No. 659,780. Patented Oct. 16, 1900.

# D. AHERN.

## STEAM BOILER.

(Application filed Apr. 13, 1900.)

(No Model.) 2 Sheets—Sheet 1.

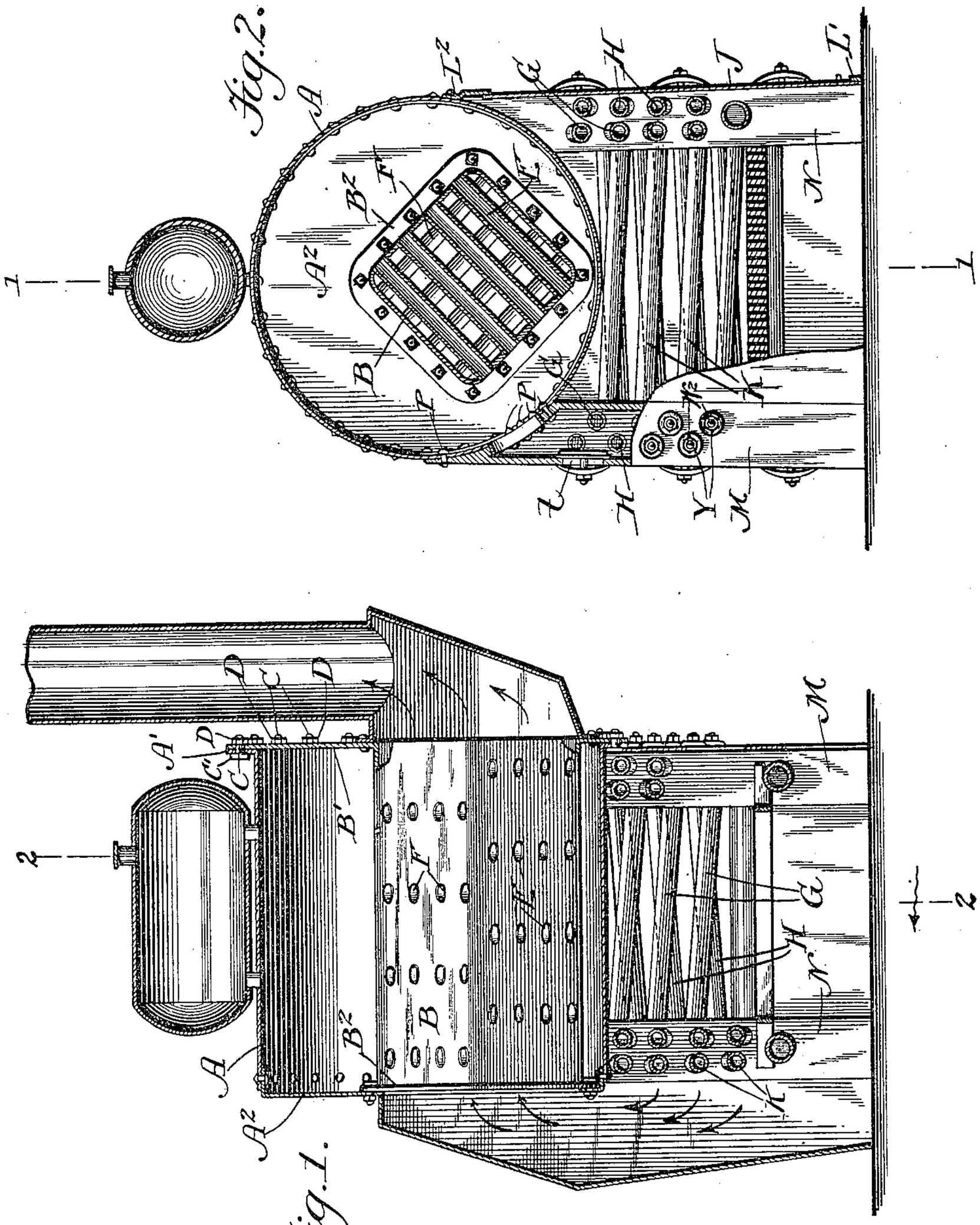


Fig. 1.

Fig. 2.

Witnesses:-
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Fig. 5.

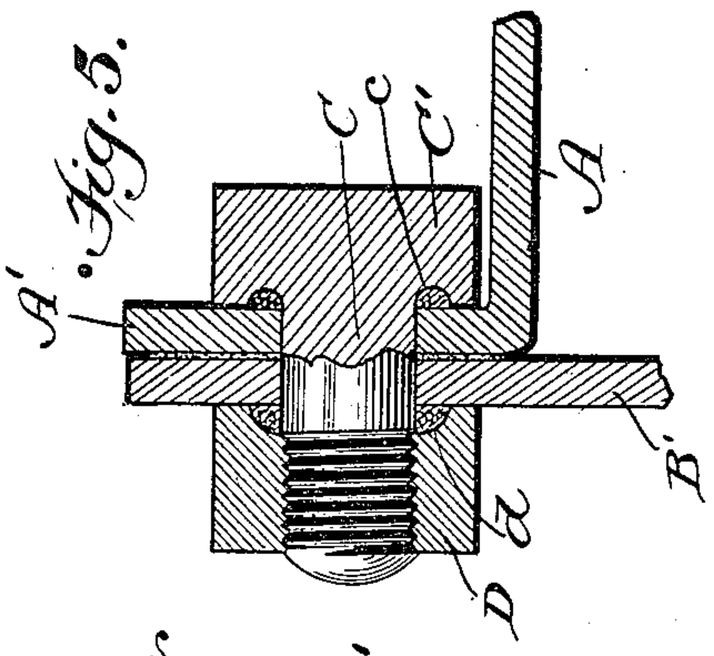



Fig. 6.

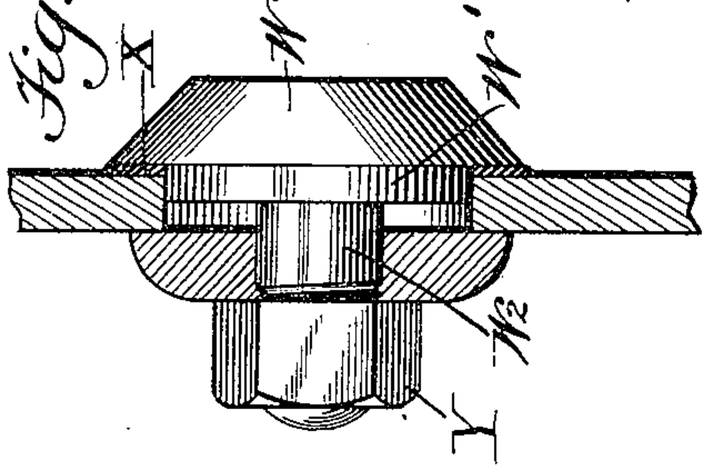



Fig. 4.

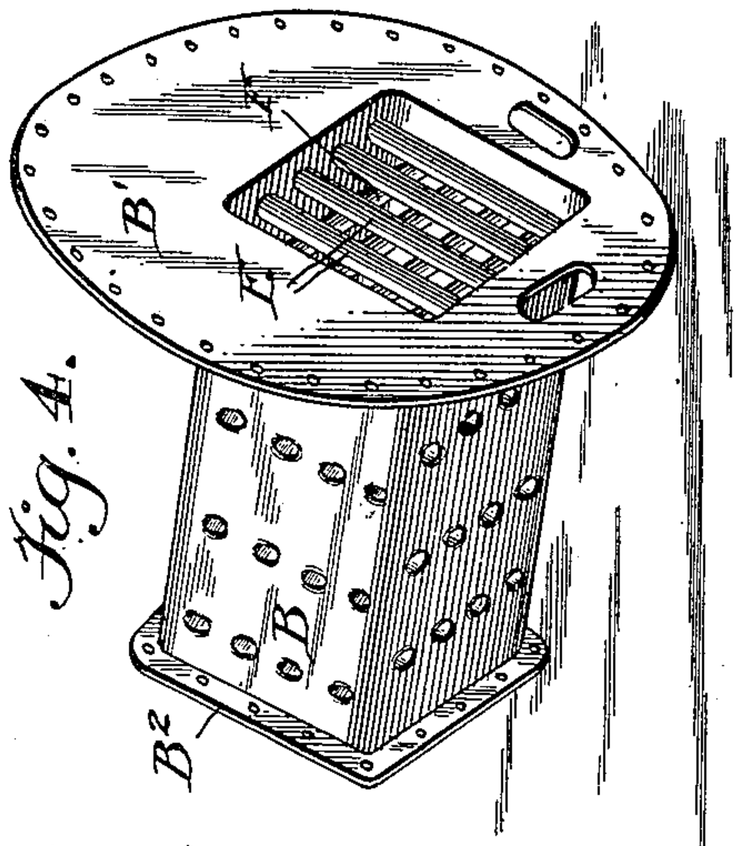
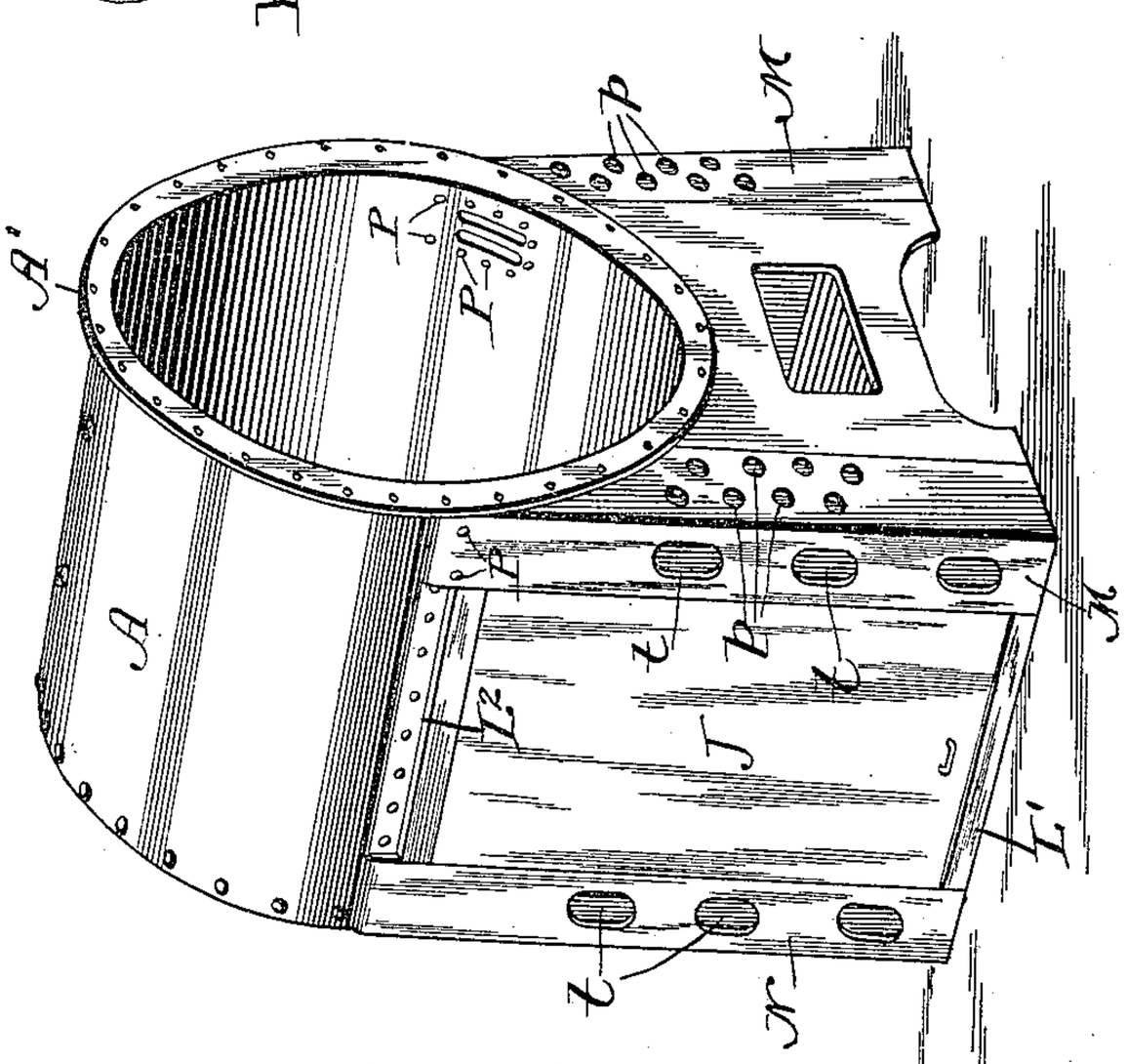



Fig. 3.




Witnesses:-
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# UNITED STATES PATENT OFFICE.

DENIS AHERN, OF NEW YORK, N. Y.

## STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 659,780, dated October 16, 1900.

Application filed April 13, 1900. Serial No. 12,661. (No model.)

*To all whom it may concern:*

Be it known that I, DENIS AHERN, a citizen of the United States, residing in the borough of Manhattan, city and State of New York, have invented a certain new and useful Improvement in Steam-Boilers, of which the following is a specification.

The invention may be carried out in boilers of any size; but I esteem it best adapted for boilers ranging from one to one-hundred horse power. It is especially adapted for locations where but little horizontal extension can be afforded.

I have in a patent to me, dated July 10, 1894, No. 522,871, set forth a construction involving some of the same principles. The present invention is an improvement on the construction therein set forth. As in the former, a removable part, of rectangular cross-section, with rounded corners, is mounted within the horizontal shell. The hot gases generated in the furnace below the shell rise at the rear end and move forward through the said removable portion, rising in a breeching at the front. I flange outward instead of inward the end of the cylindrical shell at the front. I have devised an improved construction for the junction at the front and provide means for detachably securing the flanges both at the front and rear with unusual tightness. The former boiler had horizontal tubes extending longitudinally and connecting water-legs at each side of the boiler. I use such tubes and provide an additional series alongside, inclining the series in opposite directions. I have devised peculiarly efficient and convenient means for closing the holes in the water-legs through which the tube-expander is introduced in setting the tubes and through which new tubes may be introduced when required.

The accompanying drawings form a part of this specification and represent what I consider the best means of carrying out the invention.

Figure 1 is a central vertical longitudinal section. Fig. 2 is a partial rear elevation, the main portion being a cross-section on the line 2 2 in Fig. 1. Fig. 3 is a perspective view of the shell, showing the front end; and Fig. 4 is a corresponding view of the removable portion detached. Figs. 5 and 6 represent certain details on a larger scale. Fig. 5 is a central longitudinal section of one of my bolts and of the corresponding nut securing the flanges. Fig. 6 is a corresponding section showing my provision for closing the access-holes in the water-legs.

Similar letters of reference indicate corresponding parts in all the figures where they appear.

A is a cylindrical shell flanged outward at its front end, as indicated by A′, and riveted at the rear end to the cylindrical flanged rear head $A^2$.

B is the removable casing, of rectangular cross-section, tightly and permanently united to the front plate B′, which latter is adapted to constitute when in place the front head of the boiler-shell. The casing B is flanged outward at the rear, as indicated by $B^2$.

C C are bolts thickly set in corresponding holes to connect the large front plate B′ with the flange A′ of the shell. A similar series of bolts connect the rear flange $B^2$ with the rear head $A^2$ of the shell. Each of these bolts as a large head C′, the under face of which has a annular recess *c*. The nut D has a corresponding annular recess *d*. A gasket of asbestos should be introduced under the flange in the obvious manner. The recesses *c* and *d* must be carefully filled and a little more than filled with soft cement. When the parts thus prepared are applied together and the nuts are tightened, the excess of cement spreads. The cement may be the ordinary mixture of about equal parts of white and red lead worked in oil. This construction makes a tight joint which can be easily broken and remade when required.

E and F are tubes which extend across the removable casing B and allow the water to circulate through them, inducing an active generation of steam by the traversing of the hot gases through this casing.

M and N are water-legs or headers formed as hollow steel castings of rectangular cross-section closed at the bottom. At the upper end their outline is suitably curved and adapted to match against the exterior of the shell. This joint is secured by rivets or bolts P. Cross-tubes K connect the headers N N at the rear. The headers are cast integral, with apertures cored therein, which by sub-

sequent treatment by boring-tools can tightly receive tiers of tubes G and H. These tubes extend in nearly-horizontal lines along the sides of the boiler; but they are inclined in opposite directions. The tubes G are lowest at their front ends, so that the water is received downward through the front water-leg M and delivered partially changed into steam into the rear water-leg N at the same side. The tubes M, on the contrary, are highest at the front. They receive water downward through the rear leg N and deliver it partially manufactured into steam to rise in the front leg M. I provide two liberal apertures at the junction of each leg M and N with the shell A, one of which apertures is intended to allow the descent of the water and the other the ascent of the steam in that leg. A partition I extends partially downward in each leg to better protect the descending water from the agitation and attrition due to the ascending current of steam. It is important that such partition shall not extend the whole depth of either water-leg, but shall leave a liberal space below, and there may also be spaces at various other points where the water can move across to maintain a uniform pressure, except the small difference in pressure required to maintain an active circulation.

I provide in each water-leg what may be termed "access-holes" *p*, which may be left rough, if preferred. These holes are only required to be open when a tube is to be inserted or removed and to admit the tube-expander in setting the tube. I close these by devices portions of which are applied from the interior, inserted through hand-holes *t*, which latter are closed in the ordinary manner. My provisions for closing the access-holes are as follows: Each comprises a head W, of circular form and of a diameter something larger than the hole, and a contraction W′, the latter adapted to loosely fill the hole, and a screw-threaded shank $W^2$, extending farther outward. On the annular face of the contracted portion W′ is applied a gasket or elastic washer X of sufficient size to lap on the metal of the header around the hole. These parts are introduced through a larger hand-hole adjacent, and then a nut Y is applied from the outside, which on being set tightly secures the parts together. A ring of vulcanized rubber Z is introduced under the head N and makes a tight joint with the inner face of the header.

I introduce among the tubes G H on each side of the boiler one or more stay-tubes G′ H′, which have a little greater length and are provided with screw-threaded ends, which receive nuts $G^2$ $H^2$. The other tubes may be set by expanding, the stay-tubes relieving them from tensional strain.

J is a plate preferably composed of several thicknesses of metal with asbestos interposed, which serves as a removable protection on each side of the structure between the headers M and N. It is supported in a narrow trough or groove formed in a longitudinal bottom rail L′ and by a deeper inverted groove formed in an upper rail $L^2$. The proportions are such that the plate may be lifted clear of the groove at the bottom and then on being drawn slightly outward and lowered becomes detached from the upper groove and may then be removed.

I attach importance to the fact that the flange B′ has a circular outline adapted to match to the turned-out flange A′ on the shell, because it allows as large a flange $B^2$ as may be desired on the other end of the internal shell B.

Modifications may be made without departing from the principle or sacrificing the advantages of the invention.

I have in my experiments found no difficulty in making good joints by expanding, with the tubes inclined as required; but other means may be used. I can have one or more mud-drums additional to the dead-space at the lower end of each water-leg, in which to accumulate solid matter to be blown out at intervals. There may be clothing of asbestos or other suitable material over the whole or parts of the exterior. There may be other removable or fixed plates forming further casings exterior to the side tubes G H. There may be a safety-valve, a pressure-gage, four blow-off cocks, &c., each contributing in its ordinary manner to safety and usefulness. The grate may be of any ordinary or suitable pattern.

Parts of the invention can be used without the whole. I can omit the partition I, and can have but one hole connecting each water-leg with the interior of the shell. The stay-tubes G′ H′, with their nuts $G^2$ $H^2$, may be omitted. I can dispense with the steam-drum above the shell A.

I claim as my invention—

1. In a steam-boiler having a removable internal casing B of rectangular section with cross-tubes E F set therein, the large head B′ on one end of such casing having a diameter in excess of that of the cylindrical shell, in combination with the cylindrical shell A having an outwardly-set flange A′, and provisions for releasably securing these parts together, arranged to serve substantially as herein specified.

2. In a steam-boiler having a removable internal casing B of rectangular section with cross-tubes set therein, the large head B′ on one end of such casing, in combination with a corresponding outwardly-curved flange A′ on the shell, and removable fastenings comprising each a bolt C C having an annular recess *c* and a nut D having an annular recess *d*, adapted to serve with cement substantially as herein specified.

3. In a steam-boiler having a removable internal casing B of rectangular section with cross-tubes set therein, the shell A, water-legs or headers M N connected thereto, and the

two series of oppositely-inclined side tubes G H combined and arranged to serve substantially as herein specified.

4. In a steam-boiler having a removable internal casing B of rectangular section with cross-tubes set therein, the shell A water-tubes or headers M N connected thereto and the two series of oppositely-inclined side tubes G H, the headers having access-holes *m* in line with the several tubes, and closing means for such holes comprising the internal heads W contracted portion W′ threaded shank $W^2$ yielding gasket X, and nut Y all adapted to serve substantially as herein specified.

5. In a steam-boiler having a removable internal casing B of rectangular section with cross-tubes set therein the shell A water-legs or headers M N connected thereto and the two series of oppositely-inclined side tubes G H and partial partitions I combined and arranged to serve substantially as herein specified.

6. In a steam-boiler having a removable internal casing B of rectangular section with cross-tubes set therein, the shell A, water-legs or headers M N connected thereto, and the two series of oppositely-inclined side tubes G H, the longitudinal grooved rails L′ $L^2$ the uppermost grooved the deeper, and the non-conducting-plate J mounted detachably in such grooves, all arranged to serve substantially as herein specified.

In testimony that I claim the invention above set forth I affix my signature in the presence of two witnesses.

DENIS AHERN.

Witnesses:
WILLIAM PAXTON,
J. B. CLAUTICE.