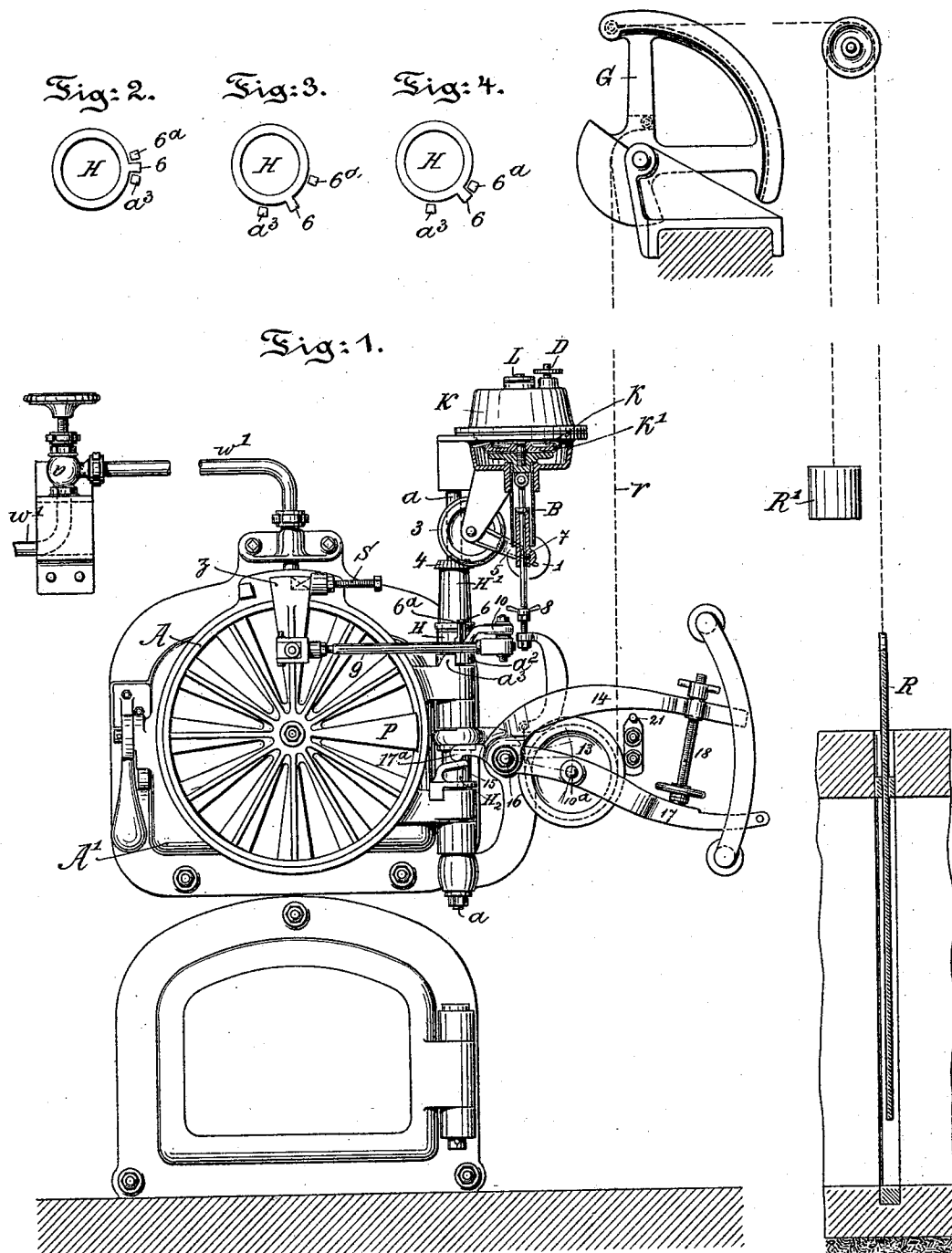


(No Model.)

T. LANGER.
SMOKE CONSUMING APPARATUS.

No. 544,767.

Patented Aug. 20, 1895.



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UNITED STATES PATENT OFFICE.

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SMOKE-CONSUMING APPARATUS.

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To all whom it may concern:

Be it known that I, THEODOR LANGER, a subject of the Emperor of Austria-Hungary, residing at Vienna, Austria-Hungary, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

My invention has relation to means for automatically regulating the stack-draft in grate-furnaces during the charging of the same with fuel and during the evolution of gas therefrom, and also for controlling the admission of air into the furnace above the grate; and in such connection it relates particularly to the construction and arrangement of such apparatus for said purposes.

My invention, stated in general terms, comprises an apparatus for regulating the stack-draft in grate-furnaces provided either with or without smoke-consuming appliances or attachments, by automatically controlling or regulating the draft from the combustion-chamber of the furnace to the stack during certain periods in the charging of the furnace, and at the same time increasing or decreasing the admission of air into the furnace above the grate. In order to convert in grate-furnaces the hydrocarbons, as well as gases of combustion, under the most favorable conditions into carbonic acid by admixture with steam to insure the most complete combustion with the least amount of air theoretically, it is necessary to regulate the amount and time of the upper grate-draft, as well as the under grate and stack-draft, naturally decreasing with the advancing consumption of the body or layers of fuel. Moreover, it is necessary to limit the stack-draft during feeding of the grate to prevent the too-rapid escape of incompletely consumed gases of combustion, due to a pernicious supply of air above the grate through the open doors of the furnace. Furthermore, care must be exercised as to the entrance and departure of the amount of air in proportion to the quantity of resultant gases of combustion and during the period in which the latter are evolved in largest quantities in the working of the furnace. It is, therefore, without regard to the by-action of the hitherto employed smoke-consuming apparatus in conjunction with furnaces as to the manner of air feeding above

the grate into the combustion-chamber that affords the greatest possible economy and practical results in the working of the furnaces; but it is due to such regulation that at the period of feeding the stack-draft must be smallest, at the period of commencement of gas evolution it must be the greatest, and during the period of one feeding to another it must be gradually decreased, depending largely upon the quantity of fuel fed to the combustion-chamber, the gas evolved from the fuel, and the height of the layer or body of fuel to be consumed.

The features hereinabove outlined constitute the characteristics of my invention, covering the means for carrying the same into effect.

In defining my present invention it will be considered in connection with a grate-furnace employing a smoke-consuming appliance therewith; but it should be understood that the invention, if used in conjunction with other furnaces, insures a simplification of the manner of feeding the furnace in general, an increase in heat action, a maintenance of the requisite temperature of combustion within the combustion-chamber of the furnace, and effects a very considerable saving of the fuel employed for the hereinbefore-recited objects and purposes.

The nature, characteristic features, and scope of my 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 front elevation, partly in section, of a furnace to which is secured the apparatus embodying my invention, whereby the mode of my invention may be carried out; and Figs. 2, 3, and 4 are top or plan views of the sleeve on the axis of the fire-door, and illustrating diagrammatically the various positions of the lug carried by said sleeve with respect to other portions which limit the movement of said lug.

Referring to the drawings, A is a circular slide connected with a radially-apertured fire-door A', to permit of the entrance of the upper air. The said slide is provided with a weight P, which constantly tends to hold the same in an open position with respect to the apertured fire-door.

R is a smoke-slide, the regulation of which is accomplished by a cataract K in the manner hereinafter more fully explained. The internal regulation of the air-feed in the combustion-chamber, controlled as to quantity and time in the same, is effected by a steam-veil, in which the steam is led to the steam-veil pipe w' leading into the combustion-chamber (not shown) and controlled by the valve v .

In the opening of the fire-door A' the piston k' of the cataract K is actuated by means to be presently fully explained, and in the closing of the door the piston descends under the control of the throttle-valve D; but, however, its descent is regulated by the adjustment of said valve, depending upon the character of fuel used, said valve D permitting the entrance of air into the receptacle k above the membrane-piston k' . This piston k' , by means of mechanism hereinafter described, controls the slide of the fire-door A' and thereby permits of the entrance of air into the furnace above the grate, to effect complete combustion of combustible gases produced in a certain period of time during gas evolution. In the instance shown in the drawings, by opening the fire-door A' the smoke-slide R is permitted to sink to the lowest point determined by the character and management of the furnace, while by closing the same the smoke-slide rises to the highest point corresponding to the amount of stack or under grate draft initially required.

The means for regulating the stack-draft and the entrance of air under the grate by gradually decreasing the opening of the channel leading to the stack corresponding to the gas evolution, as well as to the consumption of the layer or body of fuel, is controlled by the cataract K through the following mechanism, to wit: Loosely mounted on the axis a of the fire-door A' is a sleeve H, provided with a lever-arm 10. This sleeve at its lower portion is provided with a lug a^2 , adapted to abut against a lug a^3 , secured to or formed integral with the upper portion or hinge of the fire-door A' . At its upper end the sleeve H is provided with another lug 6, and above the sleeve is located a second sleeve H', provided with a lower lug 6^a and a miter-gear 4. The lug a^2 of the upper portion of the door A' by the opening of the same will thereby turn the sleeve H, which will operate the sleeve H' through the lugs 6 and 6^a . The sleeve H' in turn will operate the miter-gear 4, which meshes with a complementary gear 3. To the shaft of the gear 3 is fixed an arm 5, the end of which is movably located in the sleeve 7, sliding on the piston k' of the cataract K. The movement of the arm 5 raises the sleeve 7, which abuts against the sleeve B, secured to the membrane-piston k' , thereby elevating the same, which in turn forces air out of the receptacle k through the discharge-valve L. The circular weighted slide A must immediately after each charge of fuel be closed suf-

ficiently to prevent an undue quantity of air being admitted to the combustion-chamber when the smokeless combustion of the gases takes place and during the commencement of the period of gas evolution. This movement of the slide A is effected by the closing of the fire-door and the freeing of the lower lug of the sleeve H thereby from the lugs a^3 , thereby causing a weight 1, connected with the lever-arm 5 and sleeve 7, to bear sufficiently on the rod of the membrane-piston k' to give a certain movement to the said slide by means of the miter-gears 3 and 4, sleeve H, lever 10, and rod 9, which movement of the slide corresponds to the movement of the weight P.

The falling movement of the sleeve 7 is first limited by the threaded lug 8, against which the sleeve 7 abuts. By the contact of the said sleeve 7 with the lug 8 and farther downward movement of the weight 1, the slide is then closed in proportion to the descent of the piston of the cataract K by the entrance of air in the chamber k , controlled by the throttle-valve D.

The adjustment of the lug or stop 8 can be arranged so that the downward movement of the lever-arm to its lowest point corresponds with the complete closing of the slide A. The intermediate position in the adjustment of the lug 8 will correspond with the different open positions of the slide, according to various types of fuel as well as the quantity of upper air-draft necessary. Below the lug or stop 8 the smoke-slide R, by means of a chain passing over a roll 13, is connected with the piston-rod k' of the cataract K.

The range of movement of the circular slide A is controlled by means of an adjusting-screw S, against the end of which the lug z of the slide A rests when the slide is in an open position. The weight 1, which is connected with the lever-arm 5 and the sleeve 7, is afforded a range of descent on the piston, rod k' , so as to abut against the lug 8 in the closing of the fire-door A' , while a further movement of said parts causes an actuation of the miter-gears 3 and 4 and sleeve H', permitting the descent of the piston-rod k' to the base of the chamber k of the cataract K. By the adjustment of the screw S, and also the lug or stop 8 on the rod k' , a greater or less space is presented between the lugs 6 and 6^a after descent of the weight 1 and only after a farther descent of the piston k' for a certain distance will the lug 6 be brought into contact with the lug 6^a and move the same to completely close the circular slide. The duration of initial opening can be determined according to the kind and charge of the fuel by adjusting the lug or stop 8, while the extent of initial opening will be determined *ad libitum* by the adjusting-screw S. After the closing of the circular slide has been effected the piston k' of the cataract K will descend within certain limits to accomplish the closing of the smoke-slide R. By means

of the screw S the size of the initial opening is determined, while by the closing of the fire-door the position of the lug 6^a and the sleeve H' is ascertained by its abutting against the piston k' of the cataract K. If the screw S and the lug 8 are so adjusted that by the closing of the door the same will not contact with each other, but leave a space between the same, the piston k' of the cataract K will descend a defined distance before the lug 6^a reaches a position of contact with the lug 6 to actuate the same and thereby cause the closing of the circular slide A. According, therefore, to the adjustment of the lug 8 the direction of initial opening of the slide will be determined. The various positions regulated by the screw S and the lug 8 are illustrated in Figs. 2, 3, and 4, the position shown in Fig. 2 being that when the fire-door is open, the position shown in Fig. 3 being that when the fire-door is closed, the lever 5 occupying a lowered position on the lug 8, and the position of the lug 6 defined by the screw S, the position shown in Fig. 4 being that when the piston of the cataract has descended sufficiently as to cause the lug 6^a to abut against the lug 6, in order to cause the circular slide A to begin its closing movement of the fire-door A'. When the circular slide is closed the piston of the cataract K is afforded a still further movement of descent in order to permit of the lowered position of the smoke-slide R to the lowest point. Contrary to the general theory and to the hereinbefore-described mode of air regulation the smoke-slide R, by the opening of the fire door A', will increase the passage-way leading to the smoke-stack if the movement of the cataract K is permitted to actuate the smoke-slide directly. In order to prevent this and to expeditiously reach the necessary lowest position of the smoke-slide in the opening of the fire-door according to my invention, the axle 10^a of the roll 13 is located in the long lever-arm 17, pivotally supported at 16. During the opening of the fire-door the piston of the cataract K draws the chain *r* along, through the intervention of the weight R' of the slide R. The long lever-arm 17 will therefore rise, since the small arm 17^a can slide downward on a worm groove or cam 15 of the sleeve H², connected with the axis of the fire-door. At the point 10 the upward movement of the lever-arm 17 is in proportion to the half-movement of the piston k' of the cataract K, in order that the smoke-slide R may be kept at rest, and by the shape or form of the worm groove or cam 15 and the differences in the length of the arms 17 and 17^a, the smoke-slide R, in the ascent of the piston k' of the cataract K, will descend the required distance. If the fire-door is closed the lever 17, through the intervention of the worm groove or cam 15, swings in a downward direction to its initial position, whereby the smoke-slide R is quickly caused to assume an elevated position—for example, such as illustrated in Fig. 1 of the drawings.

A slow closing of the smoke-slide R is accomplished by lessening the chain thereof in proportion to the downward movement of the piston of the cataract K. The movement of the piston of the cataract is insufficient to adjust the smoke-slide, and therefore there is interposed a sector-lever G between the slide and the operative mechanism hereinbefore described, and as fully illustrated in Fig. 1 of the drawings. To relieve strain on the membrane and piston the weight R' of the smoke-slide R is so equalized as that the latter can descend automatically. The adjustment of the circular slide A', and also of the smoke-slide R, is of special importance. The size and duration of the opening is changeable *ad libitum*, controlled only by the nature of the fuel, the mode of regulation, and the strength of the draft to the smoke-stack. As soon as the movement of the cataract by means of the throttle-valve D has been determined during the practice of the invention and the initial opening, by means of the lug or stop 8, has been determined, the mode of closing the slide A can be modified by the adjustment of the connecting-point of the rod 9 and lever 10, through the interposition of any connecting-link. (Not shown.) With reference to the smoke-slide R, the lowest position is determined by a lug 21, against which the lever 17, carrying the roll 13, rests.

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

1. An apparatus for regulating the draft in grate furnaces, which consists of a fire door provided with openings, and a slide having a projection and adapted to be afforded a range of movement between stops, whereof one has an adjusting device connected therewith, a cataract provided with a piston, operative mechanism actuated by said cataract and controlling the openings in said fire door, a smoke slide and operative mechanism therefor controlled by said cataract and piston, substantially as and for the purposes described.

2. An apparatus for regulating the draft in grate furnaces, comprising a fire door provided with a controllable slide, a cataract provided with a chamber having a throttle valve and a membrane piston and rod, with an adjustable stop thereon, a link connecting said piston-rod with said slide, a smoke slide and actuating mechanism therefor connected with the mechanism for controlling said fire door slide and with the rod of said cataract, substantially as and for the purposes described.

3. An apparatus for regulating the draft in grate furnaces, comprising a furnace provided with a fire door having a slide, a smoke slide connected to said door by suitable intermediate mechanism and actuated by the closing of said door, a cataract operated by one movement of said fire door and released by the opposite movement thereof and adapted to control the slide in the fire door and thereby the upper draft of the furnace, and to control the

smoke slide during the charging of the furnace and the gas evolution, substantially as and for the purposes described.

4. An apparatus for controlling the draft of grate furnaces, comprising a smoke slide, a cataract provided with a piston and rod and having a throttle-valve connected therewith, a fire door provided with a circular adjustable slide, said smoke slide counterweighted and provided with a sector, and actuating mechanism interposed between said fire door slide and cataract, substantially as and for the purposes described.

5. An apparatus for controlling the draft of grate furnaces, comprising a driving mechanism, a fire door and a smoke slide, the construction of said driving mechanism being such, that one member thereof is operated by the lower door hinge, the other member by the upper door hinge and the third by interposed sleeves, and a cataract provided with a piston and rod, substantially as and for the purposes described.

6. In an apparatus of the character described, a smoke slide, a roll 13, a cataract provided with a membrane piston and rod

and an adjustable throttle valve, arms 14 and 17 controlled by an adjusting screw 18, a fire door provided with a slide having a projection and afforded a range of movement between stops, whereof one of them is provided with an adjusting screw, substantially as and for the purposes described.

7. In an apparatus of the character described provided with a fire door having a circular slide with radial openings therein, a lever connected therewith and pivotally connected with mechanism interposed between a cataract provided with a membrane piston and rod and with lugs adjustable thereon, lever mechanism connected with the frame-work of the furnace and adjustable with respect to each other, a weighted smoke slide and suitable mechanism for raising and lowering the same, substantially as and for the purposes described.

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

THEODOR LANGER.

Witnesses:

VICTOR TISCHLER,
FERDINAND SATTLER.