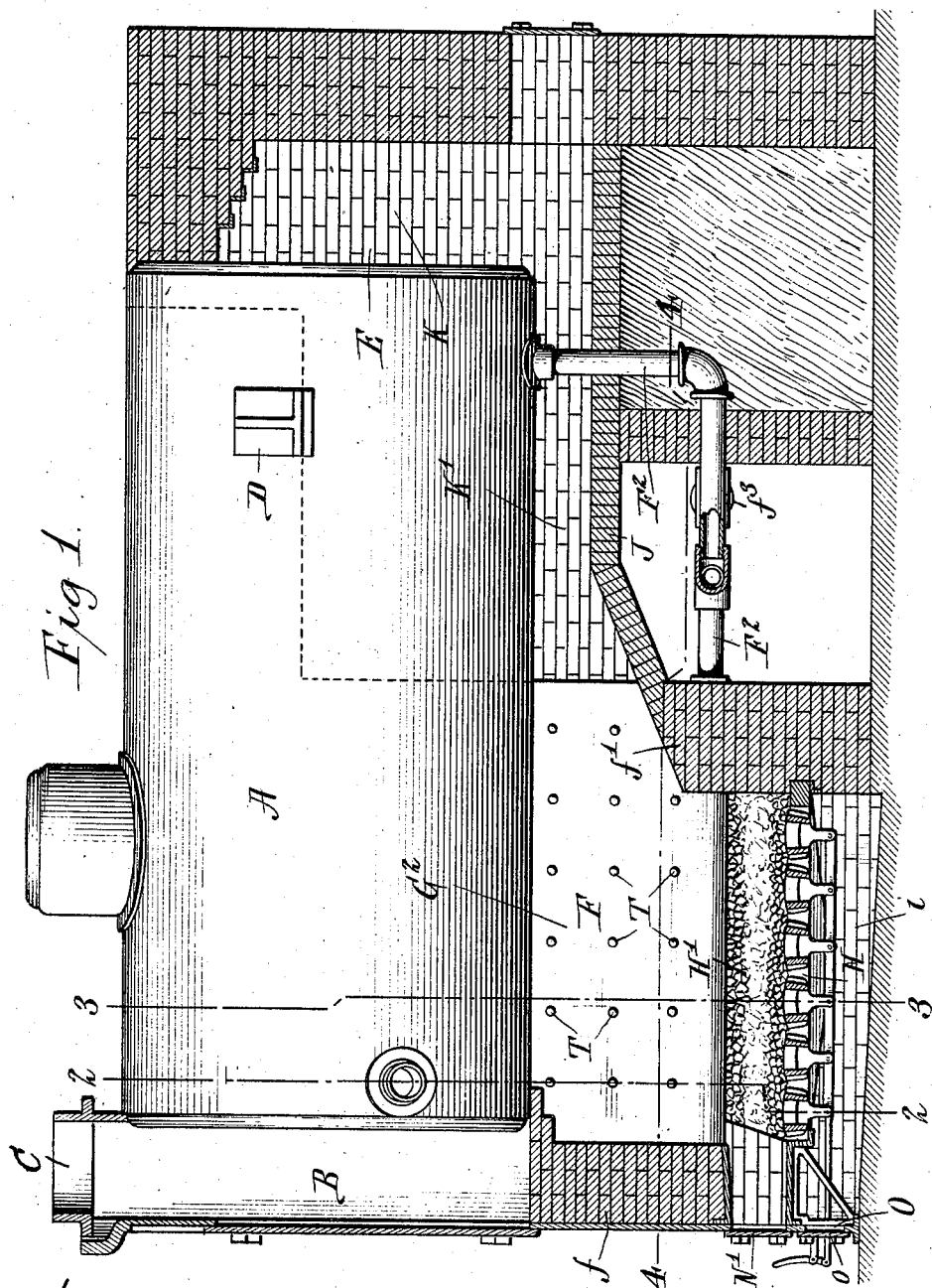


996,063.

3 SHEETS—SHEET 1.



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SMOKELESS BOILER FURNACE.
APPLICATION FILED AUG. 10, 1909.

996,063.

Patented June 27, 1911.

3 SHEETS—SHEET 2.

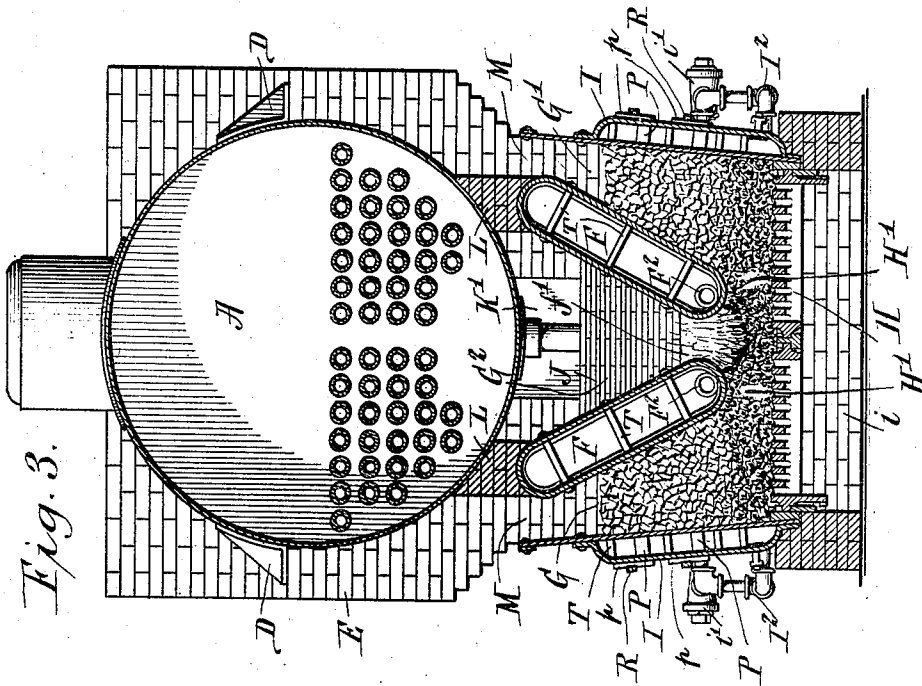


Fig. 3.

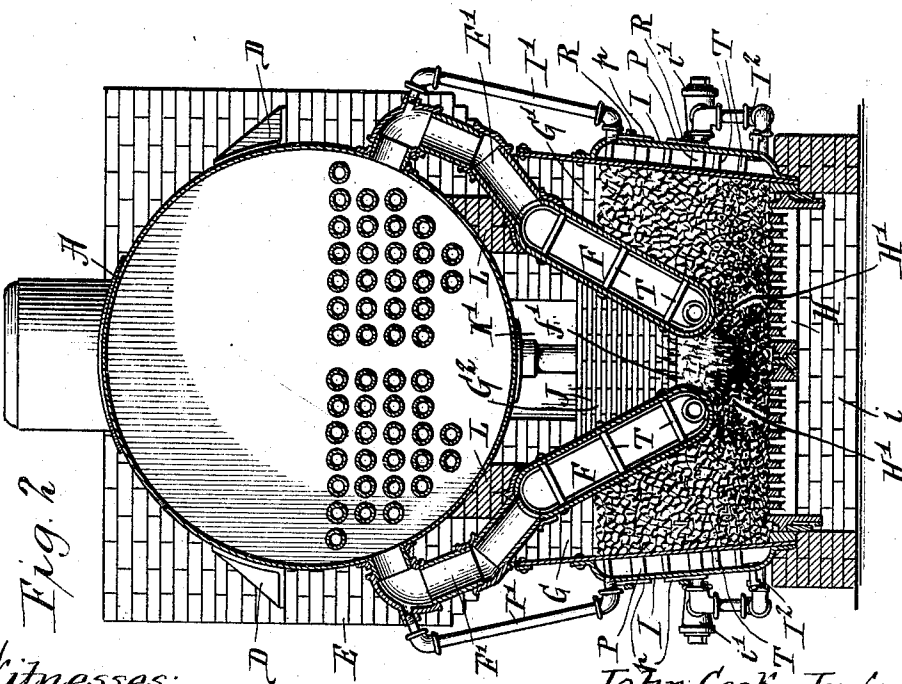


Fig. 2.

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3 SHEETS-SHEET 3.

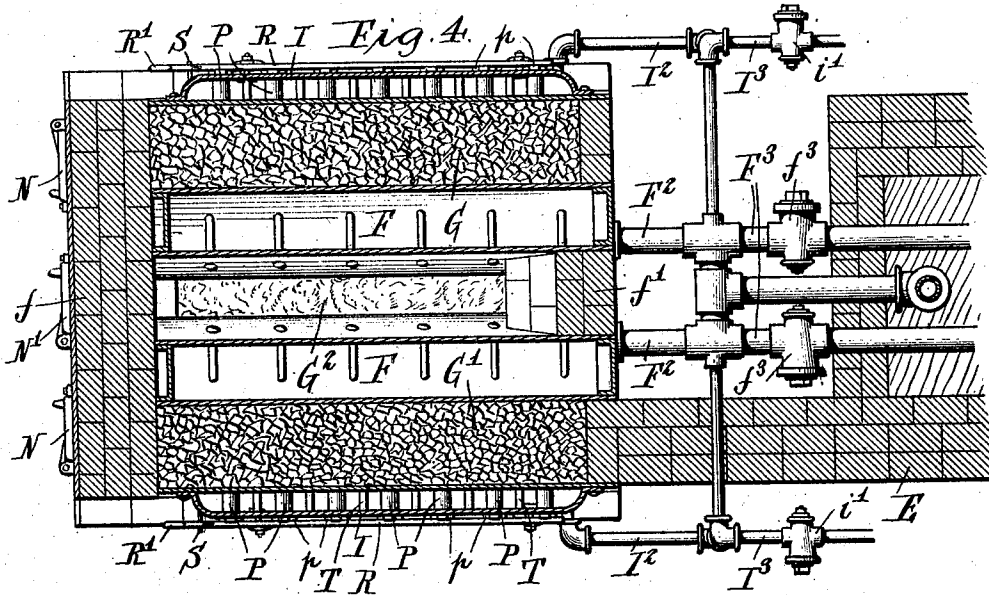


Fig. 5.

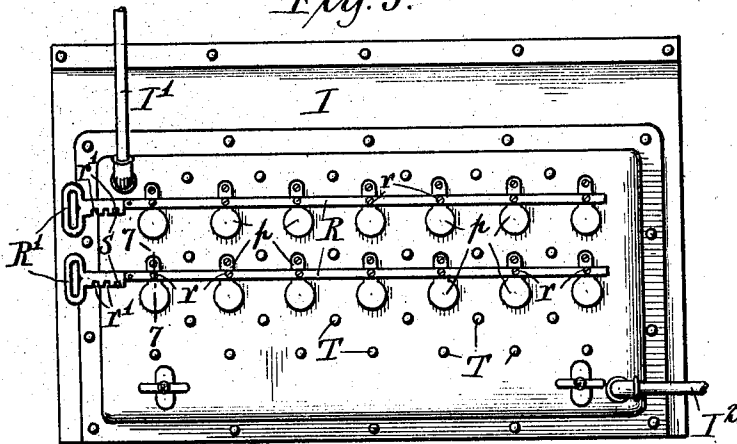
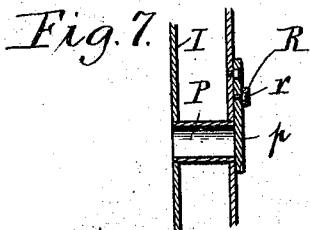
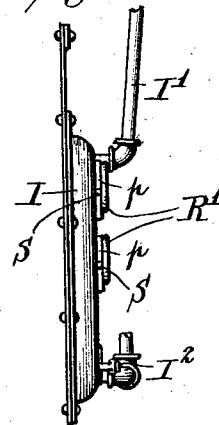
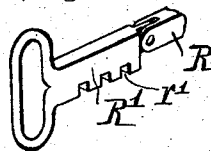


Fig. 6.



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Fig. 8.



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UNITED STATES PATENT OFFICE.

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SMOKELESS BOILER-FURNACE.

996,063.

Specification of Letters Patent. Patented June 27, 1911.

Application filed August 10, 1909. Serial No. 512,258.

To all whom it may concern.

Be it known that I, JOHN COOK, a citizen of the United States, and resident of Buffalo, in the county of Erie and State of New York, have invented certain new and useful Improvements in Smokeless Boiler-Furnaces, of which the following is a specification.

My invention relates to certain new and useful improvements in smokeless boiler furnaces; and it has for its object the production of a furnace in which substantially complete combustion takes place in the combustion-chamber, resultant from the introduction of air at the top of the fuel which passes down and unites with an upward current of air at a common point, at which point the fuel is in an incandescent state. The air becomes thoroughly heated and unites with the volatile elements, thus assuring complete combustion.

Another object of my invention is the production of a furnace in which the fuel is stored in two fuel-chambers at opposite sides of a combustion-chamber and is automatically fed to said combustion-chamber, and in which the air is introduced through the open tops of said fuel-chambers also through the sides of the same and through the grate supporting the fuel.

Other objects of my invention will be apparent from the following description.

My invention consists in the construction, arrangement and combination of parts to be hereinafter described and particularly pointed out in the subjoined claims.

In the drawings,—Figure 1 is a central longitudinal section of a furnace embodying my invention, the boiler being shown in elevation. Fig. 2 is a transverse section taken on line 2—2, Fig. 1. Fig. 3 is a transverse section taken on line 3—3, Fig. 1. Fig. 4 is a horizontal section taken on line 4—4, Fig. 1. Fig. 5 is a side elevation of one of the side members closing the outer sides of the fuel storage-chambers. Fig. 6 is an end view of the same. Fig. 7 is an enlarged vertical section, taken on line 7—7, Fig. 5. Fig. 8 is a perspective view of the end of one of the actuating-bars for operating the closures of the side air-inlets.

Referring now to the drawings in detail, corresponding letters of reference refer to corresponding parts in the several figures.

The reference letter A designates the boiler which is of the usual or any suit-

able construction; it being shown as the return-tube type beneath which the heat passes and returns through the tubes of the boiler, whence it passes through the drum or chamber B to the smoke-stack C. Said boiler is provided with brackets D which are supported on or embedded in the brick-work E surrounding at least part of the boiler.

Underneath the front end of the boiler the furnace is divided into three chambers by downwardly-converging longitudinally-disposed water-sections F which extend from the front wall *f* to the bridge-wall *f'*; the chambers G, G¹ lying outside of said water-sections being the fire-boxes and serving also as fuel-storage chambers, while the intermediate chamber G² serves as the combustion-chamber. It is to be noted that the fuel chambers G, G¹ are gradually enlarged toward their lower ends, while the combustion chamber is gradually enlarged toward its upper end.

A grate H of any suitable type serves as the bottom of the chambers G, G¹, G² and separates them from the ash-pit beneath; said grate being separated from the lower edges of the water-sections F by narrow passages H¹ which connect the combustion-chamber G² with the fuel-chambers G, G¹, as clearly shown in Figs. 2 and 3.

In lieu of forming the outer sides of the fuel-chambers of brick, as is generally done, I provide metallic water-jackets I which are supported on the brick-work closing the sides of the ash-pit *i* and secured at their ends to the brick walls at the front and at the rear portions of the sides.

The water-sections F and the water-jackets I are connected at or near their tops with the boiler by pipes F¹, I¹, respectively, pipes I¹ preferably having indirect connection with the boiler through the upper ends of pipes F¹ into which they are threaded, as best shown in Fig. 2. Said water-sections and water-jackets are also connected at or near their bottoms to the bottom of the boiler by pipes F², I², respectively, pipes I² preferably having indirect connection with the boiler through a portion of the pipes F² into which they are threaded. In this manner complete circulation of the water is obtained. Any other arrangement for assuring the proper circulation of water through the water-sections and water-jackets may be resorted to, but I consider

the arrangement shown and described highly efficient for the purpose. Connected to the pipes I^2 are blow-off pipes I^3 provided with valves z^1 and connected to the pipes F^2 are blow-off pipes F^3 having valves f^3 therein, thus providing for the proper emptying or blowing down and the necessary cleansing of said sections and jackets. The boiler may have a separate blow-off-pipe, but the connection of the pipe F^2 thereto admits of emptying or blowing down the boiler through the pipes F^3 which are connected to pipe F^2 .

In rear of the bridge-wall, the brick inclosing and supporting-structure is arched, as at J, to provide an open space in which the several valves of the blow-off pipes are situated, said valves being accessible through the open side of said space. In rear of the boiler, the usual smoke-box K is located which is connected with the combustion-chamber by a passage K^1 underneath the rear end of the boiler, as is customary in boilers of this general type.

The spaces between the tops or upper ends of the water-sections F and the boiler A are preferably closed with brick, as at L, so as to exclude all air from the combustion chamber at this point and to prevent escape of heat therefrom. If desired, said sections may be in physical contact with the boiler, but I find the construction shown to serve the purpose to good advantage.

The upper ends of the water-jackets I are separated from the boiler and from the water-sections to provide openings M which extend the full length of the fuel-chambers G, G^1 and through which the fuel is introduced to said chambers. The front of the furnace has doors N which close openings leading to the front ends of the fuel chambers and a door N^1 which closes an opening leading to the front end of the combustion-chamber; said doors permitting a view of the fire and serving, as in an ordinary furnace, as a means to render the interior accessible for stoking or otherwise attending to the fire.

The air admitted to the fuel through the grate is regulated in the usual manner through openings O in the front wall of the ash-pit i and which are closed by doors o .

Passing through the water-jackets I are air-tubes P, which may be arranged in any desired manner, but I have shown two series in different horizontal planes so as to admit air to the fuel-chambers in different planes, depending upon the height of the fire in the fire-boxes or the lower ends of the fuel-chambers. These tubes are closed with dampers p pivoted at points above the tubes so that they may be swung to open the tubes to the degree desired. Each horizontal series of dampers has connection with an actuating-rod R, as at r , and at the front end of

each rod, a handle-portion R^1 is pivoted thereto which has a series of notches r^1 in its lower edge adapted for engagement with a pin S projecting from the water-jacket. As shown in Fig. 5, the innermost notch of each handle is in engagement with a pin S, thus holding the dampers in closed position. In order to open the dampers of an entire series, the handle portion R^1 of the bar co-operating with said series is swung upward to disengage the same from the pin, after which it is only necessary to force the rod rearward so as to bring one of the remaining notches in line with the pin, the notch to be engaged depending on the degree to which the dampers are to be opened. The releasing of the handle permits it to gravitate and engage the pin with the desired notch. The tubes P supply air to the fuel from the side and by means of the dampers p the supply of air is regulated.

As the water-jackets and water-sections are subjected to considerable internal pressure, they are preferably made of sheet steel and braced with stay-bolts T.

The fuel charged into the two chambers G, G^1 passes underneath the lower ends of the water-sections F, and commingles in the bottom of the combustion chamber G^2 , and when ignited the entire grate is covered with burning fuel so that the water in the water-jackets I as well as that in the water-sections F becomes thoroughly heated. Fuel is stored in the chambers G, G^1 above the burning fuel, and as the fuel at the bottom is consumed, the fuel above is supplied by gravity to be ignited. By reason of the walls of chambers G, G^1 flaring downward, all possibility of the fuel clogging and bridging over the burning fuel is obviated; moreover, both the water-jackets I and the water-sections F trend inward so that the fuel when gravitating, tends to move inward at the same time so as to pass underneath the water-sections to the bottom of the combustion-chamber.

The burning fuel is confined to the lower portions of the fuel-chambers, which portions are to be considered as the fire-boxes, and to the combustion-chamber, owing to the air entering the open upper ends of the fuel-chambers and passing downward and around the lower ends of the water-sections F, at which points it unites with the air passing up through the grate. The air passing up through the grate at the sides is drawn toward the combustion-chamber and therefore the burning fuel is confined to the region directly above the grate but entirely covering the same. When the dampers p are opened, the air enters the sides of the fuel-chambers and is drawn downward and inward underneath the water-sections. By reason of the air being drawn to the lower end of the combustion-chamber and the

burning fuel at this point being always free from unignited fuel, there is at all times a bed of incandescent fuel at the lower ends of the water-sections through which all air and unconsumed products of combustion must pass. The oxygen in the air passes into the incandescent bed and becomes intensely heated. It combines with the incandescent bed of fuel, or the coke as it may be termed, and also unites with the volatile elements, assuring complete combustion. The hot air passes rearward through the combustion chamber, through the passage K¹, into the smoke-box K, whence it returns through the tubes of the boiler and enters the drum or chamber B, thence out the smoke stack C.

The structure herein shown and described is a representative one only, and it is apparent to any one skilled in the art to which this invention appertains that changes may be made therein without departing from my invention.

Having thus described my invention, what I claim is,—

1. A furnace comprising a boiler, a combustion-chamber beneath said boiler having upwardly-diverging walls, a fuel-chamber at each side of said combustion-chamber connected with the lower end of the latter and having downwardly-diverging inner walls.

2. A furnace comprising a boiler, a fire grate beneath said boiler, a combustion chamber centrally over said grate and having its side walls separated from said grate by fuel passages, a fuel chamber at each side of said combustion chamber having its upper end open, said fuel chambers being provided with air passages, and means for regulating the air passing through said passages.

3. A furnace comprising a boiler, a fire grate beneath said boiler, a pair of water sections spaced apart and disposed on opposite sides of the longitudinal center to form a combustion chamber between the two, said water-sections being separated from the grate by spaces and also from the side walls of the furnace by spaces forming fuel chambers, said water sections being of greater height than width and diverging upwardly and having connection with said boiler at high and low points.

4. A furnace comprising a boiler, a grate beneath said boiler, water-jackets forming the sides of the space between said boiler and said grate, a combustion-chamber centrally in said space, a fuel-chamber at each side of said combustion-chamber, said fuel-chamber being separated from said combustion-chamber by intervening imperforate walls themselves separated from each other and having their lower ends spaced from said grate and their upper ends in contact with the boiler, and water connections between said water-jackets connected to high and low points of said boiler.

5. A furnace comprising a boiler, a grate beneath said boiler, water-jackets forming the sides of the space between said boiler and said grate, a combustion-chamber centrally in said space, a fuel-chamber at each side of said combustion-chamber, said fuel-chamber being separated from the combustion-chamber by hollow continuous imperforate walls including water-sections having their lower ends spaced from said grate, and the upper ends of said walls being in contact with the boiler, and water-connection between said boiler and said water-sections and also between said boiler and said water-jackets.

6. A furnace comprising a boiler, a grate beneath said boiler and separated therefrom by an intervening space, water-jackets forming the sides of said space and having air-tubes passing therethrough, a combustion-chamber centrally in said space underneath said boiler, a fuel-chamber at each side of said combustion-chamber, said fuel-chamber being separated from said combustion-chamber by intervening walls having their lower ends spaced from said grate and being open at their upper ends for charging the same, connections at high and low points of said water-jackets with said boiler, and dampers for opening and closing said air-tubes.

7. A furnace comprising a boiler, a grate beneath said boiler and separated therefrom by an intervening space, imperforate water-sections dividing said space into a central combustion chamber and side fuel-chambers open at their upper ends and connected at their lower ends by passages between said sections and said grate, said sections diverging upwardly to form an upwardly flaring combustion-chamber and downwardly flaring fuel-chambers, a pipe connected with the lower end of each water-section, a pipe connected to the bottom of said boiler and having connection with the pipes of said water-sections, blow-off pipes in connection with the aforesaid pipes, and pipes connecting the upper ends of said water-sections with the boiler above its bottom.

8. A furnace comprising a boiler, a grate beneath said boiler separated therefrom by an intervening space, water-jackets forming the sides of said space, walls on opposite sides of the longitudinal center of said space and dividing said space into a central combustion-chamber and side fuel-chambers, the lower end of said walls being spaced from said grate to form fuel-passages and the upper ends thereof being spaced from said water-jackets, pipes leading from high points of said water-jackets to said boiler above its bottom, pipes connecting the lower ends of said water-jackets with the bottom of said boiler and blow-off pipes connected with said last-mentioned pipes.

9. A furnace comprising a boiler, a grate

beneath said boiler and separated therefrom
by an intervening space, water-jackets form-
ing the sides of said space and having air-
tubes therethrough, two longitudinally-dis-
posed walls dividing said space into a cen-
tral combustion-chamber and side chambers
connected with said combustion-chamber,
pivoted dampers closing the outer ends of

said air-tubes, and a rod connecting the
dampers of each water-jacket to cause them to
move in unison.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."
