969,250.

G. DE GRAHL.

BOILER FURNACE.

APPLICATION FILED JUNE 10, 1909.

Patented Sept. 6, 1910.

3 SHEETS—SHEET 1.

Fig. 1.

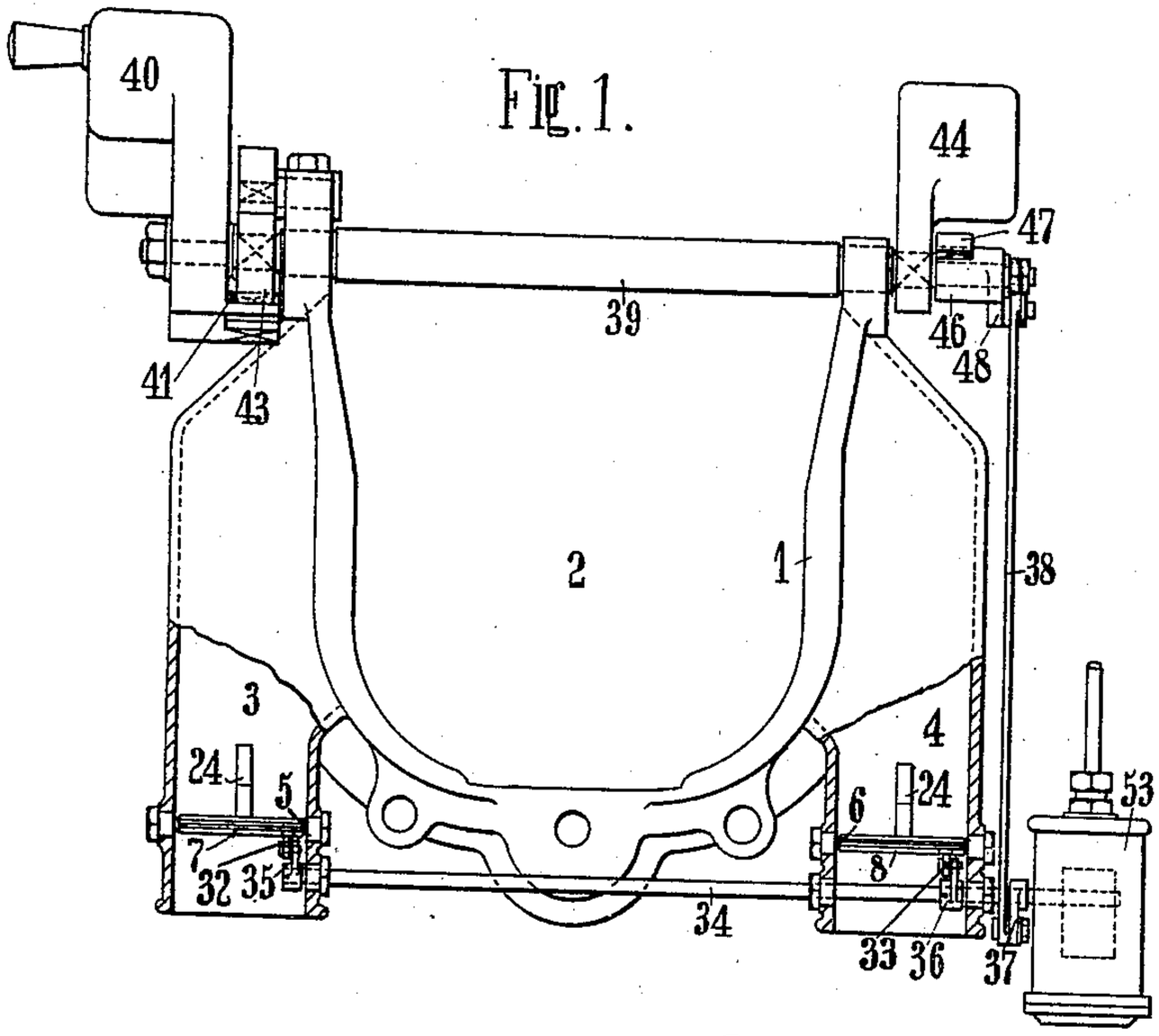


Fig. 2.

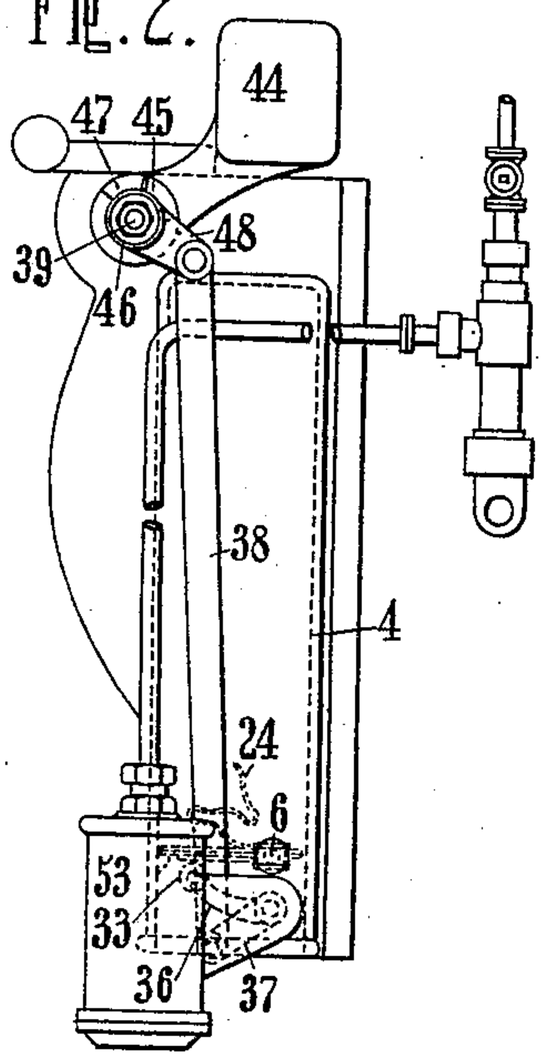
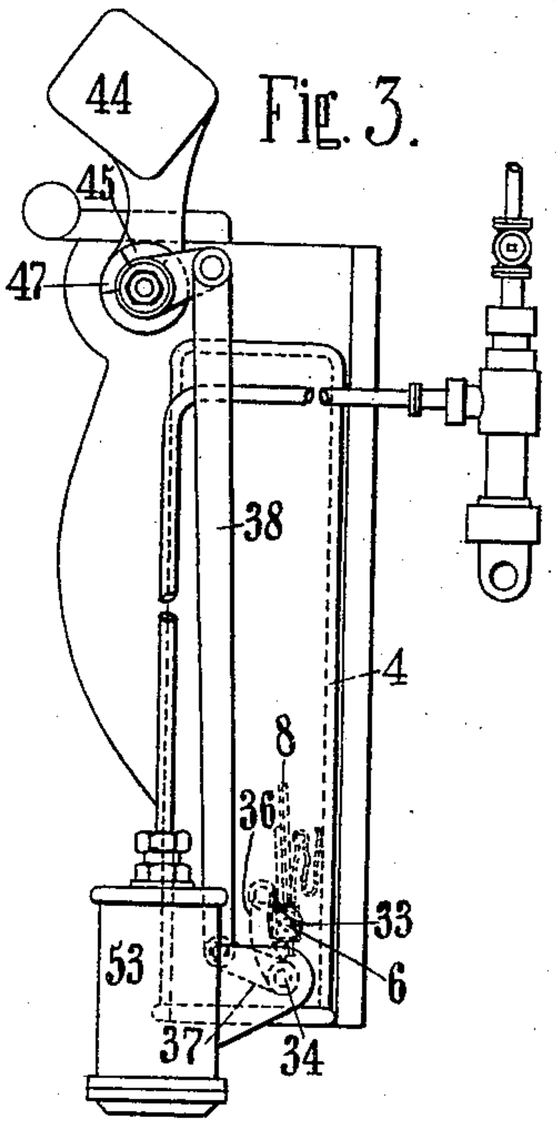


Fig. 3.



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3 SHEETS—SHEET 2.

Fig. 4.

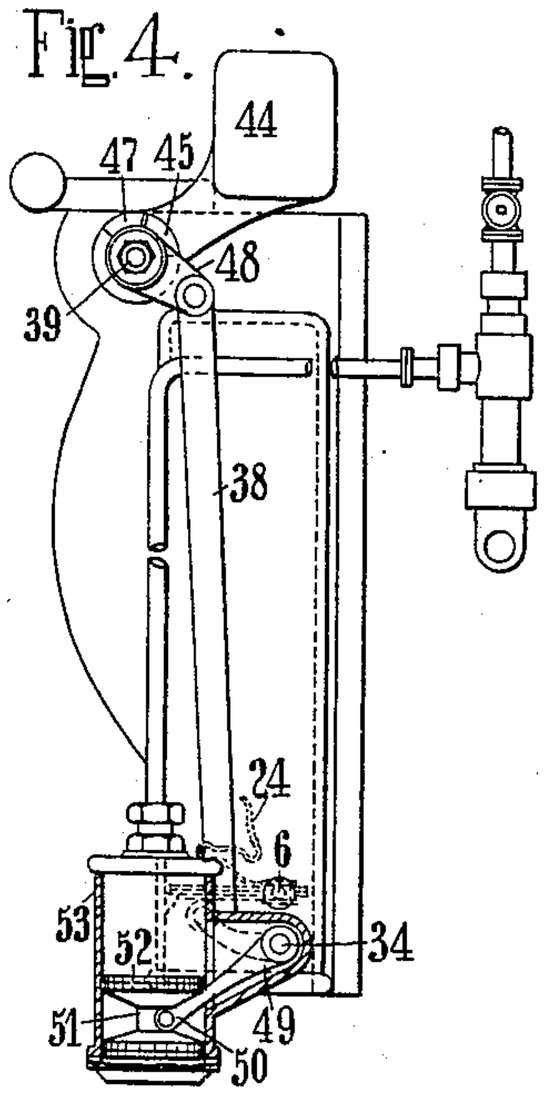


Fig. 5.

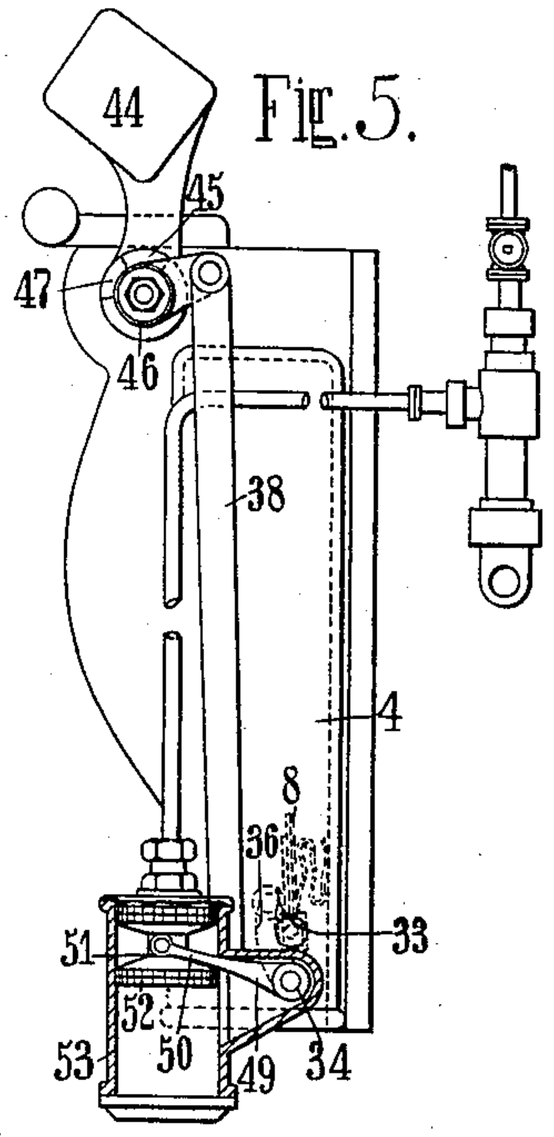


Fig. 6.

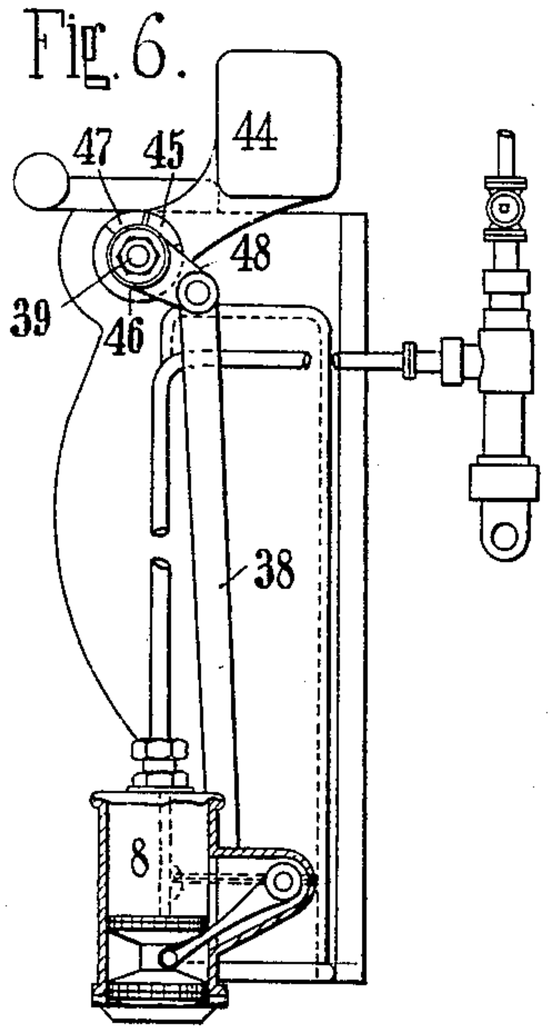
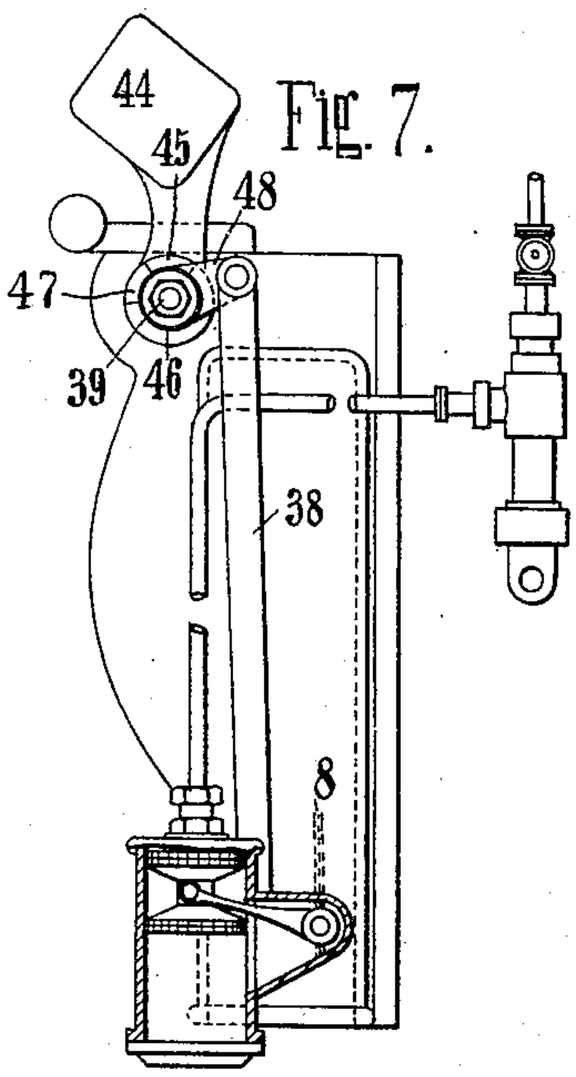


Fig. 7.



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3 SHEETS—SHEET 3.

Fig. 8.

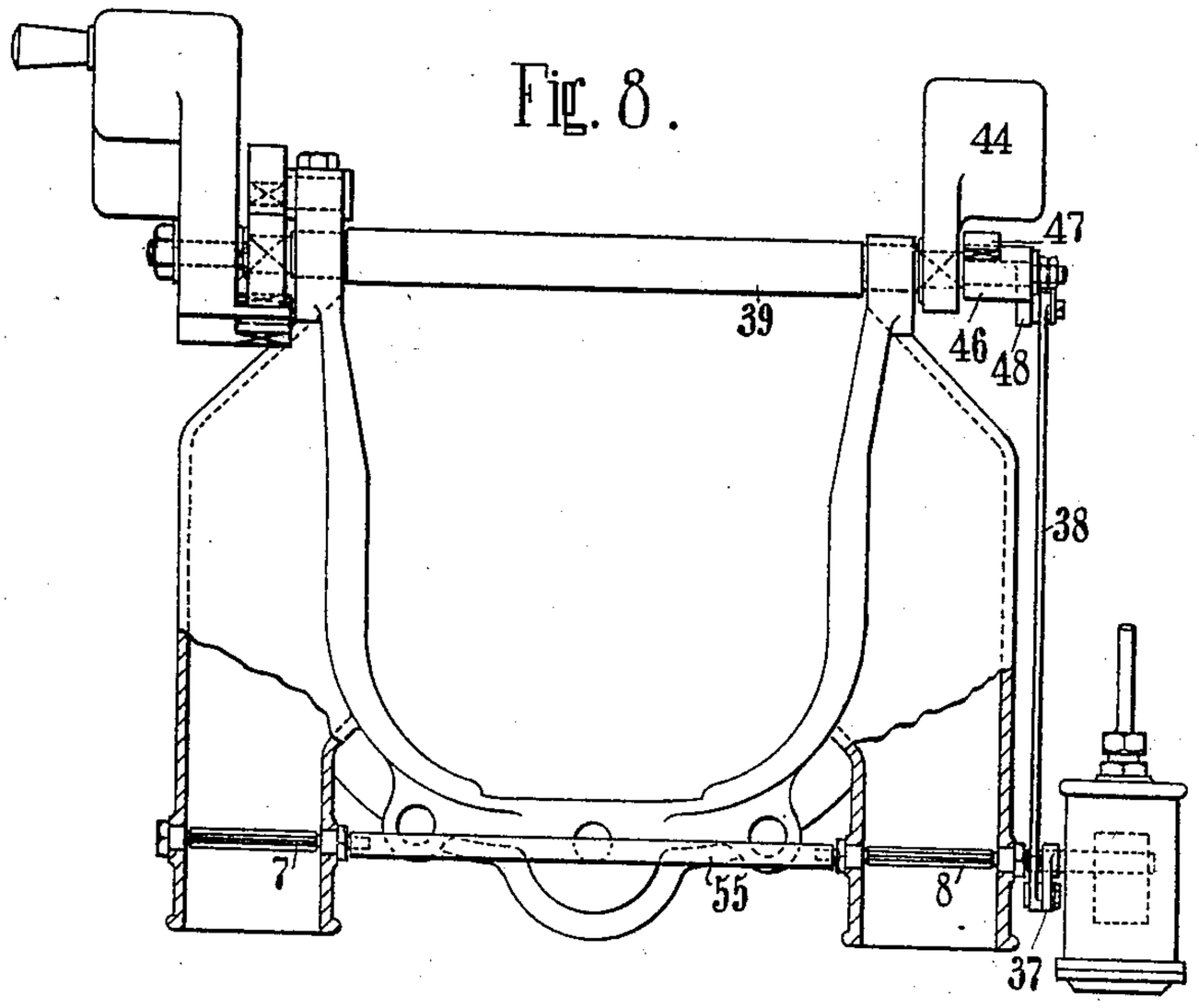


Fig. 9.

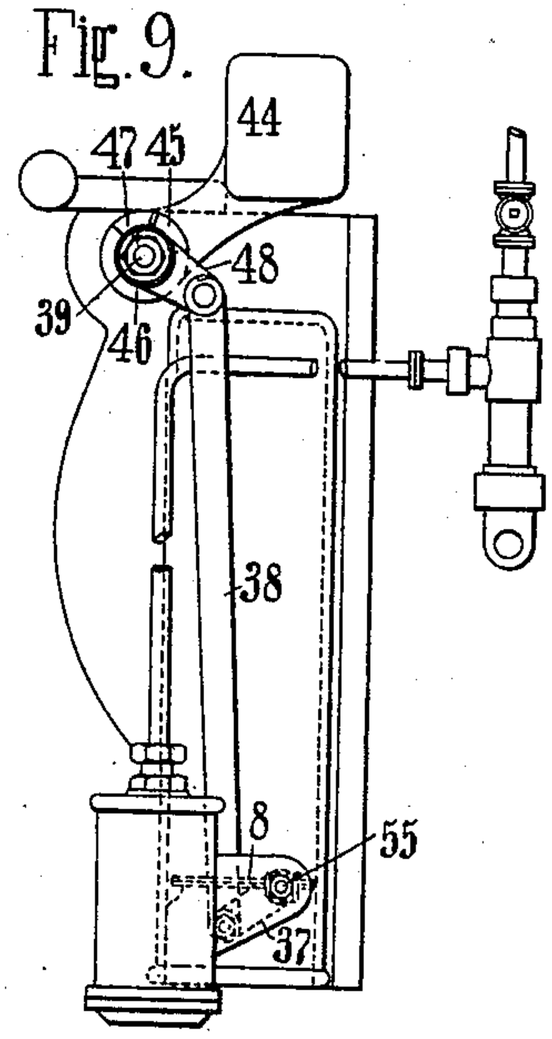
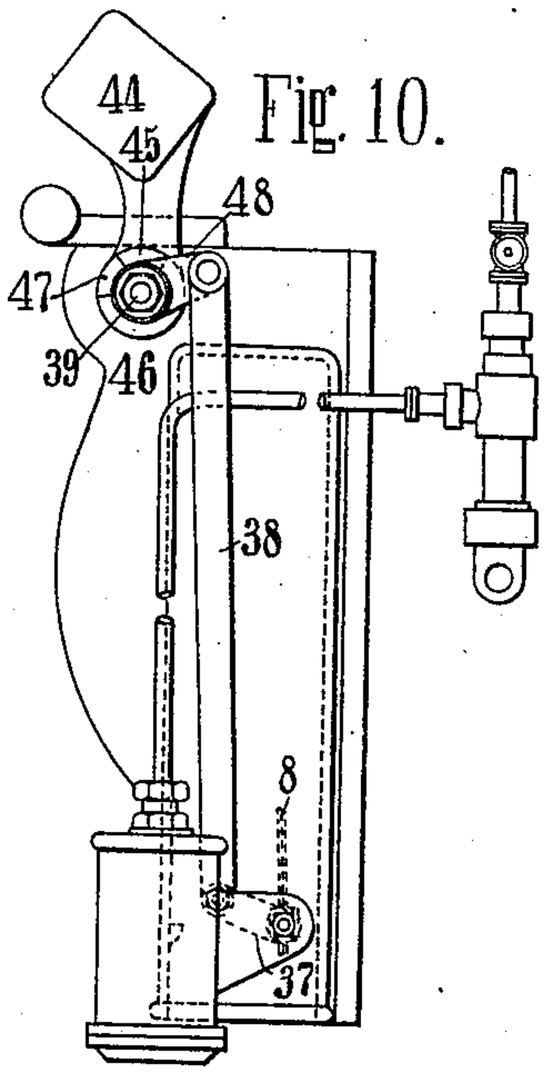


Fig. 10.



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UNITED STATES PATENT OFFICE.

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BOILER-FURNACE.

969,250. Specification of Letters Patent. **Patented Sept. 6, 1910.**

Application filed June 10, 1909. Serial No. 501,293.

To all whom it may concern:

Be it known that I, GUSTAV DE GRAHL, a subject of the German Emperor, and residing at Zehlendorf, near Berlin, Germany, have invented certain new and useful Improvements in Boiler-Furnaces, of which the following is a specification.

My invention relates to boiler furnaces and a primary object is to provide an improved fire door frame having laterally arranged conduits containing valves for introducing additional air into the fire box.

My new frame differs from fire door frames known heretofore by there being arranged in the air conduits valves which open automatically under the influence of the partial vacuum in the fire box and allow additional air to enter into the fire box, so that when there is an increasing tendency for the fuel to form carbon monoxid in the combustion chamber the quantity of air entering into the latter is increased. The increasing tendency to form carbon monoxid in the combustion chamber occurs, for example, shortly after stoking has taken place, *i. e.* at a time when the grate is completely covered with fuel and the partial vacuum in the combustion chamber attains its maximum. Now I provide that a quantity of additional air corresponding to the degree of vacuum which exists will enter into the combustion chamber and flow thence at a relatively high speed over the layer of fuel. In this manner the advantage is obtained, as compared with known furnaces in which automatically adjusting throttling members are inserted in conduits leading to the space behind the bridge wall, that the additional air introduced through the furnace front into the fire box acts equalizingly on the vacuum in the fire box and the production of carbon monoxid is avoided by the velocity at which the air flows over the layer of fuel.

In order that my invention may be clearly understood I will now explain the same with reference to the accompanying drawings in which several constructional forms are represented by way of example.

In said drawings:—Figures 1 to 5 show the fourth constructional form, namely: Fig. 1 represents the same in front elevation, partly in vertical section, whereas Figs. 2 and 3 are each a side elevation, and Figs. 4 and 5 are each a side elevation, partly in vertical section. Figs. 6 to 10 show the fifth constructional form, namely: Figs. 6 and 7 are each a side elevation, partly in section, Fig. 8 is a front elevation, partly in vertical section, and Figs. 9 and 10 are each a side elevation.

Referring to the drawings, the first constructional form according to Figs. 1 to 5 is arranged as follows: The fire door 2 is mounted pivotally on the door frame 1. 3, 4 are the two lateral air conduits. In these the pivots 5, 6 are arranged around which the valves 7 and 8, respectively, can rock. On the shaft 34, which extends through the conduit 4 and into the conduit 3, are attached the levers 35, 36 and also the lever 37 to which the rod 38 is pivotally connected. The free ends of the levers 35 and 36 are provided with rollers 32, 33, respectively, as clearly shown. The weighted lever 40 is mounted revolubly on the door shaft 39. This lever is rigidly connected or integral with a shoulder 41 which, when the lever 40 is rotated, hits against a shoulder of the sector 43 attached on the shaft. On the shaft 39 is also attached the weighted lever 44 having a shoulder 45, and the sleeve 46 having the shoulder 47 is revoluble on this shaft. A lever 48 pivotally connected with the rod 39 is rigidly attached to or integral with the sleeve 46. The shaft 34 carries a lever 49 which clasps with its fork 50 the part 51 of the piston 52 movable in the cataract-cylinder 53, as clearly shown in Figs. 4 and 5. The cylinder 52 of the cataract 53 is provided at its lower end with a suction valve, (not shown in the drawings). The same is so large, that air may enter easily into the cylinder, when the piston is raised. The cylinder is provided at its lower end with a small outlet opening (not shown in the drawings), so that the air can escape only slowly from the cylinder, when the piston descends.

The described constructional form operates as follows: When the grate is covered so thickly with coal, that a sufficient quantity of air cannot pass through the grate openings the vacuum in the combustion chamber is highest. The valves 7, 8 in the lateral air conduits 3, 4 therefore will open and additional air is drawn in by suction over the layer of fuel through the open conduits, the velocity and quantity of the air corresponding to the vacuum. As the layer of coal is consumed the vacuum is lowered and simultaneously the velocity of the en-

tering air decreases, the quantity of which is in itself diminished by the movement of valves in the air conduits toward their closed position; and finally the valves arrive in the position in which they close the conduits. On opening the furnace door the valves are brought positively in their open position in the following way. As soon as the lever 40 is turned forward and then strikes with its shoulder 41 against the shoulder of the sector 43, the door shaft 39 together with the door secured on it is turned into the position corresponding to the open position of the furnace door. During this movement the projection 45 of the lever 44 strikes against the shoulder 47 of the sleeve 46, so that the sleeve 46 is turned. The rotation of the sleeve 46 is transmitted by the lever 48, rod 38 and lever 37 to the shaft 34. By the rotation of the latter the piston 52 is raised and the air is sucked into the cylinder 53 and at the same time the levers 35, 36 are also turned upward so that the air valves 7, 8 are opened. If now after the charging has been completed the door shaft 39 with the furnace door is turned back again into the former position, the projection 45 of the lever 44 is removed from the shoulder 47 of the sleeve 46. The piston 52 is not maintained any longer in its upper position, but sinks down in the cylinder 53 under its own weight and this movement is in proportion to the amount of air escaping through the said small outlet of the cylinder. While the piston 52 is going down in the cylinder 53 the sleeve 46 together with the lever 48 are rocking. By this rocking motion the sleeve 46 with its shoulder 47 follows the projection 45 and, the movement of the same extends as far as the sinking piston of the cataract allows it. The air valves 7, 8 will thus remain open after the closure of the furnace door and will return only gradually into their position closing the air conduits 3, 4 in so far as the vacuum existing in the fire box allows. Of course the valves 7, 8 may be provided with springs in this constructional form.

The constructional form according to Figs. 6 to 10 differs from that described above in this that the shaft 55 arranged below the fire door is connected directly with the valves 7, 8, so that when this shaft is rotated the valves are rocked, *i. e.*, either opened or closed. On the shaft 55 is attached the lever 37 to which the rod 38 is pivoted. On the door shaft 39 is attached the weighted lever 44 having a shoulder 45, and the sleeve 46 having the shoulder 47 is revoluble freely on this shaft. A lever 48, which is pivoted to the rod 38, is rigidly connected or integral with the sleeve 46.

The last described constructional form operates as follows: When the vacuum in the fire box increases beyond a certain limit, the valves 7, 8 are opened. The rotation of the shaft 55 is then imparted by lever 37 and rod 38 to the lever 48 and sleeve 46, whereby the shoulder 47 of the latter is rotated away from the shoulder 45 of the weighted lever 44. The piston of the cataract is simultaneously raised and the cataract tensioned. When the vacuum in the fire box decreases again, the valves 7 and 8 will close to such an extent as the falling cataract-piston allows. When the fire door is opened, the door shaft is rotated, the shoulder 45 of the weighted lever 44 then acts against the shoulder 47 of the sleeve 46, so that the latter with the lever 48 is also rotated. The rotation of the sleeve and its lever is imparted by rod 38 and lever 37 to the shaft 55. Owing to the rotation of the shaft 55 the valves 7, 8 are opened and the cataract tensioned, whereby the valves at first remain open when the fire door closes and close only gradually as the falling cataract-piston allows.

I claim:

1. In apparatus for automatically regulating the draft in boiler-furnaces the combination of a door-frame having lateral flues, said flues communicating at their lower ends with the free atmosphere and at their upper ends with the fire-box, flap valves closing said flues and adapted to open automatically when the partial vacuum in the combustion chamber exceeds a certain limit, the pivotal axis of said flap valves being between the center of the same and one edge thereof, a shaft revolubly mounted on the door-frame, a fire door rigidly attached to said shaft, a weighted lever having a projection rigidly attached to one end of said shaft, a sleeve revolubly mounted on said shaft and being provided with a shoulder, the projection of said weighted lever abutting against the shoulder of said sleeve when the fire door is opened, a cataract, a piston in said cataract, a second shaft revolubly mounted on the door frame, means for transmitting the motion of said piston to said second shaft and the motion of said second shaft to said piston means for transmitting the rotation of said sleeve to said second shaft and vice versa and means for transmitting the rotation of said second shaft to said flap valves.

2. In apparatus for automatically regulating the draft in boiler furnaces the combination of a door frame having lateral flues, said flues communicating at their lower ends with the free atmosphere and at their upper ends with the fire-box of the flap valves closing said flues and being adapted to open the same automatically when the partial vacuum in the combustion chamber exceeds a certain limit, the pivotal axis of said flap valves being between the center line of the same and one edge thereof, a shaft revolubly

mounted on the door frame, a fire-door rigidly attached to said shaft, a weighted lever having a projection rigidly attached to one end of said shaft, a sleeve revolubly mounted on said shaft having a shoulder, the projection of said weighted lever abutting against the shoulder of said sleeve when the fire-door is opened, a cataract having a piston, a second shaft revolubly mounted on the door-frame means for transmitting the motion of said piston to the second shaft and vice-versa, levers attached to said second shaft and in engagement with said flap valves and to open the same as soon as the latter shaft rotates and raises the levers.

In testimony whereof, I affix my signature in the presence of two witnesses.

GUSTAV DE GRAHL.

Witnesses:

FRIEDRICH ROKAHR,

WOLDEMAR HAUPT.