No. 630,460. Patented Aug. 8, 1899.

G. LANGENBACH.

SMOKE CONSUMING FURNACE.

(Application filed Sept. 15, 1898.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1

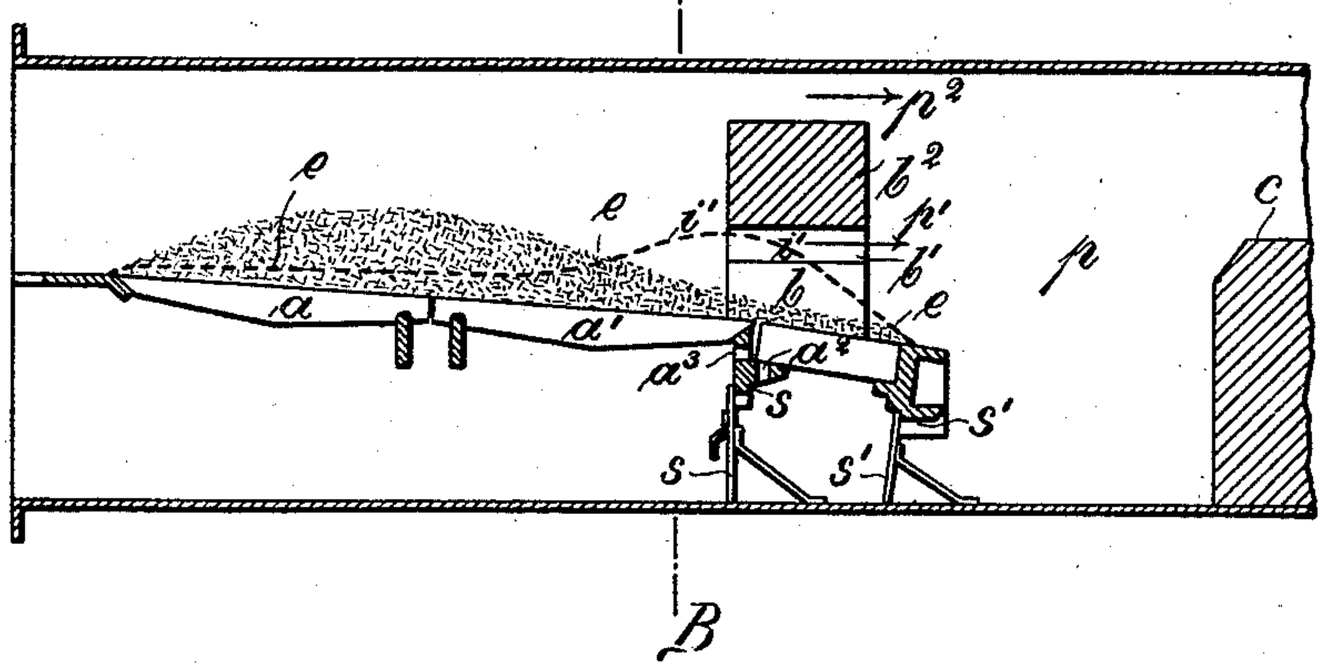
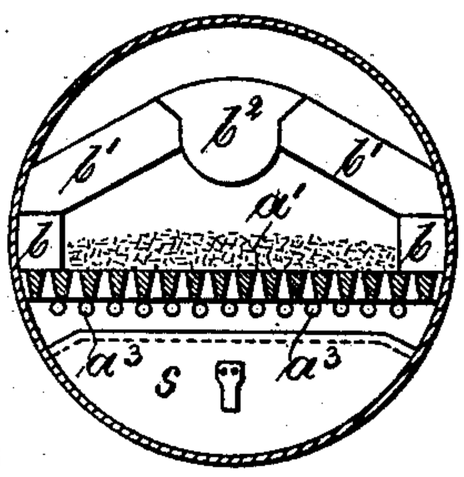


Fig. 2



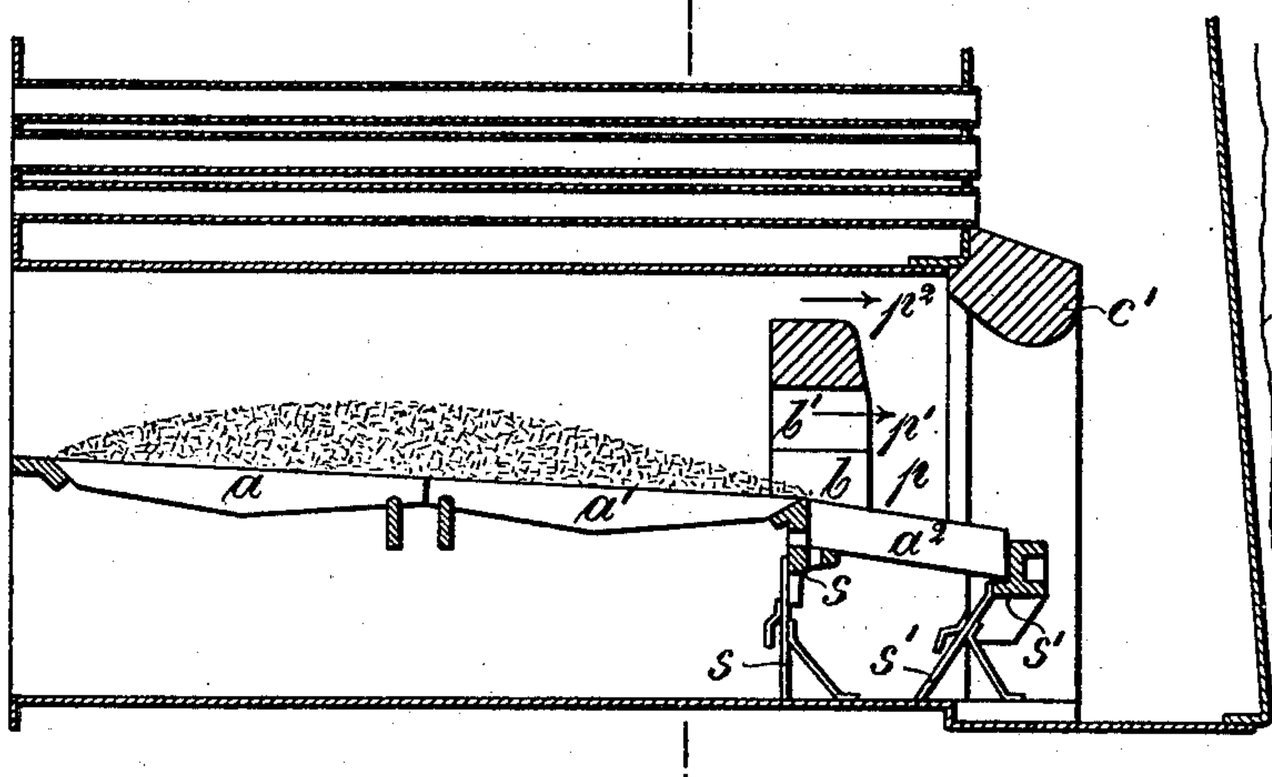


Fig. 3.

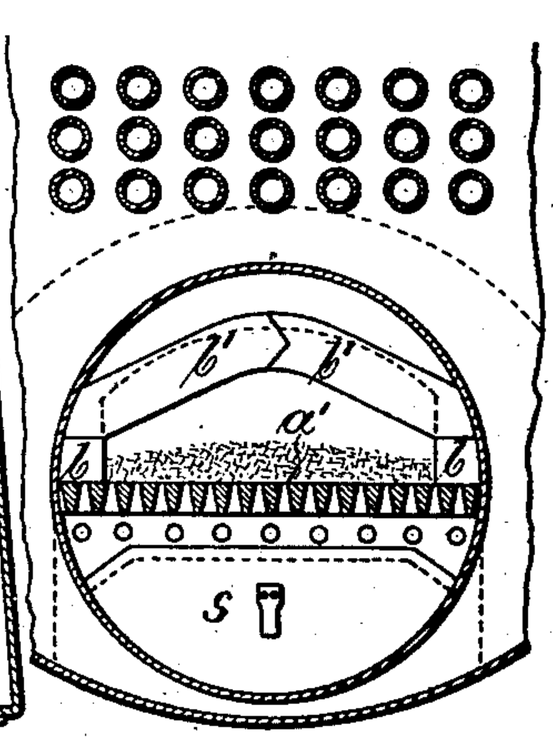


Fig. 4.

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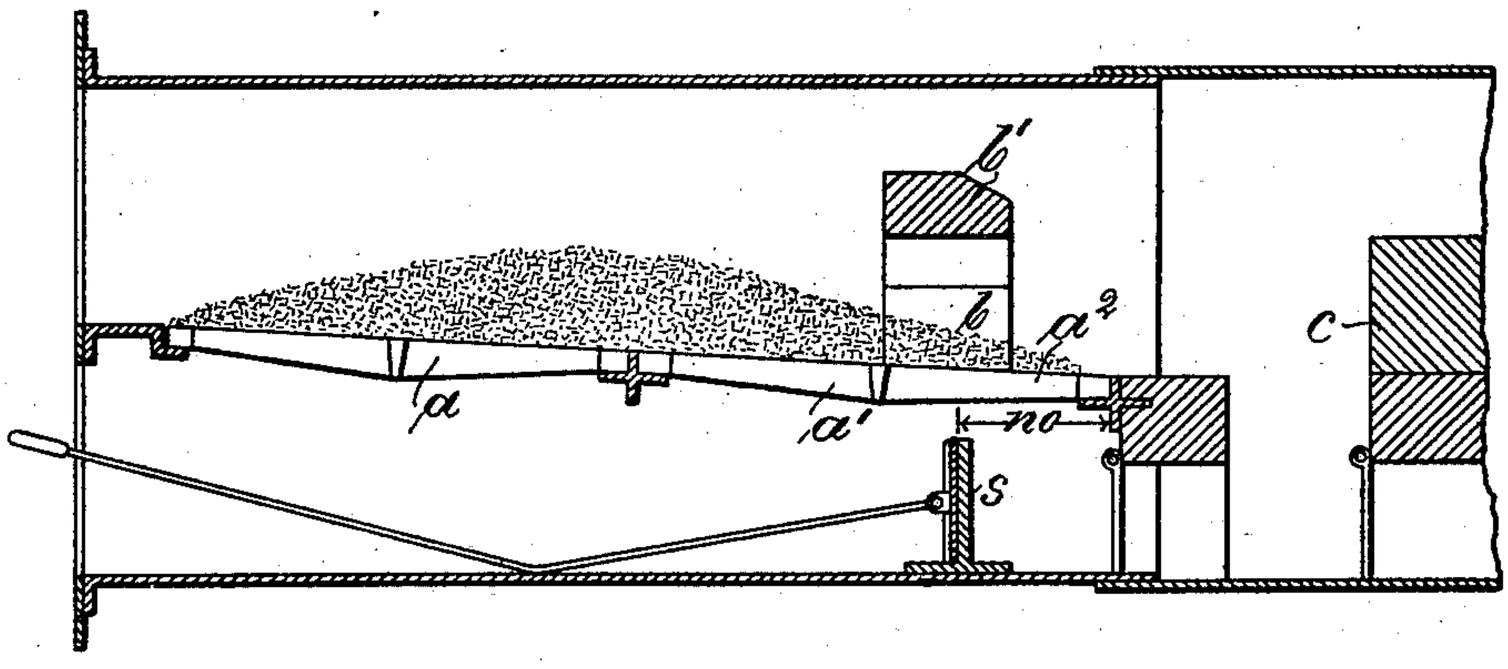
(No Model.) 2 Sheets—Sheet 2.

Fig. 5.



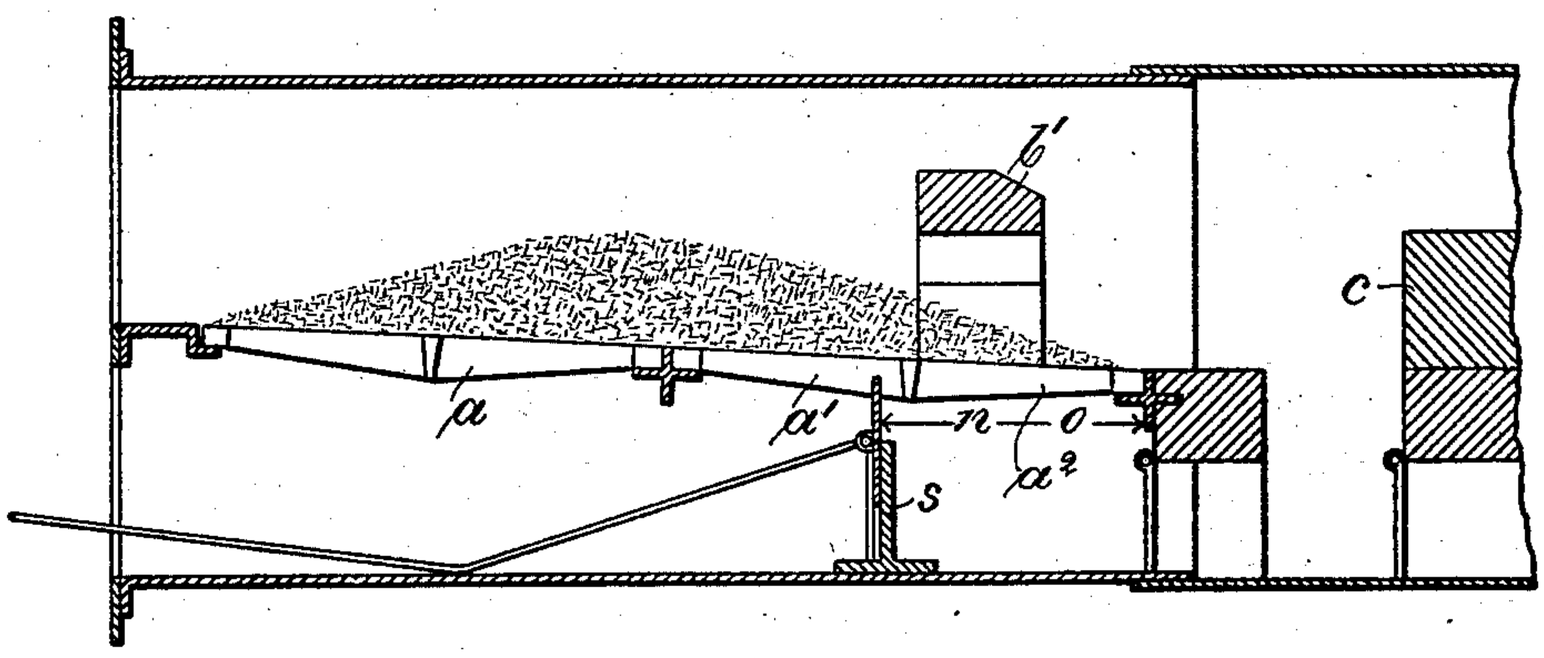


Fig. 6.

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UNITED STATES PATENT OFFICE.

GUSTAV LANGENBACH, OF GRABOW, GERMANY.

SMOKE-CONSUMING FURNACE.

SPECIFICATION forming part of Letters Patent No. 630,460, dated August 8, 1899.

Application filed September 15, 1898. Serial No. 691,052. (No model.)

To all whom it may concern:

Be it known that I, GUSTAV LANGENBACH, a subject of the King of Prussia, German Emperor, and a resident of Grabow, near Stettin, in the Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in Smoke-Consuming Furnaces, of which the following is an exact specification.

To obtain a smoke-free interior firing—that is to say, for a boiler with one or more flame-tubes in which the grate is arranged in the interior of the flame-tube—it is necessary, as it were, to divide the grate-surface into two parts and to employ the front part as a preparatory grate—the so-called "coking-grate"—while the rear part is employed as the burning-grate proper. The problem is here to cause the fuel of a certain or definite part of the grate-surface—viz., the rear portion of the grate—to burn with a bright flame, so that the fire-gases arising from the same may with certainty ignite the cold fire-gases developed upon the front portion of the grate.

In order to make my invention more clear, I refer to the accompanying drawings, in which similar letters denote similar parts throughout the different views, and in which—

Figures 1 and 2 show in longitudinal and cross-section a construction devised for the above-mentioned purpose and applicable to ordinary flame-boilers, while in Figs. 3 and 4, also in longitudinal and cross-section, a construction is shown devised for ships' boilers. Figs. 5 and 6 represent two longitudinal sections of a modified construction.

The grate-surfaces $a\,a'\,a^2$, Fig. 1, consist of one or more series of grate-bars. In the drawings three positions of such bars are assumed. Above the grate is freely arranged, Fig. 2, a strut-frame-like erection $b\,b'\,b^2\,b'\,b$, which, as shown, consists of five stones, of which $b\,b$ are the supporting-stones, $b\,b'$ the strut-frame-like part, and b^2 the headstone.

The grate $a\,a'\,a^2$ is not closed, as usual, at the back with a higher fire-bridge, but has a smooth end, the rear grate part a^2 being, by means of the separating-walls $s\,s'$, cut off or divided toward two directions—first, toward the rear portion of the flame-tube, as also toward or against the front of the furnace—viz., the part under the grate $a\,a'$. Small air-openings a^3 are, however, arranged or provided in the front wall s. It is to be remarked that the two lower portions of the separating-walls $s\,s'$ are removable, so that with ease all parts of the furnace can be cleaned from the front and freed from ashes, &c. Behind the separating-wall s', as also behind the said erection $b\,b'\,b^2\,b'\,b$, is a wall c, which tends to draw in or decrease the diameter over which the fire-gases spread or extend.

To explain the *modus operandi* of my invention I remark as follows: When the coal, stoked upon the combustion-grate proper, $a\,a'$, in the manner shown in the drawings, has to a large extent been burned or consumed, a fresh charge of coal will of course be necessary. Hereupon the remaining coal will be first brought more to the back of the furnace, so that the dotted line $e\,e\,e$ will become, as it were, the upper dividing-line, whereupon the furnace will be again stoked, of course at the front portion of the grate, as the rear portion of the same is prevented or protected by the higher mass of the before-said glowing coal, and also by the fire-bridge $b\,b'\,b^2$, from receiving any of the charge of coal.

When now the fire-door is closed, the following takes place: Upon the front portion of the grate $a\,a'$ a coking will take place for the reason that the gases generated or developing from the cold fuel are, as is clear, not hot enough to be at once ignited. These gases are forced to pass partly over and partly under the glowing fire-bridge $b\,b'\,b^2\,b'\,b$ and to come in contact with the glowing coal mass at i'. The decrease of the extent over which the cold gases would otherwise spread, which decrease, as mentioned, takes place at the fire-beam $b\,b'\,b^2\,b'\,b$ and at the glowing-coal pile at i, causes the cold gases to become heated and mixed with the ascending gases at i', whereupon the said cold gases ignite in the space p, if they have not already ignited in the flues or chambers p' and p^2. In any case it is certain that before the said gases reach the before-mentioned rear wall c, which is also highly heated, they must be ignited, for the reason that into the mixing-space p enter not only the hot gases emitted from i', but also the gases which have penetrated the grate a^2. Upon this grate portion a^2 rests, of course, only a thin layer of coal, and, furthermore, only a small air-supply enters through the apertures a^3. Thus between or from this portion a^2 of the grate very hot and

perfectly-ignited gases are emitted, which mix with the cold gases of the front grate portion a and which at the said wall or contraction c must without doubt ignite and be completely burned. As an important feature of the present invention I regard, on the one hand, the fire-bridge $b\ b'\ b^2\ b'\ b$, arranged, as above indicated, in the form of a strut-frame-like erection, whereby the same is capable of resisting every tendency to bend. This is necessary, as the chamotte-stones of the said structure c are always in the region of the hottest fire-gases. It is also regarded as new that the rear grate portion a^2 receives a contraction of the air-supply in consequence of the parting-wall s (provided with the before-said openings a^3) only permitting a small access of air to this portion of the grate, whereby I attain the following: Upon this grate portion a^2, as before stated, only the smallest layer of coal rests, as the stoker cannot with any degree of certainty push the glowing coal to the rear part of the grate without the risk of its falling behind the separating-wall s'. If this said grate portion a^2 received a powerful air-supply, the said thin coal-layer upon a^2 would not only quickly burn through, but such greater supply of air would cause too strong a draft through the grate portions $a\ a'$, (for each of which parts $a\ a'$ the fire-bridge $b\ b'\ b^2$ hinders the influence of the stack or chimney.) Thus a stagnation would take place in the supply of air, the coal would not be consumed in sufficient quantity, the grate-bars would not be cooled in suitable manner, and, furthermore, no sufficient development of steam would take place, nor would the grate be protected from burning. It will be thus clear that this contraction of the supply of air to the rear part a^2 is one of the most important and characteristic features of the present invention, together or in combination with the before-said strut-frame-like structure of the fire-bridge. Such contractions of this description, as shown at c have, it is true, been hitherto employed for a smooth grate where behind the grate a fire-bridge not of any especial height was erected; but such part was not hitherto arranged for the supply of air to such grate portion, or, in other words, such contraction c had not been constructed for the "supply" of air to the portion a^2 of the grate; but hitherto the "discharging" gases from this said grate portion had been throttled. This latter system is not, however, advantageous, as it is thereby not possible during the operation to properly ascertain the proportion of the throttling or contraction and to regulate the same. This regulation in the present invention can be easily effected by closing one or more of the apertures a^3, for which reason the arrangement of the contraction or throttling of the air supply to the rear portion of the fire-grate, as herein described, and forming, as above mentioned, a feature of my present invention, is preferable to the methods hitherto known for this purpose.

While the construction represented in Figs. 1 and 2 is intended for land-boilers, the arrangement in Figs. 3 and 4 is adapted for ships' boilers. The latter differ only from the first mentioned in that the contracting wall c or throttling of the fire-gases, which, according to the arrangement of Fig. 1, is located at the bottom of the tube, is here (Figs. 3 and 4) arranged in the form of an arch on the upper side of the fire-tube. The gases passing over the fire-distributing bridge $b\ b'\ b^2\ b'\ b$, as also underneath the same, are led downward throughout the arched structure c' and thereby caused more intimately to mix with the hot gases coming from a^2. Of course the same method of this last-mentioned contraction or throttling of the fire-gases may be also employed for land-boilers. The chief points are the especial arrangement of the boiler and the supply of air.

In Fig. 5 another modification of this arrangement is represented, in which both the before-mentioned strut-like frame structures can consist of two parts, and also the contracting or throttling of the rear part of the grate is movably arranged—*i. e.*, movable in a horizontal direction and adjustable in a vertical direction—so that when, on the one part, the throttling organ s is moved or adjusted by hand in the manner indicated in the drawings, Figs. 5 and 6, a larger portion of the grate is caused to form a burning-grate proper upon which the throttling of the air-supply acts. This result can also be achieved, on the other hand, by locating the throttling device of the air-space "between" the grate and the said air-throttling device in a higher position, so that, as desired, (or optionally,) more or less air can be conducted to the rear portion of the grate.

Fig. 5 shows the arrangement of the throttling device s in the modified form, as above mentioned, but in a rear view and in its lowest position.

Fig. 6 shows the same air-throttling device s in its highest position, and, furthermore, in its most extended position, this position corresponding to the rear part of the grate from n to o of Fig. 1 and to a^2 in Fig. 2, for which said rear grate portion the air-supply is throttled in the manner above described.

Having thus fully described the nature of this invention, what I desire to secure by Letters Patent of the United States is—

In a furnace, the combination with a grate of a fire-bridge located above the rear portion thereof, and an adjustable air-throttling device located under the grate and adapted to regulate the supply of air to the rear portion of the grate, substantially as set forth.

In witness whereof I have hereunto set my hand in presence of two witnesses.

GUSTAV LANGENBACH.

Witnesses:
HENRY HARDOR,
ALBERT SYMANOWSKI.