Oct. 20, 1931. J. E. SWENDEMAN 1,828,626

REMOVAL OF MOISTURE FROM COMPRESSED AIR

Filed July 3, 1928

Fig. 1.

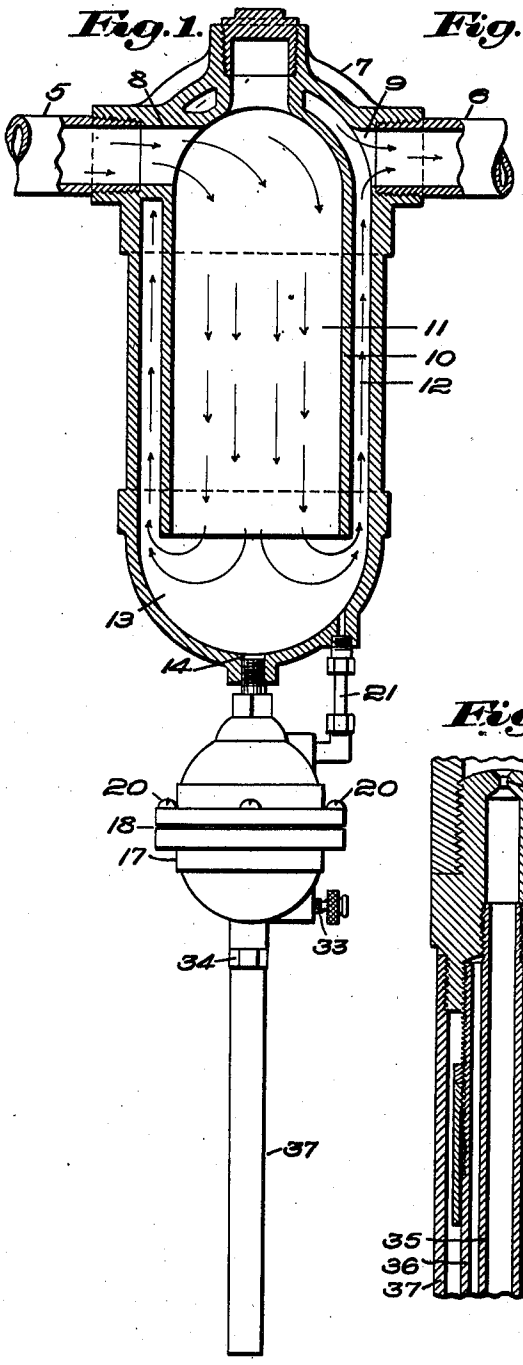



Fig. 2.

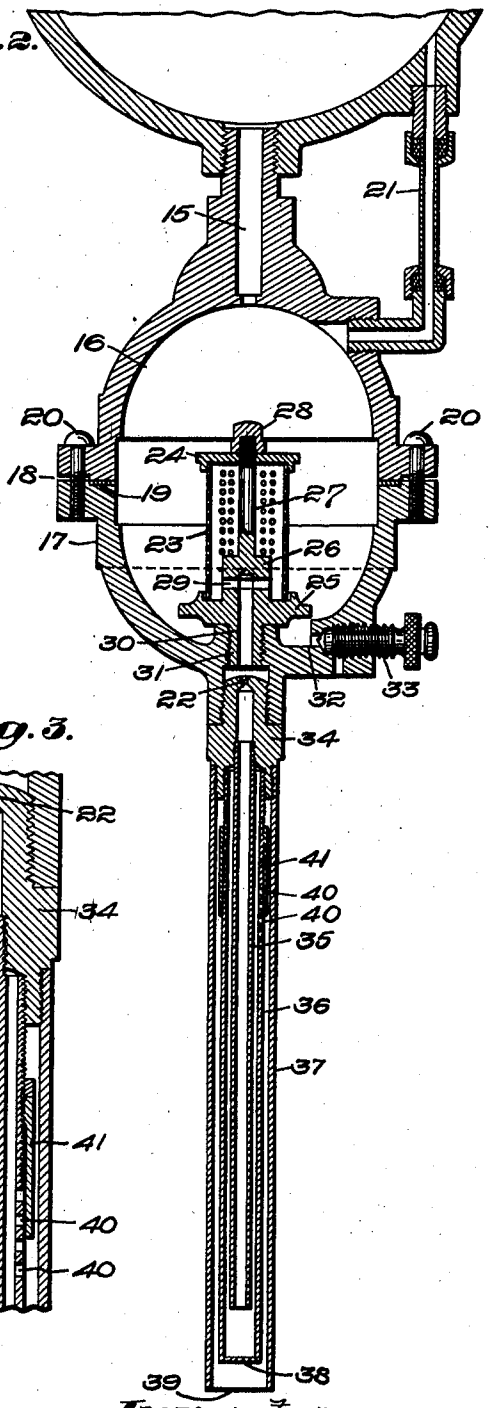



Fig. 3.




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# UNITED STATES PATENT OFFICE

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## REMOVAL OF MOISTURE FROM COMPRESSED AIR

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This invention relates to the removal of moisture from compressed air, and will be best understood by reference to the following description of one specific apparatus embodying the invention, while its scope will be more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a view, partly in elevation and partly in vertical section, of an apparatus exemplifying the invention;

Fig. 2 is a vertical, sectional view, on an enlarged scale, of the lower portion of the apparatus.

Fig. 3 is a sectional view, on an enlarged scale, of a portion of Fig. 2, illustrating the muffler throttle valve.

Referring to the drawings, and to the embodiment of the invention which is illustrated therein, there is shown an apparatus comprising a conduit 5, which leads from the air compressor (not shown), and a conduit 6, which leads to the point where the compressed air is to be utilized.

Between these two conduits, there is a casing 7 having an air inlet 8 and an air outlet 9. Between the inlet and the outlet, there is an intermediate conduit which changes the direction of the stream abruptly, and which is of much larger cross section than the inlet and outlet conduits, thereby to reduce the velocity of the stream to cause the moisture in the air to be precipitated within the casing. In the present example, this intermediate conduit is partly within and partly about a skirt 10, having therein a passage 11 directly communicating with the inlet 8, and of much larger cross-sectional area. About this skirt is another passage 12, which directly communicates with the passage 11, but leads in the opposite direction, and directly communicates with the outlet 9. The passage 11 within the skirt communicates with the passage 12 about the latter by way of a precipitating chamber 13. In the present instance, the passages 11 and 12 are vertical, and the chamber 13 is below the inlet 8 and outlet 9. The chamber is provided adjacent its bottom with an outlet 14 for moisture. The sides of the chamber 13 converge toward the outlet 14, and tend to cause the moisture to be driven through the outlet by the downward rush of the air from the inlet passage 11.

The compressed air entering the inlet 8 into the passage 11 has its velocity reduced because of the relatively larger cross-sectional area of the passage 11, as compared with the inlet 8. The direction of the stream is then abruptly changed as it passes into the chamber 13, and then in an upward direction through the passage 12 to the outlet 9. The moisture is precipitated in the chamber 13, and gravitates through the outlet 14. This precipitation of the moisture is probably due in part to the sudden temporary reduction of velocity of the air, and partly due to the abrupt change of direction. With this change of direction, the particles of moisture, by reason of inertia or centrifugal force, or both, are thrown against the converging sides of the bottom of the chamber, and pass out through the moisture outlet while the air freed of the moisture passes in an upward direction through the passage 12 to the outlet 9.

It is important to remove the moisture as quickly as possible from the separating chamber 13, so that there will be no danger of its being picked up again by the air current, and to this end, it is conducted through a short conduit 15 into a second chamber 16, herein conveniently formed in a two-part, separable casing 17, divided at 18 and provided with a gasket 19 and clamping screws 20, to make a tight joint. Another important point is that the air pressures within the chambers 13 and 16 shall be equalized, so that there shall be no resistance to the escape of liquid from the chamber 13 to the chamber 16. To this end, therefore, there is provided an equalizing conduit 21 connecting said chambers, so that, even though the passage 15 be completely filled with liquid trickling from one chamber to the other, yet the equalizing conduit which leads from the chamber 13 above the outlet 14 will provide a certain means of equalization of air pressures in the two chambers.

Another important point is that provision

is made for the continuous escape of the condensation to the atmosphere, but without the loss of more than a negligible quantity of compressed air. To this end, the condensation which escapes from the chamber 16 is compelled to pass through a very restricted constantly open passage 22. To prevent any possibility of this passage becoming clogged with solid matter carried by the air or water, there is interposed between the chamber 16 and the restricted passage 22 a screen 23, having a multiplicity of small perforations. Herein, this screen is conveniently in the form of a cylinder, whose upper and lower ends are closed by caps 24 and 25, the latter presenting an upwardly directed boss 26 and a stem 27, which passes through the upper cap 24 and is threaded to receive a nut 28, by means of which the screen is clamped between the two caps or headers. The boss 26 is provided with one or more radial passages 29 leading from the space within the screen to a central passage 30 within the boss 31, which is threaded and screwed into the lower part of the casing 17 directly above the restricted passage 22. Thus, sediment which enters the chamber 16 cannot reach and clog the restricted passage 22, but is retained in the chamber until removed therefrom through a sediment outlet 32 controlled by a sediment plug or valve 33. The number of perforations in the screen is sufficient so that, even if a large number of them become clogged, the apparatus will still be perfectly workable.

In the present embodiment, the restricted passage 22 is formed in a bushing 34, which is threaded and screwed into the lower end of the casing 17. This bushing constitutes a part of a muffler now to be described, which muffles the air which escapes through the restricted passage 22 with the condensation. This muffler gradually reduces the pressure of the escaping air, and releases it to the atmosphere at so low a pressure that it is not unpleasantly audible. In the present example, the muffler comprises a series of concentric tubes 35, 36 and 37, all carried by and having screw-threaded engagement with the bushing 34. The inner tube 35 is open at its lower end, the intermediate tube 36 is closed at its lower end by a wall 38, and the lower end of the outer tube 37 presents an outlet 39 for the escape of the air and condensation. Communication between the intermediate tube 36 and the outer tube 37 is had by one or more, herein a plurality of perforations 40. There may be, and herein is, associated with these perforations a lengthwise movable sleeve 41, which can be utilized to cover the perforations 40 to a greater or less extent, thereby to vary the degree of muffling. To this end, this throttling sleeve is conveniently threaded onto the intermediate tube 36, and may be rendered accessible for adjustment by removal of the outer sleeve 37.

The operation of the apparatus will be evident from the foregoing, without further description, except to say that in practice, it is found to cause such complete removal of moisture from the air that a sheet of clean white paper held over the outlet shows no spatters of moisture whatever, while the condensation removed from the air conveniently escapes through the outlet 39 at the bottom of the muffler.

Having thus described one embodiment of the invention but without limiting myself thereto, what I claim and desire by Letters Patent to secure is:

1. In an apparatus for removing moisture from compressed air, a casing presenting an air inlet, an air outlet, a downwardly directed inlet conduit, an upwardly directed outlet conduit, said outlet conduit being about said inlet conduit, a separating chamber below said conduits and through which one conduit communicates with the other, said conduits communicating with said inlet and said outlet, respectively, and being larger in cross-sectional area than said inlet and said outlet, and a moisture outlet from said chamber, the sides of said chamber converging toward said outlet, and a moisture-receiving chamber below and communicating with said separating chamber by way of said moisture outlet.

2. In an apparatus for removing moisture from a flowing stream of compressed air, the combination of means for slowing down the stream very substantially, means presenting a precipitating chamber into and through which the stream flows and into which the moisture is precipitated when the stream slows down, and a second chamber to which the moisture is conducted from said precipitating chamber, said second chamber having a constantly open outlet for moisture and compressed air.

3. In an apparatus for removing moisture from a flowing stream of compressed air, the combination of means for conducting the stream in a downward direction and reducing its velocity very substantially, means presenting a precipitating chamber into and through which the stream flows and into which the moisture is precipitated when the velocity of the stream is reduced, means for conducting air from said chamber in an upward direction, and a second chamber to which the moisture is conducted from said precipitating chamber, said second chamber having a constantly open outlet for moisture and compressed air.

4. In an apparatus for removing moisture from a flowing stream of compressed air, the combination of means for conducting the stream in a downward direction and reducing its velocity very substantially, means pre-

senting a precipitating chamber into and through which the stream flows and into which the moisture is precipitated when the velocity of the stream is reduced, means for conducting air from said chamber in an upward direction, means for increasing the velocity of the stream after it has been conducted in an upward direction, and means having a constantly open outlet for moisture and compressed air.

5. In an apparatus for removing moisture from a flowing stream of compressed air, the combination of means providing an inlet for the stream, a conduit downwardly directed from said inlet and having a much larger cross-sectional area than said inlet to reduce the velocity of the stream very substantially, means providing a precipitating chamber into and through which the stream flows downwardly from said conduit and into which chamber the moisture is precipitated, a conduit for conducting the stream in an upward direction from said chamber, and a second chamber to which the moisture is conducted from said precipitating chamber, said second chamber having a constantly open outlet for moisture and compressed air.

6. In an apparatus for removing moisture from a flowing stream of compressed air, the combination of means providing an inlet for the stream, a conduit downwardly directed from said inlet and having a much larger cross-sectional area than said inlet to reduce the velocity of the stream very substantially, means providing a precipitating chamber below the outlet of said conduit and into which said stream flows and in which the moisture is precipitated, a second conduit about the first and leading in an upward direction from said chamber, and a second chamber below and communicating with said precipitating chamber to receive moisture therefrom, said second chamber having a constantly open outlet for moisture and compressed air.

7. In an apparatus for removing moisture from a flowing stream of compressed air, the combination of means providing an inlet for the stream, a conduit downwardly directed from said inlet and having a much larger cross-sectional area than said inlet to reduce the velocity of the stream very substantially, means providing a precipitating chamber below the outlet of said conduit and into which said stream flows and in which the moisture is precipitated, a second conduit leading in an upward direction from said chamber, a second chamber below and communicating with said precipitating chamber to receive the moisture therefrom, said second chamber having a constantly open outlet for moisture and compressed air, and an air equalizing conduit connecting said chambers together.

8. In an apparatus for removing moisture from a moving stream of compressed air, the combination of means for reducing the velocity of the stream very substantially, means presenting a precipitating chamber into and through which the stream flows and in which the moisture is precipitated as the velocity of the stream is reduced, and means having a constantly open outlet to the atmosphere for moisture and compressed air.

9. In an apparatus for removing moisture from a flowing stream of compressed air, the combination of means for conducting the stream in a downward direction and reducing its velocity very substantially, means presenting a precipitating chamber into and through which the stream flows and into which moisture is precipitated when the velocity of the stream is reduced, means for conducting air from said chamber in an upward direction, and means presenting a constantly open outlet for moisture and compressed air from said chamber to the atmosphere.

10. In an apparatus for removing moisture from a flowing stream of compressed air, a casing presenting an air inlet, an air outlet, a downwardly directed air inlet conduit, an upwardly directed air outlet conduit, said outlet conduit being about said inlet conduit, a separating chamber below said conduits and through which one conduit communicates with the other, said conduits communicating with said inlet and said outlet, respectively, and being larger in cross-section than said inlet and said outlet, and a constantly open, water and compressed air outlet from said chamber to the atmosphere.

11. In an apparatus for removing moisture from a flowing stream of compressed air, a casing presenting an air inlet, an air outlet, a downwardly directed air inlet conduit, an upwardly directed air outlet conduit, one of said conduits being about the other, a separating chamber below said conduits and through which one conduit communicates with the other, said conduits communicating with said inlet and said outlet, respectively, and being substantially larger in cross-section than said inlet and said outlet, and a constantly open, water and compressed air outlet from said chamber to the atmosphere.

In testimony whereof, I have signed my name to this specification.

JOSEPH E. SWENDEMAN.