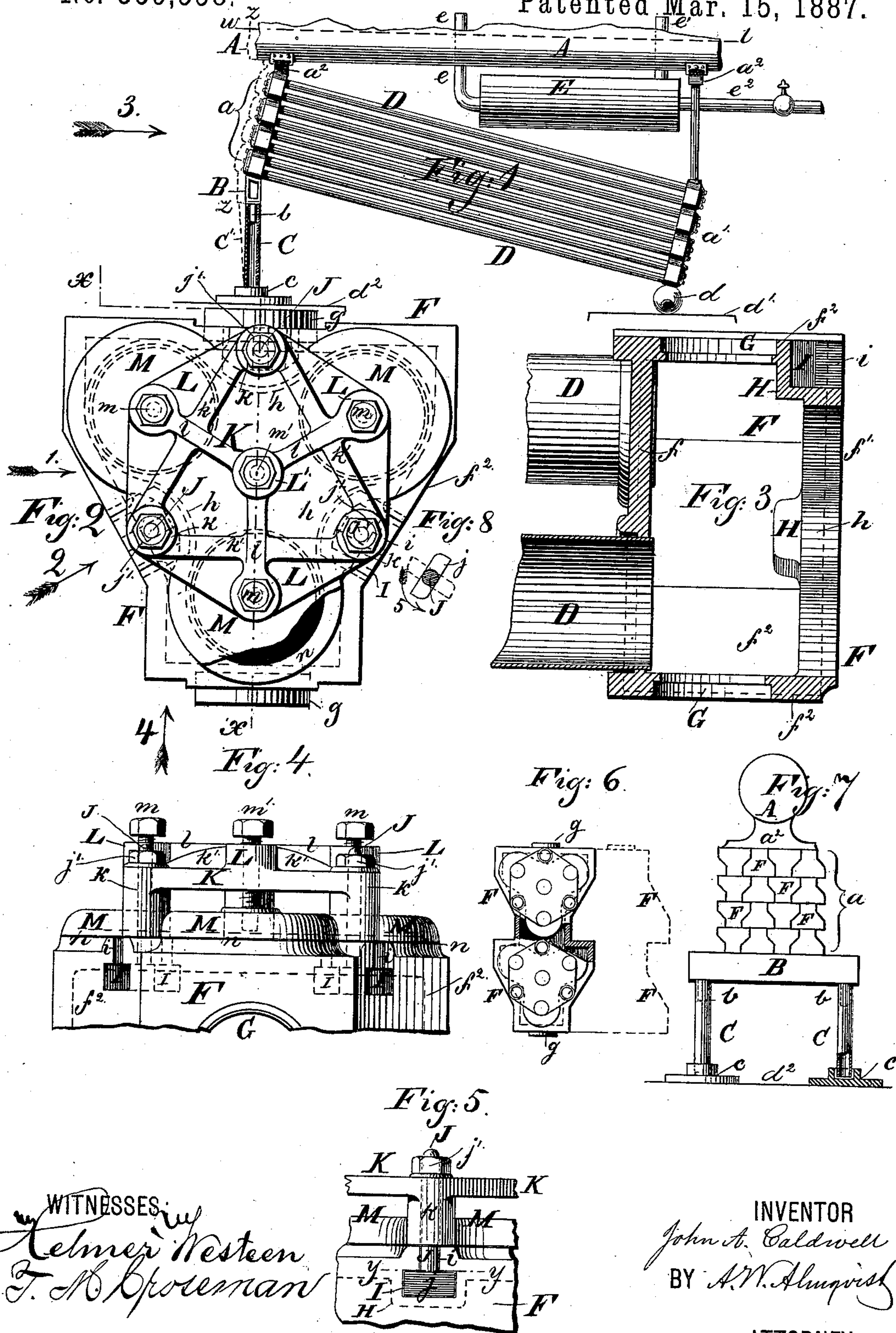


(No Model.)

J. A. CALDWELL.
STEAM BOILER.

No. 359,558.

Patented Mar. 15, 1887.



INVENTOR

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STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 359,558, dated March 15, 1887.

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To all whom it may concern:

Be it known that I, JOHN A. CALDWELL, a citizen of Great Britain, and a resident of Bay Ridge, in the county of Kings and State of New York, have invented new and useful Improvements in Steam-Boilers, of which the following is a specification.

My invention relates to sectional or water-tube boilers, in which the tubes are arranged in a nest, preferably of three to each box or header, a number of such boxes being interconnected to form the water-legs of the boiler.

My invention comprises an improved construction and device for securing the covers to the said boxes, so that a very high pressure may be maintained in the boiler without risk of leaking. No steam-joints will be required around the fastening-bolts; no bridges or other interior castings in the box will interfere with the operation of expanding the tubes and attaching them to the box, or with a free circulation of water in the boiler; clear space will be left inside to give access to the interior tubes when the covering-plate is off. The cover and the fastening-bolts are all attached to the outside of the box, and the final adjustment and replacing of the packing for the cover is facilitated; also, the manner of supporting the boiler to allow for expansion, and the manner of applying a superheater, as will be hereinafter fully described, and specifically pointed out in the claims, reference being had to the accompanying drawings, in which—

Figure 1 represents a side elevation of a water-tube boiler constructed according to my present invention, the steam and water drum being shown only partly, and the front support being broken out and the fire-place and brick-work left out. Fig. 2 is a front or end view with the cover attached and partly broken out. Fig. 3 is a vertical section of the same, taken through the line $x x$ of Fig. 2 in the direction of arrow 1. Fig. 4 is an edge view of the cover and outer part of the box, seen in direction of arrow 4 in Fig. 1. Fig. 5 is a detail view seen in direction of arrow 2 in Fig. 1. Fig. 6 is a view similar to Fig. 1, showing two boxes in one casting. Fig. 7 is a front view of the boiler, or as seen in the direction of arrow 3 of Fig. 1. Fig. 8 is a detail of the head of one of the side bolts in cross-section on line $y y$ of

Fig. 5 in position, illustrating the manner of inserting and securing it in its socket.

Like letters of reference indicate like parts in the several figures.

A is the steam and water drum, $w l$ indicating the water-line.

$a a'$ are the water-legs of the boiler, interconnected by the tubes D, and secured by saddles a^2 to the drum A. At the lower end of the rear water-leg, a' , is the usual mud-drum, d , resting on a brick or other foundation, d' .

In order to allow of free expansion, boilers of this kind are generally suspended to cross-beams above the drum A; but space and location sometimes prevent or make very difficult the putting up of such boilers on account of the necessity of providing for such beams. To avoid this I provide for expansion by securing underneath the front water-leg, a , a hollow cross-bar, B, and supporting it by means of the said bar upon tubes or socketed posts C, resting with their lower ends in a socketed plate, c , upon the brick or other foundation, d' , the bar B having downward-projecting teats or nipples b entering the upper end of the tubes or posts C.

The hollow socket in the tube C is larger than the diameter of the nipple b , and the socket in the plate c is larger than the outer diameter of the tube C, so that these parts do not fit tightly together, but allow the post C to deflect a little when the boiler expands by the heat. The mud-drum d resting firmly on its foundation d' , the whole movement due to expansion is of course forward, or toward the water-leg a .

The action of the flexible support under the water-leg a is easily understood with reference to the dotted lines toward the left, the line $z z$ indicating the supposed position of the front outline of the boiler after expansion, and the line C' indicating the corresponding inclination of the supporting-posts C.

E is the superheater, being simply a cylindrical or otherwise shaped drum arranged above the water-tubes D and underneath the water and steam drum A, directly in the path of the heat and flame from the furnace. This drum E is connected to the steam-space in the drum A by means of pipes $e e'$, at either end of the drum E, entering the drum A and pro-

jecting above the water-line. By this means nothing but steam will enter the drum E, and, superheated, will pass from there, by means of the steam-pipe e^2 , to the engine, where it is to be utilized.

F is one of the headers or boxes containing, preferably, three tubes arranged triangularly. These tubes are fastened by expanding them in holes through the back wall, f , of the box F, the front wall, f' , having one continuous opening, through which free access can be gained to the interior of the box and the three tubes D. The side walls, f^2 , of the box F are smooth, as in similar headers heretofore made, and through the upper and lower of them are made holes G, through which tubular nipples g are expanded, as usual, to connect the box F and the two adjacent boxes; or two boxes may be cast together in one piece, as shown in Fig. 6, and provided with the nipples g , to connect the same to another similar casting.

The box F has no bridges inside for the attachment of bolt-heads and the consequent obstruction to circulation of water and prevention of access to the tubes D; but the space inside is perfectly clear, as shown in Fig. 3. At three points in the sides f^2 of the casting, near the front edge thereof, and intermediate to and alternating with the location of the centers of the tubes D, are formed pockets H, with sockets I opening outward, or through the side wall. These sockets I are wide enough to receive the heads j of the bolts J, two opposite sides of the bolt-head being filed off even with the surface of the bolt-shank, and a slot, i , being made from the front to the said socket. This slot is of proper width to just receive the shank of the bolt. The mode of inserting the bolt will be readily understood by reference to Fig. 8, which is drawn opposite to the slot and socket which receive the bolt.

The bolt, with its head held in the dotted position, is inserted from the front of the casting through the slot i until the head j enters the sockets I. The bolt is then turned a quarter of a turn in direction of arrow 5, with the head in the position shown in full lines in Fig. 8, in which position it cannot of course be drawn out through the slot. To facilitate the turning, two of the diagonally-opposite corners of the bolt-head are rounded off, as shown in Fig. 8. In order to give room for the pockets H, thus accessible from the exterior, the side walls of the box are rounded off at h , so as to present a convex surface toward the inside, as shown in Figs. 2 and 3, thereby considerably strengthening the casting against the expansion due to the pressure of steam.

M is the cover common to the three tubes D and intervening space, and n is the seat or edge on the casting against which the said cover is tightened, packing being interposed, as usual, the contour or outline of the cover and the seat n being made to conform to the aforesaid inward rounding-off h .

The cover is tightened in the following manner: A hexagon plate, K, with perforated hubs

or bosses k to fit on the aforesaid three bolts, J, is secured to the box F by the said bolts and their nuts, the hubs k being long enough to make the plate K stand out a little distance beyond the cover M, which latter is of course placed between the plate K and the front of the box F. The plate K is strengthened by a triangular web, k' , formed in the casting and connecting the three bosses k . The other three corners of the hexagon plate K are also provided with bosses L, the centers of which lie in the center of the axial line of the tubes D, and a spider-web, l , cast in one piece with the plate K, unites the said three hubs L with a central hub or boss, L' . Thus the plate K is firmly secured to the box F by the three bolts J through the hubs k , and when so attached serve as a support for bolts m , which pass through holes in the aforesaid hubs L and press with their ends directly upon the outer surface of the cover M, to tighten the same to its seat. A bolt, m' , passes also through the central hub, L' , and the end of the bolt enters a socket in the surface of the cover M deep enough to support the cover temporarily pivoted upon the said bolt m' while applying or replacing the packing between the cover and its seat, while the other bolts, m , are partly unscrewed or loosened. Of course by tightening the bolt m' it will assist also in keeping down the cover to its seat.

In headers as heretofore made the cover M for three tubes, D, was held by a central bolt only, which then, however, passed entirely through the cover into the bridge or socket in the interior. This of course necessitated a packing and steam joint around the said bolt.

Experience has proved that a single bolt in the center is not sufficient to insure a tight joint, except when steam of low pressure is used, the leverage of the effective pressure being enormously large to the leverage of resistance.

By my present construction it will be seen that there are no steam-joints whatever, except that between the cover itself and its seat, and the pressure is divided upon three bolts, L, each acting in the center line of one of the tubes, and in addition to this the central bolt, L, may also be utilized, as before stated, to tighten the cover.

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

1. In a sectional steam-boiler, the combination, with a box or header having tubes communicating with the same and an opening giving access to the said tubes, of a cover, M, adapted to close the said opening, and a plate or bracket, K, bridging the said cover and secured to the outside of the said box, the said bridge-plate K being provided with set-screws or bolts m , engaging the outside of the said cover to tighten the latter against its seat, substantially as and for the purpose set forth.

2. In a sectional steam-boiler, the combination, with a box or header having tubes com-

communicating with the same and an opening giving access to the said tubes and having exteriorly pockets H, adapted to receive and retain bolts inserted from the front of the said box, of
 5 a cover adapted to close the said opening, and a plate or bracket, K, bridging the said cover and secured to the outside of the said box by bolts J, held by their heads in the said pockets, the said bridge-plate K being provided with
 10 set-screws or bolts *m*, engaging the outside of the said cover to tighten the latter against its seat, substantially as and for the purpose set forth.

3. In a sectional steam-boiler, the combination, with a box or header having tubes communicating with the same and an opening giving access to the said tubes, of a cover, M, adapted to close the said opening, and a plate or bracket, K, bridging the said cover and secured to the outside of the said box, the said
 15 bridge-plate K being provided with set-screws or bolts *m*, engaging the outside of the said cover opposite the end openings of the said tubes, and with a central set-screw, *m'*, entering a socket in the said cover M, substantially
 20 as set forth.

4. In a sectional steam-boiler, the combination, with a box or header having tubes communicating with the same, an opening giving
 25 access to the said tubes, and an inward curve in the side wall between each two adjacent tubes to afford room for fastening bolts within the outline of the box, of a cover adapted to close the said opening, and a plate or bracket,
 30 K, bridging the said cover and secured to the outside of the said box at the places provided by the said inward curving of the side walls, the said bridge-plate being provided with set-screws or bolts *m*, arranged alternately with the
 35 said fastening-bolts, the said bolts *m* engaging the outside of the said cover to tighten it against its seat, substantially as set forth.

5. In a sectional steam-boiler, the combination, with a box or header having three tubes
 40 arranged in the points of a triangle and communicating with the box, an opening giving

access to the said tubes, and an inward curve in the side wall between each two adjacent tubes to afford room for fastening bolts within the outline of the box, of a cover, M, adapted
 50 to close the said opening, and a hexagon plate or bracket, K, bridging the said cover and secured to the outside of the said box at the places provided by the said inward curving of the side walls, the said bridge-plate being provided with set-screws or bolts *m*, arranged in
 55 the three corners of the hexagon alternately with the said three corners for fastening the bridge-plate, the said bolts *m* engaging the outside of the said cover to tighten it against its
 60 seat, substantially as set forth.

6. In combination with a steam-boiler, a support, C, at one end thereof, said support being flexibly connected at its upper and lower ends to the boiler and the foundation, respectively, for the purpose of allowing free
 65 expansion.

7. The combination, with a steam-boiler, of a cross-bar, B, arranged underneath one end thereof and provided with nipples or projections *b*, posts C, and socketed plates *c*, the said
 70 nipples entering the upper end of the said posts, and the lower end of the said posts entering the sockets in the said plates *c*, substantially as specified.

8. In a sectional steam-boiler, the combination, with the water-tubes D and water and steam drum A, of a superheater, E, having end pipes, *e e'*, connecting it with the steam-space of the said drum A, and steam-supply pipe *e''*,
 75 the said heater E being arranged above the water-tubes D, between the same and the said drum A, in range of the direct heat from the furnace in the said boiler.

In testimony that I claim the foregoing as
 85 my invention I have signed my name, in presence of two witnesses, this 29th day of October, 1886.

JOHN A. CALDWELL.

Witnesses:

A. W. ALMQVIST,
 A. WAHLBERG.