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PROCESS AND APPARATUS FOR ATOMIZING LIQUID SUBSTANCES INTO VERY SMALL PARTICLES.

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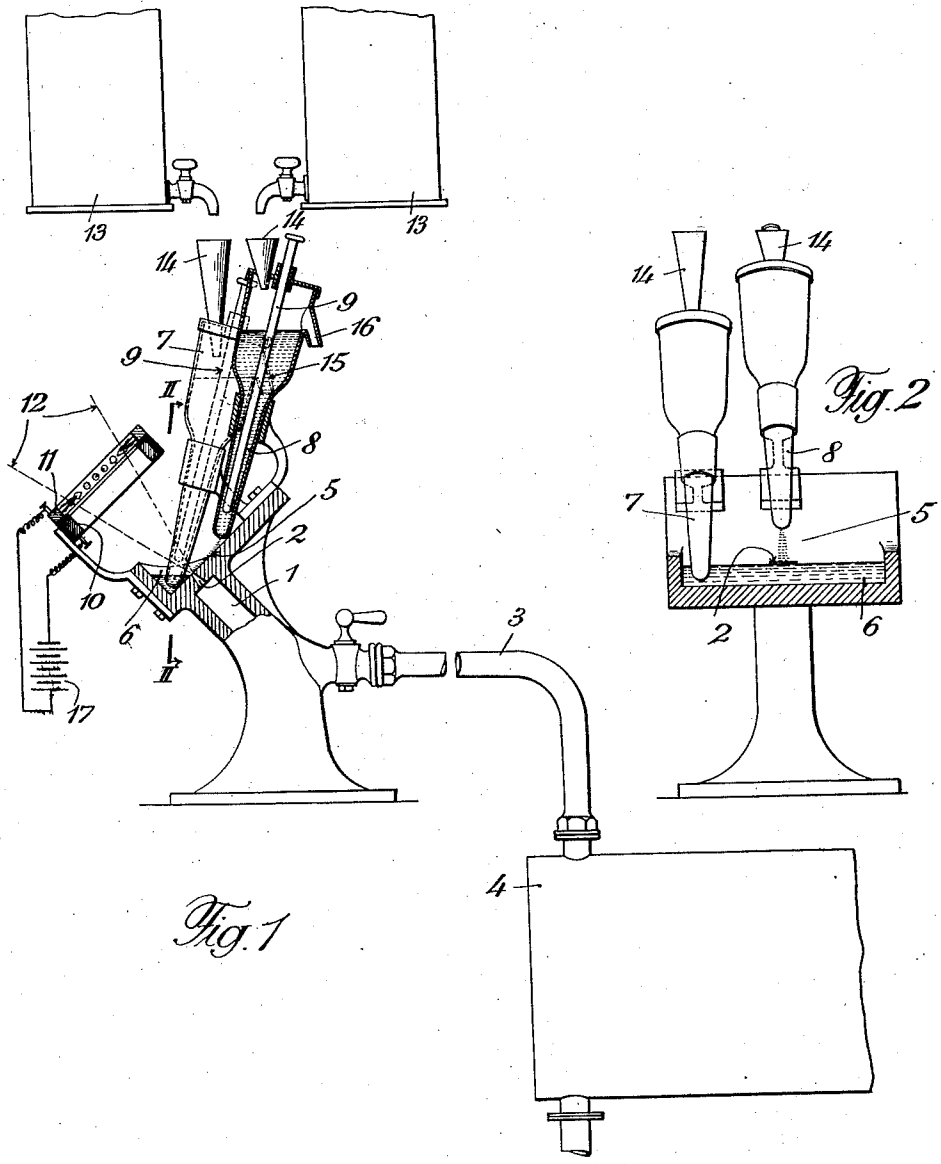


Fig. 1

Fig. 2

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UNITED STATES PATENT OFFICE.

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PROCESS AND APPARATUS FOR ATOMIZING LIQUID SUBSTANCES INTO VERY SMALL PARTICLES.

1,346,811. Specification of Letters Patent. Patented July 20, 1920.

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To all whom it may concern:

Be it known that I, FRITZ DIEBOLD, a citizen of the Republic of Switzerland, residing at Zurich, Talstrasse 11, Switzerland, have invented certain new and useful Improvements in Processes and Apparatus for Atomizing Liquid Substances into Very Small Particles; and I do hereby declare the following to be a clear, full, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawing, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to a process for spraying or atomizing liquid substances into very small particles and to an apparatus for carrying out said process. The process and apparatus according to the present invention are adapted for producing for instance, so called dispersed systems of any kind and for atomizing medicaments and for being used for inhaling purposes.

The very fine degree of dispersion obtained according to the present invention is due to the feeding of a slot nozzle provided for the discharge of a current of compressed fluid, for instance air, and having an outlet lying in a smooth surface, from two sides with the liquid substance supplied to said surface by suitable supply means. Preferably, the latter are provided with means permitting a regulation of the quantity of liquid substance supplied to the smooth surface, and a nozzle adapted to be cooled or heated is used.

Advantageously, I provide also for an electrification of the spray in order to prevent the union of small atomized particles into larger particles of different size and I prevent any decomposition and clogging of the apparatus by making the parts coming in contact with the liquid substance of glass or porcelain.

A construction of an apparatus for carrying out the process according to this invention is shown by way of example in a diagrammatic manner on the accompanying drawing, in which:

Figure 1 is a front view, partly in section, of the apparatus and

Fig. 2 a section on the line II—II of Fig. 1.

Referring to the drawing, 1 denotes a supply pipe for compressed air provided in its front wall with a narrow slot which forms the so called slot nozzle 2. The pipe 1 communicates by means of a pipe 3 with a reservoir 4 for compressed air. The outlet of said nozzle 2 lies in a surface 5 which is perfectly smooth; this surface does not under all circumstances have to be a plane surface. Beneath the nozzle 2 and adjoining the surface 5 is provided a small collecting trough 6 supplied with liquid substance by the pipe 7. 8 denotes a supply pipe arranged above the nozzle 2 and adapted to supply the same or another liquid substance to the surface 5 above the nozzle 2. In both pipes 7 and 8 are provided glass rods 9 which admit a passage of only a determined quantity of liquid through said pipes per second. When desired, said rods 9 may also be replaced by cocks or like means adapted to regulate the flow of the liquid out of said pipes. In front of the nozzle 2 are arranged a metallic ring 10 and a ring 11 provided with small metallic points. The two rings 10, 11 are insulated from one another and from the remaining parts of the apparatus. Both frames 10, 11 are for electrifying the wedge shaped or prism shaped spray 12 and they are electrically connected to the poles of a source of continuous current 17.

The spraying process is carried out by means of the described apparatus in the following manner:

The liquid substance flowing out of the receptacles 13 into the funnels 14 passes into the supply pipes 7 and 8 each of which is provided with an overflow branch 15 and 16 respectively, so that the liquid flowing out of said pipes is always subjected to the same pressure. The quantity flowing out of the pipes 7 and 8 per second can be regulated by means of glass rods of different size or similar means inserted into said pipes. The liquid substance flowing out of the pipe 7 fills the collecting trough 6 and the edge of the meniscus rises in the trough substantially to the lower edge of the slot 12, while the pipe 8 supplies the liquid substance directly to the smooth surface 5 and the upper edge

of slot 12. As the nozzle 2 lies in the axis of the supply pipe 1, the friction to which the current of compressed air is subjected within said pipe 1 is only small, nearly the whole kinetic energy of the current of compressed air being consequently used for the atomizing of the liquid substance. The prismatic spray 12 thus formed passes then through the apparatus 10, 11 which is for electrifying and for the ionization of said spray 12. When the ring 10 is highly-charged, for instance, with a positive charge, it charges the particles by influence binding thereby in the particles the negative electricity, while the negatively-charged points of the ring 11 transmit their electricity directly to the particles, effecting thereby a strong ionization of the current of compressed air. Owing to the charging of the particles, the latter are prevented from uniting into larger particles. By choosing a high pressure and a high tension, the small drops may be reduced to such a small size, that they are no longer visible to the eye. As already stated, the quantity of liquid substance or substances supplied to the nozzle 2 can be regulated in an accurate manner; by providing for a greater or smaller supply, the size of the particles can be increased or reduced in any desired manner independently of the pressure of the compressed air, which is not the case when the liquid is supplied to the nozzle by aspiration. The quantity of liquid substance atomized per second can be increased in any desired manner by arranging a suitable number of apparatuses side by side. Owing to the peculiar manner in which each single nozzle is supplied with liquid substances, it is possible to atomize simultaneously any desired number of substances which cannot be mixed. As the nozzle 2 is fed from two sides, its action is doubled with regard to the apparatuses known hitherto.

The surface 5 can be inclined or horizontal. Instead of using compressed air, also any other compressed gas, compressed steam or the like may be used. It will be noted that by feeding the liquids to the smooth glass surface 5 capillary and film action sets in between the liquids and the surface and they come to the slot as thin films, whose thickness may be varied within limits by the valve rods 9 controlling the supply. An advantage of this is that the liquid feed is always across the air stream from the nozzle 2.

What I claim now as my invention is:

1. The method of atomizing liquid substances into very small particles, which comprises producing a spray having in a cross-sectional plane at right angles to its longitudinal axis the shape of an oblong and positively feeding the substances to be atomized from opposite sides to the two wider surfaces of the spray.

2. The method of atomizing liquid substances into very small particles, which comprises producing a diverging spray having in a cross-sectional plane at right angles to its vertical longitudinal axis the shape of an oblong, and positively feeding the substances to be atomized from opposite sides at the point of smallest cross-section of the spray to its two wider surfaces.

3. The method of atomizing liquid substances into very small particles, which comprises producing a diverging spray of oblong cross-section in a plane at right angles to its longitudinal axis, feeding from two opposite sides at the point of smallest cross-section of said spray liquid substances, and electrifying the spray at a certain distance from its apex in order to prevent the atomized particles from uniting to particles of larger size.

4. The method of atomizing liquid substances into very small particles, which comprises producing a diverging spray of oblong cross-section in a plane at right angles to its longitudinal axis, feeding liquids to the spray from two opposite sides at the point of smallest cross-section and electrifying and ionizing the spray at a distance from its apex in order to prevent the atomized particles from uniting to form particles of larger size.

5. In an atomizer, a smooth surface having a slot therein, plural means for supplying liquid to be atomized to said surface to be thereby formed into a plurality of films supplied to the edge of the slot over said surface.

6. An apparatus for atomizing liquid substances into very small particles, comprising a body provided with a channel terminating in a nozzle having in a cross-sectional plane at right angles to its longitudinal axis an oblong shape, the outlet end of the nozzle lying in a smooth surface of said body and the latter being provided with a portion arranged at an angle to said smooth surface forming therewith a trough-like collecting space, means for supplying to said channel a compressed fluid, and means to feed the substances to be atomized on opposite sides of the spray issuing from said nozzle into said collecting space and against said smooth surface respectively, in order to bring them within reach of the spray.

7. An apparatus for atomizing liquid substances into very small particles, comprising means for supplying a current of compressed fluid, a nozzle provided in said means for the discharge of the compressed fluid and having in a cross-sectional plane at right angles to its longitudinal axis the shape of an oblong, the outlet end of the nozzle lying in a smooth surface of said means, means to supply the liquid substances to be atomized on two opposite sides of the spray of compressed fluid issuing from said nozzle and against said smooth surface in order to

bring them at the apex of the spray within reach of the latter, and means arranged in front of the nozzle for electrifying the spray of compressed fluid and the substances brought within reach of said spray.

8. An apparatus for atomizing liquid substances into very small particles, comprising means for supplying a current of compressed fluid, a nozzle provided in said means for the discharge of the compressed fluid and having in a cross-sectional plane at right angles to its longitudinal axis the shape of an oblong, the outlet end of the nozzle lying in a smooth surface of said means, means adapted to supply the liquid substances to be atomized on two opposite sides of the spray of compressed fluid issuing from said nozzle and against said smooth surface in order to bring them at the apex of the spray within reach of the latter, and means arranged in front of the nozzle for the electrification and ionization of the spray of compressed fluid and the substances brought within reach of said spray.

9. An apparatus for atomizing liquid substances into very small particles, comprising means for supplying a current of compressed fluid, a nozzle provided in said means for the discharge of the compressed fluid and having in a cross-sectional plane at right angles to its longitudinal axis the shape of an oblong, the outlet end of the nozzle lying in a smooth surface of said means, means to supply the liquid substances to be atomized on two opposite sides of the spray of compressed fluid issuing from said nozzle and against said smooth surface in order to bring them at the apex of the spray within reach of the latter, a source of electricity, a frame arranged in front of the nozzle and connected to one pole of said source of electricity, and a second frame also arranged in front of the nozzle and insulated from the first mentioned frame and connected to the second pole of said source of electricity, the spray of compressed fluid issuing from said nozzle and the substances brought within reach of said spray being adapted to pass through said two frames in order to be subjected to an electrification and ionization.

10. An apparatus for atomizing liquid substances into very small particles, comprising a body of glass provided with a channel terminating in a nozzle having in a cross-sectional plane at right angles to its longitudinal axis an oblong shape, the outlet end of the nozzle lying in a smooth surface of said body, means for supplying to the channel of said body a compressed fluid, two pipes to supply the substances to be atomized onto said smooth surface on opposite sides of the spray of compressed fluid issuing from said nozzle in order to bring them within reach of the spray, and means of glass adapted to regulate the flow of liquid out of said pipes.

In testimony that I claim the foregoing as my invention. I have signed my name.

FRITZ DIEBOLD.