

No. 696,165.

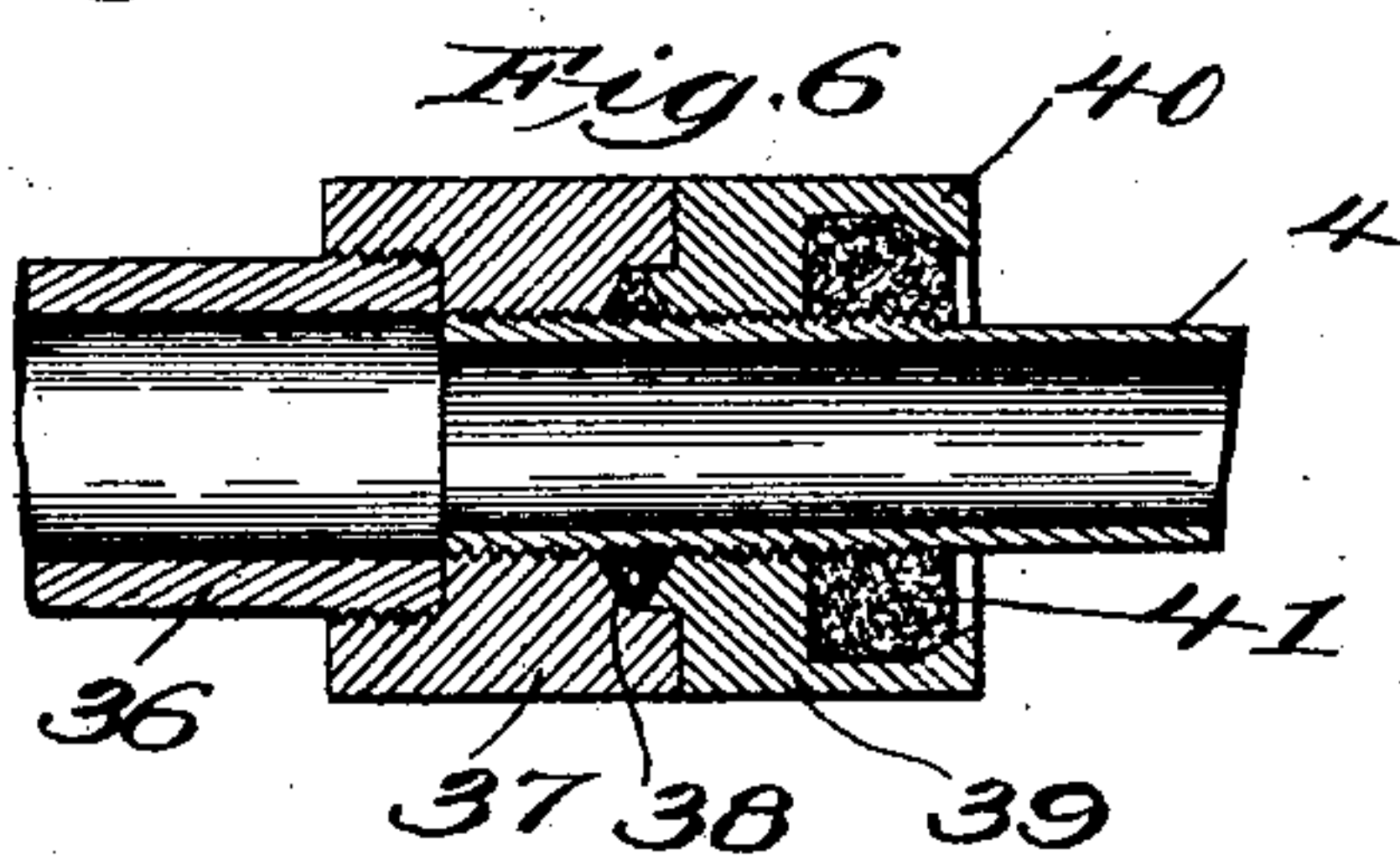
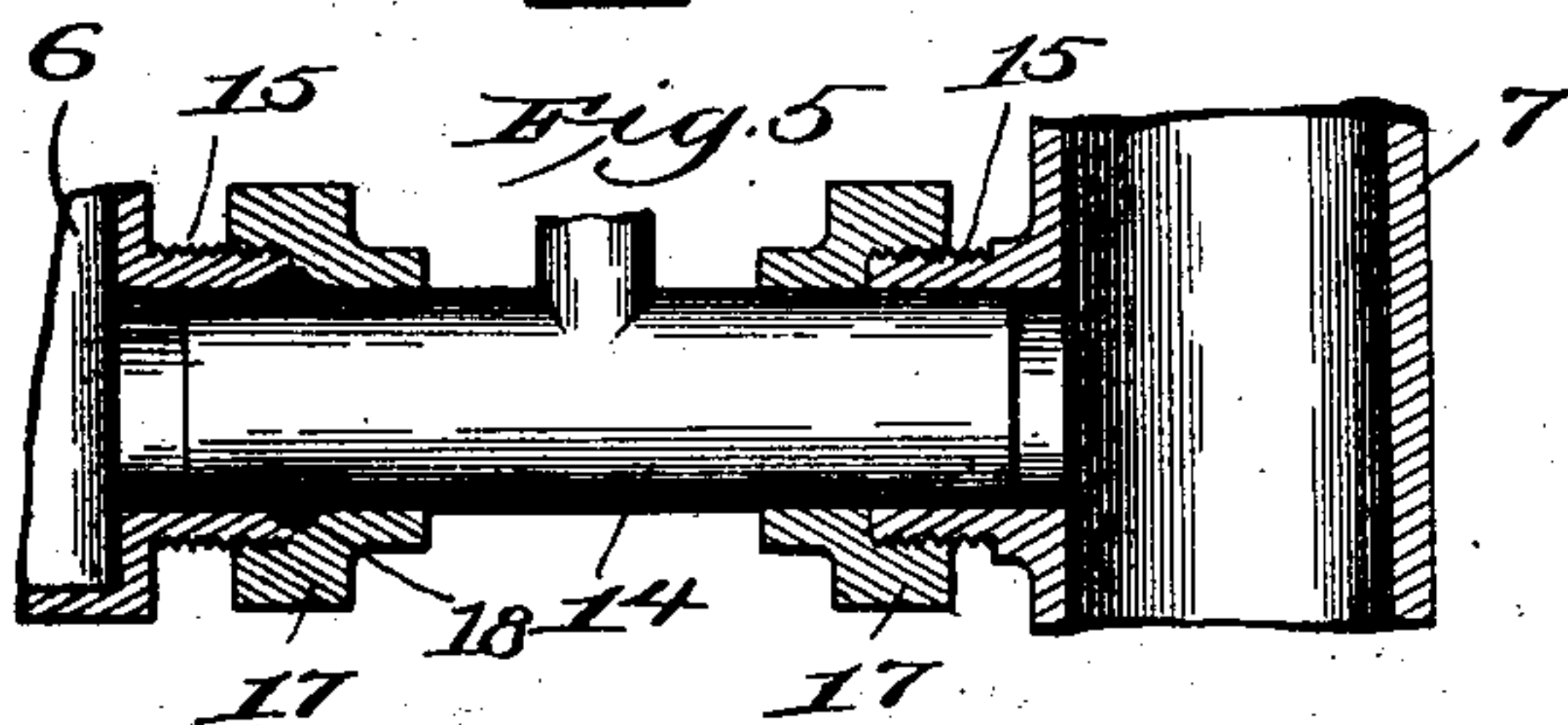
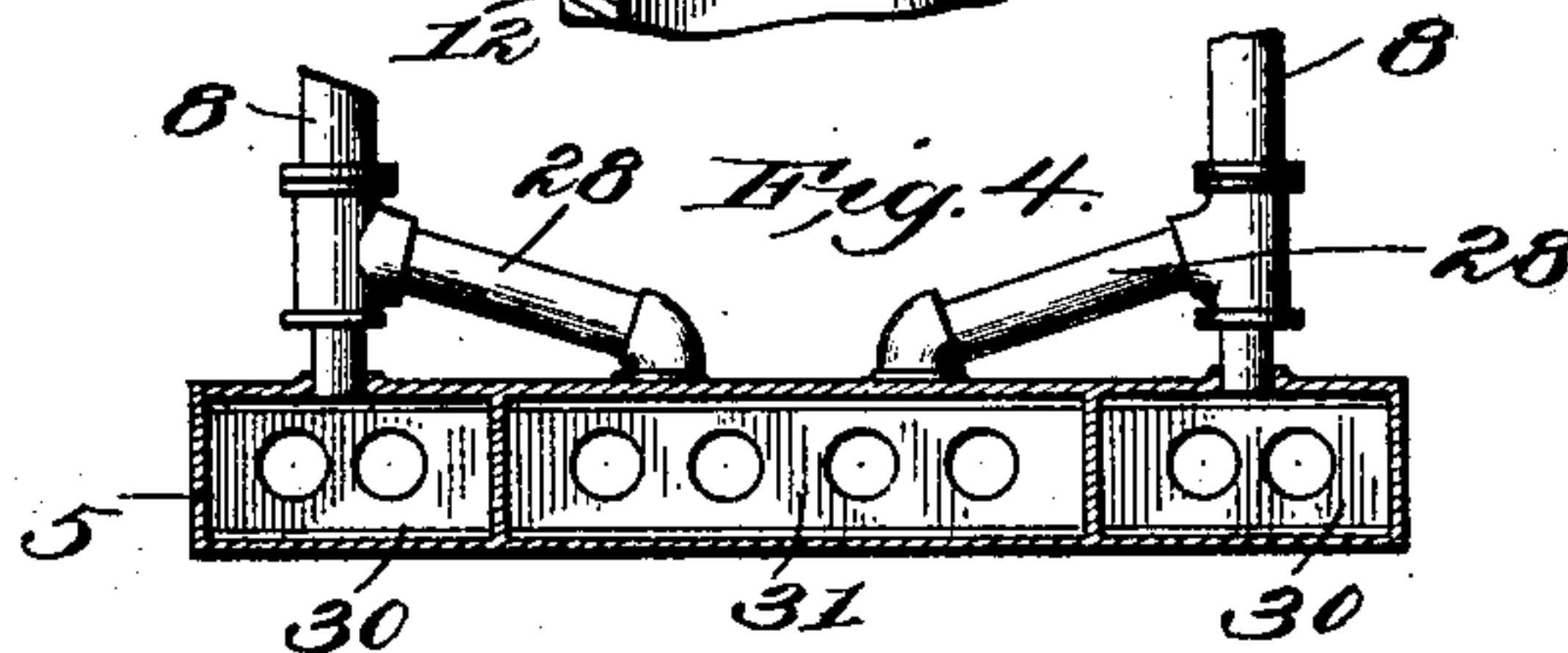
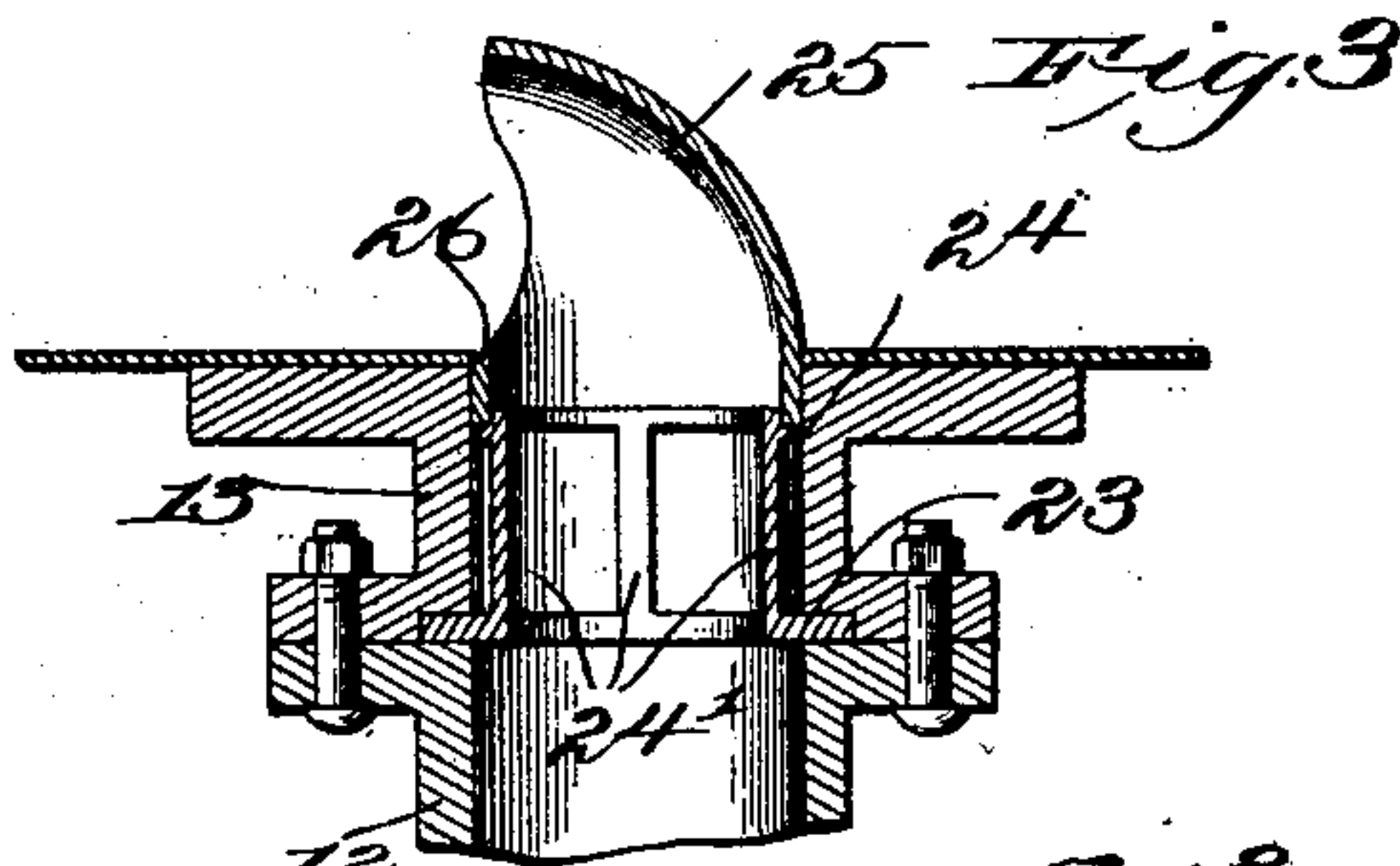
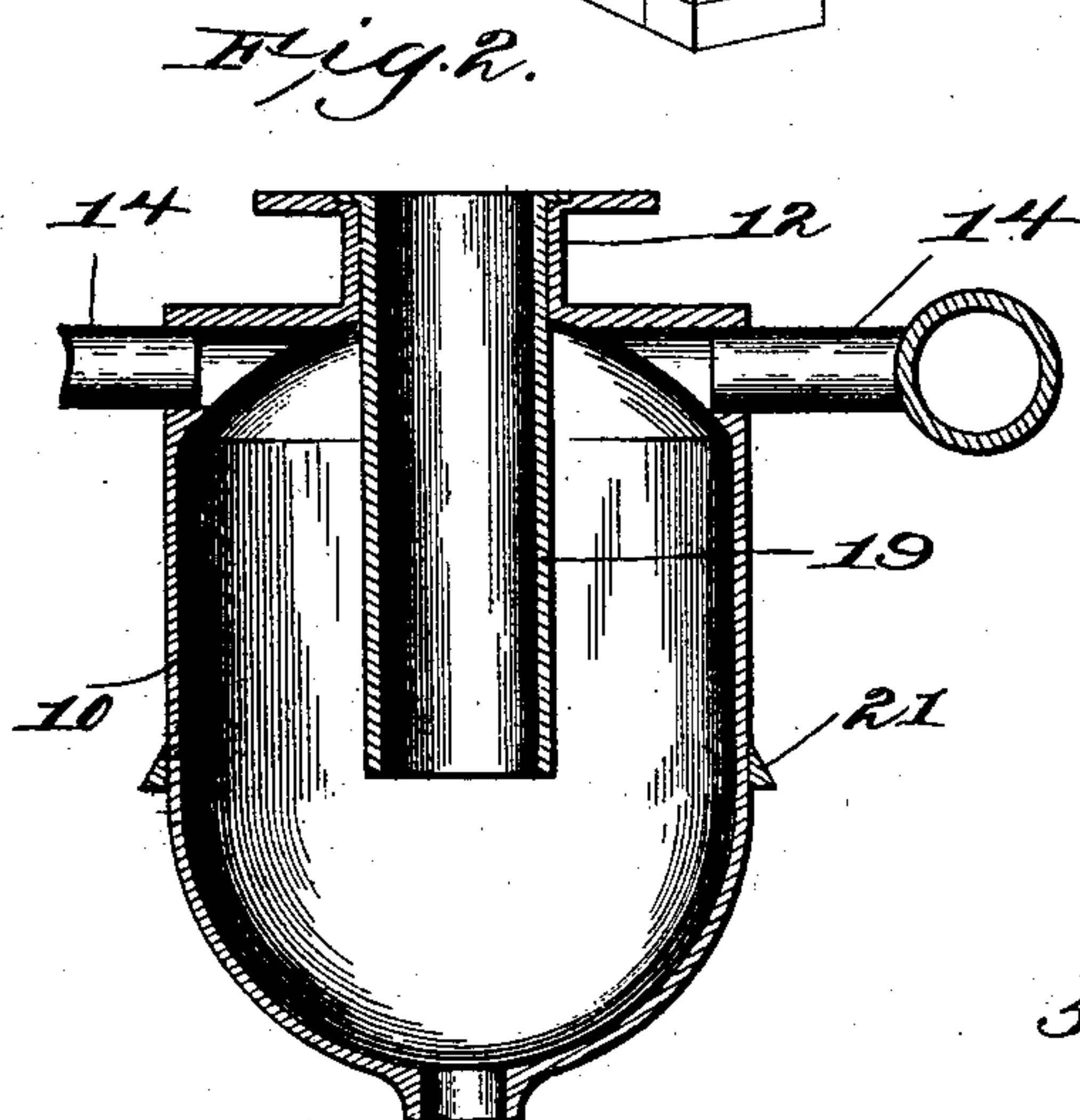
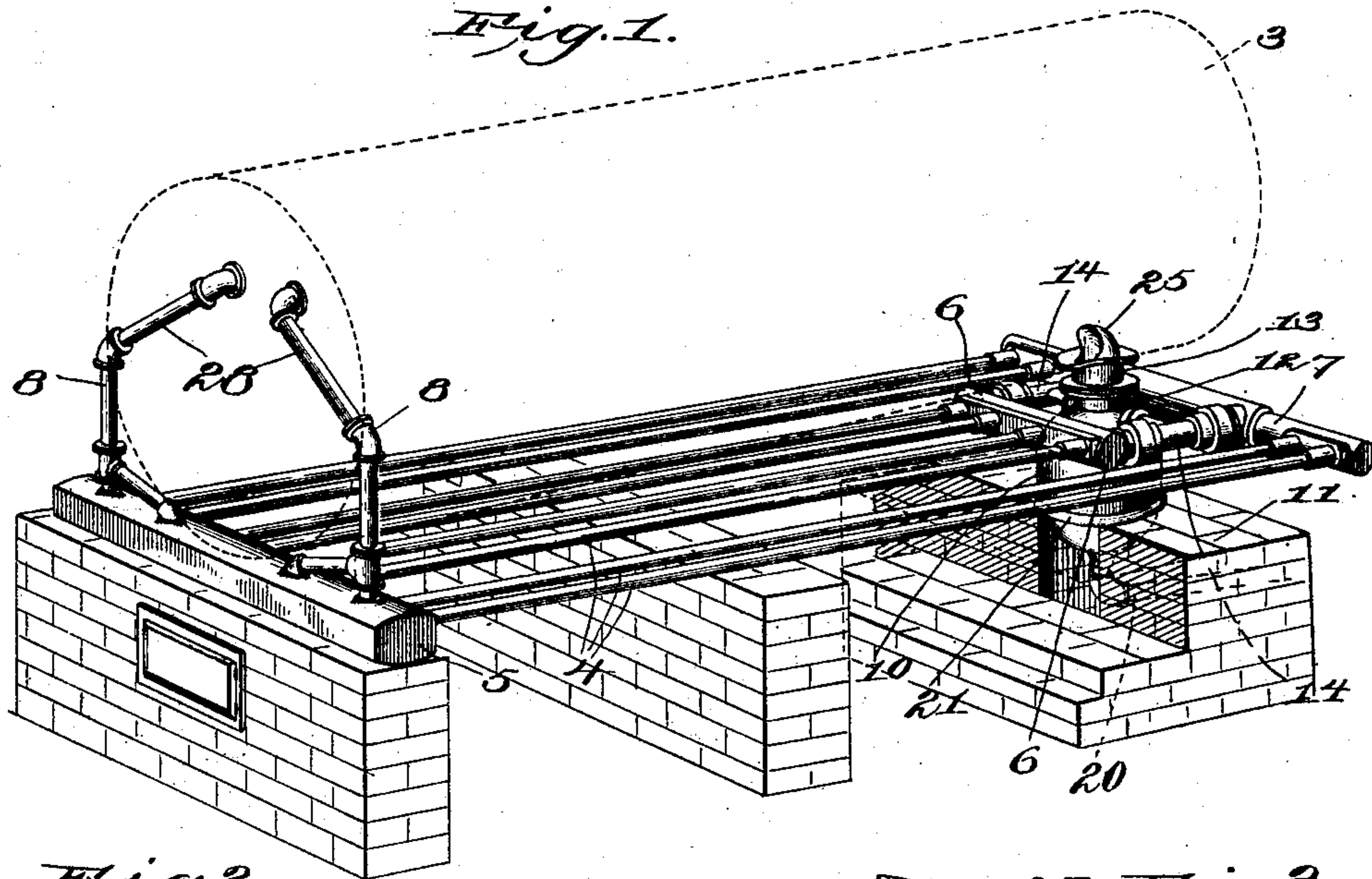
Patented Mar. 25, 1902.

H. P. J. EARNSHAW.

STEAM GENERATOR.

(Application filed May 16, 1901.)

(No Model.)



Witnesses.
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UNITED STATES PATENT OFFICE.

HENRY P. J. EARNSHAW, OF HYDEPARK, MASSACHUSETTS.

STEAM-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 696,165, dated March 25, 1902.

Application filed May 16, 1901. Serial No. 60,443. (No model.)

To all whom it may concern:

Be it known that I, HENRY P. J. EARNSHAW, a citizen of the United States, residing at Hyde-
park, in the county of Norfolk and State of
5 Massachusetts, have invented an Improve-
ment in Steam-Generators, of which the fol-
lowing description, in connection with the ac-
companying drawings, is a specification, like
numerals on the drawings representing like
10 parts.

This invention relates to steam-generating
devices such as are applicable to any ordi-
nary horizontal boiler; and it comprises the
usual circulating-pipes arranged underneath
15 the boiler and connected at their front end
with a water-box, which water-box is in turn
connected by the usual discharge-pipes with
the front end of the boiler, preferably above
the water-line. The rear ends of the circulat-
20 ing-pipes are rigidly secured to one or more
headers, which are connected to the mud-
drum by a slip-joint or expansion-joint. The
mud-drum is connected to the under side of
the boiler by a connection having what I have
25 termed a "circulating-head," said head being
preferably hood-shaped and extended into the
boiler, but having its mouth extending below
the bottom of the boiler. The connection be-
tween the boiler and the mud-drum extends
30 into the mud-drum, and the header or head-
ers are connected to the top of the mud-drum,
so that as the water circulates through the
circulating-pipes it is drawn from the bottom
of the boiler into the mud-drum and then in
35 turn taken from the mud-drum through the
headers to the circulating-pipes. By con-
necting the mud-drum to the boiler by means
of my circulating-head I prevent any sedi-
ment from collecting on the bottom of the
40 boiler, for the rapid circulation of the water
will take with it the sediment through the
connection and into the mud-drum, the sedi-
ment remaining at the bottom of the mud-
drum, while the clear water passes to the top
45 thereof and out through the headers to the
circulating-pipes, as above described. Since
the bottom of the mouth of the circulating-
head is below the bottom of the boiler, there
is no chance for any sediment to accumulate
50 on the bottom of the boiler. By making the
slip or expansion joint between the headers
and the mud-drum it will be seen that the

boiler will be subjected to no strain what-
ever, for the expansion of the circulating-
tubes will simply move the headers relative 55
to the mud-drum, the slip-joint between the
headers and the mud-drum allowing this.
The mud-drum, therefore, and the boiler are
relieved from all strain due to such expan-
sion. 60

Another feature of the improvement con-
sists in setting the mud-drum into a pier or
support made of fire-brick or similar mate-
rial, so that the lower portion of the mud-
drum, or that in which the mud and dirt ac- 65
cumulate, is protected from the action of the
flames, and thus prevents the mud from be-
coming caked by heat.

Another feature of my invention is in con-
necting the discharge-pipe from the water- 70
box to both the end and central portion of the
box, so as to prevent any dead-water remain-
ing in the box and establish a free circulation
through the box.

Still another feature of the invention re- 75
sides in the particular manner in which the
circulating-pipes are connected to the head-
ers whereby the pipes are protected from in-
jury.

In the drawings, Figure 1 is a perspective 80
view of my improved steam-generating de-
vice, the boiler to which it is attached being
shown in dotted lines. Fig. 2 is a section of
the mud-drum. Fig. 3 is a section of the cir-
culating-head. Fig. 4 is a vertical section of 85
the front water-box. Fig. 5 is a detail show-
ing the slip-joint between the mud-drum and
the headers, and Fig. 6 is a detail showing
the manner of connecting the circulating-
pipes to the headers. 90

The steam-generator comprises a boiler 3 of
any ordinary horizontal type (shown in dot-
ted lines) and the usual circulating-pipes 4,
which are connected at their front ends to a
water-box 5 and at their rear ends to headers 95
6 and 7, which in turn are connected to the
boiler, as will be hereinafter described. The
water-box 5 has extending upwardly there-
from the usual discharge-pipes 8, which enter
the boiler at the front end thereof and pref- 100
erably above the water-line. The parts thus
far described are more or less common in
steam-generators, and their function, there-
fore, will not need to be specifically described.

Heretofore, so far as I am aware, it has been the common practice to attach the header rigidly to the boiler and to provide a slip or expansion joint between the circulating-pipes and the header to allow for the expansion of said pipes; but in such construction the connection between the header and boiler must be of sufficient strength to withstand the pressure in a horizontal direction on the header due to the boiler-pressure, which may amount to several tons, and it is one of the objects of my invention to obviate the necessity for such a heavy connection between the header and boiler. In order to accomplish this, I preferably connect the mud-drum 10, which is supported upon a suitable pier or support 11, as hereinafter described, directly to the boiler and connect the headers to the mud-drum by means of a slip or expansion joint, the headers in turn being rigidly connected to the circulating-pipes. Referring to Figs. 2 and 3, it will be seen that the upper end of the mud-drum is provided with the flanged neck 12, which is bolted to the flanged collar 13, said collar in turn being fastened to the under side of the boiler-shell in any suitable way. The opposite sides of the mud-drum have connected thereto at their upper ends the T connection 14, the ends of said connection being of a size to slidingly fit nipples 15 on the front and rear headers 6 and 7, respectively. To make a tight joint, I screw upon the nipples the collars 17, having the recesses to receive a suitable packing 18, said collars and packing forming, in effect, a stuffing-box.

The circulating-pipes 4 are rigidly secured at their rear ends to the headers 6 and 7, respectively, as will be hereinafter described, so that as the said pipes expand and lengthen the headers move therewith; but owing to the slip-joint between the headers and the T 14 the headers may have a free movement without subjecting the mud-drum or the boiler to any strain. Moreover, since the headers have a slip-joint connection with the boiler and are rigidly secured to the circulating-pipes and said pipes in turn secured to the water-box, it will be seen that any pressure on the headers due to boiler-pressure is borne entirely by the headers themselves and the circulating-pipes, and the boiler is not subjected to any strain from this cause. The connection between the headers and boiler may be comparatively light, therefore, thus reducing the cost of the generator.

Another feature of my invention resides in taking the water from the boiler into the mud-drum and then from the mud-drum to the headers and the circulating-pipes, and, as shown in Fig. 2, the neck 12 of the mud-drum has attached thereto and extending into the mud-drum the pipe or conduit 19, so that the water as it passes into the mud-drum is carried nearly to the bottom thereof and then rises to pass out through the T-joints 14. Any sediment, therefore, which may be in

the water will remain at the bottom of the mud-drum and accumulate therein, from whence it may be blown off through the blow-off pipe 20. (Shown in dotted lines, Fig. 1.)

To protect the lower portion of the mud-drum from the heat of the furnace, I preferably set the same in a suitable recess in the pier 11, as shown in Fig. 1, the drum having, preferably, an annular flange 21, which rests upon the pier to support said mud-drum.

In one familiar form of so-called "back connection" between the boiler and the headers said back connection is attached to the boiler at the rear end thereof. The disadvantage of this form is that the opening into the boiler must necessarily be slightly above the lowest portion of the boiler, and consequently as the water circulates through the circulating-pipes a layer of sediment will accumulate on the bottom of the boiler, which if left to remain will soon cause the boiler to deteriorate. In order to remedy this disadvantage, the back connection has sometimes been connected to the bottom of the boiler. While this construction permits to some extent the accumulation of sediment, yet it has been found that during the circulation of the water it was drawn vertically from the boiler through the back connection and no current was established along the bottom of the boiler. With this construction, therefore, sediment would settle on the boiler-bottom to such an extent as to injure the same. I obviate this difficulty by using in connection with my back connection a hood-like circulating-head, which establishes a current along the boiler-bottom, which keeps the boiler perfectly clean.

Referring to Fig. 3, it will be seen that the collar 13 is recessed in its lower flange, and said recess receives the flange 23 of a spider 24, the flange 23 of the spider being clamped between the flanges on the neck of the mud-drum and the collar 13, as shown. To the upper end of the spider 24 is attached the hood-like circulating-head 25, the said head having its mouth directed toward the front of the boiler and having the lower portion of the mouth, as at 26, slightly below the bottom of the boiler. With this construction as the water in the circulating-pipes is heated and the steam is generated a circulation commences through the pipes and colder water is drawn through the back connection into the mud-drum and out through the headers, as will be obvious. Since the mouth of the hood-like circulating-head opens toward the front of the boiler and has the portion 26 below the bottom of the boiler, it will be seen that as the water commences to circulate it will be drawn into the mouth of said circulating-head from along the bottom of the boiler, thus establishing a current along the boiler-bottom, which current will carry with it any sediment that may be on the boiler-bottom and deposit the same in the mud-drum. I am thus enabled to keep the boiler-bottom

perfectly clean, and thus prevent any scale forming thereon. By making the spider as shown, with the uprights 24' spaced from the inner wall of the collar, the water will circulate around the same and the intense heat will not injure the circulating-head in any way.

To increase the capacity of the steam-generator, I have increased the usual number of circulating-pipes 4, and, as illustrated in Fig. 1, there are two series of pipes, one series comprising the group of four central pipes, which are connected at their rear end to the front header 6, and the other series comprising the other four pipes, there being a group of two such pipes at either side of the central series, and said second series of pipes are connected to the outside end of the rear header, as plainly seen. It will be obvious of course that the number of pipes may be greater than those illustrated, if desired; but by using the front and rear headers I am enabled to employ the center series of pipes which has heretofore been impossible with the old construction. The front end of the circulating-pipes enter the water-box 5, as usual, and the water in the water-box 5 is discharged through the discharge-pipes into the boiler. In order to prevent any dead-water accumulating in the center of the water-box, I provide each discharge-pipe 8 with a branch connection 28, communicating with the center of the box, so that the water in the box 5 has a free circulation. Preferably I will also partition the said box 5 in the three compartments, as shown in the sectional view Fig. 4, the outer compartment 30 receiving water from the outside pipes, connected to the rear head 7, and said water passing directly to the discharge-pipes 8, and the central compartment 31 receiving water from the central series of circulating-pipes, connected to the front header 6 and delivering water through the branch connection 28. This construction I find of great advantage, because it permits free circulation of the water through the water-box 5. I will preferably construct my water-box with the bottom thereof bulging or slightly rounding, (see Fig. 1,) so that the same may accommodate itself to the arch-support on which it rests, even though the boiler is not exactly horizontal.

As stated above, the circulating-pipes 4 are rigidly connected to the front and the rear headers, respectively, and I have devised a special form of connection which has the function of protecting the threads on the pipe from being burned or destroyed by the intense heat from the combustion-chamber or from becoming so clogged or filled with dirt, ashes, &c., as to render it impossible to remove the nuts when it is desired to remove or replace any of the circulating-pipes.

Referring to Fig. 6, 36 represents nipples on the headers, to which the pipes 4 are to be connected. 37 represents a collar or nut screwed upon the nipples 36 and into which the pipes 4 are screwed, thus rigidly connecting the said

pipes to the nipples. The collar or nut 37 is provided with the recess to receive a packing-ring 38, and a lock-nut 39 is screwed onto the pipe 4, said lock-nut being provided with a corresponding recess, which, in connection with the recess in the nut 7, receives the packing-ring 38, thus making a tight joint. The outer end of the nut 39 has an annular recess around the pipe 4, formed by the projecting flange 40, and in said recess is placed a protecting-packing 41 of suitable material, such as asbestos, said packing covering the exposed threads on the pipe 4 and preventing them from being destroyed by the intense heat or from getting clogged with dirt, ashes, &c. It sometimes happens that it is very desirable to remove one or more of the circulating-pipes for some reason, and with my improved construction this can always be done by simply removing the packing 41, for the threads are preserved and the nuts are prevented from getting rusted on, while in the ordinary construction it is frequently impossible to disconnect the pipes from the headers after the device has been in use a short time.

The above construction for protecting the exposed threads on a circulating-pipe forms no part of my present invention, however, but is specifically described and claimed in my copending application, Serial No. 70,619, filed August 2, 1901, which is a division of this.

Various changes may be made in the structure of my device without departing from the spirit of my invention.

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

1. In a steam-generator, a plurality of circulating-pipes, a header connected to one end thereof and connections between said header and the boiler, said connections including a slip or expansion joint.

2. A steam-generating device adapted to be connected to a horizontal boiler, said device including a mud-drum adapted to be connected to the under side of said boiler, a header connected to the mud-drum by an expansion-joint, and circulating-pipes rigidly connected to said header.

3. A steam-generating device adapted to be connected to a horizontal boiler, said device including a mud-drum adapted to be connected to the under side of the boiler, front and rear headers either side of said mud-drum, flexible connections between said headers and the top of the mud-drum, and circulating-pipes communicating with the headers.

4. A steam-generating device adapted to be connected to a horizontal boiler, said device including a mud-drum, a connection between the bottom of the boiler and the mud-drum, and a plurality of circulating-pipes connected to the mud-drum and extending beneath the boiler whereby the water, as it circulates, is taken from the boiler and through the mud-drum into the circulating-pipe.

5. A steam-generating device adapted to be connected to a horizontal boiler, said device including a mud-drum, a connection between the bottom of the boiler and the mud-drum, 5 said connection including a pipe extending into the mud-drum, and a plurality of circulating-pipes connected to the top of the mud-drum whereby, as the water circulates it is drawn through the mud-drum and delivered 10 to the circulating-pipes.

6. In a steam-generator, a boiler, a plurality of circulating-pipes below the boiler and connected thereto at the rear end thereof, said circulating-pipes being divided into 15 three groups, a water-box having a central compartment and separate end compartments, one group of said pipes connecting with each compartment, and discharge-pipes connecting each end compartment of the water-box to the front end of the boiler, each of 20 said pipes having a connection with the central compartment.

7. In a steam-generator, a boiler, a plurality of circulating-pipes below the boiler and 25 connected thereto at the rear end thereof, a water-box at the front of the boiler and connected to the circulating-pipes, a discharge-pipe at either end of the water-box connecting the same with the boiler, each of said discharge-pipes having a branch connecting 30 with the central portion of the water-box.

8. In a steam-generator, a boiler, circulating-pipes, and a back connection between said pipes and boiler, said back connection 35 being connected to the under side of the boiler and including a hood-like circulation-head extending into the boiler, and situated below the normal water-line.

9. In a steam-generator, a boiler, circulating-pipes, and a back connection between said pipes and boiler, said back connection 40 being connected to the under side of the boiler and including a hood-like circulation-head extending into the boiler, the mouth of said circulation-head having a portion thereof below the bottom of the boiler. 45

10. A steam-generating device adapted to be connected to a horizontal boiler comprising a plurality of circulating-pipes, a back 50 connection adapted to connect the same to the boiler, said back connection including a collar to be secured to the under side of the boiler, a hood-like circulating-head secured to said collar and extending into the boiler 55 with its mouth toward the front of the boiler,

the lower portion of said mouth being below the bottom of the boiler whereby the circulation of the water through the back connection carries all the sediment from the boiler.

11. A steam-generating device for a horizontal boiler, said device comprising a plurality of circulating-pipes, a header to which said pipes are rigidly connected at one end, a water-box rigidly connected to the other 60 end of said pipes, said water-box, circulating-pipes and header forming a rigid construction, and a slip or expansion joint connection between said header and the boiler. 65

12. In a steam-generating device, a back connection adapted to be connected to a 70 boiler, a rear header back of said back connection, a series of circulating-pipes divided into two groups, one group being rigidly connected to said header near each end thereof, a front header in front of said back connection, a second series of circulating-pipes situated between the two groups of the first series and rigidly connected to the front header, 75 and a slip or expansion joint connection between each header and the back connection. 80

13. In a steam-generating device, a mud-drum adapted to be connected directly to a boiler, a rear header back of said mud-drum, circulating-pipes connected to each end of said header, a front header in front of said 85 mud-drum and between the circulating-pipes connected with the rear header, and a plurality of circulating-pipes connected to the front header, whereby the entire space above the combustion-chamber is utilized. 90

14. In a steam-generating device, a mud-drum adapted to be rigidly connected directly to a horizontal boiler, a rear header back of said mud-drum, circulating-pipes rigidly connected to each end thereof, a front 95 header in front of said mud-drum, and a plurality of circulating-pipes rigidly connected to said front header and situated between the pipes connected to the back header, said circulating-pipes and headers forming a rigid 100 structure, and a slip or expansion joint connection between said headers and the top of the mud-drum.

In testimony whereof I have signed my name to this specification in the presence of 105 two subscribing witnesses.

HENRY P. J. EARNSHAW.

Witnesses:

LOUIS C. SMITH,
GEO. W. GREGORY.