

Aug. 9, 1955

K. C. THOMPSON
FOAM PRODUCING DEVICE

2,715,045

Filed Oct. 10, 1951

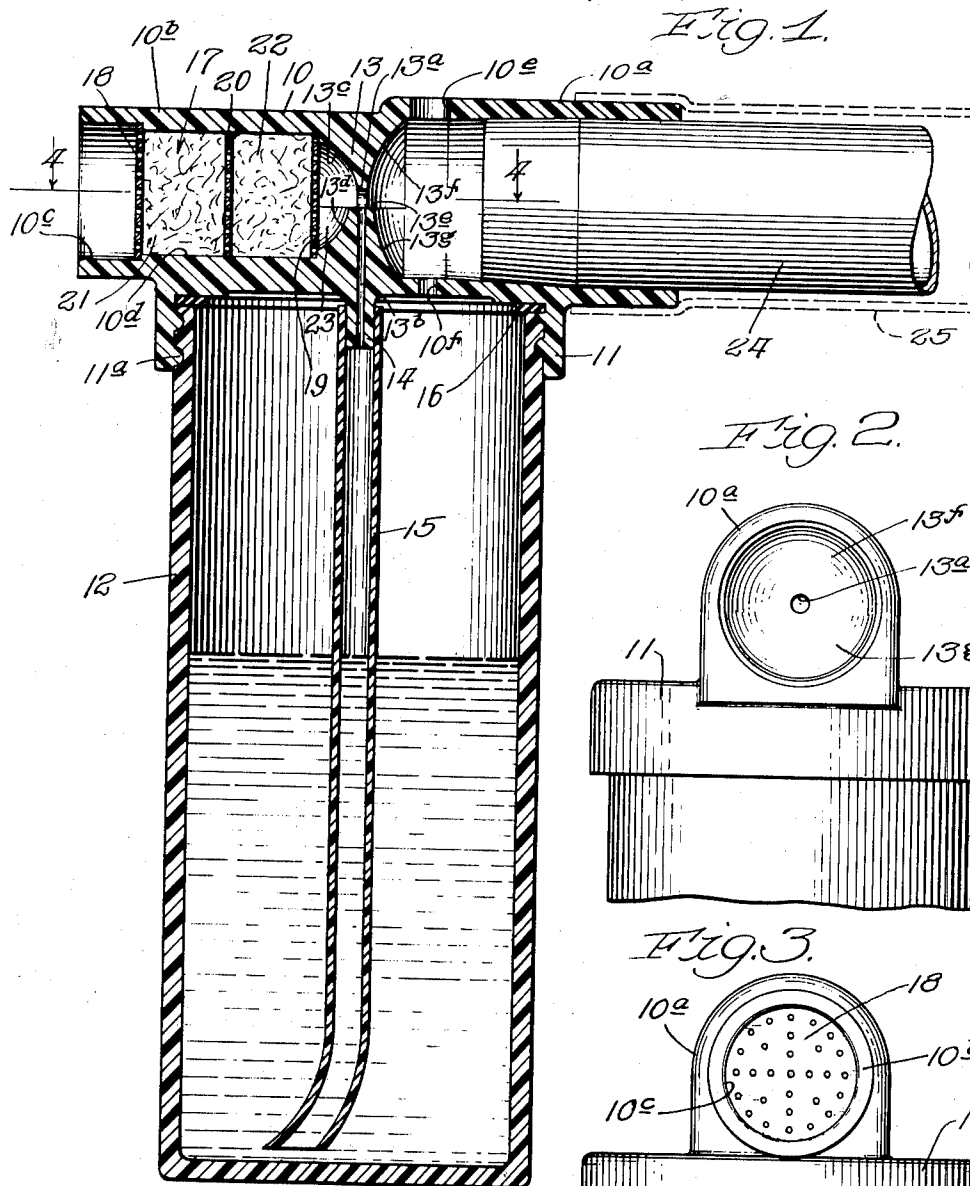


Fig. 2.

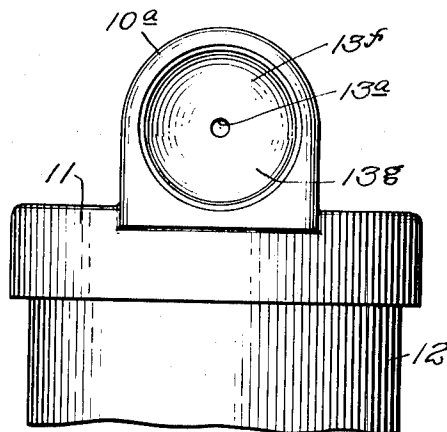


Fig. 3.

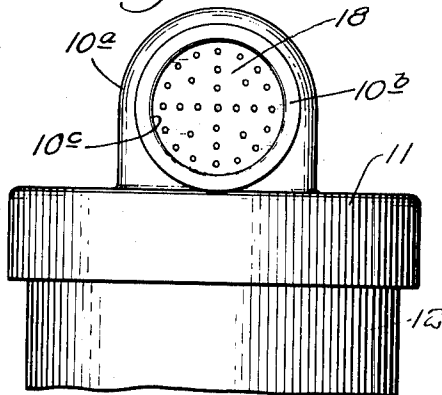
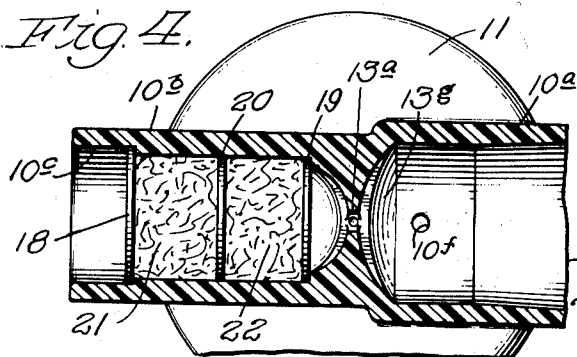


Fig. 4.



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2,715,045

FOAM PRODUCING DEVICE

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Application October 10, 1951, Serial No. 250,691

7 Claims. (Cl. 299—86)

This invention relates to a foam producing device adapted to be operated with air pressure from an air compressor such as a vacuum cleaner.

One of the features of this invention is to provide a foam producing device comprising a tubular member having a transverse wall with one surface concavely curved, a diffuser apparatus within the tubular member including a foraminous member spaced from the center of this curved surface to form an unobstructed chamber and an air and liquid inlet orifice in the transverse wall and spaced from the foraminous member, the combination of the curved surface and the chamber serving to promote even distribution of the air and liquid across the transverse area of the diffuser apparatus.

Another feature of the invention is the provision of the foam producing device comprising a tubular member having a transverse wall provided with an air orifice, diffuser apparatus in the tubular member on the downstream side of this wall and spaced therefrom and a liquid suction passage in the wall having its outlet opening in a portion of the surface defining the orifice to give a wider distribution of the air and liquid mixture across the adjacent transverse surface of the diffuser apparatus.

A further feature of the invention is the provision of the foam producing device having a diffuser apparatus therein comprising a pair of spaced transverse foraminous members fixedly held across the interior of the tubular member, a third transverse foraminous member positioned between this pair of members and also extending across the interior of the tubular member but movable relative thereto and bodies of diffusion material between the pair of foraminous members and on either side of the third foraminous member in order to aid in diffusing the liquid and air to form a foam.

Other features and advantages of the invention will be apparent from the following description of one embodiment of the invention as illustrated in the accompanying drawings.

Of the drawings:

Figure 1 is a longitudinal section through a foam producing device embodying the invention.

Figure 2 is a fragmentary end elevation taken from the right-hand side of Figure 1 but omitting the tubular connector.

Figure 3 is a view similar to Figure 2 but taken from the left-hand side of Figure 1.

Figure 4 is a fragmentary section taken substantially along line 4—4 of Figure 1.

The foam producing device of this invention is of the type wherein air under pressure as from the exhaust of a vacuum cleaner is mixed with liquid in a diffuser apparatus forming a part of the device to produce a foam. The device includes a liquid container carried by a tubular member with this tubular member terminating in a nozzle from which the foam is forced. Such a device is ordinarily used for producing soap foams used in cleaning rugs, upholstery and the like.

The foam producing device of this invention provides

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improved sudsing action in that there is more efficient mixing of the air and liquid and improved breaking up of this mixture into a substantially uniform foam or suds. The device is also easier to clean and is designed so that efficient cleaning is accomplished by merely back flushing with water under pressure. The new device also provides efficient mixing of the air and liquid prior to diffusing the air through the liquid to form the foam or suds.

In the embodiment shown in the accompanying drawings the device comprises a tubular member 10 having a downwardly extending annular cap portion 11 on the bottom thereof. This cap portion is provided on its inner surface with threads 11a arranged to fit an ordinary Ball or Mason jar. Attached to the cap portion 11 is a removable container 12 designed to contain liquid such as soap solution. This container is provided on its top outer surface with a helical groove shaped similarly to the threads 11a and adapted to be engaged by these threads to hold the tubular member 10 and container 12 in assembled relationship as shown in the drawings.

The tubular member 10 is provided with a transverse wall 13 substantially over the center of the cap 11 and thus the container 12. This transverse wall is provided at about its center with an orifice 13a. Extending upwardly through the wall 13 and transverse to the longitudinal axis of the tubular member 10 is a liquid suction passage 13b. The outlet opening of this passage is in a portion of the surface defining the orifice 13a as shown in Figure 1. The bottom end of the passage 13b passes through a downwardly extending projection 14 to which is attached the suction pipe 15. This suction pipe extends downwardly to a point adjacent the bottom of the container 12 and is used to draw liquid from the container through the passage 13b into the orifice 13a. In order to maintain a tight seal between the container 12 and the remainder of the device there is provided a gasket 16 of rubber or other relatively inert flexible material between the top rim of the container and the portion of the device adjacent the inner surface of the cap 11.

In the device shown in the drawings air enters from the right-hand side 10a of the tubular member and passes through the orifice 13a where it draws liquid up through the pipe 15 in passage 13b into the orifice 13a. Here the liquid is mixed with the air and is forced out the left-hand side 10b of the tubular member 10. In order to provide efficient diffusion of the air through the liquid so as to produce a fine bubbled foam or suds the left-hand branch 10b of the tubular member is provided with diffuser apparatus 17. This diffuser apparatus includes a pair of spaced transverse foraminous members 18 and 19 spaced apart a relatively great distance. Between these foraminous members 18 and 19 there is provided a third foraminous member 20 mounted loosely within the tubular member branch 10b so as to be movable relative thereto when sufficient force is applied. Between the foraminous members 18 and 20 there is provided diffusion material that is preferably a loose mass 21 of non-corrosive, fibrous material such as stainless steel wool or the like. A second mass 22 of similar material is provided between the transverse foraminous members 19 and 20. Although the foraminous members 18, 19 and 20 may be wire screens, perforated plates or the like, it is preferred that at least the outer member 18 be a perforated plate for maximum strength. This plate 18 is preferably somewhat oversize so that a press fit of this member 18 within the tubular member 10 results. Thus when the member 18 is in place it is somewhat dish-shaped with the concave portion being toward the outer end of the device. The other end foraminous member 19 is also immovably fixed within the branch 10b of the tubular member 10. As is shown in Figure 1 the end

of the tubular member portion 10b illustrated at 10c has a somewhat larger diameter than the remainder of this portion illustrated at 10d. As the outer foraminous member 18 is fitted within this outer portion 10c it has a diameter somewhat larger than the diameter of the foraminous members 19 and 20.

Between the innermost foraminous member 19 and the orifice 13a there is provided an unobstructed chamber 23. The outermost wall of this chamber is formed by the foraminous member 19. The other walls are formed by the adjacent surfaces of the transverse wall 13. As is shown in Figure 1 the top portion 13c of this surface is curved to a radius slightly less than the curvature of the bottom portion 13d of this surface. Furthermore the bottom 13e of the orifice 13a is considerably wider than the remainder of the orifice. Thus a step-like construction is provided where the top portion 13c and the bottom portion 13d of the surface of the wall 13 meet.

The surfaces of the wall 13 opposite the chamber 23 are also curved to different radii. Thus the portion 13f at the top of the wall 13 within the right-hand side 10a of the tubular member is curved to a lesser radius than is the bottom surface 13g of this wall. Thus although the surfaces 13c and 13f at the top of the wall are curved to different radii and the surfaces 13d and 13e are also curved to different radii, each top surface 13c and 13f has a smaller radius of curvature than has the corresponding bottom surface 13d and 13g.

The interior of the right-hand side 10a of the tubular member 10 is provided with a surface that tapers outwardly. Thus the device provides a tight fit with the ends of tubular connectors of varying diameters such as the wand 24 of a vacuum cleaner. As shown in Figure 1, the wand fits within the tubular member 10 to form a tight seal. If desired the device may be attached to the air supply by means of a flexible hose 25 instead of the wand.

The top surface of the branch 10a of the tubular member adjacent the wall 13 is provided with a hole 10e which may be used to start and stop the device. When the sudsing device is in operation the operator holds his finger over the hole 10e. When the foaming or sudsing is to be stopped he merely releases his finger from the hole so that air pressure will be directed primarily through this hole instead of through the orifice 13a. The bottom portion of the tubular member opposite the hole 10e is provided with a second hole 10f connecting with the interior of the container 12. This hole serves to provide air pressure within the container and prevent the formation of a vacuum.

By providing the center floating foraminous member 20 in the diffuser apparatus 17 the device has a greatly improved sudsing action. Such an arrangement has been found to be superior to either loose or tight packing in the diffusion material 21 and 22 in producing uniform foam of extremely small bubble size. By permitting this foraminous member 20 to be self-adjusting for all different conditions of pressure and rate of liquid flow, it has been found that the evolving of unfoamed liquid is avoided and the break up of the liquid into a foam is improved.

The provision of the unobstructed chamber 23 between the foraminous member 19 and the transverse wall 13 provides a clean out space that aids in removing trapped foreign material. When the device is to be cleaned the front end, and particularly the front foraminous member 18, is placed against a faucet and back flushed with water under pressure. Any foreign material is then forced into the chamber 23 and then back out the orifice 13a. The chamber has a further advantage in that it serves as a spray chamber to permit substantially equal distribution of the air and liquid mixture across the open face of the innermost foraminous member 19. This equal distribution is also greatly aided by the unequal construction of the orifice 13a as the bot-

tom surface 13e of the orifice is greater in width than the remainder of the orifice and thus serves to create a turbulence and promotes even distribution of the air and liquid across the member 19. The unequal curvatures of the surface 13c with respect to the surface 13d and the surface 13f with respect to the surface 13g also aids this uniform distribution as these surfaces create a turbulence in the air stream and in the air and liquid mixture stream to provide even mixing of the air with the liquid and to promote even distribution of the air and liquid across the member 19.

The liquid suction passage 13b is provided in the transverse wall 13 so that the liquid enters the air stream through the orifice 13a from the side rather than concentrically to the air stream. This arrangement provides a more efficient suction and also gives a wider distribution pattern that further aids in distributing the liquid and air mixture across the full inner surface of the foraminous member 19.

Efficient production of a substantially uniform foam of small bubble size is also improved by making the exit branch 10b of the tubular member of smaller internal diameter than the entrance branch 10a. With this construction the velocity of the air through the branch 10b is greater than it is through the branch 10a. This increased velocity forcing the liquid through the foraminous members 19, 20 and 18 and through the diffusion material 22 and 21 produces foam of fine bubble size of uniform consistency.

Having described my invention with relation to a particular embodiment thereof, it is my intention that the invention be not limited by any of the details of description unless otherwise specified but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

I claim:

1. A foam producing device adapted to be operated with air pressure, comprising: a tubular member having a transverse wall with one surface concavely curved; diffuser apparatus within the tubular member including a foraminous member spaced from the center of said curved surface to form an unobstructed chamber; and an air and liquid inlet orifice in the transverse wall and spaced from said foraminous member, the combination of said curved surface and said chamber serving to promote even distribution of the air and liquid across the transverse area of said diffuser apparatus.

2. A foam producing device adapted to be operated with air pressure, comprising: a tubular member having a transverse wall with one surface concavely curved; diffuser apparatus within the tubular member including a foraminous member spaced from the center of said curved surface to form an unobstructed chamber; and an air and liquid inlet orifice in the transverse wall and spaced from said foraminous member, said curved surface having substantially different radii of curvature at areas on opposite sides of said orifice, the combination of said curved surface and said chamber serving to promote even distribution of the air and liquid across the transverse area of said diffuser apparatus.

3. A foam producing device adapted to be operated with air pressure, comprising: a tubular member having a transverse wall therein provided with an axial air orifice passageway; diffuser apparatus in the tubular member on the downstream side of said wall and spaced therefrom; and a liquid suction passage in said wall and having its outlet opening radially of said tubular member in a portion of the surface defining the orifice to give a wider distribution of the air and liquid mixture across the adjacent transverse surface of said diffuser apparatus, said passageway surface portion that contains the outlet of the suction passage being wider than the portion of the passageway surface defining the orifice located opposite said liquid passage.

4. A foam producing device adapted to be operated

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with air pressure, comprising: a tubular member having a transverse wall provided with a pair of opposite surfaces, both said surfaces being concavely curved; diffuser apparatus within the tubular member including a foraminous member spaced from the center of one of said curved surfaces to form an unobstructed chamber; an axial inlet orifice passageway in the transverse wall and spaced from said foraminous member, each of said curved surfaces having different radii of curvature at areas on opposite sides of said orifice, the combination of said curved surfaces and said chamber serving to promote even distribution of the air and liquid across the transverse area of said diffuser apparatus; and a liquid suction passage in said wall and having its outlet opening radially of said tubular member in a portion of the surface defining the orifice to give a wider distribution of the air and liquid mixture across the adjacent transverse surface of said diffuser apparatus, said passageway surface portion that contains the outlet of the suction passage being wider than the portion of the passageway surface defining the orifice located opposite said liquid passage.

5. In a foam producing device adapted to be operated by air pressure and including a tubular member and means for forcing a mixture of air and liquid therethrough, diffuser apparatus within the tubular member, comprising: a pair of spaced transverse foraminous members fixedly held across the interior of said tubular member; a third transverse foraminous member positioned between said pair of members and also extending across the interior of the tubular member but movable relative thereto; and bodies of diffusion material between said pair of foraminous members and on either side of said third foraminous member.

6. A foam producing device adapted to be operated with air pressure, comprising: a tubular member having a transverse wall therein provided with an air orifice; diffuser apparatus within the tubular member having a transverse surface adjacent to said wall, the wall being provided with a liquid suction passage having its outlet opening in a portion of the surface defining the orifice to give a wider distribution of the air and liquid mixture across said adjacent transverse surface of said diffuser apparatus; a pair of spaced transverse foraminous members fixedly held across the interior of said tubular member on the downstream side of said wall; a third

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transverse foraminous member positioned between said pair of members and also extending across the interior of the tubular member but movable relative thereto; and bodies of diffusion material between said pair of foraminous members and on either side of said third foraminous member.

7. A foam producing device adapted to be operated with air pressure, comprising: a tubular member having a transverse interior wall provided with a pair of opposite surfaces, both said surfaces being concavely curved and containing an axial air orifice passageway; diffuser apparatus within the tubular member having a transverse surface adjacent to said wall, the wall being provided with a liquid suction passage having its outlet opening radially of said tubular member in a portion of the surface defining the orifice to give a wider distribution of the air and liquid mixture across said adjacent transverse surface of said diffuser apparatus, said passageway surface portion that contains the outlet of the suction passage being wider than the portion of the passageway surface defining the orifice located opposite said liquid passage; a pair of spaced transverse foraminous members fixedly held across the interior of said tubular member on one side of said wall with the adjacent foraminous member spaced therefrom to form an unobstructed chamber; a third transverse foraminous member positioned between said pair of members and also extending across the interior of the tubular member but movable relative thereto; bodies of diffusion material between said pair of foraminous members and on either side of said third foraminous member, each of said curved surfaces having different radii of curvature at areas on opposite sides of said orifice, the combination of said curved surfaces and said chamber and said liquid passage outlet opening serving to promote even distribution of air and liquid across said adjacent foraminous member.

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