2 Sheets—Sheet 1.

W. MOORE.

Steam-Boiler.

No. 219,292. Patented Sept. 2, 1879.

Fig. 1

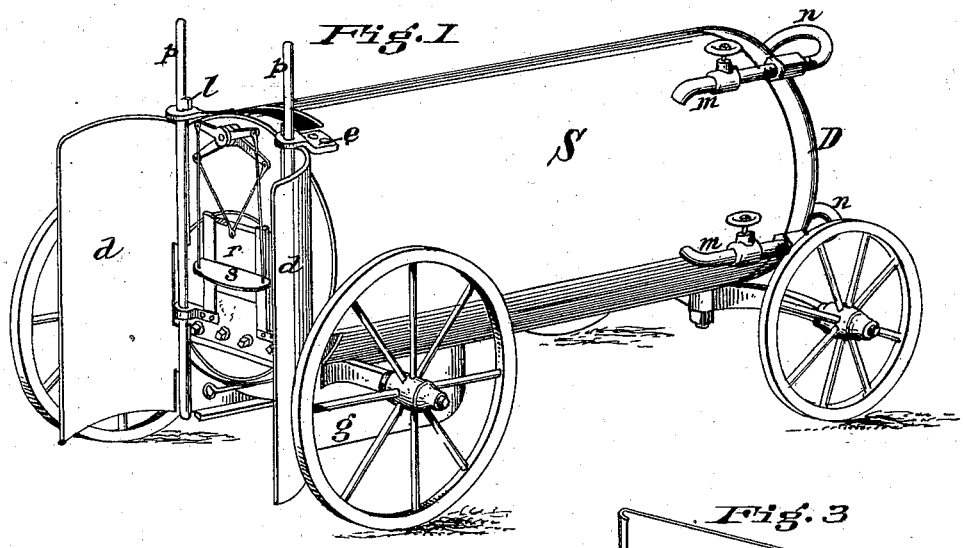


Fig. 3

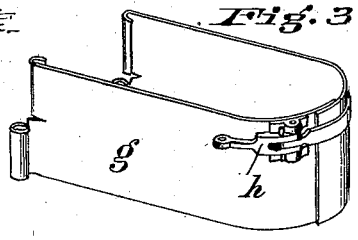


Fig. 2

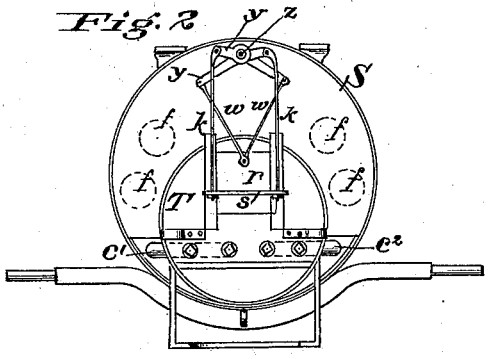
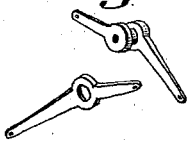


Fig. 4



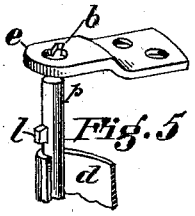
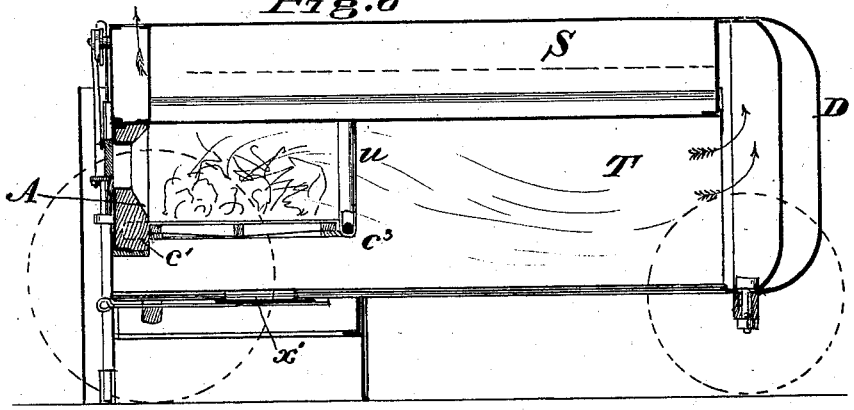


Fig. 5

Fig. 6



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Steam-Boiler.

No. 219,292. **Patented Sept. 2, 1879.**

Fig. 1

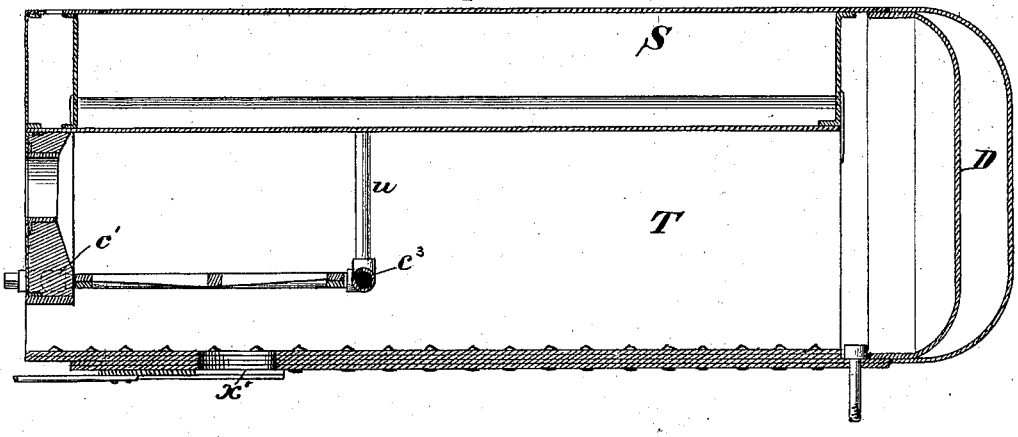


Fig. 2

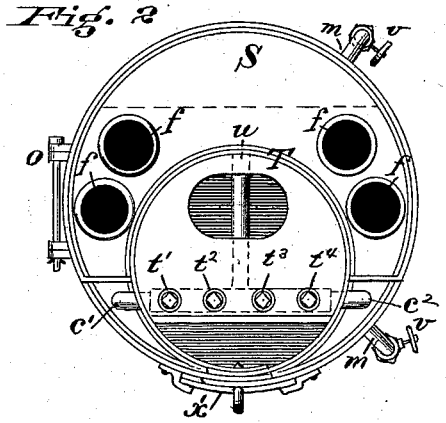


Fig. 3

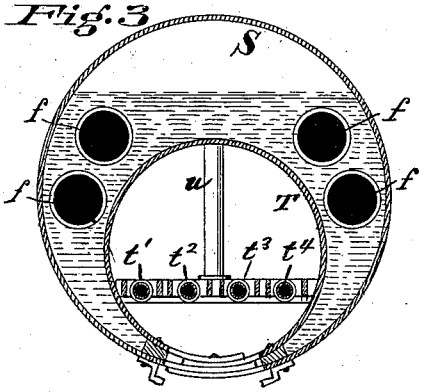


Fig. 4

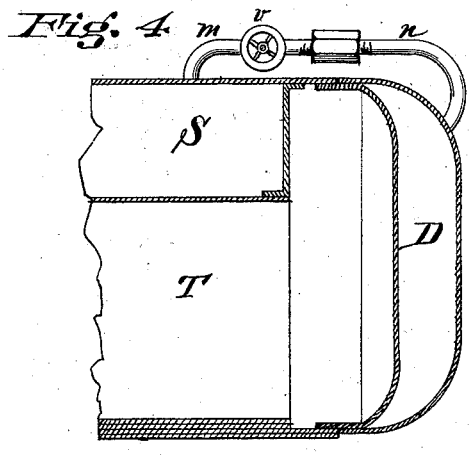
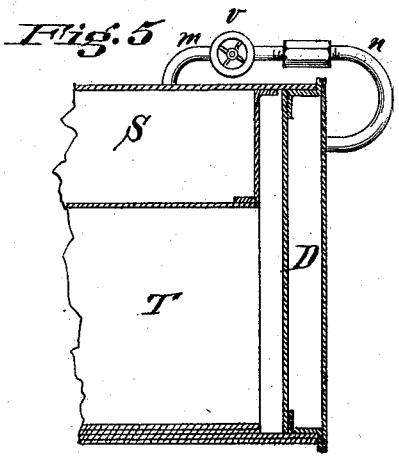


Fig. 5



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UNITED STATES PATENT OFFICE.

WILLIAM MOORE, OF KOKOMO, INDIANA.

IMPROVEMENT IN STEAM-BOILERS.

Specification forming part of Letters Patent No. **219,292**, dated September 2, 1879; application filed March 1, 1879.

To all whom it may concern:

Be it known that I, WILLIAM MOORE, of Kokomo, Howard county, Indiana, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a full and exact description, reference being had to the accompanying drawings, forming part of this specification, and the letters of reference marked thereon.

My invention relates more especially to that class of portable return-flue boilers used in agricultural and similar service, and is designed to increase the capacity and efficiency of such boilers, and adapt them more perfectly to the use of straw, stubble, brush, and other similar material as fuel, and to lessen the danger of communicating fire to surrounding objects, especially in districts where the prevalence of winds renders the use of such boilers dangerous to a degree that bars their general use for purposes to which they are best adapted, such as thrashing grain, &c.

To this end, therefore, my invention consists, first, in a peculiar construction of the boiler and flue, which, while preserving the large main flue so desirable in straw-burning boilers, obviates the disadvantages heretofore incident thereto, as hereinafter indicated; second, in a novel construction of removable water-back for the boiler, constituting the outer wall of the smoke-box or combustion-chamber; third, in a novel arrangement of an opening in the shell of the boiler and through the flue under the grate, and an ash-shield beneath said aperture, as hereinafter more particularly described; fourth, in exterior adjustable doors, in combination with the furnace-front and ash-pit, whereby the operation of firing the boiler is rendered more safe and the danger from high winds avoided; fifth, in an automatically-operating furnace-door and its attachments, to facilitate the firing of the boiler with straw and other light fuel and avoid the introduction of unnecessary drafts of cold air; sixth, in a novel combination and arrangement of the cylindrical boiler, cylindrical flue, and a water-grate arranged within the flue and connected with the water-space of the boiler, as hereinafter more particularly described.

In the drawings herewith, Sheet 1, Figure 1 is a perspective view of my invention as exhibited in a horizontal portable boiler. Fig. 2 is an end view of the boiler, showing the furnace-door and connections and exposed ends of the water-grate tubes. Fig. 3 is a perspective view of the ash-pit walls detached; Fig. 4, the double levers by which the furnace-door is operated, shown detached; Fig. 5, a detached view, in perspective, of one of the brackets supporting the hinge-pivots of the exterior safety-doors, with part of its hinge and door. Fig. 6 is a side sectional elevation of the boiler, showing details of the water-grate.

Sheet 2: Fig. 1 is a side sectional elevation of the boiler, showing details of the main flue and boiler connection. Fig. 2 is an end view of the boiler taken from the furnace end; Fig. 3, a vertical end section of the boiler taken through the water-grate and ash-pit opening; Fig. 4, a side sectional view of the forward end of the boiler, showing the water-head and connection; and Fig. 5 is the same view, showing a modified form of water-head.

Similar letters of reference indicate similar parts.

For convenience of description I will refer to the various portions of my invention in order, as hereinbefore set forth.

First, as to the construction of the boiler and flues. The usual practice heretofore has been to construct the outer shell, S, and fire-box flue T separately, and in connecting them together to have a large water-space between the two under the flue. This construction required relatively a large boiler-shell or a diminished diameter of the flue, and in either case permitted a very slight depth of water above the top of the flue which forms the crown-sheet. The disadvantages and danger of this construction are obvious, and led to a construction in which the flue was formed of a curved sheet, forming the upper part and sides of the flue, riveted to the boiler-shell in such a manner that the boiler-shell itself formed the continuation and bottom of the flue. This construction, while obviating some of the disadvantages of the former, entailed

greater danger in materially lessening the strength of the boiler, as will be obvious from a consideration of the sectional figure presented by such construction.

In my invention I combine the advantages, while avoiding the disadvantages, of both constructions. I construct both the boiler S and flue T in cylindrical form, leaving the lower joint of the boiler-shell and of the flue disunited. The joints are then placed together and riveted, so that the same set of rivets forms both joints and unites the flue and boiler-shell together at the bottom of their respective circumferences, as shown in the drawings. By thus uniting the flue and boiler together I am enabled to secure a large combustion-chamber, preserving the circular section of boiler and flue, without encroaching upon the water or steam space, besides materially lessening the cost of construction by finishing and uniting both boiler and flue in one operation. Any number of return-flues *f f* may be arranged around and above the main flue T.

The water-back D consists of a double cover with water-space between, hinged at *o* to the boiler, forming the outer wall of the smoke-box or combustion-chamber. It is united to the boiler by ordinary pipe-connections *m* and *n*, with detachable unions above and below the ordinary water-level, thus affording communication with both water and steam space of the boiler, which is constantly maintained while the boiler is in operation. When desirable to remove the water-front to obtain access to the smoke-box, the valves *v* are turned to cut off communication between the boiler and water-front, the unions unscrewed, and the water-front swung open upon its hinges.

In Figs. 4 and 5, Sheet 2, I have shown two forms, that shown in Fig. 4, with curved interior and exterior heads, being designed to afford a larger smoke-box or combustion-chamber without lengthening the shell of the boiler for that purpose.

The water-grate is constructed with two sets of horizontal tubes, upon which the fuel rests, all connected at their rear ends by a cross-tube, which is connected with the water-space of the boiler by a vertical pipe passing through the top of the main flue.

For convenience of illustration I have shown in the drawings a grate consisting of four horizontal tubes, t^1 t^2 t^3 t^4, all being connected in rear by a cross-tube, c^3, and suspended from the top of the main flue T by the central vertical tube, *u*, thus forming connection at that point with the water-space of the boiler. The tubes *t* are connected in front in pairs, as indicated in Fig. 2, Sheet 1, by pipes c^1 and c^2, which extend laterally through the shell of the flue outside of the boiler-head, and connect by suitable unions with the water-space of the boiler at the level of the grate. The grate-tubes *t* extend sufficiently beyond their respective front connecting-pipes, c^1 c^2, to project through the front wall, N, of the flue T, their open ends being provided with detachable plugs, by which convenient access is afforded to the grate-tubes for cleaning.

When necessary, intermediate grate-bars may be inserted between the grate-tubes.

When in operation, the flame, passing around the vertical connecting-tube *u*, heats its contents to a greater degree than elsewhere, and causes it to rise into the inner space of the boiler, its place being supplied by water flowing from the boiler at a lower level through connecting-pipes c^1 and c^2, and through the respective sets of grate-tubes *t* and connecting-tube c^3, thus creating and maintaining a constant circulation of water through the grate-tubes. By supplying the connecting-pipes c^1 and c^2 with proper valves to close the connection with the boiler the cleaning of the water-tubes may be effected by drawing the fire while sufficient steam-pressure is in the boiler and blowing through the grate-tubes by removing the forward end plugs.

The opening in the main flue T and shell of the boiler S, beneath the grate, is designed to permit the ashes of the fuel to fall directly downward, and avoid the necessity, otherwise incident to boilers of this construction, of raking the ashes out of the forward end of the flue T.

The construction is indicated in Figs. 1 and 3, Sheet 2, and Fig. 6, Sheet 1.

A sliding door, *x'*, moving in guiding-bracket attached to the shell of the boiler beneath and operated by a handle extending forward, governs this aperture. The use of the aperture is sufficiently obvious, and its special advantages will appear hereinafter.

In connection with the aperture before described, I provide the boiler with a flange, *g*, permanently attached to the boiler beneath and around three sides of the ash-pit opening. The sides of the flange being parallel, provision is afforded for the insertion of an ash-pan resting upon brackets secured by the inner sides of the flange *g*.

In burning straw, corn-stalks, and similar fuel, the ash-pan is dispensed with and the extension *g'* (shown in Fig. 3, Sheet 1) is attached to the permanent portion *g*. This extension, when secured in position, is intended to rest upon the ground, and form the vertical walls of the ash-pit, and prevent its communication of fire to surrounding objects. It is formed of two sheets of metal of sufficient width, bent so that when placed together they overlap and conform to the contour of the flange *g* upon the boiler, of which they are intended to constitute the extension. A suitable clamp, *h*, serves to secure the parts in position, yet permit the removal of the part *g*.

The safety-doors *d d* are attached to the furnace-front upon pivots *p*, passing through perforated brackets *e* attached to the boiler. Provision is made in the length of the pivots for the elevation of the doors sufficiently to keep them out of the way when the engine is being transported from place to place. When

stationary and in use, the doors *d d* are allowed to rest upon the ground, thus completing the front of the ash-pit, and forming in connection therewith a complete guard against the communication of fire.

The doors are sufficiently large to protect the entire furnace-front, and are curved so as to overlap when closed.

When the engine is transported the doors are raised up with their pivots *p*, and held by means of stops *l* upon the pivots, which, in a certain position of the doors, register with *b* in the perforated brackets, which allow the pivots to pass upward or downward only in that position. When depressed upon the ground the lower ends of the pivots *p* pass within loops formed by rear extensions of the extension *g* forming the walls of the ash-pit.

The automatic fire-door and its attachments consist of a door, *r*, moving between vertical guides in the front of the main flue T, and suspended by means of rods *w w* to the ends of double levers *y y*, centrally pivoted to the front of the boiler above the door at *z*. From the opposite ends of the levers *y y* depend rods *k k*, sustaining a plate, *s*, and flange *s'*, moving vertically between the door-guides below the door. The levers *y y* are shown in detail in Fig. 4, Sheet 1.

By this arrangement, as will be seen, a weight or pressure upon the plate *s* tends to elevate the fire-door *r* by means of the rods and pivoted levers.

The plate *s* is furnished with a rear flange, *s'*, which forms one-half the covering of the fuel-opening, corresponding with the fire-door *r*, which forms the upper half.

It is intended that the fire-door *r* shall be of sufficient weight to counterbalance by its gravity the plate *s* and its flange *s'*, so that ordinarily the parts shall be together, closing the fuel-aperture, but that the additional weight of a shovel of coal, stick of wood, or fork of straw, placed upon the plate, shall depress it, elevate the door *r*, and open the aperture.

It is not necessary that the part called a "plate" shall be such in fact. A simple brace extending in front will serve the same purpose. It is not intended to rest the fuel on, preparatory to feeding the fire, but simply to afford a means of depressing that part and open the door by the act and means of feeding the fire. When the pressure is removed the parts again come together by gravity and close the aperture.

The advantages of this construction in lessening the danger of communicating fire and in obviating unnecessary drafts of air are obvious without detailed description.

The flue T at the furnace-front has been usually closed heretofore by a sheet-iron wall, with an interior protecting-shield. This is eventually expensive, and requires frequent renewal. I substitute therefor a closing wall, of fire-brick material or other refractory substance, of sufficient thickness to protect the exposed end of the flue T, as shown at A, Fig. 6, Sheet 1. This construction I find far more durable, besides being much less expensive; and as boilers of this class are chiefly used in districts remote from repair-shops, the advantages are obvious.

Having fully described my invention, I claim and desire to secure by Letters Patent—

1. The combination, with the cylindrical boiler S, of the cylindrical main flue T, of approximately equal length thereto, the outer periphery of the flue touching the inner periphery of the boiler-shell at their bottoms, said flue and boiler being riveted together on a longitudinal line, the same set of rivets serving to secure the laps of both the flue and boiler-shells and to hold the flue and boiler together, and a fire box or grate arranged within one end of said flue, substantially as described.

2. The removable hollow water-back D, constructed of two concave plates riveted together at their coinciding edges, and hinged to the boiler to form the outer wall of the smoke-box or combustion-chamber, the concavity of the inner plate of said water-back forming a passage for the products of combustion, substantially as described, and connected by separable pipe-joints with the steam and water spaces of the boiler, substantially as specified.

3. In combination with a fire-box flue-boiler, constructed, as described, with an aperture beneath the grate through said flue, the shield *g*, forming an ash-pit and support for an ash-receptacle, substantially as specified.

4. In combination with a portable fire-box flue-boiler provided with an opening beneath the grate through said flue, the extensible and removable shield *g'*, forming an ash-pit upon the ground, substantially as specified.

5. The combination of the fire-door *r*, moving vertically upon guides, suspending-rods *w w*, levers *y y*, rods *k k*, and flanged plate *s*, substantially as and for the purpose specified.

6. In combination with a cylindrical boiler provided with a main flue, cylindrical in form, one end of which forms a fire-box, the bottom of said flue being provided with an aperture under and in combination with a water-grate, the inner end of which is located within the flue, and communicates with the water-space of the boiler by means of a pipe, *u*, all arranged to operate in the manner and for the purpose set forth.

In testimony whereof I have set my hand.

WILLIAM MOORE.

Witnesses:

L. M. HOSEA,

JOHN OSTERHAGE.