No. 692,741. Patented Feb. 4, 1902.

H. F. WALLMANN.

AIR EXHAUSTING APPARATUS.

(Application filed July 24, 1899.)

(No Model.)

Fig. 2.

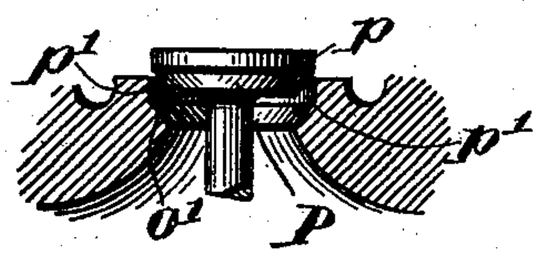

Fig. 1.

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AIR-EXHAUSTING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 692,741, dated February 4, 1902.

Application filed July 24, 1899. Serial No. 724,998. (No model.)

To all whom it may concern:

Be it known that I, HENNING FRIEDRICH WALLMANN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Air-Exhausting Apparatus, of which the following is a specification.

My invention in its broadest aspects relates to a new and useful device for setting in motion and maintaining on the exhaust principle a current of air for any desired purpose. In the principal application for which I have designed it it is intended to be used in connection with a pneumatic-despatch-tube system in place of the usual exhaust-blower; but it may be employed with equal advantage as a draft-producer in ventilating systems or for furnaces, or in any connection where a current of air or gas is produced and maintained on the exhaust principle.

The principle of my invention resides in the creation of a series of extremely rapid pulsations of the air, amounting, in effect, to a continuous flow in one direction through a tube or other air-conductor through the agency of a series of extremely rapid explosions of a combustible mixture of gas and air, the expanding gases resulting from the explosions being brought into contact and association with the air flowing through the tube or other air-conductor in such a manner as to produce an extremely rapid intermittent sucking action amounting for all practical purposes to a continuous exhaust.

In the accompanying drawings, which illustrate an apparatus for carrying out my invention, Figure 1 represents an elevation, largely in central vertical section, of the device; and Fig. 2 is a detail of the inlet-valve.

A represents the base-plate of the apparatus, on which is supported by suitable legs B a chambered cylinder-head C. Centrally in the upper face of this cylinder-head is screwed or otherwise secured a pipe or cylinder D, and surrounding the same and coaxial therewith is another larger cylinder E, forming a water-jacket for the inner cylinder. These cylinders may be of iron, brass, or any other material found best adapted to the requirements of the service the cylinders perform. The upper ends of cylinders D and E screw into a metallic block F, which is cored at one side to receive the igniter-electrodes and which on its upper face supports a pair of cylinders D′ and E′, similar in all respects to the cylinders D E, except that they may be longer or shorter than cylinders D E, if preferred. The block F has also an axial bore of a diameter just equal to the inner diameter of the cylinders D D′, so that said cylinders and the block F form, in effect, a single long narrow cylinder, which constitutes the explosion-chamber and which I designate by the letter E^2. Cold water is supplied through pipe G and its branches *g g′* to the water-jackets E and E′, respectively, and the heated water is led away therefrom through branch pipes *h h′*, respectively, and pipe H.

Secured to and closing the upper ends of cylinders D′ E′ in a manner similar to the closing of the lower ends of cylinders D E by cylinder-head C is the upper cylinder-head I, and above the latter and secured thereto by bolts *i*, passing through concentric horizontal flanges, is a cap or cover J. The cylinder-head I and its cap or cover J are each cored in such a manner that when secured together, as shown, they form three annular chambers *j*, *k*, and *l* around the vertical axis of the cylinder-head. Into the chamber *j* is led a pipe K, which in the principal application for which I have designed the apparatus may connect with the receiving terminal of a pneumatic-despatch-tube system, and into the chamber *l* is led a branch pipe K′ from the pipe K, as shown. The intermediate annular chamber *k* is tapped by a pipe L, through which the products of combustion from the explosion-cylinder are exhausted in a manner that will be hereinafter described.

I will next describe the means for admitting the combustible fuel to the explosion-chamber and then the mechanism for discharging the rapidly-expanding products of combustion to the atmosphere, in the performance of which latter operation the device accomplishes the work it is designed to do in effecting the exhaust of air through pipe K.

M is a gas-inlet pipe, and N a similar pipe for the intake of air, these pipes having check-valves *m* and *n*, respectively. Within a cored-out chamber in cylinder-head C is located a mixer O, which may be of any desired construction, but is preferably of a construction for which I have made application for Letters Patent, filed December 17, 1898, Serial No. 699,577. Pipes M and N conduct gas and air to the mixer O, and from the latter the combustible mixture flows to the chamber *o* in the cylinder-head C.

P is the inlet-valve, whose function is to control the admission of combustible mixture from the chamber *o* to the explosion-chamber E^2. By reference to Fig. 2 it will be seen that the valve-seat *o'* is formed at the bottom of a shallow circular recess *p'* in the cylinder-head and that the valve P, while of the puppet-valve type, has a short piston-shaped body *p*, designed to fit snugly the circular recess *p'*. This construction is for a purpose that will be disclosed later in the description of the operation. Valve P is normally held to its seat by a light spring p^2, which will permit the valve to open on the creation of a vacuum or substantial vacuum in the explosion-chamber E^2. The exhaust-valve Q rests in an outwardly-flaring valve-seat *q*, formed in the cylinder-head, I and when seated closes the entire upper end of the explosion-chamber. The valve-seat *q* and the face of the valve Q registering therewith are of considerable width, as shown, and are formed at such an angle to the vertical axis of the explosion-chamber that the products of combustion will when the valve is raised from its seat, as shown, be given the form of an annular outwardly-flaring jet issuing with great force into and through the narrow neck of the annular exhaust-chamber *k*. The stem of valve Q may be guided in the cover J and in a vertical boss J' thereon and is closed by a spring q^2.

It remains to describe the igniting apparatus before proceeding to an explanation of the operation of the device.

Through a cored-out passage in the side of block F are introduced a pair of suitably-insulated electric conductors *r r'*, (diagrammatically shown,) forming part of the secondary circuit of an induction-coil R, the primary of which is in circuit with a battery S through commutator r^2, connecting-wires *s s'* s^2 s^3, switch T, and an automatic circuit maker and breaker constructed and arranged as follows.

U is a lever pivoted at *t* to a suitable support and electrically connected at such pivoted end to the wire s^2. At its other end lever U carries an adjustable needle *t'*, which when the circuit is to be closed will be caused to dip in a small cup V containing mercury. This cup may be made of wood fiber or any other suitable insulating material, and the mercury therein is electrically connected to wire s^3 by a pin or screw *v*. The needle *t'* is normally held out of contact with the mercury by a light spring *u*, which engages the under side of the lever U, and said lever is depressed, so as to immerse the needle *t'* in the mercury, and thus close the circuit by the agency of the stem of the inlet-valve P and its closing-spring p^2, the said valve-stem bearing at its outer end on the upper side of said lever, as at a point *u'*, and thus normally tending to depress the lever and close the igniter-circuit at all times, except when the valve P is lifted by the suction of the incoming charge.

The operation is as follows: When the device is started up for the first time, an initial charge of combustible mixture will be forced by a hand-pump or in any other convenient manner into the explosion-chamber E^2. Valves P and Q then being closed, the igniter-circuit will be completed by the switch T, a spark will pass between the points of the electrodes *r r'* in the explosion-chamber, the charge will be fired, and the burning gases expanding instantly will shoot the valve Q from its seat and will issue with great force and velocity in the form of a circular outwardly-flaring jet through the constricted opening between the face of the valve and its seat, through the narrow neck of the annular exhaust-chamber *k* into the latter chamber, and thence to the atmosphere through exhaust-pipe L. Now as the expanding gases rush with great velocity through the narrow neck of the exhaust-chamber *k* it is obvious that a strong sucking action will thereby be produced on the air in the adjacent annular chambers *j* and *l*, the effect of which will be to start a current of air flowing through pipes K and K' in the direction indicated by the arrows. The result, however, of the sudden expulsion of the products of combustion under the impetus of their own expansion will be to leave a vacuum or substantial vacuum in the explosion-chamber E^2, and as the latter is sealed at its upper end by the instant closing of exhaust-valve Q by its spring q^2 the vacuum is relieved by the intake of a fresh charge of combustible mixture past the inlet-valve P. The lifting of the latter valve breaks the igniter-circuit at the mercury-cup V by permitting the lever U to be raised slightly by its spring *u*; but as soon as the explosion-chamber has again been filled by the incoming charge valve P returns to its seat, and in so doing again closes the igniter-circuit at the mercury-cup, at which instant a spark again passes between the electrodes *r r'*, the charge is fired, and the train of operations hereinabove described is repeated. By reason of the special construction of inlet-valve P, as hereinbefore described, all danger of back-firing is avoided, because even should the closing movement of the said valve complete the igniter-circuit and fire the charge before the valve has quite reached its seat nevertheless the piston-body *p* of the valve will fill and close the recess *p'* and the explosion will only drive the valve firmly to its seat.

It is to be noted that the cycle of operations hereinabove described will take place with extreme rapidity, the apparatus being entirely automatic and being capable of something like five hundred explosions a minute, so that the sucking or exhausting action on the air in pipes K and K′ will be uniform and practically continuous and of a strength proportional to the power and rapidity of the explosions, which latter of course may be governed by the amount and quality of the fuel employed. I may use as fuel ordinary illuminating-gas or, where that cannot conveniently be had, gasolene or any other light hydrocarbon oil. It is also to be noted that whenever the device is stopped, which is done by opening the igniter-switch T, it comes to a stop with the explosion-chamber full of fuel and ready for the next explosion, so that the device once started is always ready for operation on the closing of switch T.

This invention, as hereinabove suggested, is designed, primarily, for use in connection with a pneumatic-despatch apparatus of the exhaust type; but its utility inmines for drawing off foul or poisonous gases or in the ventilation of large buildings or in connection with furnaces to promote a draft and carry away smoke is obvious.

Having thus described my invention, I claim—

1. In an apparatus of the character described, the combination with the combustion-cylinder and an igniter therein, of an outwardly-opening discharge-valve closing one end of the cylinder and adapted to be shot open by the force of the explosion, an air-pipe having an annular discharge-opening surrounding the discharge-valve of the cylinder, means for instantly closing the discharge-valve after the exhaust of the products of combustion under the impetus of their own expansion, whereby a vacuum is created in the cylinder, and means for admitting a fresh charge through the agency of the vacuum thus created.

2. In an apparatus of the character described, the combination with the combustion-cylinder and an igniter therein, of an outwardly-opening discharge-valve closing one end of the cylinder and adapted to be shot open by the force of the explosion, an air-pipe having an annular discharge-opening surrounding the discharge-valve of the cylinder, means for instantly closing the discharge-valve after the exhaust of the products of combustion under the impetus of their own expansion, whereby a vacuum is created in the cylinder, means for admitting a fresh charge through the agency of the vacuum thus created, and means for effecting the automatic ignition of said fresh charge simultaneously with the closing of the inlet-valve.

3. In an apparatus for producing a draft of air on the exhaust principle by the action of the expanding products of combustion from previously-ignited charges of explosive mixture, the combination with a combustion-cylinder and means for discharging the expanding products of combustion therefrom against a body of air in an adjacent air-conductor, so as to induce an air-current in the latter, of an electric igniter for the combustion-cylinder, an inlet-valve for said cylinder, and a make-and-break device in the igniter-circuit controlled by the inlet-valve, so that when said valve is open the circuit is broken, and when it is seated the circuit is closed.

4. In an apparatus of the character described, in combination the combustion-cylinder having three coaxially-arranged annular chambers in one of its cylinder-heads, said chambers having constricted annular orifices arranged adjacent to each other, an air-pipe having a branched end which taps the two outer chambers, an exhaust-pipe communicating with the intermediate chamber, means for admitting and igniting an explosive charge within the cylinder, and means for directing the expanding products of combustion across the annular orifices of the outer chambers into the intermediate chamber, whereby a suction is produced in the air-pipe.

5. In an apparatus of the character described, in combination the combustion-cylinder having three coaxially-arranged annular chambers in one of its cylinder-heads, said chambers having constricted annular orifices arranged adjacent to each other, an air-pipe having a branched end which taps the two outer chambers, an exhaust-pipe communicating with the intermediate chamber, means for admitting and igniting an explosive charge within the cylinder, and a spring-controlled exhaust-valve closing the end of the cylinder and adapted to be opened by the force of the explosion and to direct the expanding products of combustion in the form of an annular jet across the annular orifices of the outer chambers into the intermediate chamber, whereby a suction is produced in the air-pipe.

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