No. 778,165. PATENTED DEC. 20, 1904.

W. N. BEST.

TUBULAR FIRE BOX FOR STEAM BOILERS.

APPLICATION FILED JULY 30, 1902.

NO MODEL.

Fig. VI

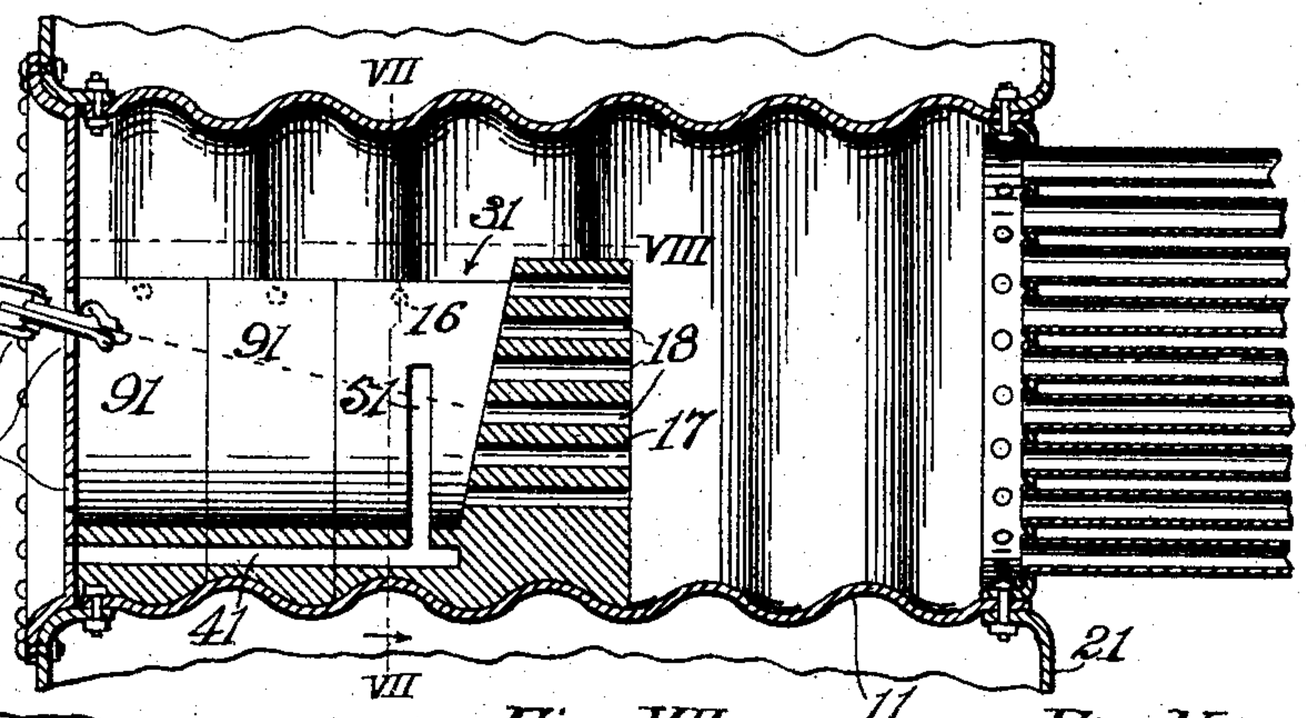
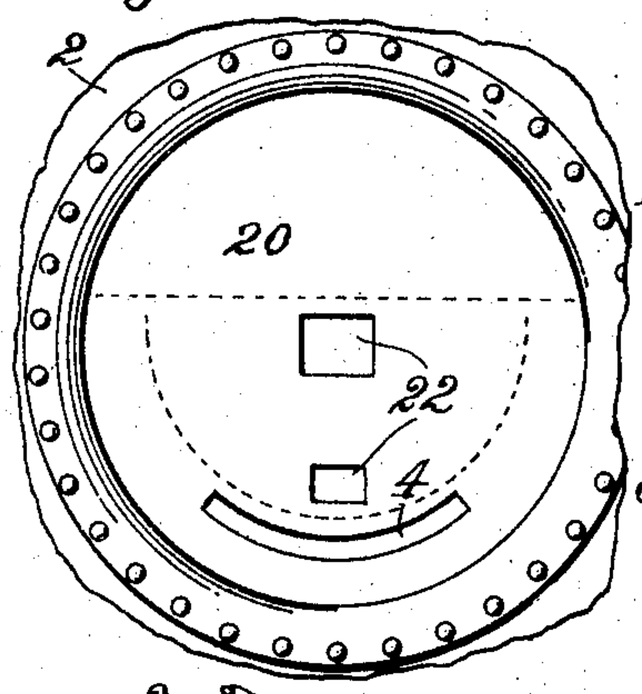
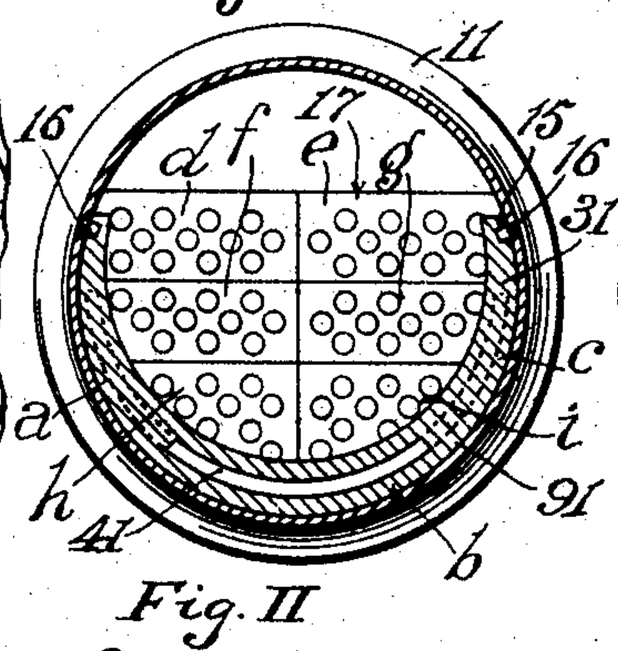


Fig. IV

Fig. VII

Fig. V





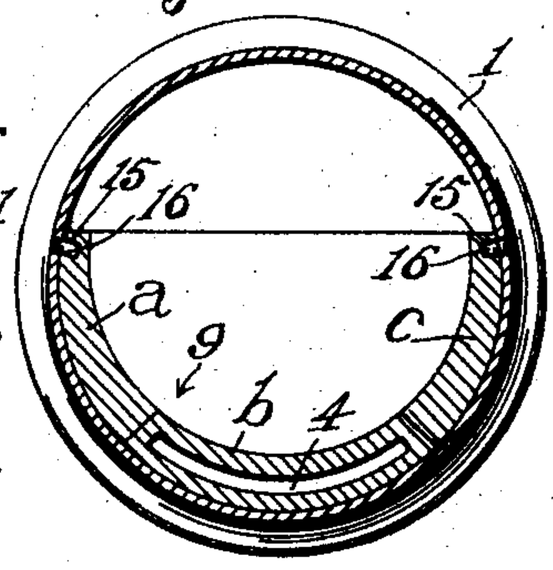


Fig. II

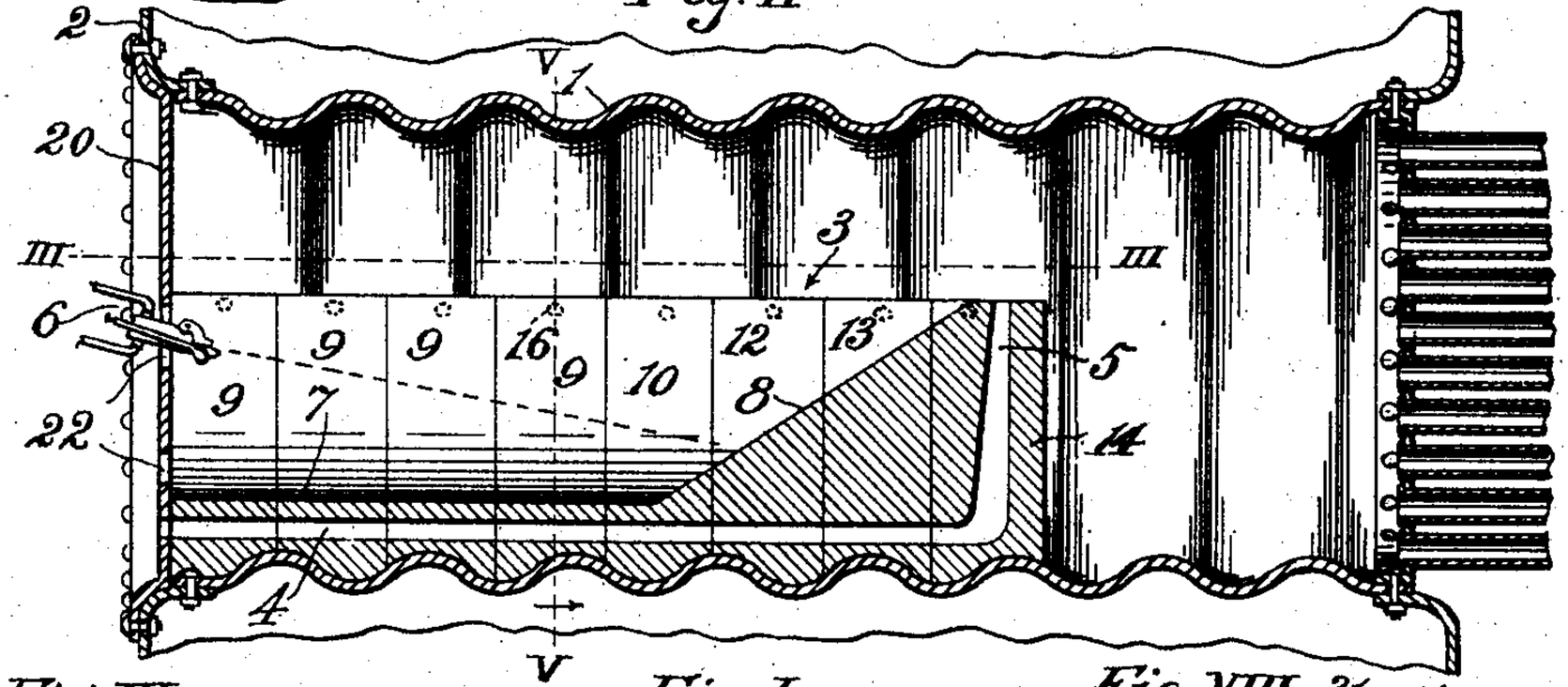
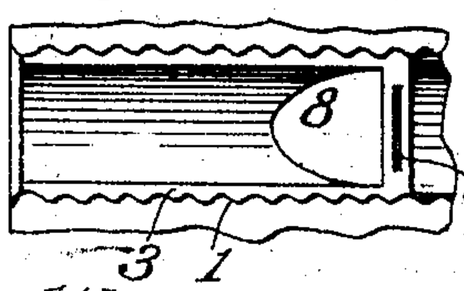
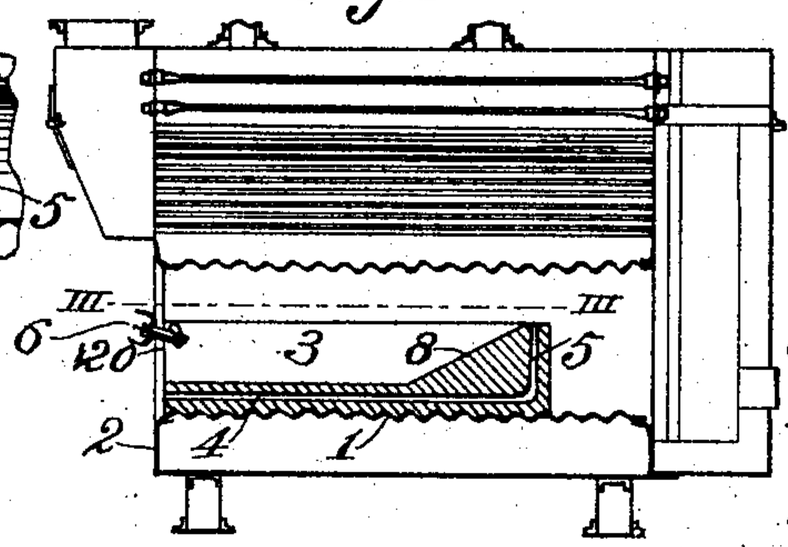


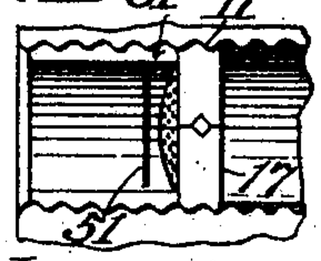
Fig. III

Fig. I

Fig. VIII







Witnesses
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by
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No. 778,165. Patented December 20, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM NEWTON BEST, OF LOS ANGELES, CALIFORNIA, ASSIGNOR OF ONE-HALF TO WILLIAM A. COOPER, OF LOS ANGELES, CALIFORNIA.

TUBULAR FIRE-BOX FOR STEAM-BOILERS.

SPECIFICATION forming part of Letters Patent No. 778,165, dated December 20, 1904.

Application filed July 30, 1902. Serial No. 117,716.

To all whom it may concern:

Be it known that I, WILLIAM NEWTON BEST, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Tubular Fire-Box for Steam-Boilers, of which the following is a specification.

An object of this invention is to provide means for burning hydrocarbon oil or gas in corrugated tubular fire-boxes of locomotive, marine, or other boilers.

It is necessary with the class of fire-boxes to which I refer that air be admitted at some point within the tubular portion; otherwise the fire will be carried through the tubes and out at the smoke-stack. It has been a practice heretofore to make the opening for the external air through the shell of the boiler and through the corrugated tubular fire-box to admit air to the inside of such fire-box. Such construction is liable to cause leakage, and an object of my invention is to appropriately supply the air and yet avoid any such leakage.

Another object is to provide a superior protection for the corrugated tubular fire-box to prevent undue and unequal expansion to produce and apply the fire in the fire-box in the most effective and economical manner.

The invention may be variously applied, the principle being to provide a refractory lining for the lower portion of the tubular fire-box to cover the shell or body thereof, where the intense heat from the oil-burner would be destructive or produce injurious strains, an air-duct being provided leading desirably from the front end of the fire-box to an appropriate place or point within the fire-box, to supply the required oxygen to the flame within the fire-box. The air-duct may be provided in various ways, and the lining may be constructed in various ways and may be made of any suitable material. Desirably the refractory material is formed in a cross-wall at an appropriate place or point in the tubular fire-box, and said cross-wall may be perforated or may be provided with a discharge-port for supplying air to the flame within the fire-box.

The invention also includes the combination, with a tubular fire-box, of a refractory body inside the fire-box covering a section of the floor and walls thereof and having a cavity in the top extending rearward from the front or door end of the fire-box and a cross-wall terminating said cavity, a passage extending rearwardly from the front end of the fire-box and opening from said body to supply oxygen to the interior of the fire-box, and an injector arranged to direct combustibles aslant downward toward the cross-wall between the bottom and top thereof.

The acompanying drawings illustrate the principle of this invention and the best mode in which I contemplate applying the same.

Figure I is a sectional view illustrating the invention as the same may be applied to a tubular marine boiler. Fig. II is a fragmental enlarged detail of the same. Fig. III is a reduced plan on line III III, Fig. II. Fig. IV is a front elevation of Fig. II, omitting the injector. Fig. V is a section of the same on line V V, Fig. II, omitting boiler-flues. Fig. VI is a fragmental detail of the invention as the same may be applied in locomotive-boilers. Fig. VII is a sectional view on line VII VII, Fig. VI, omitting boiler-flues. Fig. VIII is a reduced section on line VIII VIII, Fig. VI.

1 and 11, respectively, designate corrugated tubular fire-boxes, which are circular or curved in cross-section, and 2 and 21 are the boilers therefor, respectively. 3 and 31 are refractory linings for said fire-boxes, respectively.

4 and 41 are air-ducts, respectively, each leading from the atmospheric air at the front end of its fire-box to the discharge-port inside the fire-box.

5 designates a discharge-port for the air-passage 4, and 51 a discharge-port for the flue 41.

6 and 61, respectively, designate injector-burners.

Referring to Fig. II, 7 designates the inner face of the refractory lining extending over the body and up more than one-half way toward the top of the fire-box. 8 designates a cross-wall, the front face of which desirably

slopes upward rearwardly to receive the direct action of the fire from the injector 6 and direct it aslant up and back. 9 designates semicircular bricks or sections, which may be constructed as the crescents shown, with the air-passage 4 extending therethrough from front to rear, so that when the several sections 9 are in position a continuous duct 4 is formed throughout all of them. In the rearmost sections 10, 12, 13, and 14 the inner face 8 of the section slopes upward rearwardly, and said sections form a cross-wall, which is completed by the section 14, which may be perforated horizontally and vertically to form the discharge-port 5. In Figs. VI and VII the sections 91 correspond, practically, with the sections 9 of Fig. II. The rear portion of the refractory lining—that is to say, the portion near the door of the fire-box—is substantially crescent-shaped in cross-section with its thickened portion at the bottom and has upwardly-projecting horns, which are opposite lugs 16, hereinafter referred to. One advantage of this construction is that the injector-burner may be arranged to project the hottest portion of its flame upon the thickened portion of the lining, the intensity of the heat diminishing toward each side as the thickness of the crescent horn decreases. The air-passage 4 extends continuously along the thickened bottom portion of the crescent-shaped lining and is imperforate-walled—that is to say, without openings intermediate its ends. The sections may be variously constructed without departing from this invention. The sections 9 and 91, respectively, are shown as formed in three pieces *a*, *b*, and *c*, the lowermost section *b* being provided with the air-duct 4 and the upper or edge sections *a* and *c* being respectively provided with seats 15 for lugs 16, which project from the shell of the boiler to hold said sections in place. The horns of the crescent-shaped sections are preferably truncated, as shown, to make them less fragile and to afford better seats for said lugs. In Fig. VI, 16 designates like lugs for fastening the sections of the refractory lining in place. The rearmost section in the form shown in Fig. VI is formed in the cross-wall 17, having perforations 18, which extend longitudinally of the fire-box, so that portions of the flame may pass through the perforated cross-wall after having been acted on by the newly-admitted atmospheric air at the port 51.

In the form shown in Fig. VI the end section of the refractory lining is perforated to form the discharge-opening 51 and is further perforated horizontally, as at 18, in order that a portion of the fire may pass through the wall, while another portion is deflected upwardly toward the top of the fire-box.

With the form shown in Fig. V the lower sections *b* may be first placed in position and then the upper sections *a* and *c* be respectively brought into position resting on the opposite edges of *b* with the retaining-lugs 16 in seats 15.

The injector-burners 6 and 61 are desirably inclined downward, as shown, in order that the flame will strike against the cross-wall and that the walls of the fire-box will be protected from the intense heat thereof by means of the cross-wall.

The air-passages communicating with the external source of atmospheric supply and opening into the fire-box through the ports cause the admitted air to be highly heated, and thus in a measure avoids destructive heating of the lining.

In practical operation the flame within the fire-box is supplied with air through the usual ventilating-openings 22 in the front wall 20 of the fire-box and then is further supplied with oxygen from the outlets 5 and 51, respectively, whence the flame passes onward to heat the boiler.

In the preferred form the sections may be fire-brick constructed with the perforations extending lengthwise of the fire-box or parallel with the axis of the fire-box, as shown; but I do not limit my invention to the use of the specific form of brick shown.

The inner end sections which form the cross-walls are desirably formed in a plurality of pieces, as shown at *d*, *e*, *f*, *g*, *h*, and *i* in Fig. VII, to facilitate placing the same in the fire-box, and when these are fitted in a corrugated fire-box they are thereby held against accidental displacement under any of the conditions of operating the boiler.

Having described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. The combination with an elongated tubular fire-box, curved in cross-section, of a refractory crescent-shaped lining extending along the bottom and partially along the sides of the fire-box, and an injector-burner in position to project a hotter flame against the thicker portion of the crescent than against the horns thereof.

2. The combination with an elongated tubular fire-box, curved in cross-section, of a refractory crescent-shaped lining extending along the bottom and partially along the sides of the fire-box, said lining having a flue extending longitudinally through the thickened portion thereof.

3. The combination with an elongated tubular fire-box, curved in cross-section, of a refractory crescent-shaped lining extending along the bottom and partially along the sides of the fire-box, and an injector-burner in position to project a hotter flame against the thicker portion of the crescent than against the horns thereof, said lining having a flue extending longitudinally through the thickened portion thereof.

4. The combination with an elongated fire-box having a transversely-curved bottom, of a refractory crescent-shaped lining extending longitudinally along said bottom and constructed to form a transverse cross-wall at the rear end of said lining, said lining having a flue extending longitudinally therethrough and extending upwardly into and opening from said cross-wall.

5. The combination with an elongated tubular fire-box, curved in cross-section, of a refractory crescent-shaped lining extending along the bottom and partially along the sides of the fire-box, said crescent-shaped lining having truncated horns and the fire-box provided with fastening means engaging said horns.

6. The combination with an elongated tubular fire-box, curved in cross-section, of a refractory crescent-shaped lining extending along the bottom and partially along the sides of the fire-box, said crescent-shaped lining having truncated horns and the fire-box being provided with lugs projecting into the outer sides of said horns.

7. The combination with an elongated tubular fire-box, curved in cross-section, of a refractory crescent-shaped lining extending along the bottom and partially along the sides of the fire-box, said lining being constructed of a series of contiguous crescent-shaped bricks having openings which register with each other forming a flue extending longitudinally through the thickened portion of the lining.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, at Los Angeles, in the county of Los Angeles and State of California, this 23d day of July, 1902.

WILLIAM NEWTON BEST.

Witnesses:

JAMES R. TOWNSEND,

JULIA TOWNSEND.