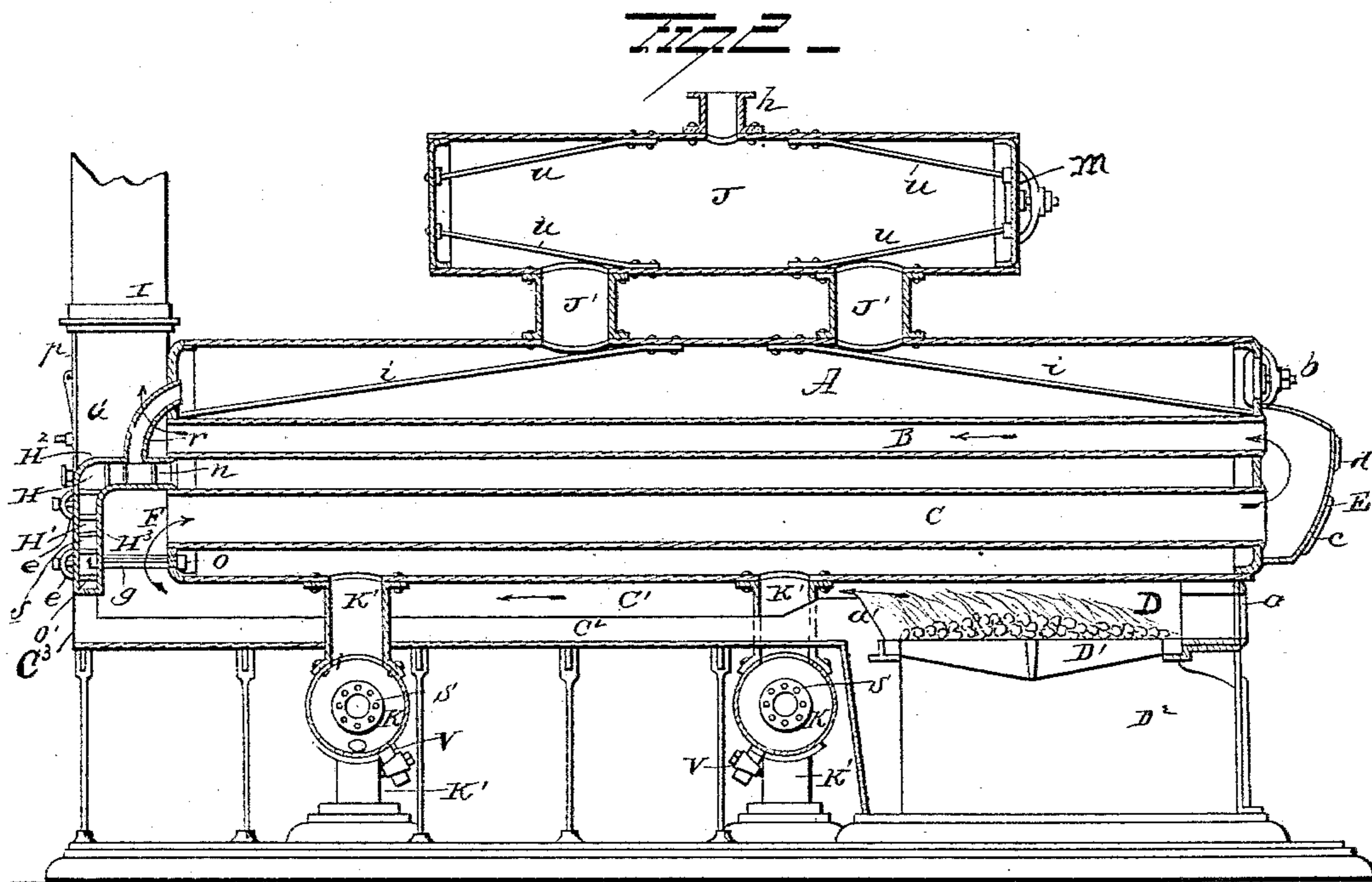
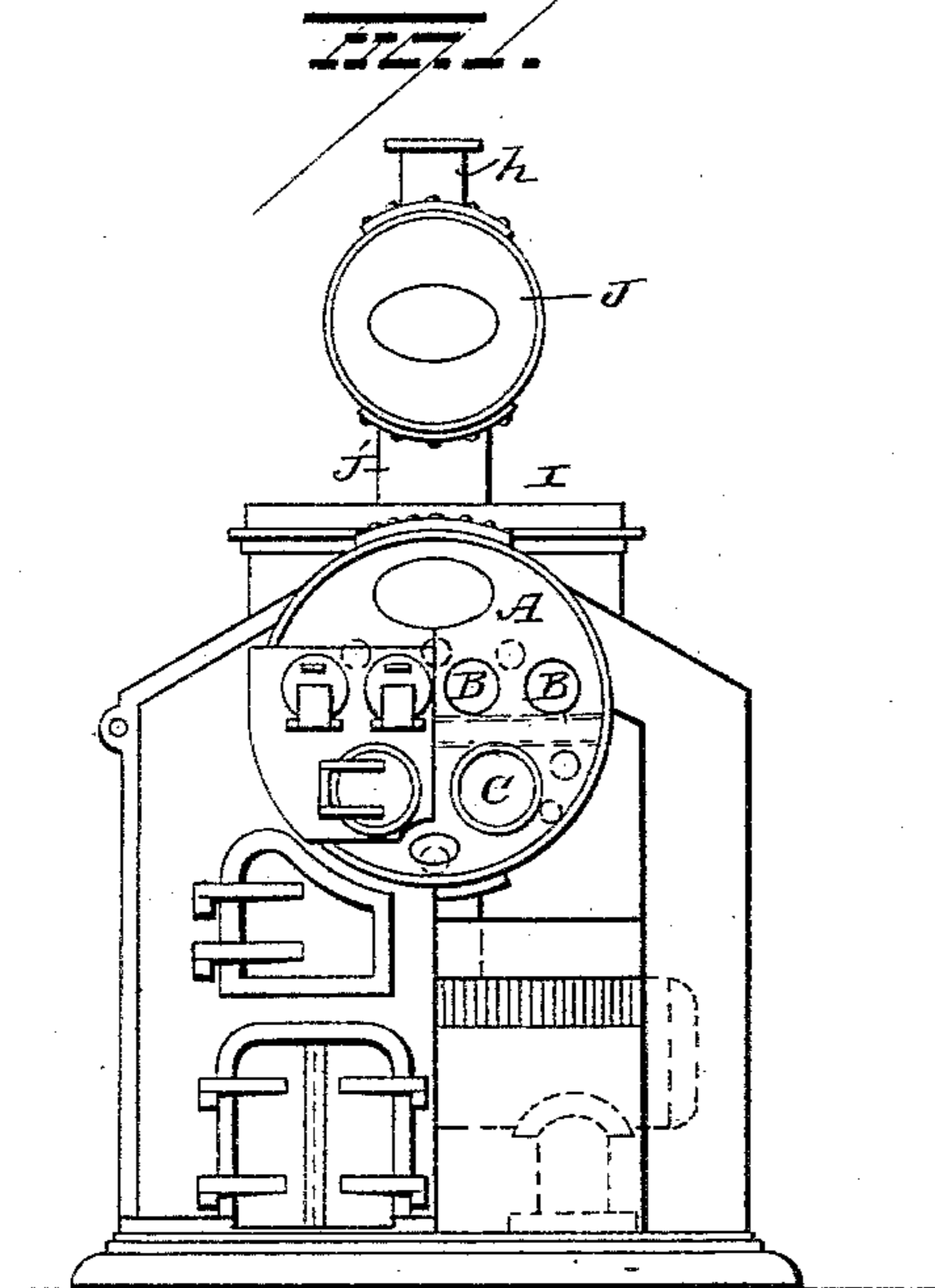


(No Model.)

P. DONALD.  
STEAM BOILER.

No. 387,776.

Patented Aug. 14, 1888.



Witnesses  
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# UNITED STATES PATENT OFFICE.

PETER DONALD, OF NEW ORLEANS, LOUISIANA.

## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 387,776, dated August 14, 1888.

Application filed May 15, 1888. Serial No. 273,923. (No model.)

*To all whom it may concern:*

Be it known that I, PETER DONALD, of New Orleans, in the parish of Orleans and State of Louisiana, have invented certain new and useful Improvements in Steam-Boilers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to an improvement in steam-boilers, the object being to provide a steam-generator in which the heat resulting from fuel-combustion is utilized to greater advantage than has heretofore been accomplished.

A further object is to so construct a steam-boiler that steam will be rapidly generated and the portions of the boiler subjected to direct heat-contact will be protected by water, so as to insure increased longevity to these parts as well as greater safety in the use of the boiler as a high-pressure steam-generator.

With these objects in view my invention consists in the construction and combinations of parts of my improved boiler in the manner hereinafter described, and set forth in the claims.

Referring to the drawings making a part of this specification, Figure 1 is a front elevation of the boiler in position as erected for use, partly in perspective and partly sectional, one half of the boiler-setting front plate being removed to expose the front end of the boiler and grates of the fire-chamber. Fig. 2 is a side elevation in section of the boiler and attached parts.

A represents the boiler-shell, which is cylindrical and provided with a series of longitudinal flues, B, secured in the front and rear heads to form passages for the hot products of fuel-combustion, as will be further explained. These flues lie in the same plane, it being understood that the boiler is "set" or inclosed by brick-masonry walls C<sup>3</sup> and supported stably in a horizontal position.

Below the flues B two or more larger flues, C, are affixed by their ends in the end flue-sheets in a plane parallel to the upper flues. These lower flues, C, are preferably made of larger diameter than the flues B to compensate for a decrease in number, it being desirable

that the combined delivering capacity or area of each series of flues be equal.

Below the front end of the boiler-shell A a fire-chamber, D, is formed in the usual manner and provided with grate-bars D', an ash-pit, D<sup>2</sup>, being afforded below the grate-bars.

A fuel-stoking orifice is formed at the front of the combustion-chamber D, which is closed by a door, a, and at the rear of the chamber D a bridge-wall, a', completes the chamber and directs the hot currents of combustion close to the lower surface of the boiler-shell, a horizontal passage, C', for these currents being also afforded by the construction of the masonry wall C<sup>2</sup> below and parallel to the boiler-shell A.

At the front end of the boiler a close chamber, E, is secured, which from its location forms a communicating-passage between the two series of flues B and C, and the doors c d are hinged to close orifices cut in the front wall of the projecting bonnet or chamber E, opposite to the flues. These serve to afford access thereto to remove any accumulation of ashes from the flues.

The enveloping masonry-wall C<sup>3</sup> is extended at the rear end of the boiler-shell A to form a smoke box or chamber, and this may be closed at the end by a metallic plate, p.

Within the smoke-box just mentioned the heat-deflecting water-chamber H is located. This consists of a double wall of plate metal with a water-space, H', between them constructed to form a close compartment. The parallel walls of the deflector H are bent at a right angle, the upper horizontal portion, H<sup>2</sup>, being connected at the end to orifices n, cut in the rear head of the boiler-shell A at a point between the ends of the upper and lower rows of flues, B C.

The vertical portion or "leg" H<sup>3</sup> of the heat-deflector H is downwardly extended to a point below the lower surface of the boiler-shell A, and is attached by the cylindrical tubes g to the water-space of the boiler below the lower tier of flues, C, so as to form several water-connections between the lower end of the deflector H and the boiler-shell.

It should here be stated that the area of surface of the depending leg H<sup>3</sup> is preferably made equal to the opposite portion of the rear head

of the boiler-shell, conforming in peripheral contour therewith. A series of stay-bolts are inserted through and between the parallel walls of the deflector to stiffen them, and hand-holes *e e* covered with properly-clamped plates are provided to allow access to the tubes *g*, opposite which they are located.

Between the top wall of the horizontal portion  $H^2$  of the deflector *H* and the upper surface of the rear boiler-head several curved water-circulating tubes, *r*, are secured by the fixed insertion of their ends in suitable orifices formed in these metal walls, which provision will afford additional means for complete circulation of water through the deflector *H*, it being evident that the heated water will rise and be discharged through the tubes *r* as it enters the orifices *n* and the tubes *g* at *o*.

It will be seen that the deflector *H*, from its form and location, divides the smoke-box into two parts, the lower division, *F*, serving to connect the heat or flame passage *C'*, that is below the boiler shell *A*, with the lower set of flues, *C*, and that the upper portion, *G*, of the smoke-box forms a communicating passage from the upper tier of flues, *B*, to the stack or vertical draft-flue of which *I* is the base.

Upon the lower surface of the boiler-shell *A* the pipes *K'* are attached. These connect the boiler with the mud-drums *K*, which are of best approved form of construction, and are supported upon the pedestals transversely of the boiler-shell, so as to receive mud, scales, or other impurity from the boiler, proper means being afforded for inspection of its interior by removable cap-plates *S* and the drawing off of sediment through the cocks *v*, as shown in Fig. 2.

On the upper surface of the boiler-shell a steam-drum, *J*, is mounted. This is a horizontal cylindrical shell, with two or more steam-inlets, *J'*, that are preferably constructed as short pipes that connect the steam-drum with the boiler-shell and form supporting-bases for said drum.

A steam-outlet flanged neck-piece, *h*, is attached to the upper surface of the steam-drum *J*, to which a steam conduit-pipe may be secured, (which is not shown.) At one end of the steam-drum *J* a man-hole plate, *m*, is secured to cover a hole formed in the head of the drum, which hole is adapted to permit an inspection of the interior of the drum. Proper stay-bolts, *u*, are affixed to the sides and heads of the drum, which afford the necessary support to these heads and render the structure capable of resisting high pressure.

On the front head of the boiler-shell a man-hole is cut to afford access to the interior of the same, which hole is covered by a suitable plate secured in place by a yoke and stud-bolt in the usual approved manner, and diagonal stay-bolts *i* are secured in the boiler-shell to render the top wall and heads capable of resisting bursting-strains in an obvious manner.

In operation the boiler, being supplied with water fed into it by any approved means, (not

shown,) is heated by a fire placed on the grate-bars *D'*. The natural draft of the stack or chimney which is attached at the top of the smoke-box *G* will induce a current of flame and conduct the hot products of combustion rearwardly through the passage *C'*, below the boiler-shell, until the rear wall, or, rather, the depending leg  $H^3$  of the deflector *H*, is reached. The impinging against said leg  $H^3$  of the hot currents will heat the water contained in it, and by impingement and consequent deflection the hot currents of carbon and oxygen in a vivid state of combustion will be returned through the lower flues, *C*, said gaseous flame having absolute contact with the entire area of the adjacent vertical and horizontal top wall of the deflector *H*, the right-angular bent wall of the same forming the rear and top wall of the lower chamber, *F*, of the smoke-box. When the flame and hot-air currents reach the front end of the boiler, they are returned through the bonnet or chamber *E* into the upper flues, *B*, and thence rearwardly through these flues to the upper division, *G*, of the smoke-box. The enforced contact of the hot currents with the curved pipes *r* will aid materially in heating the water circulating through these pipes. After entering the box *G*, the draft of the vertical chimney *I* conducts the waste products away, they having parted with a large portion of their heat, which has been absorbed by the metallic surfaces of the flues, tubes, and the deflector-wall, in which they have been conducted and with which they have had contact in their passage from the combustion-chamber *D* to said chimney-stack *I*.

It is evident that from the construction and position of the water-containing deflector *H* with regard to the water-space in the boiler-shell *A* a more perfect circulation of water and evolution of steam are effected, as it serves to conduct the water from the lower to the upper portion of the shell, and by the extensive area of heating-surface afforded and the comparatively thin sheet of water brought into contact with this hot surface of the deflector-plate a rapid evolution of steam results. The increased capacity for steam development just mentioned is produced without increase of the length or diameter of the boiler-shell or any extra use of fuel, as the volume of incandescent gaseous product resulting from the destructive combustion of fuel in the fire-chamber *D* will by its contact effect the result without increasing the use of fuel.

Many slight changes might be made in the minor details of construction of the device herein described without departure from the spirit of my invention or exceeding its manifest scope; hence I do not wish to be restricted to the exact forms herein shown; but,

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

1. The combination, with a boiler, a smoke-box, and a fire-chamber located beneath the

boiler, of two or more sets of flues extending through the boiler, a deflector located in the smoke-box and in open communication with the boiler between the sets of flues, and pipes  
5 connecting the deflector with the lower portion of the boiler, substantially as set forth.

2. The combination, with a boiler, a smoke-box, and a fire-chamber located beneath the boiler, of two or more sets of flues opening  
10 into the smoke-box at one end, a chamber for affording a communication between the flues at the opposite end, and a deflector extending across the smoke-box and in open communication at one end with the boiler between the  
15 sets of flues, said deflector having pipes extending therefrom and opening into the boiler above and below the flues, substantially as set forth.

3. The combination, with a boiler, a casing  
20 about the same, a smoke-box in one end thereof, and a fire-chamber within the casing and beneath the boiler, of two sets of flues in the boiler, a deflector extending across the smoke-box and in open communication at one  
25 end with the boilers at a point between the two sets of flues, said deflector having pipes

therein communicating with the boilers above and below the flues, and a steam-chest above the boilers and in communication therewith, substantially as set forth.

4. In a steam-boiler, the combination, with  
30 a boiler-shell and a smoke-box, of a double-walled angular deflector having a horizontal leg and a depending leg, the horizontal leg being in connection with the water-space of the  
35 boiler-shell, a set of upwardly-projected tubes which are bent to connect the top wall of the deflector with the flue-sheet of the boiler, and a set of tubes which are attached to the lower  
40 portion of the depending leg of the deflector and connect it with the lower part of the adjacent flue-sheet to afford free water-circulation through the deflector and adapt it to receive water from the boiler-shell and return  
45 it thereto, substantially as set forth.

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

PETER DONALD.

Witnesses:

W. YOUNGBLOOD,  
D. A. MULLAM.