

J. R. HARRELL.
AUTOMATIC FORCE DRAFT SMOKE CONSUMER.
APPLICATION FILED MAY 24, 1909.

967,375.

Patented Aug. 16, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

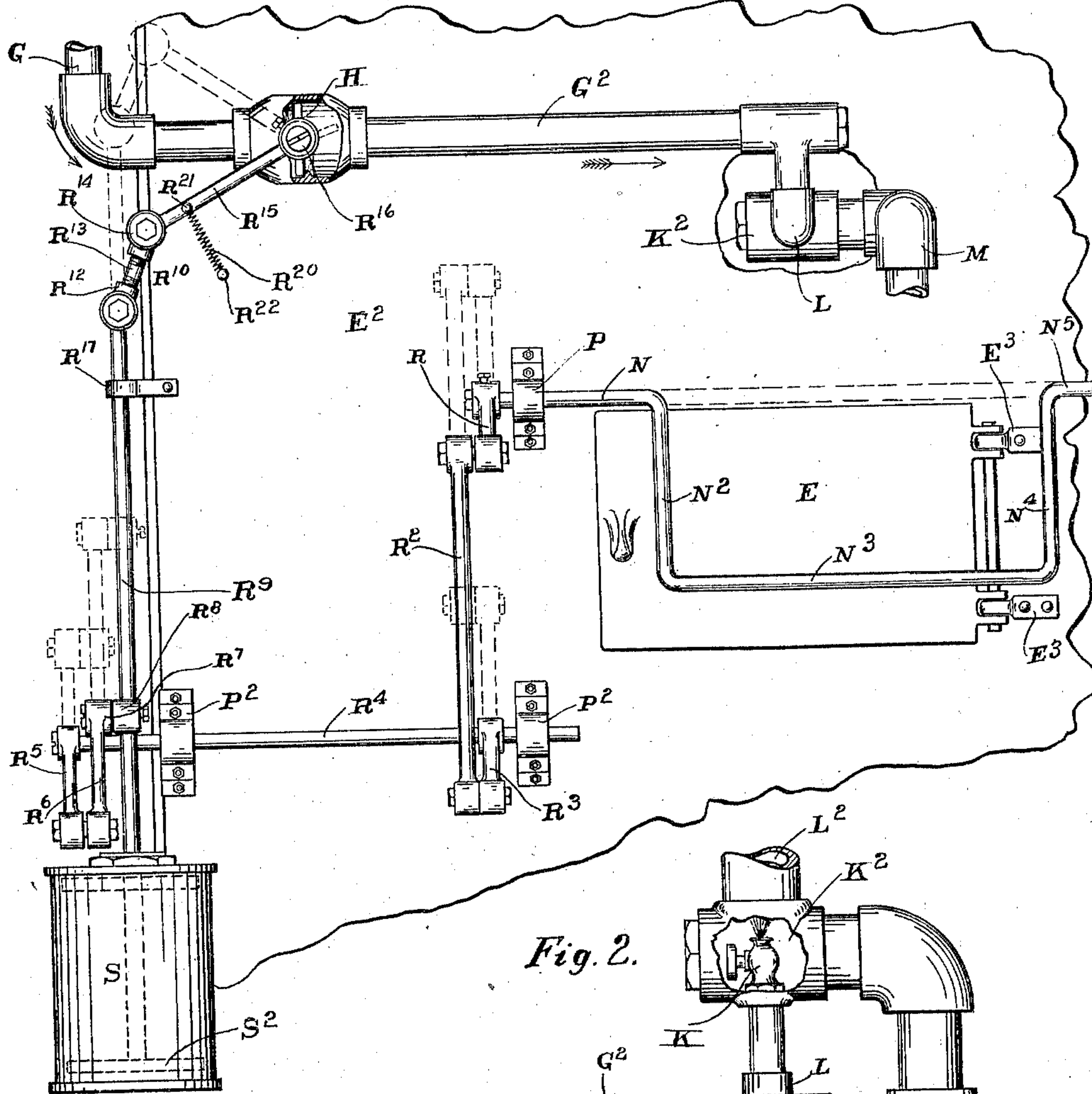
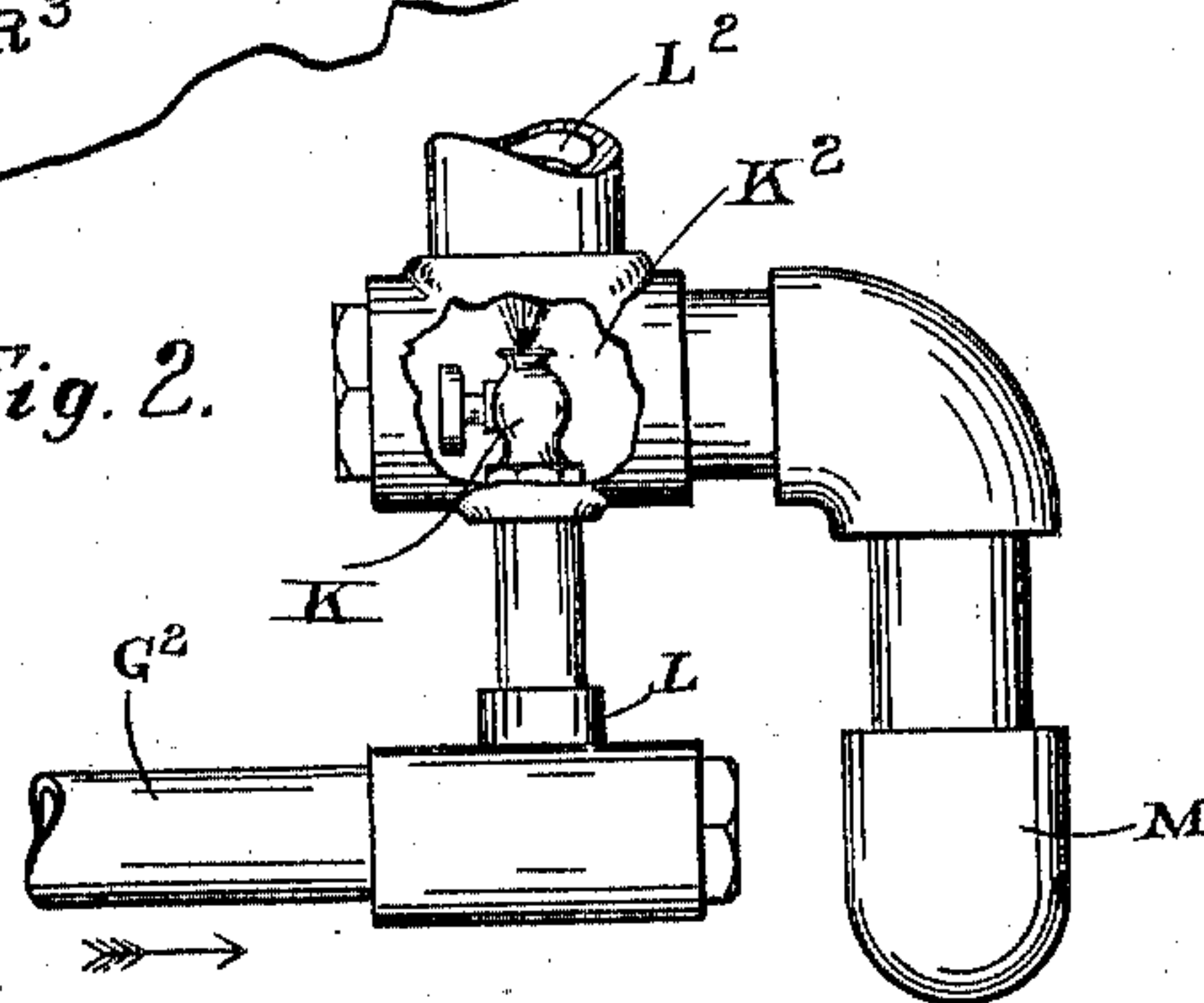


Fig. 2.



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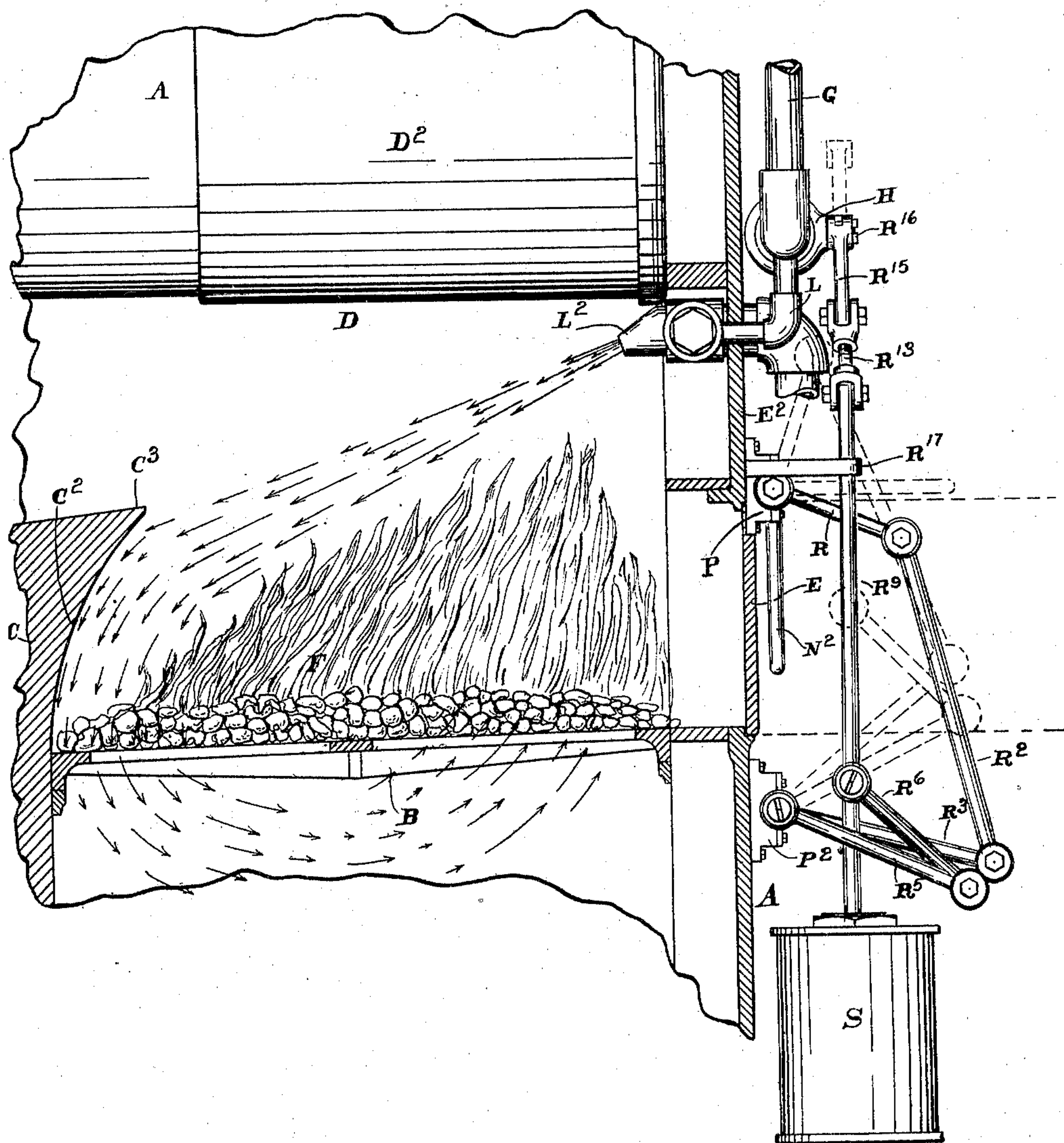
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2 SHEETS—SHEET 2.

Fig. 3.



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UNITED STATES PATENT OFFICE.

JAMES R. HARRELL, OF CINCINNATI, OHIO.

AUTOMATIC FORCE-DRAFT SMOKE-CONSUMER.

967,375.

Specification of Letters Patent.

Patented Aug. 16, 1910.

Application filed May 24, 1909. Serial No. 498,001.

To all whom it may concern:

Be it known that I, JAMES R. HARRELL, a citizen of the United States, and a resident of the city of Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Automatic Force-Draft Smoke-Consumers, of which the following is a specification.

The several features of my invention and the various advantages resulting from their use conjointly or otherwise will be apparent from the following description and claims.

My invention is applicable to furnaces of many different kinds. The features of construction necessarily present in the furnace, in order to enable my invention to be operative, are a fire grate, a feed door in front of said grate and a bridge wall within the furnace.

My invention relates to that class of smoke preventers for furnaces in which a gas injector (siphon) is used, and whereby the said gas or gases (preferably a combination of air and steam) are forced over the top of the fire at such an angle as to strike the bridge wall which is concaved, and forcing back again the said gas or gases and with the same, the unconsumed gaseous products of combustion in a loop across and over the fire.

For the purposes of illustration, I have selected a simple form of furnace, and shall now proceed to explain my invention in detail, and in its application to such furnace, premising that such application will enable the application of my invention to furnaces of other makes to be readily understood.

In the accompanying drawings, making a part of this specification, and in which similar characters of reference indicate corresponding parts,—Figure 1 is a front view of the smoke consuming devices of my invention. Fig. 2 is a top view of the siphon, a portion of the latter being broken away and disclosing the inner mechanism. Fig. 3 is a side view of the interior of a furnace, as far back as to include the front portion of the bridge wall and showing in side elevation a portion of the mechanism belonging to my invention.

I will now describe my invention in detail.

A indicates a furnace.

B indicates the fire grate. The bridge wall C is located at the rear of the fire grate, and its front side C² is preferably curved, or bent, or inclined forward, so that the

front edge C³ of this top portion of this bridge wall overhangs the part of the bridge wall immediately below.

D indicates the roof of the furnace. This roof may be of any suitable material, and be arched or flat, etc. In the present illustrative instance, the roof of the furnace is constituted by the bottom of a steam boiler D². The steam boiler may be of any desired type.

E is the door of the furnace through which fuel is fed to the fire.

F indicates the bed of coals or incandescent fuel on the fire grate.

E² indicates the front wall of the furnace. The door E is to be hung upon hinges, and can therefore swing down or up, or out sidewise, according as the hinges E³, E³, are located relative to the door and the door frame or furnace wall.

In order to obtain sufficient oxygen for combustion, while the door is open, and while combustion is started, the green coal fed to the furnace, I employ air, and I prefer to employ steam as the means for forcing this air to do the work and perform the functions mechanical and chemical, herein-after named. At the same time, the oxygen of the steam can be utilized.

The means for forcing the air into the fire and effecting the complete combustion of the fuel, can be obtained in various ways, and can assume various forms. However, in steam boiler furnaces, the steam is always present, and can be readily utilized for the purposes mentioned. I have, therefore, constructed a very complete and desirable mechanism to accomplish effectually the ends in view. This mechanism is presented in the drawings, and a description of it is as follows.

G indicates a steam pipe, which in the present instance may obtain steam from the steam boiler D². This steam pipe connects with a butterfly or gate valve H. From this valve H the steam pipe G is continued in section G², which latter connects with the cock K, in the chamber K². The chamber K² connects with the conduit L, which connects with the nozzle L² located at the inside of the furnace front. Connected to the chamber K² is an air intake M. There are preferably several of these delivery nozzles L². Each one of them is directed so that the air and steam delivered from them is sent

forward to the bridge wall C to a place on the front side C², at a distance below the top edge C³ of the said bridge wall. The mechanism for automatically regulating this discharge of mixed air and steam through the nozzle or nozzles L² is preferably as follows: N is a rod, supported in a journal bearing P, and provided with an arm N² which lies against the furnace door. While for actual operation, the rod N and its arm N² are sufficient to enable the door E when opened to move said arm N² and rotate the rod N, the construction is more symmetrical and stronger by the provision of a rod N³, united at one end to what would otherwise be the free end of the arm N² and connecting the other end of the rod N³ to the end of an arm N⁴, whose opposite end is united to a rod N⁵, which is duly journaled in a bearing not shown (for lack of room on the drawing), but similar to the bearing P, and being well understood. The rod N is extended to the left of the bearing, and is there pivotally connected to a crank arm R. The other end of this crank arm R is pivoted to one end of a connecting rod R², whose other end is pivoted to a crank R³. The opposite end of this crank R³ is fixed to a shaft R⁴, journaled in bearings P². This shaft carries a crank R⁵, and the free end of the latter is pivoted to a connecting rod R⁶, whose other end is pivotally connected by its journal R⁷ to a bearing R⁸, connected to a shaft R⁹, whose other end is pivotally connected to the adjacent end of a compound rod R¹⁰. The other end of this rod is pivotally connected to the lever R¹⁵, whose other end is fixed to the axial rod R¹⁶ of the said valve H.

The rod R¹⁰ is constructed in pieces to enable it to be lengthened or shortened at will as desired, and thus change the size of the opening given by the said valve, and thus regulate the quantity of steam admitted to the conduit L and thereby to the furnace. This regulation of the quantity of steam in turn also regulates the force with which the jet of steam and air enters the furnace. The construction of the said compound rod R¹⁰ consists of the rod R¹³ carrying a right and left hand screw screwed into the adjacent pivot ends R¹² and R¹⁴. By rotation of this rod R¹³ in one direction, the compound rod R¹⁰ is shortened, and vice versa.

S is what is known as a dash-pot, filled with air or a liquid, and having the usual piston, indicated by dotted lines S². The construction of a dash-pot being well understood, further description thereof is omitted. The lower end of the shaft R⁹ is attached to this piston. A guide R¹⁷ fixed on the furnace steadies the shaft R⁹, as the latter extends through it.

The mode in which my invention operates is as follows: Fuel being laid in the furnace and a fire started therein, and steam being

generated in the boiler, steam fills the pipe G, but the valve H being closed the steam cannot enter the conduit L². When the time arrives to feed fresh fuel to the furnace, the operator opens the door E, and throws fresh (green) fuel onto the bed of burning coals therein. As the door opens, the lever N², N³, N⁴, is moved, and the lower end of it is elevated. This elevation operates the rod R, and the latter through the series of connections already mentioned raises the shaft R⁹ and opens the valve H. Thereupon the steam rapidly passes to the cock K, and issues from this cock with great rapidity into the conduit L. At this point, it draws air in through the intake M. This air intermixed with the steam now passes on through the conduit L and issues through the nozzle L². The speed at which the current of combined steam and air issues thence carries it over the fire to the bridge wall C². Here it impinges against the upper front portion of the bridge wall and is deflected downward and backward over the fire and over not only the incandescent coals but over the green fuel just introduced in the furnace. This combined addition of steam and heated air furnishes sufficient oxygen in a hot condition, to enable the gaseous products of combustion coming off from the fresh coals now taking fire, to thoroughly consume such products. The operator having thrown into the furnace all of the fresh fuel necessary, now closes the door E. But the operation of igniting the fresh coal and of igniting the rapidly generated products of combustion as they rise from this coal will continue for a short time. The function of the dash-pot is now of use. The rotation of the arm N, as the door opens, not only opens the valve H, but operates the dash piston S², namely: elevates the latter. When the door E is closed, the weight of the arm N², etc., tends to elevate the shaft R⁹ and close the valve H, but the piston S² of the dash-pot S being drawn upward resists the immediate upward pull upon it, and responds slowly, and thus retards the closing of the valve. This retardation in closing the valve H allows a continuous stream of hot air and steam to be projected from the nozzle L² for a time after the door E is closed, and thus enables the oxygen thus added to the combustion in the furnace to effect a perfect combustion of the fuel and of those gaseous products of combustion that would otherwise unconsumed pass off in the form of smoke, and make the atmosphere impure and waste the fuel.

My invention is simple and economic in construction, effective in operation, and useful not only in the saving of fuel, but also in the case of steam boilers useful in keeping up an even and steady generation of steam for the uses to which it is devoted.

It will be noted that the cock K admits of regulating the amount of steam passing through it and can also regulate the amount of air added to the current of steam delivered to the furnace.

So far as that feature of my invention which relates to the introduction of a current or stream of oxygen into the furnace, and the reflection of it over the fire, is concerned, it is obvious that this will be operative where the furnace is not for generating steam, or where the steam of the boiler is not employed for forcing the oxygen into the furnace. In such cases, the means for forcing the air forward into the furnace may be done by a blower or other suitable means. The air will furnish a sufficient supply of oxygen. In cases where the weight of the arm N^2 , etc., is not sufficient to depress the shaft R^9 , or the location of the arm N^2 relative to the kind of door used, does not admit of the weight of the arm N being used, and close the valve H, means additional or otherwise are to be employed. Such means may consist of an extra weight or a spring, suitably attached at any proper place, to the operative levers or shaft. One such application of a spring is shown, where the spring R^{20} is connected at one end R^{21} to the lever R^{15} and at the other end R^{22} to a stationary part of the furnace.

What I claim as new, and of my inven-

tion, and desire to secure by Letters Patent, is:—

1. In a device for preventing smoke in furnaces, the combination of a nozzle at the front of the furnace for an air and steam blast, and a bridge wall, the upper front edge of which overhangs forming a recess, with the discharge opening of the nozzle located substantially above said recess and directed downwardly into the recess to raise the temperature of the bridge wall to a high degree, and the recess curved to deflect the blast back over and down through the fuel.

2. In a device for preventing smoke in furnaces, the combination of a nozzle at the front of the furnace for an air and steam blast, and a bridge wall, the upper front edge of which overhangs forming a recess, with the discharge opening of the nozzle located substantially above said recess and directed downwardly into the recess to raise the temperature of the bridge wall to a high degree, and the recess curved to deflect the blast back over and down through the fuel in the form of a loop curving downwardly at the rear and upwardly through the fuel at the front.

JAMES R. HARRELL.

Attest:

SAMUEL A. WEST,
K. SMITH.