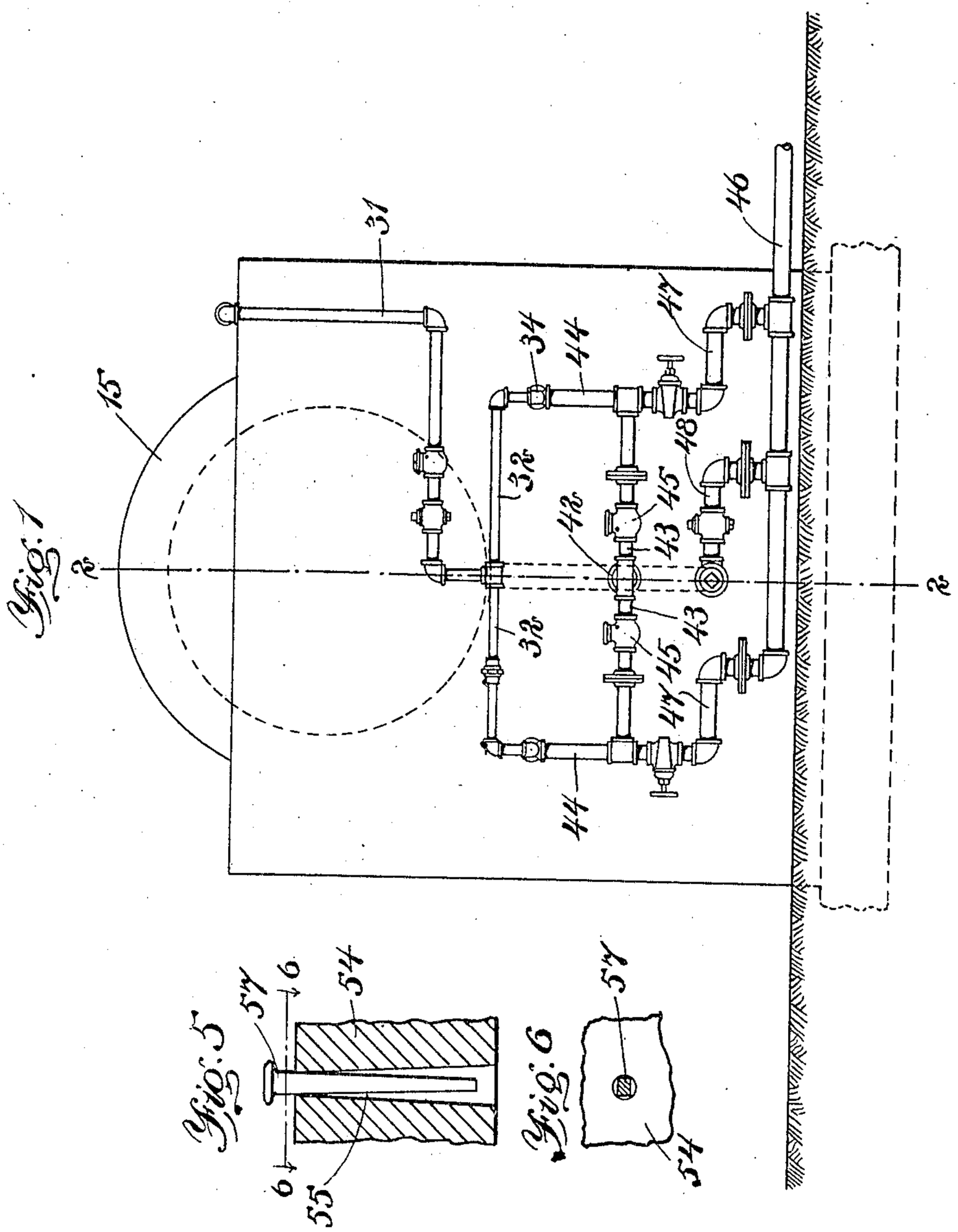
No. 844,695. PATENTED FEB. 19, 1907.

S. SMITH.

BOILER.

APPLICATION FILED DEC. 15, 1905.

3 SHEETS—SHEET 1.







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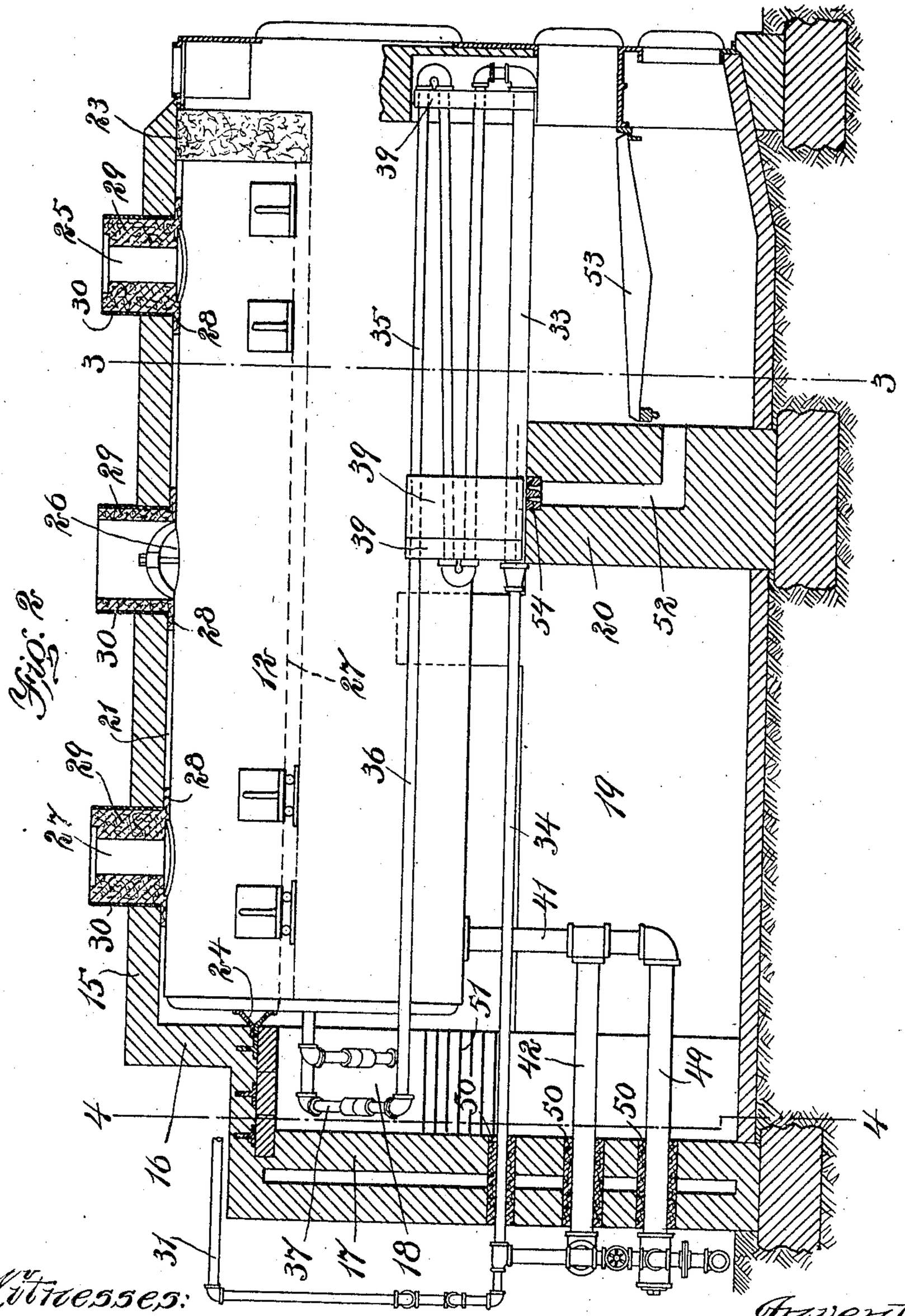
3 SHEETS—SHEET 2.

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3 SHEETS—SHEET 3.

Fig. 3

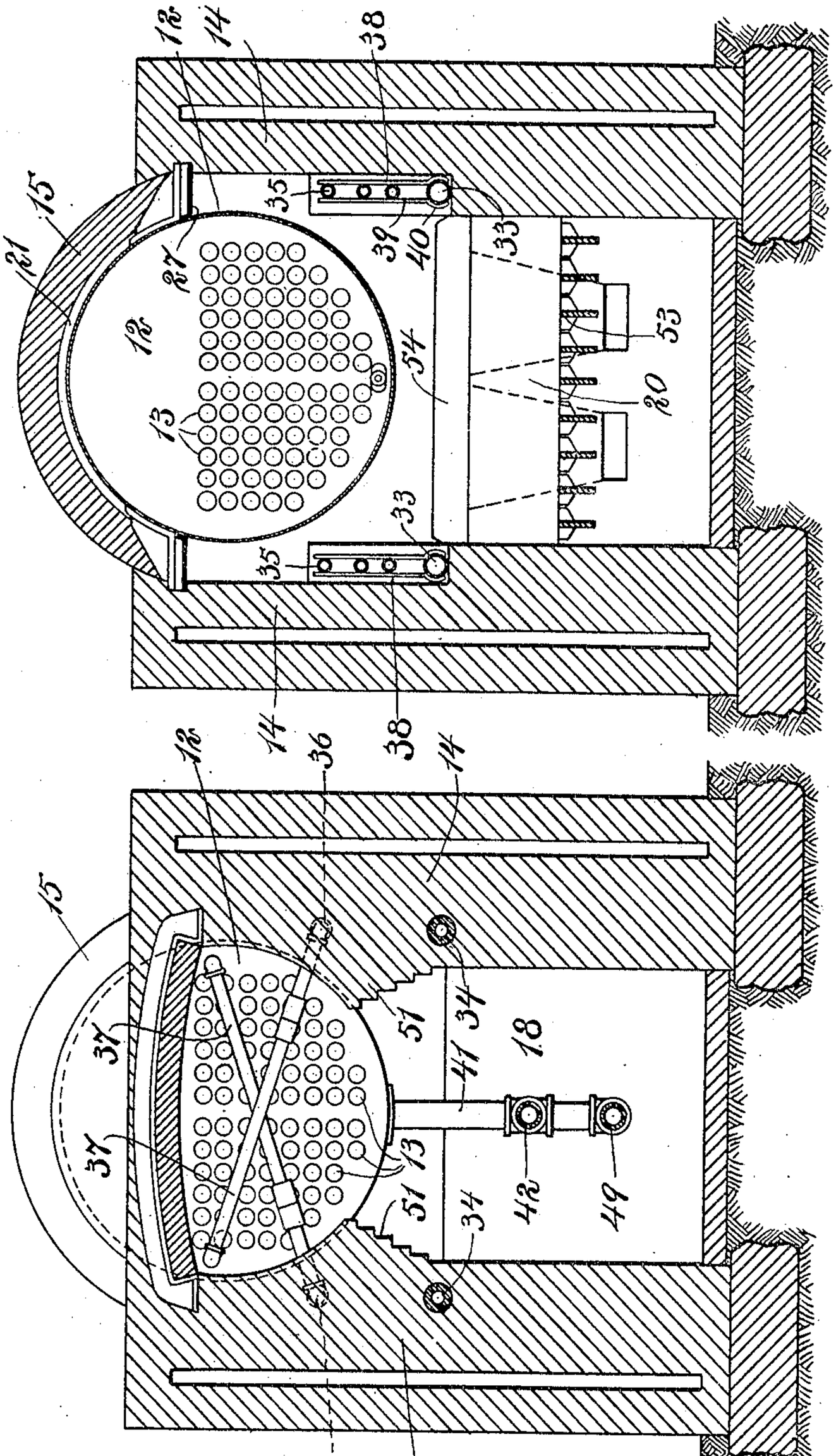


Fig. 4

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# UNITED STATES PATENT OFFICE.

SIDNEY SMITH, OF CAMBRIDGE, MASSACHUSETTS.

## BOILER.

No. 844,695. Specification of Letters Patent. Patented Feb. 19, 1907.

Application filed December 15, 1905. Serial No. 291,833.

*To all whom it may concern:*

Be it known that I, SIDNEY SMITH, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Boiler-Settings and Boilers, of which the following is a specification.

This invention relates to steam-boilers and casings or settings therefor; and it has for its object to provide certain improvements looking to the efficiency, safety, and durability of the boiler.

The invention consists in the several improvements which I will now proceed to describe and claim.

Of the accompanying drawings, forming a part of this specification, Figure 1 represents a rear end view of a boiler-setting and a system of feed-water-circulating pipes constructed in accordance with my invention. Fig. 2 represents a longitudinal section on line 2 2 of Fig. 1, the boiler being shown in side elevation. Fig. 3 represents a section on line 3 3 of Fig. 2. Fig. 4 represents a section on line 4 4 of Fig. 2. Fig. 5 represents a sectional detail hereinafter referred to. Fig. 6 represents a section on line 6 6 of Fig. 5.

The same letters of reference indicate the same parts in all the figures.

In the drawings, 12 represents a boiler, which is preferably cylindrical and has the ordinary fire tubes or flues 13 extending through the water-space of the boiler. The boiler is inclosed in a brickwork casing or setting, which comprises side walls 14 14 and an arch 15, supported by the side walls and covering the top portion of the boiler. The portion 16, Fig. 2, of the rear end wall of the casing adjoining the arch 15 is in close proximity to the rear head of the boiler, as shown in Fig. 2, the lower portion 17 of the rear wall being offset and separated from the rear head of the boiler by a throat 18, through which the products of combustion pass from the chamber 19 behind the bridge-wall 20.

In accordance with my invention I form an air-space 21 between the arch 15 and the upper portion of the boiler, said space extending between the end wall 16 and the rear head of the boiler. The said air-space covers practically the entire area of the boiler which is in contact with the live steam within the boiler. A body of dead air is confined in the said air-space by means of packing or cut-off strips of material which is a non-conductor of heat, such as asbestos. In this embodiment of my invention I have shown this packing material or cut-off as comprising, first, two longitudinal strips 22, interposed between the side walls and the lower edges of the arch 15, said strips projecting inwardly from the side walls and having upwardly-turned edges bearing against the sides of the boiler at or near the water-line; secondly, an arched transverse strip 23, interposed between the forward portion of the arch 15 and the corresponding portion of the boiler, said strip 23 bestriding the upper part of the boiler, its ends preferably joining or being in contact with the forward ends of the longitudinal strips 22, and, thirdly, a transverse strip 24, interposed between the rear wall portion 16 and the rear head of the boiler above the tubes 13 and extending across the rear head, its ends joining the rear ends of the strips 22. The strip 24 is preferably doubled or folded along its center, its folded edge being secured in the wall 16, while one of its free edges is bent upwardly and the other downwardly, the said edges resting on the boiler-head, as shown in Fig. 2.

Around the various openings in the arch 15 for the steam-pipe 25, the manhole 26, and the safety-valve connection 27 I provide gaskets or annular packings 28 of asbestos, these gaskets surrounding the said openings and being interposed between the arch and the top of the boiler, so that they coöperate with the packing-strips above described in maintaining the dead-air space between the upper portion of the boiler and the upper portion of the setting.

It will be seen that the various asbestos packing-strips or cut-offs not only confine the air in the air-space 21, but also prevent direct contact between the boiler-shell and the heated brickwork.

It often happens that when the boiler is first blown off the brickwork in contact with the boiler communicates such a degree of heat to the boiler-shell that foreign matter in the water is liable to be burned onto the boiler-shell by the heat thus communicated, this resulting in serious damage to the boiler. The dead-air space confined, as described, in contact with the upper portion of the boiler keeps the steam in the boiler at the highest possible temperature of saturated steam, the dead air reducing to the minimum the radiation or escape of heat from the upper portion of the boiler-shell. The gaskets 28 are preferably formed as flanges on the lower ends of

sleeves or collars 29, of asbestos, which extend through the openings in the brickwork. These collars may be confined by bands 30, of sheet metal or any other suitable confining means.

31 represents a feed-water-supply pipe having branches 32 32, Fig. 1, communicating with feed-water-heating conduits extending along the inner sides of the side walls 14 of the setting, said conduits including sinuous portions having a plurality of return-bends including a lower member 33, connected by a pipe 34 with one of the branches 32, and an upper member 35, connected by a pipe 36 with the rear head of the boiler, the pipe 36 having an inclined extension 37, extending crosswise of the boiler, as shown in Fig. 4, and entering the boiler preferably just below the line of the upper row of tubes 13 therein, as shown in Fig. 4. The sinuous portions of the feed-water-heating conductor are located in recesses 38 in the inner faces of the side walls 14, as shown in Fig. 3, so that the members of said sinuous portions are offset outwardly from the inner faces of the walls 14, forming the sides of the fire-box. Hence the feed-water-heating conduits are out of the path of the lines of convected heat rising from the fire-box to the boiler. Consequently they do not absorb heat to the detriment of the generation of steam in the boiler, but simply absorb such heat as would otherwise be absorbed by the side walls of the casing, and therefore wasted. The said sinuous portions of the feed-water heaters are free to slip longitudinally, so that free expansion and contraction of the feed-water heaters is permitted, the lower members 33 of the feed-water heaters resting loosely upon the lower edges of the recesses 38 and being free to slip thereon. The members of the sinuous portions of the feed-water heaters are connected together by means of clamping-plates 39, placed on opposite sides of said members and united by transverse bolts, the lower ends of the clamping-plates being curved to form jaws 40, engaging the lower members 33 of the feed-water heaters.

41 represents a circulating-pipe which extends downwardly from the bottom of the boiler and is connected with the feed-water heaters above described in such manner that when the supply of feed-water through pipe 31 is shut off there will be a constant circulation of water downwardly from the boiler through the pipe 41 and back to the boiler through the feed-water heaters, so that the feed-water heaters are constantly in operation, thus adding materially to the efficiency and economy of the boiler. The connections here shown between the circulating-pipe 41 and the feed-water heaters include a branch pipe 42, extending from the pipe 41 through the rear wall of the casing, lateral branches 43 extending from the outer end of the pipe 42 and vertical pipes or branches 44 connecting the branches 43 with the portions 34 of the feed-water heaters. The branches 43 are provided with check-valves 45, which open outwardly from the boiler. When the feed-water-supply pipe 31 is closed, the check-valves open and permit a flow of water from the boiler through the pipe 41 and the described connections to the feed-water heaters. When the feed-water pump is in operation, the pressure of the feed-water on the check-valves closes the same, so that there is no circulation through the pipe 41 and its branches.

To permit the convenient blowing-off of the boiler and of the feed-water heaters, I provide a blow-off conduit 46, having branches 47 47, which are connected with the pipes 44 44, and a branch 48, which is connected with a branch 49 of the circulating-pipe 41. The branches 47 47 and 48 are provided with suitable valves. When the valves in the branches 47 47 are opened, the feed-water heaters may be blown off, and when the valve in the branch 48 is opened the boiler may be blown off through the pipe 41 and its branch 49. The openings in the rear wall of the setting, which accommodate the various pipes passing through said wall, are provided with bushings 50, Fig. 2, of asbestos, which permit such play of said pipes as is required for expansion and contraction and at the same time maintain tight joints around the pipes.

The side walls 14 of the setting are provided at opposite sides of the throat 18 with inwardly-projecting buttresses or flame-deflectors 51, which contract the upper portion of said throat, as shown in Fig. 4. The object of these deflectors is to cause a uniform distribution of the products of combustion through the boiler tubes or flues 13 and prevent all or the greater part of the products of combustion from passing through the upper tubes to the exclusion or avoidance of lower tubes, which is the material tendency when there are unobstructed spaces between the upper portions of the side walls of the setting and the rear head of the boiler. The inner ends of the deflectors 51 are within about two inches of the rear head of the boiler, so that they permit only portions of the products of combustion to pass directly from the sides of the setting to the upper tubes of the boiler. Other portions of the said products are forced by the deflectors to pass into the lower tubes, so that an equal distribution is insured.

The bridge-wall 20 is provided with an air-conduit 52, which communicates with the ash-pit under the grate 53 and receives heated air therefrom, the said conduit extending to the top of the bridge-wall. The upper end of the conduit is partially closed by a block 54, having numerous circular perfora-

tions 55, which distribute the air and cause it to emerge from the top of the bridge-wall in numerous jets or streams. This perforated block or plate, which I term an "Argand burner," is a well-known device and is shown in Letters Patent heretofore issued to me. I have improved the said Argand burner, however, by inserting in the orifices 55 obstructions 57, adapted to restrict the area of the openings and to form numerous narrow slits or crevices through which the air is compelled to pass in minutely-subdivided jets.

In practice the obstructions 57 may be ordinary cut nails which are substantially rectangular in cross-section and are dropped into the orifices 55 until their corners bear upon the walls of the orifices. The central portions of the orifices are thus filled, and the air-outlets are restricted to the narrow crevices between the surfaces of the nails and the walls of the orifices.

It will be observed that the rear bends of the feed-water-heating conduits are located directly above the bridge-wall, so that the length of the stretches of the conduits between the front and rear bends is limited to substantially the length of the fire-box. I find that this limitation of the length of the feed-water-heating conduits is very important, because it reduces to the minimum the frictional resistance to the flow of feed-water to the boiler and increases to the maximum the rapidity of the flow. This relatively rapid flow prevents the formation or the accumulation of masses or bubbles of steam in the conduits, and therefore prevents the liability which exists of the burning out of the metal of the conduits when steam is present in bubbles or masses in the conduits, in which case the portions of the conduits which are filled by the steam are subject to rapid deterioration by the external heat, such portions often becoming red hot. It is not safe to have free steam or water at the temperature of saturated steam in feed-water-heating pipes which are exposed externally to the heated products of combustion in a fire-box, because the portions of the pipes subjected to such temperature rapidly deteriorate and are destroyed. Conduits limited in length to substantially the length of the fire-box, as here shown, are free from liability to deterioration and destruction by heat.

I claim—

A boiler, a casing or setting therefor having longitudinal recesses in its walls at opposite sides of the boiler, and offset outwardly from the inner surfaces of the sides of the fire-box, the bottoms of said recesses forming substantially horizontal shelves or seats extending lengthwise of the fire-box, and located outside the inner surfaces of the sides of the fire-box, return-bend feed-water-heating conduits located in said recesses, the lower members of said conduits resting on said shelves, and being adapted to expand and contract longitudinally thereon, clamps engaged with the said lower members, and supporting the upper members, whereby the upper members are permitted to expand and contract with the lower members, the latter being protected by the shelves against injury from the heat of the fire, and connections between the upper members of said conduits and a portion of the boiler higher than the conduits, the rear bends of the conduits being located adjacent to the bridge-wall, so that the length of the longitudinal members of the conduits is limited to substantially the length of the fire-box, and to the region of convected heat, whereby the flow of feed-water through said conduits is facilitated, and the formation of steam-bubbles therein is prevented, substantially as set forth.

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

SIDNEY SMITH.

Witnesses:
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P. W. PEZZETTI.