(No Model.) 4 Sheets—Sheet 1.

E. C. CONDIT.

FURNACE.

No. 464,241. Patented Dec. 1, 1891.

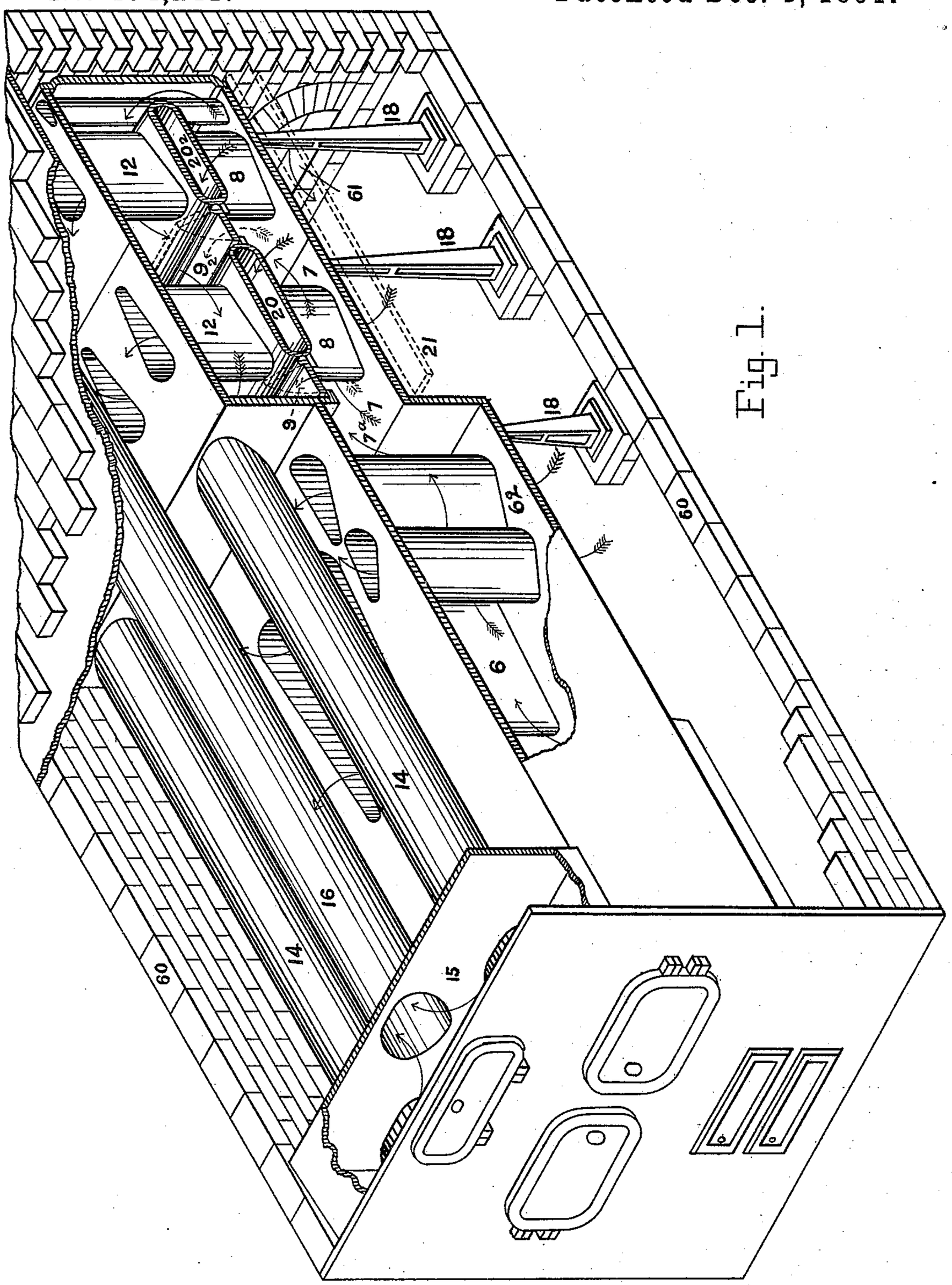

Fig. 1.

Witnesses.
M. A. Condit.
Frank E. Shepard

Inventor.
Ezekiel C. Condit.

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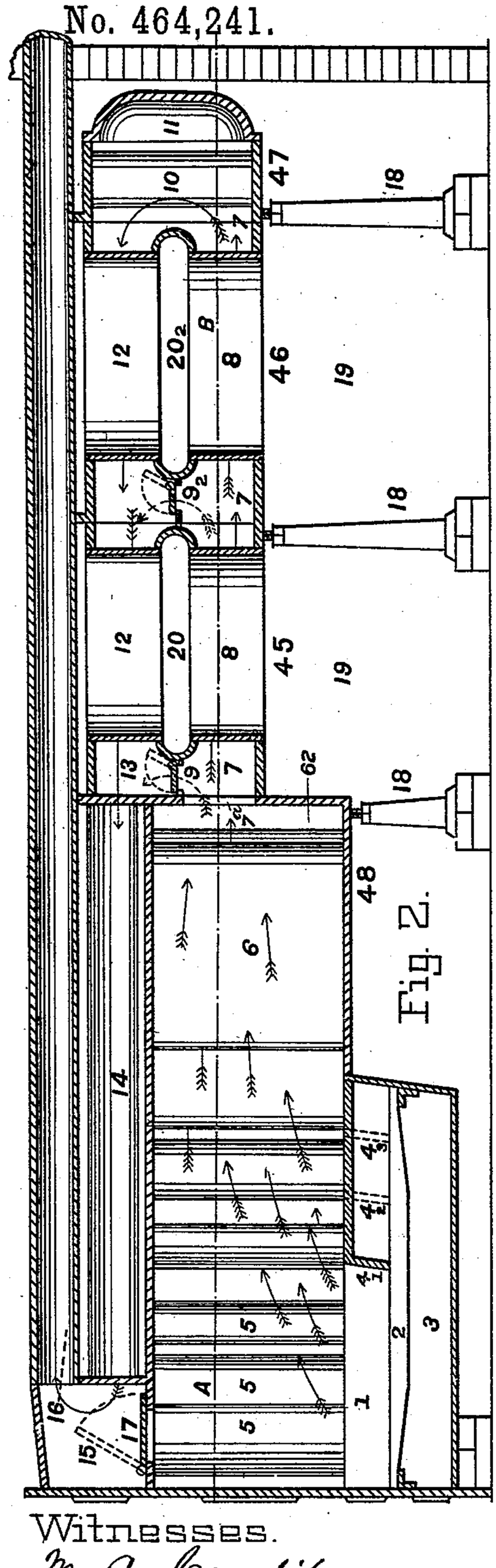

Fig. 2.

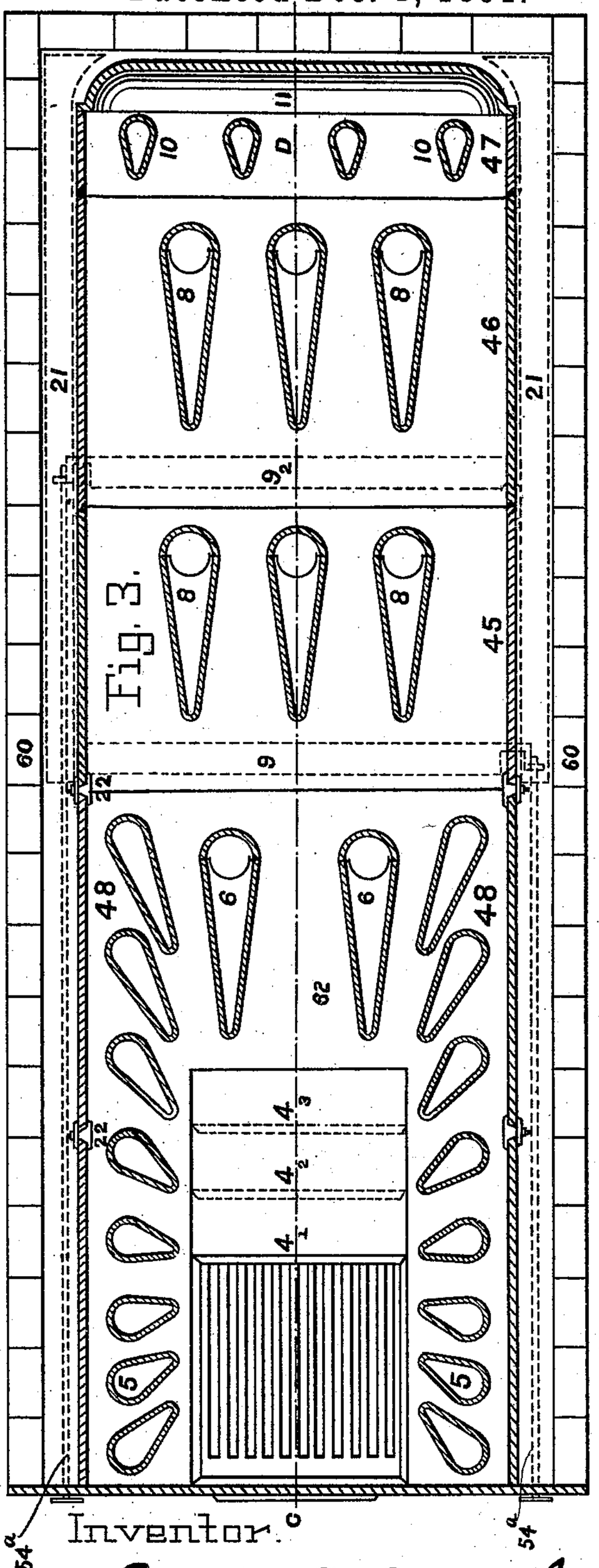

Fig. 3.

Witnesses.
M. A. Condit.
Frank E. Shepard

Inventor.
Ezekiel C. Condit.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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E. C. CONDIT.

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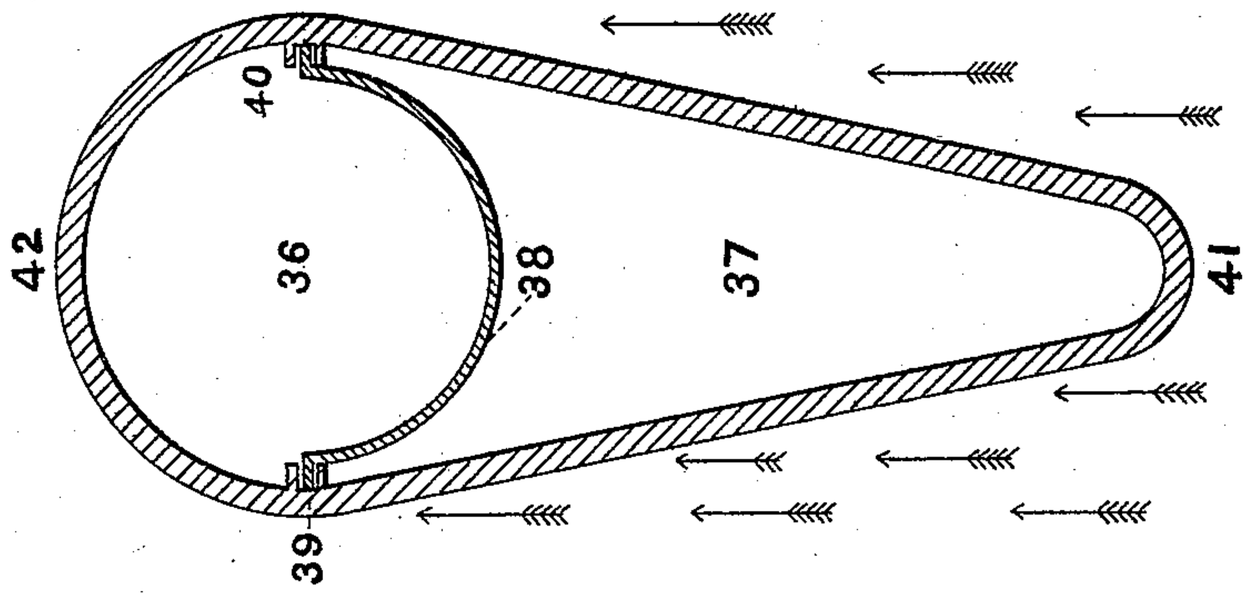

Fig. 7.

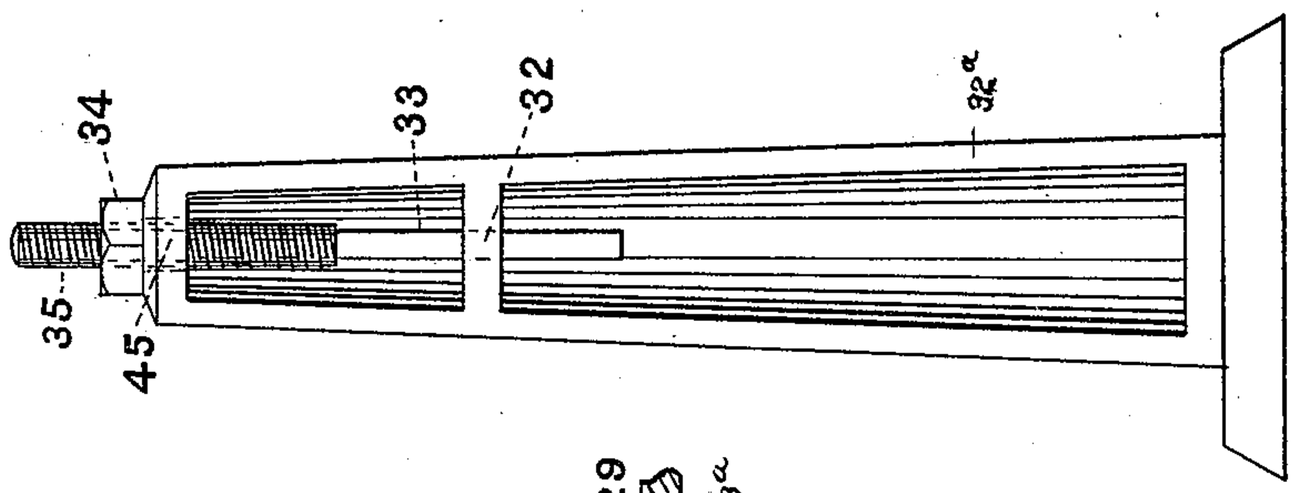

Fig. 6.

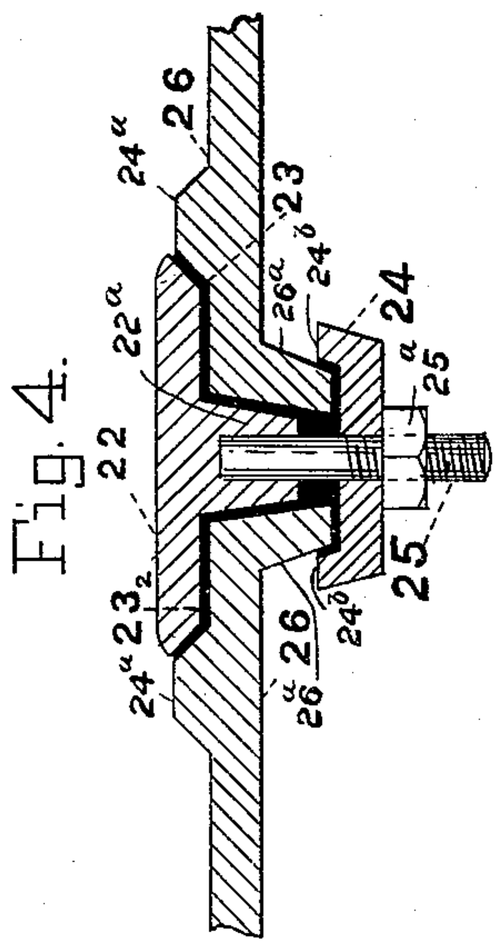

Fig. 4.

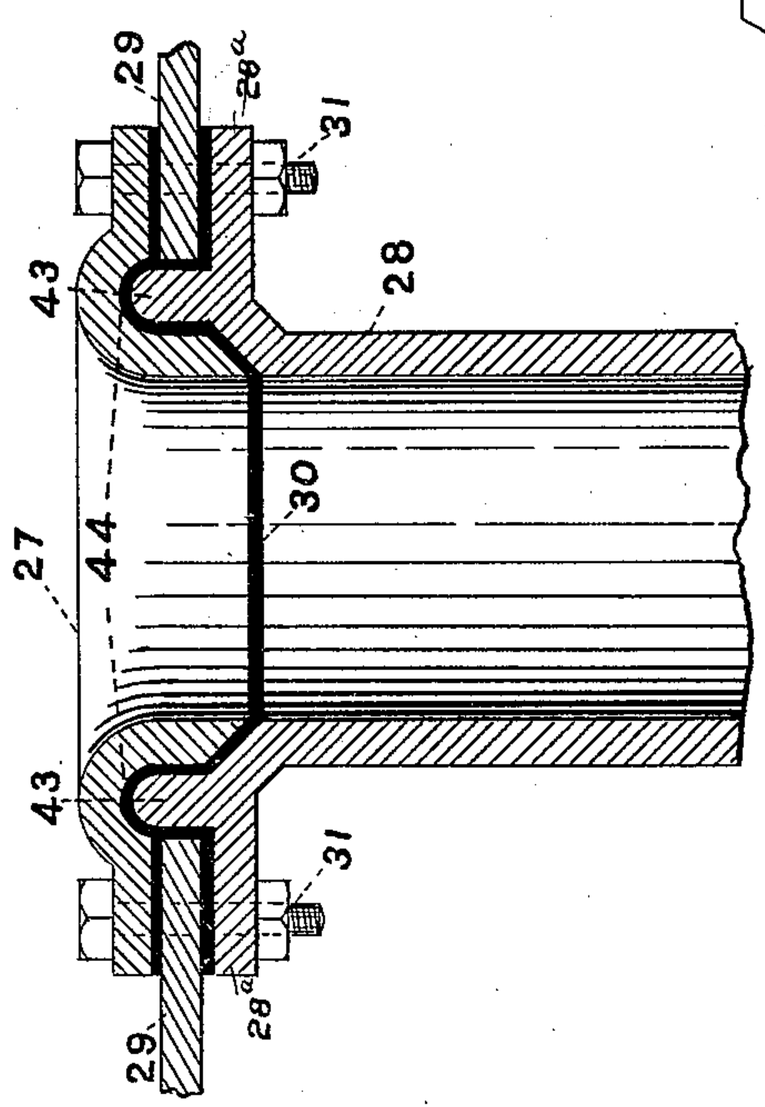

Fig. 5.

Witnesses.

M. A. Condit.

Frank E. Shepard

Inventor

Ezekiel C. Condit.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.)

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E. C. CONDIT.

FURNACE.

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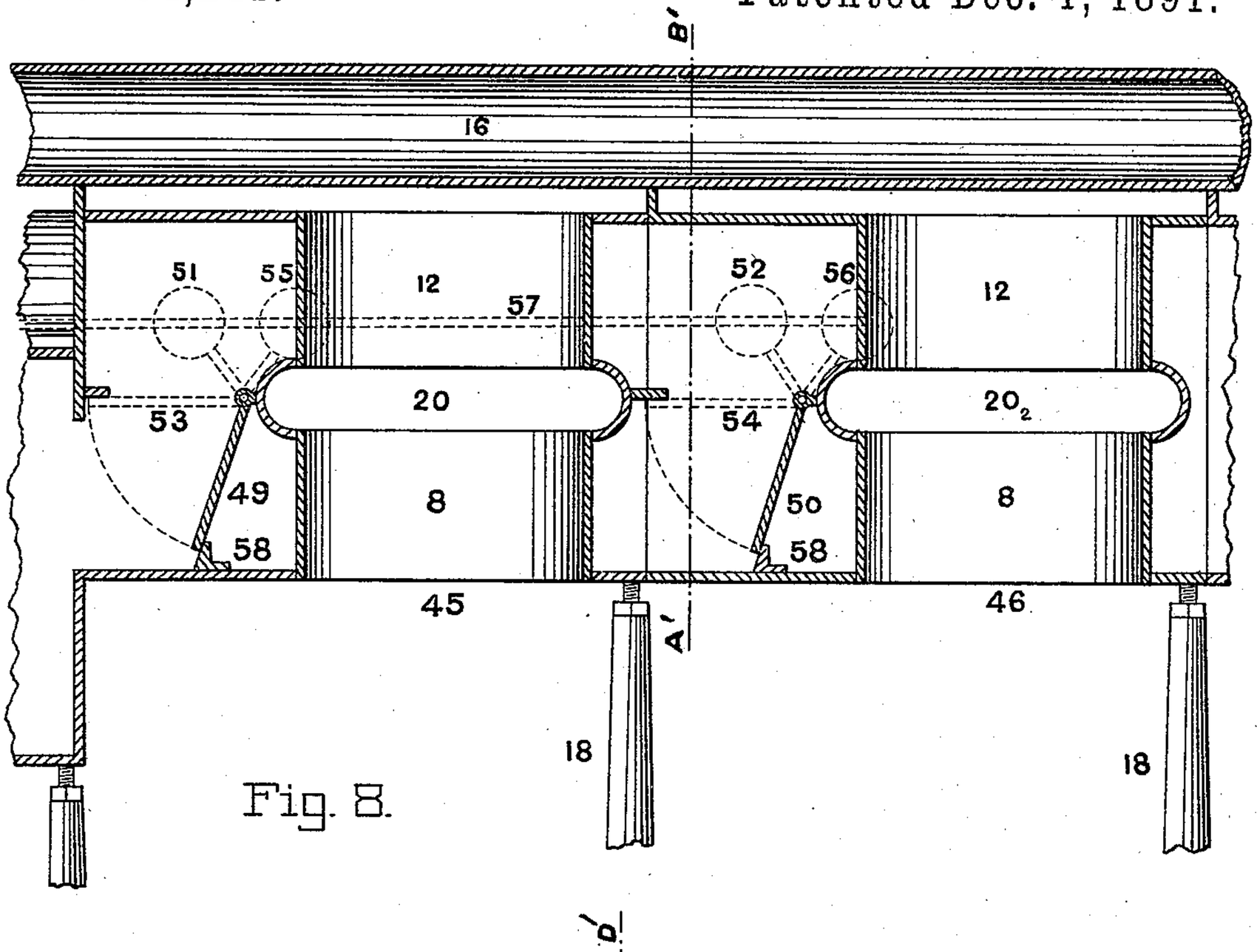

Fig. 8.

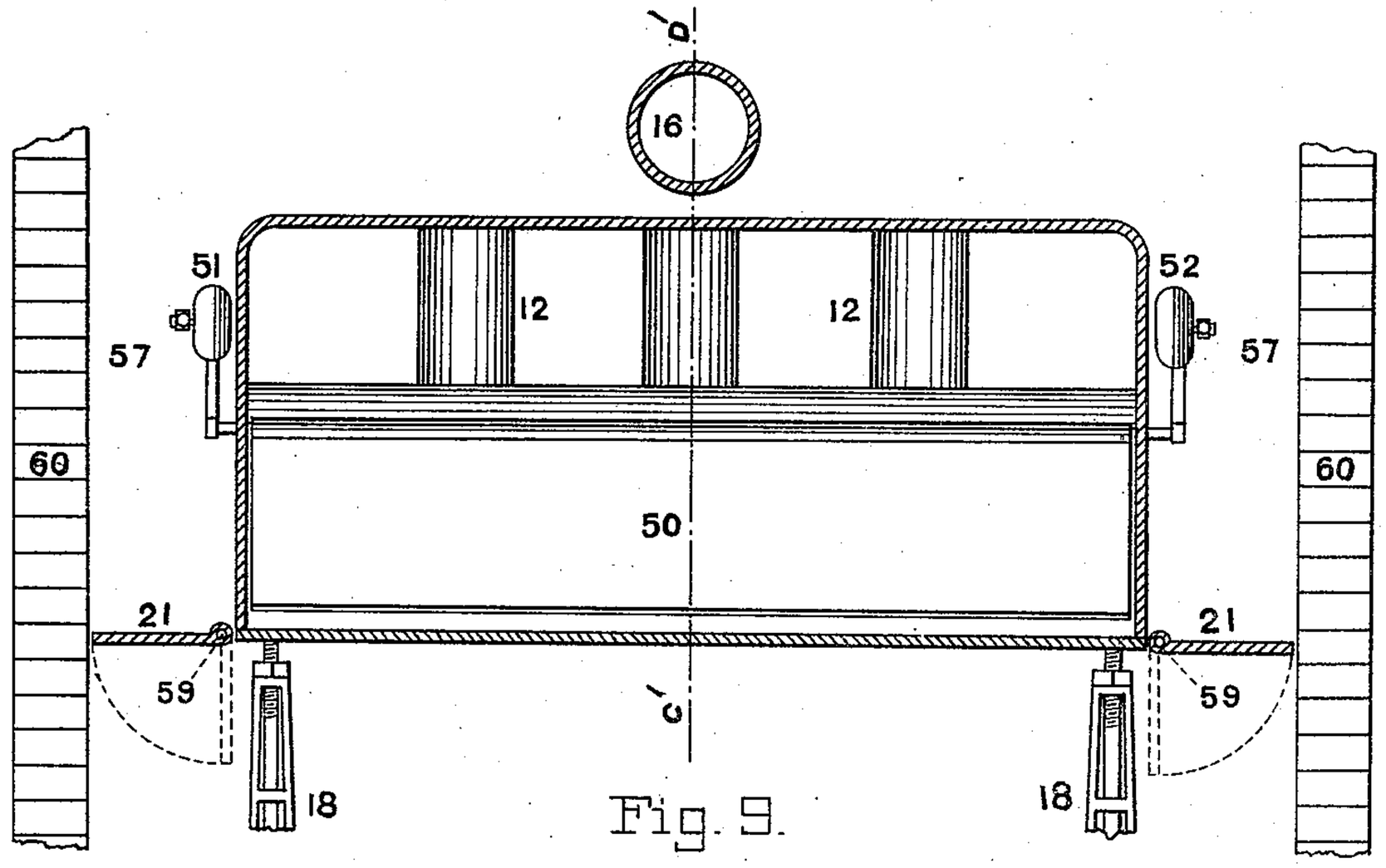

Fig. 9.

Witnesses.

M. A. Condit.

Frank E. Shepard.

Inventor.

Ezekiel C. Condit,

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

EZEKIEL C. CONDIT, OF DENVER, COLORADO.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 464,241, dated December 1, 1891.

Application filed February 12, 1891. Serial No. 381,240. (No model.)

To all whom it may concern:

Be it known that I, EZEKIEL C. CONDIT, of Denver, Arapahoe county, Colorado, have invented certain new and useful Improvements in Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to certain new and useful improvements in apparatus for warming air, the object being to provide means for a general improvement in the construction of such apparatus; and it consists in the details of the combination and arrangement of the parts of which it is composed.

It also has for its object—

First. To provide a variable quantity of warmed air, according to the state of the weather; and I accomplish this by so constructing my apparatus as to enlarge or reduce the heating-surface as desired.

Second. To provide means whereby the area of the grate-surface may be varied as required; and for this purpose I use castings adapted to reduce or enlarge the grate-surface.

Third. To provide an air-heating pipe that will expose the greatest possible surface to the direct action of the products of combustion with the minimum obstruction to the passage thereof, and in which pipes two separate currents of air may be heated to different temperatures. This I accomplish by using a pipe a cross-section of which would be approximately cone-shaped, the thin edge of which faces the fire or heat-currents. In this pipe I place a diaphragm, forming two separate channels for two separate currents of air.

Fourth. To provide a means for supporting the fire-box in a fixed position, regardless of any settlement of the base, which is accomplished by using screw-actuated extensible supports for the latter.

Fifth. To prevent the passage of gases of combustion from the fire-box into the warm-air chamber, which I prevent by a peculiar form of joint.

Sixth. To prevent the air from passing into the room without having first passed over heated surface. This I accomplish by placing dampers in the passages for air in the space between the apparatus and the structure surrounding it, so that when certain parts are not heated the air cannot pass upward, all of which will be hereinafter more fully described and claimed.

In the drawings, Figure 1 is a perspective view of the furnace constructed in accordance with my invention, parts thereof being broken away. Fig. 2 is a central vertical longitudinal section thereof on line C D of Fig. 3. Fig. 3 is a horizontal section on line A B of Fig. 2. Fig. 4 is a detailed sectional view of joint between two contiguous plates. Fig. 5 is a detailed sectional view of a joint between a plate and a pipe. Fig. 6 is a detail view of the adjustable leg or support. Fig. 7 is a horizontal section of the air-heating pipes 6 and 8, showing the form of diaphragm. Fig. 8 is a vertical longitudinal section on line C′ D′ of Fig. 9. Fig. 9 is a section on line A′ B′ of Fig. 8.

60 is the structure or casing surrounding my invention and may be of any approved construction, it having at its base an aperture 61 for the entrance of cold air. This may be located at any other point in the base of the structure, if desired. The fire-box, constructed substantially as shown, is supported within the casing 60 by the legs 18, the said fire-box having a top, bottom, sides, and rear, its front of iron forming the front of the structure 60. The heating-chamber 7 is also supported within the structure 60 by the legs 18, and is in the rear of and slightly higher than the fire-box 62, with which it is connected by the aperture 7^a in the rear of the latter, the said heating-chamber 7 having a top, bottom, side, and rear, and also having a front for that portion which projects above the top of the fire-box. It will thus be seen that the fire-box and heating-chamber divide the interior of the structure 60 into two compartments communicating at their sides, the fire-box and heating-chamber being of less width than the interior of the structure and being adapted to be regulated by the dampers 21, pivoted at their opposite ends on the pins 59 therein, (or the said pins can be made in the form of a rod extending through the dampers from end to end,) so as to shut off cold air from part of the apparatus when not in use.

To reduce or enlarge the grate-surface, I provide a number of castings $4'$ 4^2 4^3, &c., of

different sizes, which are adapted to fit over the rear of the grate-bars, and thus vary the exposed surface thereof and secure a proper proportion between the grate area and the area of the heating-surfaces.

6 are pipes, the cross-section of which are approximately cone-shaped, passing from the bottom of the fire-box to the top thereof, thus affording a connection between the air-space above and that below the said fire-box, through which air will rise and be heated during its upward passage, the narrow edge of the said pipes pointing toward the fire-space.

8 are similarly-shaped pipes rising from the bottom of the heating-chamber and passing through the top thereof, thus also affording a communication between the top and bottom compartments of the structure 60, and 10 are other pipes located in the extreme rear of the chamber, they being of smaller size and utilizing any heat that may remain in the products of combustion after passing through the spaces between the pipes 6 and 8. All of the pipes 8 and 10 have their narrow edges toward the heat-currents, and it will thus be seen that each has a large surface exposed to the full effects of the products of combustion, while a comparatively small surface will be only heated by reflected heat and conduction. I therefore form in the pipes 8 and in the pipes 6 at the throat of the fire-box vertical channels 39 40, one on each side thereof near the base 42, and slide within the said channels the edges of the diaphragm 38, (which may be of any shape desired,) which will thus divide the interior of the said pipes into two passages. In the forward one 37 the air will be heated to a higher degree than in the rear one 36. It will thus be seen that when the contents of the two compartments 36 and 37 are mixed in the upper compartment of the structure 60 they will thus form a large volume of moderately-heated air for use in rooms above where needed. This diaphragm can be put in other pipes, as desired. The pipes 8 are arranged in rows across the heating-chamber and bisected by the horizontal ducts 20 20^2, which have a flattened contour and communicate with the said pipes, the ends of the said pipes 20 20^2 projecting through the sides of the heating-chamber and communicating with the passage between the sides of the chamber and the side wall of structure 60, above the dampers 21 therein, thus providing for a thorough mixing of the contents of the upper compartment of the structure with the heated air arising through the pipes 8 8, which are divided by the pipes 20 20^2 into two sections 8 and 12, the lower and the upper.

9 9^2 are valves pivoted to the forward edge of each of the pipes 20 20^2, and are adapted when raised to permit the products of combustion to rise to the upper portion of the heating-chamber, from the forward portion of which they may flow through the pipe 14 to the box 15, located in the forward upper portion of the structure 60, from which box the products of combustion flow to the chimney or stack through the pipe 16. It will be noticed that if the valve 9 is open the products of combustion will pass through the opening thus made and escape through the pipes 14 to the front chamber 15, and thence through the pipe 16 to the smoke-flue, and thereby heat only the body of the furnace, giving all the heat that would be required during moderate weather. By closing the damper 9 and opening 9^2 the additional heating-surface of section 45 would be added to meet the requirements of colder weather, and by closing both 9 and 9^2 the products of combustion will pass to the extreme rear of the heating-chamber and thence forward, thereby heating all the surface and supplying the maximum amount of heat.

I make the sides of fire-box in sections, each section consisting of a single casting, the said sections being adapted to be readily joined together, when desired, by the form of joint shown in Fig. 4, and it will thus be seen that the fire-box may be extended as desired, after which the heating-chambers 45 46 47, and 11, or any of them, may be added to complete the furnace, and the joints thus made are described as follows:

Let the plate 26, which represents a side, top, &c., of one of the sections of the fire-box, have an inwardly-extending tapered flange 24 thereon, and have on its outer face the flanges 26^a, the flanges 24^a upon the contiguous end of adjoining plates leaving a tapered slot, the inner width of which is greater than the outer. 22 is a plate of a width equal the distance between the flanges 26^a of the adjoining plates, the said plate 22 having the longitudinal tongue 22^a thereon, from which extends the threaded bolt 25, adapted to receive the cap 24, having the opposite flanges 24^b upon its edges, the said cap being forced down over the flanges 26^a by means of a nut 25^a, working upon the thread of the bolt. Such being the construction of the several parts of the joint, the space between the flanges 24^b and between the flanges 26^a is filled in with some suitable cement before the parts are assembled. The plate 22 is then forced in place and the cap 24 down over the flanges 26^a by the nut 25^a pressing the cement in place and rendering the joint gas-tight, thereby preventing the products of combustion from mingling with the air supplied through the chamber surrounding the furnace. To repack the joint it will only be necessary to remove the nut 25^a and the casting 22, after which the joint can be refilled with cement and the casting replaced without disturbing any other part of the furnace.

In order to make a joint between any plate shown herein and a pipe, I use the joint shown in Fig. 5, in which 28 represents the pipe, having its end flared outward in the form of an annular flange 28^a, from the forward face of which arises the annular tongue 43, which

is adapted to fit within an annular channel 44, formed on the collar 27, the inner edge of the collar being bent rearwardly and projecting within the pipe 28, while the plate 29 is contained between the outer edge of the forward face of the annular flange 28^a and the outer edge of the rear face of the collar, between which it is secured by bolts 31, and in this case also the spaces between the several parts are occupied by suitable fire-proof cement, which is put in place before the parts are assembled, it occupying when the parts are drawn together the position indicated in solid black lines in Fig. 5.

The legs or supports 18 consist of two members capable of extension for the purpose of permitting the fire-box and heating-chamber to be adjusted to any position irrespective of the settling of the base upon which the legs rest, and in Fig. 6 I have shown the form of such legs that I prefer to use. The lower portion 32^a has a cross-section of approximately a semicircle, the flat side being left open. A partition 32 is formed in the hollow of the leg some distance below the top of the portion 32^a, which, together with the top 45 of the portion 32^a, is perforated to permit the passage of the annular rod 33, which is prevented from rotating by the corresponding shape of the aperture in the partition 32, while the upper portion of the said rod 33 is rounded and has screw-threads thereon, which are engaged by the nut 34, resting upon the top of the portion 32^a of the leg, and it will be evident that by a rotation of the said nut the position of the rod 33, which thus forms the second portion of the leg, may be varied, causing the leg to become shorter or longer, and permitting a corresponding adjustment of the fire-box or heating-chamber resting thereon.

In Figs. 8 and 9 I have shown another form of damper for regulating the course of the heated products of combustion in the heating-chamber, and in this case the dampers are pivoted, as before described, to the pipes 20 and 20^2, but are adapted, when swung down, to rest against the stop 58 at the bottom of the heating-chamber, closing the lower portion thereof and acting as a deflector to cause the products of combustion to rise to the top through the openings 53 and 54, which they occupy when they are in a closed position, and being adapted, when raised, to close such openings, causing the products of combustion to flow along the base of the heating-chamber, as before described.

In order to hold the dampers 49 and 50 to the position in which they may be placed, I arrange counter-weights 51 52 on crank-arms connected with their shafts, the said weights being so adjusted as to hold the dampers up and close the openings 53 54 whenever they are placed in that position by the actuating-rods 54^a, which extend through the front of the structure for that purpose. The weights 51 52 are contained and operated in the space 57 between the sides of the heating-chamber and the interior of the side walls of the structure 60.

The operation of my invention is obvious from the foregoing, and therefore needs no further description here.

Having thus described my invention, what I claim is—

1. In a hot-air furnace, the combination, with a heating-chamber, of series of vertical pipes therein, horizontal pipes communicating with all of the vertical pipes of each series, and valves within the said heating-chamber, adapted to cut out any of the said series of pipes, as described, so as to obtain more or less heating-surface, as desired.

2. An air-heating pipe for warm-air furnaces, the cross-section of which is approximately cone-shaped, substantially as described.

3. In a hot-air furnace, the combination, with a grate and a heating-chamber, of a series of pipes within the said chamber, the cross-section of which is approximately cone-shaped, valves within the said heating-chamber, adapted to cut out any of the said series of pipes, and horizontal distributing-pipes connecting said first-mentioned pipes of each series.

4. In a furnace, a series of air-heating pipes, a cross-section of which would be approximately cone-shaped, contained therein, so placed that each one will expose its thin edge to the direct rays of heat and receive upon its oblique sides the influence of the heat-currents as they pass through the fire-chamber while presenting the least possible obstruction to the draft, substantially as described.

5. In a hot-air furnace, a series of vertical pipes through which the air to be heated passes, the cross-section of said pipes being approximately cone-shaped, in combination with a horizontal distributing-pipe connecting said vertical pipes, substantially as described.

6. A joint for hot-air furnaces formed by forming inwardly-extending tapered flanges upon the contiguous ends of adjoining plates, the said plates having flanges upon their outer face, a plate having a tongue thereon contained between the tapered flanges of the said plates, a bolt secured to the said tongue and projecting to the outer sides of the said plates, and a cap having flanges upon its edges adapted to be forced down over the said tapered flanges, the space between the said parts being filled with a suitable cement, as described.

7. The combination, with a pipe 28, having an annular flange upon its ends, the said flange having an annular tongue 43 projecting from its forward face, of a collar 27, having an annular groove therein adapted to receive the said tongue, the inner edge of the collar being bent rearwardly and extending into the said pipe, the space between the said

flange and collar being adapted to be filled by a suitable cement and by a plate 29, as described.

8. In a hot-air furnace, the combination, with a heating-chamber having pipes arranged in rows therein, the said chamber being connected with a fire-box at its base and with an eduction-flue at its top, of dampers within the said chamber adapted when opened to cause the products of combustion to pass upward to the eduction-flue, and when raised to cause the products of combustion to pass adjacent to the base of the said pipes and then adjacent to their tops, as described.

9. In a hot-air furnace, the combination, with an inclosing structure, of a heating-chamber arranged within the said structure and having passages between its sides and that of the structure, the said heating-chamber communicating with a source of heat at its base at one end and having its top at its same end communicating with an eduction-flue for the products of combustion, pipes arranged in rows within the said heating-chamber and extending through the top and bottom thereof, horizontal pipes extending through the sides of the said chamber and communicating with the several pipes forming a row, and dampers pivoted at the forward surface of the said horizontal pipes and adapted to permit or prevent the immediate rising of the products of combustion to the top of the heating-chamber, as described.

10. In a heating-furnace having an exterior structure, the combination, with a fire-box and hot-air chamber contained therein, dividing the interior of the said structure into an upper and lower compartment and forming communicating passages 57 between their sides and the side of the said structure, of vertical pipes passing through the said fire-box and heating-chamber and dampers adapted to close the said passages 57, as described.

11. In a hot-air furnace, a fire-box, a heating-chamber, one or more series of vertical air-heating pipes located therein, horizontal pipes connecting all of the vertical pipes of each series and communicating with a cold-air passage between the heating-chamber and the furnace structure, and a valve located in said passage, substantially as described.

12. A pipe within a fire-chamber, a cross-section of which would be approximately cone-shaped, and a diaphragm therein, substantially as shown and described.

In testimony whereof I affix my signature in presence of two witnesses.

EZEKIEL C. CONDIT.

Witnesses:
L. H. CLAPP,
H. C. JOHNSON.