting from said walls, contract the current of heated gases and concentrate them on the lower surface of the upper boiler.

F is the grate; G, fire-bridge butting against the partition or diaphragm E. The side walls, f, may join the upper boiler on the line H. (See Fig. 1.)

K L M N are parts for regulating the draft, K being the damper, actuated by the lever N and shaft M, while L is the flue containing the damper. (See Fig. 2.) W are the side columns to support forward end of the boiler. Y is the outlet for steam. U U are channels or flues built in the side walls for warming the air supplied for combustion which passes through them and by branches u u under the grate. Doors or dampers for regulating the supply may be placed on the ends of flues u u. (See Fig. 1.)

With boilers of small heating-surface the diameter of the central waist, tube, or boiler may be the same, or nearly so, as that of the water-tubes, and the end chambers are carried straight up, covering the area of the lower and of the upper boiler.

As stated, the air needed for combustion is heated in passing through the channels in the side walls. The continuity of the flames is

also preserved, as they are not required to pass through a long flue, but can strike the lower boiler and its water-tubes in almost a perpendicular direction, and thus to completely surround said water-tubes. The front ends of the upper and lower sections being in the hottest portion of the flames, and, further, being somewhat higher than the rear ends, which are surrounded by a somewhat cooler heat, the circulation of the water is produced in the directions indicated by the arrows.

For marine boilers, the head-chambers D D′ can be made cylindrical, (see Figs. 3, 4,) and be riveted to or extended across a pair of upper boilers, B′ B², between which the draft passes through G′, as shown; or said head-chambers can be riveted to an elliptical shell, C³, (see Fig. 7,) through which cylindrical flues *s* pass for the escape of the products of combustion; or said head-chambers D D′ can be made rectangular in form and riveted to upper drums, B³ B³, set crosswise to the axis of the lower boiler, and which are connected by cylindrical waists C′ C², between which the smoke and gases escape, and as indicated in Figs. 5 and 6.

I prefer to arrange the water-tubes, when seen in a front view, on concentric lines around the central waist, tube, or boiler. If all of them are placed in this manner, the main form of the chambers may be cylindrical; but whenever the end chambers are so shaped as to connect by direct extension of said chambers the upper and lower sections of the boiler, the arrangement of the water-tubes will also depend on the shape of the end chambers, and the particular requirements of the case. Always, however, the arrangement of the water-tubes will be such that, through the man-hole or the hand-hole, (of the front chamber,) opposite to the central waist or tube of the lower boiler, the opening or mouth of each water-tube may be easily reached, as I am thus enabled, for the purposes of cleaning the boiler, to carry a water-hose through the open man-hole, as mentioned, into the mouth of each water-tube, which, being the highest point of the tube, a forced jet of water will sweep any sediment which may have settled in the tube readily away into the hind chamber, whence they are led off by the blow-off pipe or taken out by the hand. The inside of the water-tubes can therefore be cleaned without opening, the hand-hole covers giving direct access to them. With this provision of the water-tubes all inside covers of their respective hand-holes are also readily accessible.

I claim—

1. In combination with the sheets of the boiler having hand-holes, the inside covers, *d′*, consisting of the cap-plate d^3, having a cylindrical projection, d^4, the body of which is provided with internal locking-spaces, d^5 d^6, into which the rectangular head *i* of a bolt or screw, *i′*, is passed and locked, the outer cover, d^2, placed upon the said bolt, the nut i^2 on the bolt, by means whereof, inserting the nut i^2 and turning the bolt a quarter of a turn to the left, the said bolt, its nut, and outside cover, d^2, can be withdrawn at once from the inside cover or cup-plate, d^3, and both said inside and outside covers can be made to close the hand-holes on both sides thereof, in the manner and for the purposes set forth.

2. The upper and lower boiler sections—that is, either or both of said sections—consisting of the head-chambers D D′, tubular connecting-waists between said heads, water-connecting tubes outside of the waists and between said heads or head-chambers, the side walls, *f*, having channels U U and branches *u u*, the diaphragm E, composed of duplicate jointed sections *e*, and the tiles at J, all said parts combined and constructed substantially as and for the purposes set forth.

3. The upper and lower sections—that is, boiler B, with its series of water-tubes C—the front and rear head-chambers, D D′, the upper section or boiler, B′, provided with the feed-pipe p^2, the inclined plate X X, the drip and check plates Z′ Z^2, the lower diaphragm, E, grate, and inclosing-walls, all arranged, constructed, and operating as described, and for the purposes set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

HERMANN HEINE.

Witnesses:
BERTHOLD ROI,
C. C. STODDARD.