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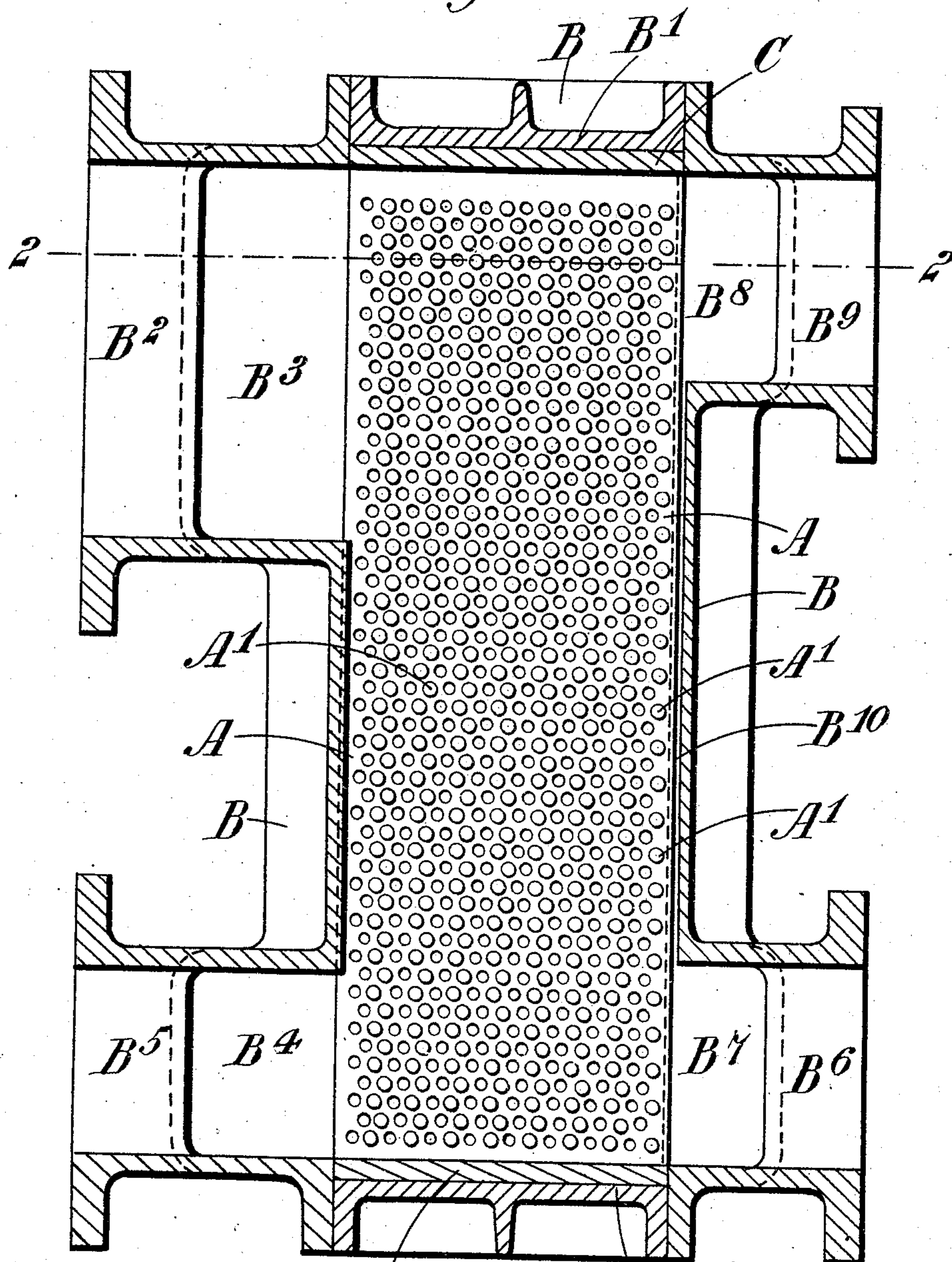
PATENTED MAR. 21, 1905.

A. SHIELDS & J. S. L. ALEXANDER.
APPARATUS FOR CONDENSING PURPOSES.

APPLICATION FILED NOV. 7, 1904.

5 SHEETS—SHEET 1.

Fig. 1.



Witnesses
Thos Howe
Am. Gallun Jr.

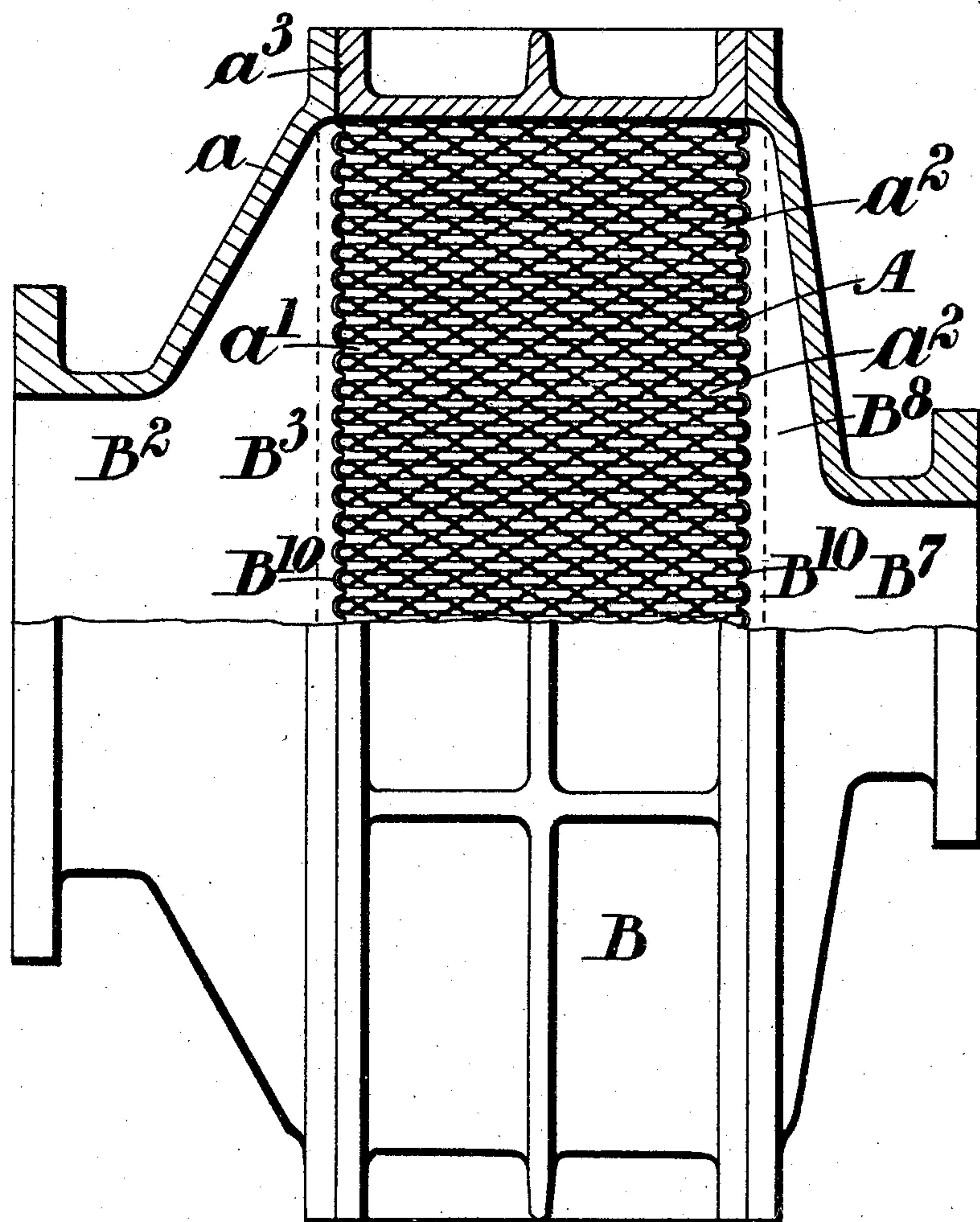
B B1 Inventors
Alexander Thiels
John Stewart-Lowe Alexander
By Peter Furman & Nelson
Attorneys

A. SHIELDS & J. S. L. ALEXANDER.
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5 SHEETS—SHEET 2.

Fig. 2.



Inventors
Thos. Howe
Am. Gillman Jr.

Inventors
Alexander Shields
John Stewart-Lowe Alexander
by John Freeman Watson
Attorneys.

No. 785,580.

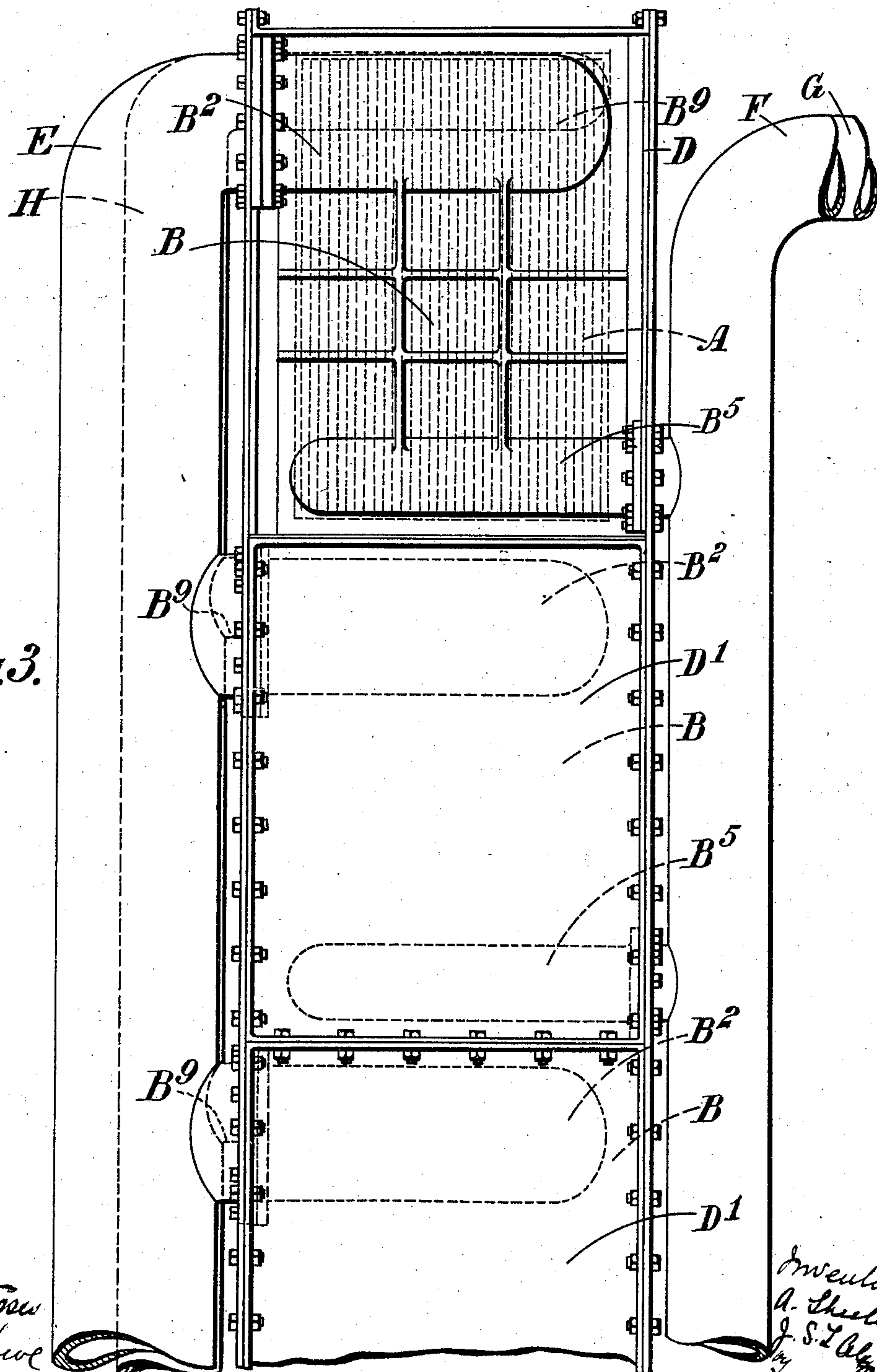
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5 SHEETS—SHEET 3.

Fig. 3.



Witness
Thos. Howe
Am. Gillman & Co.

Inventors
A. Shields
J. S. L. Alexander
By
Foster Freeman Watson
Attorneys

No. 785,580.

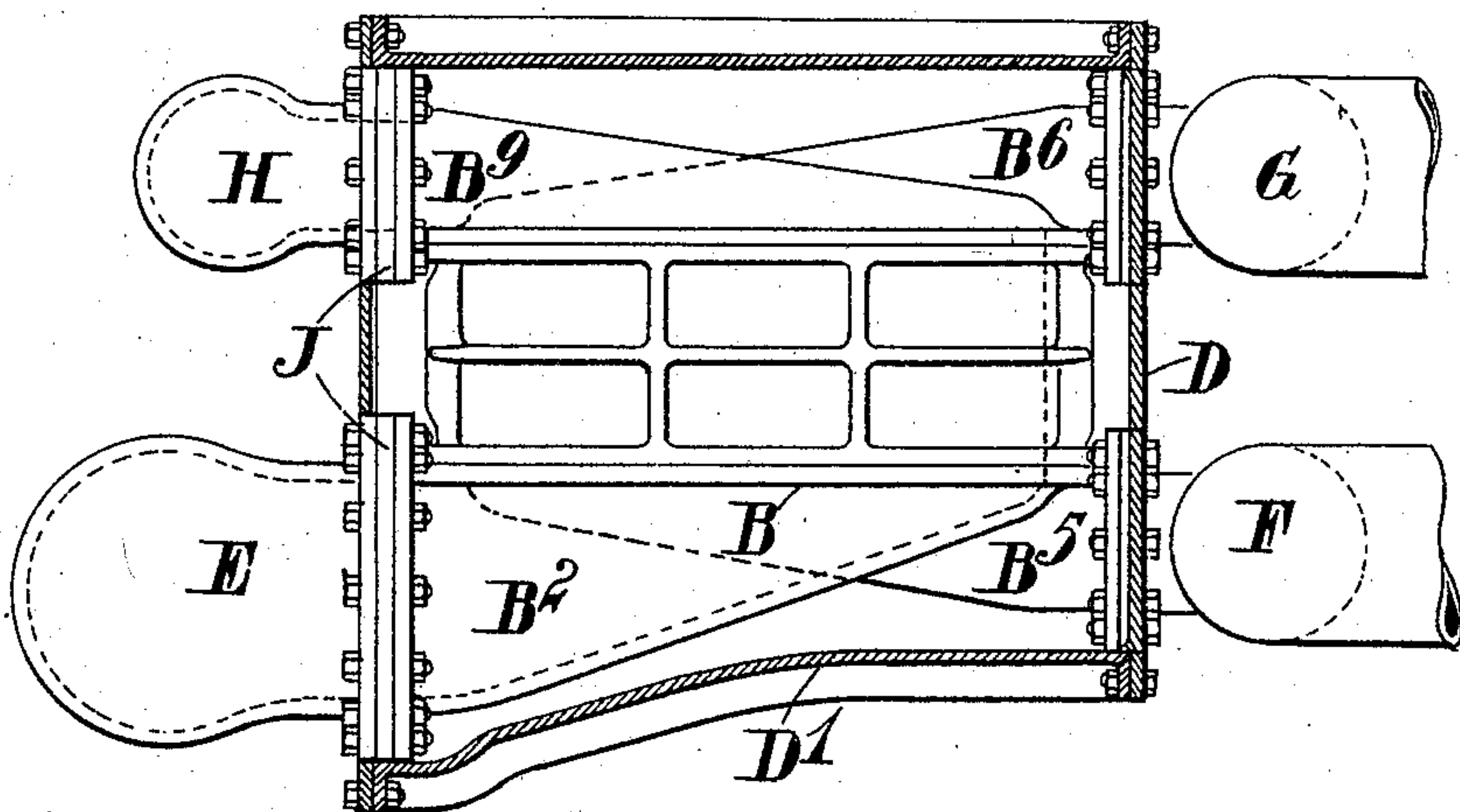
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5 SHEETS—SHEET 4.

Fig. 4.



Witnesses
Thos Howe
Am Gilman Jr.

Inventors
Alexander Shields
John Stewart Love Alexander
by Foster Freeman Watson
Attorneys.

A. SHIELDS & J. S. L. ALEXANDER.
APPARATUS FOR CONDENSING PURPOSES.

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5 SHEETS—SHEET 5.

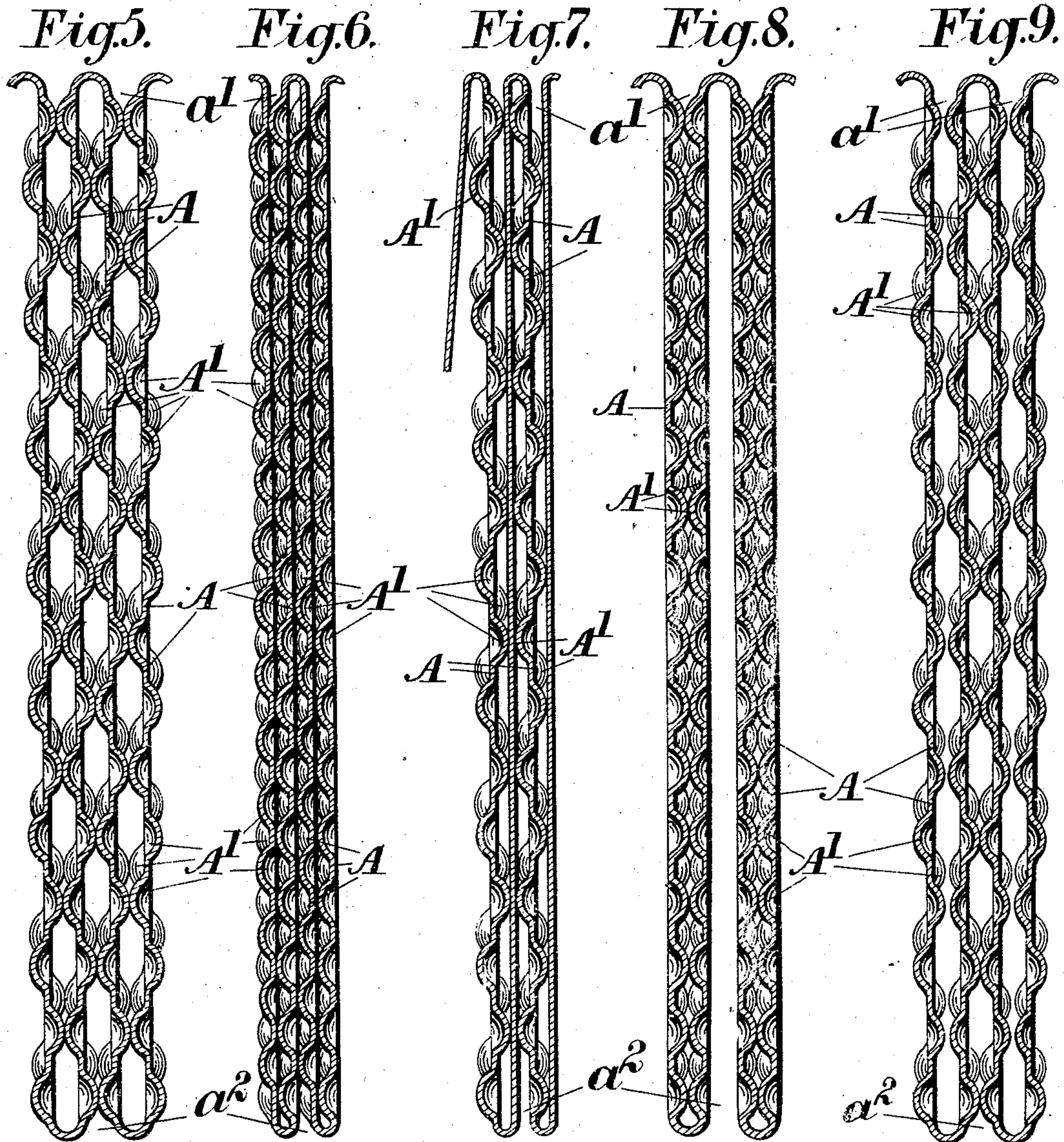


Fig. 10.

Witnesses
Thos. Howe
Chas. G. Leman, Jr.

Inventors
Alexander Shields
by John Stewart Jones Alexander
Frederick Heuman, Watson
Attorneys.

UNITED STATES PATENT OFFICE.

ALEXANDER SHIELS AND JOHN S. L. ALEXANDER, OF LONDON,
ENGLAND.

APPARATUS FOR CONDENSING PURPOSES.

SPECIFICATION forming part of Letters Patent No. 785,580, dated March 21, 1905.

Application filed November 7, 1904. Serial No. 231,802.

To all whom it may concern:

Be it known that we, ALEXANDER SHIELS, M. B. C. M., B. Sc., and JOHN STUART LOWE ALEXANDER, subjects of the King of England, residing in London, England, have invented certain new and useful Improvements in or Relating to Apparatus for Heating, Cooling, Condensing, Evaporating, and Similar Purposes, of which the following is a specification.

This invention relates to apparatus for heating, cooling, condensing, evaporating, and similar purposes, and refers chiefly, though not exclusively, to condensing apparatus for exhaust-steam.

According to this invention the fluid to be treated and the medium acting upon it are caused to pass through independent series of chambers or compartments into which the interior of the apparatus is divided by partitions, the chambers of one series alternating with those of the other series. Projections, nodules, or the like are formed on either or both surfaces of the partitions, which are constituted by a sheet of material bent or folded in opposite directions alternately or by separate sheets each secured to the sheet on either side of it at opposite edges, the nodules projecting into some or all of the chambers.

Several sections or elements constituted as above described may be joined together to form a multicompartmental apparatus.

A filter may be used with the apparatus. It is not desired, however, to limit the invention to any particular construction of filter, as any convenient arrangement of filtering apparatus may be employed.

Referring to the drawings, Figure 1 is a sectional elevation, and Fig. 2 a plan, partly in section, of a preferred embodiment of the invention as applied to the condensation of exhaust-steam. Fig. 3 is an elevation, and Fig. 4 a plan, of a multicompartmental condenser constructed in accordance with this invention. Figs. 5 to 9 are sectional views showing various constructions or forms of the sheet employed to form the chambers within the apparatus, and Fig. 10 is an edge view of a sheet before it is bent.

A is the sheet which is bent or folded to

form the chambers within the apparatus, and B is the casing.

The apparatus illustrated in Figs. 1 and 2 is chiefly applicable for the condensation of steam and will be described in this connection, it being understood that the apparatus may be employed for other purposes without departing from the invention.

A single sheet A, of copper, aluminium, or other appropriate metal, is bent upon itself in opposite directions alternately, as shown at Fig. 2, to form two independent series of separate chambers and is disposed within the casing B in such a manner that the bends or folds—that is to say, the long edges of the chambers—are vertical, and the chambers on one side of the sheet are separate from those on the other side. The sheet in the example shown has formed on both surfaces projections or nodules A', so arranged that when the sheet is bent as described the nodules on one wall of the chamber come opposite and are in contact with the nodules on the other wall of the same chamber. An enlarged view of the sheet thus constructed is shown in Fig. 5; but the nodules may be otherwise arranged, as hereinafter referred to. These projections or nodules are conveniently formed by stamping or punching up the sheet, or they may be otherwise formed integral with the sheet or attached to it in any convenient manner. The various inlet and outlet openings in the casing B are conveniently formed in the side walls, so that the fluid to be treated and the cooling-water can enter and leave their respective chambers in such a manner that any tendency of the fluid to leak from one series of chambers to another is avoided and the ends of the chambers can be made fluid-tight in a thorough manner. A preferred method of making the fluid-tight joints at the open ends of the chambers consists in pouring in at the ends of the various chambers a mass C of white-metal or other appropriate metal. Conveniently the end plates B' of the casing are set back so that when the molten metal is poured in it is level with the edges of the inlet and outlet openings, as the case may be. The plates B' may be channeled or cut out to

form a groove corresponding, approximately, to the configuration of the bent sheet, and the metal may be poured into this channel or groove. When it is desired to remove a sheet from the casing, this white-metal joint may be destroyed and one of the end plates removed to permit the sheet being drawn out at that part. In the construction shown the steam enters through the inlet-opening B^2 , which communicates with a conduit B^3 , extending to each side of the apparatus, as shown in Fig. 2. The conduit B^3 tapers toward its ends, and the steam is distributed equally to all the chambers a' . The steam in passing through the chambers impinges on the nodules A' , causing cross currents and eddies to be set up and bringing fresh portions of the steam into contact with the walls of the chambers. The water of condensation passes to a conduit B^4 and is drawn off from the apparatus by an outlet-opening B^5 . The series of chambers a^2 on the opposite side of the sheet are in communication with the cooling-water, which enters by the opening B^6 at the lower part of the apparatus, and this water is distributed equally to the chambers by a conduit B^7 . In its passage upward through the chambers a^2 the water is churned and divided up into small streams, so that fresh portions of cooling-water are constantly coming in contact with the walls of the chamber, and the water finally passes from the chambers up a conduit B^8 to an outlet-opening B^9 . The various inlet and outlet openings are thus situated at parts where there is no possibility of the steam leaking to the water-chambers or the water leaking into the steam-chambers. The rounded parts or edges of the sheet formed by the bends may press against the sides of the casing sufficiently tight to prevent any inconvenient leakage of steam from one steam-chamber to another; but preferably the side walls are provided with grooves B^{11} , into which the folded parts of the sheet may be inserted, and these grooves serve to steady the sheet and prevent it from rattling, at the same time avoiding any undue leakage of steam or water, as the case may be, from one chamber to another. The sheet is preferably secured within the casing at its ends by leaving flanges or extensions a^3 , which pass between the end cover or walls and the chamber and the body part, so that the bolts which secure the cover to the casing may also pass through the sheet and secure it. For convenience in bending the sheet there are formed along the parts where the bend is to take place grooves a , (see Fig. 10,) which serve as hinges and permit the sheet to be partially extended after being removed from the casing and allow for the ready insertion of a brush, scraper, or other cleaning appliance. In Fig. 2 the grooves formed on the side walls are shown of such a nature that the folds of the sheet appear to have a considerable amount of movement therein; but in

practice the space will not be so large. However, it is not easy to show the precise dimensions in a drawing of this scale. Further, it is to be noted that only the nodules on the line of section are shown, the others being omitted for clearness. The section part of Fig. 2 is made on the line 2 2 of Fig. 1. All the nodules, however, are shown on the enlarged section of the sheet in Fig. 5.

In the modification shown in Fig. 6 the nodules A' are so formed that when the sheet is bent as shown these nodules all point in one direction and the apices of the nodules bear against the flat portions of the sheet. As in the previous case, the nodules are arranged in staggered rows; but they may be otherwise situated.

Another modification is illustrated in Fig. 7, and in this arrangement each alternate section of the sheet A —that is to say, only one wall of each chamber—is provided with nodules, which may be arranged in regular or staggered rows and conveniently are in contact with the plain or flat wall of the chamber.

When impure water is to be circulated through the apparatus, there will be a tendency for grit to lodge round the nodules, and so choke up the passages, and in order to avoid this the chambers through which this cooling-water passes may be formed so that no nodules extend into them. One method of accomplishing this is illustrated in Fig. 8, in which a sheet is shown having the nodules all projecting from one surface of the sheet. Thus when the sheet is bent the chambers a' for the steam have nodules extending from both walls, whereas the chambers a^2 for the cooling-water have no projections extending into them, but have a series of pockets formed on the rear side of the nodules extending into the steam-chambers. Other methods of arranging the nodules may be employed where it is desired to give the chambers for the cooling-water greater capacity than the chambers to which the steam is admitted or to tend to prevent grit from lodging round the nodules. For instance, the chambers to which the cooling-water is admitted may have projections extending into them from one or both walls, and conveniently a space is left between the apices of the nodules, as shown in Fig. 9, so that any grit entering the chamber can pass through between the nodules. In place of arranging the nodules on the opposite walls of the chambers so as to be in contact or with a space between them these nodules may be arranged so that they overlap and either touch the opposite wall or approach to within a convenient distance thereof.

When the apparatus is intended to be used with large engines or where the amount of work required to be done varies, it is preferable instead of increasing the capacity of the single chamber to divide the apparatus into an appropriate number of separate compart-

ments each complete in itself and independent of the other compartments. A convenient method of accomplishing this is illustrated in Figs. 3 and 4, in which a casing D is divided into compartments or chambers in which are placed a number of chambers B, having the interior divided into chambers for the steam and the cooling-water, as above described. Each of these chambers B is provided with a steam-inlet and condensed-water outlet and also an inlet and outlet for the cooling-water in a similar manner to the apparatus illustrated in Figs. 1 and 2. In the example shown three casings B are placed in the casing D and are situated one above the other, and each casing communicates by a steam-inlet pipe B² with the steam-exhaust pipe E from the engine. The water of condensation leaves the casing by the opening B⁵, communicating with the pipe F, and the cooling-water is supplied to each section or chamber by a pipe G, leading to the opening B⁶, and after circulating through the chambers leaves by the opening B⁹, communicating with the pipe H. Each compartment of the casing D, containing a section or chamber B, is provided with a separate cover D', bolted to the casing or secured in any other convenient manner so that it may be removed when it is desired to lift one of the sections from the casing. Between the flanges of the pipes E and H and the flanges on the openings B² and B⁹, respectively, are disposed distance pieces or rings J. When it is desired to remove one of the casings or sections B or to throw it out of action, the bolts between the flanges of the various connections are loosened and removed, when the distance-rings J are forced out of position, a blank stop-plate being inserted to take their place. These stop-plates can be secured to the pipes so that the section B can be removed, or since both the supplies of steam and cooling-water or steam alone are cut off the section is out of action, but does not interfere with the operations of the other sections, or the supply of steam and the cooling-water may be cut off from any section by suitable cocks. Until the various sections B of the multicompartmental apparatus are placed one above the other they may be arranged side by side in place of or in addition to the arrangement shown in the drawings, or the compartments B may be otherwise grouped together to form multicompartmental apparatus.

A filter may be employed in connection with the inlet for the cooling-water, and this may be of any appropriate construction. A convenient arrangement of filter consists of a box or casing in which is removably inserted a filter-plate or strainer, which is conveniently placed at an angle to the top and bottom walls of the box, so as to provide the largest possible amount of filtering area. The water

may enter at the lower part of the box and be led off from the top, or the filter may be disposed at the upper part of a box to the lower side of which the water is admitted, so that the water in passing through this box will deposit some of the mud or impurities before passing into the condensing apparatus.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. In apparatus for heating, cooling, condensing, evaporating, and similar purposes, the combination with a casing having therein a chamber provided with channels or grooves in opposite walls, of a metal sheet extending from one end of said chamber to the other and bent or folded upon itself in opposite directions alternately, the edges of said sheet extending into the aforesaid channels in the walls of the chamber, whereby said sheet forms within the chamber two independent series of passages, substantially as described.

2. In apparatus for heating, cooling, condensing, evaporating, and similar purposes, the combination with a casing, of a metal sheet bent or folded upon itself in opposite directions alternately and forming within the casing two independent series of chambers, said sheet having oppositely-extending nodules formed thereon between successive bends, substantially as described.

3. In apparatus for heating, cooling, condensing, evaporating, and similar purposes, the combination with a casing, of a metal sheet bent or folded upon itself in opposite directions alternately and forming within the casing two independent series of chambers, said sheet having oppositely-extending nodules formed thereon between successive bends, the nodules on one section of said plate contacting with another section thereof, substantially as described.

4. In apparatus for heating, cooling, condensing, evaporating, and similar purposes, the combination with a casing, of a metal sheet bent or folded upon itself in opposite directions alternately and forming within the casing two independent series of chambers, said sheet having oppositely-extending nodules formed thereon between successive bends, the nodules on one section of the plate contacting with nodules on adjacent sections, substantially as described.

5. In apparatus for heating, cooling, condensing, evaporating and similar purposes, the combination with a casing of a sheet bent or folded upon itself to form within the casing two independent series of chambers, nodules on the sheet projecting into the chambers, side walls to the casing bearing against the folds of the sheet, grooved or recessed end walls to the casing for the reception of the edges of the sheet, and a hermetic joint between the grooves and the sheet, substantially as described.

6. In apparatus for heating, cooling, con-
densing, evaporating, and similar purposes,
the combination of a casing having inlet and
outlet openings formed in the side walls there-
5 of and extending entirely across said walls,
means dividing the interior of the casing into
a plurality of passages, each series extending
from one of said inlets to one of the outlets
and being independent of the other series of
10 passages, and a conduit communicating with
each of said inlets and outlets throughout the

length thereof, substantially as and or the
purpose described.

In testimony whereof we have signed our
names to this specification in the presence of 15
two subscribing witnesses.

ALEXANDER SHIELS.
JOHN S. L. ALEXANDER.

Witnesses:

CLAUDE GILLIES,
ROB. THOMSON.