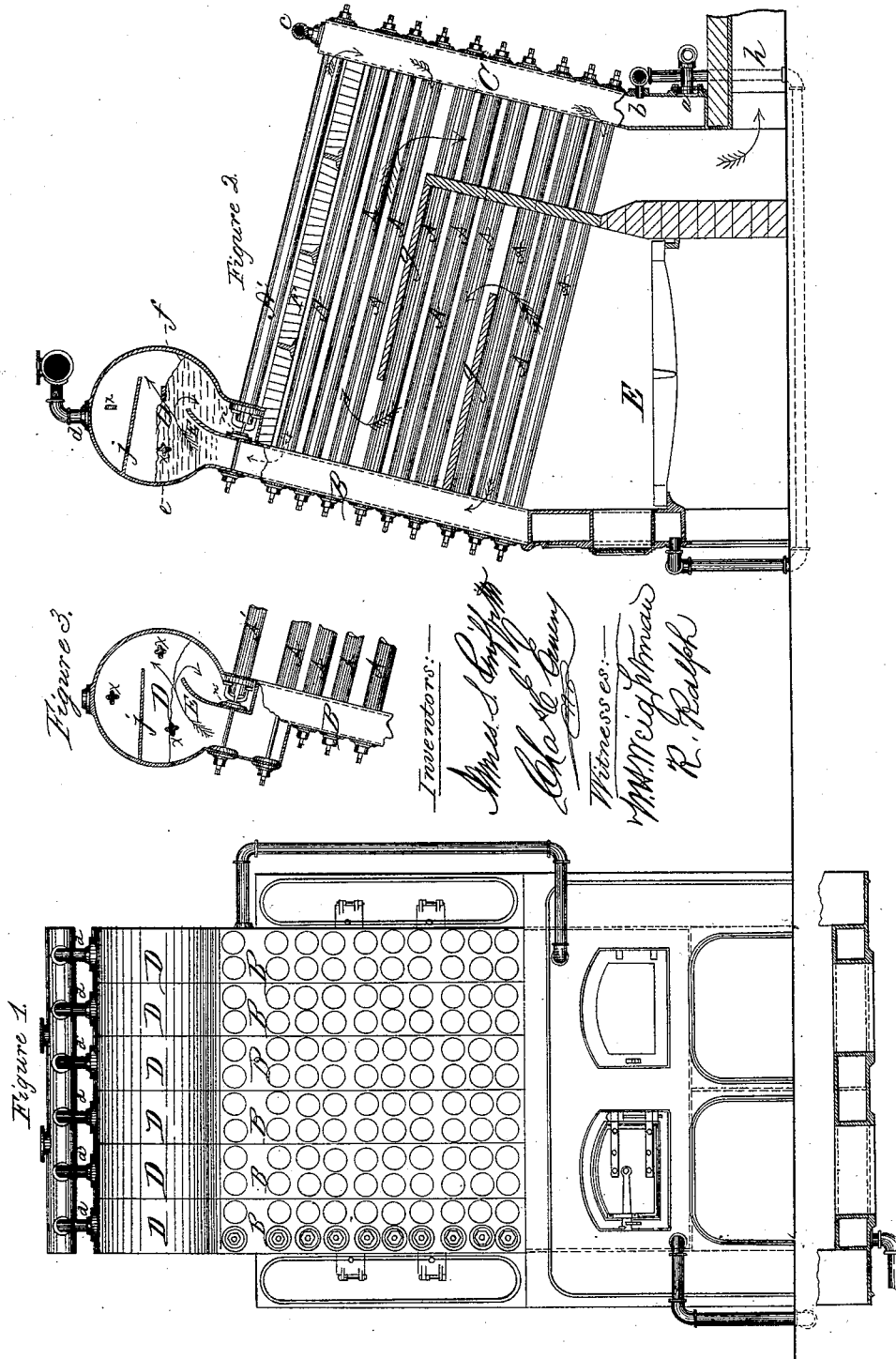


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SECTIONAL BOILER.

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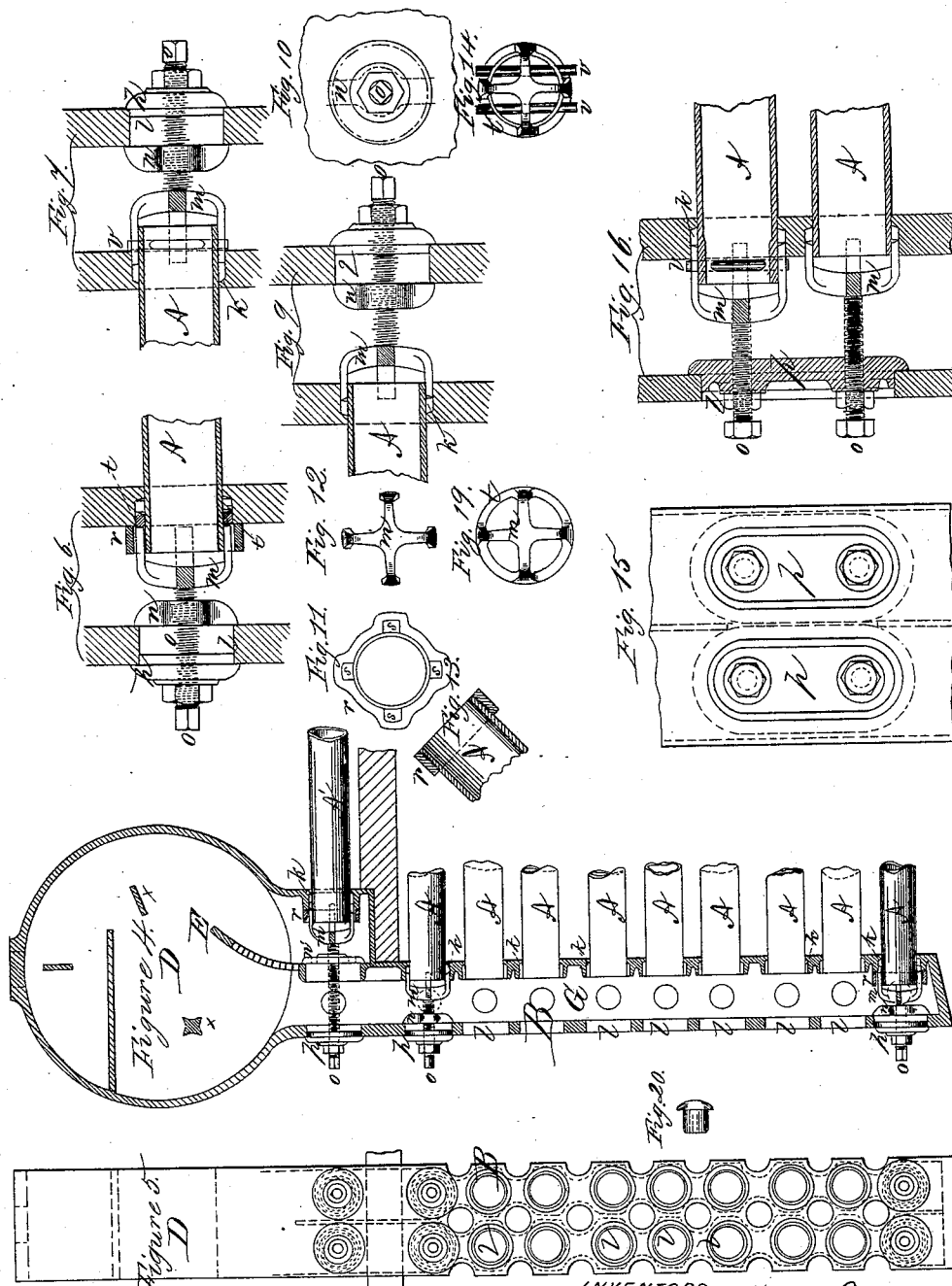
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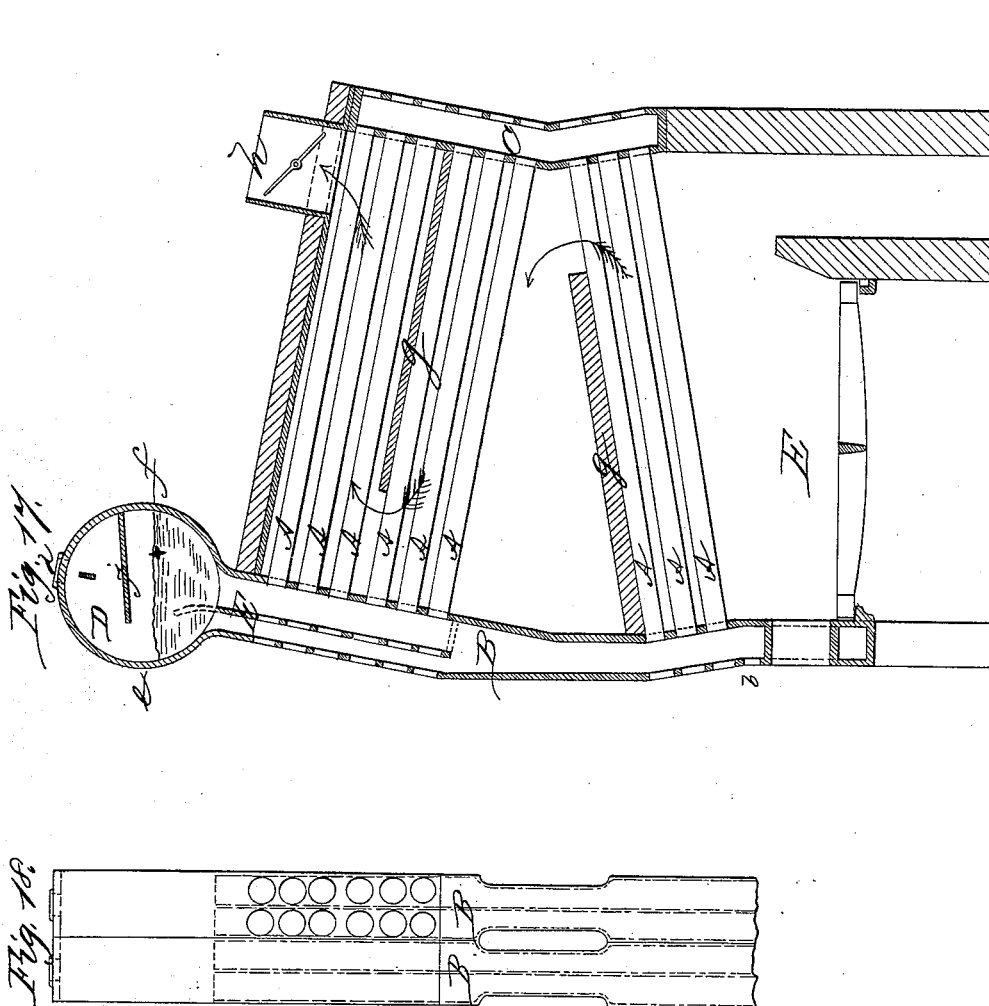
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WITNESSES:—

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Letters Patent No. 111,639, dated February 7, 1871.

IMPROVEMENT IN SECTIONAL STEAM-BOILERS.

The Schedule referred to in these Letters Patent and making part of the same.

Be it known that we, JAMES S. GRIFFITH and CHARLES E. EMERY, both of the city, county, and State of New York, have invented a new and Improved Sectional Steam-Boiler; and we do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing making part of this specification.

Our invention relates to that kind of boiler which is formed of wrought-iron tubes connected together at their ends by means of chambers, in what are technically called "tube-heads," or sometimes "sections."

In our boiler, however, we prefer to connect one or more (preferably two) vertical rows of tubes to each tube-head, and we apply the name "section" to the small complete boiler, which is formed of two tube-heads connected by a number of tubes.

We construct a large boiler by increasing the number of such sections.

Our invention consists in—

First, an improved tube-head for sectional boilers, provided with an enlarged top, serving as a steam-drum and chamber for the separation of the steam and water, and suitable openings through which the water-tubes may be cleaned or removed.

Second, the arrangement of one or more tubes in each section, wholly or partially out of direct contact with the flames or heated gases, and in such manner as to return the water from one tube-head to the other, and thus complete the circulation.

Third, a new arrangement of partitions in a tube-head, whereby the circulation of the water and the separation of the same from the steam is secured in a very efficient manner.

Fourth, a boiler tube-head combined and connected with a tube by a stuffing-box joint; said tube-head being provided with an opening opposite the tube through which the joint may be packed and the tube cleaned or removed.

Fifth, the combination and arrangement of a bonnet and stuffing-box gland with a bolt in such manner that both of the former are held in place by the latter.

Sixth, the combination of a stuffing-box gland with a nut, or its equivalent, secured to the tube in such manner as to prevent the separation of the tube-heads, and permit also the free adjustment of the gland.

In the drawing—

Figure 1 represents the front elevation of a boiler constructed in accordance with our improvements.

Figure 2 is a vertical longitudinal section between two of the boiler sections and through portions of the tube-heads.

Figure 3 is a vertical longitudinal section of a steam-drum, designed to be attached to the front tube-head,

and varied somewhat in construction from that shown in fig. 2.

Figure 4 is a longitudinal section of the front tube-head of a section of the boiler on the line of a vertical row of tubes.

Figure 5 is a front elevation of the same.

Figures 6 to 16 inclusive, and

Figures 19 and 20 show the details of construction, and are more particularly described hereafter.

Figure 17 represents a vertical longitudinal section of a boiler, in which the tubes are differently arranged from those shown in fig. 2.

Figure 18 is a front elevation of two of the front tube-heads of a boiler constructed as shown in fig. 17.

In the usual method of construction the water-tubes designated by the letter A in the drawing are set slightly inclined from the horizontal, with their ends connected to cast-iron boxes or tube-heads.

Those at the higher ends of the tubes are designated the "front tube-heads" B, and those at the lower end of the tubes the "rear tube-heads" C.

Each of these tube-heads, B and C, is made of sufficient size to receive any desired number of tubes, but for convenience in transportation, and to insure proper strength, we generally use in each head two vertical rows of tubes with from seven to twelve tubes in each row.

The upper part of the front tube-head is expanded longitudinally into a steam-drum, D, the thickness or width of which is the same as that of the tube-head B, so that a number of the latter with their attached drums can be erected closely side by side, as shown in fig. 1.

The rear tube-heads are usually extended a short distance below the tubes, so as to form a space for deposits which are blown out through pipes *a*, leading from each tube-head into a cross-pipe.

A front tube-head, B, a rear tube-head, C, and the connecting-tubes form one section, which is a complete boiler in itself; and larger boilers are constructed by multiplying the number of sections.

The several sections are connected together through pipes *d*, leading from the steam-drums into a larger connecting-pipe, by the blow-off pipes *e*, and preferably, also, by feed-pipes placed near the bottom of the rear section, as at *b*, or at the top, as at *c*.

The water-level is carried in the steam drums D at or near the line *e f*.

The flames and heated gases from the furnace E are conducted around any suitable arrangement of deflecting-plates, *g*, so as to circulate among the tubes, and are then discharged into the chimney-flue *h*, either at the bottom, side, or top of the boiler.

As the water in the tubes receives heat its density is diminished, and it is forced by the heavier water in

the rear tube-heads C out of the tubes and up the front tube-heads B into the steam-drums D, where the steam escapes, and the water flows over a cross-partition or dam, E, and enters the upper tubes A', which return it to the rear tube-head C, and thus maintain the circulation.

The tubes A' in the upper row are wholly or partially screened from the flames and heated gases by a partition, F, made usually of fire-brick or tile.

This is done for the reason that, if heat be admitted to the tubes A', the density of the water in the descending current will be diminished and the rapidity of the circulation correspondingly lessened.

By the construction shown a heavy and light column are continually maintained, the water in the first continually displacing that in the other, and thus making a free circulation.

It is not essential that the tubes A' should be entirely screened from the heated gases, but in no case should they receive sufficient heat to form steam-bubbles.

In some instances we make the chimney-flue at the top, and thus permit the escaping gases to pass over the rear ends of the tubes A'.

In some cases also we place more than one horizontal row of tubes above the partition F, and at other times make the tubes A' larger than the lower tubes A, so that the area of the heating-tubes will not be more than six to eight times that of the upper tubes.

In order to prevent the water from being carried into the upper part of the drum we place a little above the water-line a cross-partition, j, which deflects the steam and water downward, and the latter falls into the descending current, over the dam E, while the steam rises through an opening at the end of the partition into the steam-space above the partition j.

Usually the tubes A' are made shorter than the other tubes, which permits of a straight passage for the water up the front tube-head B; but in other cases the tubes are made of the same length, and the partition forming the dam E is projected outside of the inner sheet of the tube-head, and the front part of the tube-head is offset, to keep up the area, as is shown in fig. 3. The dam E is sometimes dispensed with altogether, which permits the water to be carried lower in the drum, if desired; but in such case the ascending and descending currents conflict very much.

In other cases we make a dam, but perforate it, as shown in fig. 4, so that it separates the currents, and yet permits circulation to take place after the water falls below the top of the dam.

We prefer to make the fronts of the furnace hollow, and fill the same with water, to prevent their being burned out. We either discharge the water thus heated into a tank, or open communications from the water-front to the boiler proper, as shown in figs. 1 and 2.

In figs. 16 and 17 the combined tube-head and steam-drum is adapted to a different arrangement of the tubes, the water in the latter running first to the rear in the lower tubes, and back to the front in the upper tubes. The descending current of water passes in front of a partition, E, and is thus kept separate from the water and steam issuing from the tubes. This partition E may be joined to the tube-sheet at the bottom, as shown in the dotted lines, in which case all the water will necessarily pass over the top of it. If there be an opening at the bottom, as shown, the water partially separates from the steam as it issues from the tubes, and drops down and joins the current outside the partition.

The tubes are secured in place in any desired manner, but, preferably, by means of stuffing-box joints formed around them in the inner sheets of the tube-heads, as is distinctly shown in fig. 4. In front of each tube is a hand-hole opening, l, of sufficient size

to permit the insertion of the tube and the stuffing-box gland. The form of gland generally employed is shown in fig. 19. It consists of a ring, to press upon the packing, provided with a number of curved arms, joining together in the center, as shown. When the gland is slipped over the tube the curved arms extend outside the end of it, leaving a passage for the water between them, as is shown in fig. 4, k representing the stuffing-box, t the ring of the gland, and m the arms of the same.

On the inside of each hand-hole opening l, except the upper one, is placed a cross-bar, n, which forms a nut for a screw-bolt, o. The point of the latter presses against the center of the arms n of the gland, and the bolt may be turned in its nut so as to tighten the stuffing-box to any desired degree.

Over the bolts o are slipped hand-hole plates, p, which cover the hand-hole openings l on the outside, and said plates are held in place by nuts upon the screw-bolts o, as is clearly shown.

The bolt o, opposite the upper tube A', is screwed through a plate, n', covering the opening in dam E, and the cross-bar n is omitted. The plate n' is usually made oval, so that it can be removed through the opening it covers, and it need not make a tight joint on the partition E. In some instances, the hand-hole plates, or bonnets p, and openings l are made oval, so that the former may be put inside. In such case the plates form the nuts for the bolts o, and no cross-bars are needed. This arrangement is shown in figs. 15 and 16, in which the opening l extend opposite two tubes. In both cases the one bolt serves to secure both the hand-hole plate and stuffing-box gland.

To prevent the front and rear tube-heads from becoming separated by the pressure, we, in some cases, screw upon the top and bottom tubes in each tube-head nuts r, figs. 4, 6, 11, and 13, which bear upon the metal surrounding the stuffing-boxes.

To permit the adjustment of the stuffing-box glands the nuts are grooved inside, so that when they are screwed upon the tubes, openings, s, fig. 11, are left, through which the arms m, fig. 12, of the stuffing-box gland extend and press upon a ring, t, made in this case separate from the arms m, which ring tightens the packing.

In other cases, the ring t is formed upon the arms m, as at first described, and, to tie the front and rear tube-heads to the tubes and to each other, pins, r, figs. 7 and 14, are run through the ends of the upper and lower tubes, between the arms m, such pins lying upon the metal surrounding the stuffing-box, and preventing the tube-heads from being pulled off the tubes the same as the nuts r, heretofore described. Both the nuts r and the pins o permit the free adjustment of the stuffing-boxes, though either the nuts or pins must be removed temporarily when new packing is required.

The front and rear walls of the tube-heads are tied together between the tubes by a partition, G, seen beyond the plane of section in fig. 4, and shown in dotted lines in fig. 5. This partition is generally provided with openings through it, as shown in fig. 4.

The side walls of the steam-drum are tied together by studs, x x, which are usually cast in one piece with the walls.

In order to see the fire and permit the introduction of hose to clean the tubes, we make half-holes in the sides of the tube-heads, and full holes in the middle thereof, which extend entirely through the heads, and are surrounded by metal, to make the heads watertight structures. These openings are closed by simple plugs, shown in fig. 18.

Bolts may be used to tie the front and rear tube-heads together, and the nuts r and pins r, described, be thereby dispensed with.

The stuffing-boxes are usually packed with a preparation of hard rubber, but we do not confine ourselves to the use of that material.

By the use of the stuffing-box joint, the tubes are allowed to expand and contract without hindrance, and any one can be cleaned in place or removed without difficulty. Nearly the full area of the tubes is available for the passage of the water, and the arrangement is such as to secure a very perfect circulation.

What we claim as new, and desire to secure by Letters Patent, is—

1. An improved tube-head for sectional boilers, provided with an enlarged top, serving as a steam-drum and chamber for the separation of the steam and water, substantially as and for the purpose specified.

2. The return-tubes A', in each section, arranged, as shown and described, in relation to a partition, F, and the front and rear tube-heads, substantially as and for the purposes specified.

3. In combination with a steam-drum, the deflecting partition *j* and dam E, arranged substantially as and for the purposes specified.

4. A boiler tube-head, combined and connected with a tube by a stuffing-box joint, said tube-head being provided with an opening opposite the tube, through which the joint may be packed and the tube cleaned or removed, substantially as shown and described.

5. The combination of a bonnet, *p*, and gland *m* with a bolt, *o*, substantially in the manner and for the purposes specified.

6. A boiler-tube, with nuts *r* or pins *v* secured to the ends thereof, combined with stuffing-boxes and glands, substantially in the manner and for the purposes specified.

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CHAS. E. EMERY.

Witnesses:

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