No. 621,420. Patented Mar. 21, 1899.

F. JONES.

HORIZONTAL STEAM BOILER.

(Application filed Dec. 3, 1896.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

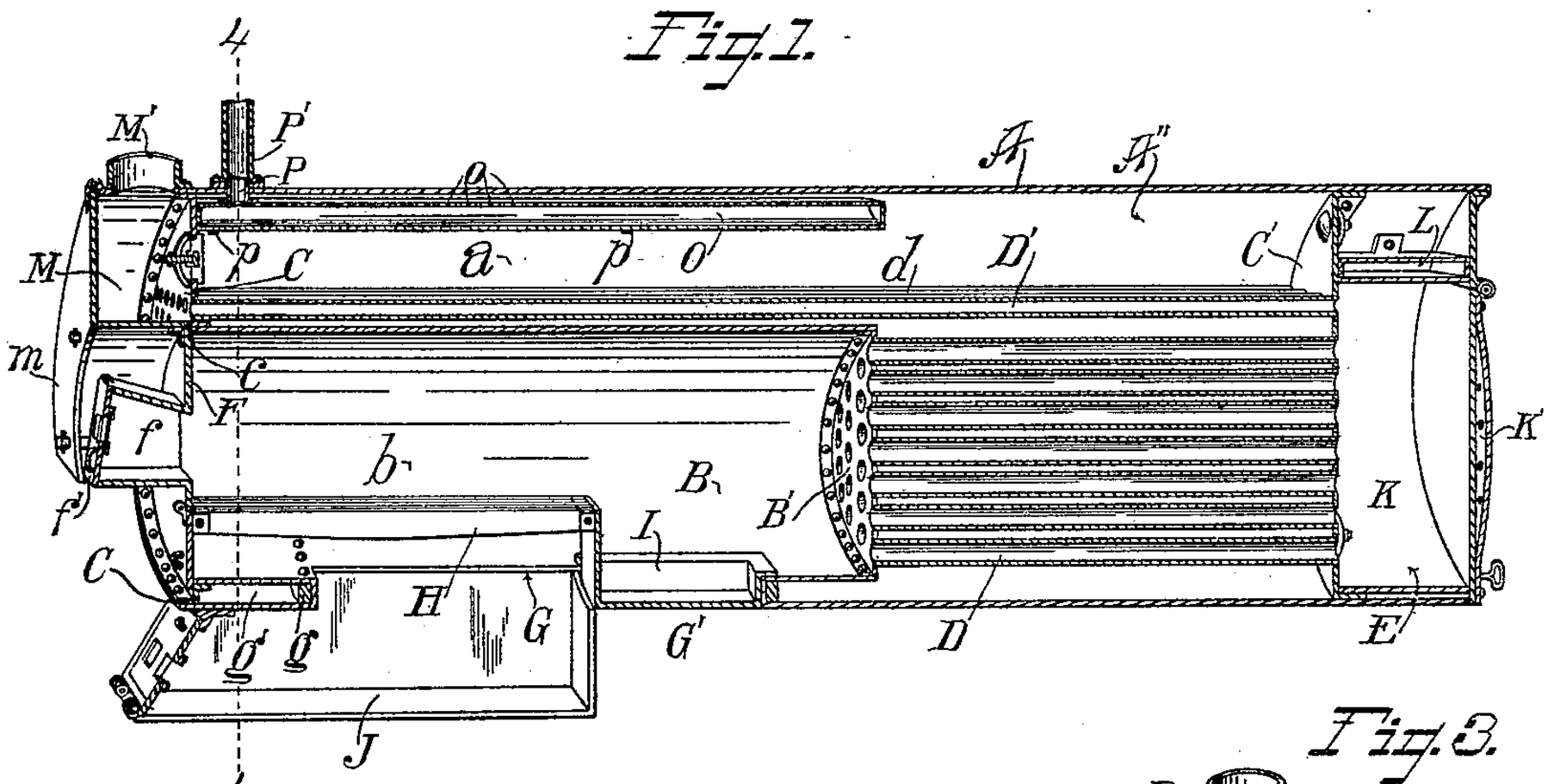

Fig. 3.

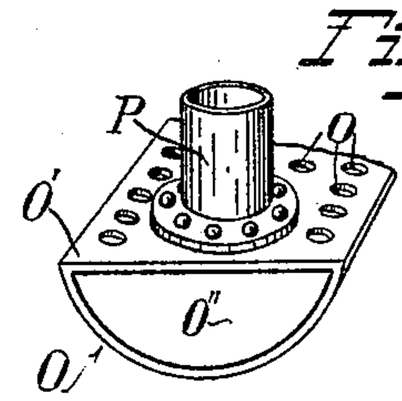

Fig. 2.

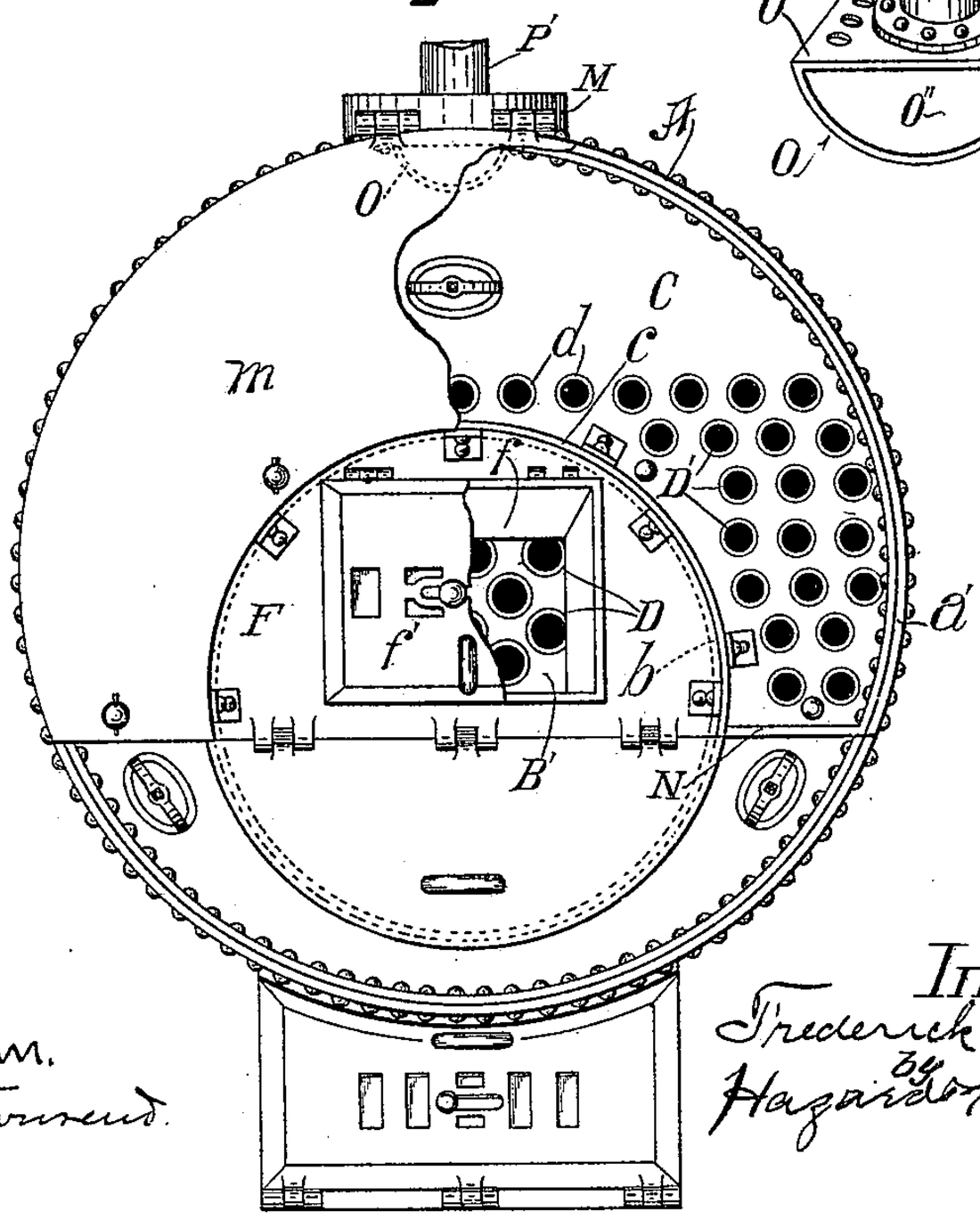

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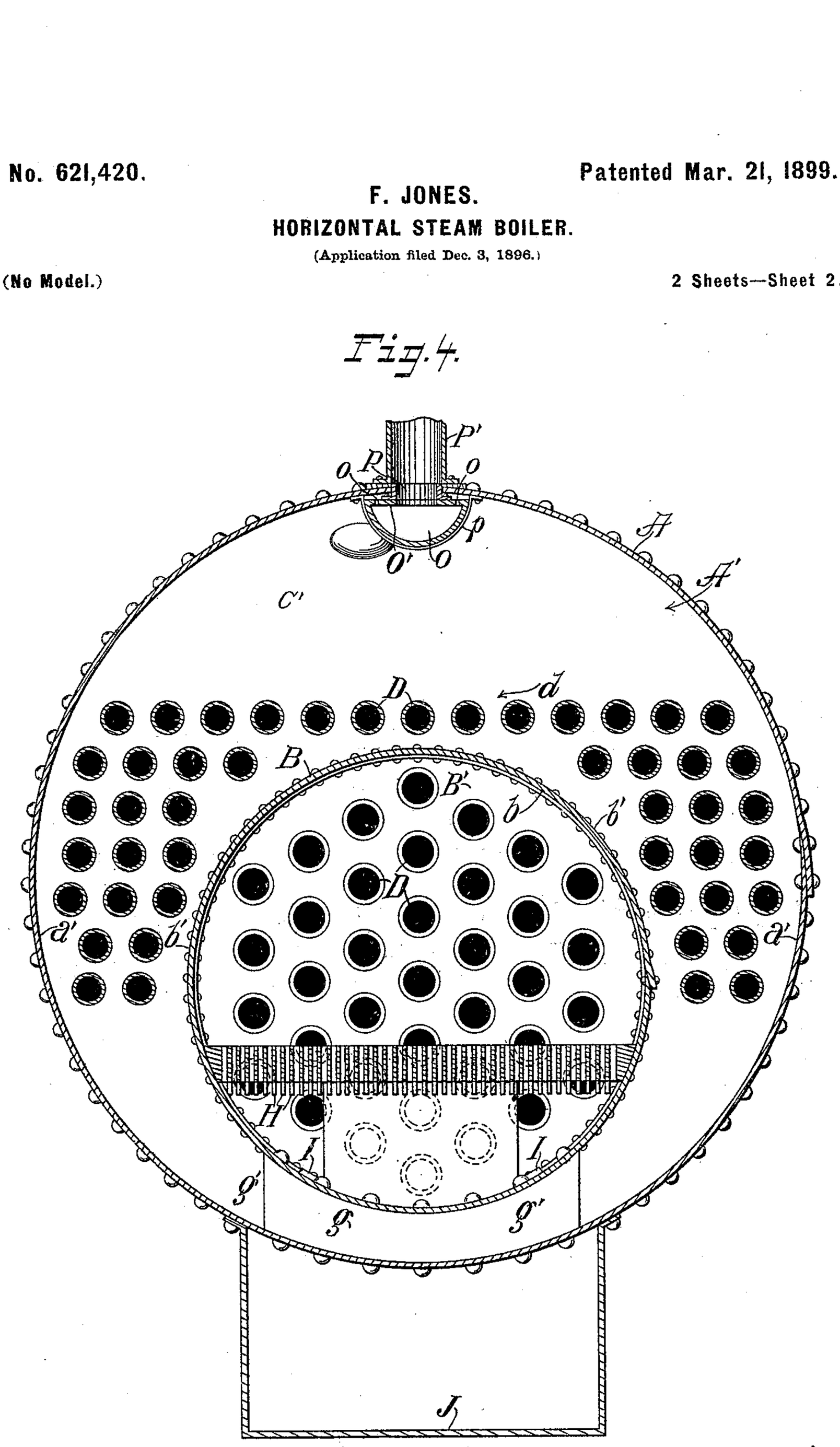
Fig. 4.



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UNITED STATES PATENT OFFICE.

FREDERICK JONES, OF SANTA PAULA, CALIFORNIA.

HORIZONTAL STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 621,420, dated March 21, 1899.

Application filed December 3, 1896. Serial No. 614,332. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK JONES, a citizen of the United States, residing at Santa Paula, in the county of Ventura and State of California, have invented new and useful Improvements in Steam-Boilers, of which the following is a specification.

The especial object of my invention is to produce a boiler which will generate more steam in proportion to its size than any other boiler of which I am aware.

A further object of my invention is to produce a boiler having an internal fire-box and so arranged that when the flues require rolling it will not be necessary to remove the grate-bars, doors, or ash-pan in order to gain access to the fire-box and one in which while at work the operator will be permitted to stand upright, thus to avoid the inconvenience of operation and great length of time heretofore required in performing such work.

In southern California there is much demand for engines for running threshing-machines, and it is essential that these engines be capable of burning to good advantage straw, since other fuel is ordinarily expensive and inconvenient to obtain. Furthermore, it is desirable to burn the straw to avoid encumbering the ground. Straw is a difficult fuel to burn and to maintain steam, the tendency being to make a smoldering or dead fire, with much smoke and little heat. It is customary in order to obtain the necessary draft to exhaust from the engine into the smoke-stack and to so arrange the discharge-nozzle of the exhaust as to give a forced draft of great strength. This heavy draft carries the burning straw out of the fire-box through the flues and into the air, entailing danger from fire; but in the engines heretofore produced steam cannot be maintained otherwise.

In the case of beans, which are raised in immense quantities in portions of southern California, it is especially difficult to burn the bean-stalks and maintain a sufficient amount of steam to run the engine. It is essential that portable boilers be very compact and yet have a large amount of heating-surface exposed, so as to be capable of rapidly generating steam, and it is also essential that the boilers be so arranged as to allow access for the purpose of rolling or expanding the tubes when they become leaky through expansion and contraction of the tubes and flue-sheets. Owing to the quick fire produced by burning straw and the rapidity with which it burns out when feeding is not continuous the flues of such boilers are unusually liable to become leaky and require rolling.

One particular object of my invention is to provide a boiler which will be capable of burning straw of any description, bean-stalks, and analogous material and, although occupying but small space, to generate from such fuel a large amount of steam.

Another object of my invention is to provide means whereby a large amount of air may be admitted beneath the grate-bars and to so arrange the parts that there will be no liability of the air-passages becoming obstructed by ashes. It is necessary in order to successfully burn straw, and especially is it true of bean-stalks, that a large amount of air be supplied to the fire-box. Otherwise a dead fire will be produced. It also is an object of my invention to set the grate-bars low in the fire-box in order to give room enough to hold sufficient fuel to afford the required heat, and also to thus more effectively apply the heat to a greater area of the walls of the fire-box than is possible where the grate-bars are set high in the fire-box.

My invention comprises the various features of construction and combinations of parts hereinafter set forth and claimed.

The accompanying drawings illustrate my invention.

Figure 1 is a perspective longitudinal section of a boiler embodying my invention. In this view the fire-box is shown attached to the boiler, and portions of the steam-pipe and the smoke-stack are also shown in position thereupon; but it will be understood that the smoke-stack is not attached to the boiler until it is in position upon its trucks in case it is designed for a portable boiler or its supporting-bed in case it is used as a stationary boiler. Fig. 2 is an end view of my improved boiler, a portion of the doors being broken away in order to expose the construction. Fig. 3 is a fragmental view of one end of my improved dry pipe, whereby I am enabled

when desirable to dispense with the steam-dome ordinarily required. Fig. 4 is a cross-section on line 4 4, Fig. 1.

In the drawings, A represents the outer shell of the boiler, and B represents an inner cylindrical shell of less diameter and length than the outer shell, arranged within the outer shell and eccentric thereto.

C is a head which is arranged to close the space between the rear end of the inner shell and the outer shell. This head is provided at its front end with an opening *c*, which corresponds to the internal diameter of the inner shell B. The inner shell B has its inner end closed by means of a head B′ and the outer shell has its front end closed by means of a head C′. Direct tubes or flues D are arranged connecting the head B′ with the head C′, so that the products of combustion pass directly from the fire-box through the flues and into the combustion-chamber E in the usual manner.

The inner shell B, which forms the fire-box, occupies more than one-half the total length of the boiler and the flues D extend through the boiler the rest of the distance, thus making the direct flues less than one-half the length of the return-flues. This arrangement of the extremely long fire-box allows the grate-bars to be arranged at the front end of the box, leaving at the rear of the grate-bars a combustion-chamber which is larger than the fuel-burning space, so that the flame and smoke travels a considerable distance within the fire-box and through the combustion-chamber before it reaches the flues, becoming thoroughly admixed with the air, whereby its combustion is facilitated. The flame which passes through the short direct flues is very intense, emerges from the flues into the rear combustion-chamber, where the gases and air are again thoroughly admixed, and thence pass into the return-flues. By the time it emerges from the return-flues the greater portion of the heat is abstracted and converts the water into steam. I am aware that it is old to provide a round flue extending entirely through the boiler from end to end, the front portion of the flue being arranged to form a combustion-chamber; but such construction does not secure the best results, in that the air to supply the products of combustion has been admitted at the front end of the flue beneath the grate-bars, and thus the tendency is to always cause the flame to feed away from the front end of the flue, there being no opening through the two shells to allow the admission of air from beneath in the manner in which I admit it.

I will now describe one particular feature of my invention which assists me with the same amount of heating-surface to generate more steam with my improved boiler than any other boiler of which I am aware. One essential feature of this comprises the manner in which I arrange the return-flues D′. These flues (excepting one row *d*) are all arranged below the top of the inner shell and between the side walls *b′* of the inner shell and the side walls *a′* of the outer shell, thus passing through the space between the inner and the outer shells, as clearly shown in Fig. 2. A single row of flues *d* is arranged extending in a horizontal line across the boiler at a point immediately above the top of the inner shell. By making the fire-box cylindrical the top of the inner shell or fire-box of the boiler slopes from its top downward toward either side, and thereby no angular obstruction is offered to the free circulation of the water in any direction, and no dead water is present in the boiler. Also by arranging the return-flues in the space between the side walls of the fire-box and the side walls of the boiler the small quantity of water which occupies this space is very rapidly heated, thus causing it to rise, while the water which is not heated to as high a degree descends into such space and in turn becomes highly heated. This causes a more perfect circulation than is possible where no flues are arranged between the side walls of the fire-box and the side walls of the boiler and a large number of flues are arranged in the upper portion of the boiler, since in such case, the heating being practically uniform in all parts of the boiler, circulation is checked and rapid generation of steam prevented.

The rear end of the inner shell B is closed by means of a plate F, and a flaring chute *f*, having a door *f′*, is arranged to permit the introduction of fuel through the plate into the fire-box. It is well to state in this relation that my improved boiler is designed for burning straw, bean-stalks, and other refuse matter. It has been employed with great success in threshing beans, using the stalks for fuel. Heretofore it has been found extremely difficult to secure a boiler which will generate anywhere near the quantity of steam required when bean-stalks are used for fuel; but with one of my improved boilers using such fuel I have generated twenty-nine horse-power, while other boilers of the same heating-surface and calculated capacity have with the same fuel generated only twenty horse-power. This is principally owing to the large combustion-chamber between the rear end of the grate-bars and the rear end of the fire, which allows the gases and smoke to become thoroughly admixed and converted into heat before passing into the direct flues.

In order to allow the convenient rolling of the flues when necessary or the removal and replacement of any flues when desired and also to permit the admission of air into the fire-box, I cut away a portion of both the inner and outer shells at the bottom thereof, as indicated by G in Fig. 1. A retaining-ring *g* is arranged between the inner and the outer shells and encircling such opening, and both shells are riveted thereto. This opening does not extend to the front end of the two shells, but leaves a water-space *g′* beneath the grate-bars at the front end thereof, as clearly shown

in the drawings. By reason of the shells being unsevered at their front ends the strength of the boiler is fully retained, and by making the inner shell cylindrical I am enabled to dispense with the use of stay-bolts or other connections between the two shells of the boiler.

The grate-bars H do not extend the entire length of the opening G, but are arranged to leave a space G′ between the end of the grate-bars and the end of the opening G. This space is closed by a removable trap-door I, which, as shown, is box-shaped and when in use is filled with fire brick or clay or any other material suitable to prevent the trap-door being burned or warped by the heat. Thus when it is desired to roll the flues or for any other reason to gain access to the fire-box of the boiler the trap-door I is raised and slid back upon the grate-bars H, when the operator can from beneath the boiler insert his head and trunk into the fire-box, and thus perform the work required. If the boiler is too near the ground for the operator to stand upright, a hole may be dug, so as to bring his body into the proper position to perform the work. The ash-pan J terminates at the rear end of the grate-bars H, so that neither the ash-pan nor the grate-bars need be disturbed when making repairs to the boiler.

It will be seen that by providing the ash-opening through the two shells and arranging the ash-pan beneath the opening I am enabled to place the grate-bars very close to the bottom of the fire-box without danger of so restricting the ash-space as to prevent the free entrance of air beneath the grate-bars. This also gives more room for fuel in the fire-box and allows the heat from the fire to be more effectively applied to the walls of the fire-box than is possible when the bars are set high in the box, since those portions of the walls of the box which are below the grate-bars are only heated by radiation and at best very imperfectly.

I have found in practice that by my arrangement of the fire-box and ash-pan I can invariably supply air in such quantity as to prevent a dead smoldering fire. I am not aware of any other boiler of this class in which this effect can be produced.

The front end of the outer shell A extends out a sufficient distance to form the combustion-chamber and a lining K is arranged inside the shell in order to prevent the intense heat from destroying the shell. The combustion-chamber is closed by means of a door K′, which is also lined.

L is a chamber through which the feed-water passes before entering the boiler, and is thereby heated. This chamber also protects the steam-space at the end of the boiler from the flame. The rear end of the shell of the boiler A also extends outward to form the second combustion-chamber or draft-chamber M, with which the stack M′ communicates, and a flange-plate N projects from the rear head of the boiler to form the lower wall of such chamber. A door *m* is arranged to close the open end of such chamber.

O represents a steam dry pipe which I preferably make by flattening a length of gas or water pipe, as shown in Fig. 3, and closing the ends by suitable means, such as the plate O″, welded therein. Within its flattened top O′, I drill numerous perforations *o* and to the top I secure a collar P, which projects upward and fits tightly within the steam-pipe P′, which leads from the boiler. The pipe O is secured within the top portion of the steam-space A″ of the boiler by means of straps *p*, secured to the side walls of the boiler, so as to hold the dry pipe close to the top of the boiler, but allowing room for steam to be admitted between the boiler and the dry pipe. Thus when the steam is drawn from the boiler it must pass through the perforations *o* into the dry pipe, losing its moisture, which passes through suitable perforations which may be provided in the bottom of the dry pipe and falling into the boiler, while the dry steam passes through the steam-pipe to the engine. I have found in practice that when running my boiler at its highest capacity it is impossible to draw water into the engine. By arranging the dry pipe within the boiler I thereby avoid not only considerable expense, but also the projecting steam-dome, which has heretofore been a source of much annoyance because of preventing the convenient handling of the boiler.

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

In a boiler, the combination set forth of the inner and the outer shell; grate-bars arranged within the inner shell; a draft and ash opening passing through both the inner and the outer shell; an ash-pan controlling the draft-opening; a manhole arranged opening through both the inner and the outer shells at the rear of the ash-pan and the grate-bars; and a removable trap-door for the manhole.

FREDERICK JONES.

Witnesses:
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