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ANIMATED INTESTINAL TUBE

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The present invention relates to a novel method and apparatus for self-cleansing and propelling an intestinal suction tube through the gastrointestinal tract; more specifically for the purpose of advancing through the gastrointestinal tract by animated heads employing such devices as jet stream, impulse-momentum, and balloon crawl with friction hold; and employing self-cleansing principles such as alternating hydraulic pressure, suction flushing, and knife shearing of obstructing orifice particles.

The primary object of the tube is the elimination of manual attendance and increased facility for movement through the gastrointestinal tract. The ordinarily employed tube is inert and as it is employed for suction of intestinal contents usually due to bowel obstruction, intestinal peristalsis is usually weak or absent and propulsion of the tube is difficult; however, the present invention employs various animated heads capable of self-propulsion. Existing intestinal tubes frequently become clogged necessitating frequent syringing, which method is primitive and quite often ineffective. The present invention by utilizing sudden and powerful thrusts of the hydraulic column, controlled by a series of automatic valve actions which will be further related, will dislodge the most stubborn obstructing particles, and further, the knife shearing head will remove the obstructing particles by subdivision rather than flushing; both principles being employed in actual operation.

The fundamental mechanism is a single lumen tube traveling from the patient to a three-way valve, which is automatically time controlled permitting a period of suction and a briefer period of hydraulic thrust and the head of the tube which acts within the intestinal tract of the patient withdrawing contents and specifically propelling and cleansing itself by the above enumerated principles. Three fundamental heads are employed, each of which derives its energy from the alternate pressure and suction of a hydraulic column and two of which are cleansed by the automatic flushing principle and shearing knife principle and each of which is propelled by the same energy principle of alternating pressure suction; but each differs in the mode of its propulsion mechanism.

FIGURE I gives a cross-section view of the animated tube showing the solenoid pump having just forced fluid through the three-way solenoid actuated valve; and the port leading to the suction pump being closed. FIGURES II, III, and IV illustrate different designs of head that cause the tube to advance when alternate pressure and suction is applied.

Head A, FIGURE II, by direct use of the impulse-momentum principle, causes a jet reaction resulting in a forward thrust of the head.

Head B, FIGURE III, is a bellows shaped balloon which is alternately expanded and contracted by the medium of hydraulic pressure, causing the entire tube to crawl forward. When the balloon is compressed, the suction valve is open, thus permitting the removal of intestinal fluid by suction. On the return stroke, the suction valve closes and fluid is forced into the bellows balloon causing it to extend and draw the entire tube forward. The reciprocating metal valve insert in its forward motion acts as a shearing knife subdividing any particles which may be obstructing the suction orifices. On the return stroke, the bellows balloon head is slowly deflated so that

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frictional forces between the bellows and the body conduit will hold the head in position while the tube advances. A holding action is also further obtained by the lateral suction being applied at the head orifices.

Head C, FIGURE IV, has an outer housing that reciprocates with alternate forward and backward strokes of the piston in the hydraulic cylinder. The forward stroke of the piston places the column of fluid under pressure and forces the fluid through the orifices against the housing, causing the housing to move forward to a ball stop. The fluid under pressure, will clean the orifices in the head with flushing action and the reciprocating metal housing acts as a shearing knife subdividing any particles which may be obstructing the suction orifices.

Referring more particularly to the drawings, in FIGURE I 1 designates an electric motor which drives a pump 2 that has a discharge spout 3. A flexible hose 4 leads from the pump to a three-way solenoid actuated valve 11. When the solenoid 9 of this valve is not engaged, the plunger is forced back into normal position by compression spring 10. Fluid is introduced into the system from storage tank 5 by passing through orifice 6 which contains a check valve permitting flow of fluid only toward the solenoid actuated pump 7. The solenoid 8 drives the plunger of pump 7 forcing fluid through the three-way valve 11 and into the exhaust tubing 12. The timing of the forward stroke of the solenoid pump 7 is integrated with the forward stroke of the plunger on the three-way valve 11. Thus during the forward stroke of the solenoid pump, fluid cannot be pumped out the orifice leading to flexible tubing 4 that connects the motor driven pump, but will be forced through flexible tubing 12 to the actuating head.

FIGURE II illustrates actuating head A, where by direct use of the impulse-momentum principle, a jet reaction results in a forward thrust of the head. The forward stroke of the piston causes a flow of fluid through orifices 19 and 20 in hollow intestinal tube 18 and the return stroke of the piston induces a suction, causing removal of viscous material lodged in body conduits through the orifices 19 and 20.

FIGURE III illustrates actuating head B, where upon entering hollow intestinal tube 13, the fluid forces concentric sleeve 16 against the forward end of said intestinal tube, thus closing intake orifices 14 and 15. The fluid then enters the contracted bellows balloon 17 and expands it.

FIGURE IV illustrates head C, where upon entering hollow intestinal tube 21, the fluid flows through orifices 26 and 27 and strikes the inside surface of housing 22 causing said housing to move forward against ball stop of hollow intestinal tube 21. Upon the application of suction in hollow intestinal tube 21, housing 22 will be retracted to shoulder of housing 25 allowing removal of viscous material lodged in body conduits through the orifices 23 and 24.

This case is a continuation-in-part of parent application S.N. 798,058, filed March 4, 1959, now abandoned.

What is claimed as new is as follows:

1. A single lumen intestinal tube comprising in combination a flexible tube; a head attached to one end of said flexible tube; said head being comprised of a rigid tube one end of which is attached to said flexible tube; a flexible balloon capable of marked longitudinal expansion fastened to the end of said rigid tube remote from said flexible tube; a sleeve slidably positioned within said rigid tube; orifices positioned on said rigid tube capable of being opened and closed by slide action of said sleeve whereby there is intermittent suction of intestinal contents through said head; and means for regulating the inflation and deflation of said flexible balloon

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in timed relation thus permitting alternate progressive forward movement of said head and suction.

2. A single lumen intestinal tube comprising in combination a flexible tube; a head attached to one end of said flexible tube; said head being comprised of a rigid tube one end of which is fastened to said flexible tube; orifices positioned on said rigid tube; a cylindrical housing rigidly connected to and surrounding a portion of said rigid tube proximal to the end attached to said flexible tube; a cylindrical element surrounding said rigid tube and said cylindrical housing slidably connected to said rigid tube whereby a fluid thrust directed through said rigid tube and through said orifices will force said slidably connected cylindrical element forward; and

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means for regulating alternate suction and fluid thrust within said tube resulting in advancing and retracting said slidably connected element along said rigid tube whereby said slidably connected element will shear and dislodge obstructing particles lodged in said orifices during the suction cycle.

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