

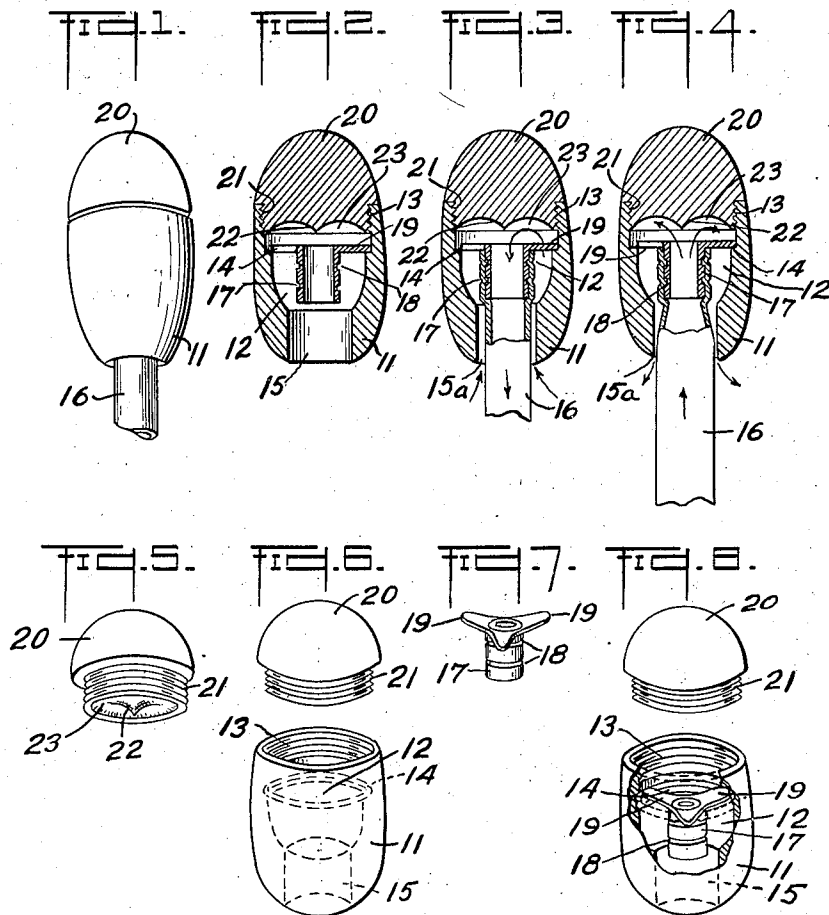
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NOZZLE FOR DUODENAL PUMP TUBES

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NOZZLE FOR DUODENAL PUMP TUBES

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The present invention relates to improvements in the nozzles of apparatus for the pump treatment of sinuous organic channels and, more particularly, in nozzles or tips for duodenal pump tubes.

In my U. S. Patent 2,356,659, issued on August 22, 1944, I have described a tip for a duodenal pump tube which is so constructed that liquid pumped through the tube emerges from rearwardly directed openings provided in the tip in order to propel the tip and the attached tube in a forward direction through the duodenal channel.

I have found that in a device of the type set forth in my prior patent the most satisfactory propelling effect is obtained if the cross-section of the rearwardly directed outflow openings provided in the tip is kept comparatively small so that the liquid is caused to emerge from the tip in the form of thin jets of great velocity. When the tip has reached the desired position in the duodenal channel, it is possible to inject through such small openings a sufficient quantity of liquid by forcing the liquid under suitable pressure through the tube and tip. However, difficulties have been encountered if it is desired to use a tube having a tip with small openings for the removal of liquid from the duodenal or any other organic cavity by suction, because, in this case, strong suction forces act on very limited areas instead of a desirable more uniform suction force acting on a larger area.

One object of the present invention is to overcome this disadvantage and to provide an apparatus for the pump treatment of sinuous organic channels which can be used with equal efficiency for the propulsion of the tip and tube through the organic channel and the injection of liquids through the tip into the organic channel and also for the removal of liquids from the channel by suction.

Another object of the invention is to provide a duodenal pump tube including a tip with a rearwardly directed outflow opening of variable cross-section.

A further object of the invention is to provide an apparatus for the pump treatment of sinuous organic channels including a tube and a tip with a rearwardly directed flow passage in which the cross-section of the flow passage is automatically reduced when liquid is pumped through the tube and tip and hence out through the passage, whereas the cross-sectional area of the flow passage is automatically restored to its normal larger size when liquid is sucked through the tip into the tube.

A still further object of the invention is to provide a tip of the type set forth which can be easily manufactured, assembled, taken apart, cleaned and reassembled and to which the tube can be attached in a simple manner.

According to the invention, I accomplish these objects by the arrangement and combination of parts set forth in the following detailed description, defined in the appended claims and illustratively exemplified in the accompanying drawing in which:

Fig. 1 is a side elevation of a tip according to the present invention with the attached end of the tube.

Fig. 2 is an axial section through the tip without the tube.

Figs. 3 and 4 are sections similar to that of Fig. 2, but with the tube attached to the tip and showing two different operative positions, respectively.

Fig. 5 is a perspective view of the cover portion of the tip.

Fig. 6 is an exploded perspective view of the tip without the tube holder.

Fig. 7 is a separate perspective view of the tube holder and

Fig. 8 is an exploded perspective view of the tip with the wall of the lower tip portion partly broken away to show the inserted tube holder.

The tip according to the present invention comprises a cup shaped rear portion 11 having a comparatively large cavity 12 provided with an internal screw thread 13 adjacent its upper edge and with an annular shoulder 14 a short distance below the screw thread 13. An axial bore 15 having a diameter exceeding the normal outer diameter of the elastic tube 16 in its not distended condition permits passing of the end of the tube 16 from the outside into the cavity 12. The difference between the diameter of the bore 15 and the normal diameter of the tube 16 is such that the concentric flow passage 15a formed between the bore 15 and the tube 16 in its distended condition has a cross-sectional area smaller than the inner cross-sectional area of the tube 16. The end of the tube 16 is fixed in the cavity 12 by means of a tube holder (see Fig. 7) which consists of a short tubular element 17 of an outer diameter approximately equal to that of the tube 16 in its normal not distended condition said tubular element 17 being provided with annular grooves 18. At its upper edge, the tubular element 17 is formed with three flat uniformly spaced radial projections 19 which seat on the shoulder 14 when the tube holder is inserted into the cavity 12.

When the tip is assembled with the tube, the tube 16 is passed through the bore 15 until its end emerges from the cavity 12 to a sufficient extent to permit free manipulation thereof, and this end is then pushed, outside of the cavity 12, onto the tubular element 17 on which it is retained by friction augmented by the grooves 18. If necessary, additional precautions may be taken to secure the attachment of the tube to the tube holder. Then, the tube 16 is pulled back through the bore 15 until the projections 19 of the tubular element 17 are seated on the annular flange 14 of the cavity 12.

The cavity 12 is closed by means of the cover 20 which is shaped to form with the rear portion 11 a smooth bulb-shaped unit having a rounded front end. Along its peripheral edge, the cover 20 is recessed and provided with an external screw-thread 21 which screws into the internal screw-thread 13 of the cup shaped portion 11. The inner face of the cover 20 is formed with a rearwardly pointing deflector surface, which, when the cover has been screwed home, has its apex 22 disposed in alignment with the axis of the tip near the inner end of the inlet passage formed by the tube 16 and tubular element 17, said deflector surface including concave walls 23 to guide the liquid emerging from the tube smoothly toward the annular passage 15a.

The device operates as follows: When liquid is pumped through the tube 16 into the tip cavity 12, the pump pressure, aided by the smaller flow cross-section of the passage 15a as compared to that of the tube 16, acts on the wall portion of the elastic tube 16 disposed in the bore 15 to distend this wall portion, as shown in Fig. 4, thereby decreasing the size of the flow passage 15a and causing the liquid to emerge from the tip in the form of a thin walled cylindrical jet of considerable velocity which exerts a comparatively large propelling force on the tip.

When the pump action is discontinued and, for instance, a suction force is applied to the tube 16, the wall portion of the latter in the bore 15 returns to its original size (see Fig. 3) and the cross-section of the annular passage 15a is accordingly enlarged, thus facilitating the sucking of liquid through the tip into the tube.

It will be noticed that the spaced projections 19 of the tubular element 17 which support the latter in the cavity 12 do not impede the flow of

liquid from the inner end of the tube 16 toward the passage 15a or vice versa to any noticeable extent.

I claim:

1. In an apparatus for the pump treatment of sinuous organic channels, the combination with an elastic tube of a tip comprising a bulb shaped body having a rounded forward end and being provided with an internal cavity of substantial size and, opposite said forward end, with an axial bore through which the end of said tube passes into said cavity, said bore having a diameter exceeding the normal outer diameter of said tube in the not distended condition of the latter so as to leave between said bore and tube an annular flow passage, and means for holding the inner end of said tube in said cavity so as to permit the free flow of liquid between the inner end of the tube and said annular flow passage, whereby the full cross-section of said flow passage is available for liquid sucked therethrough into said cavity and hence into the tube while the cross-sectional area of said annular flow passage is reduced due to the distention of the wall portion of said tube located in said bore when liquid is pumped through the tube into said cavity and out through said flow passage.

2. An apparatus, as claimed in claim 1, in which the front wall of said cavity opposite said bore is provided with a rearwardly pointing deflector surface having its apex in alignment with the axis of the tip and including concave walls to guide liquid emerging from the tube into said cavity smoothly towards said annular flow passage, said tube and tube holding means cooperating to form an axial inlet passage leading into said cavity to a point near the apex of said deflector surface.

3. An apparatus, as claimed in claim 1, in which said tip includes a rear portion provided with a cup-shaped cavity having at a distance from its rim an inwardly projecting annular shoulder and a removable cover shaped to form with said rear portion a smooth bulb-shaped unit, and said tube holding means includes a short tubular element axially arranged in said cavity and having the inner end of said elastic tube mounted thereon, said tubular element being provided at its front end with spaced radial projections to seat on said annular shoulder.

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