

No. 657,912.

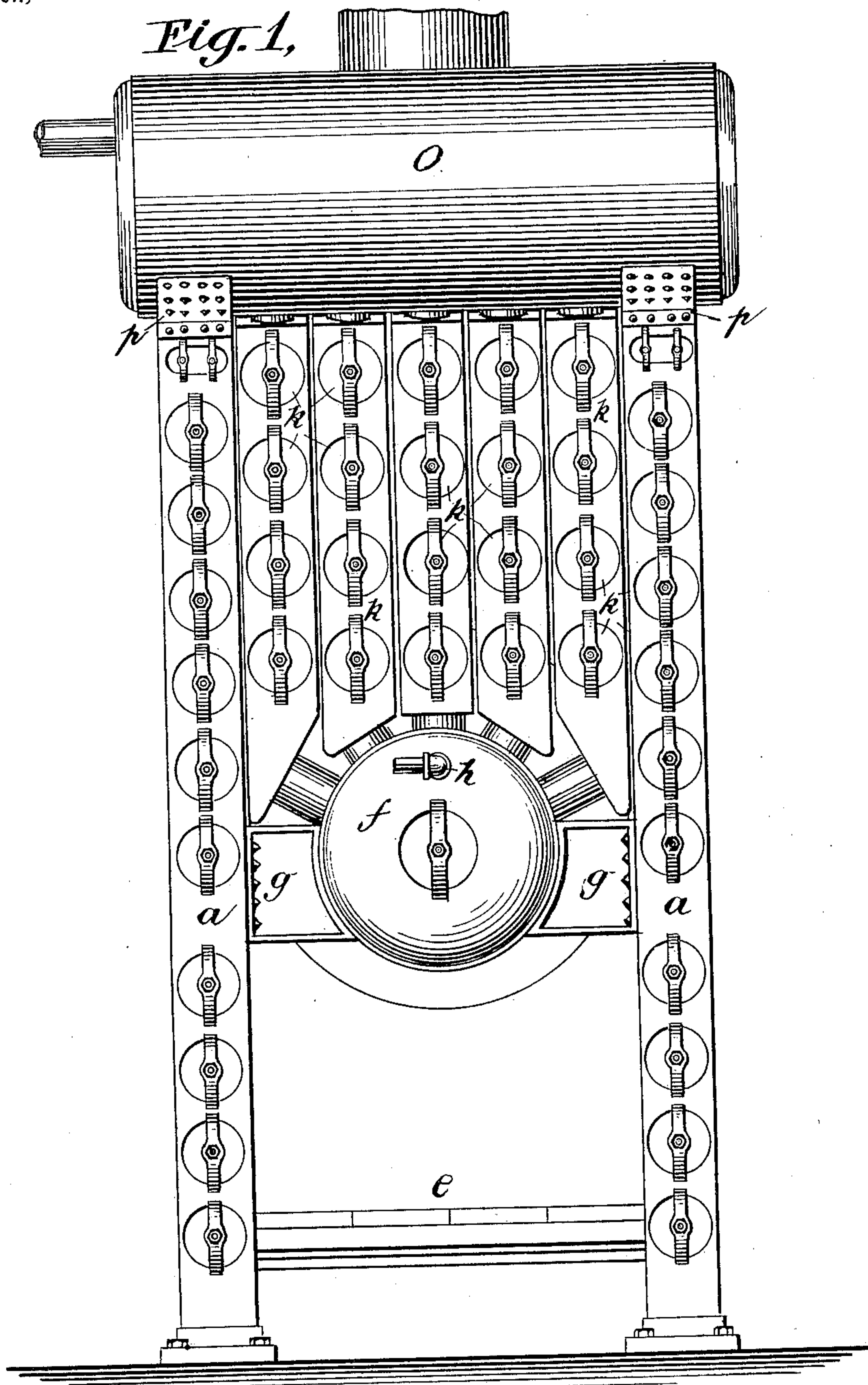
Patented Sept. 18, 1900.

J. J. CAIN.  
STEAM BOILER.

(Application filed Nov. 20, 1899.)

(No Model.)

3 Sheets—Sheet 1.



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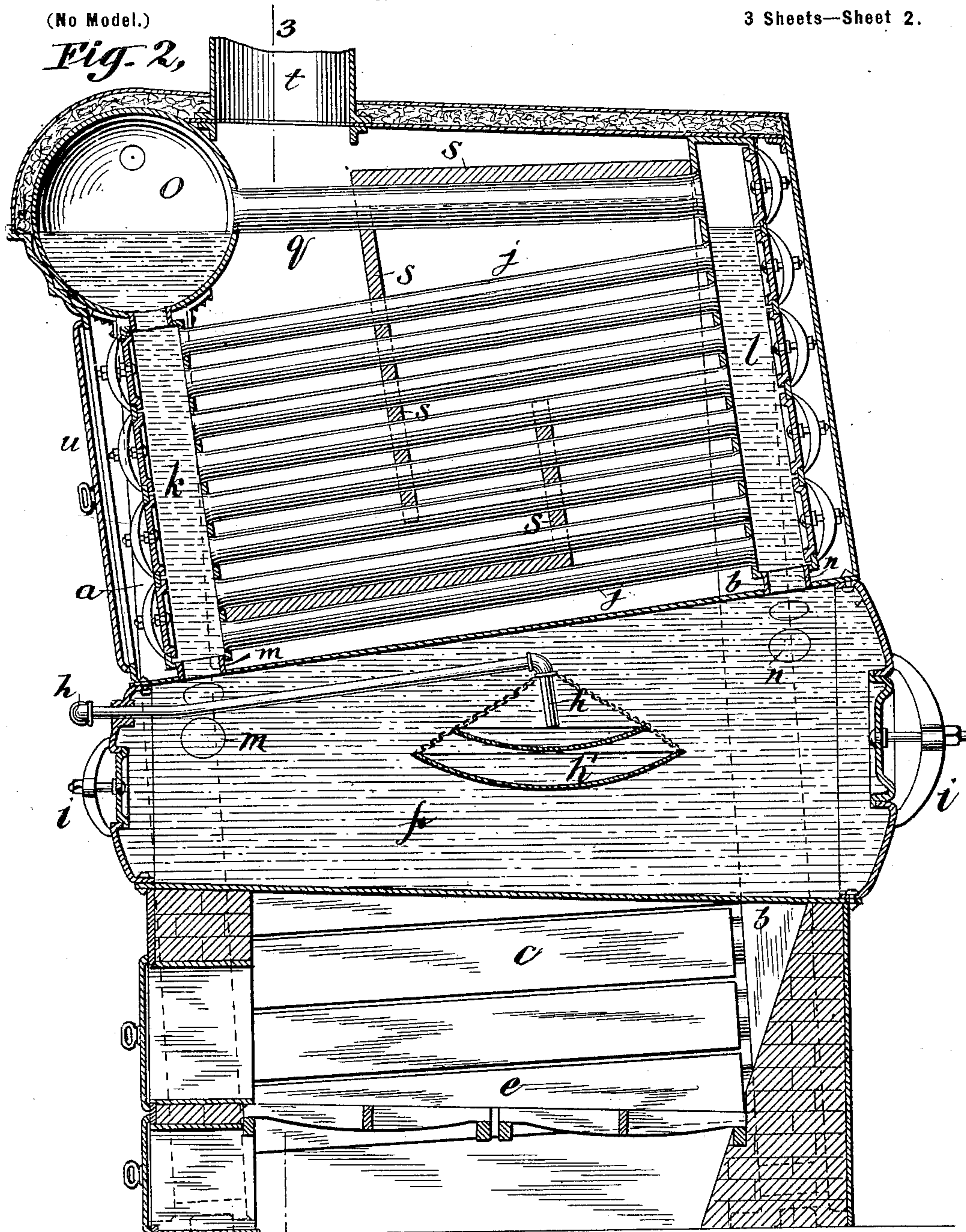
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Fig. 2,



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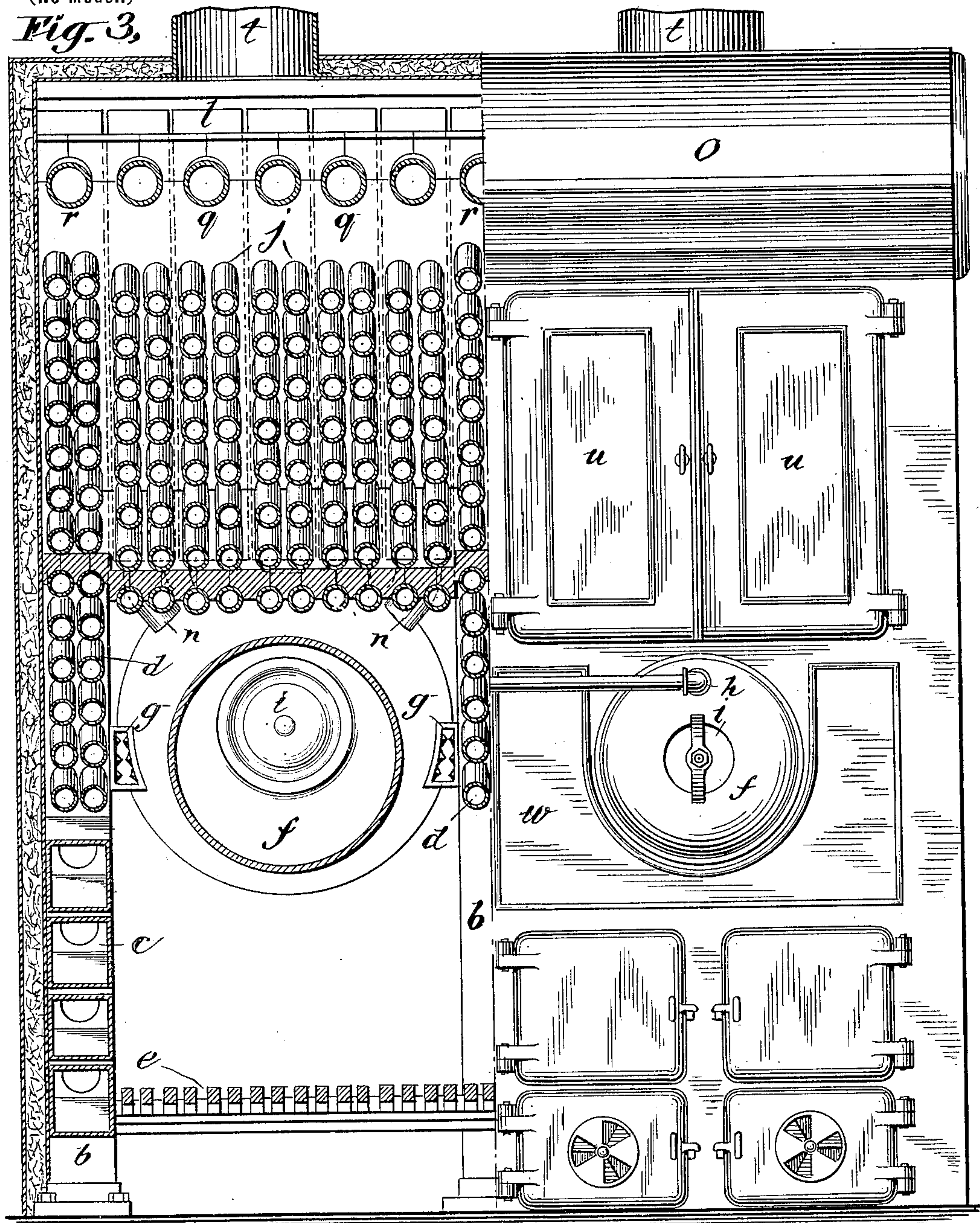
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# UNITED STATES PATENT OFFICE.

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## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 657,912, dated September 18, 1900.

Application filed November 20, 1899. Serial No. 737,547. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN J. CAIN, a citizen of the United States, and a resident of Bayonne, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

Tubular steam-boilers, the class of boilers to which this invention relates, have as an offset to the many advantages of their construction the disadvantage of the liability of the lower tubes burning out by reason of their close proximity to the furnace and consequent rapid production of steam in them, which is supposed to prevent a perfect supply of water to and constant flow through these tubes.

This invention has for its object to remove this objection and also to add to the efficiency and steaming capacity and to generally improve the construction of this class of boilers.

The essential and main feature of this invention is the application to tubular boilers, comprising tubes connected in series or sections to headers, of a drum or drums arranged in the general direction with the tubes, located beneath the tubes, so as to receive the direct heat of combustion of the fuel in the furnace and the initial heating effects of the flames, said drum or drums being connected at its or their ends to the lower parts of the headers and preferably having the feed-water supplied to it. By thus shielding the tubes from the intense heat of the furnace by the drum or drums located beneath them, which present a considerable mass or masses of water to the action of the direct heat of the furnace, all danger of the banking of the water in the tubes and their consequent rapid destruction is avoided, the connections between the drum or drums and the tubes being such that a perfect circulation of the water through the tubes is assured and provisions had for the free escape of the steam as fast as generated.

The invention also comprises the application of a steam or steam-and-water drum located above the tubes, preferably arranged transversely to the tubes above one set of the headers and corner-boxes at one end of the boiler, to which headers the drum is connected by suitable pipe connections and also to

the upper end of the corner boxes or chambers at this end of the boiler, said drum also being in communication, by means of pipe connections, with the upper ends of the other set of headers and the corner boxes or chambers at the other end of the boiler.

Figure 1 of the accompanying drawings is a front elevation of a boiler embodying my improvements with the casing removed. Fig. 2 is a vertical longitudinal central section of the boiler; and Fig. 3 represents the proposed method of mounting or combining two boilers made according to my invention, the right-hand half of said view showing a boiler in front elevation and the left-hand half a vertical transverse section taken on the line 3 3 of Fig. 2.

The frame or side walls of the boiler are shown as consisting of the front corner rectangular boxes or chambers *a a*, the rear corner rectangular boxes or chambers *b b*, the longitudinal boxes *c c*, connecting the front and rear corner-boxes together at their lower parts by suitable nipples, and the tubes *d d*, arranged above the boxes *c c* and connecting together the upper parts of the corner-boxes. These boxes *c c* and tubes *d d* are joined to the corner-boxes *a a* and *b b* at right angles thereto, and the corner-boxes are shown erected slightly out of the vertical, and the side boxes *c c* and tubes *d d* are thus caused to lie in inclined positions to facilitate the flow of water through and escape of steam from them. The furnace-grate *e* and its back wall and front fixings are made and arranged in the ordinary manner.

The drum *f* is located above the furnace-grate, arranged longitudinally thereto, and is supported by the saddle-brackets *g g*, which are secured to and extend from the inner sides of the corner-boxes *a a* and *b b*, said drum being firmly connected to one pair of the brackets at one end of the boiler and merely held and controlled at its other end by the other pair of brackets at the other end of the boiler, thus allowing for the free expansion and contraction of the drum and the side walls without interference between them. This drum may advantageously be made conical in form, so that it may be arranged, as shown, with its lower side about parallel with the furnace-grate and its upper side at a consid-



erable angle to the horizontal, thus providing for the free escape of steam therefrom and placing its upper side about parallel to the tubes, which are arranged above it. It is proposed to supply the feed-water to this drum by means of the pipe *h*, which enters it at one of its ends and supplies the water to it at about its central part. The drum will thus be fully charged with water and having a comparatively-large capacity the direct heat from the furnace will act on a large mass of water and the metal of the boiler directly under the influence of the intense heat of the furnace will be always covered with water. Another advantage due to the use of a drum of this character in conjunction with a tubular boiler is that all, or practically all, deposits from the water will occur in the drum and the formation of scale in the tubes will be avoided, thus insuring to the boiler constant full steaming capacity. Manholes *i i* at the ends of the drums provide for the easy removal of all deposits and scale from the boiler. As ordinarily, hand-holes will be provided opposite the ends of the tubes; but the cleaning of the tubes, which with tubular boilers as now made is of frequent necessity, will in this construction in boiler be obviated or necessity for the same greatly reduced. The tubes *j j* are in sections, connected to the headers *k k* and *l l*, which are preferably rectangular in form, and for facility of manufacture the tubes are placed and joined at right angles to the headers. The lower ends of the headers *k k* at the front of the boiler are placed in communication with the upper part of the small end of the conical drum *f* by means of the nipples *m m*, and the lower ends of the headers *l l* at the rear of the boiler are placed in communication with the large end of the drum by means of the nipples *n n*, the tubes *j j* being thus arranged parallel to the upper part of the drum and the headers *k* and *l* at right angles thereto, the lower ends of which are angularly formed to properly receive the nipples, as shown at Fig. 1. A steam or steam-and-water drum *o* is located above the front headers *k k* and over the tops of the front corner-boxes *a a*, the same being connected to each of the headers *k k* by suitable nipples and to the upper ends of the corner-boxes *a a* by the saddle-pieces *p p*. This drum *o* is also in communication with the upper ends of the rear headers *l* and the upper ends of the rear corner-boxes *b b* by means of the pipes *q* and *r*, respectively. By this construction and arrangement of parts it will be seen that provisions are had for the perfect circulation of water and full steaming capacity and the liability of delays due to the burning out of the tubes of tubular steam-boilers avoided and that the inclination given to the corner-boxes and the headers admits of all right-angle pipe connections being made in a structure occupying the least possible space.

To insure a perfect and uniform circulation

of the products of combustion around and over the drum *f* and tubes *j j*, baffle-plates and walls *s s* of ordinary construction may be arranged, as shown, said products ultimately leaving the boiler by the stack or pipe *t*. The boiler is also provided with the ordinary casing *u*, fire-doors, ash-pit doors, &c.

In combining two boilers having the features of this invention the plan shown at Fig. 3 will be adopted, central, front, and rear boxes or chambers corresponding to the corner-boxes of individual boilers being common to the two boilers, the lower rectangular boxes *c c* being omitted from said central standard boxes, but the side tubes *d d* retained, forming a dividing-wall between the drums *f f*, the sections of the tubes *j j* of the two boilers, and the upper part of the furnace. The grate-furnace *e* is proposed to be extended from one side of the combined boilers to the other, being a continuous grate-surface beneath the two drums *f f* and the tubes *j j* above the drums. One steam-drum *o* may in such a construction be used, extending over and connected to the front headers and the corner and central boxes or chambers of the two boilers and connected to the rear headers and corner and central boxes or chambers in the same manner as heretofore described in the single boiler.

While the corner-boxes and headers are shown arranged in inclined position, it is evident that, if thought desirable, they may be vertically arranged. Pans *h'* may be advantageously located in the water-drum *f*, beneath the discharge-opening of the feed-water pipe *h*, in which will be collected most of the muddy deposits from the water and which will tend to distribute the cold water throughout the interior of the drum.

I claim as my invention—

1. In a steam-boiler comprising a grate-furnace, series of tubes, and headers to which the tubes are connected, the combination therewith, of a drum located beneath and arranged in the same direction as the tubes and in the furnace and wholly above the grate, so as to receive the direct heat of combustion of the fuel; and connections between the ends of the drum and the headers.

2. In a steam-boiler comprising a grate-furnace, series of tubes arranged in inclined position, and headers, to which the tubes are connected, the combination therewith of a drum located and in the furnace wholly above the grate and beneath the tubes and arranged with its upper side parallel with and in the same direction as the tubes, so as to receive the direct heat of combustion of the fuel; and connections between the ends of the drum and the headers.

3. In a steam-boiler comprising a series of inclined tubes, and headers to which the tubes are connected and arranged at right angles to the tubes, the combination therewith of a conical drum, located beneath and arranged in the same direction as the tubes,



so as to receive the direct heat of combustion of the fuel, the large end of the drum being beneath the upper ends of the inclined tubes; and connections between the ends of the drum

5 and the headers.

4. In a steam-boiler comprising a grate-furnace, series of tubes, and headers to which the tubes are connected, the combination therewith, of a drum located beneath and arranged in the same direction as the tubes, so as to receive the direct heat of combustion of the fuel; connections between the ends of the drum and the headers; and a water-supply pipe arranged to feed water to the central

15 part of the drum.

5. In a steam-boiler comprising a grate-furnace, series of tubes, and headers to which the tubes are connected, the combination therewith, of a drum located beneath and arranged in the same direction as the tubes, so as to receive the direct heat of combustion of the fuel; connections between the ends of the drum and the headers; a steam-drum located transversely to the tubes, and above the headers at one end of the boiler to which said drum is connected; and pipe connections between the upper ends of the headers at the other end of the boiler and the steam-drum.

6. In a steam-boiler comprising a series of inclined tubes, a grate-furnace, and headers to which the tubes are connected and arranged at right angles to the tubes, the combination therewith, of a conical drum, located beneath and arranged in the same direction as the tubes, so as to receive the direct heat of combustion of the fuel, the large end of the drum being beneath the upper ends of the inclined tubes; connections between the upper sides of the ends of the drum and the lower ends of the headers; a steam-drum located transversely to the tubes and connected to the upper ends of the headers of the lower ends of the tubes; and pipe connections between the upper ends of the headers of the upper

45 ends of the tubes and the steam-drum.

7. In a steam-boiler comprising corner boxes or chambers, connections between the front and rear corner-boxes, a grate-furnace, series of tubes, and headers to which the tubes are

50 connected, the combination therewith, of a drum located beneath and arranged in the same direction as the tubes; connections between the ends of the drum and the headers; and saddle-brackets secured to the corner-boxes, and by means of which the drum is held and supported.

55 8. In a steam-boiler comprising corner boxes or chambers, connections between the front and rear corner-boxes, a grate-furnace, series

60 of tubes, and headers to which the tubes are

connected, the combination therewith, of a drum located beneath and arranged in the same direction as the tubes; connections between the ends of the drum and the headers; saddle-brackets secured to the sides of the

65 boxes and by means of which the drum is held and supported; a steam-drum located transversely to the tubes above the headers and front corner-boxes at one end of the boiler, and connected to said headers and

70 corner-boxes; and pipe connections between the upper ends of the headers and corner-boxes at the other end of the boiler and the steam-drum.

9. In a steam-boiler comprising corner boxes

75 or chambers, connections between the front and rear corner-boxes, a grate-furnace, series of inclined tubes, and headers to which the tubes are connected and arranged at right angles to the tubes, the combination there-

80 with, of a conical drum located beneath and arranged in the same direction as the tubes so as to receive the direct heat of combustion of the fuel, the large end of the drum being beneath the upper ends of the inclined tubes,

85 connections between the ends of the drum and the headers; and saddle-brackets secured to the sides of the corner-boxes, and by means of which the drum is held and supported.

90 10. In a steam-boiler comprising corner boxes or chambers, connections between the front and rear corner-boxes, a grate-furnace, series of tubes, and headers to which the tubes are connected and arranged at right angles to the tubes, the combination there-

95 with, of a conical drum, located beneath and arranged in the same direction as the tubes, so as to receive the direct heat of combustion of the fuel, the large end of the drum being beneath the upper ends of the inclined tubes;

100 connections between the upper sides of the ends of the drum and the lower ends of the headers; saddle-brackets secured to the corner-boxes and by means of which the drum is held and supported; a steam-drum located

105 transversely to the tubes and connected to the upper ends of the headers of the lower ends of the inclined tubes and the upper ends of the front corner-boxes; and pipe connections between the upper ends of the headers,

110 of the upper ends of the tubes, and of the upper ends of the rear corner-boxes and the steam-drum.

Signed at Bayonne, in the county of Hudson and State of New Jersey, this 14th day of

November, A. D. 1899.

JOHN J. CAIN.

Witnesses:

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JAMES T. BOYLAN.