G. M. BEAN.

LOCOMOTIVE BOILER FIRE BOX.

APPLICATION FILED AUG. 3, 1914.

1,138,066.

Patented May 4, 1915.

2 SHEETS—SHEET 1.

Fig. 1

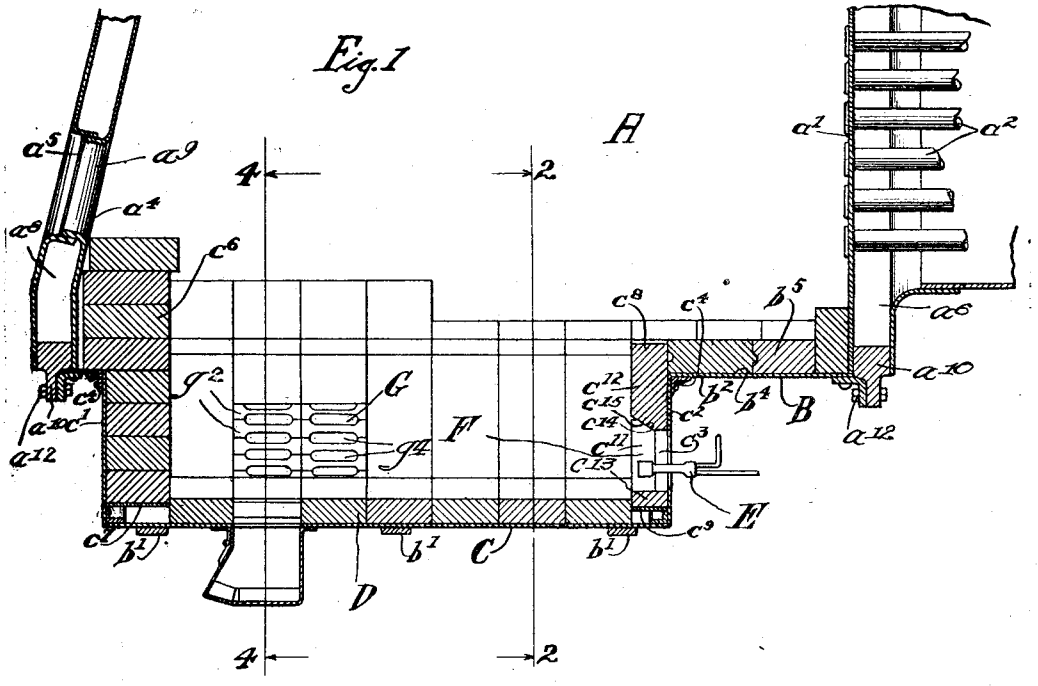


Fig. 2

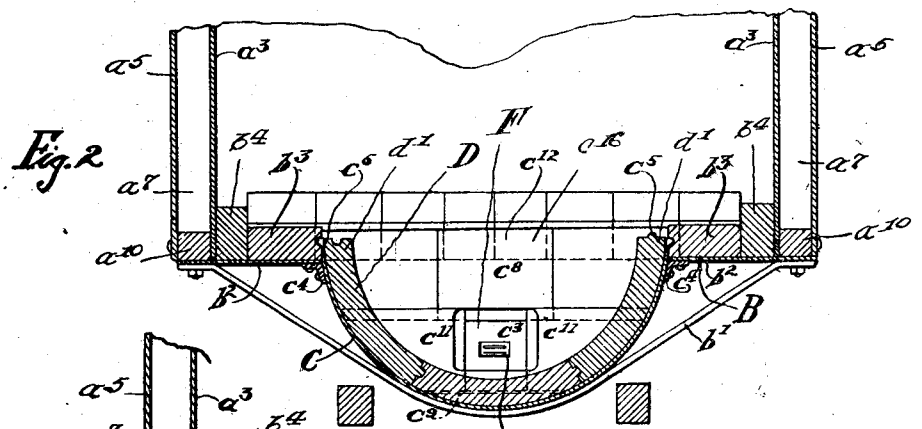
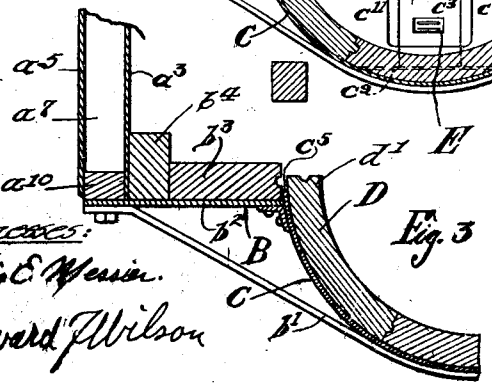


Fig. 3



Witnesses:

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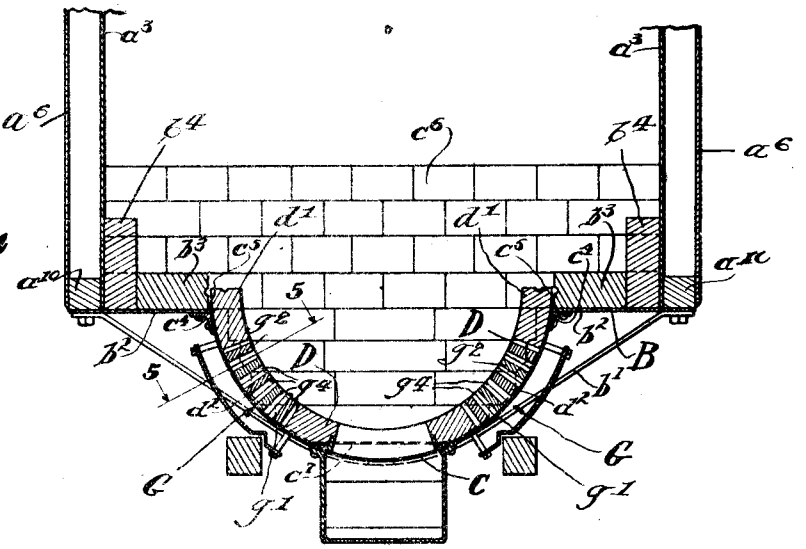
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2 SHEETS—SHEET 2.

Fig. 4



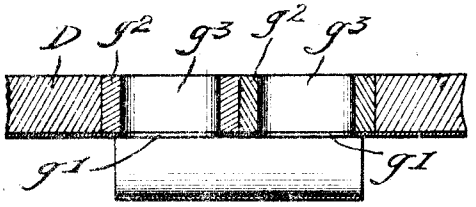


Fig. 5

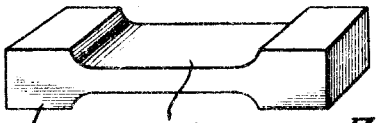


Fig. 6

Witnesses
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UNITED STATES PATENT OFFICE.

GUY M. BEAN, OF LOS ANGELES, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO AMERICAN ARCH COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

LOCOMOTIVE-BOILER FIRE-BOX.

1,138,066. Specification of Letters Patent. Patented May 4, 1915.

Application filed August 3, 1914. Serial No. 854,784.

To all whom it may concern:

Be it known that I, GUY M. BEAN, a citizen of the United States, and a resident of Los Angeles, county of Los Angeles, and State of California, have invented certain new and useful Improvements in Locomotive-Boiler Fire-Boxes, of which the following is a specification.

The object of my invention is to provide a refractory lined closure for the fire boxes of oil-burning locomotives, which shall cost less and be more durable than those at present in use; which shall be more easily and cheaply repaired; and which shall result in greater economy in use of the fuel oil.

My invention resides in a locomotive fire-box pan or closure having a round bottomed portion, the curved surface of which is lined with a plurality of segmental bricks, its end walls protected with refractory members held in place by the lining and provided in one end wall with a burner opening.

My invention also resides in a metallic closure for the bottom of a locomotive fire box having a semi-cylindrical depressed portion lined with a plurality of segmental fire bricks and the remaining portions protected by refractory bricks held in place by the lining of the depressed portion, and provided in one end wall with a burner opening.

My invention also resides in the several combinations of constructions and arrangements of parts whereby the above mentioned and other objects are attained and all as hereinafter described and particularly pointed out in the appended claims.

My invention will be more readily understood by reference to the accompanying drawings forming part of this specification and in which:—

Figure 1 is a central longitudinal sectional view of the lower part of a locomotive boiler firebox embodying my invention in a preferred form; Fig. 2 is a transverse sectional view of the fire box on the line 2—2 of Fig. 1; Fig. 3 is an enlargement of a portion of Fig. 2 for more clearly illustrating one feature of my invention; Fig. 4 is a fragmentary transverse sectional view of the firebox on the line 4—4 of Fig. 1. Fig. 5 is a detail longitudinal sectional view of the depressed portion of the pan on the line 5—5 of Fig. 4; and Fig. 6 is a perspective view of one of the small ventilator bricks.

The fire box A, as illustrated in the drawings, has a flue sheet a^1 at its forward end from which flues a^2 lead forward into the barrel of the boiler, side sheets a^3, a^3, and a rear sheet a^4. The fire box is inclosed within the boiler shell and forms with the shell a^5 the front, side, and rear water legs a^6, a^7, and a^8 respectively. The rear end of the fire box contains the usual fire door or opening a^9. The water legs are closed at their lower ends by means of the mud ring a^{10} which extends completely around the bottom of the fire box.

I close the lower end of the fire box by means of a pan B, which is substantially flat and secured at its edges to the mud ring a^{10} with bolts a^{12}, and in the form illustrated is also supported by cross straps or bars b^1 which extend across the fire box beneath the depressed portion of the pan and have their ends bolted to the mud ring. The floor b^2 of the pan B is substantially on a level with the mud ring or the lower end of the fire box and I provide the pan with a central depressed or drop portion C which is substantially semi-cylindrical in cross section and extends from the rear end of the fire box to a point spaced rearwardly from the flue sheet or the forward end of the fire box. This depressed portion forms the initial combustion or mixing chamber wherein the oil, air and gases are primarily heated, partially consumed and thoroughly mixed before they rise into the fire box proper. I close the rear end of the drop portion with a vertical wall c^1 and I close the forward end with a similar wall c^2. I provide the forward end with a large central opening c^3 to receive the oil burner E. I make the drop portion C of the pan semi-cylindrical in form for several reasons: The sheet metal of which it is made can be most easily formed into the shape desired and with the least amount of labor. This form best accommodates itself to fulfil one of the main objects of my invention, which is to line substantially all of the bottom and sides thereof with a number of bricks which are identical with each other in form and dimensions. I have shown the depressed por-

tion C as being substantially semi-circular in form. It will be understood that it may be somewhat less than a half cylinder and still preserve substantially all of the advantageous features and functions, the principal point being that it is substantially semi-cylindrical in shape so that, except for the provision of the holes g^4, it is possible to line it with segmental bricks, that are curved to correspond with the arc of the circle upon which the pan is formed, and which are substantially identical. The drop portion C is connected or secured at its upper longitudinal edges to the horizontal floor plate b^2 by means of angle members c^4. The extreme upper longitudinal edges c^5 of the lower portion of the pan may extend above the floor plate b^2 and form abutments for retaining the bricks in position which protect the plate b^2 and when used these upper edges prevent the floor bricks from forcing the lining of the drop portion of the pan out of place. This fire brick lining not only protects the pan but also serves to provide a combustion chamber which is adapted to be very highly heated and thus assist in the vaporization, ignition and combustion of the fuel oil.

I protect the rear end of the pan and the fire box with a relatively thick refractory wall c^6 built up of a plurality of layers of fire brick, sometimes supporting them upon a horizontal plate or shelf c^7 secured in the lower part of the semi-cylindrical part of the pan beneath the wall. This horizontal plate c^7 serves as a convenient foundation on which to build the wall and eliminates the necessity of conforming the lower bricks of the wall to the circle of the sheet C. I protect the forward end by the wall c^8, supporting it upon a horizontal plate c^9 similar to the plate c^7. This wall has an opening F which is coincident with the opening c^3 to receive the burner E. The burner E projects the oil longitudinally through the pan and against the wall c^6. The bricks D conform with the inner surface of the portion C and are so related thereto in size, in the form shown, that it requires three of these bricks to complete each transverse row and the upper edges of the bricks of each row project above the floor b^2. I proportion the bricks D in this manner so that the lining of the depressed portion will retain the bricks in position which protect the floor b^2. The bricks D may have tongued and grooved ends which assist in retaining them in position, although this construction is not essential. A fire box of ordinary length requires a number of the transverse rows of the bricks D to completely line it, and I preferably proportion the thickness of the front and rear walls c^6 and c^8 and the width of the bricks D so that the several rows of the bricks D, when in position, fit snugly between the front and rear walls whereby the front and rear walls and the lining of the shell C mutually retain each other in position. The front wall is preferably made up of two lower bricks c^{11}, one at each side of the burner opening, and an upper row c^{12} formed of similar bricks which rest upon the lower row and are retained thereby in position. I retain the bricks c^{11} in proper separated relation by means of a center spacing brick c^{13} which I place between them upon the plate c^9. The upper edges c^{14} of the bricks c^{11} and the lower edges c^{15} of the upper bricks are so formed that the lower parts of the upper bricks are retained between the lower bricks and the end wall c^2 of the pan and the middle brick c^{16} of the upper row is long enough to span the burner opening and rest at its ends upon the bricks c^{11}, whereby it is retained in position. The construction of the front wall, here described, is not claimed in this application, but is both described and claimed in my application Ser. No. 854,783, filed August 3, 1914. Under ordinary conditions, the burner opening c^3, is large enough to allow sufficient air to enter the fire box for the proper combustion of the oil, but I sometimes make use of auxiliary air admission openings G arranged, as shown, adjacent to the rear end of the depressed portion C to admit additional air for combustion purposes. In order to protect the horizontal floor b^2 and complete the lining of the pan I cover this part with fire bricks b^3 arranged between the upwardly projecting edge d^1 of the bricks D and the adjacent water legs or side sheets of the fire box, and in order to protect the lower part of the several water legs, I arrange other floor bricks b^4 placed on edge and between the bricks b^3 and the inner sheets of the fire box. The bricks b^4 project above the bricks b^3 and thoroughly protect the lower part of the water legs from the direct action of the flames. These bricks which thus protect the plate b^2 are prevented from sliding off of the plate b^2 by the upper projecting edges c^5 of the depressed portion of the pan, but, as stated, I sometimes omit these metallic abutments, and even when originally provided they sometimes burn away, but even then the floor bricks cannot be displaced by the jarring of the locomotive when running, as they are retained in position by the upper ends of the segmental bricks D. I also cover the portion b^4 of the floor b^2 which connects the upper end of the plate c^2 to the front water leg, by means of floor bricks b^5 similar to the bricks b^3. These bricks b^5 are retained upon the floor against the jarring action of the locomotive by the upper parts of the bricks c^{12} forming the upper row of the front wall c^8. The two bricks forming the lower part of the wall at the forward end

of the cylindrical portion are held in position by the cylindrical lining. The outer bricks of the upper row are held in their positions by the overlapping lining and by the two lower bricks and the center brick of the upper row of end bricks is held in position by the two lower bricks. Furthermore, the upper row of the end bricks holds the floor bricks in position which protect the rear part of the pan, consequently the lining of the cylindrical portion of the pan serves to retain the other portions of the refractory lining in position.

A particularly advantageous feature of my invention resides in the ease with which I can repair the lining at any time. The several segmental bricks and the floor bricks are free to be removed and replaced without disturbing any considerable number of bricks; in fact, most of them can be replaced without removing any brick but the one to be replaced. This results in the reduction of the repair expense, and as the depressed portion of the pan, not including its ends, is completely lined with bricks which are all of one pattern (save where the small sections g^2 are used) the capital tied up in stocks of repair bricks is reduced to a minimum.

Preferably I arrange the auxiliary air admission openings G one at each side and adjacent to the rear end of the depressed portion of the pan. It is advisable to divide the streams of air which enter through the auxiliary openings, into a large number of small streams, to assist in the rapid mixing of this air with the burning gases. I cut out relatively large portions of the pan C forming relatively large openings g' therein, extending circumferentially of the pan. I provide two of the openings g' at each side, and I make them somewhat shorter longitudinally of the pan than the width of the segmental bricks D to provide supporting ledges for the bricks with which I line the pan at these points. Instead of the bricks D I line the pan with ventilator bricks g^2 over the openings g'. These bricks g^2 are of the same length as the width of the bricks D and are used in place thereof, and are formed to span the openings g' and rest at their ends upon the wall of the pan C. The ventilator bricks g^2 are long and narrow and I cut away their center portions at each side forming recesses g^3 therein and extending from their inner to their outer surfaces, so that when the bricks are laid together, as shown in Figs. 1 and 4, the recesses g^3 will form subsidiary air inlet openings g^4 extending through the lining of the pan, these openings being arranged over the openings g' in the pan itself serve to admit air at these points into the combustion chamber. I taper these bricks radially so that they will lie in firm and solid contact with each other and with the adjacent segmental lining bricks D. The ventilator bricks g^2 as thus arranged side by side form what may properly be termed "gratings" covering the openings g' in the wall of the pan. The air inlet slots therein are long and narrow serving to divide the incoming air into a plurality of thin streams thereby causing the air to effectively mingle with the gases of combustion which results in the most complete oxidation of the fuel. The ventilator bricks as thus made can be produced at a lower cost and the repairing thereof is much cheaper than the perforated bricks in common use, for this purpose. It is only necessary in case one of these ventilator bricks gives way to replace or renew one small relatively inexpensive brick, whereas in replacing the usual perforated brick it requires the replacing of a relatively large brick which is much more expensive and requires the expenditure of more time and labor.

Having thus described my invention I claim as new and desire to secure by Letters Patent:

1. A locomotive boiler firebox in combination with a bottom closing pan provided with a centrally disposed longitudinally extending semi-cylindrical portion depending below the lower edge of the firebox, horizontally disposed floor plates connecting the depressed portion with the lower edge of the firebox, a lining for said pan chiefly comprising a plurality of substantially identical curved [illegible] arranged within said depressed portion, the outer edges of said lining extending above said floor plates, and flat refractory bricks on said horizontal floor plates held in place by the upper edges of the curved bricks.

2. A locomotive boiler firebox in combination with a bottom closing pan, having a longitudinally extending centrally disposed substantially semi-cylindrical depressed portion, horizontally disposed floor plates connecting the edge portions of the depressed portion with the lower side edges of the firebox, the lateral edges of the semi-cylindrical portion of the pan rising above the horizontal floor plates and serving as retaining abutments for floor bricks placed upon said floor plates.

3. The fire box of an oil burning locomotive and a pan closing the lower end thereof, said pan having a longitudinally extending depressed portion, and one end of said depressed portion being provided with a burner opening, in combination with an oil burner smaller than the opening in said end and adapted to project oil longitudinally through said depressed portion, auxiliary air inlets in the wall of said depressed portion adjacent to the opposite end of said depressed portion, said inlets being formed of

elongated narrow bricks having recessed sides arranged side by side with their recesses in registry.

4. A locomotive boiler fire box in combination with a bottom closing pan having an elongated, depressed portion, provided with a burner opening in one end and having a plurality of longitudinally elongated auxiliary air inlets in its side walls adjacent the end opposite to the burner opening, said inlets being formed of narrow elongated bricks having recessed sides and together forming a plurality of narrow elongated air inlets.

5. A locomotive boiler fire box in combination with a bottom closing pan having a semi-cylindrical elongated depressed portion, one end of said depressed portion being provided with a burner opening, and the side walls thereof being provided with auxiliary air inlets adjacent to the end opposite to said burner, said inlets being formed by narrow elongated bricks having recessed sides and arranged side by side and adapted when thus arranged to provide a plurality of narrow elongated air inlets.

6. An oil burning locomotive boiler firebox, in combination with a shelf plate attached to and closing the bottom of said firebox, said shelf plate containing an elongated central opening, a plate transversely curved on the arc of a cylinder which intersects the plane of said shelf plate, the upper edges of the curved plate being fastened to said shelf plate, end plates joining the ends of said curved plate to said shelf plate, one of the end plates containing a burner and air admission opening, and said curved plate containing auxiliary air openings, for the purposes described.

7. An oil burning locomotive boiler firebox, in combination with a shelf plate attached to and closing the bottom of said firebox, said shelf plate containing an elongated central opening, a plate transversely curved on the arc of a cylinder which intersects the plane of said shelf plate, the upper edges of the curved plate being fastened to said shelf plate, end plates joining the ends of said curved plate to said shelf plate, one of the end plates containing a burner and air admission opening, said curved plate containing auxiliary air openings, and a lining of refractory bricks protecting the several plates and containing corresponding openings,—for the purposes described.

8. An oil burning locomotive boiler firebox, in combination with a shelf plate attached to and closing the bottom of said firebox, said shelf plate containing an elongated central opening, a plate transversely curved on the arc of a cylinder which intersects the plane of said shelf plate, the upper edges of the curved plate rising above and being fastened to said shelf plate in the opening thereof, end plates joining the ends of said curved plate to said shelf plate, one of the end plates containing a burner and air admission opening and said curved plate containing auxiliary air openings for the purposes described.

9. An oil burning locomotive boiler firebox, in combination with a shelf plate attached to and closing the bottom of said firebox, said shelf plate containing an elongated central opening, a plate transversely curved on the arc of a cylinder which intersects the plane of said shelf plate, the upper edges of the curved plate rising above and being fastened to said shelf plate in the opening thereof, end plates joining the ends of said curved plate to said shelf plate, one of the end plates containing a burner and air admission opening and said curved plate containing auxiliary air openings, refractory bricks on said shelf plate and held by the upwardly extending edges of the curved plate and a lining of refractory bricks protecting the remaining plates and containing corresponding openings, for the purposes described.

10. An oil burning locomotive boiler firebox, in combination with a shelf plate attached to and closing the bottom of said firebox, said shelf plate containing an elongated central opening, a plate transversely curved on the arc of a cylinder which intersects the plane of said shelf plate and having its upper edges attached thereto, end plates closing the ends of and completing the depressed pan formed by the said curved plate, one of said end plates containing a burner and air admission opening, said curved plate containing auxiliary air openings, refractory lining bricks upon said shelf plate, refractory bricks protecting said end plates, refractory bricks protecting the bottom portion of said curved plate, and each side of said curved plate being protected by a single row of correspondingly curved bricks with bricks interposed in the row containing continuations of said auxiliary openings.

11. In an oil burning locomotive boiler, a firebox having a closed bottom containing a semi-cylindrical longitudinally elongated pan having a burner and air admission opening in one end and provided with auxiliary air openings in its sides, in combination with a refractory lining in the bottom of said pan and upon the ends thereof, refractory linings for the sides of the pan, each chiefly composed of curved refractory bricks each of which extends from the refractory lining in the bottom of the pan to the upper edge of the pan, for the purposes described.

12. In an oil burning locomotive boiler, a firebox having a closed bottom containing a semi-cylindrical longitudinally elongated pan having a burner and air admission open-

ing in one end and provided with auxiliary air openings in its sides, in combination with a refractory lining in the bottom of said pan and upon the ends thereof, refractory linings for the sides of the pan, each chiefly composed of curved refractory bricks each of which extends from the refractory lining in the bottom of the pan to the upper edge of the pan, and the remainder of the side linings being composed of narrow elongated bricks presenting openings that form continuations of the auxiliary openings in the sides of the pan.

In testimony whereof, I have hereunto set my hand, this 31st day of March, 1914, in the presence of two subscribing witnesses.

GUY M. BEAN.

Witnesses:

KATHERINE E. TITUS,

PAUL WEEKS.