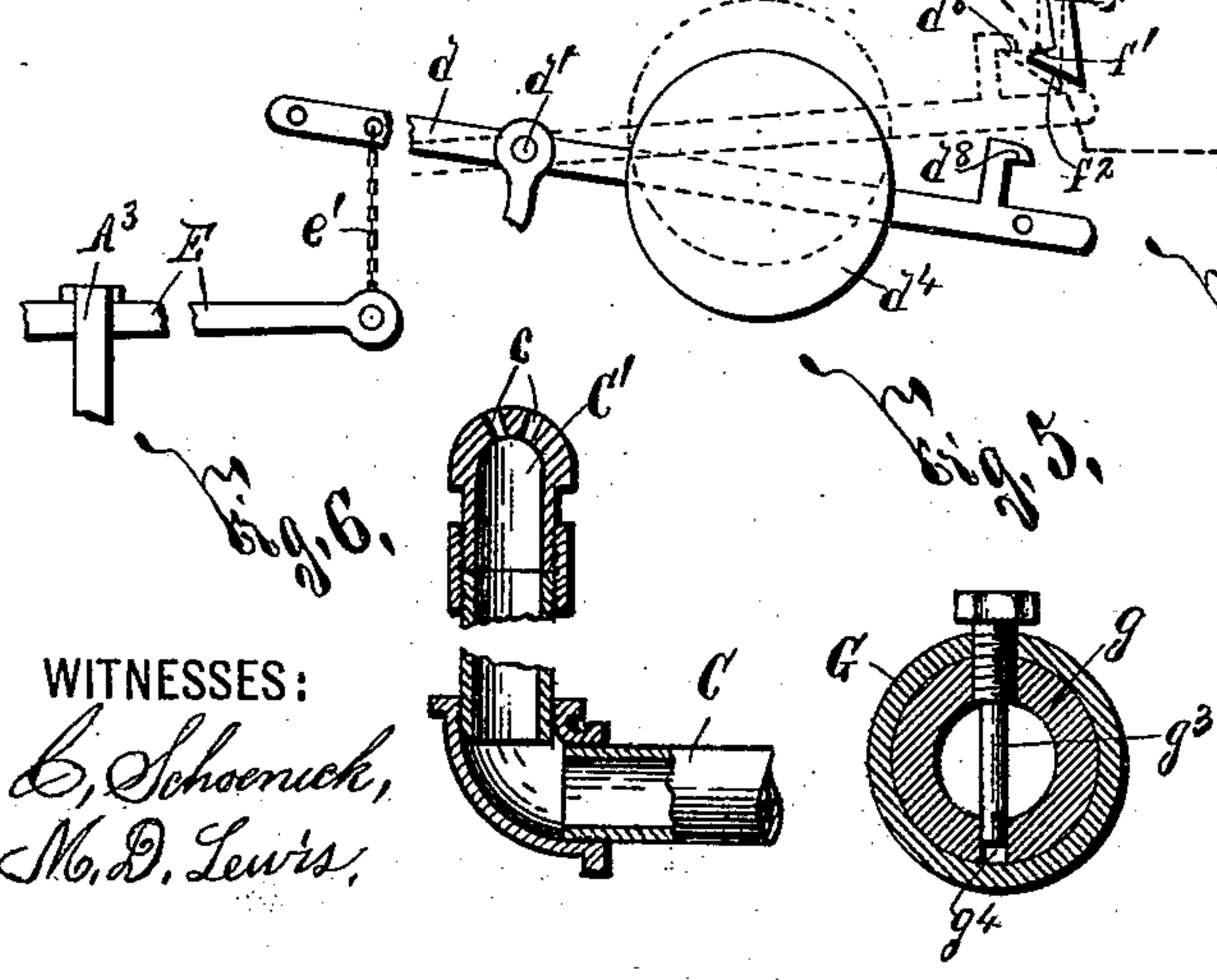
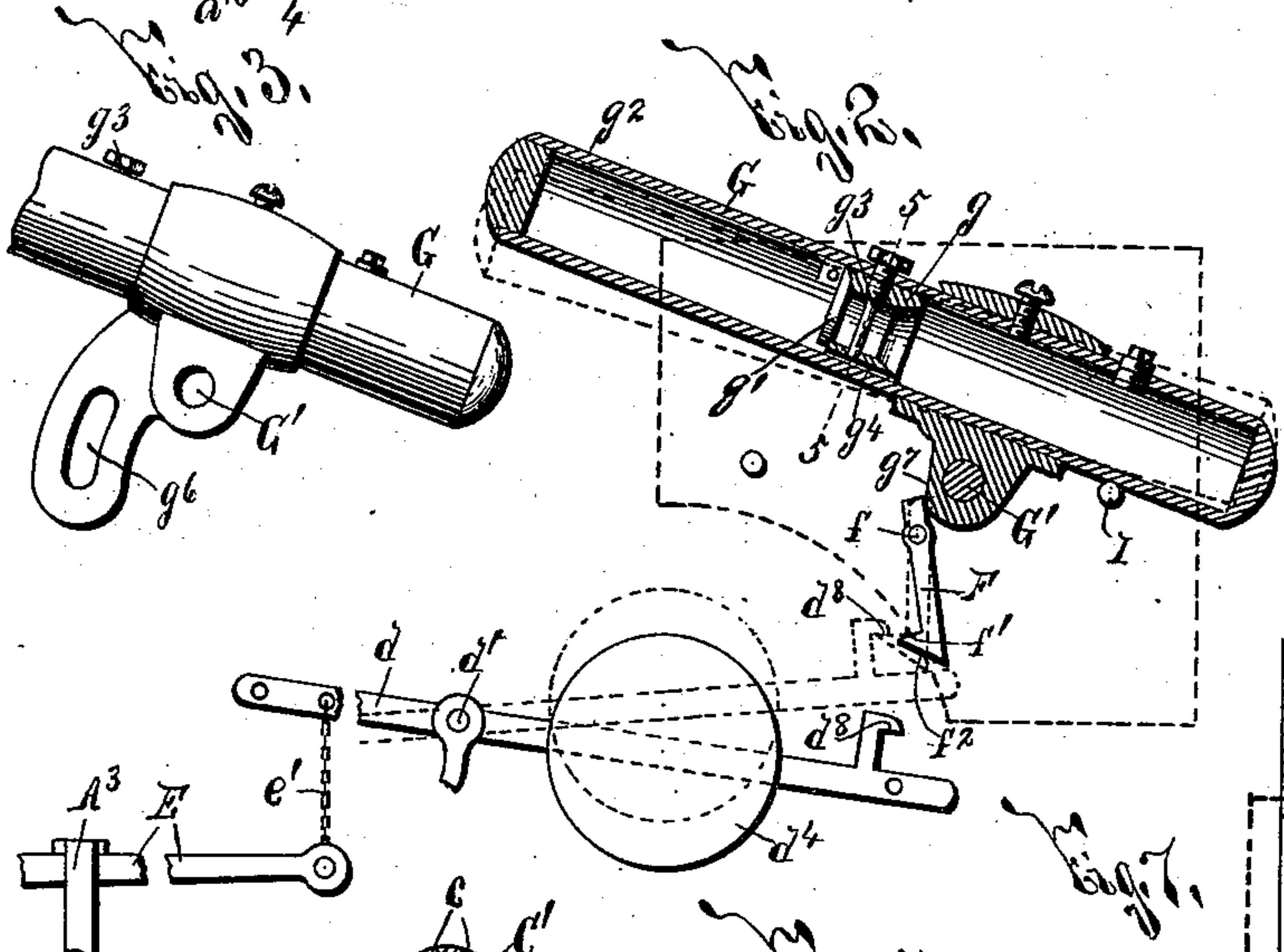
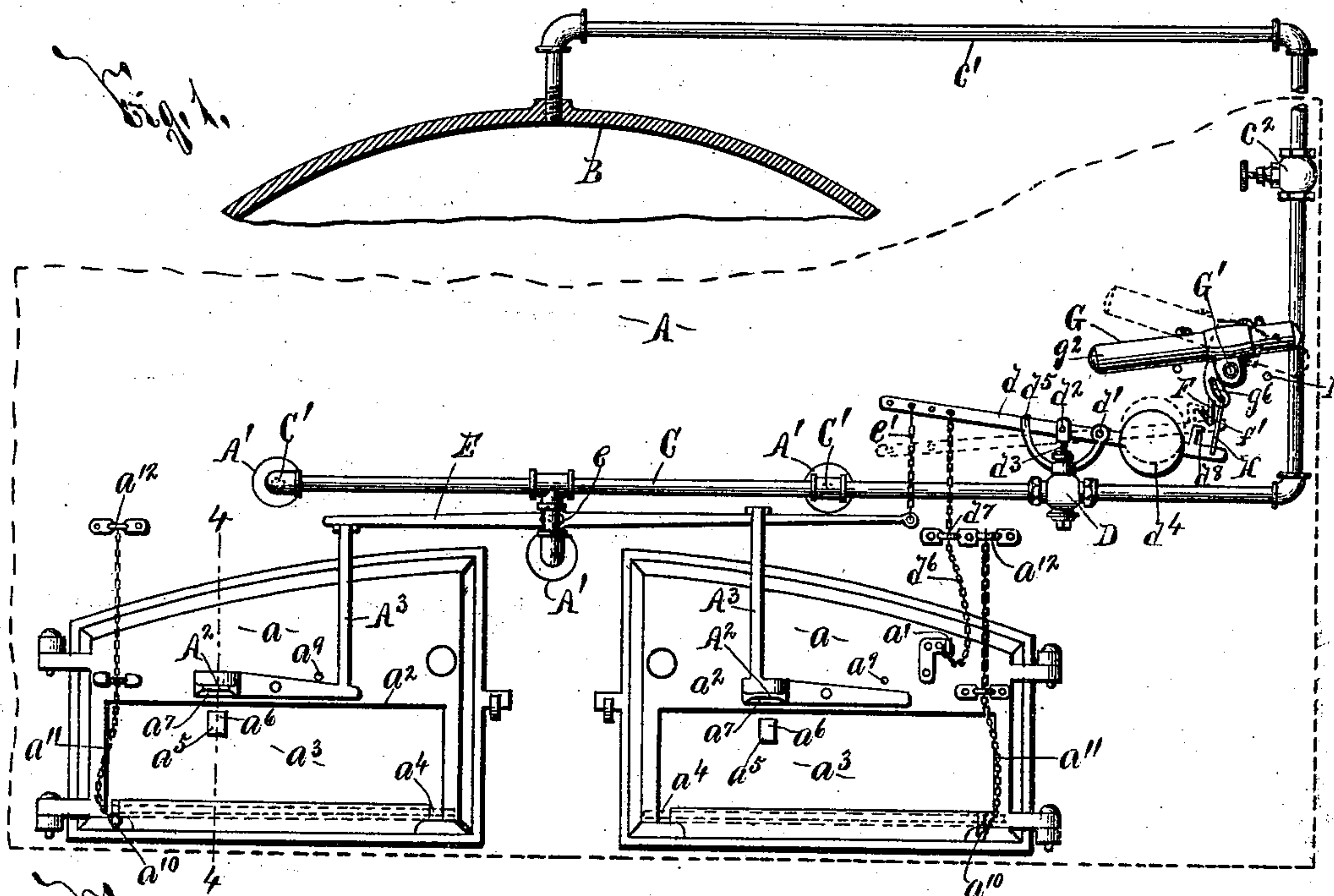


(No Model.)

T. CLIFFORD.  
FURNACE ATTACHMENT.

No. 550,017.

Patented Nov. 19, 1895.



WITNESSES:  
*B. Schoenick,*  
*M. D. Lewis,*

INVENTOR  
*Thomas Clifford*  
BY  
*Ray, Wilkinson & Parsons*  
ATTORNEYS



# UNITED STATES PATENT OFFICE.

THOMAS CLIFFORD, OF ROCHESTER, NEW YORK.

## FURNACE ATTACHMENT.

SPECIFICATION forming part of Letters Patent No. 550,017, dated November 19, 1895.

Application filed October 22, 1894. Serial No. 526,537. (No model.)

*To all whom it may concern:*

Be it known that I, THOMAS CLIFFORD, of Rochester, in the county of Monroe, in the State of New York, have invented new and useful Improvements in Furnace Attachments, of which the following, taken in connection with the accompanying drawings, is a full, clear, and exact description.

My invention relates to improvements in furnace attachments of the class set forth in my previous patent, No. 467,157, dated January 19, 1892, for preventing the escape of carbon with the gases of combustion, especially directly after fresh fuel is inserted within the furnace, and has for its object the production of a practical and efficient device which is economically manufactured, is readily placed in operative position, and is automatic in its action; and to this end it consists, essentially, in a steam-pipe discharging within the combustion-chamber of the furnace, a valve for said pipe provided with an operating part or lever connected to the door of the furnace, whereby when the door is opened the valve is automatically opened, a movable stop for holding the valve-operating part or lever in its position assumed when the valve is open, and an automatic operating-piece for forcing said stop from operative position.

The invention also consists in an air-inlet for the combustion-chamber, through which the steam discharges for automatically drawing the air through said inlet into the combustion-chamber, a supplemental door for the movable door of the furnace, a stop for holding the supplemental door in its open position, and in the detail construction and arrangement of the parts, all as hereinafter more particularly described, and pointed out in the claims.

In describing this invention reference is had to the accompanying drawings, forming a part of this specification, in which like letters indicate corresponding parts in all the views.

Figure 1 is an elevation, partly in section, of a portion of a furnace provided with my invention. Fig. 2 is a detail elevation, partly in section, of a portion of one of the stops for the supplemental doors, a part of the lever for operating said stop, the operating part or lever for the valve of the steam-pipe, the stop

for said lever, and the movable operating-piece for rocking said stop from operative position. Fig. 3 is an enlarged elevation of one end of the detached operating-piece. Figs. 4 and 5 are transverse detail sectional views taken, respectively, on lines 44, Fig. 1, and 55, Fig. 2. Fig. 6 is a detail top plan view, partly in section, of a portion of the steam-pipe, illustrating particularly the steam-discharging jet; and Fig. 7 is a detail sectional view illustrating a modified form of supplemental door-opening device.

It is well known that a great waste in fuel is occasioned in the operation of furnaces of the various kinds by the escape of carbon with the products of combustion, especially directly after fresh fuel is inserted within the combustion-chamber. Various devices have been produced for preventing the escape of the carbon; but none of these have as yet come into general use.

My present invention consists of a simple device which can be attached to any furnace without the exercise of great skill, is automatic in its action, and is effective in operation.

A represents the front plate of a furnace, provided with hinged doors *a a*, opening into the combustion-chamber, (not illustrated,) and B a generator, which may be of any desirable form, size, and construction, and is supported in the usual manner above the combustion-chamber.

C is a pipe for conveying steam or other fuel within the furnace combustion-chamber, and, as clearly seen in the drawings, one end of said pipe is provided with a series of outlets or jets *C'*, Fig. 6, removably secured to lateral branches of said pipe and provided with outwardly-diverging outlet-apertures *c*, and the other end may be connected by a branch *c'* to the generator B and may be provided with a hand-valve *c<sup>2</sup>*, of any desired construction, not necessary to herein illustrate or describe, for regulating the amount of steam passed through said pipe.

D is an automatic valve, also of any suitable construction, for the pipe C, which regulates the flow therethrough when the valve *c<sup>2</sup>* is open, and *d* is an operating part or lever pivoted at *d'* to an arm of the valve-shell and hinged at *d<sup>2</sup>* to a plunger *d<sup>3</sup>*, which opens and



closes the valve D. As this valve D may be of any desired construction and is well known to one skilled in the art, it is unnecessary to further illustrate or describe the same.

5 One extremity of the operating part or lever  $d$  is provided with a weight  $d^4$  for normally elevating the opposite end of the operating part or lever  $d$ , and thereby elevating the plunger  $d^3$  and closing the valve D. The op-  
10 posite end of the operating part or lever  $d$  is guided in an arm  $d^5$  upon the frame of the valve and is connected by a chain or other suitable connection  $d^6$  to an arm  $a'$  upon the corresponding door  $a$ . The connection  $d^6$  is  
15 passed through an eye  $d^7$  upon the front plate A.

As the door is opened, the connection  $d^6$ , which is normally more or less slack, is operated to depress the adjacent end of the lever  
20  $d$  and elevate its weighted extremity to the position indicated by dotted lines at Fig. 1, and thereby open the valve D, whereupon the steam is discharged through the jets or outlets  $C' C'$  of the pipe C into the combustion-  
25 chamber. Consequently as fuel is added after opening the door the steam discharged within the combustion-chamber greatly accelerates its combustion and reduces the escape of carbon with the products of combustion. This action is greatly augmented by  
30 the inlet of air within the combustion-chamber, and the inlet of the air is effected by providing the front plate A with a series of inlets  $A' A'$  and discharging the steam from the outlets or jets  $C' C'$  through said air-inlets,  
35 and thereby drawing the air within the combustion-chamber. I also effect the inlet of the air by providing each of the doors  $a a$  with an opening  $a^2$  therethrough at its base, arranged beneath the outlets or jets of the  
40 pipe C, and a supplemental door  $a^3$ , hinged by a pivotal pin  $a^4$  at its lower edge. The upper edges of the supplemental doors are movable inwardly, as clearly seen at Fig. 4, and  
45 said doors consequently form inclined walls, by which the air entering the openings  $a^2 a^2$  is directed upwardly toward the steam discharged by the outlets or jets of the pipe C.

Each supplemental door is provided on its  
50 outer face with a laterally-extending arm  $a^5$ , having an upturned end or engaging shoulder  $a^6$ , and each door  $a$  is provided with a movable stop or catch  $A^2$ , having a weighted extremity formed with an upwardly-inclined engaging face  $a^7$ , and a stop-shoulder or face  $a^8$ , slightly separated from the adjacent portion of the outer face of the door. Pins or lugs  $a^9$   
55 upon the doors  $a$  limit the downward movement of the weighted ends of the stops or catches  $A^2$ .

The lower edge of each of the supplemental doors  $a^3$  is provided with an arm  $a^{10}$ , secured to one extremity of a chain or other suitable connection  $a^{11}$ , having its upper end secured  
65 to a support or loop  $a^{12}$  upon the front plate A. As the doors  $a$  are opened, the chains or connections  $a^{11}$  elevate the arms  $a^{10}$  of the sup-

plemental doors  $a^3$  and rock inwardly the upper portions of said supplemental doors and permit the entrance of air to the combustion-  
70 chamber through the openings  $a^2 a^2$  when the doors  $a$  are closed. As the supplemental doors are opened, their engaging ends  $a^6$  encounter the inclined faces  $a^7$  of the stops  $A^2$  and elevate the weighted ends thereof, and  
75 then engage the adjacent portions of the outer faces of the doors  $a a$  and limit the inward movement of the supplemental doors. The weighted ends of the stops  $A^2$  are automatically depressed as the ends  $a^6$  of the arms  $a^5$   
80 pass beyond the faces  $a^7$  of the stops, and the faces  $a^8$  of said stops then engage the outer face of the engaging end of the arms  $a^5$  and prevent the retrograde or closing movement of the supplemental doors  $a^3$ .  
85

The adjacent ends of the stops  $A^2$  for the supplemental doors are provided with upwardly-extending arms  $A^3$ , having lateral extremities, one being arranged beneath and the other above the opposite extremities of a lever  
90 E, pivoted at  $e$  to the front plate A and having one end connected by a chain or other connection  $e'$  to the free unweighted end of the operating part or lever  $d$ .

F is a stop for holding the lever  $d$  in its position assumed when the valve D is open, and  
95 G is a movable operating-piece for forcing said stop from operative position. The stop F is pivoted by a pivotal pin  $f$  at its upper end and normally assumes a vertical position, and  
100 is provided at its lower end with a shoulder  $f'$  for engaging a shoulder  $d^8$  upon the weighted end of the lever  $d$  and preventing the descent of said weighted end. The stop F is also  
105 formed with an inclined face  $f^2$ , extending from the shoulder  $f'$ , and as the operating part or lever  $d$  is rocked to its position (shown by dotted lines at Fig. 1) and its weighted end is elevated the shoulder  $d^8$  of the lever  $d$  engages the inclined face  $f^2$  of the stop F and rocks  
110 said stop on its pivot. As soon as the shoulder  $d^8$  is elevated above the shoulder  $f'$ , the stop F assumes its normal position, with its shoulder  $f'$  directly beneath the shoulder  $d^8$ , and the weighted end of the lever  $d$  is then pre-  
115 vented from downward movement.

The operating-piece G is preferably supported at one side of the doors  $a a$ , and consists, preferably, of a closed cylinder pivoted at  $G'$  and provided with an internal chamber  
120 containing mercury or other similar liquid, and provided at its central portion with a transverse partition  $g$ , having a central passage opened and closed by a valve  $g'$  for permitting the ready passage of the liquid to the  
125 normally-depressed end  $g^2$  of said operating-piece and preventing the return movement of said liquid. The operating-piece G is also provided with a valve  $g^3$ , consisting of a screw having its inner end movable within a groove  
130  $g^4$  in the transverse partition  $g$  in the chamber of the operating-piece and having its outer end extended beyond said chamber for facilitating adjustment of said valve. This



valve is readily adjusted to regulate the return movement of the liquid through the groove  $g^4$  when the operating-piece is forced to its position. (Indicated by dotted lines at Fig. 1.)

H is a link having one end hinged to the normally-depressed or weighted end of the operating part or lever  $d$  and the other connected with a lost motion to the operating-piece G for forcing said operating-piece to its position (indicated by dotted lines at Fig. 1) as the operating part or lever  $d$  is actuated to open the valve D by the opening of the door  $a$ . The connection of the link H to the operating-piece G by a lost motion may be effected in any desired manner; but as preferably constructed said operating-piece is formed with a lateral arm having a curved slot  $g^6$ , the opposite ends of which form separate bearing-faces, between which the upper end of the link is movable. Said end of the link normally engages the lower end or bearing-faces of the slot  $g^6$ , and as the operating part or lever  $d$  is rocked to its position (indicated by dotted lines at Fig. 1) the end of the link engages the upper end or bearing-face of the slot  $g^6$  and rocks the operating-piece G to its position, (indicated by dotted lines at Fig. 1,) with its normally-elevated end depressed into close proximity to a stop I.

When a sufficient amount of the mercury or other liquid within the chamber of the operating-piece has flowed through the passage  $g^4$  by means of the adjustment of the valve  $g^3$  to counterbalance the end  $g^2$  of the operating-piece, said operating-piece is rocked on its pivot until its opposite end engages the stop I.

The operating-piece G is provided with a face  $g^7$ , which is by this movement of the operating-piece engaged with the upper end of the stop F and rocks said stop on its pivot until its shoulder  $f'$  is disengaged from the shoulder  $d^8$  of the lever D, whereupon the weighted end of said lever is automatically depressed, and thereby closes the valve D and operates the lever E to elevate the weighted ends of the stops  $A^2$   $A^2$  for the supplemental doors  $a^3$ . As the operating part or lever  $d$  assumes its normal position, the link H engages the lower engaging face of the slot  $g^6$  of the operating-piece and rocks said operating-piece to its normal position, whereupon the liquid within the same returns to its end  $g^2$ .

In the practical operation of my invention the doors  $a$  are opened to permit the entrance of fuel and the supplemental doors are automatically opened, and by the connection  $d^6$  and the lever  $d$  the valve D is opened and steam passes from the jets or outlets  $C'$  of the pipe C through the inlets  $A'$  into the combustion-chamber of the furnace and forcibly draws any air through said inlets into the combustion-chamber. As the operating part or lever  $d$  is operated to open the valve D, the stop therefor prevents the downward movement of the weighted end of said lever, and the move-

ment of the operating part or lever  $d$  also rocks the operating-piece on its pivot. The doors are then closed and the air enters the combustion-chamber through the openings in said door since the supplemental doors are open, and after a suitable interval of time the operating-piece automatically rocks on its pivot and forces from operative position the stop for the operating part or lever  $d$ , whereupon said operating part or lever closes the valve D, and thereby shuts off the entrance of steam within the combustion-chamber and operates the lever E to permit the automatic closing of the supplemental doors. By the adjustment of the valve  $g^3$  the length of time required to effect the automatic rocking of the operating-piece for shutting off the entrance of steam to the combustion-chamber may be regulated at will, and the amount of steam passed to the valve D may be regulated at will by the valve  $c^2$ .

At Fig. 7 I have shown a modified form of supplemental door-opening means in which the door  $a^{20}$  is provided with an opening  $a^{21}$  and with a supplemental door  $a^{30}$ , hinged thereto at  $a^{40}$  for closing said opening  $a^{21}$ . The supplemental door  $a^{30}$  is provided with a movable arm  $a^{50}$ , having its upper end pivoted upon the hinge-pin  $a^{40}$  and provided with a shoulder extending upwardly above the hinge-pin  $a^{40}$  for engaging the outer face of the door  $a^{30}$  as the lower end of the arm  $a^{50}$  is rocked outwardly from the door  $a^{20}$ . As the door  $a^{20}$  is closed, the lower end of the arm  $a^{50}$  engages a stationary cam  $a^{60}$ , secured to a suitable support beneath the doors  $a^{20}$   $a^{30}$ , and the shoulder projecting from the upper end of said arm engages the supplemental door  $a^{30}$  and rocks the same inwardly from its normal closed position. When the door  $a^{20}$  is in normal closed position, the arm  $a^{50}$  is free to assume its inoperative position, as its lower end has passed beyond the stationary cam  $a^{60}$ , and when said door  $a^{20}$  is opened the arm  $a^{50}$  is free to swing on the hinge-pin  $a^{40}$ , since its lower end swings toward the door  $a^{20}$  and the shoulder at its upper end moves away from the supplemental door  $a^{30}$ .

It is evident that the detail construction and arrangement of the parts of my furnace attachment may be considerably varied without departing from the spirit of my invention. Hence I do not herein specifically limit myself to its detail construction and arrangement.

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

1. The combination with the combustion chamber and movable door of a furnace; of a pipe discharging within the combustion chamber, a valve for said pipe provided with an operating part or lever connected to the door, whereby, when the door is opened, the valve is automatically opened, a movable stop for holding the valve operating part or lever in its position assumed when the valve is open, and a movable operating piece connected to the stop for forcing said stop from operative



position, substantially as and for the purpose set forth.

2. The combination with the combustion chamber and movable door of a furnace; of  
5 a pipe discharging within the combustion chamber, a valve for said pipe provided with an operating part or lever connected to the door, whereby, when the door is opened, the valve is automatically opened, a movable stop  
10 for holding the valve operating part or lever in its position assumed when the valve is open, a fixed support, and a movable operating piece mounted on said support and connected to the stop for forcing said stop from operative  
15 position and connected to said operating part or lever of the valve with a lost motion, substantially as described.

3. The combination with the combustion chamber and movable door of a furnace; of  
20 a pipe discharging within the combustion chamber, a valve for said pipe provided with an operating part or lever connected to the door, whereby, when the door is opened, the valve is automatically opened, a movable stop  
25 secured to the door for holding the valve operating part or lever in its position assumed when the valve is open, a hollow movable operating piece for forcing said stop from operative position provided with a liquid containing chamber, and valves for regulating the flow of the liquid through said chamber,  
30 substantially as and for the purpose specified.

4. The combination with a furnace combustion chamber having an air inlet and a movable door of the furnace; of a steam pipe discharging through the air inlet for drawing the air therethrough into the combustion chamber, a valve for said pipe provided with an operating part or lever connected to the door,  
40 whereby, when the door is opened, the valve is automatically opened, a movable stop for holding the valve operating part or lever in its position assumed when the valve is open, and a movable operating piece for forcing said  
45 stop from operative position, substantially as and for the purpose described.

5. The combination with a furnace combustion chamber having an air inlet and a movable door of the furnace; of a steam pipe discharging through the air inlet for drawing the air therethrough into the combustion chamber, a valve for said pipe provided with an operating part or lever connected to the door, whereby, when the door is opened, the valve  
55 is automatically opened, a movable stop for holding the valve operating part or lever in its position assumed when the valve is open, a fixed support, and a movable operating piece for forcing said stop from operative position  
60 connected to said operating part or lever of the valve with a lost motion, substantially as specified.

6. The combination with a furnace combustion chamber, the movable door of the furnace  
65 provided with a supplemental door, and a stop for holding said supplemental door open; of a pipe discharging within the combustion cham-

ber, a valve for said pipe provided with an operating part or lever connected to the door and to the stop for the supplemental door, 70 whereby, when the door is open, the valve is automatically opened, and, whereby when the valve operating part or lever is moved from its position assumed when the valve is open, the stop for the supplemental door is also 75 moved from its operative position, a movable stop for holding the valve operating part or lever in its position assumed when the valve is open, and a movable operating piece for forcing said stop from operative position, 80 substantially as and for the purpose described.

7. The combination with a furnace combustion chamber, the movable door of the furnace provided with a supplemental door, and a stop 85 for holding said supplemental door open; of a pipe discharging within the combustion chamber, a valve for said pipe provided with an operating part or lever connected to the door and to the stop for the supplemental door, 90 whereby, when the door is open, the valve is automatically opened, and, whereby when the valve operating part or lever is moved from its position assumed when the valve is opened, the stop for the supplemental door is also 95 moved from its operative position, a movable stop for holding the valve operating part or lever in its position assumed when the valve is open, a fixed support, a movable operating piece for forcing said stop from operative po- 100 sition connected to said operating part or lever of the valve with a lost motion, and provided with a liquid containing chamber, and valves for regulating the flow of the liquid through said chamber, substantially as and 105 for the purpose specified.

8. The combination with a furnace door, an automatically closing supplemental door hinged to the furnace door and formed with a lateral arm having an engaging end, a movable stop or lever for detachably engaging the lateral arm having a weighted end provided with an inclined engaging face, a movable operating piece connected to the stop for forcing said stop from operative position and a stop 115 shoulder or face, substantially as and for the purpose set forth.

9. The combination with a furnace combustion chamber, the movable doors of the furnace, each provided with an automatically 120 closing supplemental door, independently moving stops for preventing closing of the supplemental doors, and a movable lever for operating said stops; of a pipe discharging within the combustion chamber, a valve for 125 said pipe provided with an operating part or lever connected to the door and to the stop operating lever, whereby the stop operating lever is actuated, a movable stop for holding the valve operating part or lever in its posi- 130 tion assumed when the valve is opened, and a movable operating piece for forcing said stop from operative position, substantially as and for the purpose described.



10. The combination with the combustion chamber and movable door of a furnace; of a pipe discharging within the combustion chamber, a valve for said pipe provided with  
5 an operating weighted part or lever connected to the door, a movable stop for holding the valve operating part or lever in its position assumed when the valve is opened, a movable operating piece having a shoulder for  
10 actuating said stop and provided with separated engaging faces, and a link having one end secured to the operating part or lever and the other engaged with said faces of the movable operating piece, substantially as de-  
15 scribed.

11. The combination with the combustion chamber and movable door of a furnace; of a pipe provided with a removable jet having outwardly diverging outlet passages discharg-  
20 ing within the combustion chamber, a valve for said pipe provided with an automatically movable operating part or lever connected to the door, whereby, when the door is opened, the valve is automatically opened, a movable  
25 stop for holding the valve operating part or lever in its position assumed when the valve is open, and a movable operating piece for forcing said stop from operative position, substantially as and for the purpose set forth.

30 12. The combination of the combustion chamber of a furnace, a movable door for permitting access to the furnace provided with an opening therethrough, an automati-  
cally closing supplemental door for closing  
35 said opening, and an operating piece sup-

ported at one side of the door for automati-  
cally controlling the closing of the supple-  
mental door, substantially as described.

13. The combination of the combustion chamber of a furnace, a movable door for  
40 permitting access to the furnace provided with an opening therethrough, an automati-  
cally closing supplemental door for closing said opening, a stop supported by the mov-  
able door and preventing its closing for en-  
45 gaging the supplemental door, and an oper-  
ating piece for automatically controlling the closing of the supplemental door, substan-  
tially as specified.

14. The combination of the combustion  
50 chamber of a furnace, a movable door for permitting access to the furnace provided with an opening therethrough, an automati-  
cally closing supplemental door for closing  
said opening, a connection for automatically  
55 opening the supplemental door, and an oper-  
ating piece supported at one side of the door for automatically controlling the closing of  
the supplemental door, substantially as and  
60 for the purpose described.

In testimony whereof I have hereunto  
signed my name, in the presence of two at-  
testing witnesses, at Rochester, in the county  
of Monroe, in the State of New York, this  
18th day of September, 1893.

THOMAS CLIFFORD.

Witnesses:

HAMPDEN HYDE,  
WARREN H. BOLES.