

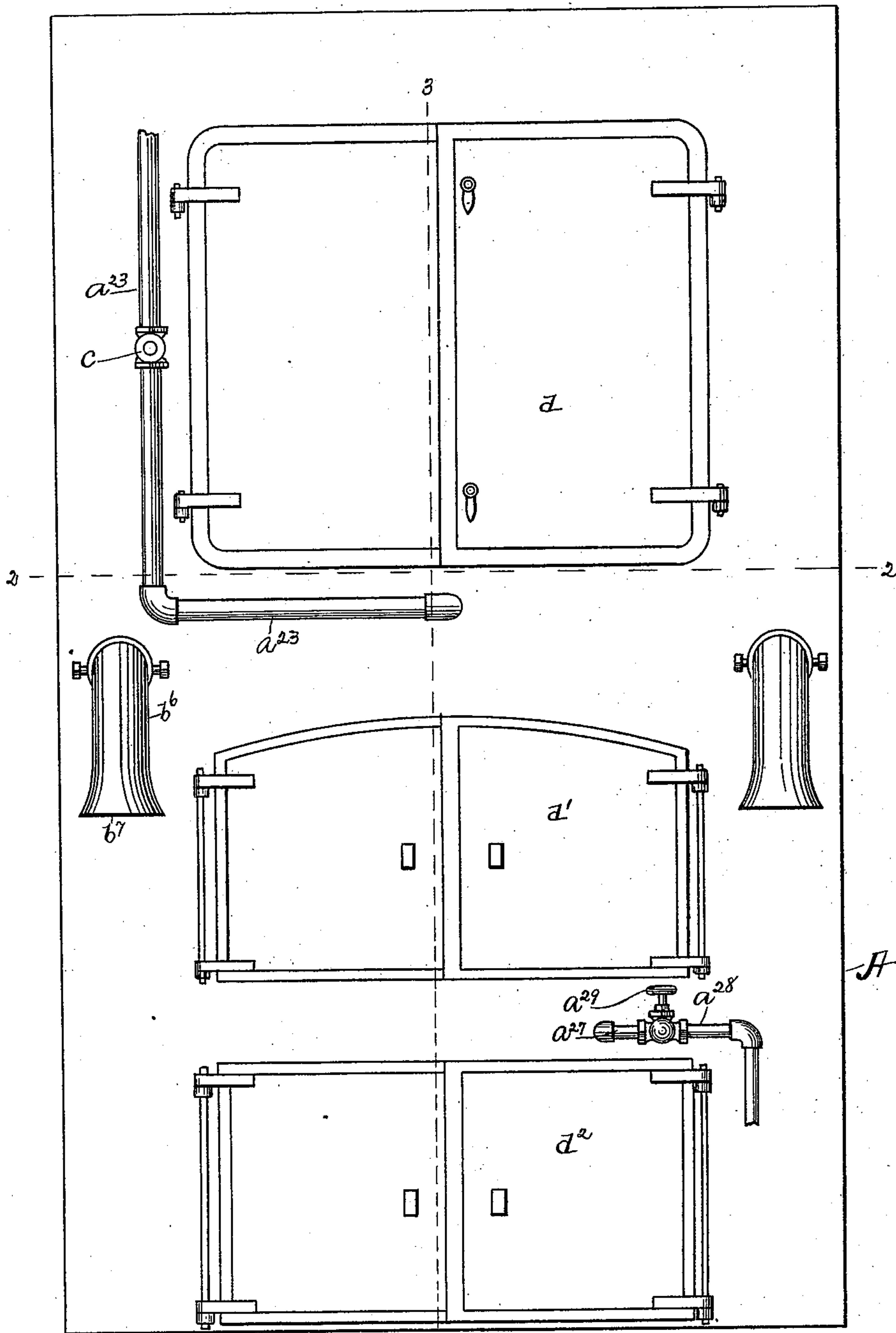
(No Model.)

3 Sheets—Sheet 1.

G. F. TINKHAM.
SMOKE CONSUMING FURNACE.

No. 534,297.

Patented Feb. 19, 1895.



WITNESSES.

Ivings H. Fay.
J. Murphy.

Fig. 1.

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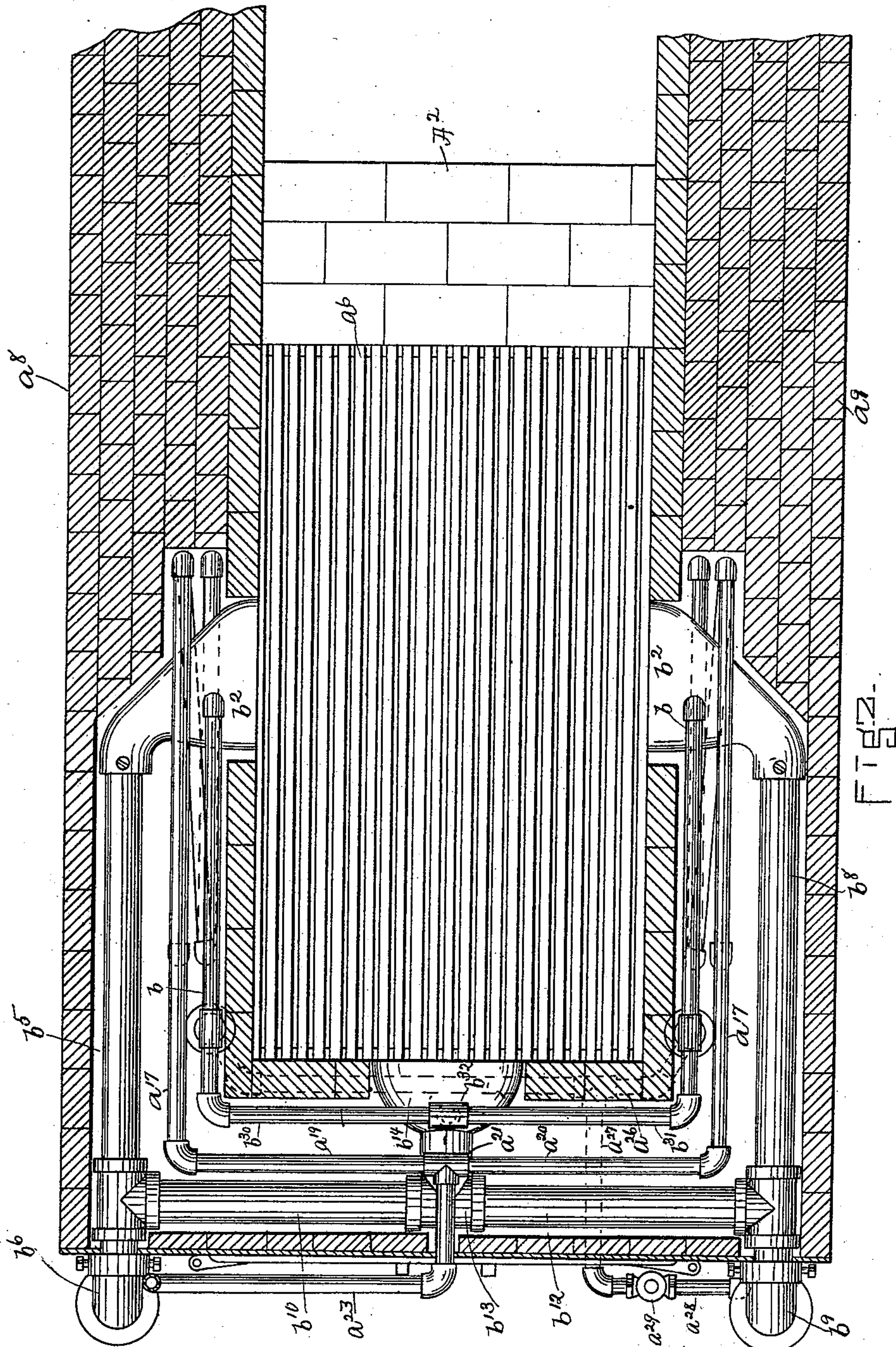
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(No Model.)

3 Sheets—Sheet 3.

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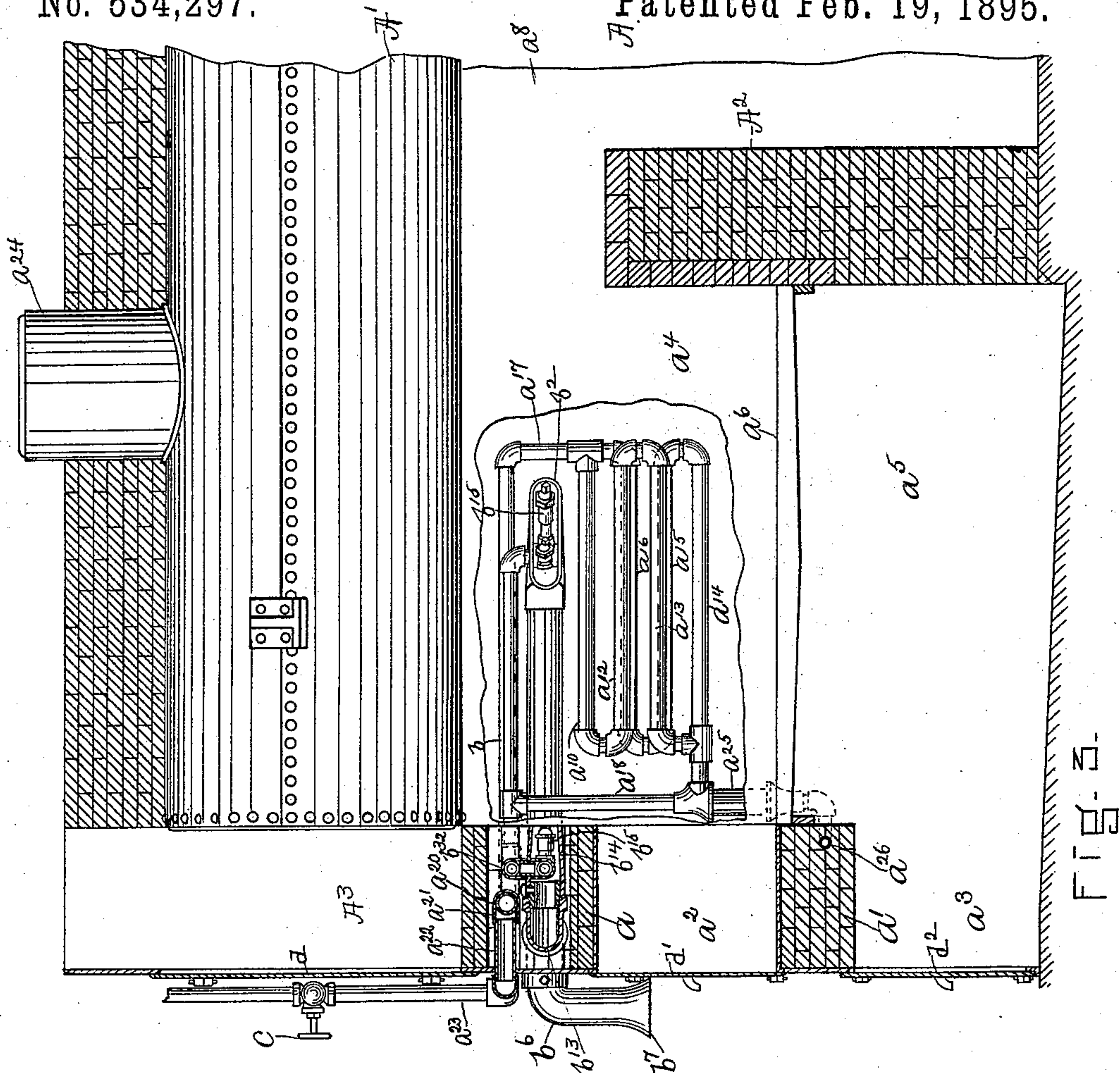


FIG. 5.

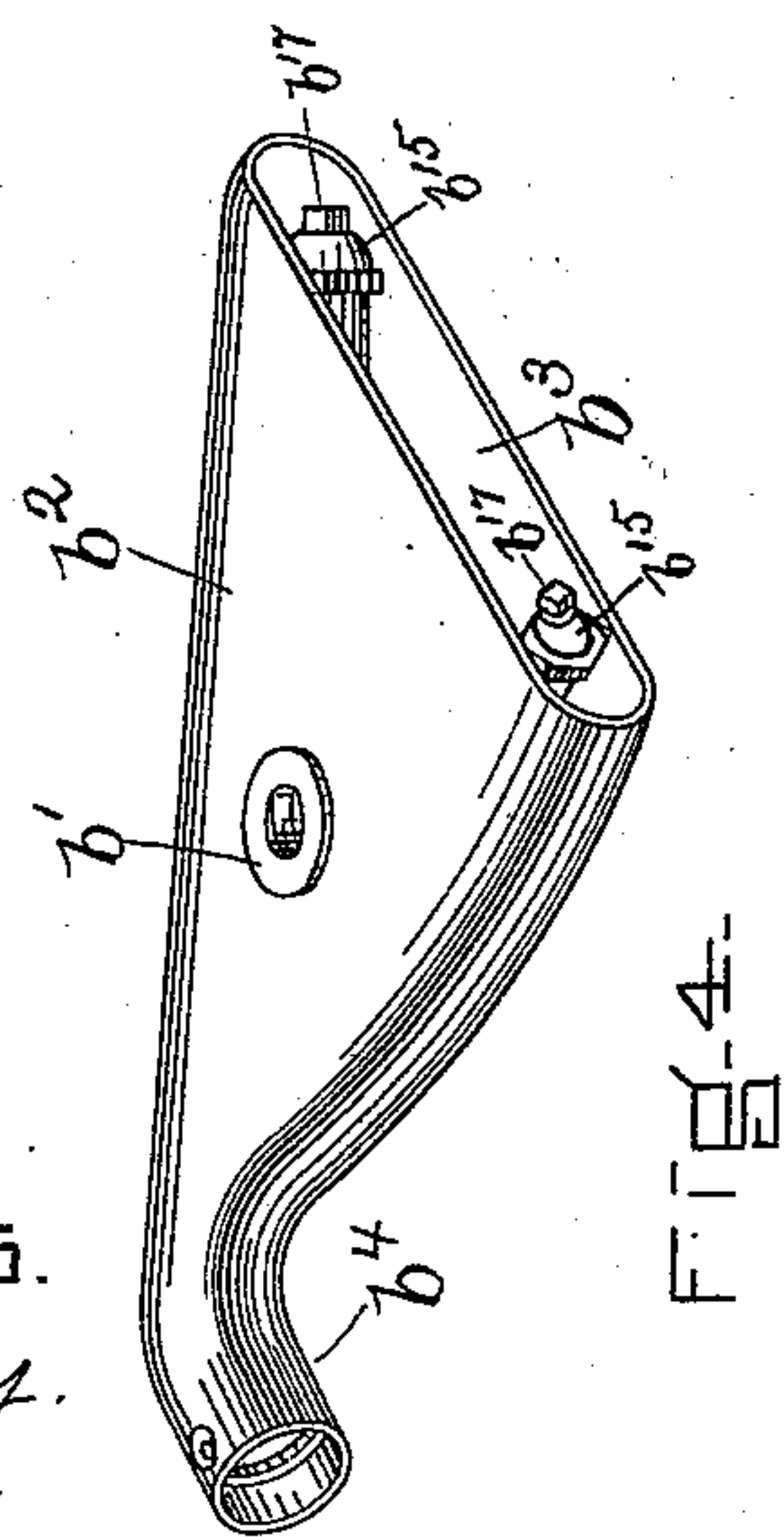


FIG. 4.

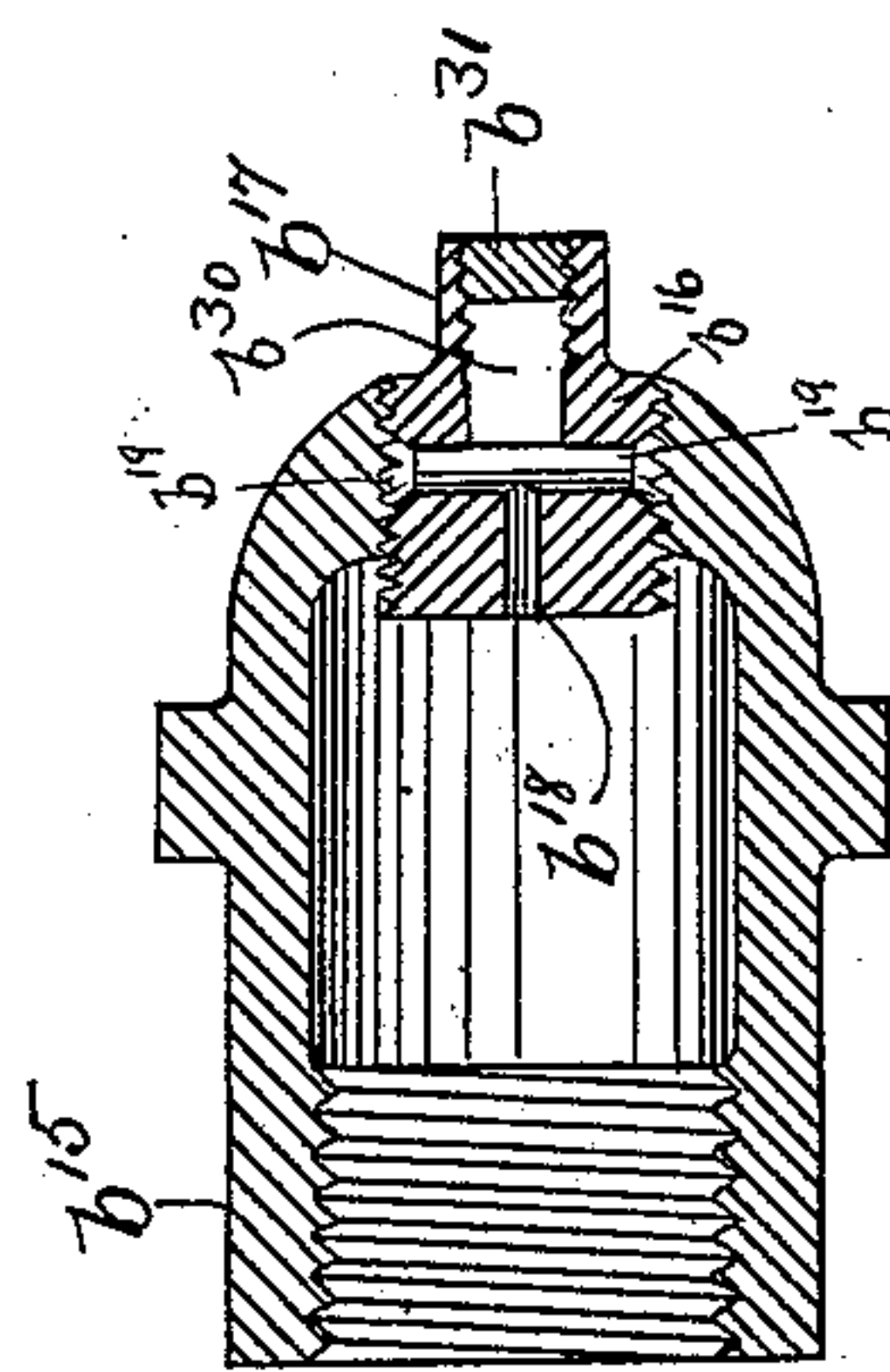


FIG. 3.

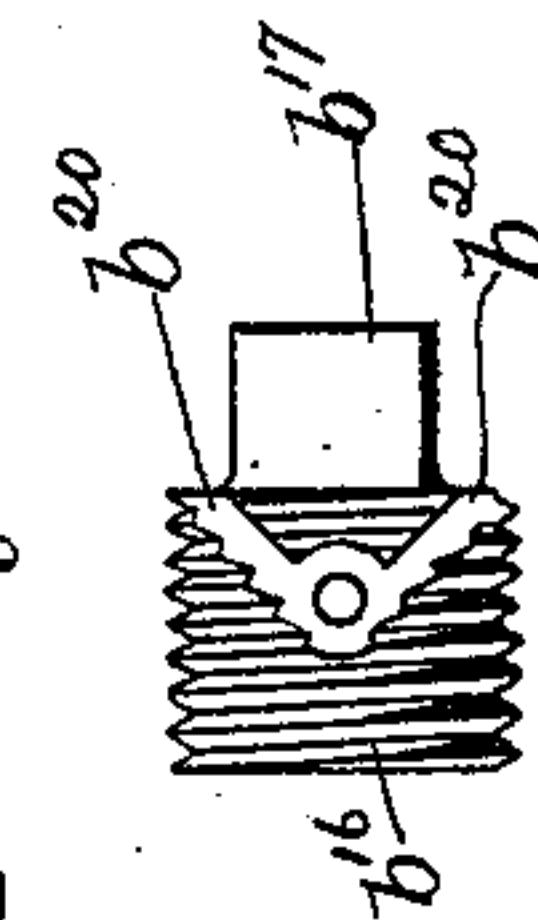


FIG. 6.

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UNITED STATES PATENT OFFICE.

GEORGE F. TINKHAM, OF BOSTON, MASSACHUSETTS.

SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 534,297, dated February 19, 1895.

Application filed April 27, 1893, Serial No. 472,068. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. TINKHAM, residing in Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Smoke-Consuming Furnaces, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

10 This invention relates to smoke-consuming furnaces of that class in which steam and heated air are commingled with the products of combustion in the fire-box or combustion chamber of the furnace,

15 One feature of my present invention consists in a novel construction and arrangement of apparatus within the furnace, whereby, furnaces now in use and of old style construction may be readily equipped without the
20 necessity of special construction and without change in the form or style of the furnace, as will be described.

Another feature of this invention consists in a novel construction of steam jet nozzles
25 by which the steam is efficiently divided or sprayed without the disagreeable whistling noise usually attendant on nozzles as heretofore constructed, such for instance, as shown and described in United States Patent No.
30 390,193, granted to me September 25, 1888.

The particular features in which this invention consists will be pointed out in the claims at the end of this specification.

Figure 1, is a front elevation of a furnace
35 embodying my invention; Fig. 2, a sectional plan view, partially broken out, of the furnace shown in Fig. 1, the section being taken on the line 2—2, and part of the brick-work of the furnace being omitted to enable the
40 steam and air-conducting pipes to be more clearly shown; Fig. 3, a vertical longitudinal section, partially broken out, of the furnace, the section being taken on the line 3—3, Fig. 1, and Fig. 4, a detail to be referred to; Fig. 5,
45 a longitudinal section on an enlarged scale of the nozzle, and the pipe or coupling connected therewith, and Fig. 6, a detail to be referred to.

50 The furnace A, having its walls made of brick or other refractory material and provided with the boiler A', may be of any usual or well-known construction such as commonly

used, the furnace, herein represented, being provided with the bridge-wall A² and up-take A³. The furnace is provided at its front with
55 arches *a a'* below which are the entrances *a²* *a³* to the fire-box *a⁴* and ashpit *a⁵*, respectively, the fire-box being provided with the usual grate-bars *a⁶*. In order to equip the furnace A with an efficient smoke-consuming ap-
60 paratus at a minimum expense and without altering the construction of the furnace, preferably each side wall *a⁸* *a⁹* and the front arch *a* of the furnace have embedded in them, two steam-spraying or atomizing nozzles and an
65 air-chamber of special construction, as will be described. Each side wall also has embedded in it a steam superheating apparatus, preferably consisting of two sets of coils *a¹⁰* *a¹²* *a¹³*, *a¹⁴* *a¹⁵* *a¹⁶* connected to a steam-inlet
70 pipe *a¹⁷* and a steam outlet pipe *a¹⁸*, the steam inlet pipes *a¹⁷*, in the side walls *a⁸* *a⁹* being joined by pipes *a¹⁹* *a²⁰* embedded in the front arch *a*, to a T-shaped coupling *a²¹* joined by a pipe *a²²*, extended through the front arch *a*
75 to the outside of the furnace and which is connected to a main steam supply pipe *a²³* communicating with the steam space or dome *a²⁴* of the boiler, the pipe *a²³* being shown as broken off in the drawings. 80

The steam outlet pipe *a¹⁸* of each superheating apparatus has connected to or forming part of it, an enlargement *a²⁵* forming a well or reservoir for any water of condensation which may collect in the superheating coils
85 when the temperature of the walls *a⁸* *a⁹* is low enough to condense the steam, as for instance, in case the fire is banked or permitted to be extinguished. The wells *a²⁵* in the side walls *a⁸* *a⁹* are connected to a pipe *a²⁶* embedded in
90 the arch *a'*, as shown by dotted lines, Fig. 2, and the pipe *a²⁶* has connected to it a pipe *a²⁷*, extended through the arch *a'* to the outside of the furnace and joined to a drip pipe *a²⁸* provided with a cock or valve *a²⁹*. 95

The steam outlet pipes *a¹⁸* of the superheating coils are joined by pipes *b* to hollow fittings *b'* located within casting *b²* embedded in the side walls *a⁸* *a⁹* of the furnace, and having their delivery ends communicating with
100 the fire-box *a⁴*, the said castings forming air-expanding chambers. Each casting *b²* is preferably made of substantially the shape shown in Figs. 2 and 4, it having a substantially

long delivery mouth or opening b^3 and a contracted inlet or neck b^4 . The casting b^2 , embedded in the side wall a^8 , is connected by an air conducting pipe b^5 to an air inlet pipe b^6 located at the front of the furnace and preferably provided with a bell-shaped mouth b^7 . The casting b^2 in the side wall a^9 , is connected by an air conducting pipe b^8 inclosed or embedded in the said side wall to a similar air inlet pipe b^9 located at the front and outside of the furnace, the air conducting pipes b^5 b^8 being extended through the arch a . The air conducting pipes b^5 b^8 are connected respectively by pipes b^{10} b^{12} , embedded in the arch a and extended to near the center of the same, by a T b^{13} , joined to a substantially circular casting b^{14} forming an air-expanding chamber for the front of the fire-box. The casting b^{14} is also provided with a fitting, not shown, similar to b' in the side casting b^2 . The fittings within the casting b^2 and b^{14} have connected with them, steam distributing or spraying devices consisting of a pipe b^{15} (see Fig. 5) and a nozzle b^{16} of special construction, which is screwed into the outer end of the pipe b^{15} . The nozzle b^{16} , in accordance with my present invention, has its front portion or nose piece b^{17} made practically solid and without a steam outlet opening, the rear portion of the nozzle being also made solid and provided with a steam inlet hole b^{18} , which communicates with a radial hole b^{19} extended through the solid nozzle and communicating with channels or grooves b^{20} on the surface of the nozzle and extended toward the front of the same, the channels b^{20} , for the best results, diverging to effect a more efficient distribution of the steam, the said channels, in my improved form of nozzle, constituting the sole outlets for the steam.

By means of the construction of nozzle herein shown and described, objectionable noises, such as whistling of the steam, are avoided and the nozzles are thus rendered substantially noiseless in their operation. The nose piece b^{17} is preferably provided with a steam chamber b^{30} , which is best formed by tapping through the solid nose and closing the hole or opening at its outer end by a plug b^{31} , which may be screw-threaded to permit the same to be readily removed for the purpose of cleaning. The steam-chamber thus formed in the nose piece and closed at its outer end, serves to cool the nose piece and prevent the same from being burned off, as in practice, the nose piece of the nozzle is exposed to the heat in the furnace.

Each air-expanding chamber or casting will preferably be provided with two nozzles, as in practice, I find this arrangement to give most satisfactory results.

The nozzles in the central casting or air chamber b^{14} are supplied with steam from the steam inlet pipes a^{18} of the superheating coils in the side walls a^8 a^9 , by pipes b^{30} b^{31} connected to a T b^{32} joined to the fitting of the casting b^{14} .

In the operation of my improved smoke-consuming furnace, the steam from the steam-dome is supplied to be various nozzles by opening the cock or valve c in the supply pipe a^{23} . The steam first passes to the inlet pipes a^{17} of the superheating coils embedded in the side walls of the furnace, and then from the steam outlet pipes a^{18} of the said coils to the steam nozzles in the side castings or air expanding chambers b^2 by the pipes b , and to the nozzles in the central air-expanding chamber b^{14} by the pipes b^{30} b^{31} . The steam, issuing from the nozzles into the fire-box, draws with it the supply of heated air, which is taken from the front of the furnace through the air inlet pipes b^6 b^9 . In Fig. 2, I have shown a portion of the brick-work as omitted, but in practice, I prefer to fill in the space between the various pipes with brick or other refractory material, so as to completely embed the superheating coils and the steam and air conducting pipes, and by thus embedding the said pipes, they are effectively protected against being burned out. Furthermore, by the arrangement of pipes herein shown, the air may be taken from the front of the furnace, and the apparatus may be applied to furnaces as now constructed and in use, without necessitating any change in the construction of the furnace, so that a furnace of the old type or style may be equipped with the smoke-consuming device herein shown, in a substantially short space of time and at a minimum expense.

As represented in Fig. 1, the furnace is provided with three sets of doors, one set d for the up-take; a second set d' for the entrance a^2 to the fire-box; and a third set d^2 for the ash-pit.

I claim—

1. In a smoke-consuming furnace, the combination with a steam superheating apparatus embedded in the side walls of the furnace, and connected to the steam space or dome of a boiler supported by the furnace, of steam spraying nozzles located within the air chambers or castings embedded in the side walls of the furnace and communicating with the interior of the furnace below its boiler, air conducting pipes connected to the said air chambers or castings and embedded in the side walls and extended through the front of the furnace, to open directly to the atmosphere substantially as described.

2. The combination with a furnace having its side walls connected by the front walls a a' , of a steam-superheating apparatus embedded in the side walls of the furnace, and air chambers b^2 embedded in the said walls, and air-chamber b^{14} embedded in the front wall a as described, steam spraying nozzles in said chambers and pipes connecting the steam nozzles with the superheating apparatus, and air-conducting pipes embedded in the side walls and extended through the front of the furnace, substantially as described.

3. The combination with a furnace pro-

vided with a steam boiler, of a superheating coil embedded in a side wall of the furnace, an air-chamber also embedded in the side wall and provided with a steam-fitting b' , one
 5 or more steam-spraying nozzles connected to the said steam fitting within the air-chamber, the said air-chamber communicating with the fire-box of the furnace, steam inlet and outlet pipes for said superheating coil
 10 embedded in the side wall of the furnace, the said steam outlet pipe being connected to the steam fitting of the air-chamber, and an air-conducting pipe embedded in the side wall of the furnace and extended through the
 15 said side wall to the front of the furnace and connected to the air-chamber within the side wall, substantially as described.

4. The combination with a furnace provided with side walls $a^8 a^9$ and the front walls
 20 $a a'$, and a boiler supported by said furnace, of superheating coils embedded in the side walls $a^8 a^9$, steam inlet pipes a^{17} for said coils embedded in the said side walls, and connected to a steam supply pipe located outside the fur-
 25 nace, steam outlet pipes for the superheating coils, air-chambers b^2 embedded in the side walls and provided with a steam fitting b' to which the steam outlet pipes are connected, an air-chamber b^{14} embedded in the front wall
 30 a and provided with a steam fitting, pipes $b^{30} b^{31}$ connecting the steam fitting of the air-chamber b^{14} with the steam outlet pipes of the superheating coils, the said pipes being embedded in the front wall a , steam spray-
 35 ing nozzles connected to the steam fittings of the air-chambers $b^2 b^{14}$, air-conducting pipes $b^5 b^8$ extended from the front of the furnace through the side walls and connected to the air-chamber b^2 , and an air pipe embedded in
 40 the front wall a and connected to one or both side pipes $b^5 b^8$ and to the air-chamber b^{14} , substantially as described.

5. The combination with a furnace provided with side walls $a^8 a^9$ and the front walls
 45 $a a'$, and a boiler supported by said furnace, of superheating coils embedded in the side walls $a^8 a^9$, steam inlet pipes a^{17} for said coils embedded in the said side walls, and connected to a steam supply pipe located outside the fur-
 50 nace, steam outlet pipes for the superheating coils, air chambers b^2 embedded in the side

walls and provided with a steam fitting b' to which the steam outlet pipes are connected, and an air-chamber b^{14} embedded in the front wall a and provided with a steam fitting, pipes
 55 $b^{30} b^{31}$ connecting the steam fitting of the air-chamber b^{14} with the steam outlet pipes of the superheating coils, the said pipes being embedded in the front wall a , steam spraying
 60 nozzles connected to the steam fittings of the air-chambers $b^2 b^{14}$, air-conducting pipes $b^5 b^8$ extended from the front of the furnace through the side walls and connected to the air-chambers b^2 , and an air pipe embedded in
 65 the front wall a and connected to one or both side pipes $b^5 b^8$ and to the air chamber b^{14} , wells or reservoirs connected to the steam coils and to a drip pipe embedded in the front wall a' and extended through the same to the
 70 outside of the furnace, substantially as described.

6. The herein described steam nozzle consisting of the solid plug adapted to be fitted into a steam-pipe, and provided with the steam inlet hole or passage extended but a
 75 portion of the length of the said plug, a radial hole or passage extended from the steam inlet passage to the outside of the plug, and one or more delivery channels or passages on the outside of the plug and extended from
 80 the radial holes toward one end of the said plug, substantially as described.

7. The herein described steam nozzle consisting of the solid plug adapted to be fitted into a steam-pipe, and provided with the
 85 steam inlet hole or passage extended but a portion of the length of the said plug, a radial hole or passage extended from the steam inlet passage to the outside of the plug, and one or more delivery channels or passages on
 90 the outside of the plug and extended from the radial holes toward one end of the said plug, and a steam chamber in the front end of the plug and closed at its outer end, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE F. TINKHAM.

Witnesses:

JAS. H. CHURCHILL,
 J. MURPHY.