

June 1, 1965

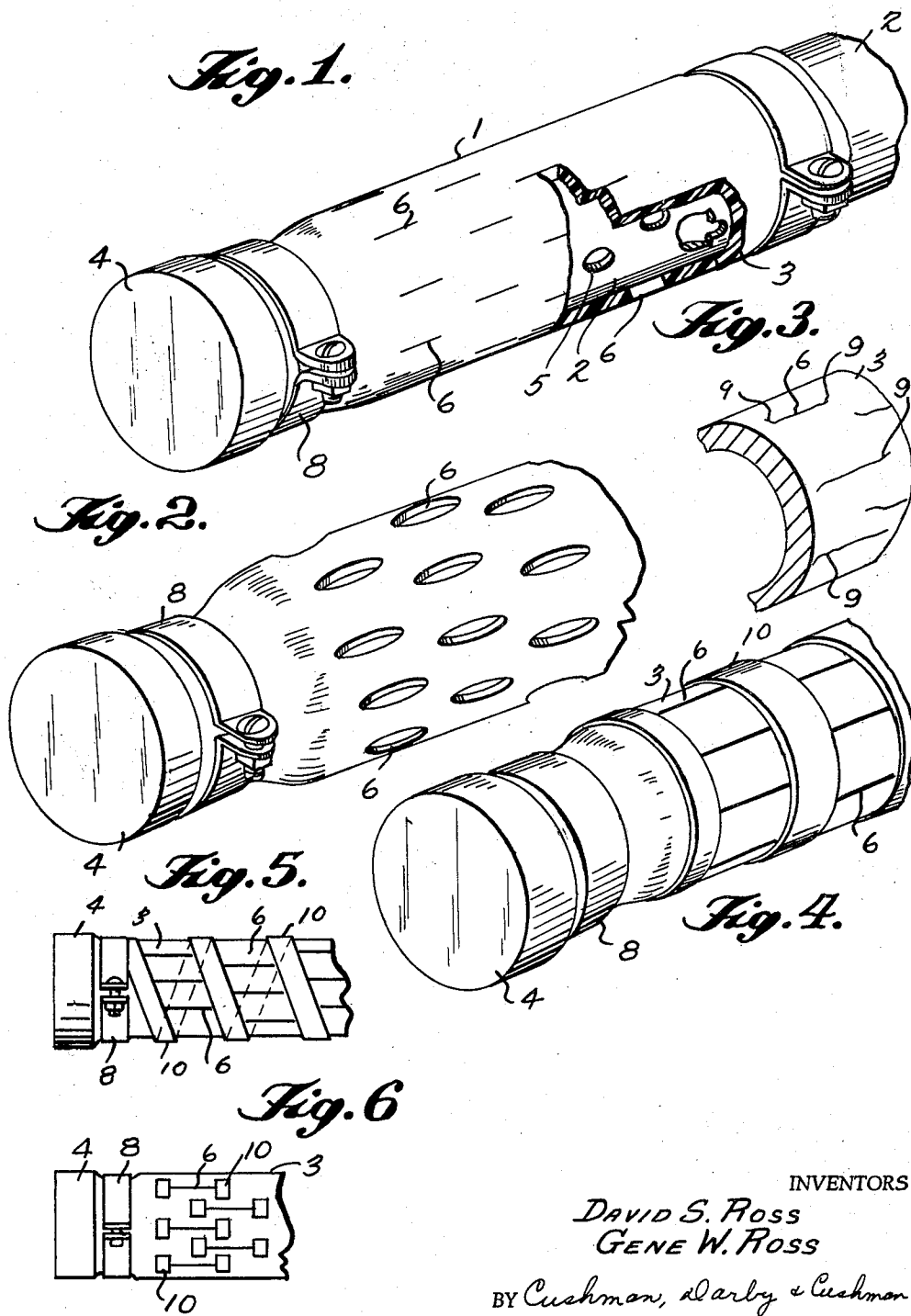
D. S. ROSS ETAL

3,186,644

DIFFUSER HEAD

Filed Feb. 6, 1963

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 7.

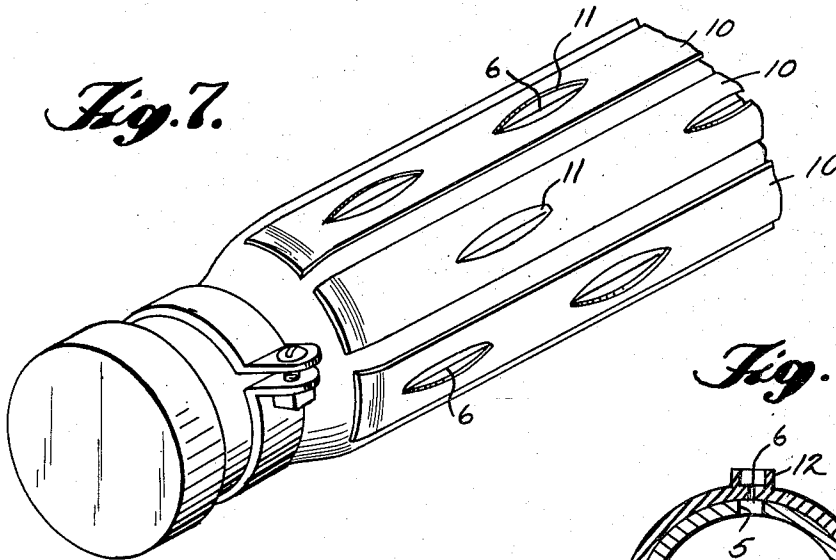


Fig. 8.

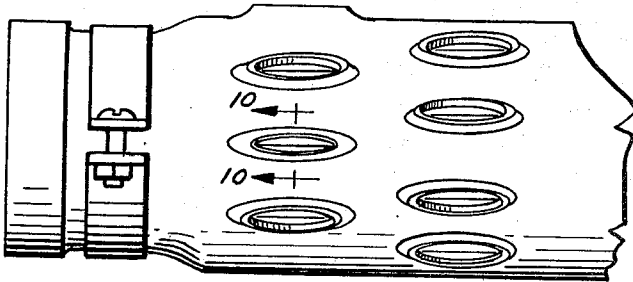


Fig. 9.

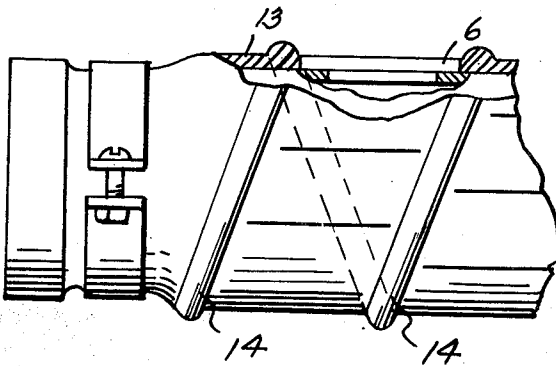
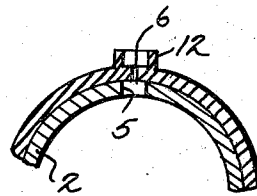


Fig. 10.



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3,186,644

DIFFUSER HEAD

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11 Claims. (Cl. 239-534)

This invention generally relates to a diffuser head and more particularly to a diffuser head wherein gas, typically air, is supplied under pressure and passes into a liquid through orifices provided in the walls of the diffuser head.

Such diffuser heads are of particular utility in the treatment of sewage, ore flotation processes, treatment of industrial wastes, various fermentation processes and certain chemical processes where gas-liquid contact is essential.

Frequent clogging of the orifices of the diffuser head is experienced, particularly in the aeration of sewage, when the air supply is cut off, and the surrounding liquid backflows through the orifices, carrying with it bits of debris that are not removed when the flow of air is resumed. Thus, frequent and expensive maintenance was required to unclog the orifices or to replace the diffuser head.

Heretofore attempts to provide a diffuser head which will resist this clogging have not been completely satisfactory and resulted in relatively cumbersome and expensive devices which were unable to endure extended and repeated use.

Therefore, the principal object of the present invention relates to a novel diffuser head of simplified construction, the orifices of which will not clog due to debris carrying backflow when the air supply is cut off.

A further object of this invention relates to a novel diffuser head of simplified construction which resists clogging and will endure extended and repeated use.

Other objects and the entire scope of the present invention will become apparent from the following detailed description and by reference to the accompanying drawings. It should be understood, however, that the detailed description and specific examples while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent as the description herein progresses.

Reference is made to the accompanying drawings which form a part hereof.

FIGURE 1 is a fragmentary perspective view partly in section showing a diffuser head constructed in accordance with our invention;

FIGURE 2 is a perspective view of our novel diffuser head with interior operating pressure applied thereto;

FIGURE 3 is a fragmentary perspective view of the resilient sleeve;

FIGURE 4 is a perspective view showing a modified form of our invention;

FIGURE 5 is a view in side elevation showing another modification of our invention;

FIGURE 6 is a view in side elevation showing an additional modification of our invention;

FIGURE 7 is a perspective view showing an additional modification of our invention;

FIGURE 8 is a view in side elevational showing another modification of our invention;

FIGURE 9 is a view in side elevation with parts in

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section showing a further modification of our invention; and

FIGURE 10 is a view in section taken along the line 10-10 of FIGURE 8.

In the drawing numeral 1 generally indicates one form of a diffuser head constructed in accordance with our invention.

As shown in FIGURE 1, the diffuser head generally comprises a hollow core 2 of metal or other suitable material and an expansible resilient cover or sleeve 3 of rubber or other suitable elastomeric material such as plastic.

The core 2 is provided with a plurality of perforations or orifices 5 for the passage of a gas, typically air, from the inside of the core to the interior of the sleeve 3. One end of the core is blanked by a cap 4 or by other suitable means.

The sleeve 3 is provided with a plurality of normally closed slits 6 which extend through the thickness of the sleeve.

As best seen in FIGURE 1, the sleeve 3 is adapted to receive the core 2 with the slits 6 remaining in their normally closed condition. The end portions of the sleeve 3, adjacent the end of the core 2, must be in sealing engagement therewith. This seal may readily be effected by any suitable means, such as by means of the clamp 8 shown in FIGURE 1. Other means of effecting such a seal will be apparent to those skilled in the art.

When the core 2 and sleeve 3 are assembled in operative relation to form our novel diffuser head shown in FIGURE 1, and diffusing gas pressure is supplied to the diffuser head, it is readily seen that the gas will pass through the orifices 5 into the interior of sleeve 3 and thus cause the sleeve to resiliently distend or expand. The distention of the sleeve 3 will cause the slits 6 to open, as shown in FIGURE 2, and thus permit the passage of gas therethrough.

When the diffusing gas pressure is cut off the sleeve 3 will no longer be acted upon by the interior expanding pressure. As a result, the sleeve 3 will contract and return to its normal unexpanded condition and simultaneously therewith the slits will close, and return to their normally closed condition.

It is readily seen that debris-carrying backflow is effectively prevented since the orifices of the diffuser head are closed whenever there is no positive diffusing gas pressure. Thus, clogging of the orifices by debris carried by the backflow when the diffusing pressure is cut off, is prevented.

When the aforementioned embodiment has been effective, it has been found that during extended use, where the resilient sleeve undergoes repeated distentions and contractions, there is a tendency for the slits to enlarge or elongate as a result of a tearing at their end portions, as indicated at 9 in FIGURE 3. The elongation of the slits results from the expansion of the sleeve at the end portions of the slits. This enlargement of the slits will shorten the useful life of the sleeve and necessitate relatively frequent replacement thereof.

The problem of slit enlargement is particularly acute in large treatment operations wherein a plurality of simultaneously operating diffuser heads are supplied gas pressure from a common main or conduit, and it is necessary to remove a diffuser head from the liquid being treated. In such instances if the diffusing gas pressure is not cut-off from the diffuser head, slit enlargement is likely to occur due to severe expansion of the sleeve. This results from

the increased pressure differential tending to expand the sleeve, i.e., the amount by which the interior expanding pressure exceeds the exterior expansion restraining pressure, due to the absence of the normal operating fluid head which tends to restrain expansion of the sleeve. The expensive alternatives of cutting off the supply of diffusing gas to all the diffuser heads in order to merely remove one from the treatment tank or installing individual cut-off valves for each diffuser head are obviously not desirable.

Therefore, in order to extend the useful life of the sleeve it is necessary to provide the sleeve with a means to prevent this undesirable slit enlargement.

It has been found that the aforementioned slit enlargement or elongation may be effectively prevented by providing a means to prevent or restrain expansion at the end of each slit. Such restraining means may comprise clamps, wire windings, textile or plastic cord, but preferably comprises tape which may be positioned adjacent the ends of each slit and, when so positioned, adhered to the sleeve or alternatively the sleeve itself may be provided with a thickened restraining portion adjacent the ends of each slit.

FIGURES 4, 5 and 6 show embodiments of our novel diffuser head provided with means to prevent slit enlargement, such means being in the form of tape.

In FIGURE 4, it will be seen that the sleeve is provided with a plurality of slits arranged in generally parallel rows or bands, spaced longitudinally of, and along the periphery of the sleeve 3. A suitable tape 10 has been adhered to the sleeve 3 at the end of each slit and forms parallel bands intermediate each row of slits. In the illustrated embodiment the tape is of sufficient width to extend from the ends of the slits in one peripheral row to the opposing ends of the slits in the adjacent peripheral row. If it is desired to utilize a tape that is narrower than the distance between adjacent rows of slits, a separate length of tape for the ends of the slits in each row may be employed.

FIGURE 5 illustrates the use of tape 10 to prevent slit enlargement when the slits 6 are arranged in parallel spiral rows about the periphery of the sleeve 3. Tape 10 has been adhered to the sleeve 3 at the end of each slit 6 and forms a spiral band about the periphery of sleeve 3 intermediate the adjacent spiral rows of slits. As pointed out above, separate lengths of tape for the ends of each row of slits may be employed if a tape narrower than the distance between adjacent rows of slits is utilized.

FIGURE 6 illustrates a further modification of the use of tape 10 to prevent slit enlargement. In this embodiment small sections of tape 10 are adhered adjacent the end of each slit 6 rather than a continuous length of tape being adhered adjacent the ends of several slits as in the aforementioned embodiments. It is readily seen that this modification may advantageously be employed where the particular slit pattern does not readily lend itself to the application of continuous lengths of tape.

FIGURE 7 illustrates a further modification of the use of tape 10 to prevent slit enlargement. In this embodiment a suitable length of tape 10 is placed directly and completely over a plurality of slits and adhered to the immediately adjacent surface portions of the sleeve. The portions of the tape that immediately overlie the slits are then cut out or removed as at 11 to provide apertures exposing the slits 6, with the tape adhered adjacent each end of each slit. While in the aforescribed embodiment the portions of the tape overlying the slits were removed after the tape had been adhered to the sleeve, it is apparent that tape having pre-cut apertures located so as to register with the slits might readily be employed. This modification lends itself to rapid and effective application of the tape to the sleeve as well as providing an effective means for preventing slit enlargement.

FIGURES 8, 9 and 10 show a further modification of our novel diffuser head provided with means to prevent slit enlargement, such means comprising an increased

wall thickness of the sleeve adjacent the ends of each slit. In FIGURES 8 and 10 the thickened wall portions of the sleeve which function as means to prevent slit enlargement are seen to comprise a plurality of continuous elliptical raised portions 12 which form crater-like projections laterally enclosing each slit 6. Thus it will be noted that adjacent the ends of each slit the wall of the sleeve is provided with thickened portions which prevent slit enlargement.

FIGURE 9 illustrates a modification wherein the thickened wall portions of the sleeve 3 are in the form of continuous circumferential bands or ribs 14 located at the ends of each slit 6. It will be readily apparent that the thickened wall portions of the sleeve may assume many other configurations and is not to be limited to those now shown and described. The aforementioned modification is of particular utility from the point of view of ease of manufacture since the thickened built-up wall portions of the sleeve may readily be formed or molded during the formation of the sleeve.

While in the above examples the slits are shown to extend longitudinally of the sleeve it is clear that the slits may extend in other directions relative to the longitudinal axis of the sleeve, in which case tape may be suitably positioned and adhered adjacent the ends of each slit, or suitably located thickened wall portions may be provided in the sleeve.

The present invention will thus be seen to completely and effectively accomplish the objects enumerated hereinabove. By providing a diffuser head of our novel construction, clogging of the orifices due to debris carrying backflow is completely eliminated. Moreover, our diffuser head is of a simplified construction thus facilitating manufacture and at the same time is durable and able to withstand extended use with a minimum of maintenance.

It will be realized, however, that various changes and substitutions may be made to the specific embodiments disclosed herein for the purposes of illustrating the principles of this invention without departing from these principles. Therefore, while the present invention has been described with particular reference to the specific forms shown in the drawings, it is to be understood that such is not to be construed as imparting any limitations upon this invention, which includes all modifications encompassed within the spirit and scope of the following appended claims.

What is claimed is:

1. A diffuser head comprising, in combination, a perforated hollow core adapted to receive gas under pressure, a resilient sleeve receiving said hollow core, said sleeve being adapted to distend under said air pressure, a plurality of slits in said sleeve, the opposed wall surfaces of each of said slits being in intimate contiguous sealing engagement when said resilient sleeve is in a relaxed condition, and tape means adhered to said sleeve adjacent the ends of the slits to restrain expansion of the sleeve at the end portions of said slits.

2. A diffuser head as set forth in claim 1 wherein said diffuser head includes means for sealing said core within said sleeve.

3. A diffuser head as set forth in claim 1 wherein said slits are arranged in parallel rows spaced longitudinally of the sleeve.

4. A diffuser head as set forth in claim 3 wherein said tape means is arranged in parallel bands intermediate adjacent rows of slits.

5. A diffuser head as set forth in claim 1 wherein said slits are arranged in longitudinally spaced and parallel spiral rows.

6. A diffuser head as set forth in claim 5 wherein said tape means is arranged in longitudinally spaced parallel rows intermediate said rows of slits.

7. A resilient sleeve adapted to receive the multiperforated hollow core of a diffuser head, said sleeve being further adapted to expand under interior gas pressure, a

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plurality of slits in said sleeve, the opposed wall surfaces of each of said slits being in intimate contiguous sealing engagement when said sleeve is in a relaxed condition and tape means adhered to said sleeve adjacent the ends of the slits to restrain expansion of said sleeve in the areas adjacent the ends of said slits. 5

8. A resilient sleeve as set forth in claim 7 wherein said slits are arranged in parallel rows spaced longitudinally of the sleeve.

9. A resilient sleeve as set forth in claim 8 wherein said tape means is arranged in parallel bands intermediate adjacent rows of slits. 10

10. A resilient sleeve as set forth in claim 7 wherein said slits are arranged in longitudinally spaced and parallel spiral rows. 15

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11. A resilient sleeve as set forth in claim 10 wherein said tape means is arranged in longitudinally spaced parallel rows intermediate said rows of slits.

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