

D. F. MORGAN.

BOILER.

(Application filed Jan. 23, 1899.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1

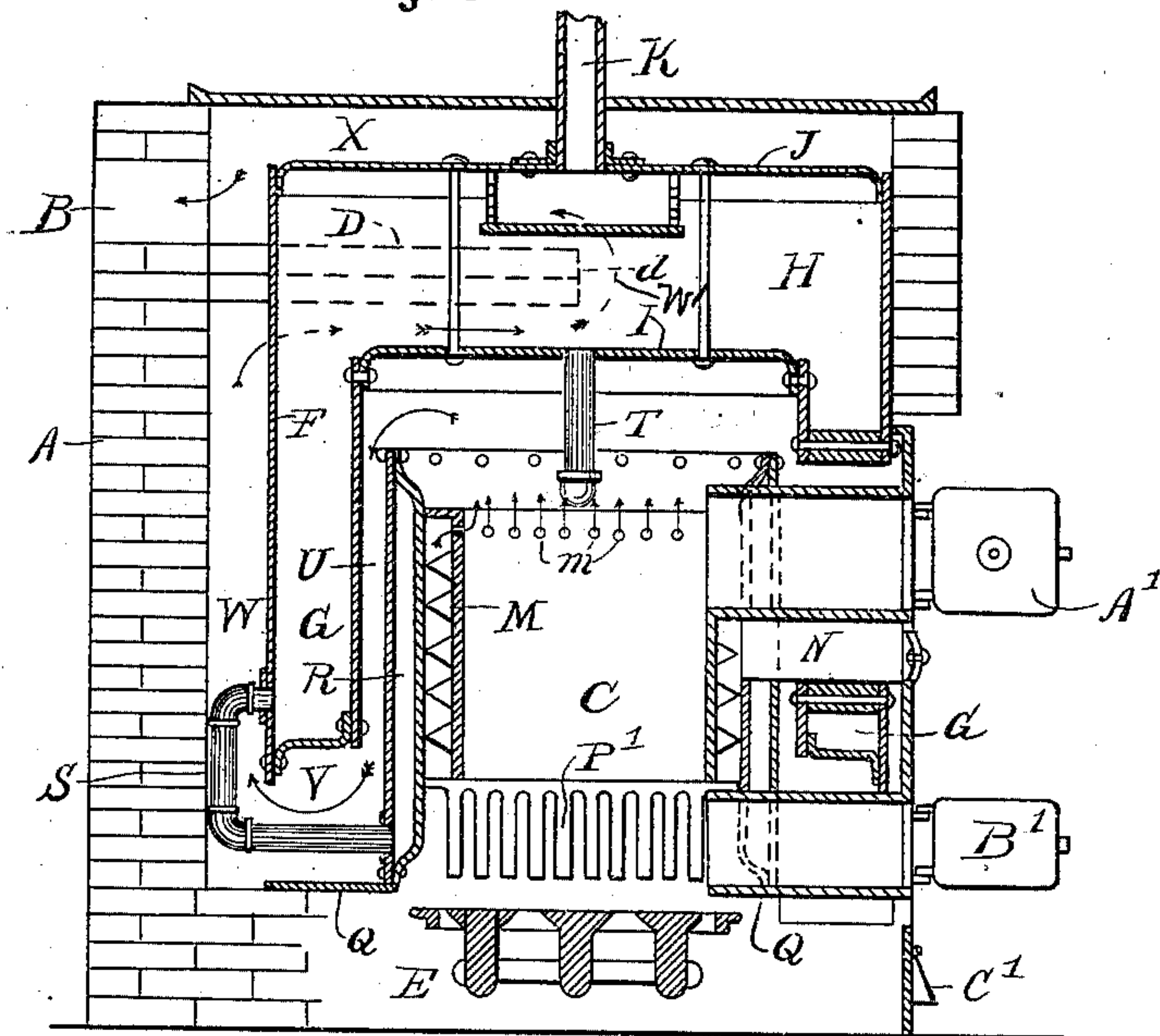
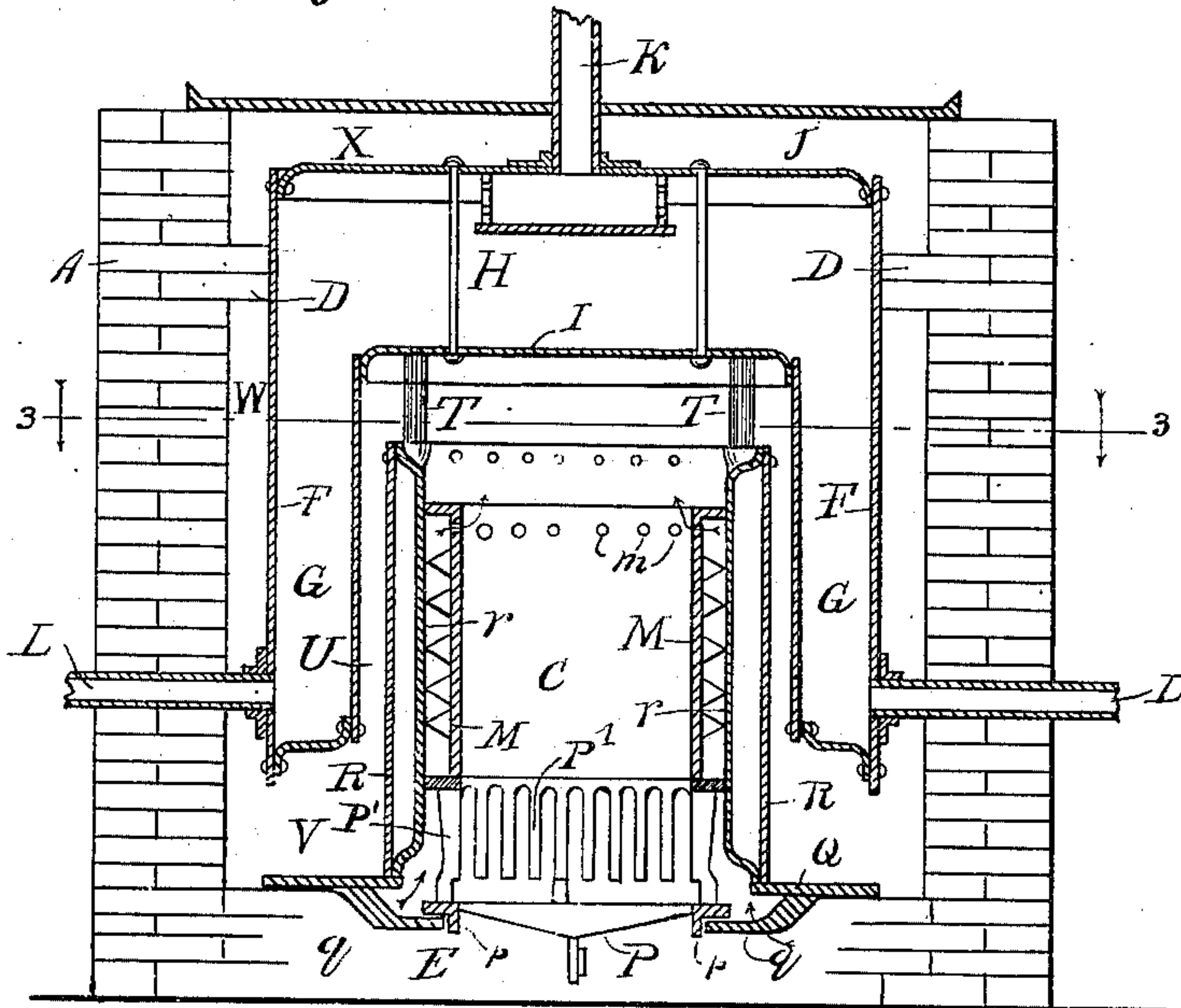


Fig. 2



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2 Sheets—Sheet 2.

Fig. 3.

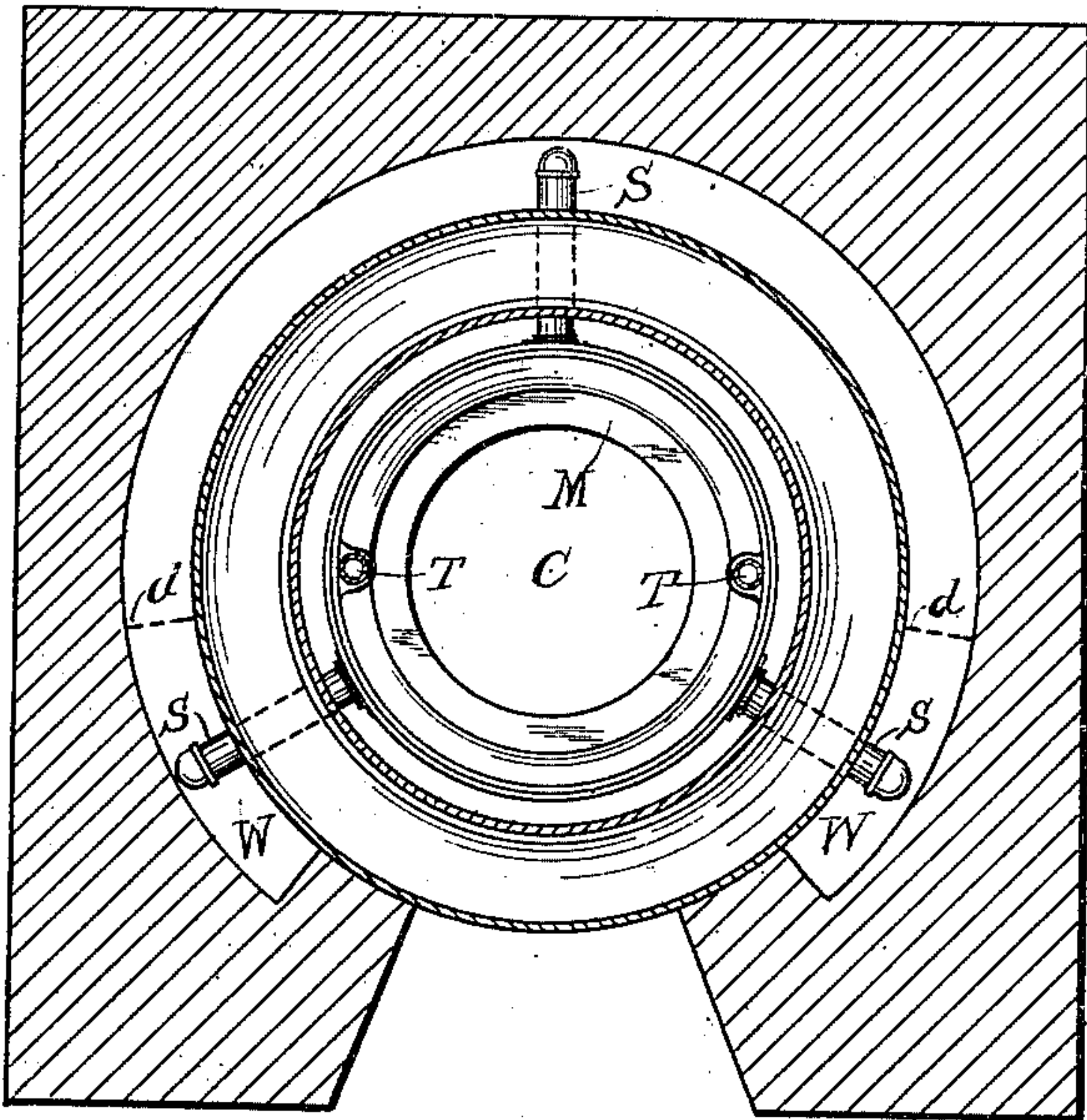
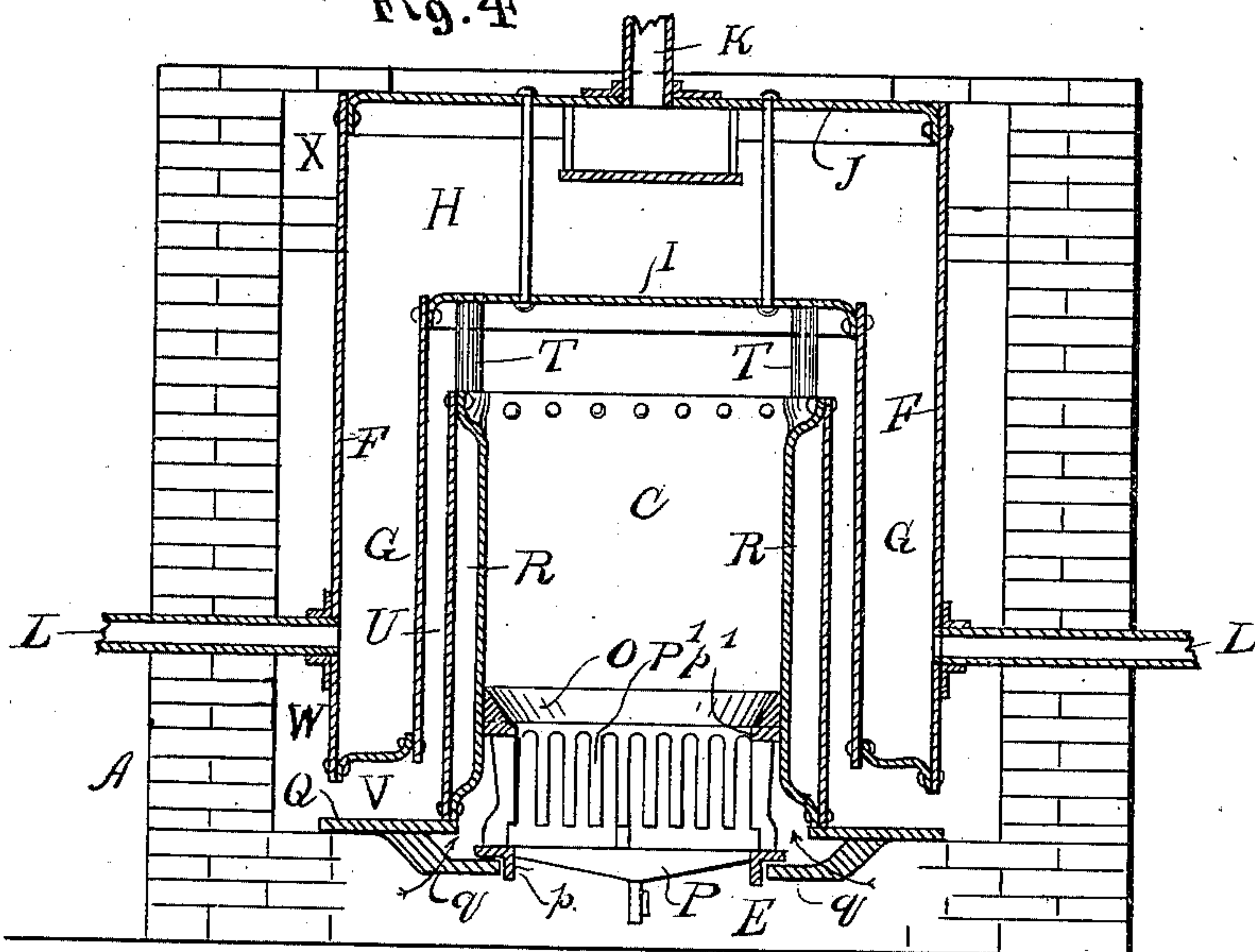


Fig. 4.



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# UNITED STATES PATENT OFFICE.

DOCTOR FRANKLIN MORGAN, OF CHICAGO, ILLINOIS.

## BOILER.

SPECIFICATION forming part of Letters Patent No. 663,818, dated December 11, 1900.

Application filed January 23, 1899. Serial No. 703,167. (No model.)

*To all whom it may concern:*

Be it known that I, DOCTOR FRANKLIN MORGAN, 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 Boilers, of which the following, when taken in connection with the drawings accompanying and forming a part hereof, is a full and complete description, sufficient to enable those skilled in the art to which it pertains to understand, make, and use the same.

This invention relates to boilers for heating water or generating steam by the combustion of anthracite or soft coal, as preferred—that is, the invention is applicable to both kinds of boilers.

This invention is also an improvement on the boiler for hot water or steam set out and described in Letters Patent of the United States granted to me on the 22d day of September, 1896, No. 568,167. It is not, however, confined in its application to such boiler, as is hereinafter more specifically shown.

One object of this invention is to obtain a boiler wherein a large body of water is contained for conversion into steam and by which steam can be generated in a short time without raising the temperature of all or of a greater part of the water in the boiler to the boiling-point.

A further object of the invention is to obtain a boiler by means of which steam may be occasionally generated, as well as rapidly, and in which good combustion of the fuel used will be obtained.

A further object of the invention is to obtain a boiler having an auxiliary water-leg through which the circulation shall be at all times in a determined direction—that is, from the lower end thereof up toward the upper end and through the crown-sheet into the part H of the boiler.

A further and important object of the invention is to obtain a boiler in which the combustion of the coal shall be such as to obviate the necessity of sifting the ashes to reclaim unburned coal.

In the drawings referred to, and wherein a reference-letter applied to designate a given part is used to indicate such part throughout

the several figures wherever the same appears, Figure 1 is a vertical sectional view of a boiler arranged to burn soft or bituminous coal as fuel and having my invention embodied therein. Fig. 2 is a vertical sectional view of the boiler illustrated in Fig. 1 on a line at right angles to the line on which Fig. 1 is sectioned. Fig. 3 is a horizontal sectional view on line 3 3 of Fig. 2. Fig. 4 is a vertical sectional view of a boiler arranged to burn hard or anthracite coal and having my invention embodied therein.

A is a shell, preferably of brickwork, surrounding the boiler.

B is the outlet for the products of combustion from the fire-pot C. The course of such products from the fire-pot C to outlet B is hereinafter fully set out.

D is a horizontal baffle-plate, preferably made of brick when the boiler is set in brick, as illustrated. It is evident metal may be substituted for brick in the shell or casing A surrounding the boiler.

E is the ash-pit of the boiler.

F is the outer shell of the water-receptacle of the boiler, and G is the water-leg of the boiler.

H is the water-space in the boiler above the crown-sheet.

I is the crown-sheet of the boiler, (over the fire-pot C,) and J is the top of the boiler.

K is the steam-outlet of the boiler, and L L are return-pipes thereto.

M is an inner shell used by me when soft or bituminous coal is to be used as fuel in fire-pot C, and *m m* are holes in shell M.

N is the air-supply to the air-space surrounding inner shell M. Inner shell M, holes *m m*, and air-supply N are fully set out in the patent hereinbefore named and form no part of the invention hereinafter described and claimed. Inner shell M and air-supply N are not used by me in this boiler when hard or anthracite coal is used as fuel, ring O, Fig. 4, being substituted for the inner shell M.

P P are horizontal grate-bars supported by grate-ring *p*, and P' indicates vertical bars forming a portion of the walls of the fire-pot or forming a basket inclosed by the lower end of the auxiliary water-leg, hereinafter described, and between which bars and the lower end of



the fire-pot air is supplied from the ash-pit E to the fuel in the fire-pot. The lower end of some of the bars P' rest on grate-ring *p*.

*p'* is a ring at the upper end of bars P' P'.

5 Ring *p'* is preferably integral with the bars P', and ring O and ring *p'* may be made integral, and I prefer so to do when the boiler is constructed for burning anthracite coal.

Q is a plate supported by brickwork A.

10 *q q* are lugs or extensions on plate Q, serving to support grate-ring *p*, on which the vertical bars P' P', or some of them, rest.

R is a supplemental or auxiliary water-leg supported by plate Q and immediately surrounding fire-pot C. In the construction illustrated in Figs. 1, 2, and 3 the inner wall M is concentric with the inner wall *r* of this supplemental boiler. The inner wall *r* of the auxiliary water-leg R forms the wall of the fuel-pot in the construction illustrated in Fig. 4.

S S S, Figs. 1 and 3, are tubular connections forming, respectively, passage-ways between water-leg G and auxiliary water-leg R.

25 The boiler, including part H and the water-leg G thereof, is held and supported by the tubular connections S S S, the return-pipes L L, and the baffle-plate or wall D, the principal support of such boiler being the tubular connections S S S and the return-pipes L L.

30 T T are tubular connections extending from the upper part of the auxiliary water-leg R to and through the crown-sheet I of the boiler. The tubular connections T T may also be relied upon to partially support the boiler. Tubular connections S S S form communicating passage-ways through which water may pass from water-leg G of the boiler into the auxiliary water-leg R, and T T form communicating passage-ways through which the contents of the auxiliary water-leg R extend through crown-sheet I into space H of the boiler. When the boiler is in use, a constant circulation is maintained, as last above described, from water-leg G through auxiliary water-leg R and back to the boiler above the crown-sheet I, the direction of the current being from water-leg G through tubular connections S S and back to the boiler through the tubular connections T T.

50 U is an annular space forming a passage-way for the products of combustion from the fire-pot C to pass down between the outer wall of the auxiliary water-leg R and the inner wall of the water-leg G. V is a passage-way underneath the water-leg G for such products of combustion to pass, and W is an annular passage-way between the outer wall of the boiler and the brickwork A, up which passage-way the products of combustion pass from passage-way V to the baffle-plate or brick D. By the baffle-plate or brickwork D the products of combustion are deflected to the forward edge thereof, (lettered *d d* and indicated by dotted lines in Figs. 1 and 3,) as is indicated by the arrow lettered W', and

from thence pass into the passage-way X and to the outlet B.

A' is the fuel-door of the fire-pot C.

B' is a door exposing to view the vertical bars P' P', or a portion thereof, and C' is the draft-damper of the ash-pit E.

The operation of the boiler embodying this invention is as follows: A deep fire is made in the fire-pot, such fire extending above the vertical bars P' P'. Air in support of combustion is supplied through the ash-pit E, grate-bars P P, and vertical bars P' P', and in the construction used for soft coal through the openings *m m* in inner shell M. The products of combustion leaving the fire-pot pass down in passage-way U through the space or passage-way V underneath water-leg G, up the passage-way W to the baffle-plate or brickwork D, around such baffle-plate (or forward thereof) into the space or passage-way X, and from the boiler through outlet B.

In the construction illustrated in Figs. 1, 2, and 3 air is supplied to the products of combustion which are about to leave the fire-pot through apertures *m m*; but such supply of additional air forms no material part of the invention herein illustrated, described, and claimed.

It will be observed that the water in the auxiliary water-leg R is adjacent to the greatest heat, and hence steam is generated therefrom (its contents being practically isolated from the main boiler) before the contents of the water-leg G are substantially raised in temperature, and that the temperature of the contents of such auxiliary water-leg R is at all times greater than the temperature of the remainder of the boiler. Further, it will be seen that the fresh air being supplied to the fire-pot through the upright bars P' tends to keep the temperature of the lower part of the water-leg R cooler than that of the upper part thereof—that is, the part with which (in the construction illustrated in Fig. 4) the fire is in direct contact. The contents of boiler which are over the crown-sheet I are of higher temperature than the contents of the water-leg G, and the circulation is at all times assured from the water-leg G through the passage-ways in the tubular connections S S S to the auxiliary water-leg R, upward through such auxiliary water-leg, and through the passage-ways in tubular connections T T to above the crown-sheet I of the boiler, steam leaving the boiler through the outlet or discharge pipe K.

In the burning of anthracite coal where the inner surface of the water-leg is the outer wall of the fire-pot, as is illustrated in Fig. 4 of the drawings, the rapid conduction of heat from the fire-pot to the water in the water-leg at times materially interferes with the combustion in the coal adjacent thereto to the extent of extinguishing the burning of some thereof. This unburned coal following down the wall of the fire-pot in the ordinary con-



struction to the horizontal grate-bars finally reaches the ash-pit unconsumed and makes it necessary to sift the ashes to reclaim it.

In making the auxiliary water-leg substantially isolated from water-leg G and part H of the boiler it is necessary to insure upward circulation in such auxiliary water-leg, and owing to the high heat to which the contents thereof are raised and their consequent expansion I have found it necessary to provide means whereby there shall be no backward current from such auxiliary water-leg through connections S S S. By having the auxiliary water-leg extend down to near the plate Q and making the outside diameter of the basket obtained and formed by the vertical bars P' P' less than the inner diameter of the auxiliary water-leg I present a construction in which the above-named difficulties are obviated—that is, unburned coal dropping into the basket from near the inner wall of the auxiliary water-leg is ignited and consumed and the current of fresh air entering such basket through such vertical bars from the spaces surrounding them (between the basket and the auxiliary water-leg) constantly maintains the contents of the lower end of the auxiliary water-leg at a lower temperature than they would otherwise be maintained, insuring an upward movement of such contents. The cross-sectional area of the openings in the vertical bars P' P', combined with the cross-sectional area between the horizontal grate-bars, is sufficient to admit a volume of air producing good combustion in the fire-pot, and I prefer to make the cross-sectional area thereof approximately the same as the cross-sectional area of the fire-pot.

The circular construction of the walls of the fire-pot and water-leg is given thereto, it will be understood, for convenience and economy of construction. Further, to insure the delivery to the auxiliary water-leg of water at as low a temperature as can be obtained (to increase the certainty of upward circulation in the auxiliary water-leg) the several tubular connections S S S are made, preferably, to the outer wall of the water-leg G and are carried therefrom to the lowest practicable point in the auxiliary water-leg.

The vertical bars P' P' may be made integral with—that is, connected together by—the ring *p*, or they may be connected together at any point between the rings *p* and *p'*, in which case such bars are turned outward at the upper ends thereof to come in contact with the inner wall of the auxiliary water-leg.

It is evident that the advantages obtained by me in the use of the basket so constructed as not to be in contact with the inner wall of the auxiliary water-leg and with an air-space between it and the auxiliary water-leg, so far as the same relate to the burning in such basket of coal the combustion whereof has been extinguished by contact with the inner wall having a water-backing thereto, may be ob-

tained if the boiler is constructed without an auxiliary water-leg and such basket is enlarged to come into contact and the same relative position with water-leg G as it is shown in the drawings and herein described relative to the auxiliary water-leg R, as the combustion of such unburned coal is largely due to the fact that the vertical bars are set in to obtain an air-space between them and a wall with a water-backing.

Having thus described my invention and its manner of operation, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination of a boiler provided with a depending water-leg, an auxiliary water-leg of less diameter than the depending water-leg and surrounded thereby, means for connecting the lower ends of the water-legs, whereby a combustion-chamber is obtained between the water-legs, a horizontal grate, upright bars forming a basket-grate the diameter whereof is less than the diameter of the auxiliary water-leg, such auxiliary water-leg and basket-grate forming the fire-pot of the boiler, and such auxiliary water-leg extending to substantially near the plane in which the horizontal grate is mounted, whereby an air chamber or space is obtained between the auxiliary water-leg and the basket-grate and fresh air supplied to the fire-pot between the upright bars of the basket-grate passes through such chamber or space, substantially as described.

2. The combination of a boiler provided with a depending water-leg an auxiliary water-leg of less diameter than the depending water-leg and surrounded thereby, means for connecting the lower ends of the water-legs, whereby a combustion-chamber is obtained between the water-legs, a horizontal grate, upright bars forming a basket-grate the diameter whereof is less than the diameter of the water-leg, a lining of less diameter than the auxiliary water-leg supported on the basket-grate, whereby an air-chamber is obtained between the lining and the water-leg, and such lining provided with openings substantially near the upper end thereof, such auxiliary water-leg, the lining thereto and basket-grate forming the fire-pot of the boiler, and such water-leg extending to substantially near the plane in which the horizontal grate is mounted, whereby an air space or chamber is obtained between the auxiliary water-leg, the lining thereto and the basket-grate, and fresh air supplied to the fire-pot between the upright bars of the basket-grate and from the openings in the lining, respectively, passes through such chamber or space, substantially as described.

3. The combination in a boiler, of a water-leg, means for supplying water to the lower end of the water-leg, a horizontal grate, upright bars forming a basket-grate the diameter whereof is less than the diameter of the



water-leg, such water-leg and basket-grate forming the fire-pot of the boiler, and such water-leg extending to substantially near the plane in which the horizontal grate is mounted, whereby an air chamber or space is obtained between the water-leg and the basket-grate and fresh air supplied to the fire-pot

between the upright bars of the basket-grate passes through such chamber or space, substantially as described.

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