

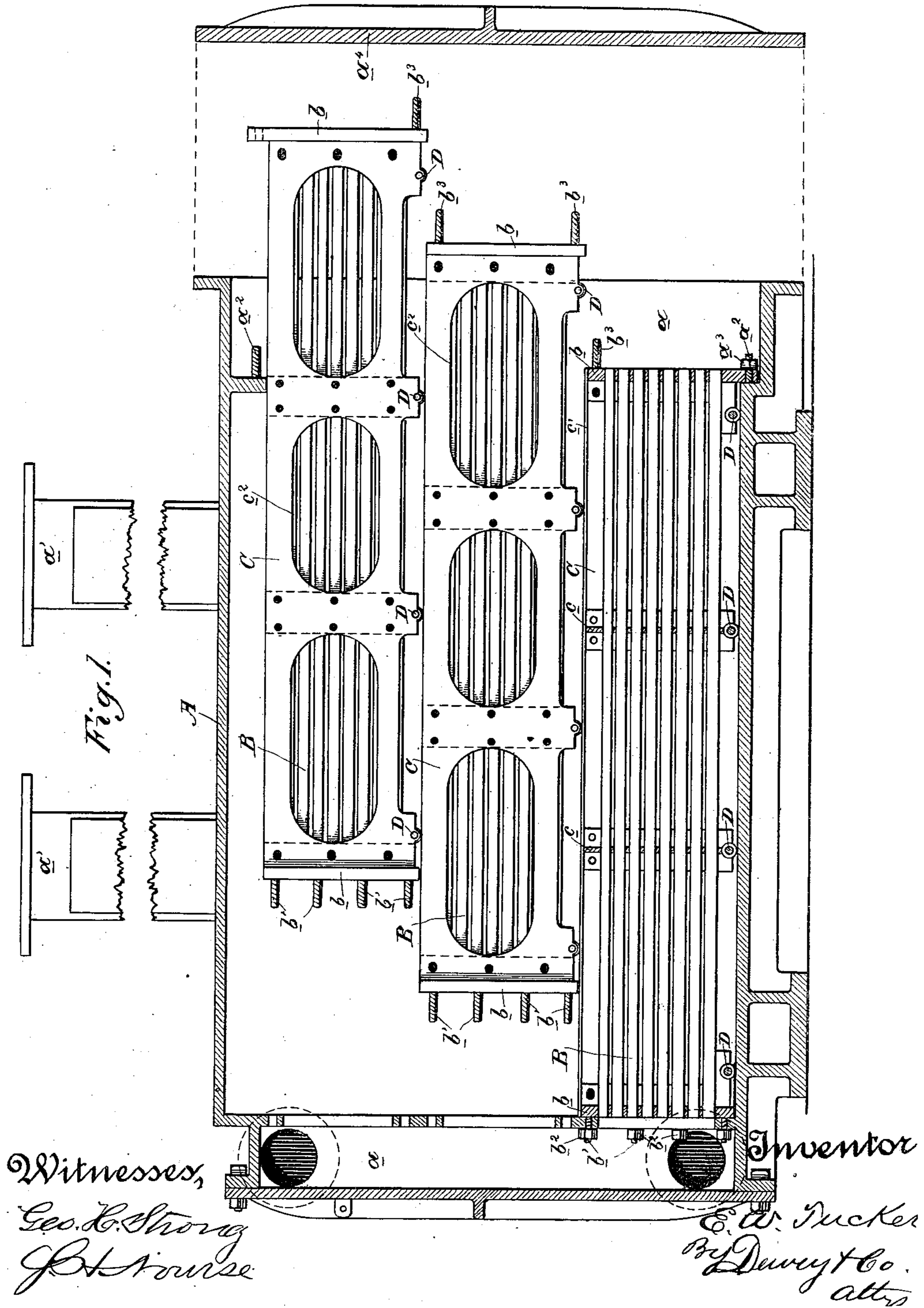
(No Model.)

2 Sheets—Sheet 1.

E. W. TUCKER.
SURFACE CONDENSER.

No. 403,799.

Patented May 21, 1889.



(No Model.)

2 Sheets—Sheet 2.

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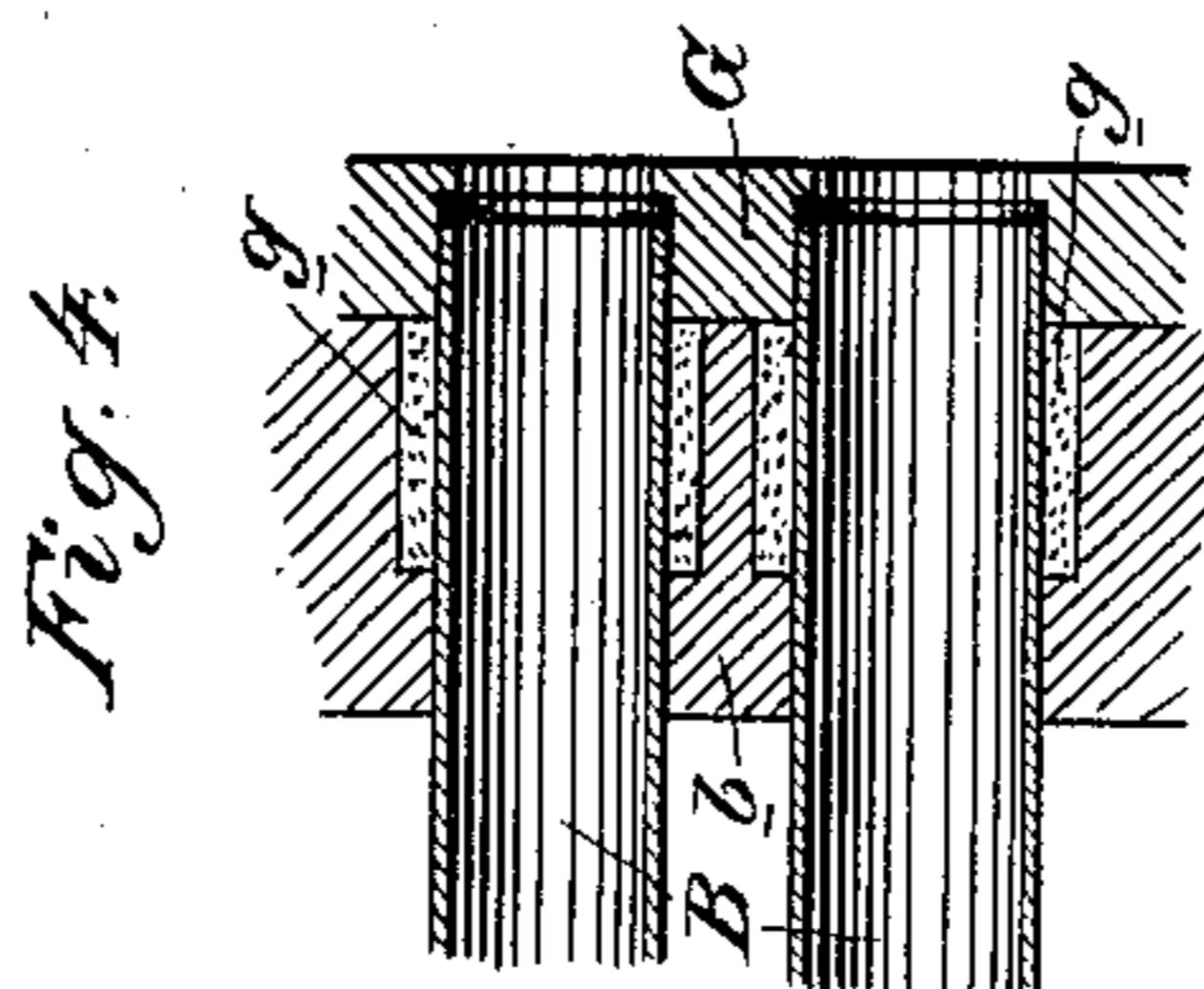


Fig. 3.

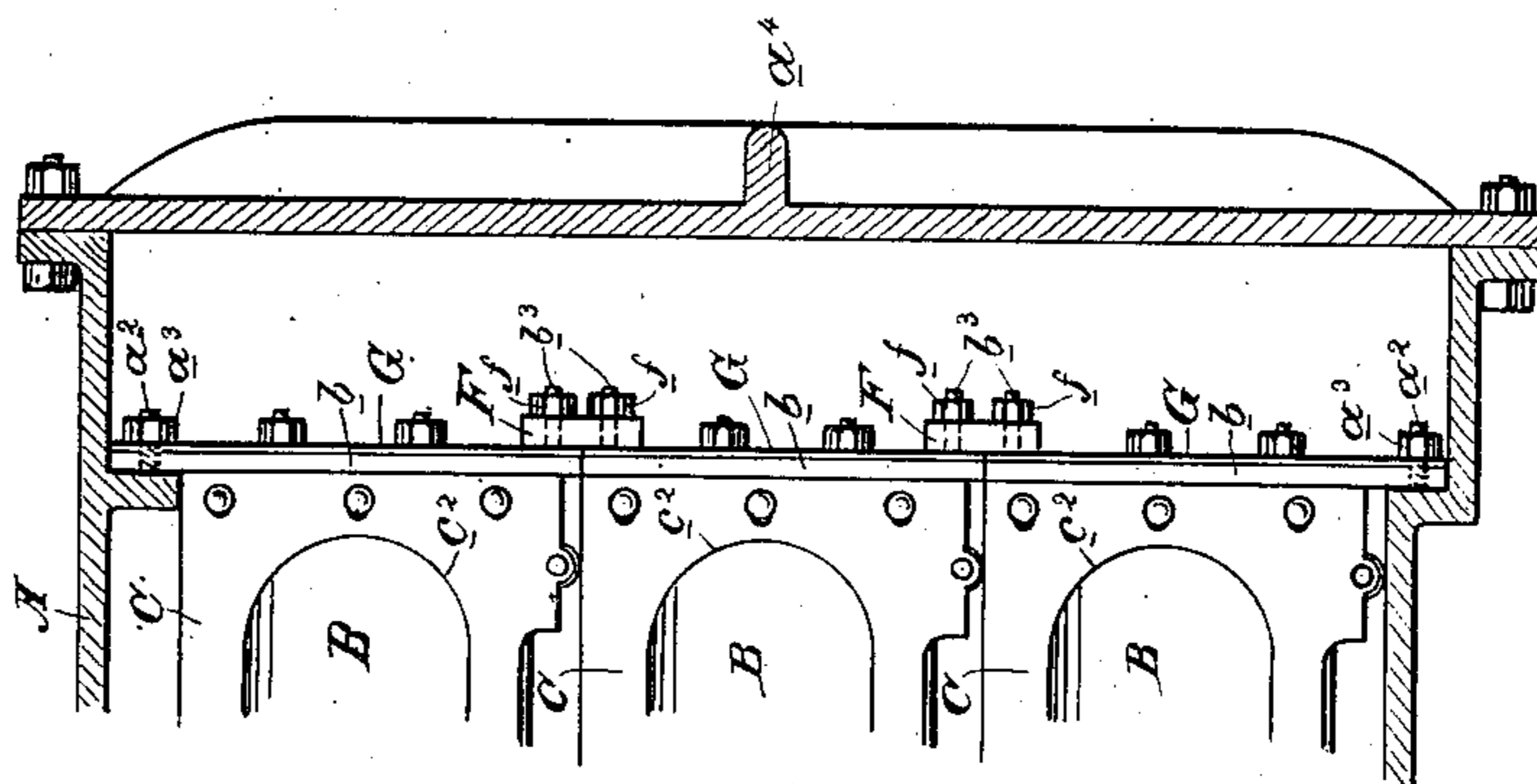
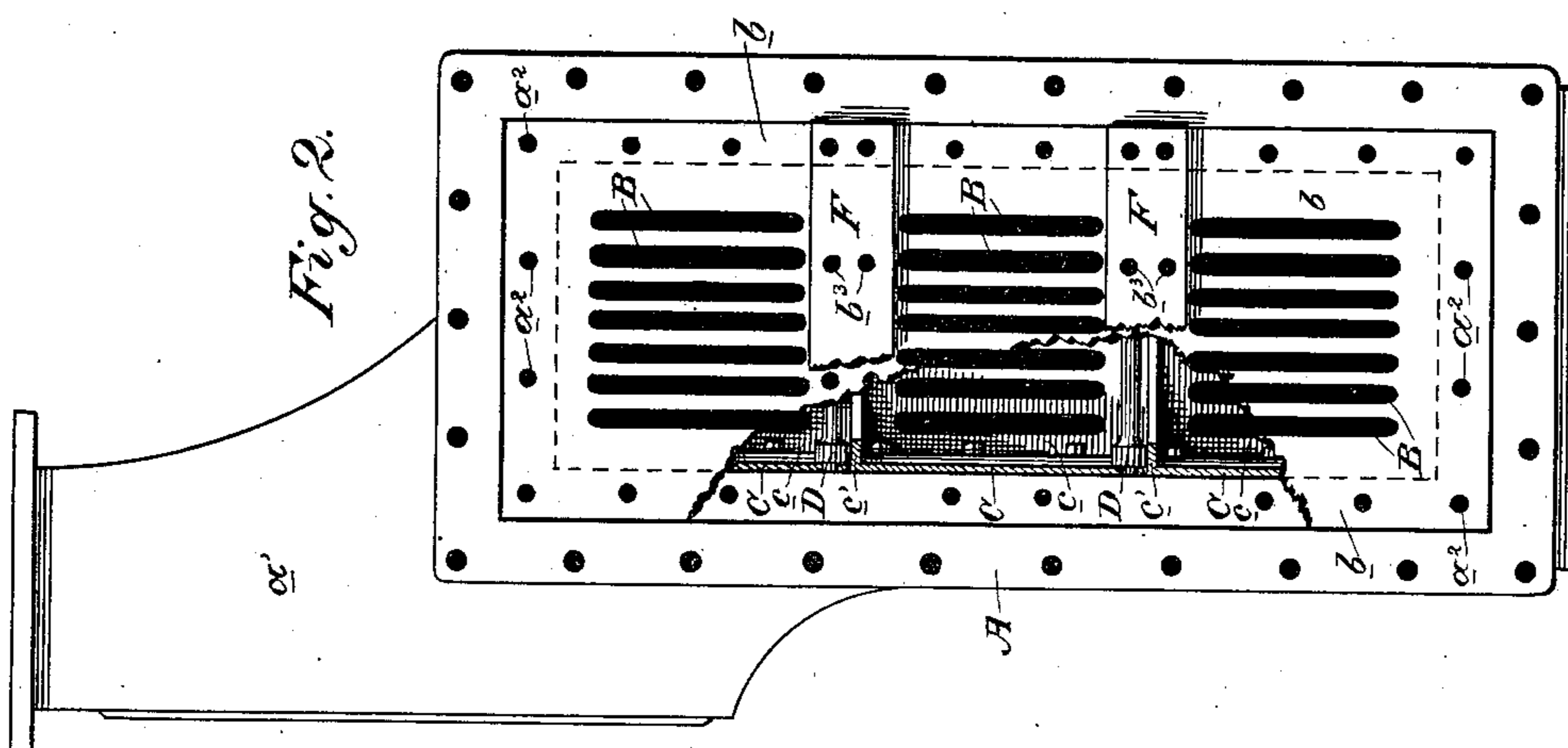


Fig. 2.



Witnesses,
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UNITED STATES PATENT OFFICE.

EDWIN W. TUCKER, OF SAN FRANCISCO, CALIFORNIA.

SURFACE CONDENSER.

SPECIFICATION forming part of Letters Patent No. 403,799, dated May 21, 1889.

Application filed July 6, 1888. Serial No. 279,201. (No model.)

To all whom it may concern:

Be it known that I, EDWIN WARREN TUCKER, of the city and county of San Francisco, State of California, have invented an Improvement in Surface Condensers; and I hereby declare the following to be a clear, full, and exact description of the same.

My invention relates to that class of surface condensers in which the tubes are arranged in groups or sections, adapting any group or section to be readily removed and replaced when desired.

My invention consists in the novel framing of the sections, their arrangement with relation to each other and to the shell or casing of the condenser, and their novel connection therein.

It further consists in a novel plate secured to the face of the tube-sheet and receiving and holding the forward ends of all the tubes; and my invention finally consists in a novel construction of the tubes themselves, all of which I shall hereinafter more fully describe.

The general object of my invention is to provide a practically-constructed condenser in which groups or sections of tubes may be readily removed and replaced without interfering with other groups or sections. The object of the securing-plate on the face of the tube-sheet is to avoid the use of separate gland-nuts for each tube and to permit any or all of the tubes of any given section or group or of the whole condenser to be readily taken out upon the removal of said plate.

The object of the peculiar construction of tubes is to avoid interference with the steam by affording it a clearer passage, thereby reducing back-pressure, and also to effect the required condensation with less cooling-surface than is usual with the ordinary tubes. Further objects and advantages will be hereinafter set forth.

Referring to the accompanying drawings for a more complete explanation of my invention, Figure 1 is a longitudinal vertical section of the condenser, two of the groups or sections of tubes being in elevation and partly pulled out. Fig. 2 is an end view of the condenser, the front plate, a^4 , being removed and a portion of the tube-sheets broken away, and showing also the improved shape of the tube. Fig. 3 is a vertical sec-

tion of the forward end of the condenser-shell, the groups or sections of tubes being in elevation. Fig. 4 is a detail section showing the improved means for securing the tubes in their sheets.

A is the casing or shell of the condenser, having at each end the usual water-space, a , and division-plates, so that the circulating water can be passed through as many times as desired, with inlet and outlet, and at the top the usual steam-passage, a' .

B are the tubes, and b are the tube-sheets at each end. These tubes are grouped in sections, here shown as three in number, and located in vertical series. The tubes of each section are thus framed in.

Parallel side plates, C, are bolted to the tube-sheets, and cross-plates c are bolted to the side plates, and the tubes pass through and are supported by the cross-plates. There are no top and bottom plates, so that each section is open above and below, and a free passage is afforded throughout the vertical series.

Mounted in the lower edges of the side plates near each end and also opposite the cross-plates are the rollers D. The rollers of the lowermost section rest and travel upon the bottom plate of the shell A, and the rollers of the other sections travel upon the top of the side plates of the section below, said top being made with a flange, c' , to afford a proper bearing.

The rear tube-sheets, b , have projecting studs or bolts b' , which pass through holes in the back plate of the shell and are secured by nuts b^2 . The forward end of the shell has an inner flange, from which project the fixed studs or bolts a^2 , over which fit the projecting edges of the forward tube-sheets, b , said tube-sheets being secured by nuts a^3 . Upon the adjacent edges of the tube-sheets of each section are fitted the studs or bolts b^3 , and over these are fitted the horizontal butt-straps F, which overlap the edges of the sections and hold them in place, said butt-straps being secured by nuts f , fitted to the bolts b^3 . To the outer flange of the front of the shell is bolted the head-plate a^4 , forming the other water-shell. Now it will be seen that upon removing the head-plate a^4 , thus exposing the tube-sections, and by removing one or more of the butt-straps and taking off the nuts a^3 , any or

all of the tube-sections may be separately pulled out from the shell, the nuts b^2 at the rear end having, of course, been previously removed, being reached by removing the rear head of the condenser. In moving out, the lowermost section travels on the bottom of the condenser-shell, while the other sections travel on the top of the side plates of the section below, and it is obvious that any of the said sections may be drawn out without interference with the others, for the upper sections do not depend for their support upon the sections below, because their rear tube-sheets are connected with the rear plate of the shell, which serves to sustain the rear end of an upper section while the upper one is pulled out, the forward end being supported by the inner flange of the face of the shell. Thus the sections are wholly independent of each other, and may be pulled out independently. The rollers on which the sections are mounted enable them to run easily, so that they may be pulled out and replaced without any trouble. When the sections are pushed back in place, they are secured quickly by the application of the butt-straps.

The ordinary way of securing the tubes in the tube-sheet is to hold them by means of a gland-nut, which presses upon packing to form a tight joint. With this construction, in order to remove any single tube, it is necessary to take off the gland-nut, and where a number of tubes have to be separately removed, or all of them, to re-tin or clean them, the gland-nut of each tube is first taken out. In order to avoid this laborious operation and to provide for a simple and convenient manner of securing the tubes in the sheets and forming an equally tight joint, I apply to the face of the tube-sheets a supplemental plate, G, having holes which receive the projecting ends of the tubes, said holes being countersunk, as shown in Fig. 4, to prevent the tubes from working forward. Packing, g, is placed in the tube-sheet around the tube and is held in place by the supplemental plate. This plate is bolted to the face of the tube-sheet, and thereby serves to secure all the tubes in the tube-sheet. By removing this plate all the tubes can be taken out and all are again secured by the single operation of replacing the plate, instead of having to replace each one separately. This plate forms a tight joint with the face of the tube-sheet, as the pressure is inwardly, and the packing is held well in place.

Although I have shown the ordinary round or cylindrical tube, I have invented an improved tube, which I show in Fig. 2. The ordinary tube I would allow to remain in those condensers which are already in use, for to this tube the improvements heretofore described may be as readily applied; but in condensers to be hereafter manufactured, in addition to the improvements heretofore described, I would make the tubes as shown in said figure. The tubes, instead of being

round or cylindrical in cross-section, are made elongated, and lie one above the other, as shown. The advantage of this is, that a clearer passage is provided for the steam flowing from the top to the bottom of the condenser. In the ordinary construction of tubes arranged as they usually are, out of line with each other, or staggered, it is obvious that obstruction is opposed to the downward passage of the steam, which results in considerable back-pressure, and, moreover, a great deal of cooling-surface is wasted; but with the elongated tube which I propose to use a clear passage is formed from top to bottom of the condenser, down which the steam may readily pass without obstruction, thereby avoiding so much back-pressure, and by the rapidity of its movement it comes sooner in contact with fresh cooling-surfaces, whereby a smaller amount of surface is made to effect the same degree of condensation as the larger cooling-surface of the ordinary form. The side plates by which the tube sections or groups are framed in have openings c^2 made in their sides, in order to lighten them up and to afford greater facility in cleaning the tubes and guiding them through the division-plates.

The general advantages of these improvements are these: In having the tubes in removable sections, in substantial framing, constructed as shown, so that they can be easily and quickly removed and replaced without injury. Each section can be easily and conveniently handled and can be set upon trestles at a convenient height on the deck or wharf in the daylight, so that men can work to advantage either in placing or removing the tubes from the frame. A man can be worked on each end of each section, making six men, where there would and could only be two with the old style, and they working by lamp-light below. The largest ships can have their condensers cleaned during their ordinary lay-days, thereby saving the expense and loss of laying the ship up.

The mode of packing the tubes and holding the packing in position by the supplemental plate saves a great deal of expense in construction and time in placing and removing the tubes, as it does away with the glands and the tapping of the tube-sheets.

The elongated tubes allow the exhaust-steam to come so much sooner in contact with the cooling-surfaces that it requires less surface, is more easily cleaned, and only requires about one-third the time to either place them in or remove them from the frame, and will keep clean very much longer, both inside and out.

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

1. In a surface condenser, independent sections or groups of tubes, each framed in by side plates and arranged adjacent to each other in such a manner as to provide a communication between the sections and to per-

mit each section to be independently removed and replaced in the condenser-shell without disturbing the others, substantially as herein described.

2. In a surface condenser, independent sections or groups of tubes, each framed in by side plates, said sections or groups being arranged the one above the other and communicating vertically, and adapted each to be separately removed from and replaced in the condenser-shell, substantially as herein described.

3. In a surface condenser, the independent sections or groups of tubes, each section or group having a tube-sheet at each end and side plates framing it in, whereby each section or group may be separately removed from and replaced in the condenser-shell without disturbing the others, substantially as herein described.

4. In a surface condenser, the independent sections or groups of tubes, each provided with a tube-sheet at each end, side plates by which each is framed in, and cross-plates bolted to the side plates and supporting the tubes between the tube-sheets, substantially as herein described.

5. In a surface condenser, independent sections or groups of tubes, each section or group having a tube-sheet at each end, side plates framing each in, and cross-plates for supporting the tubes between the tube-sheets, and rollers mounted in their lower portion, upon which said sections rest and travel, whereby they may be separately removed and replaced, substantially as herein described.

6. In a surface condenser, and in combination with the shell, independent sections or groups of tubes arranged in vertical series in the shell, each section or group having a tube-sheet at each end, side plates framing each in, and cross supporting-plates for the tubes, and rollers in the lower portion of each section or group, whereby said sections may be moved within the shell and upon each other and adapted to be readily drawn out and pushed in independently, substantially as herein described.

7. In a surface condenser, the shell A, having a back plate with holes and a front flange with fixed studs or bolts, in combination with the independent separately-removable sections or groups of tubes, each having a tube-sheet at its rear end with studs or bolts fitting in the holes of the back plate, and a front tube-sheet with holes fitting over the studs or bolts of the front flange, whereby said sections or groups are supported in the shell, substantially as herein described.

8. In a surface condenser, the shell A, having a back plate with holes and a front flange with fixed studs or bolts, in combination with the independent separately-removable sections or groups of tubes, each having a tube-sheet at its rear end with studs or bolts fitting in the holes of the back plate and a front tube-sheet with holes fitting over the studs or bolts of the front flange, the side plates framing in each section or group of tubes, and the cross-plates supporting the tubes between the tube-sheets, substantially as herein described.

9. In a surface condenser, the independent separately-removable tube sections or groups, in combination with the butt-straps secured across their fronts and overlapping their adjacent edges, substantially as herein described.

10. In a surface condenser, the shell having fixed studs or bolts on its front, in combination with the independent separately-removable tube sections or groups having tube-sheets with holes fitting over the studs or bolts of the shell, whereby they are secured, and the butt-straps secured across the front of the sections and overlapping their adjacent edges, substantially as herein described.

11. In a surface condenser, and in combination with the shell thereof, the independent separately-removable tube sections or groups arranged in vertical series and each having tube-sheets bolted to the shell, and side plates and cross-plates, as described, whereby each may be slipped in or out without interfering with one another, and the butt-straps bolted across the front of the sections or groups and overlapping their adjacent edges, substantially as herein described.

12. In a surface condenser, the independent separately-removable sections or groups of tubes, each tube having an elongated shape in cross-section, said sections or groups being framed in by side plates and having cross-plates supporting the tubes between the ends, the sections resting upon one another in vertical series, whereby they may be separately slipped in or out, substantially as herein described.

In witness whereof I have hereunto set my hand.

EDWIN W. TUCKER.

Witnesses:

JNO. S. BOONE,
S. H. NOURSE.