

F. P. DIMPFEL.  
STEAM BOILER.

No. 7,506.

Patented July 16, 1850.

Fig 3.

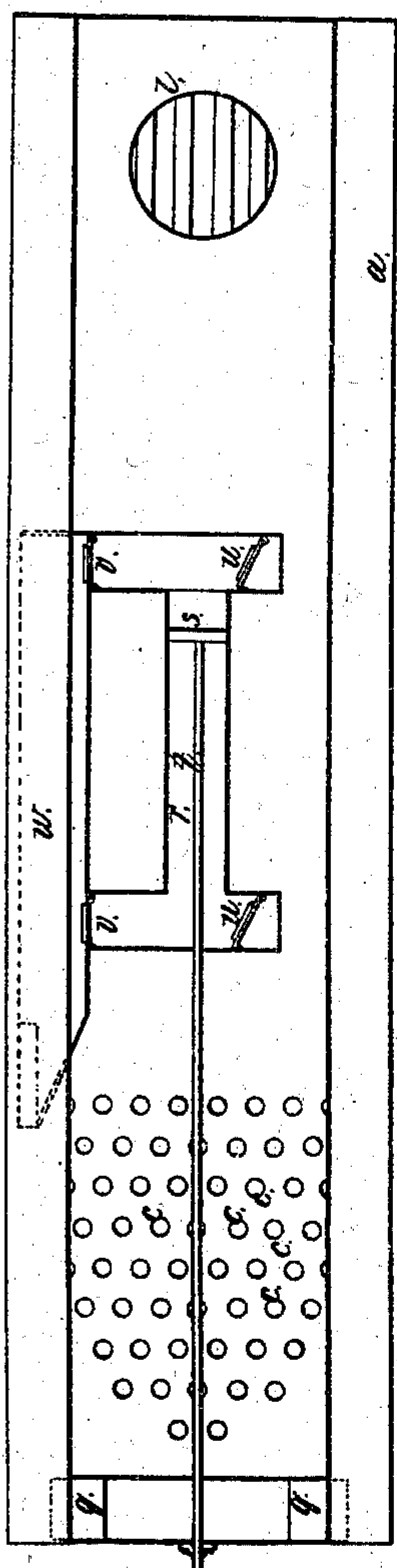


Fig 2.

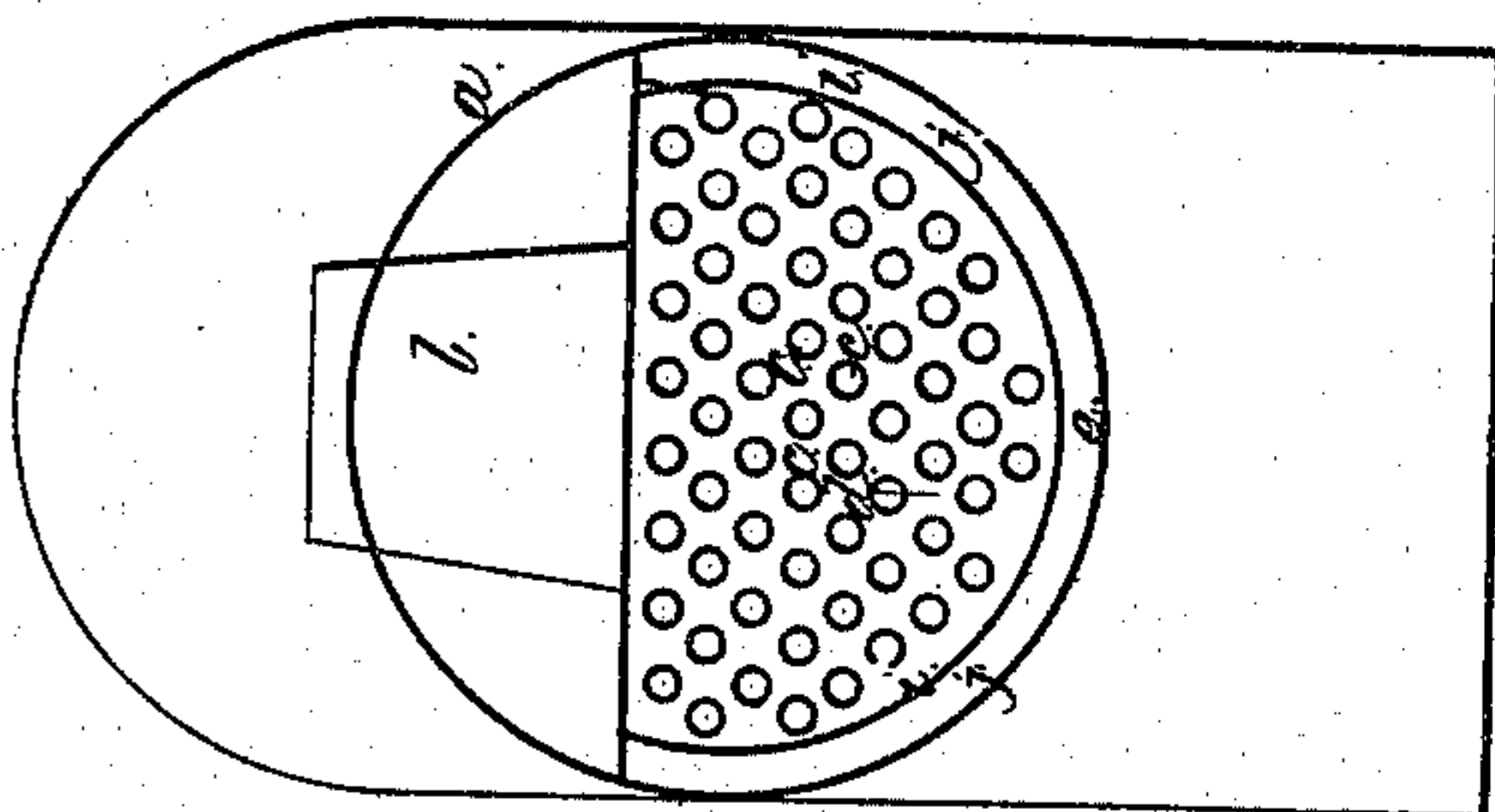
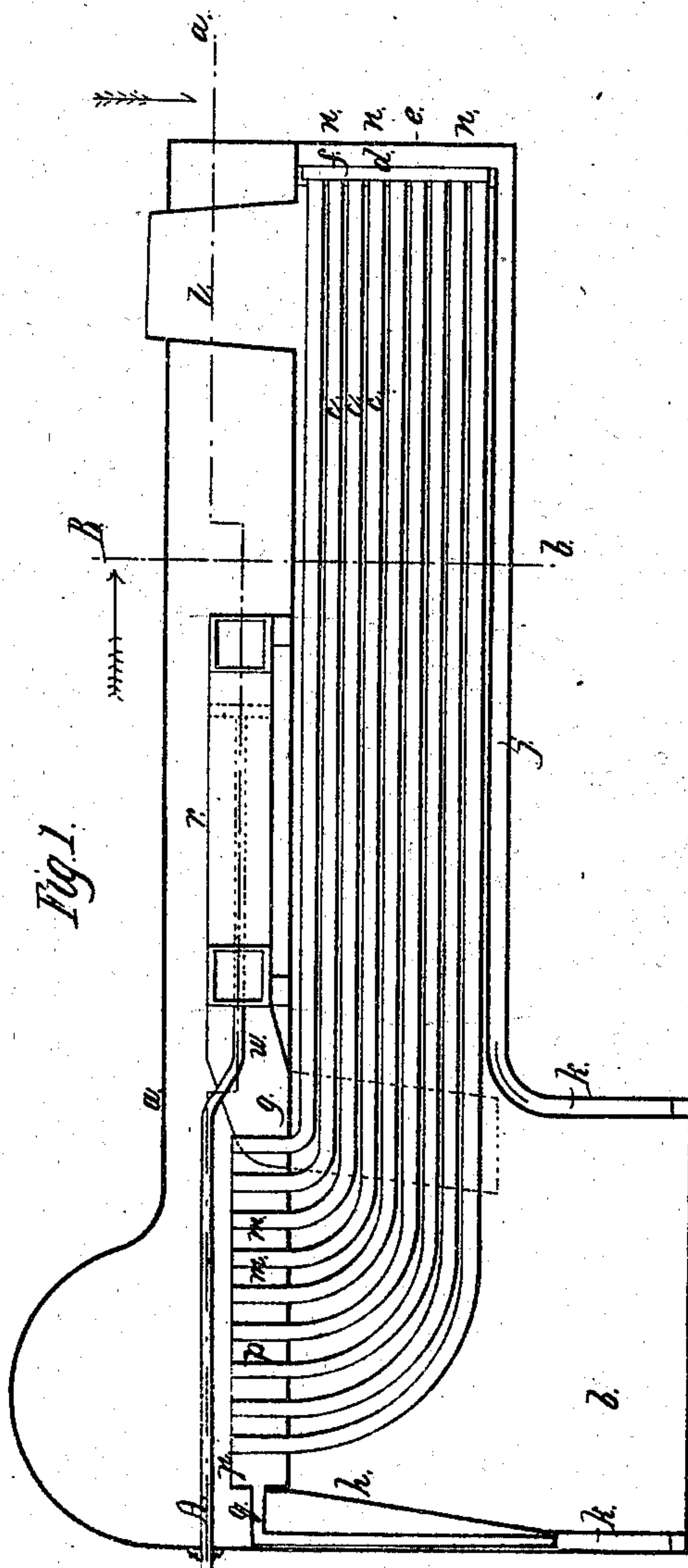


Fig 1.





# UNITED STATES PATENT OFFICE.

F. P. DIMPFEL, OF PHILADELPHIA, PENNSYLVANIA.

## STEAM-BOILER.

Specification of Letters Patent No. 7,506, dated July 16, 1850.

*To all whom it may concern:*

Be it known that I, F. P. DIMPFEL, of Philadelphia, in the State of Pennsylvania, have invented certain new and useful Improvements in Steam Boilers and Generators, in which—

Figure 1 is a longitudinal vertical section of a boiler such as would be adapted to a locomotive, Fig. 2 a cross section of the same and that the following is a full, clear, and exact description of the construction and operation of the same.

The same letters indicate like parts in all the figures.

15 The principle of the first part of my invention relates to the employment of tubes or pipes within a boiler which communicate at both ends with the body of water in the boiler and through which the water circulates, and consists in making such tubes or pipes with one end bent up when such bent up ends are attached to the crown plate of the boiler or the plates forming the sides or end of the firebox or flue at or near the junction with the crown plate provided the other end is attached to a water space of the flue and at or near the end of the same substantially as hereinafter described whereby the water is caused to circulate freely through such tubes and is freely delivered out of the bent up ends without any counteracting effect, and the circulation of the water through the tubes is always insured in the same and required direction, the bends in the said tubes at the same time giving the required elasticity to yield to the expansion and contraction due to the changes of temperature to which they are necessarily exposed. And this part of my invention also consists in combining such bent tubes with a water bottom of any form whatever or other bottom water communication which will freely supply water to the space with which the straight ends of the tubes connect by means of which combination a full supply of water is given to insure the circulation through the tubes, and which at the same time prevents the overheating of the plate or plates to which the straight ends of the tubes are attached, and consequently avoids the evil effects which otherwise would take place, for the heating of the plate tends to repel and drive up the water and hence prevents it from entering the tubes freely. But by the arrangement herein specified the water is supplied to this space freely and by

the rapid circulation prevents in a great measure the heating of the plate to which the ends of the tubes are attached, and hence admits of the more free circulation of the water into the tubes. This part of my invention also consists in connection with bent tubes attached at one end within some part of the flue in attaching the bent up ends of the exit tubes to the crown plate or roof of the firebox that the current of water through the tubes may be discharged over the said crown plate or roof and thus prevent the overheating thereof, for the heat in the firebox acts upward and impinges on the under surface of this plate and tends to heat it to a high degree and if by accident the water be suffered to sink below it soon becomes overheated and endangers the safety of the boiler. But by attaching the bent up ends of the tubes to this plate the current of water discharged by them will flow over the upper surface of this plate and thus keep it covered with water even after the level of the body of water in the boiler has fallen below it. In this way the parts of the boiler most exposed to the effects of intense heat are fully protected.

The second part of my invention consists in combining with the bent up tubes attached to the crown plate of the firebox the making of such crown plate with a ring or projection around the edges thereof, the better to retain on its surface the water discharged into it by the circulation through the tubes.

The third part of my invention consists in extending the bent up ends of the tubes above the surface of the crown plate or other plates on one side of which the fire or products of combustion acts to which they are attached when the other end of the tubes communicate with a water space or body of water below or farther from the firebox than the said bent up ends whereby the disturbance of the water above the crown sheet or other plate to which the bent up ends of the tubes are attached is avoided. And the last part of my invention consists in giving a forced circulation to the water in steam boilers or generators by mechanical means whereby the water is caused to pass with greater velocity over the heated surface and thereby to take up the heat more rapidly.

In the accompanying drawing (a) represents the external shell of the boiler which



may be of any desired form and (b) the fire chamber; within the shell is arranged a series of water tubes or pipes (c) which are secured at the back end to a vertical plate (d) which plate (a) is at such distance from the end plate or head (e) of the boiler so as to have a space (f) for the free admission of water to this end of the tubes or pipes. The other ends of the said tubes or pipes are curved or bent upward and attached to the roof or crown plate (g) which runs back to and is connected at the back end with the plate (d) before described, at the front end with a vertical plate (h) or lining of the furnace, and at the sides with the upper edges of a plate (i) within the boiler and at such distance from it as to leave a water space (j) all around and communicating with the space (f) at the back end, and with the water space (k) surrounding the furnace. This plate (i) together with the roof or crown plate constitutes the fire flue which leads from the furnace to the chimney (2) so that the flame and other products of combustion in passing from the furnace to the chimney act first on the curved or bent up part of the tubes or pipes and then in passing toward the chimney act on and impart heat to the external surface of all the water tubes or pipes; the most intense heat being applied to the curved or bent ends of the tubes which first receive the action of the heat. The products of combustion also heat the plate (i) which is the inner shell of the water space surrounding the flue and which constitutes the water bottom. The tubes being bent or curved upward as the water in them is heated and rarefied it will tend to rise in the curved end, and thus establish a rapid circulation through the entire length, and as their other end is connected with the body of water at the back and when the water is not heated to so intense a degree, the circulation in the tubes or pipes will be fully supplied. The water space (j) between the plate (i) and the outer shell of the boiler, as well as the space (f) at the back are closed at top from the back to the space (k) around the furnace or fire box, and the crown plate or fire roof to which the bent up ends of the tubes are attached, is surrounded by a rim (p); two or more tubes (q) form communications between the space above the crown plate and the lower end of the space (k) around the fire-box; and this space (k) in turn communicates (as indicated by the arrows) with the space (j) which as stated constitutes the water bottom. The effect of this arrangement will be that as the water above the crown plate or fire-roof cannot pass down the side or back spaces (j) and (f), it will run down the tubes (q) to the bottom or lower part of the spaces (k) surrounding the furnace or fire-box and thence through the water bottom to the space (f)

to supply the circulation in the tubes. The current thus supplied to the space (f), which cannot rise above the covering of the said space (f), by reason of its being closed up at top, will effectually supply the tubes; for if the said space (f) were open at top and not connected with the water-bottom, the heat which the plate (d) receives from the impingement of the products of the combustion in passing through the flue, would have the effect to repel the water from the surface of the plate and to induce an upward circulation in the said space (f) so rapid as not to give an adequate supply of water to the tubes. And as the curved and bent up ends of the tubes are either directly over or nearest to the fire chamber, they will be more highly heated than the rear ends, so that the water by its circulation through the tubes or pipes will move in a direction the reverse of the current of heat as it passes from the fire-chamber to the chimney thus increasing the absorption of heat by the water.

The bent up ends of the tubes are extended above the roof or crown plate as at (m) which will induce a more rapid circulation and avoid the agitation of the water on the surface of the roof around the tubes.

The shell of the boiler at the horizontal end of the tubes or pipes may be perforated as at (n) with a series of holes corresponding with the bore of the tubes, for which one large hole for the whole series, covered with a plate in the manner of a man hole may be substituted for giving access to the tubes or pipes for cleansing or repairing them.

A short distance above the top flue-plate there is a cylinder or case (r) provided with a reciprocating piston (s) the rod (t) of which passes through the head of the boiler that it may be connected with any moving part of the engine or any other first mover to give it a reciprocating motion. The said cylinder is provided on one side with two induction valves (u. u.) one at each end, and on the other side with two eduction valves (v. v.) discharging into a pipe (w) leading down into one of the outer spaces. It will be obvious from this that the reciprocating motion of the piston will produce a current of water down the water space in which the pipe is located and that this will induce a circulation through the boiler to return the water to the induction valves of the cylinder, and in this way establish a circulation of the water over the heating surface of the boiler with a velocity dependent on the capacity of the cylinder and the motion of the piston.

I do not wish to limit myself to the precise construction herein above described nor to the employment of all the various parts of my invention in connection, as the construction and arrangement of parts may be vari-



ously modified within the range of the several parts of my invention and improved results can be obtained from the use of one or more of the improvements enumerated as constituting the several parts of my invention without the others, although the best results will be obtained when all of them are used in connection, as they either depend upon or assist one another in effecting the special purposes contemplated by me, viz: the more rapid, safe and economical generation of steam.

As to the mechanical means for producing a forced circulation of the water through the boiler any other known mechanical arrangement may be substituted for that herein described, such as rotating valves or paddles, duck foot paddles, and a variety of others not necessary to enumerate.

What I claim as my invention and desire to secure by Letters Patent, is—

1. Arranging a series of bent water tubes within the flue space of a boiler, and connected at each end with the body of water in the boiler, substantially as herein described, by means of which the circulation of water is greatly increased, and the injurious effects due to expansion and contraction avoided, substantially as described.

2. I also claim surrounding the crown

sheet to which the ends of circulating tubes or their equivalent are attached with a rim, substantially as and for the purpose specified.

3. Extending the ends of the tubes, or the equivalent thereof, above the crown-plate or roof of the fire box, or any other plate or plates, one side of which is fire surface, to which they are attached, when the other or lower end communicates with a water space or spaces below or beyond the plate to which the upper ends are attached, substantially as and for the purpose specified.

I am aware that a patent was granted to Richard Prosser in England February 1839—see Newton Journal Vol: 15 conjoined series page 271—in which are represented circulating tubes with one end projecting above a plate. I do not claim such arrangement, believing that described by me to be substantially different, and producing an entirely different effect.

4. Giving a forced circulation to the water through the boiler or generator by mechanical means, substantially as and for the purpose specified.

F. P. DIMPFL.

Witnesses:

ALEX. PORTER BROWNE,  
C. BROWNE.