

(No Model.)

4 Sheets—Sheet 1.

W. SELLERS, G. S. STRONG & H. B. BRADFORD.
STEAM BOILER.

No. 544,130.

Patented Aug. 6, 1895.

Fig. 2.—

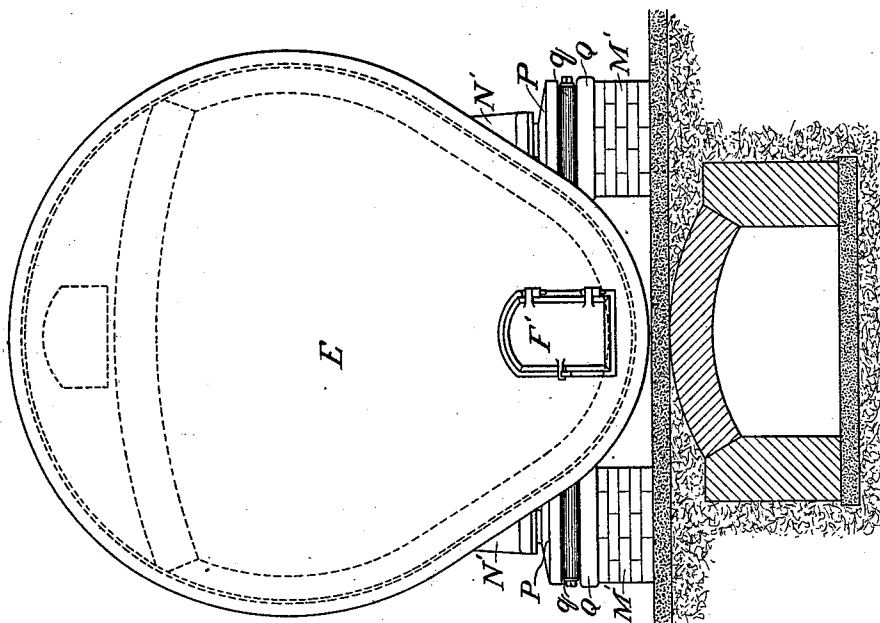
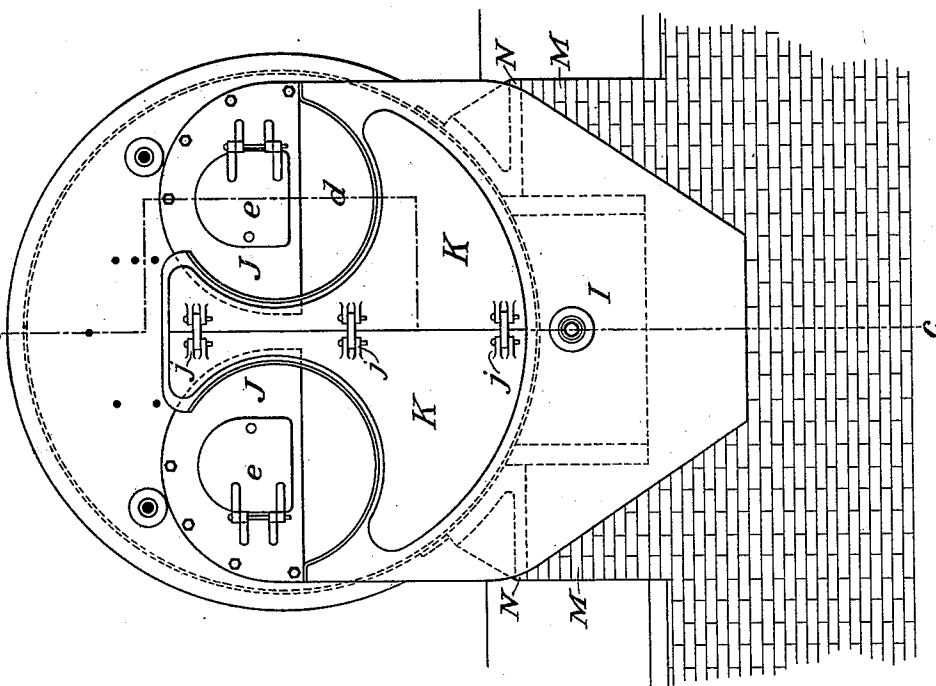


Fig. 1.—



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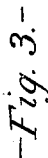
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(No Model.) 4 Sheets—Sheet 2

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STEAM BOILER.

Patented Aug. 6, 1895.



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(No Model.)

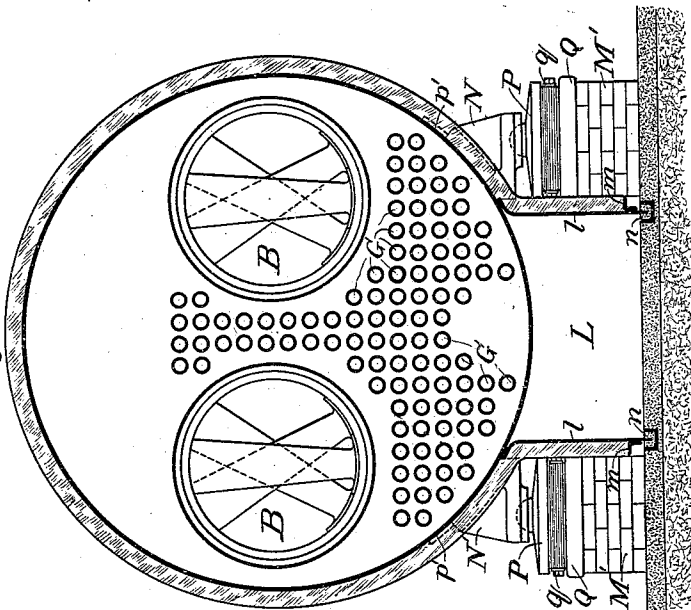
4 Sheets—Sheet 3.

W. SELLERS, G. S. STRONG & H. B. BRADFORD.
STEAM BOILER.

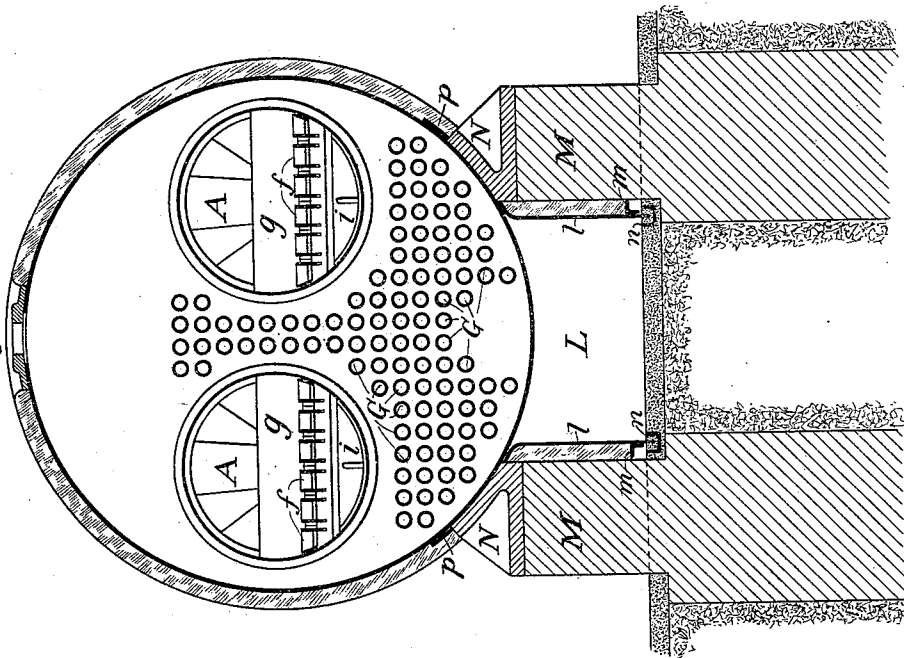
No. 544,130.

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—Fig 5—



—Fig. 4—



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4 Sheets—Sheet 4.

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STEAM BOILER.

No. 544,130.

Patented Aug. 6, 1895.

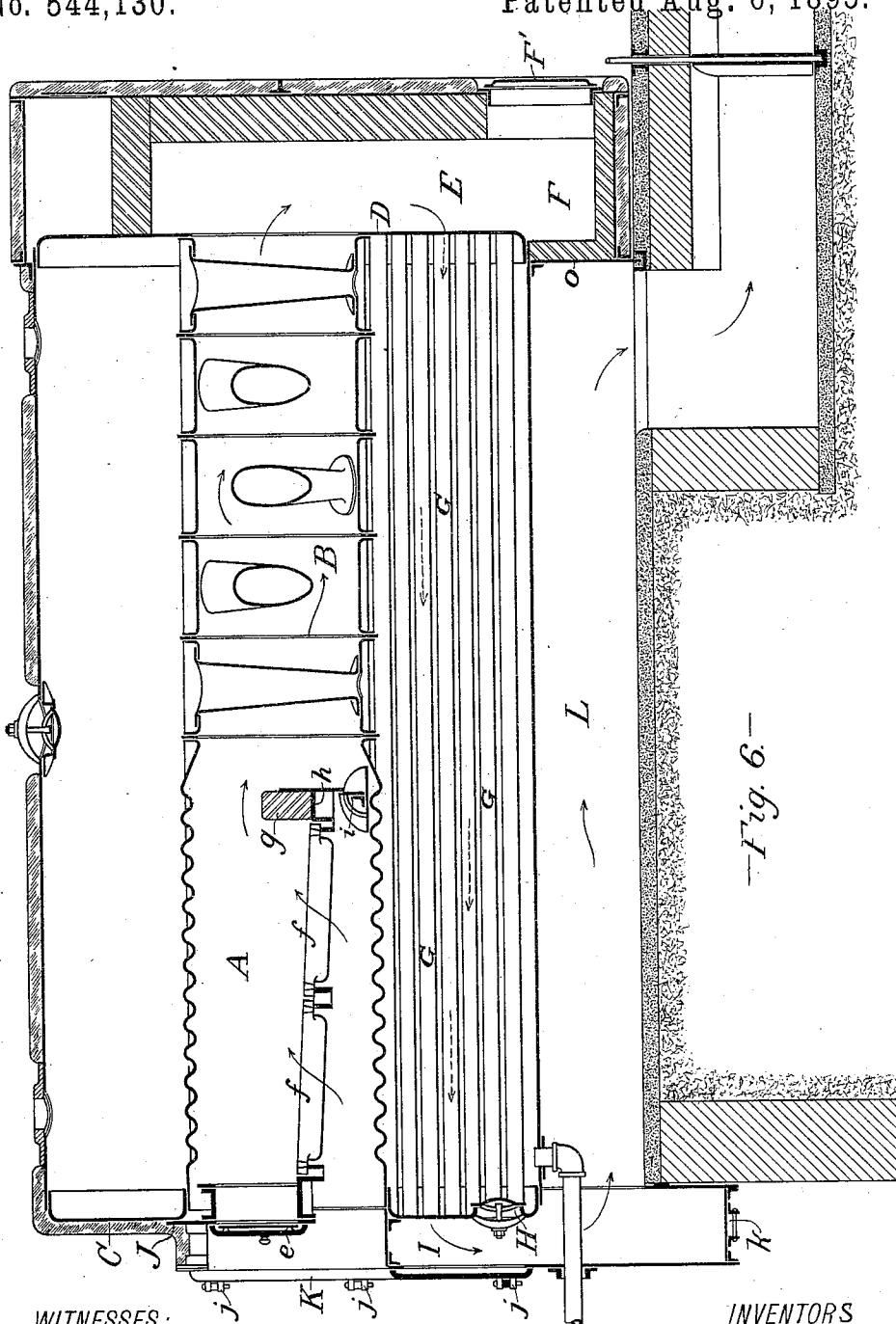


Fig. 6.—

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UNITED STATES PATENT OFFICE.

WILLIAM SELLERS, OF PHILADELPHIA, PENNSYLVANIA, GEORGE S. STRONG, OF NEW YORK, N. Y., AND HENRY B. BRADFORD, OF WILMINGTON, ASSIGNORS TO THE EDGE MOOR IRON COMPANY, OF EDGE MOOR, DELAWARE.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 544,130, dated August 6, 1895.

Application filed May 1, 1895. Serial No. 547,741. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM SELLERS, of the city of Philadelphia, in the State of Pennsylvania, GEORGE SIMPSON STRONG, of the city of New York, in the State of New York, and HENRY BANNING BRADFORD, of the city of Wilmington, in the State of Delaware, have invented certain new and useful Improvements in Steam-Boilers, of which improvements the following is a specification.

These improvements relate to that class of cylindrical steam-boilers known as "internally-fired return tubular."

This form of boiler is usually provided with two furnaces and a manhole between and below them for access to the interior of the boiler-shell and an uptake within the boiler near the rear end, into which the products of combustion from the furnaces are discharged, and from which they are carried through tubes above the furnaces to a smoke-flue at the front of the boiler and above its fire-doors to the chimney. With this construction the greatest heat of combustion is far below the surface of the water, so that the evolution of steam produces foaming when the work of the boiler is pushed to its maximum. Moreover, the smoke-flue being above the firing-doors compels the discharge of the products of combustion upward, whereby the light cinders and ashes must be carried forward with the current of heated gases without opportunity to separate otherwise than as a deposit in the flues or tubes, while ashes accumulate in the uptake, which cannot be removed while the boiler is in service.

One object of our improvement, therefore, is to apply the greatest heat as near as possible to the surface of the water and at the same time to render the interior of the boiler accessible throughout its length, also to avail of the greater specific gravity of the cinders and ashes and to separate them from the gaseous products of combustion whenever the downward direction of the currents of gaseous products is changed.

Another is to carry off the products of combustion to the chimney along the under side of the boiler and at the same time provide for

the expansion and contraction of the boiler without affecting its setting.

Another is to provide a support for that end of the boiler which is movable upon its setting, which shall automatically adjust itself to produce a uniform pressure thereon.

Another is to provide for removing the solid products of combustion from the tubes without removing from the boiler any part of the covering of its smoke-flues; and another is to provide a descending smoke-flue on the front head of the boiler outside of and between and below the fire-door frames, which flue forms an extension of the ash-pits under the furnaces.

To these ends our invention consists in two or more furnaces with combustion-chambers, which respectively connect the front and back heads of the boiler and open through both, a smoke-flue outside the back head, and return-tubes secured in both heads between and below the tops of the furnaces and combustion-chambers.

It further consists in downward smoke-flues with cleansable receptacles below their outlets for the products of combustion.

It further consists in a series of horizontal tubes arranged in vertical lines and a hinge-jointed cover secured upon the front smoke-flue, the joint in this cover in a plane that will pass between the vertical lines of the tubes.

It further consists in a smoke-flue, the top of which is the boiler, from which the two sides and one end of the flue are suspended and penetrate a sand-joint on the bottom to a depth that will practically exclude the air.

It further consists in two fixed supports at one end of a boiler and two roller-supports at the other, the weight at the roller end transmitted to the roller-supports respectively through a ball and socket, and it further consists in a descending smoke-flue on the front boiler-head, which flue is outside of and between and below the fire-door frames and forms an extension of the ash-pits under the furnaces.

That our improvements may be more clearly understood, we will now describe the draw-

ings, which form a part of this specification, in which—

Figure 1 represents a view of the front end of our boiler, showing the firing doors and frames with the descending smoke-flue at this end between and below the firing-door frames. Fig. 2 is a view of the descending smoke-flue at the back end of the boiler with its cleaning-door. Fig. 3 is a side elevation of the boiler, showing its descending smoke-flues at the back and front ends and the flue underneath the boiler. Fig. 4 is a cross-section of the boiler on the line *a a*, Fig. 3. Fig. 5 is a cross-section of the boiler on the line *b b*, Fig. 3; and Fig. 6 is a longitudinal section of the boiler on the lines *c d c*, Fig. 1.

In all of the figures similar letters indicate similar parts.

The fire-door *e*, grate-bars *f f*, and bridge-wall *g* are clearly shown with the furnaces A A, Figs. 4 and 6. The bridge-walls *g g* rest upon bars *h*, which are supported by their ends resting against the curved sides of the furnaces A A, and under the bars *h* are stopper-plates *i i*, which are removable for the purpose of cleaning the ashes from the combustion-chambers B B at the rear of and securely fastened to the furnaces A A.

The front head C of the boiler is flanged to receive the ends of the two furnaces A A, to which it is firmly riveted, and the rear ends of the combustion-chambers B B are flanged to afford suitable attachment to the back head D, to which they are securely riveted, and openings slightly larger than the interior of the combustion-chambers B B are made through the back head D, which admit the products of combustion from the furnaces A A to pass into the descending smoke-flue E. This smoke-flue is composed of plates of iron or steel suitably joined and braced with angle and T irons and securely fastened to the rear end of the boiler. Its interior is lined with fire-brick, as shown, and its exterior, as also that of the boiler, is covered with suitable non-conducting material. This flue E extends below the bottom of the boiler to form a receptacle F for the light cinders and ashes that will be carried through the combustion-chambers B B by the currents of gaseous products of combustion, from which, by reason of their greater specific gravity, they will tend to separate, as these currents change their downward direction to a horizontal one to enter the tubes G G.

The receptacle F is provided with a door F', shown in Figs. 2 and 6, through which the contents of the receptacle can be conveniently removed.

The location of the tubes G G in the boiler-heads C and D is clearly shown in Figs. 4 and 5. The space in the bottom of the boiler is provided for access to clean or repair the boiler-shell or the tubes, and entrance thereto is afforded through the manhole H, Fig. 6. The tops of the highest tubes are not required to extend above the tops of the furnaces to af-

ford sufficient draft area and they are limited to this line that the water-level may be conveniently determined. The ends of the tubes G G are expanded into the front and back heads C and D of the boiler, and these tubes, with the furnaces A A and combustion-chambers B B, afford efficient support for the boiler-heads.

The descending smoke-flue I and its doors for affording access to the tubes for cleaning them are shown in Figs. 1, 3, and 6.

The fire-door frames J J are secured against the front head of the boiler in the usual way, and the smoke-flue I is between and below the fire-door frames, extending outward from the boiler-head a distance sufficient to afford the requisite draft area, and the top of that part of the flue under the fire-doors conforms to the curvature of the furnace, so as to extend the ash-pits thereof. The front of this smoke-flue is partially covered by the hinge-jointed doors K K, the opening through the front plate of the smoke-flue under the doors being such as to permit any tube to be withdrawn from the boiler through this opening. The doors are bolted to the front plate of the flue and are hinged together by the hinges *j j j*.

When it is desired to clean the inside of the tubes one of the doors is unbolted from the smoke-flue and swung backward over the other and when the tubes opposite this door are cleaned the door is replaced and rebolted to the flue. The other door may then be treated in the same way, and when its tubes are cleaned it can be replaced and secured as before.

It is necessary for the purpose of repairing or for cleaning the tubes that the hinge-joint of the doors shall be opposite the space between the tubes, as otherwise all of the tubes could not be exposed, and thus arranged each door becomes in turn the fulcrum-post for the other to swing upon.

That part of the smoke-flue I below the doors K K is covered permanently, and this part of the flue is carried down below the horizontal flue L, which passes under the boiler, so as to form a receptacle for ashes at this point, and a sliding door *k* in the under side of the flue I is provided for their convenient removal.

The smoke-flue L is formed by plates *l l* secured to the under side of the boiler, as shown in Figs. 4 and 5, the lower edges stiffened by angles *m m*, below which the plates project into troughs *n n* filled with sand, the plates entering the sand to a depth which will practically exclude the air from entering the flue, while the sand will permit freedom of movement to the plates. The back end of the flue L is closed by a plate *o*, Fig. 6, secured to the boiler at its upper edge, and at its lower edge it enters a trough filled with sand, like the side plates. The troughs for sand extend thus around the flue L, which may then extend from the descending smoke-flue I on the front head of the boiler to the descending smoke-

flue E on the back head, and as the boiler itself forms the top of the flue L the whole length of the boiler is exposed to the heat of this flue. We have described these troughs as filled with sand, that being the substance commonly used for such a purpose, but any other granular substance that is sufficiently fine and refractory may be used.

The boiler is supported upon four piers of masonry, two on each side of the flue L. Upon the two M M at the front end, Figs. 3 and 4, two castings N N are secured, which fit the curvature of the boiler and are supported thereon by the plates p p, which are riveted to the boiler-shell. Similar castings N' N' are fitted and supported by the plates p' p' on the boiler-shell at the back end of the boiler; but that part of these castings over the piers M' M' at this end are provided with sockets, into which hemispherical projections on the centers of the plates P P are fitted. The under sides of the plates P P are planed true and rest upon a series of rollers q q, journaled at their outer ends and connected together by bars on each side, which are perforated to fit the pin-journals on the outer ends of the rollers, as is well understood. The rollers q q are supported upon the plates Q Q, the upper surface of which is planed true, and the under side rests upon and is firmly secured upon the top of the masonry in the piers M' M'.

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

1. An internally fired return tubular boiler, provided with two or more furnaces with combustion chambers, which respectively connect the front and back heads of the boiler, and open through both to a smoke flue outside the back head, in combination with return tubes secured in both heads, between and below the tops of the furnaces and combustion chambers.

2. An internally fired return tubular boiler

arranged to discharge products of combustion outside of its back and front heads respectively, into downward smoke flues, provided with cleansable receptacles for ashes and cinders, below that point in each flue, where the direction of its gaseous current is changed and with doors leading into said receptacles.

3. An internally fired return tubular boiler provided with horizontal return tubes arranged in vertical lines in combination with a smoke box on the front of the boiler into which said tubes open, and a cover for said smoke box made in jointed sections with the joints lying in planes passing between vertical lines of tubes, and each cover section hinged to the adjacent section so as to fold back upon it and leave all tubes normally covered by it exposed.

4. An internally fired boiler, provided with a smoke flue, the top of which is the boiler, from which the two sides and one end of the flue are suspended, in combination with a seal of granular material supported on the independent bottom of the flue and into which the suspended plates extend to a depth which will practically exclude the air.

5. An internally fired boiler provided with two fixed supports at one end and two roller supports at the other, the weight at the roller end transmitted to the roller supports respectively, through two ball and socket joints.

6. An internally fired return tubular boiler provided with two or more furnaces, and a series of return tubes arranged between and below the furnaces and a descending smoke flue on the front boiler head, which flue is outside of and between and below the fire door frames, and forms an extension of the ash pits under the furnaces.

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