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N. E. NASH.

HEAT REGULATING APPARATUS.

APPLICATION FILED NOV. 21, 1905.

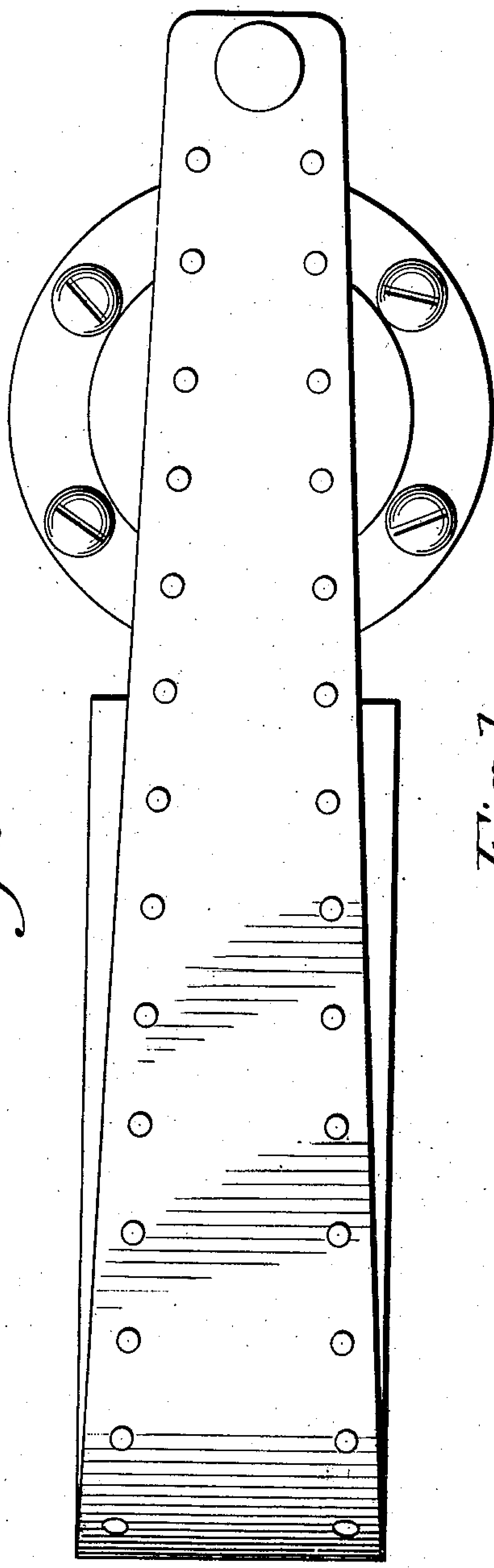
Fig. 2.

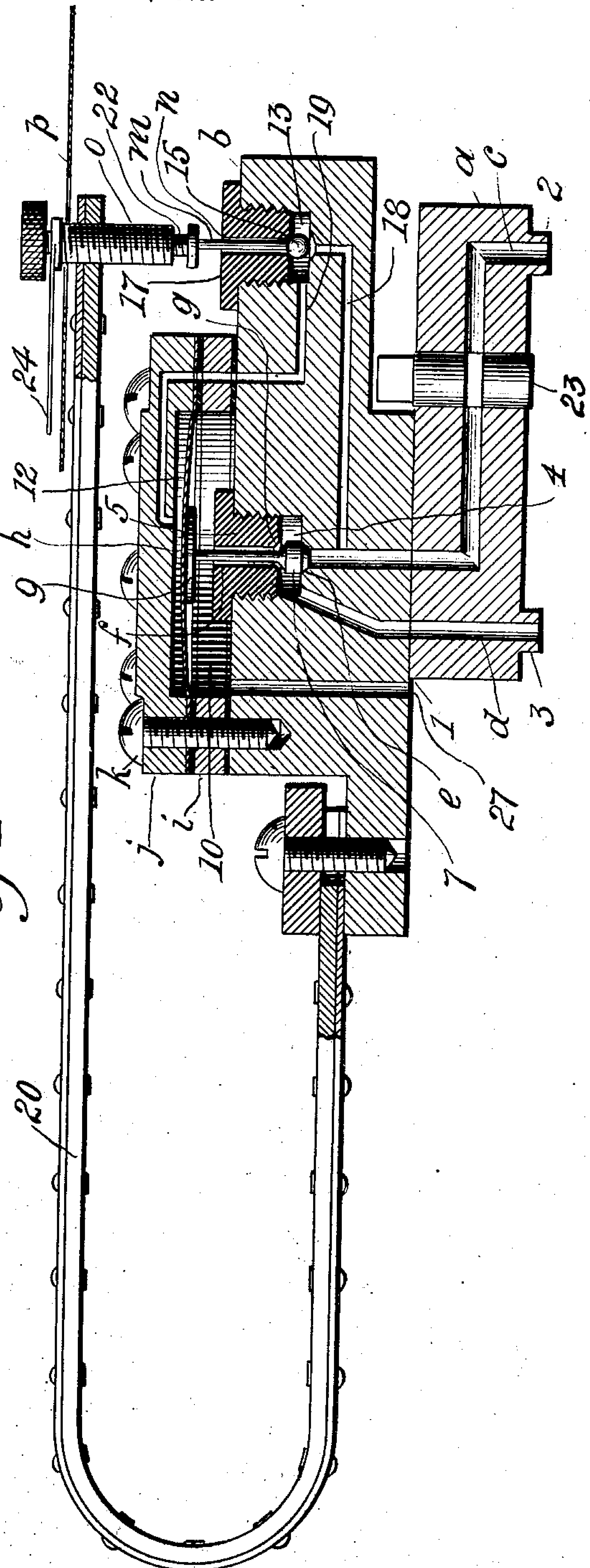
Fig. 1.

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UNITED STATES PATENT OFFICE.

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HEAT-REGULATING APPARATUS.

No. 843,093. Specification of Letters Patent. Patented Feb. 5, 1907.

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To all whom it may concern:

Be it known that I, NATHAN E. NASH, of the city of Toronto, in the Province of Ontario, Dominion of Canada, have invented certain Improvements in Heat-Regulating Apparatus, of which the following is a specification.

This invention relates to certain improvements in that class of heat-regulating apparatus in which the opening and closing of the radiator-valve, or that valve which admits steam or hot water to a radiator, is effected, primarily, by a thermostat which in its movement consequent upon a change in temperature of the air surrounding the thermostat controls the admission to and the discharge of air from a diaphragm adapted to either open or close the radiator-valve, as may be arranged, the reverse movement being effected by a spring.

The principal object of the present invention is to reduce the expenditure of compressed air used as the motive force to actuate the diaphragm of the radiator-valve; and the invention consists in a peculiar construction of certain air-passages in the heat-regulating apparatus and the controlling-valves used in connection with the said air-passages, whereby direct communication between the tank in which the compressed air is stored and the atmosphere is only momentary or during the period of time required by the said valves to pass from one extreme position to another—a period so minute as to be hardly appreciable.

In the description of the improved apparatus which follows reference is made to the accompanying drawings, forming a part hereof, and in which—

Figure 1 is a vertical side section of the improved heat-regulating apparatus, and Fig. 2 an exterior front view of the same.

Referring now to the drawings, 1 is a shell having the inlet and outlet nozzles 2 and 3, adapted for connection by means of pipes, (not shown,) respectively, to a source of supply of air under pressure, such as a tank, and the motor (not shown) whereby the radiator-valve is operated in one direction, and in the present case that in which the valve is closed. The body of the shell 1 is shown as in two parts *a* and *b*, the former, which is provided with the nozzles 2 and 3, being designed as a permanent fixture on the wall of the building and the latter removable. The two parts *a* and *b* are held together by means of screws. (Not shown.)

4 is a valve-chamber situated in part *b* of the shell 1 and in communication with the nozzles 2 and 3 by means of the air-ducts *c* and *d*, respectively. The said valve-chamber is covered by the screw-plug 5, which is provided with a polygonal head, whereby the plug is screwed into position with the inner surface of its head closely in contact with the outer surface of the shell. The inner end of the duct *c* is adapted as a valve-seat *e*, and the plug 5, which has a central aperture *f*, is similarly arranged, the valve-seat being denoted by *g*.

7 is a double-faced valve situated in the valve-chamber 4, having a stem *h*, which passes loosely through the aperture *f*, and provided with a disk 9 at its end.

10 is an air-chamber situated exteriorly of and at the front of the shell 1. It is formed by a ring *i* and a recessed head *j*, and the two parts are held to the shell 1 by means of screws *k*.

12 is an extremely thin slightly-dished diaphragm, preferably of metal—such, for instance, as hard copper—held tightly between the ring *i* and the recessed head *j* by screws *k*, and the disk 9 of the valve-stem *h* is in contact with the inner and dished surface of the said diaphragm when the valve 7 is on the seat *e*.

13 is a second valve-chamber in the part *b* of the shell 1. It contains a valve 15, which, like the valve 7, is double-faced and is provided with a stem *m*. This second chamber is covered by a screw-plug 17, which is centrally bored, and the aperture *n*, through which the stem *m* passes, is considerably larger in diameter than the stem, and the differential areas of the aperture and stem are availed of to produce certain important results hereinafter described.

18 is a passage having a transverse area which is much less than that of the aperture *n*, leading from the duct *c* to the second valve-chamber 13, and at its end is formed a seat for the valve 15. The second seat for the valve 15 is at the inner end of the aperture *n*.

19 is a second passage which connects the air-chamber 10 at a point exterior of the diaphragm 12 with the valve-chamber 13 and is

constantly in communication with the said chamber and at times open to the atmosphere, as hereinafter described.

20 is a curved thermostatic blade constructed, preferably, of plates of steel and zinc, one end of which is secured in any suitable manner to the part *b* of the shell 1, and the other and free end provided with a screw-sleeve *o*, having a comparatively coarse exterior thread and a much finer internal thread.

22 is a screw within the sleeve *o*, the end of which is in contact with the end of the valve-stem *m* when the apparatus is in use.

23 is a cock-key whereby the duct *c* may be closed to prevent the escape of compressed air from the air-tank in case the part *b* of the shell, with its attachments, should have to be temporarily removed for repair.

24 is an indicating finger or pointer secured to the sleeve *o*, which may be moved circumferentially by hand to alter the position of the end of the screw 22 with respect to the end of the valve-stem *m*, and *p* a dial suitably marked with numbers representing different temperatu es.

The whole apparatus as described is covered by an ornamen al open-work casing, whereby it is fastened to the wall of the room in which a uniform and predetermined temperature is to be maintained. This casing, however, is omitted from the drawings, as it embodies no part of the present invention.

The operation of the apparatus is as follows: Supposing the various parts of the apparatus to be arranged with respect to each other, as shown in the drawings, with the radiator-valve held open by its spring, and that the temperature of the surrounding atmosphere is to be maintained at 70°, the sleeve is turned until the pointer indicates "70" on the dial. The screw 22 is then withdrawn from contact with the valve-stem *m* until the atmosphere of the room reaches the predetermined temperature of 70°, when the said screw is turned in a reverse direction until the valve 15 closes the passage 18. It will be seen that in the seating of the valve 15, as described, the air which had been confined above the diaphragm 12 in the chamber 10 has now free access to the outer air by means of the passage 19, the valve-chamber 13, and the aperture *n*. Consequently no resistance is offered to the outer movement of the said diaphragm, as hereinafter described. The valve 15 being seated as described, the full pressure of the compressed air acts on the valve 7 and causes that device to be forced from its seat *e* and brought into contact with its outer seat *g*, the diaphragm 12 being lifted in the movement. The compressed air then passes through the duct *d* to the diaphragm of the radiator-valve, and the valve, which up to this time had been open, is closed, thus preventing further admission of steam to the radiator. As soon as the temperature of the air surrounding the apparatus is slightly lowered by radiation the contraction of the zinc element of the thermostatic blade causes the pressure of the screw 22 on the valve-stem *m* to be reduced and the valve 15 is unseated. I have before stated in substance that the outlet-aperture *n* has a greater area than the passage 18, and this difference in area is largely depended upon for the successful operation of the apparatus. In describing the effect of the differential areas I will assume that "10" represents the area of the passage 18, "20" the area of the aperture *n*, and "15" the area of the stem *m* of the valve 15, and that the air-pressure is ten pounds per square inch. When the valve 15 has closed the passage 18, the force necessary to keep the valve seated would be represented by "100," which figure is obtained by multiplying the area "10" of the passage 18 by the pressure per square inch—viz., "10"—thus: $10 \times 10 = 100$; but the moment the valve is unseated it is subjected to a pressure represented by "150," this figure being arrived at by multiplying the area "15" of the valve-stem by the air-pressure of ten pounds per square inch, thus: $15 \times 10 = 150$. In this case the area of the aperture *b* must not be taken into consideration. The valve 15 is then moved rapidly outward and suddenly closes the aperture *n*, and the end of the thermostatic blade 20 being elastic is pushed outward in the movement through the medium of the screw 22. As soon, however, as the aperture *n* is closed, the area of the valve-stem *m* ceases to be a factor in the operation and has not to be taken into consideration. Consequently the valve 15 is held to its second or outer seat by a pressure represented by "200" and securely held in its new position, or that shown in the drawings. The pressure "200" is found by multiplying the area "20" of the aperture *n* by the pressure "10," thus: $20 \times 10 = 200$. It will be understood that when the aperture *n* is closed by the valve 15 communication between the outer surface of the diaphragm 12 and the atmosphere is suspended, and the full force of the compressed air acts on the said surface, which causes the diaphragm to move inward, thus seating the valve 7 on its seat *e*, whereby the duct *c* is again closed and the air which had been keeping the radiator-valve shut escapes through the channel 27, thereby admitting of the action of the spring, which then opens the radiator-valve. From the foregoing description it will be understood that practically no air escapes directly from the air-tank, and the only air that does escape is that which is confined at each operation of the apparatus above the diaphragm 12 in the air-chamber 10, together with that contained in the pipe leading from the regulating apparatus to the diaphragm of the radiator-valve. As soon as the temperature of the room has risen slightly above 70° a reverse action of the thermostatic blade takes place, with the result that when the pressure of the screw 22 upon the valve-stem *m* is increased beyond "200" the valve 15 is unseated, and then, in view of the differential areas of the stem *m* and the aperture *n*, the resistance is lowered from "200" to "150," which change practically assists the blade in effecting the closure of the passage 18. The apparatus is now in the condition in which steam is again cut off from the radiator, and it remains cut off until the temperature falls below the predetermined point.

I claim as my invention—

1. In a heat-regulating apparatus comprising a valve-chamber having a passage leading therefrom to a source of supply of air under pressure, and an aperture extending from the said valve-chamber to the outer air, the transverse area of the passage being less than that of the aperture, a double-faced valve situated within the said valve-chamber having a stem which extends through the aperture to the outer air, and a thermostatic blade to directly actuate the said valve through the medium of its stem, and in its vibration close either the said passage or the outlet-aperture, substantially as specified.

2. In a heat-regulating apparatus, a shell having an inlet and an outlet air-duct, which ducts converge in a valve-chamber, an air-chamber in communication with the valve-chamber and provided with a channel at all times open to the outer air, a double-faced valve situated within the valve-chamber having a stem which extends from the valve-chamber into the air-chamber, the said valve being adapted to close the inlet-duct or the aperture leading to the air-chamber, and a diaphragm held within the air-chamber and over the end of the valve-stem, combined with a second valve-chamber having an air-escape aperture and a passage leading to the outer side of the said diaphragm, a double-faced valve situated within the second valve-chamber having a stem which passes through the said air-escape aperture, the two double-faced valves coacting to prevent a continuous escape of air from the source of air-supply to the atmosphere, and a thermostatic blade which in its vibration due to change in temperature of the air, operates to establish communication between the inlet-duct and the air-chamber at a point above the diaphragm, or to cut off such communication and expose the outer side of the diaphragm to the air, substantially as specified.

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Witnesses:
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