No. 711,557. Patented Oct. 21, 1902.

R. M. DOWNIE & D. A. MESSNER.

STEAM BOILER.

(Application filed Feb. 21, 1902.)

(No Model.) 2 Sheets—Sheet 1.

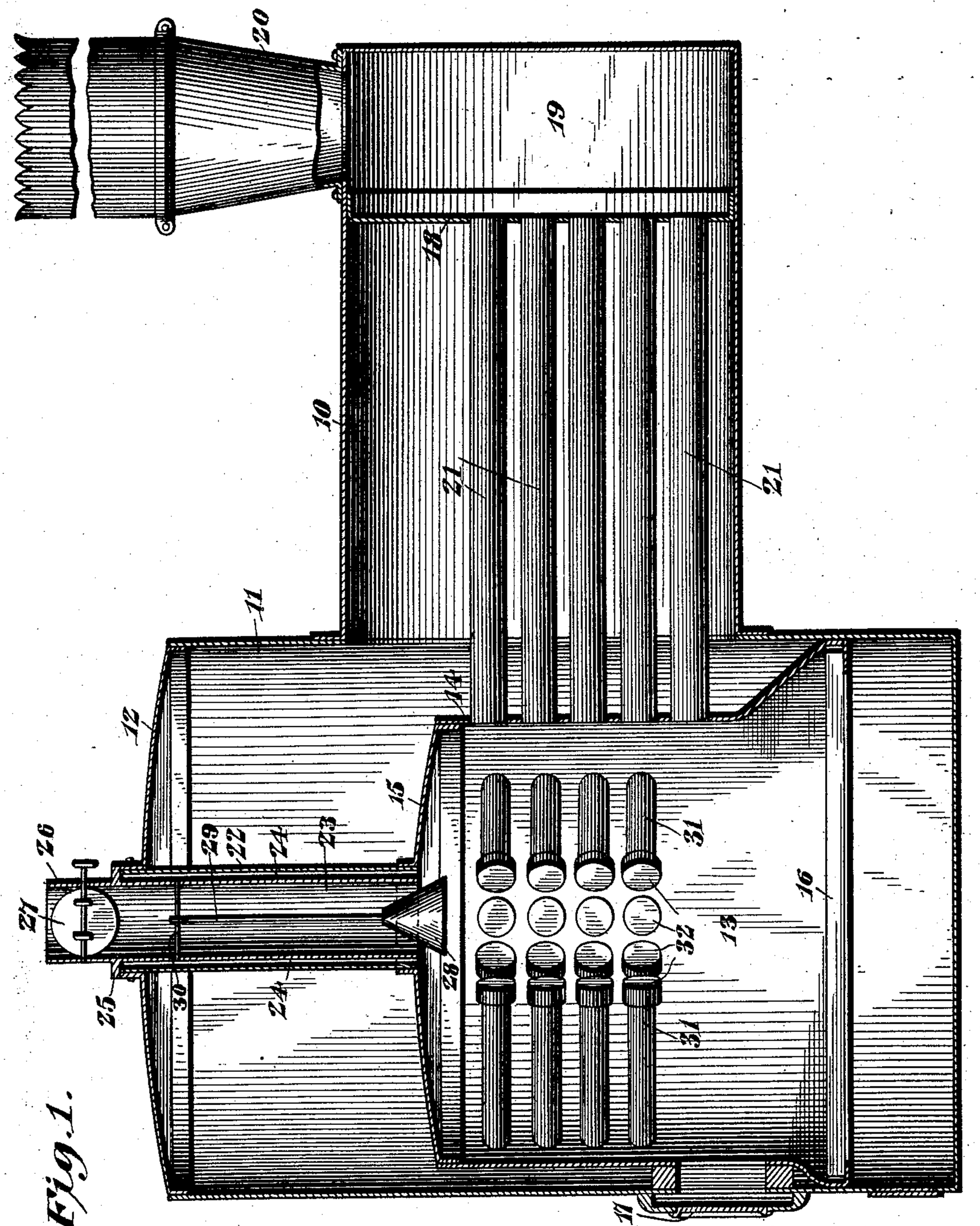

Fig. 1.

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Fig. 2.

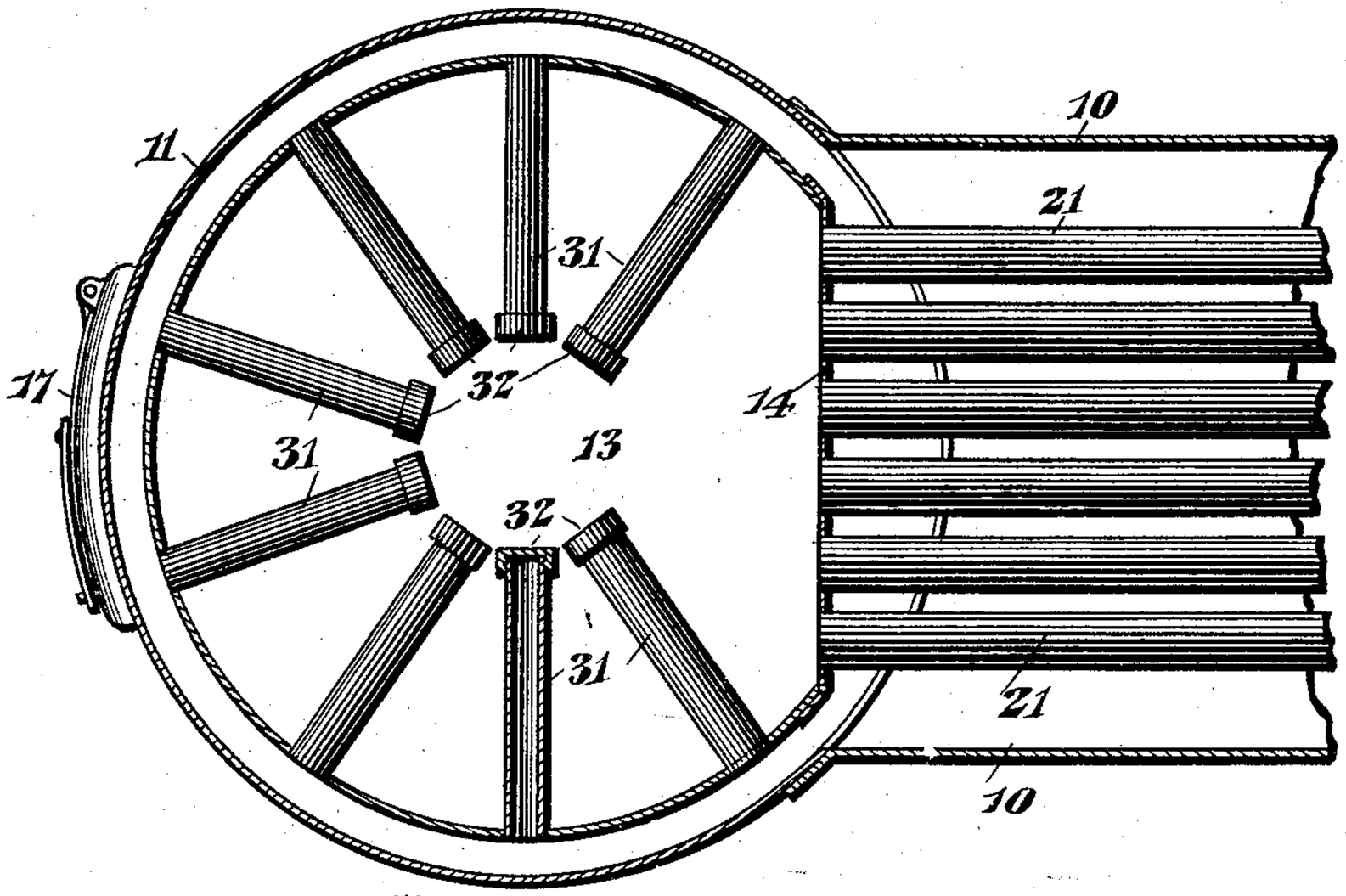


Fig. 3.

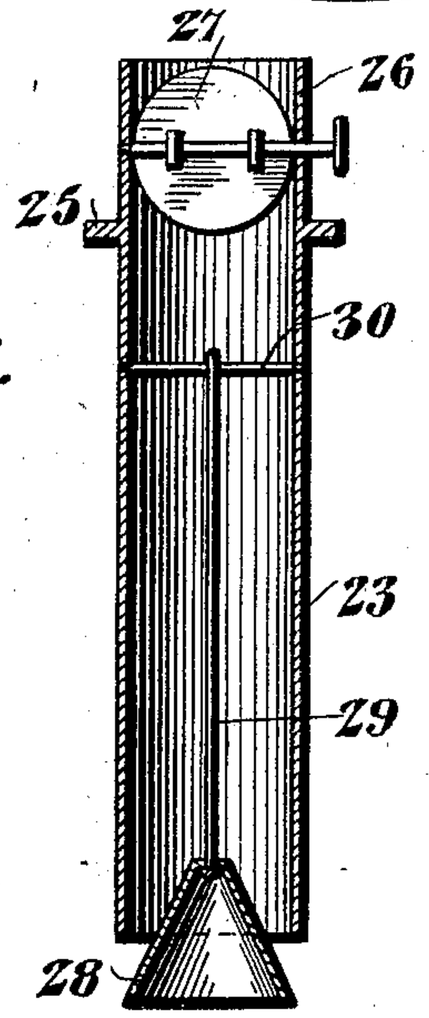
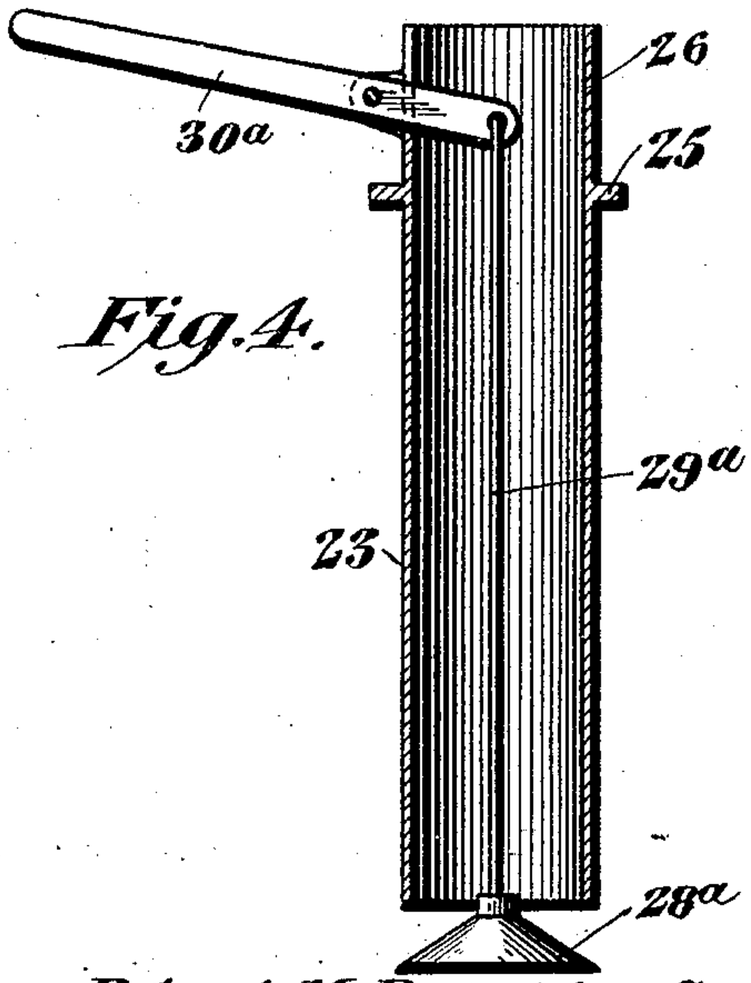


Fig. 4.



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UNITED STATES PATENT OFFICE.

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STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 711,557, dated October 21, 1902.

Application filed February 21, 1902. Serial No. 95,103. (No model.)

To all whom it may concern:

Be it known that we, ROBERT M. DOWNIE and DAVID A. MESSNER, citizens of the United States, residing at Beaverfalls, in the county of Beaver and State of Pennsylvania, have invented a new and useful Steam-Boiler, of which the following is a specification.

The present invention relates to steam-boilers, and while particularly appertaining to tubular boilers it will be readily understood that certain features may be employed in connection with boilers of other classes.

When first raising steam in a horizontal tubular boiler, the tubes being surrounded with cold water, it is difficult to secure a draft through the stack. When the fuel used is bituminous coal, crude petroleum, or the like, the cold surfaces of the tubes collect and retain unconsumed carbon in the shape of soot or lampblack, which substances still further obstruct the draft. These difficulties disappear when the boiler and stack eventually become heated; but for the time, owing to the obstructed draft and imperfect combustion, getting up steam is a slow and tedious process, requiring in an ordinary-sized boiler from an hour to an hour and a half under ordinary circumstances. One of the objects of the present invention is to overcome the above difficulty by providing an auxiliary stack having direct communication with the fire-box, so that a draft may be created immediately for a fire when first started. Even after the fire is well started the combustion is imperfect unless a forced draft is maintained, in which case the products of combustion pass through the boiler so rapidly that much of the heat is lost and passes out through the stack. Another very important aim of the invention is to overcome this defect by so constructing the above-mentioned auxiliary stack that it may be also employed as an air-inlet, which will provide sufficient oxygen to insure complete combustion, and at the same time the indraft and exhaust may be balanced so that the heated gases are delayed sufficiently in their transit through the boiler to allow the water and boiler-surface to absorb the heat thereof.

The features of the invention will be readily appreciated after an understanding of the preferred embodiment, which is illustrated in the accompanying drawings and described in the following specification.

In said drawings, Figure 1 is a vertical longitudinal sectional view through a horizontal or T boiler. Fig. 2 is a horizontal longitudinal sectional view through the front portion of the same. Fig. 3 is a vertical sectional view of the draft-tube employed. Fig. 4 is a slight modification thereof.

Similar numerals of reference designate corresponding parts in all the figures of the drawings.

The shell of the boiler is substantially of the ordinary construction, comprising a cylindrical body 10, having at one end an enlarged portion formed into a dome 11, said dome being closed by the usual head 12. Within this enlarged portion is arranged a furnace 13, comprising cylindrical side walls and a flue-sheet 14, the upper end of said furnace being closed by a crown-sheet 15. A grate 16 is located in the lower portion of the furnace, and access is had to said furnace through a door 17. The cylindrical body 10 is provided contiguous to its front end with a flue-sheet 18, forming in front of the same a smoke-box 19, from which extends the main stack 20, that projects a considerable distance above the boiler. Communication between the furnace and the smoke-box is obtained by means of the usual tubes 21, the ends of which are expanded into the flue-sheets 14 and 18.

So far as thus described the structure is well known to the art and constitutes no part of the present invention.

The crown-sheet 15 and the dome-head 12 are connected by an open-ended flue-tube 22, which is secured to said sheet and head, so as to constitute a rigid brace between them, thus obviating the necessity of stay-bolts. In the preferred form a single centrally-disposed tube is shown, though more than one may be employed, if desired. Within this tube is located a draft-tube 23, that is spaced from the walls thereof to leave an intermediate dead-

air space 24, said draft-tube being suspended by means of an outstanding annular flange 25, that rests upon the upper end of the flue-tube. The upper end 26 of this draft-tube projects some distance above the dome to form an auxiliary stack, which stack is considerably shorter than the main stack 20. Within the upper end of the draft-tube is journaled an adjustable rotatable damper 27, while a deflector 28, preferably in the form of the cone, is suspended beneath the lower end of said tube, said deflector having a hanger-stem 29, which is secured to a cross-bar 30, fastened within the draft-tube. By this arrangement it will be seen that a substantially open-ended draft-tube communicates with the upper end of the fire-box, and the passage-way through said tube can be readily controlled by means of the damper 27. The entire tube is removable from the flue 22 for the purpose of renewal or repair. Instead of a separate damper 27 and deflector 28 an adjustable deflector 28^a may be employed, as shown in Fig. 4, said deflector being secured, by means of a stem 29, to an actuating-lever 30^a, pivoted upon the upper end of the draft-tube. In this construction the deflector 28^a performs also the function of a damper to regulate the passage-way through the tube.

Within the furnace 13 are arranged a series of water-tubes 31, which tubes are secured in the side walls of the furnace, their inner ends being closed by caps 32, which are preferably located in substantial alinement with the walls of the flue-tube 22, so that an open passage-way extends from the end of said tube to the bottom of the furnace, the passage-way, however, being to a certain extent obstructed by the deflector-cone 28.

When the fire is first started in the furnace 13, the damper 27 is opened, so that a free passage-way is provided through the draft-flue 23, and as this affords direct communication with the outside air the fire has a free and sufficient draft. As the boiler becomes heated, however, the products of combustion will begin to pass through the tubes 21 and the main stack 20 until said tubes and stack are thoroughly heated. Then the main stack, being so much longer than the auxiliary stack, will furnish the necessary draft, so that the outdraft through the auxiliary stack will cease and an influx of air through the same will begin. The damper 27 or 28^a, as the case may be, is now closed by the fireman, provided the combustion is thorough; but if it be imperfect, as is the case in all boilers of this class, the damper is left open or partially open and the draft-tube now performs another distinct service of great advantage—namely, that of supplying the necessary oxygen and air to insure complete combustion. This fresh supply of air is by the peculiar arrangement not only controllable at the will of the attendant, but is also delivered at the top of the furnace against the upward-tending products of combustion, thus securing the complete mixing of the two. The water-tubes 31 are also placed and arranged so that the intense heat resulting from the regenerated flame will act directly upon them, while their presence in the path of and at the place of meeting of the two currents serves the purpose of scattering and thoroughly mixing them and insuring thorough combustion before the products enter the tubes 21. It will be observed that the incoming air through the draft-tube will be spread by the deflector-cone 28 over the tubes.

It is well known that when perfect combustion can be had without a great or rapid draft through the fire-channels of a boiler great economy of fuel is attained. The longer the heated products of combustion are retained in transit through the boiler the more heat will be absorbed from a given quantity of fuel by the heating-surfaces of the boiler. As already described, the main stack 20 being much taller than the auxiliary stack said main stack when heated will furnish a much stronger draft than said auxiliary stack, and the consequent inflow of air through the latter can be regulated by the attendant, who thus, while securing perfect combustion, is enabled to delay the heated gases in their transit, and consequently partly balance the draft of one stack against that of the other without interfering with the normal passage of air through the grate.

Other advantages reside in the particular construction of the auxiliary stack. In the first place the outer tube forms a stay or brace between the crown-sheet and the fire-box, thereby not only greatly strengthening the boiler, but eliminating the necessity of stay-bolts. The inner draft-tube protects the outer tube from being burned out, and, being furthermore spaced from said outer tube, prevents the cold air coming into contact with the same and cooling the steam within the dome. When the inner tube is burned out, it may be readily removed and replaced by a new one.

From the foregoing it is thought that the construction, operation, and many advantages of the herein-described invention will be apparent to those skilled in the art without further description, and it will be understood that various changes in the size, shape, proportion, and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a steam-boiler, a furnace, a main stack having indirect communication with the furnace, an auxiliary stack having a freely-open passage-way therethrough in direct communication with the furnace, said auxiliary stack being shorter than the main

stack, and an adjustable damper for controlling the passage-way through one of the stacks.

2. In a steam-boiler, the combination with an outer shell, of a furnace located within the shell, a main stack in indirect communication with the furnace, an auxiliary stack having a freely-open passage-way also in direct communication with the furnace and extending through the shell, said auxiliary stack being shorter than the main stack, and an adjustable damper located in the auxiliary stack to vary the size of the passage-way therethrough.

3. In a steam-boiler, the combination with an outer shell, of a fire-box located within the shell, a flue-tube connecting the fire-box and outer shell, and a combined draft-tube and stack located within the flue-tube and spaced therefrom to leave an air-space between the inner and outer tubes, the ends of the said tube and stack being open.

4. In a steam-boiler, the combination with an outer shell, of a fire-box located within the shell, a flue-tube connecting the fire-box and outer shell, and a draft-tube removably suspended within the flue-tube, said draft-tube having open ends and terminating at the top of the fire-box.

5. In a steam-boiler, the combination with an outer shell, of a fire-box located within the shell, a flue-tube connecting the fire-box and outer shell, an open-ended draft-tube removably mounted within the flue-tube and terminating at the top of the fire-box, and a damper carried by the draft-tube.

6. In a steam-boiler, the combination with an outer shell, of a fire-box located within the shell, a flue-tube connecting the fire-box and outer shell, and an air-deflector suspended in the fire-box beneath the lower end of the tube and spaced from the walls thereof.

7. In a steam-boiler, the combination with an outer shell, of a fire-box located within the shell, an open-ended flue-tube connecting the fire-box and outer shell and terminating at the top of the fire-box, and a conical deflector suspended in the fire-box beneath the lower open end of the tube and spaced from the same.

8. In a steam-boiler, the combination with an outer shell, of a fire-box located within the shell, a flue-tube connecting the fire-box and outer shell, an open-ended draft-tube removably mounted within the flue-tube and terminating at the top of the fire-box, and a deflector suspended from the draft-tube and located below its lower end, said deflector being spaced from the lower end of the draft-tube.

9. In a steam-boiler, the combination with an outer shell, of a fire-box located within the shell, a flue-tube connecting the fire-box and outer shell, and a draft-tube suspended within the flue-tube and having an outstanding flange resting upon the upper end of said flue-tube and constituting a support for the draft-tube.

10. In a steam-boiler, the combination with an outer shell, of a fire-box located within the shell, a flue-tube connecting the fire-box and outer shell, a draft-tube suspended within the flue-tube and having an outstanding flange resting upon the upper end of the flue-tube and constituting a support for the draft-tube, and a revoluble damper mounted in the upper end of the draft-tube.

11. In a steam-boiler, the combination with an outer shell, of a fire-box located within the shell, a flue-tube connecting the fire-box and outer shell, an open-ended draft-tube suspended within the flue-tube and having an outstanding supporting-flange resting upon the upper end of the flue-tube, said draft-tube terminating at the top of the fire-box, a revoluble damper mounted in the upper end of the draft-tube, and a conical deflector suspended from the draft-tube and located below the lower end thereof, said deflector being spaced from the walls of the draft-tube.

12. In a steam-boiler, the combination with an outer shell, of a fire-box located within the outer shell, a stack having communication with the fire-box, radially-disposed tubes located within the fire-box, a draft-tube extending through the outer shell and into the fire-box, a damper located within the draft-tube, and a conical deflector suspended below the lower end of the draft-tube to distribute the air over the radial tubes.

13. In a steam-boiler, a furnace, a main stack having indirect communication with the furnace, an auxiliary stack having a freely-open passage-way therethrough in direct communication with the furnace, said auxiliary stack being shorter than the main stack, and means for controlling the passage-way through one of the stacks.

14. In a steam-boiler, the combination with an outer shell, of a fire-box located within the shell, a flue-tube connecting the fire-box and outer shell, and a draft-tube removably suspended within the flue-tube and spaced therefrom throughout the length thereof, to form a dead-air space, said tubes terminating at the top of the fire-box, the draft-tube being freely open to permit the escape of smoke.

15. In a steam-boiler, the combination with a boiler-shell, of a fire-box located at one end of the shell and a smoke-box at the other end, flues connecting the fire and smoke boxes, a main stack in communication with the smoke-box, a combined draft and smoke tube in direct communication with the top of the fire-box and extending through the shell, and a damper arranged in the draft-tube.

16. In a steam-boiler, the combination with an outer shell, of a fire-box located within the outer shell, radially-disposed tubes located within the fire-box and secured at their outer ends in the walls of the box, said tubes having their inner ends closed and spaced from each other, and an open-ended draft-tube connecting the fire-box and outer shell, said tube having its inner end located above

the radial tubes on a line with the space separating their inner ends.

17. In a steam-boiler, the combination with an outer shell, of a fire-box arranged in the outer shell and having a grate, a draft-tube communicating with the top of the fire-box, and draft deflecting and commingling devices secured in the fire-box between the grate and the lower end of the tube.

In testimony that we claim the foregoing as our own we have hereto affixed our signatures in the presence of two witnesses.

ROBERT M. DOWNIE.
DAVID A. MESSNER.

Witnesses:
F. W. RANSOM,
R. G. FORBES.