

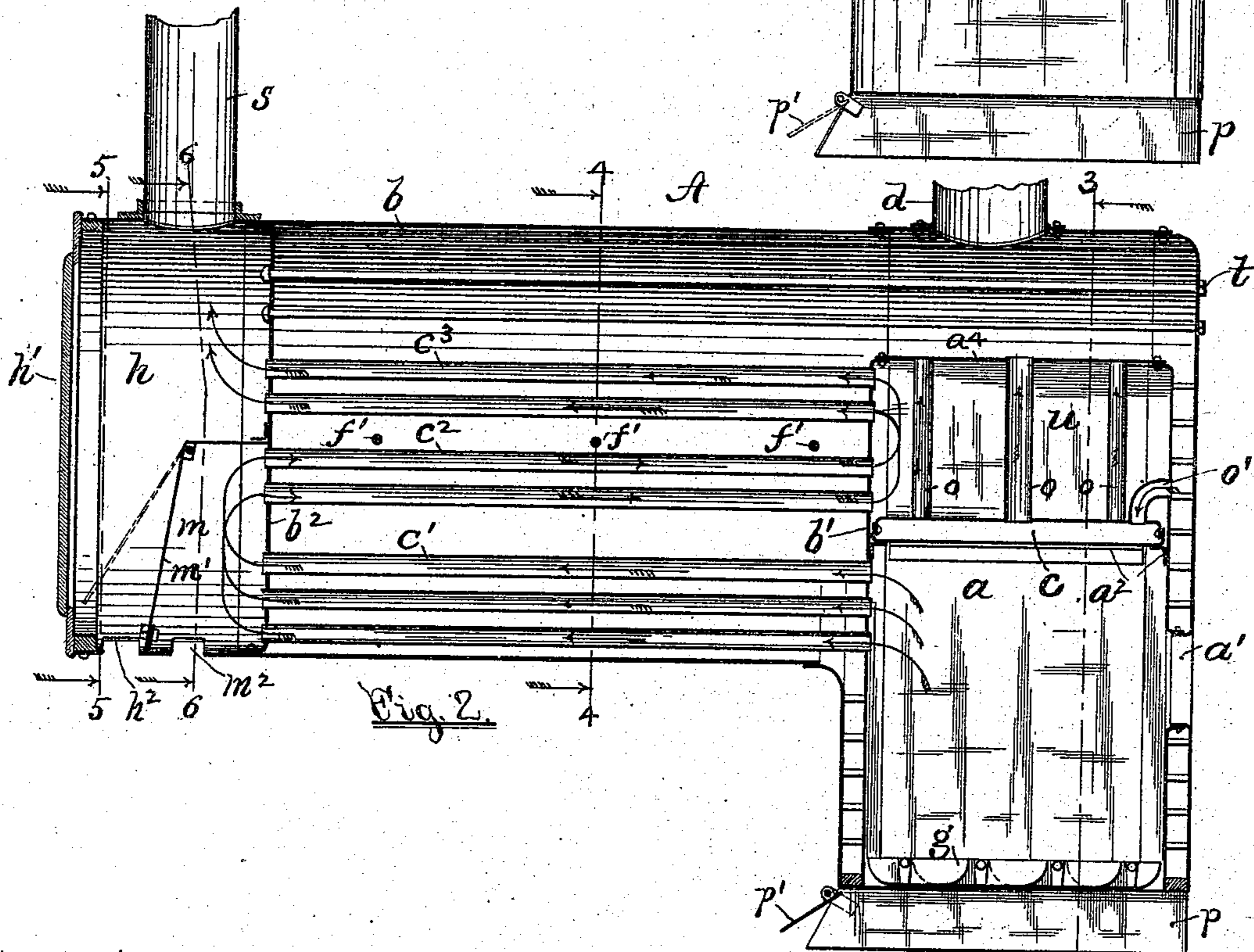
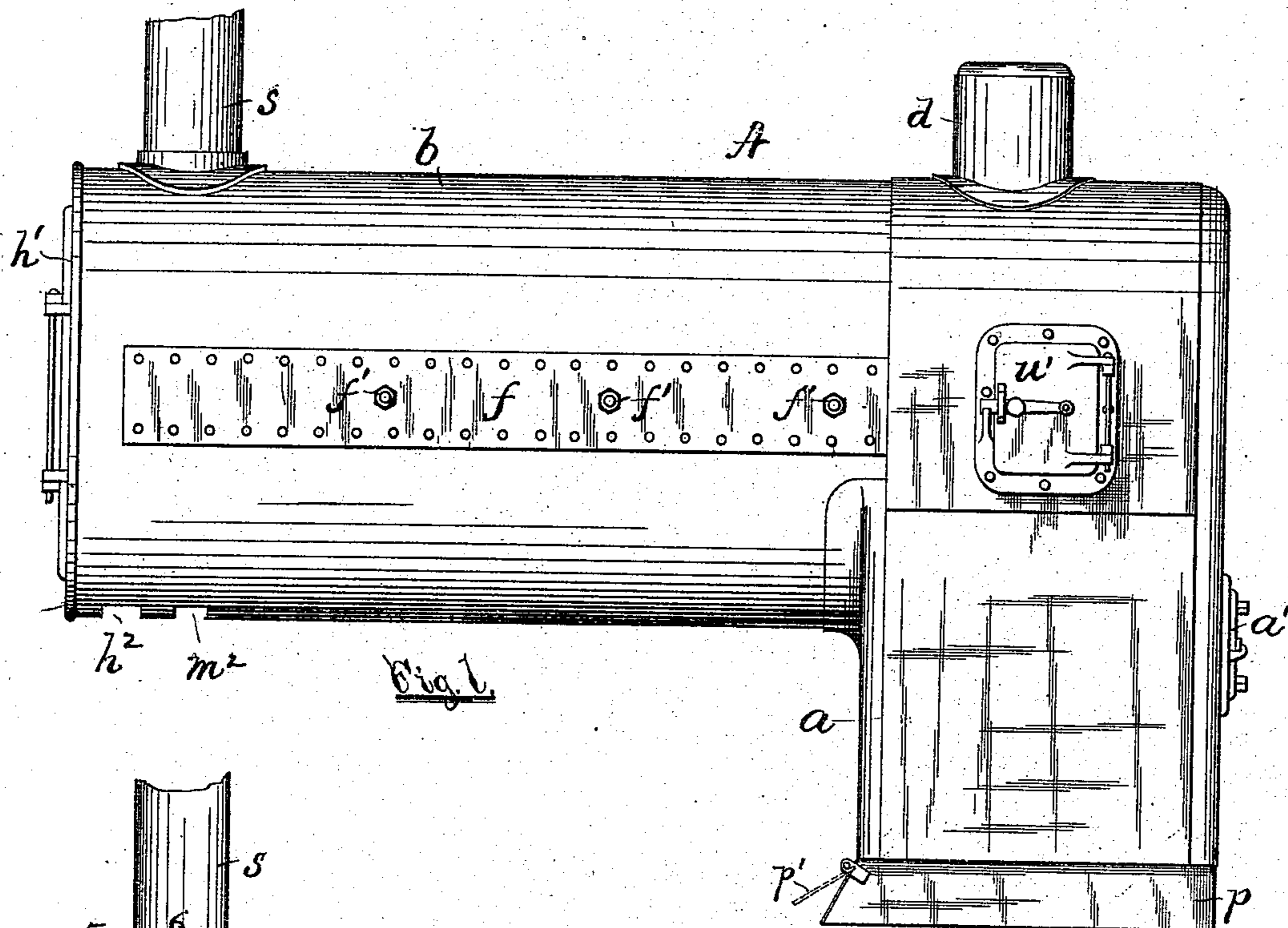
(No Model.)

2 Sheets—Sheet 1.

W. McDONALD.
STEAM BOILER.

No. 551,137.

Patented Dec. 10, 1895.



Witnesses.

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Fig. 4.

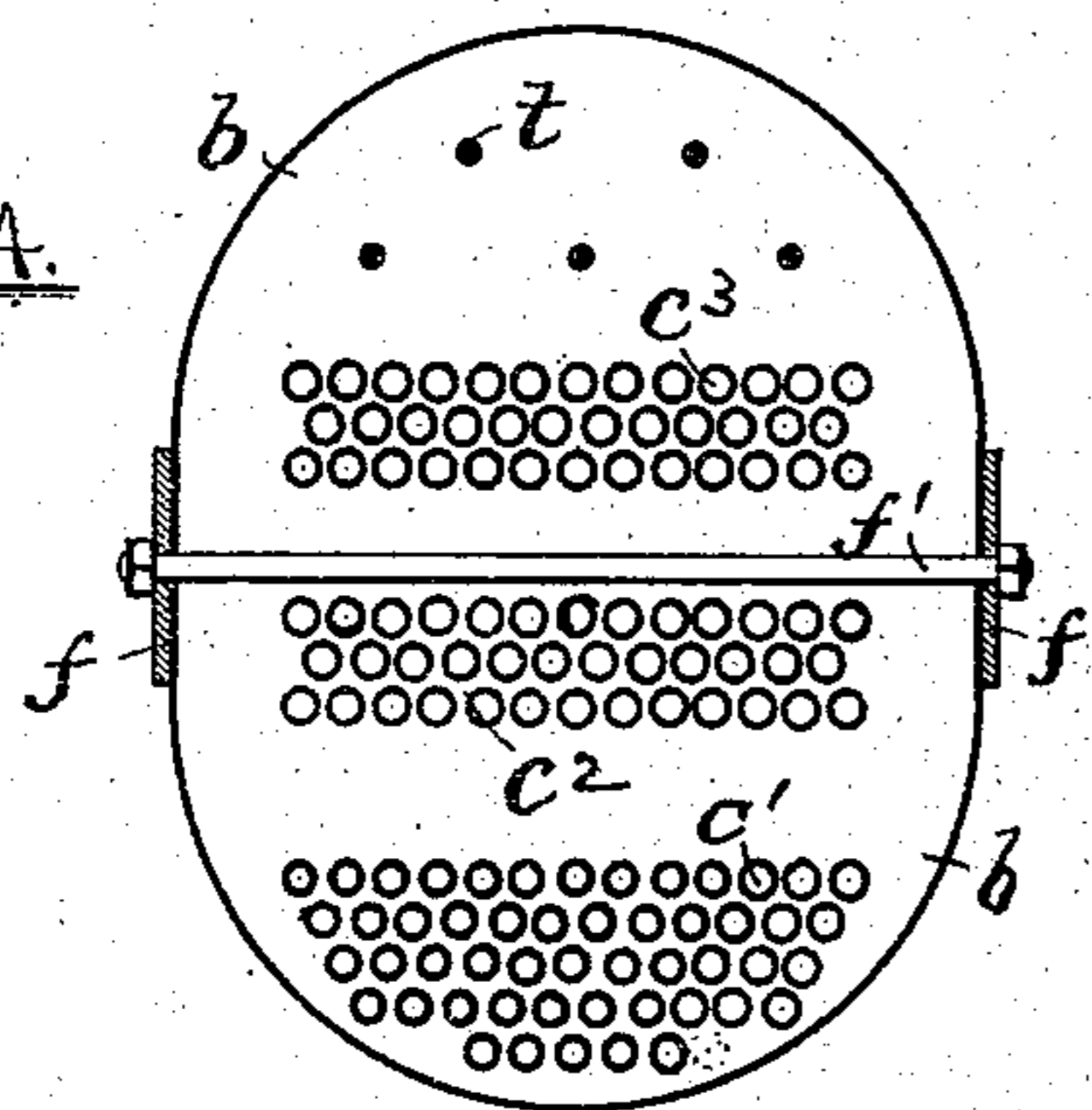


Fig. 3.

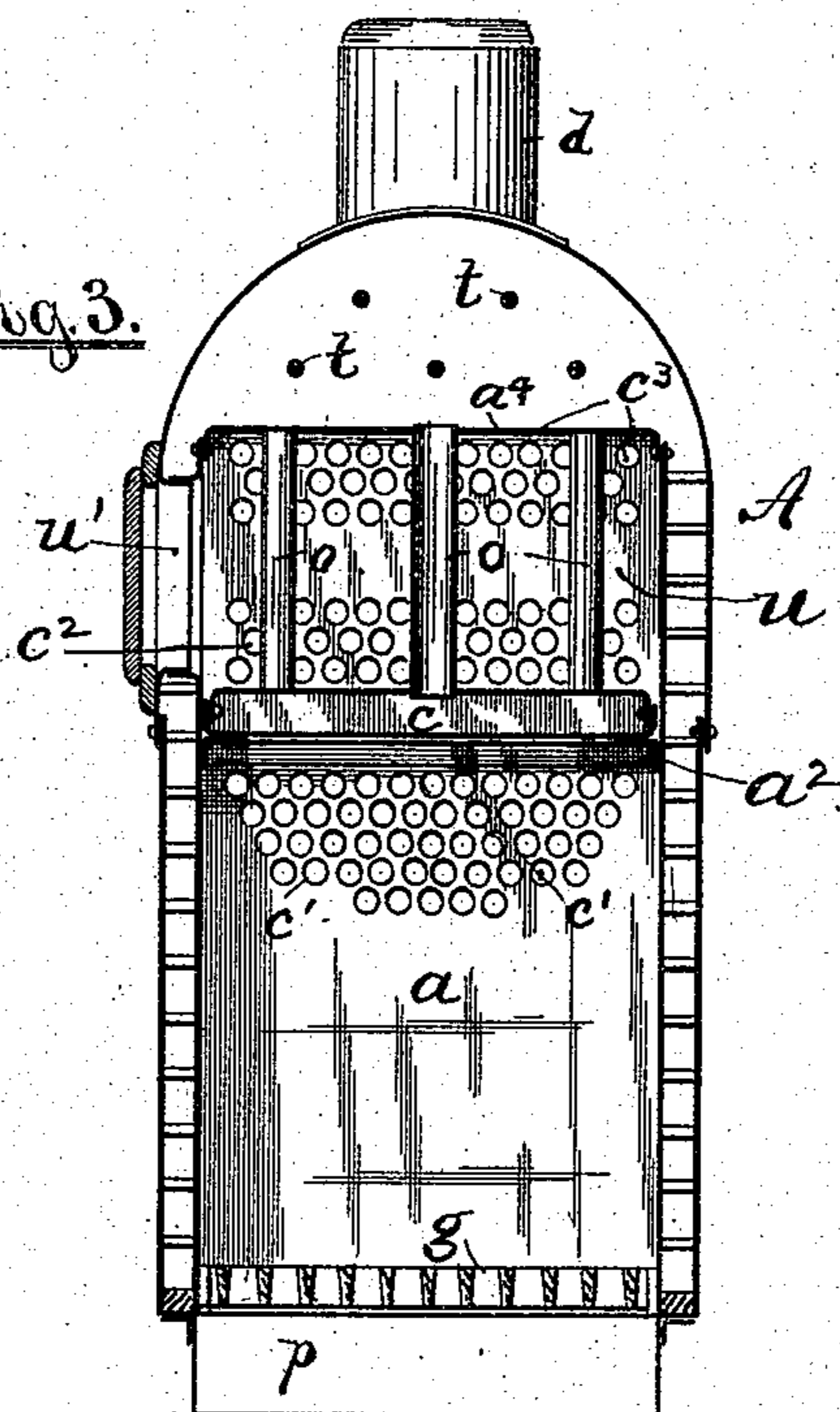


Fig. 5.

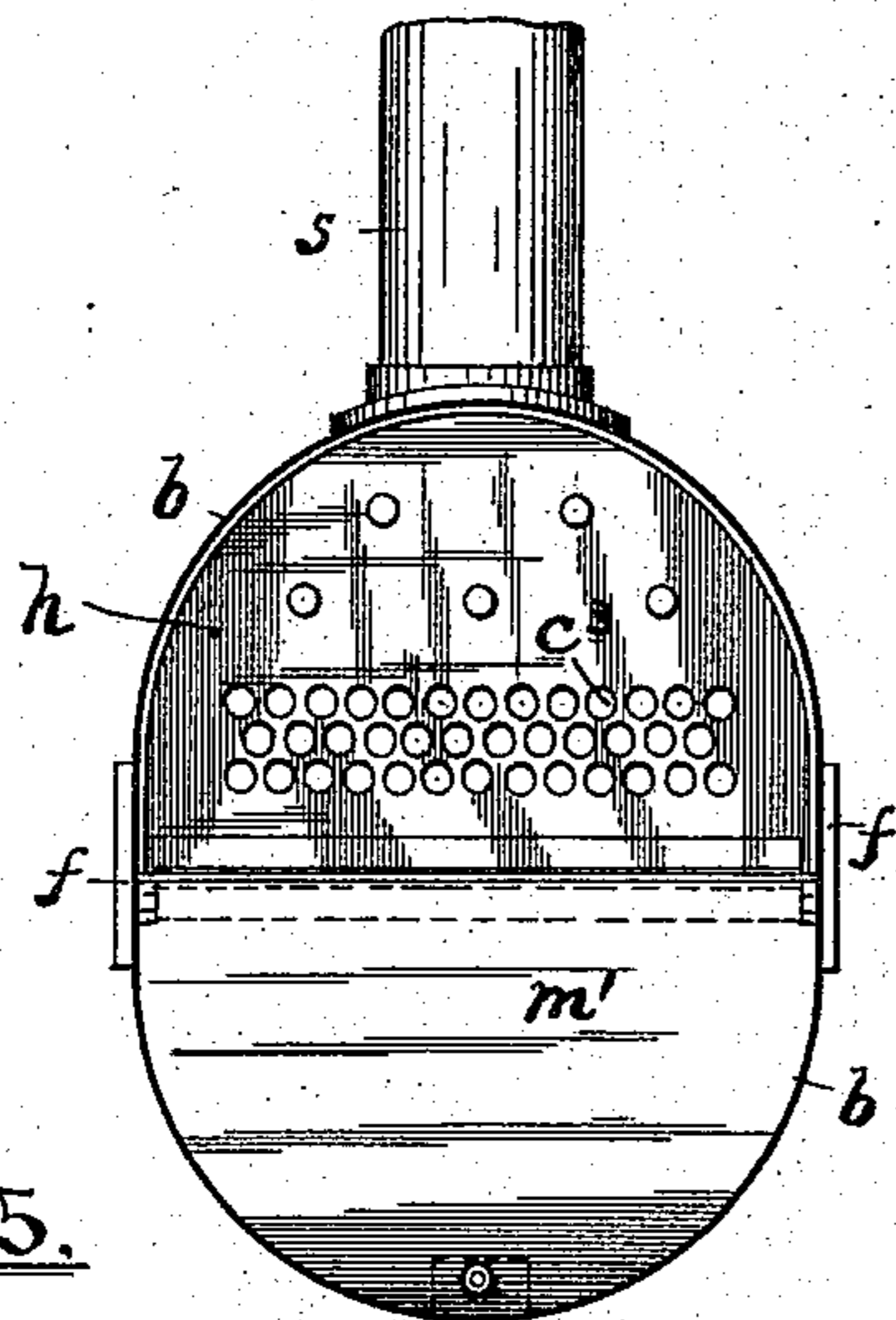
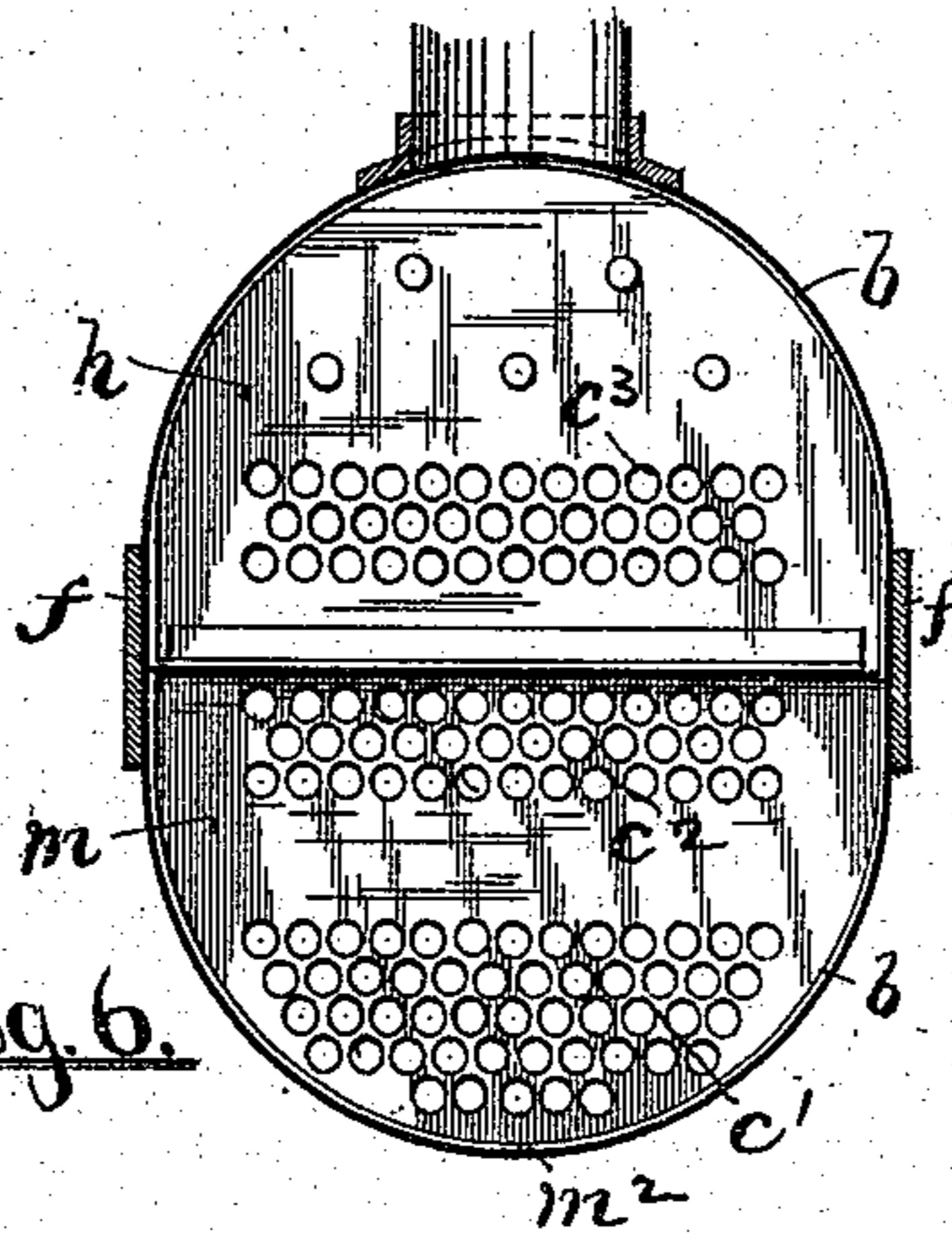


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILLIAM McDONALD, OF READVILLE, MASSACHUSETTS.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 551,137, dated December 10, 1895.

Application filed October 8, 1895. Serial No. 565,045. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM McDONALD, a citizen of the United States, residing at Readville, in the county of Norfolk and State of Massachusetts, 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, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in steam-boilers, and more particularly to boilers of the locomotive type; and it consists essentially in the combination, with the usual furnace and front head or smoke-box and the shell surrounding same, of a series of lower tubular flues leading from the furnace, a series of return or intermediate flues, a front flue-chamber located in said smoke-box communicating with the front ends of both said series of flues, a series of upper flues discharging directly into the smoke-box, and a rear flue-chamber located over the furnace communicating with the rear ends of the said intermediate and upper flues.

It further consists in providing the upper part of the furnace with a steam-surrounded flue-chamber having a hollow base-wall, the latter also forming the crown-sheet, and tubes connecting said base with the steam-space above the flue-chamber, thereby providing means for the free circulation of steam and water.

It consists, finally, in providing the boiler with a barrel portion having its major or vertical axis somewhat greater than its transverse axis, the upper and lower plates of the shell being riveted to interposed flattened side sheets and having the barrel portion provided with stay-bolts arranged transversely of the shell and secured to the side plates, thereby increasing the strength of the shell and preventing lateral expansion.

By means of my improvement boilers of the locomotive or fire-box type are capable of being provided with a greater amount of heating-surface, thereby increasing the efficiency of the boiler at a comparatively small additional cost.

In the accompanying two sheets of drawings, Figure 1 is a side elevation of a fire-box boiler embodying my present improvements. Fig. 2 is a longitudinal section of the same, taken through the center. Fig. 3 is a transverse section taken through or on the line 3 3 of Fig. 2; and Figs. 4, 5, and 6 are transverse sections of the barrel, taken, respectively, on lines 4 4, 5 5, and 6 6 of Fig. 2.

A, again referring to the drawings, indicates a boiler embodying my improvements.

The furnace or combustion-chamber *a* is or may be constructed substantially as common, its lower portion being provided with a grate *g* and an ash-pan *p*, the latter being supported below the grate and having the usual door *p'* in front. The side walls of the furnace are hollow and suitably stayed and form water-legs, as common. The rear wall is provided with an opening or fire-door *a'*. The crown-sheet or top wall *c* of the furnace is also hollow and rests on a series of angle-irons *a²* fixed to the side walls. The sheets or plates forming the inner side walls of the furnace extend a distance above the said hollow crown-sheet *c* and are riveted to the top sheet or wall *a⁴*, thereby forming a rear flue-chamber *u* between said wall and crown-sheet, as clearly shown in Figs. 2 and 3. The chamber *u* while being suitably stayed is provided with a series of vertical circulating-tubes *o* communicating with the main steam and water space and the crown-sheet *c*. It may be further provided with one or more bent tubes *o'*, communicating with the water-leg and crown-sheet, as shown in Fig. 2. The said tubes *o o'* afford a free circulation for the water and steam.

The front portion of the boiler is provided with a head or smoke-box *h*, entrance to which is effected by means of the usual swinging door *h'*. It is also provided with a smoke-stack or chimney *s*, as usual.

The front tube-sheet *b²* forms the rear wall of the smoke-box *h*, and the back tube-sheet *b'* forms the front wall both of the furnace and chamber *u*. Into the said sheets *b' b²* are secured three series of fire or draft tubes—viz., the lower tubes *c'*, the upper *c³*, and the intermediate *c²*. These tubes are arranged substantially parallel with each other, as shown, whereby the gases and waste products of combustion travel the length of the barrel

portion of the boiler three times—that is to say, the gases, &c., first pass from the furnace *a* through the lower tubes *c'*, thence return through the intermediate series of tubes *c*² into the chamber *u*, and from the latter through the upper tubes *c*³ into the head *h* and chimney *s*.

The smoke-box or head *h* contains a front flue-chamber *m*, arranged so as to isolate the lower and intermediate series of tubes *c'* *c*² from the head *h*, said tubes at the same time communicating directly with the chamber *m*. The rear flue-chamber *u* is in direct communication with the rear ends of the intermediate and upper series of tubes *c*² *c*³.

Access to the flue-chamber *m* is through a swinging front door *m'*, first opening the main door *h'*. The upper tubes may be cleaned from the head or box *h*, and the intermediate and lower tubes through the front flue-chamber *m*. The sparks and cinders collected in the front box *h* and chamber *m* may be removed through the respective independent openings *h*² and *m*², located at the bottom of the shell. The rear flue-chamber *u* is provided with a cleaning-door *u'*, the same covering an opening formed in the adjacent side wall of the boiler. (See Figs. 1 and 3.)

The front and rear heads of the boiler are braced as usual, and are provided with longitudinal tie-bolts or stays *t*. The upper part of the boiler may be provided with a steam-dome *d*, from which the steam generated in the boiler may be taken, as common.

The barrel portion *b* of my improved steam-boiler I prefer to make non-cylindrical—that is to say, its form cross-sectionally is substantially ellipsoidal, its vertical or major axis exceeding that of its transverse axis. The said portion *b* consists essentially of the semicylindrical top and bottom sheets, the same being united along the adjacent edges or center portion of the barrel by flat side plates *f*, to which they are riveted, a series of internal stay-bolts *f'* passing through said plates being employed to prevent the shell from spreading when under internal pressure.

In my improved steam-boiler the heated waste gases traverse the boiler three times, thereby increasing its heating capacity; the internal rear flue-chamber *u* becomes highly heated and likewise adds to the heating-surface of the boiler; the hollow crown-sheet *c* cannot become overheated, since a continuous circulation of water is maintained in it through the series of water-tubes *o o'*; all the fire-tubes or flues *c'* *c*² *c*³ are conveniently accessible for cleaning or repair, as well as the several corresponding flue-chambers; the area of the barrel portion is increased cross-sectionally by reason of the ellipsoidal shape, and the barrel is strengthened by the side plates *f* and cross-ties *f'*.

I claim as my invention and desire to secure by United States Letters Patent—

1. In a steam boiler of the fire-box type,

three suitably arranged series of heating or fire tubes, *c'*, *c*², *c*³, located below the water line, interposed between the furnace and chimney portions, through which tubes the heated gases, &c., pass, and front and rear flue chambers communicating with said tubes, capable when in use of changing the direction of travel of said gases, and having said rear flue chamber accessible for cleaning, &c., and provided with water circulating tubes, as *o*, substantially as described.

2. In a tubular steam boiler of the fire-box or internally fired type, a furnace proper, a hollow crown-sheet, as *c*, arranged for the circulation therein of steam and water, forming the roof of said furnace and an inclosed flue chamber, as *u*, located directly above said crown-sheet, communicating with the fire tubes and in use surrounded with steam and water under pressure, and having said flue chamber provided with water circulating tubes, substantially as described.

3. In an internally-fired tubular boiler, the combination with the fire-box and an inclosed flue chamber *u* located above the fire-box capable of being subjected to the pressure of steam carried in the boiler, of the hollow crown-sheet *c* interposed between and separating the said flue chamber from the fire-box, and circulating tubes, as *o*, *o'*, communicating with the crown-sheet and the steam and water space of the boiler, substantially as described and for the purpose set forth.

4. A tubular boiler having the barrel portion thereof ellipsoidal in form cross-sectionally, composed of reversely arranged curved upper and lower sheets, longitudinally extending flattened side sheets, as *f*, interposed between and rigidly secured to the adjacent edges of said curved sheets, and a series of stay-bolts, as *f'*, extending across the boiler and secured to the said side plates to prevent the boiler from spreading when under internal pressure, substantially as described.

5. The fire-box boiler *A*, substantially as hereinbefore described, the same comprising interiorly a furnace *a* located at the rear part, a smoke-box *h* at the front end of the boiler, a flue chamber *m* arranged in said smoke-box, a rear flue chamber *u* arranged over the furnace *a*, a steam and water holding crown-sheet *c* interposed between and separating the furnace from the chamber *u*, three series of substantially parallel fire-tubes *c'*, *c*², *c*³, interposed between the said furnace and smoke-box and in communication with the front and rear chambers *m*, *u*, and having said chambers and smoke-box accessible through suitable openings or doors, for the purpose specified.

In testimony whereof I have affixed my signature in presence of two witnesses.

WILLIAM McDONALD.

Witnesses:

GEO. H. REMINGTON,
REMINGTON SHERMAN.