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3,344,523

MULTI-STAGE EVACUATING DEVICE

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FIG. 1

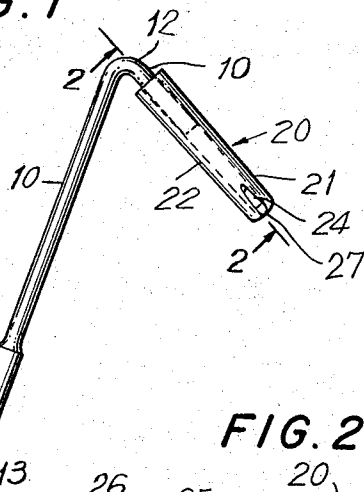


FIG. 6

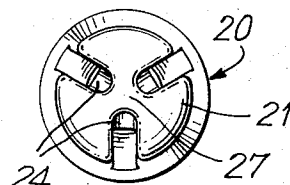


FIG. 2

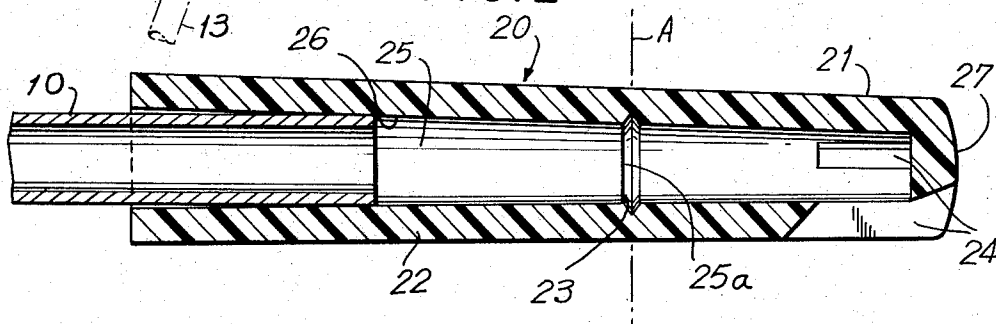


FIG. 3

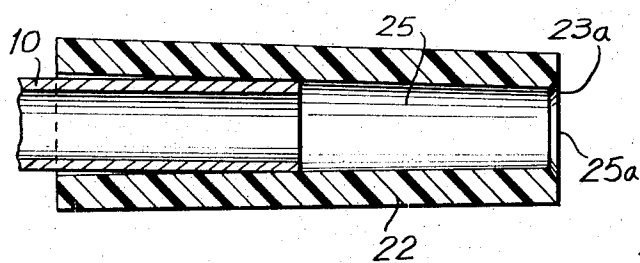


FIG. 4

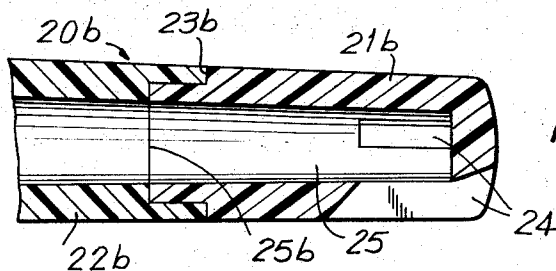
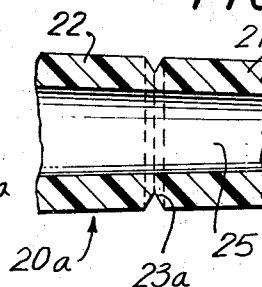


FIG. 5

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MULTI-STAGE EVACUATING DEVICE

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ABSTRACT OF THE DISCLOSURE

A one-piece multi-stage evacuating device having a pair of spaced portions connected by a frangible intermediate portion. In attached condition one end of the device is adapted to be connected to a suction generating device while the other end has a relatively small liquid-admitting inlet opening. When the frangible connection is broken the remaining suction-connected portion develops a relatively large opening for entry of solid particulate matter.

The above abstract of disclosure is set forth for identification purposes only and is not intended in any way to limit the scope of the appended claims.

The present invention relates to multi-stage evacuating devices in general and more particularly to disposable evacuating devices of the kind to be used in laboratories, operating rooms and similar institutions for withdrawing liquid and particulate matter, for example, to withdraw such matter from the mouth of a patient undergoing dental treatment.

It is an object of the present invention to provide a multi-stage device one stage of which is capable of evacuating liquid and the other stage of which is capable of evacuating particulate matter.

Another object of the present invention is to provide an expendable evacuating device.

A further object of the present invention is to provide a device of the above type which is expendable in a number of stages.

A concomitant object of the invention is the provision of a device having the above characteristics which is capable of being placed in the mouth of a patient undergoing dental treatment which cannot damage the tissue of the mouth, which is non-toxic, and which will not irritate the patient.

Still another object of the invention is to provide a device having the above characteristics which can be cheaply and easily manufactured using readily available materials, and which may, if desired, be thrown away after being used once, thus obviating entirely the necessity for sterilizing.

It is a still further object of the present invention to provide a device of the above characteristics which is not likely to become clogged.

A still further object of the present invention is to provide a device of the above type which can be easily and quickly connected with conventional suction generating apparatus.

A further object of the present invention is to provide a device of the above type which can be broken up without resorting to tools.

A further object of the invention is to provide a device which is so constructed that it can be broken into sections by exertion of a small force.

It is still another object of the present invention to provide a saliva evacuating or extracting device having the aforesaid characteristics which is so constructed that it can operate effectively in two stages without either stage injuring the tissues of the mouth.

A still further object of the present invention is to provide a device having the above characteristics which is

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useful not only in dentistry but for other applications as well.

With the above object in view, one feature of the present invention resides in the provision of a multi-stage evacuating device which is particularly suitable for withdrawing liquid and particulate matter from the mouth of a dental patient. In its preferred form, the device comprises an elongated, substantially tubular, evacuating member including a first end portion arranged to be connected to a suction generating apparatus, and a cup-shaped second end portion spaced from the first end portion by an intermediate portion which readily detachably connects the two end portions with each other. The second end portion is provided with at least one relatively small inlet in the form of a slot or the like for drawing liquid matter when the end portions are connected to each other, while the first end portion develops a relatively large inlet for admitting solid particulate matter when the second end portion is detached therefrom.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The exact construction and configuration of the improved evacuating device, however, together with additional features and advantages thereof, will be best understood from the following detailed description of some specific embodiments with reference to the accompanying drawings, in which:

FIG. 1 is a side elevational view of a two-stage evacuating device which embodies the present invention, with the evacuating device mounted on a suction tube;

FIG. 2 is an enlarged axial sectional view taken along the line 2—2 of FIG. 1 and showing both stages connected and in position on the end of a suction tube which latter is shown in part only;

FIG. 3 is an enlarged axial sectional view of one stage of the evacuating device shown in FIG. 1, after the other stage has been detached therefrom;

FIG. 4 is an enlarged axial sectional view of the weakened wall portion of a modified evacuating device;

FIG. 5 is an enlarged axial sectional view of a portion of a modified evacuating device; and

FIG. 6 is a front elevational view of the evacuating device illustrated in FIG. 2.

Referring now in greater detail to the illustrated embodiments, and first to FIG. 1, there is shown the intake tube 10 and connecting hose 13 of a suction generating device of known design. Tube 10 may be curved as at 12 into hook form for its intended application over the lower tooth ridge of a dental patient's mouth. Applied over the end portion of tube 10, and covering the same substantially to the curved portion 12 thereof is the evacuating device 20 of the present invention. In its preferred form the evacuating device comprises a one-piece elongated hollow tubular body having a cup-shaped intake portion 21, and a tubular outlet portion 22. The intake portion 21 is provided with openings 24 (see FIG. 6) through which saliva or other liquids may be drawn into the tubular body. Between the intake portion 21 and the outlet portion 22 is located a weakened annular wall portion 23 which permits the portion 21 to be readily detached from portion 22, when desired. The device is preferably constructed of elastomeric material such as, for example, rubber or synthetic plastic. A preferred synthetic plastic material is polyethylene having a high wax content and a durometer of 16–20. It has been found that such plastic material may be readily molded to the desired shape, may be cheaply mass produced, is non-toxic and may be formed with a surface which is both smooth and sufficiently soft to be comfortably received in the mouth of a patient. These characteristics prevent injury

to the tissues of the mouth even after one portion has been detached and the tissue is exposed to a previously covered part of the remaining portion.

As illustrated in FIG. 2, the evacuating device 20 may be formed with a tapering axial bore 25. The taper of the internal surface 26 surrounding the bore 25 facilitates the application of the device onto the suction tube 10. The taper further permits the device to be used with suction tubes of varying diameter, since a slightly different suction tube diameter will merely cause the engagement with the device 20 to occur at a different location along the length thereof. The hollow members, i.e., the portions 21 and 22 of the evacuating device 20, are readily detachably connected to each other in a plane A, i.e., in a plane in which the portions are separable from one another.

It is an important feature of the present invention that the evacuating device 20 is formed of two or more portions which are readily detachably connected. As seen in FIG. 2, the device 20 may be formed with a weakened annular wall portion such as results from the internal annular groove 23, located in the plane A. It is obvious, however, that portions 21 and 22 may be connected in another manner for readily detachably yet preferably sealingly connecting such portions. For example, and as illustrated in FIG. 4, the tubular body of a modified evacuating device 20a may be provided with a circumferential groove 23a intermediate the portions 21 and 22. Alternatively, the portions 21 and 22 may be connected by means of an annular wall portion of frangible material (not shown), or, the entire portion 21 may be formed of frangible material so that it may be entirely shattered and in that manner detached from portion 22. It is important only that a relatively large opening such as inlet opening 25a be developed in portion 22 when it is desired to withdraw particulate matter.

In the modified embodiment of my device, illustrated in FIG. 5, the tubular body of the evacuating device 20b is formed of two separate portions 21b and 22b which may be connected frictionally or in any similar manner such as, e.g., by bonding, by means of a threaded connection, which will permit the portions to be readily detached from one another, as at shoulder 23b, to expose, at the uncovered end of portion 22b, the relatively large inlet opening 25b.

In its preferred embodiment, however, the evacuating device is molded in one piece, as illustrated in FIG. 2. A particular advantage is derived when the device 20 is molded with a grooved portion such as groove 23 or 23a. As a result of molding, a stress concentration is attained in the grooved wall portion as a result of which the force required to be applied to the weakened wall portion to detach the portions 21 and 22 from each other is actually reduced, not merely proportionally with the decrease in remaining wall thickness, but as a multiple of such decrease.

Another important features of the present invention resides in such details of construction of the device 20, 20a or 20b which permit the saliva to be evacuated while preventing the mouth tissues to be drawn into the suction openings 24. Referring to FIGS. 2 and 6, it is to be noted that the evacuating device 20 is formed in its portion 21, with a plurality of circumferentially spaced, elongated axially directed, slot shaped, inlet openings 24 surrounding an end wall 27. The illustrated arrangement insures that not all of the openings 24 will be covered by mouth tissue at any one time thus preventing discomfort to the patient and damage to the tissue. Such narrow, elongated, openings 24 aid even further to resist the tendency of tissue being drawn in as a result of the suction. In the event that in the intended use of the evacuating device there should be any tendency toward tissue being drawn through some of the slots 24, the suction will never become so strong as to cause any discomfort to the patient since, as a result both of the circumferential spacing as well as the elongated shape of the slots 24, at

least part of the opening of at least one of the slots will be at all times positioned sufficiently away from the collected saliva and from the tissues of the mouth, to admit air and to thus control suction which can develop in the bore 25. While slot-shaped openings 24 are preferred, inlet openings having other configurations, as, for example, small circular apertures, may be provided on the portion 21 instead. Alternatively, the entire portion 21 or a part thereof may be formed of liquid permeable material (not shown), in a manner to permit liquid to be drawn into the evacuating device 20 while still at all times providing at least some access for air so as to reduce suction and thus prevent tissue injury.

As illustrated in FIGS. 2 and 6, the device 20 is preferably provided with three equally spaced inlet slots 24 positioned circumferentially about the end wall 27 and extending axially through the tapering tubular wall and into the interior of portion 21 so as to communicate with bore 25.

The device constructed in accordance with my invention may be cheaply mass-produced, pre-sterilized, packaged in sterilized condition so as to be readily available when desired, and thrown away after one use. It is an important feature of the present invention, therefore, that the device 20 is disposable, and preferably disposable in two stages, thus obviating the need for sterilization not only of the saliva extraction stage, i.e., portion 21 but also of the particle extraction stage, i.e., the portion 22. In operation the device 20 shown in FIGS. 1-3 and 6 may be manipulated as follows:

With the portion 22 applied to the end of a suitable suction tube 10, the tubular body of device 20 is positioned in the mouth so as to extend inwardly along the floor of the mouth. Suction created in tube 10 by its connection to hose 13, will be transmitted to the inlets 24 in tubular member 20. This will draw saliva from the mouth through the inlets 24 and into the bore 25 of the device 20. While the inlets 24 admit saliva they are, for the reason stated above, too small to admit the larger particulate matter which settles in the mouth as a result of drilling, chipping, and other operations performed on the teeth. It will be seen that I provide a saliva evacuator which is not only disposable, so that the need for sterilization is obviated, but is disposable in two stages.

Thus, after the saliva evacuating operation is completed, and if it is desired to evacuate the larger particulate matter then remaining in the mouth of the patient, the portion 21 may be readily detached by merely squeezing the end portion 21, near the weakened annular portion 23, between the thumb and the forefinger or by twisting or bending the portion 21 relative to the portion 22 so as to fracture the tubular body of device 20 in the plane A, as seen in FIG. 2. The detached portion 21 may then be thrown away leaving exposed the relatively large opening 25a of the portion 22, as seen in FIG. 3, while portion 22 remains connected with the end of suction tube 10. The opening 25a may then be moved along the interior of the mouth to evacuate therefrom all larger particulate matter which could not pass through the relatively narrow slots 24. After completion of the operation of evacuating the larger particulate matter the portion 22 may be detached from the tube 10 and also discarded. No portion of the tube 10 need, therefore, come in contact with the patient's mouth so that there is no need to sterilize any part of the saliva evacuation equipment.

The wall surrounding opening 25a, as seen in FIG. 3, being of deformable material will not cause injury to the tissue when said wall is passed over the interior of the mouth after portion 21 has been detached. In addition, such deformable characteristics assure a tight seal with the tube 10 to prevent entry of false air.

It will be readily apparent that an evacuating device constructed in accordance with the present invention may be advantageously used not only in the practice of dentistry but wherever it is desired to evacuate a liquid in

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one stage, and particulate matter in another stage, particularly where, as for example in the course of certain other medical or laboratory procedures, a sterilized evacuating device is required. The pre-sterilized sectionally disposable device of the present invention also permits the user to detach the end portion 21 merely by grasping that end portion and squeezing and/or twisting the same until the end portions 21 and 22 separate from each other, all without touching and, thus, without contaminating, the remaining end portion 22 which may then safely be used to evacuate particulate matter. It will also be readily apparent that the device may comprise more than two stages, each such stage developing a larger inlet opening than the prior one when the prior one is detached therefrom and discarded. It will further be readily seen that the evacuating device 20b of FIG. 5 need not necessarily be expendable since the portions 21b, 22b can be reattached to each other as often as desired.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A one piece two-stage evacuating device, particularly a disposable device for withdrawing liquid and solid matter from the mouth of a dental patient, comprising an elongated substantially tubular member consisting of a single piece of deformable synthetic plastic material including a tubular section having a first end portion arranged to be connected to a suction generating device and a second end portion; a hollow section having a first end portion adjacent to the second end portion of said tubular section and a substantially cup-shaped second end portion; and a frangible connection portion, comprising an annular portion having at least one circumferential groove intermediate said sections, for integrally but readily detachably connecting said sections with each other so that, on detachment of said second section, the second end portion of said tubular section develops a relatively large opening for entry of solid particulate matter, said hollow section having at least one relatively small inlet for drawing liquid matter into said tubular section when said sections are connected with each other.

2. A one-piece evacuating device, particularly a disposable device for withdrawing liquid and solid matter from the mouth of a dental patient, comprising an elongated substantially tubular member consisting of a single piece of deformable synthetic plastic material including a tubular section having a first end portion arranged to be connected to a suction generating device and a second end portion; a hollow section having a first end portion adjacent to the second end portion of said tubular section and a substantially cup-shaped second end portion; and a frangible connecting portion comprising a weakened annular wall located intermediate said sections for integrally but readily detachably connecting said sections with each other so that, on detachment of said second section, the second end portion of said tubular section develops a

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relatively large opening for entry of solid particulate matter, said hollow section having at least one relatively small inlet for drawing liquid matter into said tubular section when said sections are connected with each other.

3. As an novel article of manufacture, an elongated substantially cylindrical evacuating member for solid and liquid matter, including a tubular end portion, a cup-shaped end portion spaced from said tubular end portion and being provided with a substantially transverse end wall and a plurality of annularly arranged inlet openings, and an intermediate tubular portion comprising a circumferential groove for integrally but readily detachably connecting said end portions with each other, said elongated member tapering in the direction of said end wall.

4. A novel article of manufacture as set forth in claim 3, wherein said inlet openings include channels extending substantially axially from the periphery of said end wall along the outer surface of said cup-shaped end portion and into the interior of said tubular member.

5. A two-stage evacuating device, particularly a disposable device for withdrawing liquid and solid matter from the mouth of a dental patient, comprising an elongated tubular member consisting of deformable synthetic plastic material and including a first elongated section having an outlet portion and an inlet portion spaced from said outlet portion, said outlet portion being adapted to be connected to a suction generating device; a second section having a liquid-admitting inlet portion and an outlet portion spaced from said last named inlet portion; and a frangible connecting portion intermediate said sections integrally but readily detachably connecting said outlet portion of said second section with said first named inlet portion so that on detachment of said second section said first named inlet portion develops a large opening for admission of solid particulate matter, the walls of said first named inlet portion which define said opening being deformable so as not to injure mouth tissue in contact therewith, the inlet portion of said second section comprising a substantially cup-shaped body provided with a plurality of apertures angularly spaced from each other for admission of liquid into said tubular member when said sections are connected with each other the spacing between said aperture being such that at least one of said apertures will remain out of contact with the tissue in the interior of the mouth when suction through the others of said apertures is prevented by closure thereof with mouth tissue, whereby injury to such tissue will be prevented.

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