

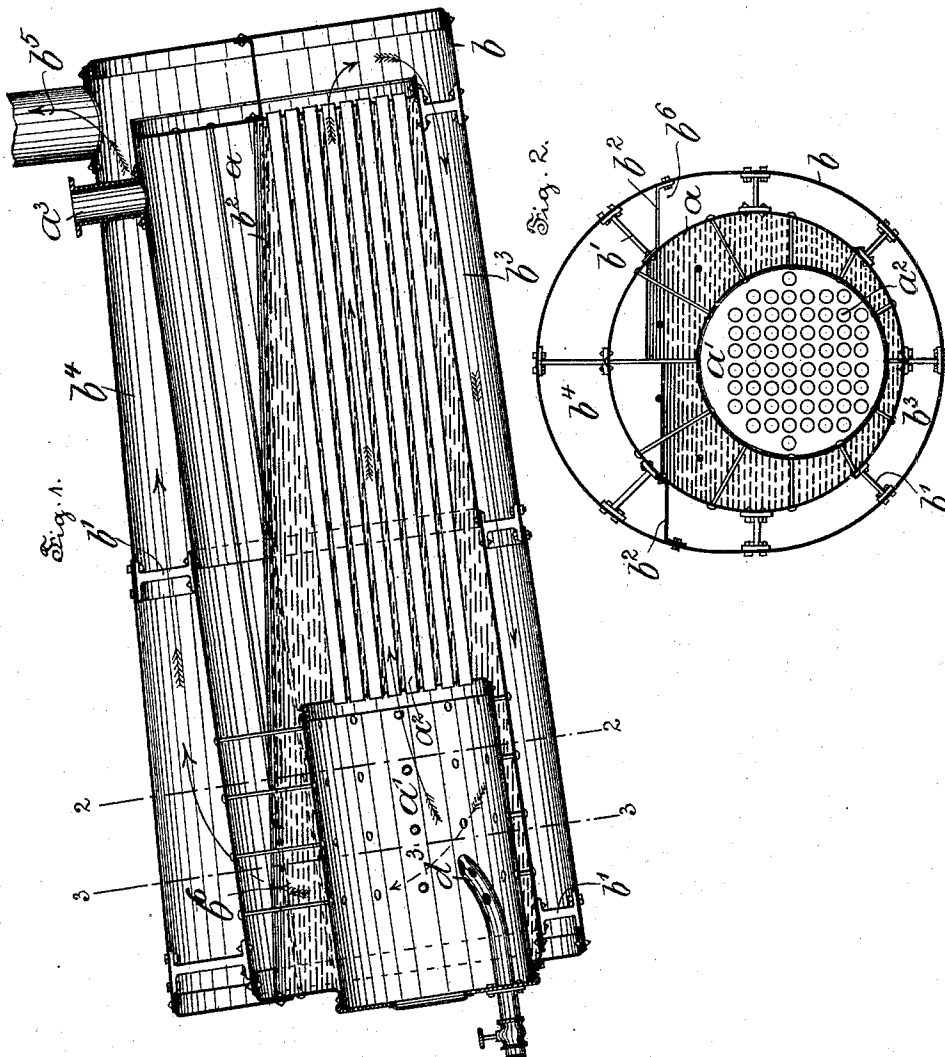
(No Model.)

2 Sheets—Sheet 1.

J. J. TONKIN.
STEAM BOILER.

No. 474,785.

Patented May 10, 1892.



Witnesses.
Hermann Bormann.
Thomas M. Smith.

Inventor:
John J. Tonkin,
by Walter Douglas
att'y.

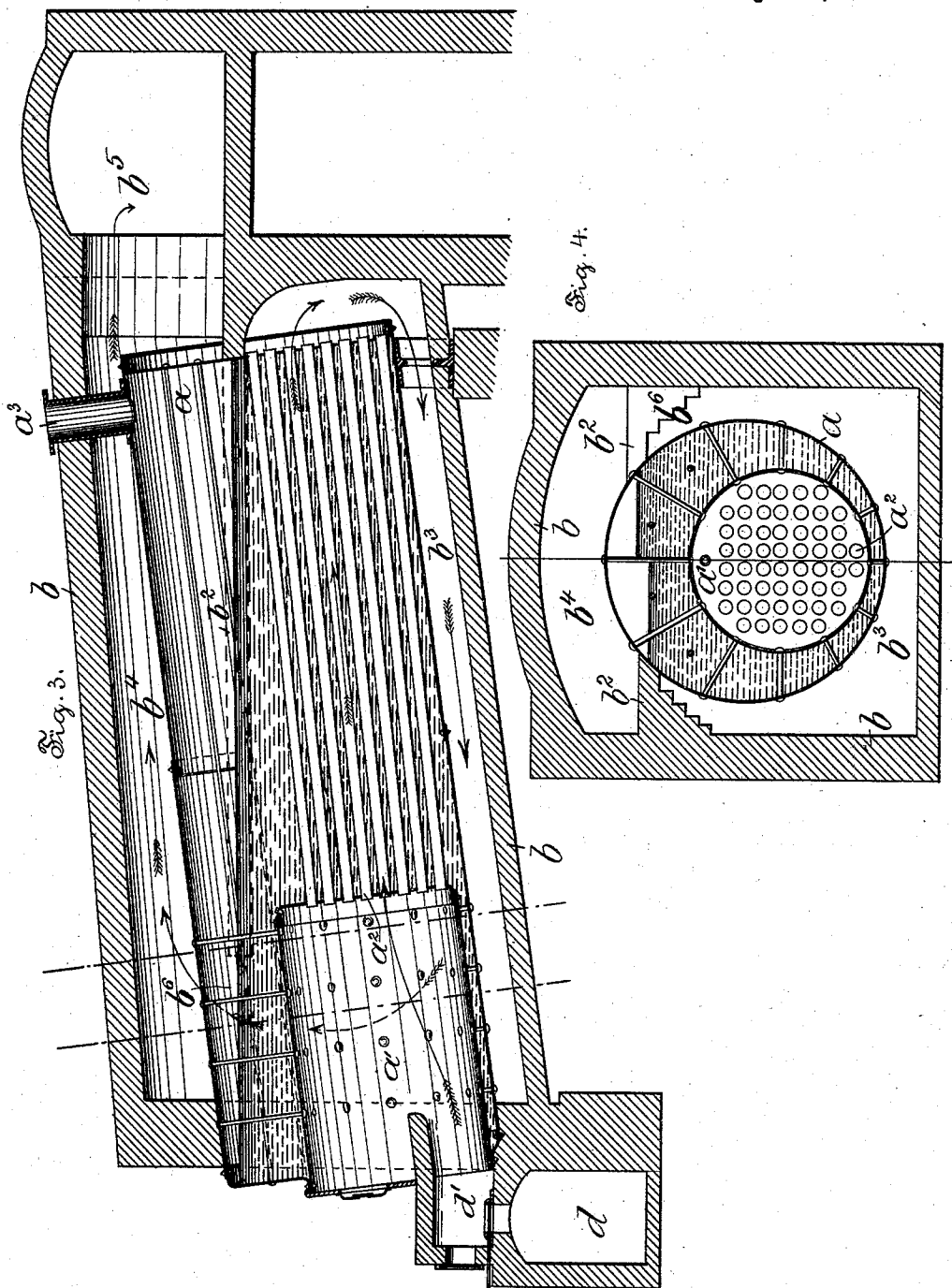
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UNITED STATES PATENT OFFICE.

JOHN JAY TONKIN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO
WILLIAM G. WARDEN, OF SAME PLACE.

STEAM-BOILER.

SPECIFICATION forming part of Letters Patent No. 474,785, dated May 10, 1892.

Application filed October 8, 1891. Serial No. 408,099. (No model.)

To all whom it may concern:

Be it known that I, JOHN JAY TONKIN, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Boilers, of which the following is a specification.

The principal objects of my invention are, first, to generate steam in an internally-fired boiler by the combustion of gaseous fuel in an expeditious and economical manner, and, second, to provide compact, durable, and efficient means for carrying the invention into effect.

My invention consists of an internally-fired boiler having an exterior casing or mounting surrounding the side walls and end plate thereof and a partition in alignment with the normal water-line in the boiler and extending between the rear plates of the boiler and mounting or external casing and between the side walls thereof to a point near the front of the boiler to form two flues communicating near the front of the boiler, whereof the lower one is connected with the fire-tubes and the upper one with the offtake; and my invention further consists of the improvements herein-after described and claimed.

The nature and characteristic features of the invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming part hereof, and in which—

Figure 1 is a vertical central section of a portable internally-fired steam-boiler, showing the exterior of the walls and end plate thereof surrounded by a mounting or casing horizontally partitioned to form two communicating flues, whereof the lower one communicates with the fire-tubes and the upper one with the offtake pipe leading to the chimney. Fig. 2 is an end view of the same, showing at the left-hand side thereof a section on the line 2 2 of Fig. 1 in order to illustrate the horizontal partition between the upper and lower flues and showing at the right-hand side thereof a section on the line 3 3 of Fig. 1 in order to illustrate the passage-ways by which the two flues communicate at the front of the

boiler; and Figs. 3 and 4 are views similar in all respects to those illustrated in Figs. 1 and 2, with the exception that a stationary boiler is shown therein.

My improved method of generating steam in an internally-fired boiler by the combustion of gaseous fuel may be carried into effect in the following manner.

A supply of gaseous fuel is introduced into the internally-located fire-box of the boiler and is ignited and burned therein. This combustion of gas not only heats the fire-box and the parts of the boiler adjacent thereto, but also gives rise to long flames, which will burn for a considerable length of time, and which are capable of imparting a great amount of heat. These long flames, together with the hot and inflammable gaseous products of combustion, are led backward from the fire-box through the fire-tubes to and around the lower exterior portion of the rear end of the boiler and are then passed forward in contact with the exterior surface of the water-space of the boiler in order to permit the flames to be completely consumed, or nearly so, in contact with only such portions of the exterior of the boiler as are protected by water. The hot gaseous products of combustion resulting from both the combustion of gaseous fuel in the fire-box of the boiler and from the complete combustion of flames beneath the boiler are then permitted to ascend around the exterior walls of the boiler-shell at the front end thereof to the upper exterior surface of the steam-space, over which they are passed in a backward direction to the rear end of the boiler, from which they are permitted to escape into a suitable offtake or chimney, so that only hot gases are in contact with such portions of the boiler-shell as are in contact with steam. In the utilization of gaseous fuel very long flames are produced, and by the above-described method these flames are permitted to burn out in contact with water-cooled portions of the boiler. This result is advantageous, because such flames, if permitted to contact with a portion of the boiler-shell that is not protected by water, would seriously in-

jure and ultimately burn out the shell itself, thus causing serious damage and injury. Moreover, there are numerous other advantages incident to the above-described method of utilizing gaseous fuel. However, the following may be particularly mentioned: First, all the heat available from the long flame due to the combustion of gaseous fuel is utilized, because the flame is permitted to remain in contact with the exterior of the steam-space of the boiler-shell until the flame itself has burned out and imparted all the heat due to direct combustion thereto; second, the large heating-surface over which the flame and gaseous products of combustion travel insures a complete combustion of the gaseous fuel before it is permitted to escape into the chimney or offtake; third, loss of heat by radiation from the exterior surface of the boiler-shell is avoided, because substantially the whole of the latter is surrounded by flame and highly-heated gases, and, fourth, the passage of the heated gases in contact with the upper exterior surface of the portion of the boiler-shell inclosing the steam space or chamber insures the superheating of the steam previously generated in the boiler.

The above-described method of utilizing gaseous fuel for generating steam in an internally-fired boiler may be carried into effect by means of various types of apparatus. However, one form of such apparatus and a modification thereof are illustrated in the accompanying drawings, in which—

a is an internally-fired boiler supported by means of brackets or in any other suitable manner (not shown) and provided with a fire-box a' , fire-tubes a^2 and a steam offtake a^3 .

b is a jacket or casing surrounding the side and rear end walls of the boiler-shell and preferably having its axis parallel with but disposed above the axis of the boiler-shell, Figs. 2 and 4, for a purpose to be presently described. This jacket or casing b may be constructed of fire-brick, as shown in Figs. 3 and 4. However, in such case the boiler is immovable. If preferred, the jacket or casing may be constructed of sheet-iron and connected with the boiler a by means of distance-pieces b' , as shown in Figs. 1 and 2, in which case the boiler is portable and may be moved about from place to place. In both cases the mounting or casing is horizontally partitioned by walls b^2 , in order to form two flues b^3 and b^4 , whereof the lower one b^3 surrounds the exterior surface of the lower portion of the boiler a and communicates at the rear end thereof with the fire-tubes a^2 , and the upper one b^4 surrounds the exterior surfaces of the upper portion of the boiler a and communicates at the rear of the boiler with the offtake or chimney b^5 . Moreover, the upper and lower flues b^3 and b^4 communicate at or near the front of the boiler by means of passages b^6 , formed in each of the walls b^2 , as shown more particularly at the right-hand side of

Figs. 2 and 4, and are preferably so proportioned as that all the flames resulting from the combustion of the gaseous fuel in the fire-box a' are consumed in the tubes a^2 and lower flue b^3 in order to prevent contact of the flames with the exterior of the steam-space of the boiler.

In most instances the walls b^2 are placed in alignment with the normal water-level in the boiler in order to permit the hottest gases and flames to contact with the exterior of the water-space and the cooler gases to contact with the exterior of the steam-chamber.

The eccentric disposition of the jacket or casing b with reference to the boiler-shell causes the respective areas of the cross-sections of the flues b^3 and b^4 to be substantially equal, so that the contraction of the passages for conveying the heated products of combustion from the boiler that would occur if the two shells were disposed concentrically by reason of the location of the partition-walls b^2 in alignment with the water-line is obviated and a good draft is assured.

My improved method of generating steam in an internally-fired boiler by the combustion of gaseous fuel may be carried into effect by means of the hereinabove-described apparatus in the following manner: After the introduction of a proper quantity of feed-water into the boiler a a supply of producer or other heating gas is introduced into the fire-box a' by means of a suitable gas-conduit d and burner d' (illustrated in Figs. 3 and 4) and by means of a pipe d^3 in Figs. 1 and 2. This supply of gas is then ignited and burned in the fire-box a' . The long flame and hot gaseous products of combustion in the fire-box a' are led backward through the fire-tubes a^2 and then traverse the flue b^3 , in which the flame is consumed or burned out, and the hot gases traverse the passages b^6 and flue b^4 and finally escape through the offtake b^5 to the chimney. The directions of travel of the flames and hot gases are indicated upon the drawings by the arrows.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In combination, an internally-fired tubular boiler, an exterior casing or mounting surrounding the side walls and rear end plate of the boiler, and a partition in alignment with the normal water-line in the boiler and extending transversely between the rear plates and side walls of the boiler and casing to a point near the front of the boiler to form two flues communicating at or near the front of the boiler and connected, respectively, at the rear of the boiler to the fire-tubes and offtake, substantially as and for the purposes set forth.

2. In combination, an internally-fired tubular boiler, an external casing or mounting surrounding the side walls and end plate of the boiler, and a partition in alignment with the normal water-line and ranging transversely

between the side walls and end plates of the boiler and casing to a point near the front of the boiler to form two communicating flues, and the axis of said casing disposed parallel
5 with but above the axis of the boiler to equalize the cross-sectional area of said flues, substantially as and for the purposes set forth.

In witness whereof I have hereunto set my signature in the presence of two subscribing witnesses.

JOHN JAY TONKIN.

Witnesses:

THOMAS M. SMITH,
RICHARD C. MAXWELL.