

April 17, 1945.

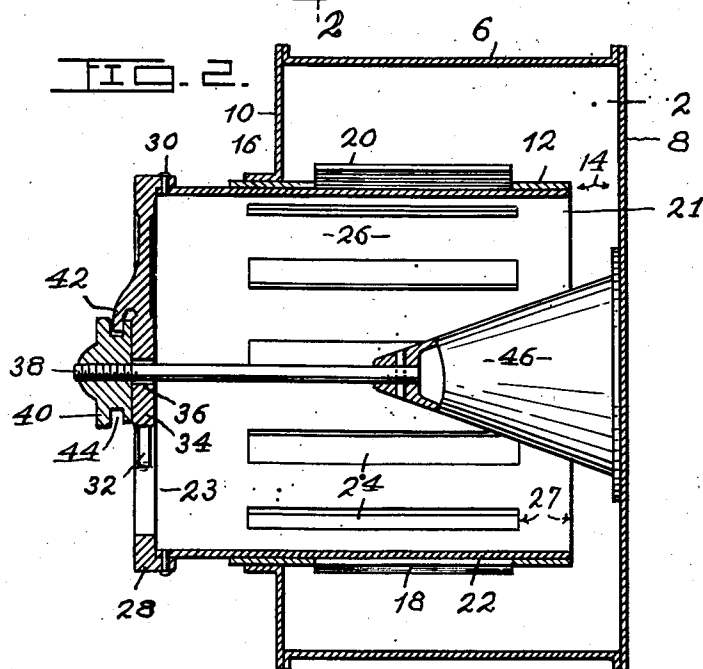
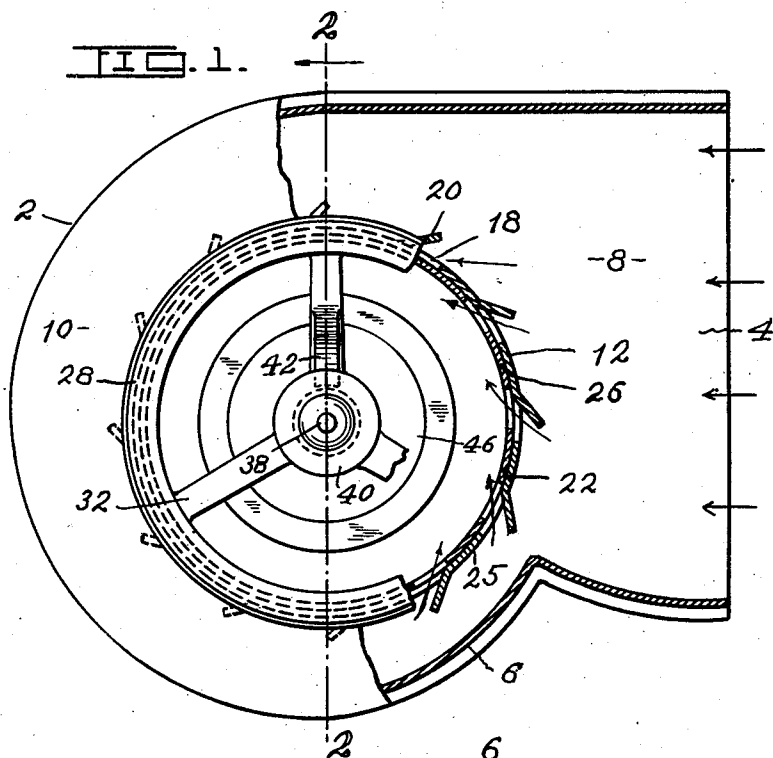
W. J. CALDWELL

2,373,741

ADJUSTABLE NOZZLE

Filed March 13, 1942

2 Sheets-Sheet 1



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FIG. 3.

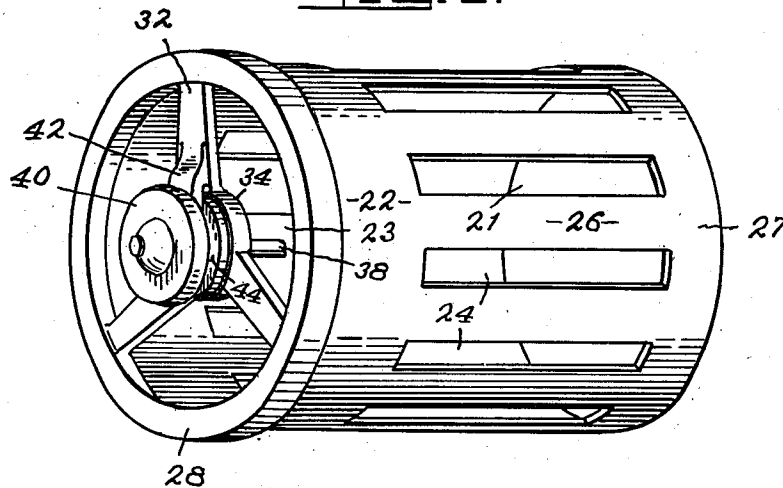


FIG. 4.

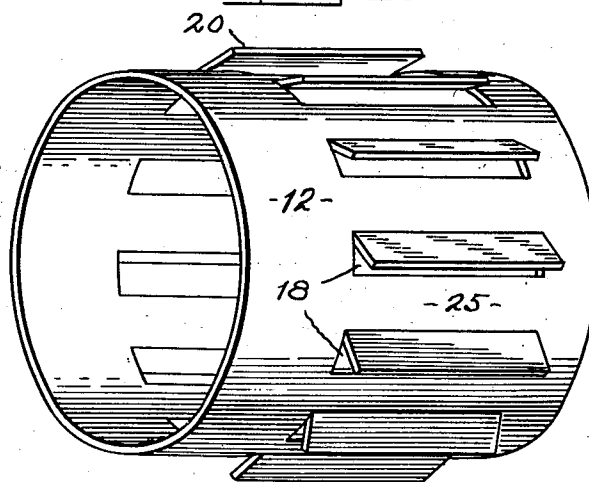
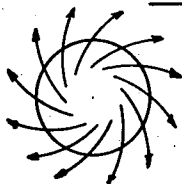


FIG. 5.



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UNITED STATES PATENT OFFICE

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ADJUSTABLE NOZZLE

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7 Claims. (Cl. 98—40)

My invention relates to an adjustable nozzle and my object is to provide an efficient device of this character for controlling the volume, velocity, pressure and directional flow of air, or other fluid received under pressure from any suitable source and injecting it into rooms, ships, processing compartments and various other places for the purpose of heating, cooling and ventilating such places.

Another object is to provide a nozzle which may be adjusted to different positions in one direction to discharge a relatively dense stream of fluid various distances, or adjusted to other positions in another direction to spread the fluid to different degrees as desired.

A further object is to provide a nozzle having a housing with a fluid inlet and containing two cylindrical valve members with peripheral inlet ports and a discharge opening which latter is arranged exteriorly of the housing and at approximately right angles to the fluid inlet, one of said valve members being rotatable within the other so that its ports may be either closed or carried into varying degrees of coincidence with the companion ports, said inner valve member also being adjustable with respect to a rear wall of the housing to control an intervening port through which additional flow of fluid in desired volume may be obtained.

Another object is to provide a nozzle having tangential deflectors which cooperate with the inner valve member in imparting a rotary motion to the incoming fluid, the latter being divided into a multiplicity of streams when passing through the peripheral ports, that combine into a common rotary stream in which sound waves are reduced to a minimum, the combined stream being finally discharged from the nozzle as a conical air flow at right angles to the inlet opening in the housing, the speed and volume of the stream being controlled as desired by proper adjustment of said inner valve member.

A further object is to provide an adjustable nozzle of simple, inexpensive construction which is quiet in operation, can be easily and accurately adjusted, and is not liable to get out of order.

Other objects will hereinafter appear and in order that the invention may be fully understood, reference will now be had to the accompanying drawings, in which:

Fig. 1 is a front elevation of the nozzle with a portion thereof broken away.

Fig. 2 is a vertical cross section of the nozzle on line 2—2 of Fig. 1.

Fig. 3 is a detail perspective view of a movable cylindrical valve member.

Fig. 4 is a detail perspective view of a fixed cylindrical valve member.

Fig. 5 is a diagrammatic view of the outlets of two nozzles located side by side, with arrows indicating the fluid whirling in reverse directions to obtain more uniform distribution of the fluid as it is discharged from the nozzles.

Referring in detail to the different parts, 2 designates a housing preferably of the scroll type, provided with an inlet 4 and consisting in the present instance of a peripheral wall 6, an imperforate rear wall 8 closing the rear end of the housing and a front wall 10. Transversely arranged within the housing is a fixed cylindrical valve member 12 which is open at both ends and spaced inwardly from the rear wall 8 to leave an intervening port 14.

The valve member 12 extends outwardly at right angles to the inlet 4 through an opening in the front wall 10 of the housing 2, which, in the present instance, has an annular flange 16 to which the valve member is brazed or otherwise fixed. The valve member 12 may be provided with one or more peripheral inlet ports of any desired shape. Preferably a series of equally spaced peripheral inlet ports 18 are employed and arranged in the form of longitudinal slots disposed in parallelism with the axis of the valve member 12. Air or other fluid under pressure entering housing 2 through the inlet 4, is directed to the inlet ports 18 by deflectors 20 preferably struck from the valve member 12 and bent outward at a tangent to the periphery thereof, Fig. 1, to form the ports 18.

The ports 18 are simultaneously controlled by a movable cylindrical valve member 22 slidably and rotatably mounted within the fixed valve member 12. The movable valve member 22 is open at each end to provide an inlet 21 communicating with the port 14, and an outlet 23 through which the fluid is discharged from the nozzle. The valve member 22 is also provided with a series of peripheral inlet ports 24 spaced to register with the peripheral ports 18. The ports 18 are spaced apart to leave intervening peripheral surfaces 25 of sufficient width to close ports 24, when the valve member 22 is rotated to carry the ports 24 into coincidence with the respective surfaces 25. The ports 24 are spaced far enough from the inlet port 21 of the valve member 22 to leave sufficient surface 27 to close the intervening port 14 when the valve member 22 is slid backward against the rear wall 8 of the housing 2, as will presently appear.

Any suitable means may be employed for operating the movable valve member 22. In the pres-

ent instance I have shown such means comprising a hand wheel provided with a ring 28 which is secured to the outer end of the movable valve 22 by rivets 30, or other suitable means, so that the valve member 22 may be turned axially to control the ports 18 and 24. The ring 28 has spokes 32 radiating from a hub 34 having a central aperture 36 through which a stationary rod 38 freely extends and is provided at its outer threaded end with a nut 40, which may be operated to move the valve member 22 longitudinally against or away from the rear wall 8 of the housing 2 to control the port 14. The nut 40 is operably connected to the hub 34 in any suitable manner, a lug 42 for that purpose being shown in the present instance fixed to one of the spokes 32 and projecting into a peripheral groove 44 in the nut 40.

The rod 38 is fixed at its rear end in the apex of an imperforate conical member 46 arranged axially within the movable valve member 22 and fixed at its base to the rear wall 8 of the housing, Fig. 2. The conical member 46 is of substantially less diameter than the valve member 22 to leave an intervening annular space for the free ingress of air through the ports 24.

Operation.—Assuming that the parts are in the position shown by Figs. 1 and 2, it is apparent that fluid under pressure admitted to the inlet 4, will flow through the ports 14, 18 and 24 and be discharged through the outlet 23. When it is desired to discharge a relatively dense stream of fluid the maximum distance the valve member 22 is turned axially to close the peripheral ports 18 and 24, and moved longitudinally to open the intervening port 14 to its full capacity, whereupon the fluid entering the inlet 4 will flow through the port 14 and be discharged with a rotary motion from the outlet 23 in a dense and approximately cylindrical stream. The density of the stream and the distance it will flow can be varied by moving the valve member 22 more or less towards closed position. When it is desired to spread the fluid to the maximum extent the valve member 22 is adjusted to close the intervening port 14 and open the peripheral ports 18 and 24, whereupon a whirling motion is imparted to the fluid by the longitudinal deflectors 20 as they direct the fluid to the ports 18 and 24. As the fluid flows through the ports 18 and 24 and is discharged from the outlet 23 the whirling motion causes it to spread to the maximum extent. When both the whirling motion and distances of different extents are desired the valve member 22 is adjusted to open the ports 14, 18 and 24, accordingly.

In flowing through the ports 18 and 24, the fluid is divided into a multiplicity of streams which combine into a common spiral stream that is ejected from the nozzle outlet 23.

While the nozzle is designed more particularly for varying the velocity and volume of air discharged therefrom, it may be adapted to control and discharge steam, or various other fluids under pressure.

The nozzle may be appropriately calibrated with scales and indexes, not shown, so that the position of the movable valve member 22 can be readily determined.

If two nozzles are to be placed near each other, as shown by Fig. 5, the deflectors of one are arranged to extend in a reverse direction to the deflectors of the companion nozzle so that the two streams of fluid will rotate in opposite direc-

tions to each other and thus become more equally distributed.

From the foregoing description taken in connection with the drawings, it is apparent that I have provided an adjustable nozzle possessing the advantages above pointed out, and while I have shown a preferred form of my invention I reserve all rights to such other forms and modifications thereof as properly fall within the scope of the claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent, is:

1. An adjustable nozzle comprising a housing having an inlet and a rear wall, a cylindrical valve member fixed in said housing and spaced from the rear wall to leave an intervening port communicating with the housing inlet, said valve member having a peripheral inlet port also communicating with the housing inlet, and a cylindrical valve member movably mounted in the fixed valve member and provided with a peripheral inlet port and an outlet which latter communicates with the former and the exterior of the housing, said movable valve member being slidable longitudinally with respect to the rear wall of the housing to open or close the above-mentioned intervening port, or turned axially to one position to close the peripheral inlet port in the fixed valve member, or turned axially to other positions to carry its peripheral inlet port into varying degrees of coincidence with the peripheral inlet port of the fixed valve member, said movable valve member also having an open end which communicates with the intervening port when the latter is opened.

2. A nozzle comprising a housing having an inlet and a rear wall, a cylindrical valve member fixed in said housing and spaced from the rear wall to leave an intervening port communicating with the inlet, said valve member having peripheral ports communicating with the inlet, a cylindrical valve member mounted movably in the fixed valve member and provided with peripheral ports, an inlet adapted to communicate with the intervening port and an outlet which communicates with the inlet and the peripheral ports and leads to the exterior of the housing, said movable valve member being slidable longitudinally with respect to the rear wall of the housing to control the intervening port, or turned axially to control the peripheral ports, and manually controlled means for operating the movable valve member.

3. An adjustable nozzle comprising a housing having a fluid inlet, a cylindrical valve member fixed in said housing at right angles to the inlet and provided with a plurality of spaced peripheral inlet ports alternating with closed portions of greater area than said ports and coacting therewith in dividing incoming fluid under pressure into a plurality of streams, tangential deflectors on said valve member for directing the fluid to the respective ports, a rotatable cylindrical valve member mounted in said fixed valve member and provided with a plurality of spaced peripheral inlet ports and an outlet, said rotatable valve member being adapted to cooperate with the tangential deflectors in imparting a whirling motion to the incoming fluid and to control the peripheral ports, and a hand wheel fixed upon the outlet end of the rotary valve member for operating the latter.

4. An adjustable nozzle comprising a housing having a rear wall and a fluid inlet, a cylindrical valve member fixed in said housing at approximately right angles to the inlet and provided with a peripheral port communicating with said inlet,

said valve member having open front and rear ends, the latter end being spaced from the rear wall of the housing to leave an intervening port, a movable cylindrical valve member associated with the fixed valve member and provided with an open end communicating with the intervening port, an outlet and a peripheral inlet port which latter is adapted to register with the first-mentioned peripheral port, said movable valve member being adjustable to one position to close the port in the fixed valve member, or adjustable to other positions to carry its port into varying degrees of coincidence with the peripheral port of said fixed valve member, a conical member fixed at its base to the housing and projecting into the movable valve member, a hand wheel fixed to the outlet end of the movable valve member to control the same, said hand wheel having spokes radiating from a central hub, a rod fixed to the apex of the conical member and extending freely through a central opening in the hub, and a manual member rotatably mounted on the hand wheel and threaded upon the outer end of said rod to adjust the movable valve member relative to the rear wall of the housing and thereby control the intervening port.

5. An air nozzle comprising a housing having an air inlet and including a rear wall, a cylindrical valve member open at each end and provided with peripheral air inlet ports, said valve member being fixed in the housing at right angles to the housing inlet and spaced from the rear wall to provide an intervening air port which communicates with said housing inlet, an adjustable cylindrical valve member open at each end provided with peripheral air inlet ports adapted to register with the first-mentioned peripheral air ports, said adjustable cylindrical valve member being operably mounted in the fixed valve member, a hand wheel fixed to the adjustable valve member to turn the latter axially and thereby control the peripheral ports, and means associated with the hand wheel and the rear wall of the housing for adjusting the last-mentioned valve

member with respect to said rear wall to control the intervening port.

6. An air nozzle comprising a housing having an air inlet and including a rear wall, a cylindrical valve member open at each end and provided with peripheral air inlet ports, said valve member being fixed in the housing at right angles to the housing inlet and spaced from the rear wall to provide an intervening air port which communicates with said housing inlet, an adjustable cylindrical valve member open at each end provided with peripheral air inlet ports adapted to register with the first-mentioned peripheral air ports, said adjustable cylindrical valve member being operably mounted in the fixed valve member, means fixed to the adjustable valve member for turning the latter axially to control the peripheral ports, a rod fixedly associated with the rear wall of the housing, and a nut threaded on said rod and operably mounted on the means for turning the adjustable valve member axially, whereby the latter may be adjusted with respect to the rear wall of the housing to control the intervening air port.

7. A nozzle comprising a housing having an air inlet and including a rear wall, a tubular valve member fixed in said housing at right angles to the inlet and provided with open ends one of which is spaced from the rear wall to leave an intervening port communicating with the air inlet, a movable tubular valve member mounted in the fixed valve member and provided at one end with an inlet communicating with the intervening port and provided at its opposite end with a discharge opening, a conical member fixed at one end to the rear wall of the housing and projecting axially into the movable valve member, and rotatable threaded means associated with said conical member and the discharge end of the movable valve member for adjusting the latter with respect to the rear wall of the housing to control the intervening port.

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