No. 842,012. PATENTED JAN. 22, 1907.

E. RICHTER.

APPARATUS FOR FORCING FLUIDS.

APPLICATION FILED JUNE 15, 1906.

2 SHEETS—SHEET 1.

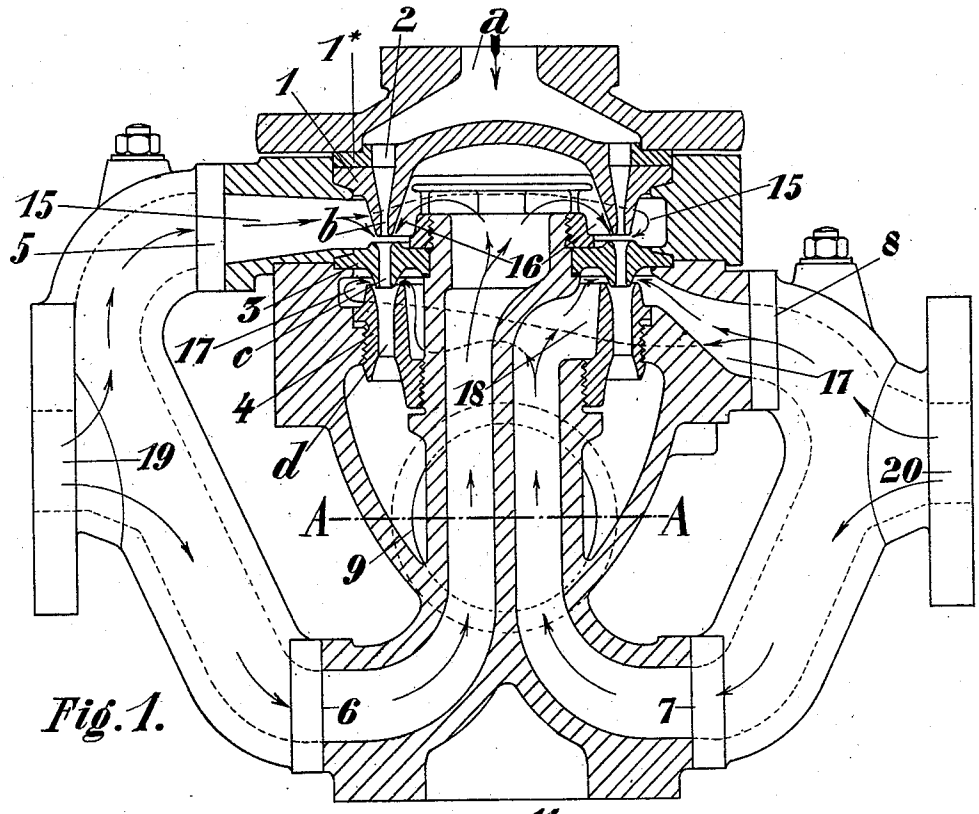

Fig. 1.

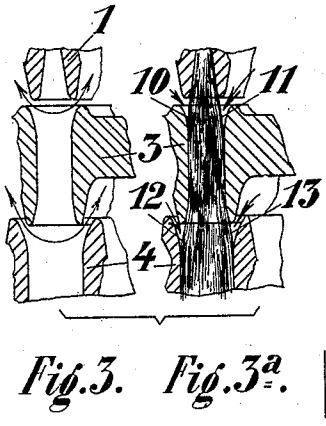

Fig. 3. Fig. 3a.

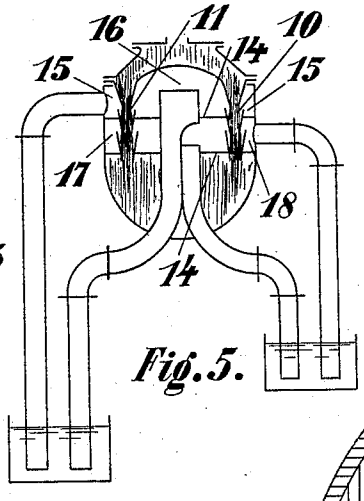

Fig. 5.

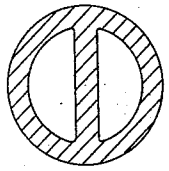

Fig. 2.

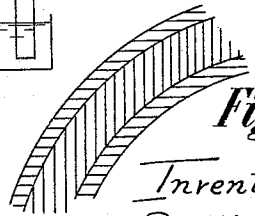

Fig. 4.

Witnesses:—
Chemnitz H. Schilling
Paul Arras

Inventor:—
Emil Richter
by Paul Schilling
his attorney

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2 SHEETS—SHEET 2.

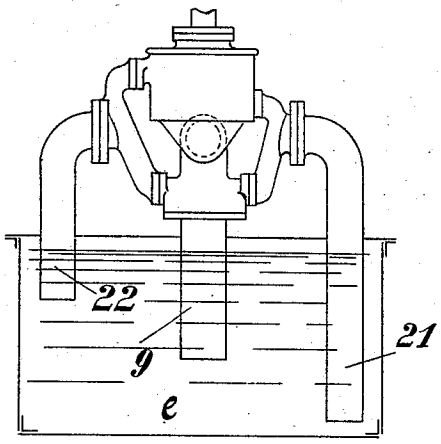

Fig. 6.

Witnesses:—
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UNITED STATES PATENT OFFICE.

EMIL RICHTER, OF ZABRZE, GERMANY.

APPARATUS FOR FORCING FLUIDS.

No. 842,012. Specification of Letters Patent. Patented Jan. 22, 1907.

Application filed June 15, 1906. Serial No. 321,853.

To all whom it may concern:

Be it known that I, EMIL RICHTER, a subject of the German Emperor, residing at Zabrze, Silesia, Germany, have invented certain new and useful Improvements in Apparatus for Aspirating, Treating, and Forcing Fluids, of which the following is a specification.

The present invention relates to improvements in apparatus for aspirating, treating, and forcing fluids, in which the fluids to be acted on are brought in contact with a jet of the working fluid in the well-known manner. An annular inlet-nozzle for the jet of working fluid is arranged in combination with annular mixing-nozzles for the fluids to be treated. The working jet is given an annular or cylindrical form, and not only the outer surface but also the inner surface of the same is utilized to produce an operative effect.

In order to make the invention more readily understood, I have illustrated it in the accompanying drawings, in which—

Figure 1 is a vertical sectional elevation of the apparatus. Fig. 2 is a section of the central divided tube only on line A A of Fig. 1. Figs. 3, 3ª, 4, and 5 represent diagrammatic views illustrating the action of the apparatus. Fig. 6 is an elevation of a modified construction of apparatus.

As shown in Fig. 1, within the exterior casing an inlet-nozzle 1 is arranged, provided with an annular passage *b*. In the cover or cap 1* of the nozzle 1 are several annularly-disposed orifices 2 for the entrance of the working, medium—such as steam, gas, compressed air, or the like—to the passage *b*. Below the inlet-nozzle 1 is a mixing-nozzle 3, provided with an annular passage *c*, concentrically beneath the passage *b* of the nozzle 1. Below the nozzle 3 is a further nozzle provided with an annular passage *d*, concentrically under passage *c* of nozzle 3.

As indicated in Fig. 1 of the drawings by arrows, the fluids to be aspirated, forced, or treated are introduced through the opening 5 to the outlet of annular passage *b* of the nozzle 1 and through the openings 7 and 8 to the inner and outer periphery, respectively, of the outlet of the annular passage *c* of the mixing-nozzle 3. 9 is the outlet for the resultant mixture.

The action of the apparatus is as follows: The working agent or fluid—for instance, steam—introduced at *a* entering the passage *b* of the inlet-nozzle 1 by means of the orifices 2 passes out downwardly in the form of an annular or cylindrical jet and passes into the annular passage *c* of the nozzle 3, retaining its annular form.

On entering the passage of the nozzle 3 the jet fills the space between the inner and outer faces of the annular passage *c* of the nozzle, so that whereas free communication normally exists between the said faces, as indicated in the left-hand part of Fig. 3, the jet causes separate suction zones 10 and 11 to be produced—*i. e.*, at the outer and inner faces of the annular passage of the nozzle 3, as indicated in Fig. 3ª. The jet of the working fluid thus produces a suctional effect both at its inner and at its outer circumference, as indicated in Fig. 4, in which the horizontally-hatched part represents, for example, water and the vertically-hatched part, for example, steam.

From the passage of the nozzle 3 the mixture, which also forms an annular or cylindrical jet, passes into the passage *d* of the nozzle 4. An effect similar to that already described is produced in the passage *d* of the nozzle 4, inasmuch as the jet causes two separate suction zones 12 and 13, Fig. 3ª, to be formed at the inner and outer annular faces of the passage *d*. The nozzle 3 operates as a pressure-nozzle on the action of nozzle 1 and as a suction-nozzle on the action of the nozzle 4, as indicated by arrows in Fig. 3. The efficiency of the improved apparatus exceeds that of the known kind, since the energy of the steam or other working fluid is completely utilized.

If in suction apparatus steam is brought into contact with a cooler fluid, the former condenses, causing the formation of a vacuum, which is filled again by the fluid flowing thereto. The more complete and rapid the condensation the more energetic is the flow or suction. For producing perfect condensation a sufficient quantity of the cooler fluid must be present and the contact between the latter and the steam must be intimate and widespread. In the case of an ordinary steam-jet the core of the same is not perfectly reached by the cooler fluid, so that condensation of the core of the jet is slight. Also if steam is brought into contact with a solid jet of water the core of the water-jet is

not operative in the condensation process. By means of the present invention a more perfect condensation is produced, as the annular or cylindrical jet of working fluid is operative both on its inner as on its outer surfaces and is brought into intimate contact with considerably larger quantities of cooler fluid than would be possible with a solid jet.

If according to the quantity and nature of the fluid to be aspirated, treated, forced, or otherwise dealt with instead of a single annular pressure-nozzle, as in Fig. 1 of the drawings, several concentrically-arranged annular nozzles of the kind described are utilized, the working jet retains until its exit from the last nozzle its annular form, and its efficiency is as great at the commencement as at the finish of its passage through the several nozzles.

On account of the annular formation of the nozzles they can be arranged closely together without affecting the area of their working action, so that the steam loses but little energy by expansion.

The improved apparatus can be used for forwarding great quantities of steam, water, air, gas, and the like and also for cleansing or for the absorption of gases by fluids, for mixing various gases and fluids, for condensing steam by fluids, and for various other purposes.

In another form of the improved apparatus the nozzles are arranged in the casing in such a manner that they are prevented by the action of the annular jet of working fluid from direct action on each other.

As shown in Fig. 5, partition-walls 14 are arranged in the casing of the apparatus, so as to form chambers. Each separate suction or pressure zone of the annular nozzles operates in a separate suction-chamber—10 in 15, 11 in 16, 12 in 17, and 13 in 18. (See Fig. 1.)

The various suction-chambers may be connected to a common suction source or the chambers 15 and 16 to a suction source either through a common suction-pipe 19 or, as in Fig. 5, through separate suction-pipes, and the chambers 17 and 18 to a second suction source through a common suction-pipe 20 or through separate suction-pipes.

As by this arrangement each nozzle can act independent of the other, the apparatus can be arranged, as shown in Fig. 5, for action on separate fluids or for simultaneous suction from different levels of the same fluid, as will be described hereinafter. Further, the nozzles can be arranged in groups, each group acting in combination through separate suction-pipes.

In Fig. 6 the apparatus is shown arranged as a counter-current heater. Through the suction-pipe 21 the fluid from the colder zone of the fluid *e* being treated is forwarded to the nozzle 4, in which a mixture is produced with the warmer fluid entering from the nozzle 3, Fig. 1. The mixture from both nozzles passes through the outlet 9 between the cold and warm zone of the fluid *e*. Through the shorter suction-pipe 22, terminating in the warm zone of the fluid *e*, the warm fluid is drawn up again and passes to the nozzle 3, where it is further heated. The jet of working fluid (in this case steam) acts, therefore, on the warm fluid and the warmed fluid on the colder fluid.

By the circulation thus produced the fluid is rapidly heated and little heat is lost by radiation.

In the form of construction of the apparatus shown in Fig. 1 the annular working jet passes intact from the last nozzle 4 into a single outlet 9. If the apparatus is used, for instance, for airing and removing the dust from rooms, at the outer and inner circumferential face of the annular working jet air is drawn up and the air and dust particles taken with it into a common collecting-chamber. By means of the improved apparatus foul or dust-filled air can be removed from residential or other rooms, as is done by ordinary exhausters. With the ordinary exhauster the air drawn off is replaced by fresh air, which enters the room to be ventilated principally through badly-fitting parts of windows and doors. Apart from the fact that drafts are consequently produced the air is not freed from dust. These inconveniences are overcome by the present apparatus by causing the inner cylindrical face and the outer cylindrical face of the working jet to operate on different sources. The jet is subsequently divided into an inner and outer part, which can be conveyed away separately.

The working jet draws out the foul air and simultaneously supplies fresh air to the room without causing draft or dust-clouds, and the apparatus can be operated by water-pressure, air-pressure, steam, or the like.

What I claim is—

1. An apparatus of the character described comprising a casing and a plurality of pressure-nozzles arranged in series therein, having annular openings and separated from each other, the spaces between adjacent nozzles forming inner and outer suction-chambers separated by the jet of fluid passing through the nozzles, substantially as described.

2. An apparatus of the character described comprising a casing and a plurality of pressure-nozzles arranged in series therein, having annular openings and separated from each other, the spaces between adjacent nozzles forming inner and outer suction-chambers separated by the jet of fluid passing through the nozzles, and suitable sources of supply for said suction-chambers, substantially as described.

3. An apparatus of the character described comprising a casing and a plurality of pressure-nozzles arranged in series therein having annular openings and separated from each other, the spaces between adjacent nozzles forming inner and outer suction-chambers separated by the jet of fluid passing through the nozzles, and suitable separate sources of supply for said inner and outer suction-chambers, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

EMIL RICHTER.

Witnesses:
SIEGFRIED LUSTIG,
ERNST KATZ.