

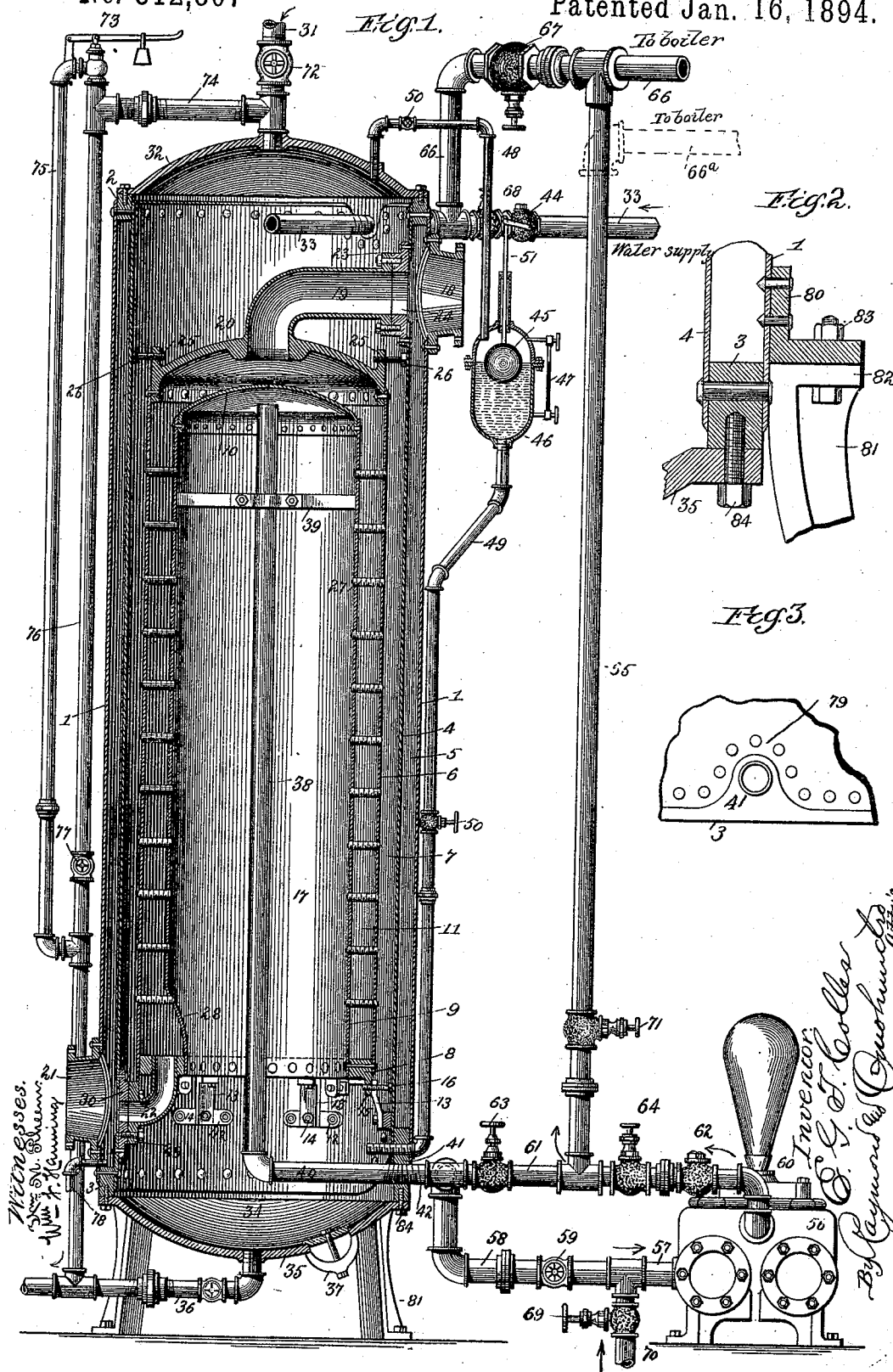
(No Model.)

4 Sheets—Sheet 1.

E. G. T. COLLES.
COMBINED FEED WATER HEATER AND RECEIVER.

No. 512,807

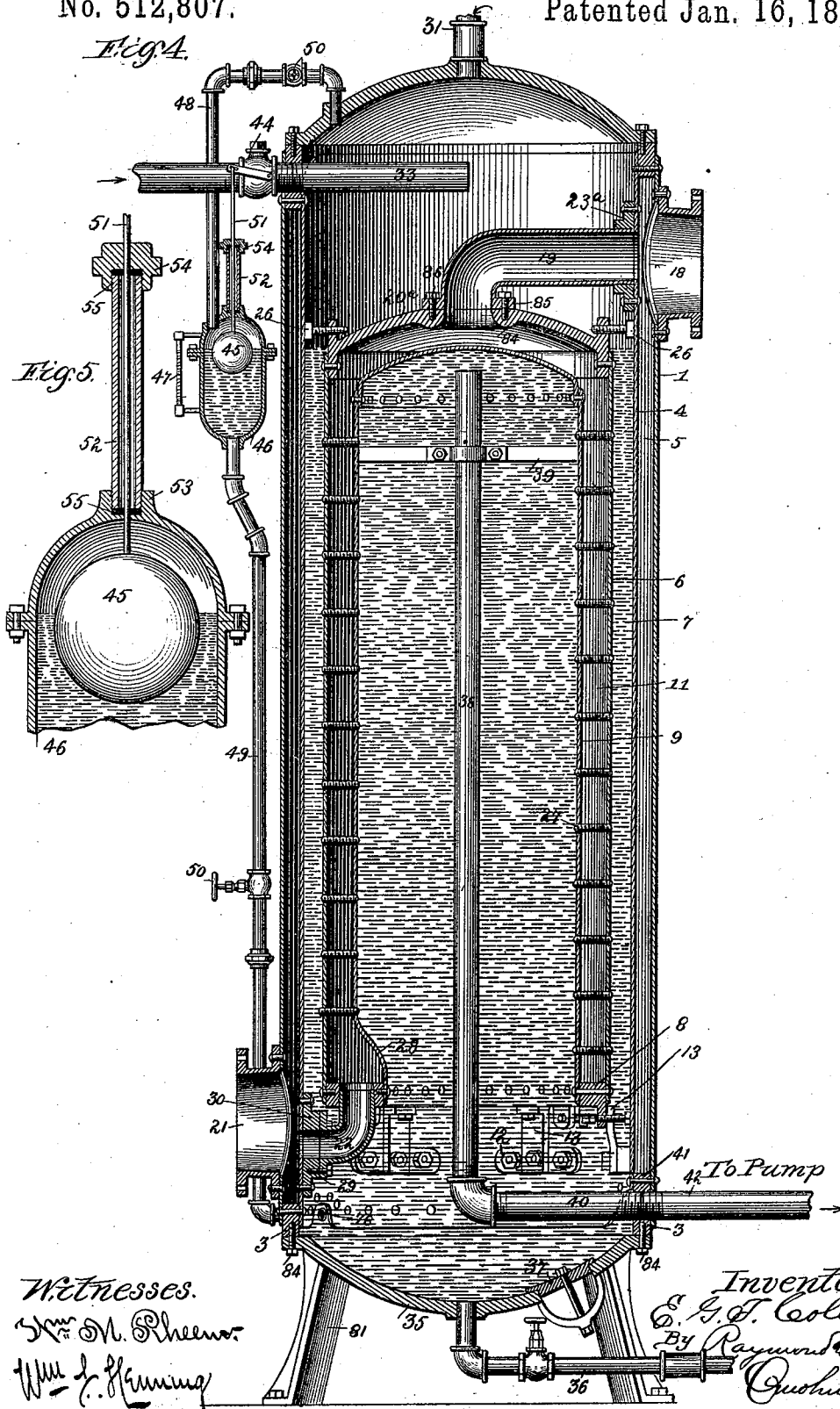
Patented Jan. 16, 1894.



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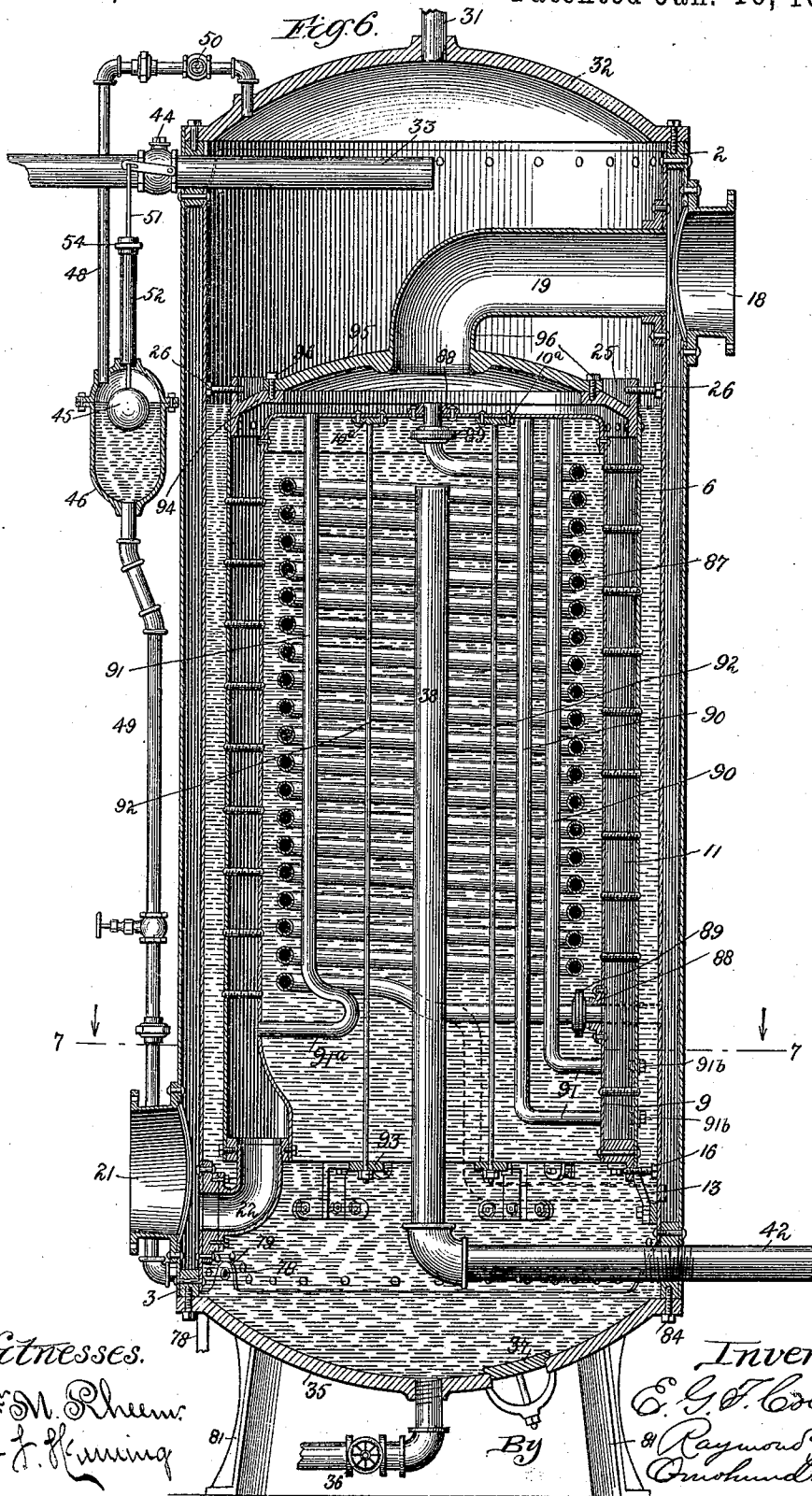
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Witnesses.
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(No Model.)

4 Sheets—Sheet 4.

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Fig. 7.

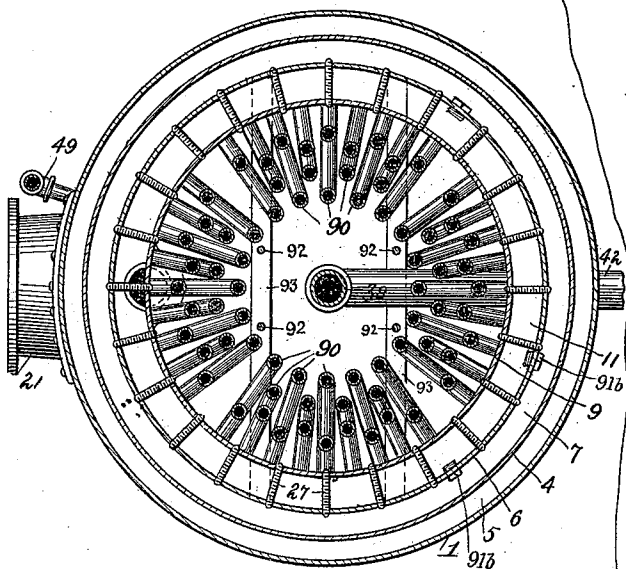


Fig. 9.

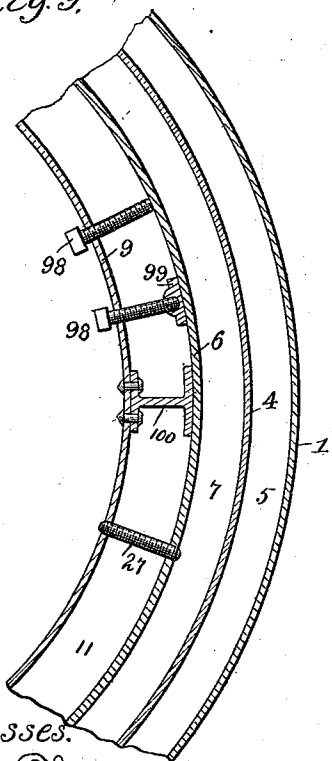
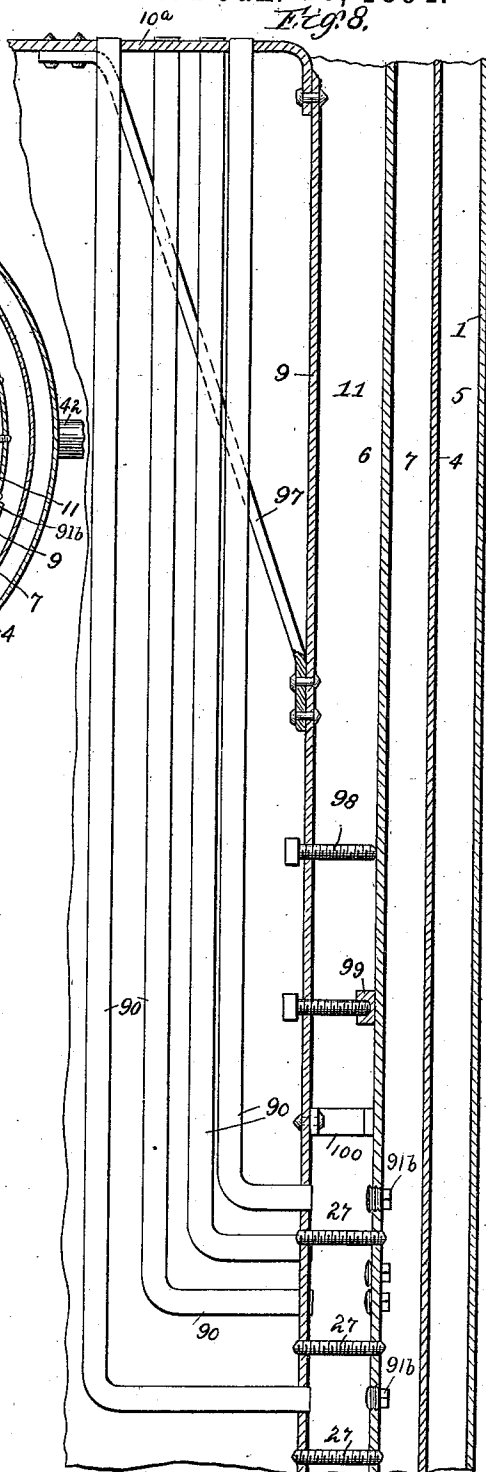


Fig. 8.



Witnesses.

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Inventor:
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UNITED STATES PATENT OFFICE.

EDWARD G. T. COLLES, OF CHICAGO, ILLINOIS.

COMBINED FEED-WATER HEATER AND RECEIVER.

SPECIFICATION forming part of Letters Patent No. 512,807, dated January 16, 1894.

Application filed February 15, 1893. Serial No. 462,492. (No model.)

To all whom it may concern:

Be it known that I, EDWARD G. T. COLLES, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in a Combined Feed-Water Heater and Receiver, of which the following is a full, clear, and exact specification.

My invention relates to improvements in feed water heaters which are designed to receive the waters of condensation directly from radiator systems and other sources, and at the same time, which utilize such water to assist in raising the temperature of the fresh water let into the heater for compensating for any loss resulting from evaporation, leakage or escape of steam.

More particularly, my invention relates to that class of such heaters known as "low pressure heaters," that is, heaters in which the water is maintained at a given level or volume less than the whole capacity of the water space of the heater.

My invention also has reference, however, to improvements by which the low pressure heater may be converted into a "superior pressure heater," at such times when there is no condensation in the radiator system or other steam passages returning to the heater.

One of the objects of my invention is to so construct a feed water heater and its connections, that the same may be readily and conveniently converted from a low pressure heater into a superior pressure heater, or vice versa.

Another object of my invention is to so construct a low pressure heater that the exhaust steam utilized therein for heating the feed water shall be maintained out of contact with such water.

A further object of my invention is to do away with the necessity of employing steam packing as heretofore, around the connection between the float for regulating the water supply, and the valve which said float controls; and my invention has for its object still further to improve generally, the construction and arrangement of parts of feed water heaters whereby the same will be more durable, effective and convenient.

With these ends in view, my invention consists in certain features of novelty in the construction, combination and arrangement of

parts hereinafter described with reference to the accompanying drawings and particularly pointed out in the claims.

In the said drawings, Figure 1, is a transverse vertical section of my improved combined feed water heater and receiver showing the same in connection with a pump for supplying the heater with fresh water or drawing the water from the heater and forcing the same into the boiler. Fig. 2, is a detail sectional view on an enlarged scale illustrating the method of attaching the supporting legs to the heater. Fig. 3, is a detail view illustrating the manner of connecting the pipes to the heater shell. Fig. 4, is a view similar to Fig. 1, showing the heater proper equipped as a low pressure heater only, and also illustrating certain modifications in the details of construction. Fig. 5, is an enlarged detail, sectional view of the float chamber, showing the float therein. Fig. 6, is a transverse vertical sectional view of the heater proper showing the same equipped as a low pressure heater only, and illustrating various further modifications in details of construction. Fig. 7, is a sectional plan taken on the line 7—7, Fig. 6. Fig. 8, is an enlarged detail transverse vertical section of a portion of the various shells comprising the steam and water spaces of the heater illustrating a modified arrangement of the internal steam pipes, and also illustrating various devices for bracing or reinforcing the shells, and Fig. 9, is a horizontal sectional view drawn to the scale of Fig. 8, of a portion of the shells, illustrating in plan view the various devices shown in Fig. 8, for reinforcing or bracing the shells.

While the modified forms of heaters proper, are shown in Figs. 4, 6, 7 and 8 of the drawings as low pressure heaters only, it will, nevertheless, be understood that the same may be substituted for the heater proper shown in Fig. 1, and utilized as a superior pressure heater; or in other words, the bypass pipe connections shown in Fig. 1, and hereinafter explained, may be applied to any of the modified forms of my heater without involving any change in the form or arrangement of their parts.

Like signs of reference indicate like parts throughout the several views.

In carrying out my invention I employ sep-

arate or independent chambers for the feed water and the exhaust or other steam employed for heating the same; I connect the radiator system or other source from which
 5 water of condensation may be drawn, and also a fresh water supply pipe directly to the water chamber of the heater and I regulate the level of the water in such chamber by means of a float having connection with a
 10 valve in the water supply pipe; and in order that the heater thus constructed may be utilized interchangeably as a low pressure and a superior pressure heater, I connect the water space or chamber thereof to the boiler
 15 supply pipe and also to a pump and provide suitable valve-guarded bypass pipes between such pump and the boiler pipe whereby the pump may be utilized for drawing the hot water from the heater and forcing it into the
 20 boiler, thus operating the heater as a low pressure heater, or forcing the fresh water through the heater into the boiler, and thus utilizing the heater as a superior pressure heater. In carrying these main features of
 25 my invention into effect, I also employ certain novel details of construction and arrangement which I will now more particularly describe with reference to the drawings.

1, is the outer shell or casing of the heater
 30 proper which is suitably riveted or secured at its upper and lower ends to stout rings or flanges 2—3 respectively. To the inner side of these rings 2—3 is riveted an inner shell or cylinder 4, which, together with the shell
 35 1 and rings 2—3 forms an annular steam space 5, constituting a jacket surrounding the inner water spaces. Supported within the cylinder or shell 4 is a smaller cylinder or shell 6, which constitutes with such cylinder 4, an annular
 40 water space or chamber 7. Riveted or otherwise secured to the lower end of this cylinder or shell 6, is a stout ring 8, and to the inner side of this ring is secured the lower end of a still smaller cylinder or shell 9, open at its
 45 lower end but closed at its upper end by means of a head 10, thus constituting with the shell or cylinder 6, a second annular steam-space 11. The two inner cylinders 6—9 are preferably supported concentrically within the cylinder
 50 4 by means of braces 12 13, preferably constructed of two parts bolted together at 14, the portion 12 being riveted or bolted to the shell 4, while the upright angular portions 13 are bolted to the under side of the ring 8 between
 55 the shells or cylinders 6 and 9.

The exhaust or other steam employed for heating the water in the chambers or spaces 7—17, may be admitted to the first annular steam-space 5, through a suitable steam-port
 60 or coupling 18, riveted or otherwise secured to the exterior shell 1. From the space 5 and also directly from the port 18 through a neck 19 of the head 20 secured to the cylinder or shell 6, a slight distance above the head 10 the
 65 exhaust or other steam is admitted to the steam-space 11. The steam after traversing the spaces or chambers 5—11, is permitted to

exhaust or be carried off to heat dry kilns, radiators, &c., through an exhaust-port 21, secured to the lower end of the exterior shell or
 70 cylinder 1, the inner chamber or space 11 being placed in communication with such port by means of an elbow pipe 22 secured in the ring 8, and coupled to a port in the shell 4.

The head 20 and its neck 19 are preferably
 75 constructed of a single piece as shown in Fig. 1, and the upper extremity of the neck is formed with a flange 23, whereby the neck may be bolted to a reinforcing ring 24, riveted to the shell or cylinder 4.

Around the upper edge of the head 20 at intervals, and around the lower edge of the
 80 ring 8 are formed a number of lugs or ears 25 and 15 respectively, through which pass horizontal screw bolts 26 and 16 respectively, arranged with their heads resting against, but
 85 not entering, the second shell or cylinder 4, thus providing means for centering the shells or cylinders 6—9 and holding them rigidly in place within the shell 4.

The inner shell or cylinder 9 is preferably reinforced or braced throughout its height by means of short stud bolts 27, whose ends are threaded in both cylinders 6 and 9, thus hold-
 90 ing the inner cylinder against lateral play and better adapting it for sustaining both internal and external pressure.

The inner cylinder 9 where the elbow pipe 22 is connected to the ring 8, is preferably enlarged inward as shown at 28, to make room
 100 for such pipe. The upper end of the elbow pipe 22 is provided with screw-threads turned in the ring 8, and its lower end is provided with a flange 29. This flange 29 is connected
 105 by bolts or screws, as shown, to a reinforcing ring 30, riveted to the shell 4, it being understood that the said shell itself is not of sufficient thickness to hold the screws or bolts, nor is there sufficient room between the pipe 22 and its flange 29 to permit of riveting such
 110 flange directly to the shell.

When the apparatus is used as a low pressure heater and receiver for receiving the water of condensation directly from the radiators or other source, the return pipe 31 from
 115 the radiator system is preferably connected to the upper end of the heater, it being secured in the head 32 which in turn is bolted to the ring 2. The fresh water supply for compensating for any loss resulting from
 120 evaporation, leakage or wastage of steam may be let into the water-space of the heater through a pipe 33, which preferably projects into the upper end of the heater and terminates at a point approximately over the center
 125 of the convex head 20, so that the water as it enters will fall upon such head and will be equally distributed in the annular chamber 7 running down the sides of such head and the cylinder 6, in the form of a thin sheet,
 130 and thus subjecting itself to the maximum degree of heat afforded by the steam in the annular chambers 5—11. The water after passing down the chamber 7 falls into a space

or chamber 34, left at the lower ends of the inner cylinders or shells and then rises again in the chamber 17, the sediment, &c., collecting in the concave or basin-like head 35 bolted to the ring 3 and provided with a valve-guarded blow-off pipe 36, and a hand hole 37. When the water reaches the upper end of the chamber 17, it is drawn off through a stand pipe 38, held preferably concentrically within the cylinder 9 by means of a suitable spider 39, the lower end of such pipe 38 being connected to a horizontal section 40, screw-threaded in an enlargement 41 of the ring 3, as shown in Figs. 1 and 3, and such section 40 being placed in communication with another section, 42, likewise secured in the enlargement 41, and having communication with a pump hereinafter described.

The fresh water supply pipe 33 is provided with a balanced or other suitable valve 44 connected to, and adapted to be actuated by a suitable float 45, which is governed by the level of the water within the heater. This float, however, is provided with a separate or independent exterior chamber 46, for the reason that it is desirable to keep the water on a level with or slightly below the head 20, and there is not sufficient room in the annular space or chamber 7 to accommodate the float. It is thus so arranged for the further reason that when the heater is employed as a superior pressure heater at which time the float is not needed, the outer chamber may be entirely cut off from the high pressure in the water space of the heater, and thus prevent leakage around the connection between the float and the valve 44 without the employment of tight packing which would be liable to render the float inoperative or sluggish at such times as its functions are required.

The chamber 46 is provided with a suitable gage 47 to indicate the level of the water in such chamber, and as such chamber is connected at top and bottom with the upper and lower ends of the water-space of the heater by means of pipes 48—49, it follows that the level of the water in the chamber 46 will be the same as that in the heater.

The pipes 48—49 may be provided with suitable valves 50, whereby the chamber 46 may be shut off from the heater when desired, as described.

I prefer to connect the float 45 to the valve 44 by means of a vertical rod 51, passing through and guided by a sleeve 52 screwed into a socket 53 in the upper end of the chamber 46 at its lower end, and having a cap 54 at its upper end—light gaskets of rubber or other suitable material 55, being arranged at the ends of the sleeve 52 for preventing the escape of any vapor that may return to the heater through the return pipe 31 from the radiators, all as shown more clearly in Fig. 5.

As the water in the annular chamber 7 lowers, the valve 44 will be accordingly opened by the float 45, permitting the influx of fresh water which will run down the sides of the

cylinder 6, as described, and rising in the chamber 17 will be drawn off by the pump 56 or other equivalent apparatus such as an inspirator or injector, the construction and operation of which are well understood. The suction pipe 57 of the pump is connected with the pipe 42 by means of a pipe 58 having a valve 59; and the eduction pipe 60 of the pump is connected to the pipe 42 by means of a pipe 61 which is provided with the usual check-valve 62 and two cocks or plugs 63 64. This pipe 61 at a point between the valve 63 and the pump is connected by a by-pass pipe 65 with a boiler supply pipe 66 which latter is connected with the supply pipe 33 between its discharge end and the valve 44 and is provided at a point between its connection with the pipe 65 and the pipe 33 with a cock or plug 67, the pipe 33 being provided with a cock 68 preferably at a point between the pipe 66 and the valve 44. Thus it will be seen that by this system of valve-guarded by-pass pipes the suction port of the pump may be connected with the water chamber of the heater, while its eduction port may be connected with the boiler, and when thus connected, the heater operates as a low-pressure heater. This connection may be established by closing the valve 63 so as to direct the water from the heater into the suction pipe 57 of the pump, and closing the valve 67 to prevent the return of the water into the upper end of the heater, the valve 59—64 being opened to permit the water to pass into the by-pass pipe 65.

When the heater is to be utilized as a superior pressure heater, necessitating a reversal of the course of the water the valve 69 in the pump supply pipe 70 is opened to supply the pump with water, and the valve 59 in the suction pipe 58 is closed, as is also the valve 71 arranged in the by-pass pipe 65 to prevent the water from going directly into the discharge pipe to the boiler, the other valves, excepting the valve 68 in the water supply pipe 33, being opened. With the communication thus established, it will be seen that the pump will draw its supply through the pipe 70, and it will force the water directly into the upper end of the chamber 17, whence it will descend in such chamber and again pass upward between the cylinders 4 and 6, and rising above the head 20 and filling the upper end of the heater, will discharge into the boiler *via* the water supply pipe 33 and the discharge pipe 66 to the boiler, the return pipe 31 at such time of course being closed by means of a suitable valve 72. In this manner the pipes 33 and 38 are utilized interchangeably as inlet and discharge pipes.

In order that the pressure in the water spaces of the heater may be relieved, if at any time it should become excessive, I provide the same with a safety valve or vent. This safety-valve is preferably arranged in or between two pipes 74, 75 having communication with the pipe 31 below its valve 72,

the pipe 75 being connected with the blow-off or other discharge pipe 36 at a point beyond the blow-off valve whereby, when the safety-valve 73 is forced open the excess of pressure will discharge into such blow-off or discharge pipe; and in order that the heater may be sluiced out at any time by pumping water therethrough, I connect the pipe 74 between its point of connection with the pipe 31 and the valve 73, to a by-pass pipe 76 which may also be connected with the discharge pipe 36 and is provided with the valve 77. When the valve 77 is opened the contents of the water spaces of the heater will be free to escape through the pipe 76 into the discharge pipe 36, but when such valve 77 is closed there can be no escape excepting *via* the safety valve 73 and the pipe 75. As shown in the drawings the pipe 75 communicates with the pipe 36 through a portion of the pipe 76, and hence the valve 77 is located between the point of connection between such pipes 75—76 and between such pipe 76 and the pipe 31.

The oil, grease, and condensations carried into the steam space of the heater may be continuously drained off through a suitable discharge pipe 78 arranged at the lower end thereof.

Where convenient the pipes having a communication with the heater are arranged to enter the same through the rings 2 or 3 instead of being connected directly to the thin shells, and to this end wherever a pipe passes through either of these rings, the same is provided with an enlarged portion, such as 41, shown in Fig. 3, which is provided with a screw-threaded perforation to receive the end of the pipe, and around which the sheeting of the shell is cut and riveted as shown at 79, Fig. 3.

It is often necessary during the life of the ordinary water-heater to remove the lower head 35 and to the end that this may be accomplished with as little inconvenience as possible, and without dismantling the heater, I provide the lower end of the outer shell with a number of angle-irons 80 riveted thereto and forming means of attachment for the legs 81, the legs being provided at their upper ends with horizontal flanges 82 which match the horizontal portions of the angle-irons 80 and which may be bolted to such angle irons by means of the bolts 83. Thus it will be seen that when so desired the lower head 35 may be readily removed by unscrewing the bolts 84 which secure it to the ring 3 without depriving the heater of its support.

In the form shown in Fig. 4 the construction of the heater proper is substantially the same as that already described, excepting that the head of the shell or cylinder 6 and its neck 19 are formed separate. This head which is here indicated by the sign 20^a is provided around its central opening with a welt or enlargement 84 and the lower end of the neck 19 is provided with a flange 85 through

which screw-bolts 86 pass into the enlargement 84 and thus secure the head to its neck. In this instance also in order that there may be no difficulty in adjusting the parts to their proper positions the flange 23^a at the upper end of the neck instead of being formed integrally therewith, is formed separately and riveted directly to the inner shell 4, the neck and the flange being secured together by screw-thread connection. In this latter form the heater is equipped solely as a low pressure heater, and consequently the by-pass pipe system before described for converting the apparatus into a superior pressure heater is omitted, and such system of by-pass pipes being omitted, there is of course no need for the safety valve and sluice pipe 76 employed in the other form. In this instance, the water of condensation is supplied through the return pipe 31 and the fresh-water supply pipe 33, and it is drawn off by means of the pump, not shown, through the stand-pipe 38.

In the form of heater shown in Fig. 6, the heating surface is still further increased by a series of pipes arranged within the interior of the water chamber and having communication with the upper or lower sides of the interior annular steam chamber 11. These pipes may be arranged in the form of a coil 87 connected at its upper end by means of a flange 88 and coupling 89 to the head 10^a of the inner water chamber so as to be in direct communication with the neck 19 and at its lower end said coil is connected by similar devices to the inner annular steam space 11, or the outer annular steam space 5, as shown by dotted lines in Fig. 6. Arranged preferably within this coil and in juxtaposition thereto is a series of vertical tubes or pipes 90 connected at their upper ends to the head 10^a, while at their lower ends they are provided with bends 91 connected to the shell 9, the inner one of these pipes 90 of each pair being slightly shorter than the other and arranged above it as more clearly shown in Fig. 7. In Fig. 6 of the drawings the full complement of upright pipes or tubes 90 is omitted for the sake of clearness, only three of such tubes being shown. On the left in Fig. 6 the tube shown is provided with a hook bend 91^a as an example of a means for permitting of the expansion and contraction of the tubes or pipes. In the shell 6 opposing the end of each of the pipes 91 or 91^a are fixed plugs 91^b not only affording access to the tubes for cleaning them, but also affording a means by which the ends of the tubes may be expanded to render them water and steam-tight in the setting up of the apparatus or to re-expand them in the event of leakage. Obviously, the use of these plugs will avoid the great expense as well as loss of time which would otherwise be necessary to repair a leakage at the joint of these pipes with the shell 9, for after the apparatus is once set up there would be no way in which to accomplish this result except by taking the apparatus entirely apart.

In this form shown in Fig. 6, the head 10^a is preferably constructed of sheeting like its cylinder or shell, and in order that this head may be reinforced or braced against the pressure of the water, in case the heater should be employed as a superior pressure heater, I provide the same with depending brace bars or rods 92, which may be secured at their lower ends to suitable cross bars 93, taking their bearing against the lower side of the ring 8. Where steam tubes or pipes are employed in the inner chamber, it becomes necessary that the head arranged above the head 10^a, should be capable of ready removal in order to afford access to such tubes or pipes, and to this end, instead of forming the head 20 in one part as in Fig. 1, I form the same in two parts 94—95, the portion 94 being secured to the shell 7 as before described and provided with the lugs or flanges 25, while the portion 95 is formed integrally with the neck 19 and connected to the portion 94 by means of screw bolts 96 or other convenient means of attachment. Instead of the brace rods 92, if desired, the head 10^a may be reinforced by the ordinary oblique braces 97, riveted or otherwise secured to the head 10^a and to the side of the shell 9, as indicated in Fig. 8. Fig. 8, illustrates also a further modification in the arrangement of the internal steam tubes, which consists in employing a number of the vertical tubes 90 arranged one above the other as described, and in close order as indicated in Fig. 7.

Instead of the double ended stud bolts 27, the shells may be braced against each other by means of bolts 98 passing through one of the shells and impinging the other, but not entering it, or if desired, such bolt may be provided at its inner end with a bearing plate 99 resting against one of the shells, or again, instead of a bolt, one of the shells may be provided with a double T or I casting 100, riveted thereto at suitable intervals and bearing against the other shell, all as shown in Figs. 8 and 9.

Instead of connecting the by-pass 65 directly to the discharge pipe 66 leading to the boiler, the by-pass may have a separate pipe 66^a leading to the boiler, as indicated in dotted lines in Fig. 1, although the construction previously described is preferred by reason of the greater simplicity thereof and the saving in material.

It will be understood that in the claims in referring to the head of the inner cylinder I mean thereby either the head 20^a shown in Fig. 4, or the head 94 shown in Fig. 6, and by the flange connecting the pipe 19 with the head I mean the flange 85 shown in Fig. 4 or the flange 95 shown in Fig. 6 and the flange head 20 shown in Fig. 1.

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

1. In a feed water heater, the combination of separate chambers or spaces for the steam

and water, a valved water supply pipe and a valved discharge pipe to the boiler connected with said water chamber, a pump also connected by valved pipes with said water chamber, and valved by-pass pipes between the pump and water chamber and the pump and boiler, whereby the pump may be utilized for drawing water from the heater or forcing water through the heater into the boiler, substantially as set forth.

2. In a feed water heater, the combination of independent chambers for the steam and water, a water supply pipe and a valved discharge pipe to the boiler connected with said water chamber, a pump and a system of valve-guarded by-pass pipes between the pump and the water chamber and between the pump and said boiler supply pipe, whereby the pump may be utilized for drawing the water from the heater and forcing it into the boiler, or forcing the water into the boiler through the heater, substantially as set forth.

3. In a feed water heater, the combination of separate chambers or spaces for steam and water, a water supply pipe and a valved discharge pipe to the boiler connected with said water chamber, a pump, a pipe 61 connecting one port of said pump with said water chamber, a valve in said pipe 61, a valved by-pass pipe connected with said boiler supply pipe and with said pipe 61 between the said valve and the pump, a valve in said boiler supply pipe between the heater and said by-pass pipe, and a second valved by-pass pipe connected with the other port of said pump and with said water space or chamber, substantially as set forth.

4. In a feed water heater, the combination with independent chambers for the steam and water, a water supply pipe, a boiler pipe and a return pipe for water of condensation connected with said water chamber and a system of valve-guarded by-pass pipes between said pump and water chamber and said boiler pipe and pump, substantially as and for the purposes set forth.

5. In a feed-water-heater, the combination with independent chambers for steam and water, a water-supply pipe, a boiler-pipe and a return-pipe for water of condensation connected with said water-chamber, a system of valve-guarded by-pass pipes between the pump and the water-chamber and said boiler-pipe and pump, of an independent float-chamber connected with said water-chamber above and below the water-line thereof, a float located in said independent water-chamber, and a stem connecting the float with a valve in the water-supply pipe, substantially as set forth.

6. In a feed water heater, the combination with a shell or cylinder, of the ring 3 secured thereto, the head 35, screw bolts attaching said head to said ring, angle brackets secured to said shell or cylinder independently of said head, and supporting legs bolted to said angle brackets, substantially as set forth.

7. In a feed water heater, the combination of the shells or cylinders, the rings, to the inner and outer peripheries of which said shells or cylinders are riveted, said rings being provided with integral enlargements having screw-threaded perforations for the attachment of the pipe connections, and extending parallel with the cylinder sheeting the sheeting of the cylinder being riveted around said perforations, substantially as set forth.

8. In a feed water heater, the combination of a number of concentric shells or cylinders forming steam and water spaces, and screw-threaded braces or studs arranged between and re-inforcing said cylinders with one another, substantially as set forth.

9. In a feed water heater, the combination with inner and outer steam chambers each formed by a pair of concentric shells or cylinders, the space between which pairs constitutes a water chamber, of a head for the

outer one of the inner pair of cylinders provided with a central opening, and a pipe flanged at one end and bolted to said head and at its opposite end connected to the inner one of the outer pair of cylinders, substantially as described.

10. In a feed water heater, the combination with inner and outer steam chambers each formed by a pair of concentric shells or cylinders, the space between which pairs constitutes a water chamber, of a head for the outer one of the inner pair of cylinders provided with a central opening, and a pipe flanged at one end and bolted to said head, and at its opposite end having a screw thread connection with the inner one of the outer pair of cylinders, substantially as described.

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Witnesses:

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