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IMPREGNATION DEVICE FOR LOCATING THE SITE OF INTERNAL BLEEDING

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Fig. 1.

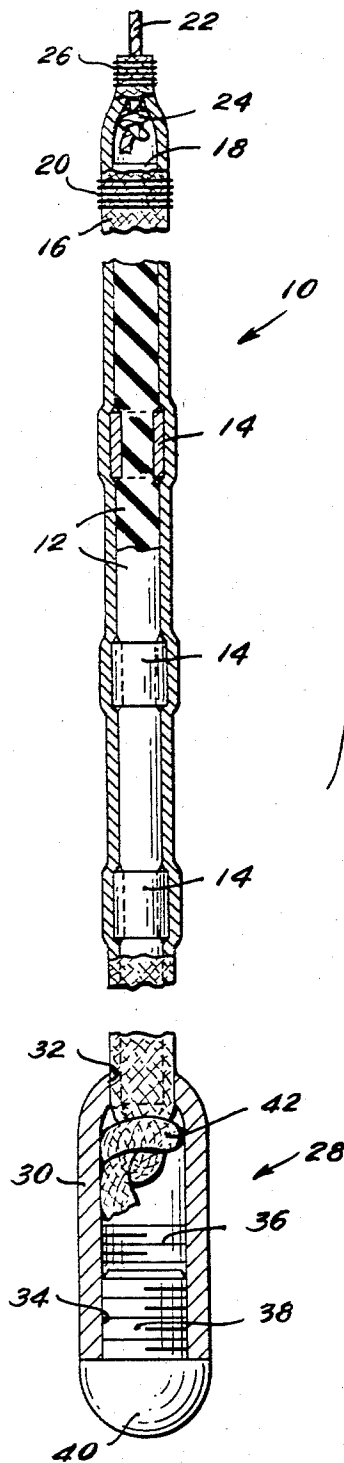
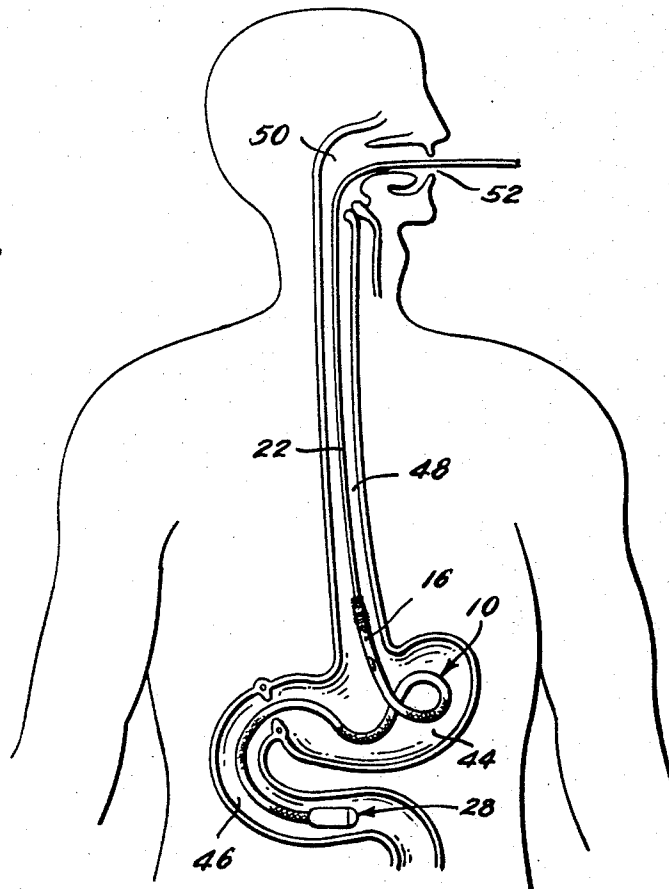


Fig. 2.



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**IMPREGNATION DEVICE FOR LOCATING
THE SITE OF INTERNAL BLEEDING**

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1 Claim

ABSTRACT OF THE DISCLOSURE

An impregnation device for locating the site of internal bleeding having a radiopaque core with more pronounced radiopaque means secured to the core at spaced intervals and with a weight secured to the distal end of the core and a mouthpiece portion located at the proximal end of the core, there further being a soft, absorbent sheath surrounding that portion of the core located between the weight and the mouthpiece portion.

The present invention relates generally to the surgical arts, and is more particularly concerned with the provision of a novel and improved impregnation device for locating the site of internal bleeding, and particularly gastro-intestinal bleeding.

It has heretofore been conventional to locate the site of gastro-intestinal bleeding by utilizing an impregnation string that is swallowed by the patient. More specifically, impregnation strings of this general type traditionally comprise some sort of a radiopaque core having longitudinally spaced radiopaque marking members attached thereto. The core and marking members are covered by an absorbent sheath, preferably of soft woven or knitted fabric or braided tubing, and the distal end of the string is provided with some sort of a suitable weight. The string is then swallowed by the patient, it being understood that the distal weight will facilitate travel of the string through the patient's esophagus, stomach and duodenum, it being further understood that the proximal end of the string is always maintained outside of the patient's mouth. Once the string has settled in the patient's stomach and duodenum, an X-ray is taken, whereupon the radiopaque portions of the string enable the diagnostician to know just how the string is positioned within the patient. The string then remains in the patient for a sufficient period of time, which in many cases may be many hours. The string is then withdrawn from the patient, and the absorbent sheath is inspected for evidence of blood. Once blood has been located on the absorbent sheath, it is an easy matter to correlate the position of the blood on the sheath with a specific site in the patient's gastro-intestinal tract, this being done by referring to the X-ray and then establishing in the X-ray the precise positions where blood appears on the string, this being facilitated by the spaced radiopaque markings which show up in the X-ray.

Certain disadvantages have been found to exist in the prior art impregnation strings used for carrying out the above-described procedure. First of all, when the patient is X-rayed, it is frequently very difficult to detect the radiopaque core in the X-ray, even though the spaced radiopaque markings are usually clearly visible. The problem here is that where the core itself is not clearly visible in the X-ray throughout its entire length, it is frequently very difficult to properly correlate the spaced radiopaque markers, particularly since it often happens that the string is looped and intertwined within the patient's stomach, thus raising the possibility that one marker may be positioned substantially behind another marker so as to be obscured thereby when the X-ray is taken. If, on the other

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hand, the radiopaque core itself were clearly visible in the X-ray, then it would be possible to readily ascertain when one marker is being obscured by another.

Another disadvantage that has existed heretofore in impregnation devices of the type above described is the fact that, although highly flexible, the device has sufficient body so that when in a patient for extended periods of time, irritation and discomfort to the patient's esophagus, throat and mouth frequently result.

A further disadvantage in prior art devices of the instant type resides in the fact that the distal weight is frequently not as effective as is desired, and is often somewhat difficult to assemble to the string.

It is therefore a primary object of our invention to provide an impregnation device of the character described wherein the core of the device is so constructed as to be radiopaque throughout its length in such a way that the entire length of the core will show clearly in an X-ray.

Another object of our invention is the provision of an impregnation device of the character described that is so constructed as to greatly minimize any irritation or discomfort to the esophagus, throat and mouth of the patient.

A further object is the provision of an impregnation device of the character described having a novel and improved distal weight, which is not only highly effective in use, but which also is relatively easy to assemble to the device.

Another object is the provision of an impregnation device of the character described having novel and improved radiopaque means longitudinally spaced on the core of the device.

Still another object is the provision of a novel and improved impregnation device of the character described that is not only highly effective in use, but which is also relatively simple and economically feasible to manufacture.

Other objects, features and advantages of the invention will become apparent as the description thereof proceeds when considered in connection with the accompanying illustrative drawings.

In the drawings which illustrate the best mode presently contemplated for carrying out the instant invention:

FIG. 1 is an elevational view, partly in section, of an impregnation device constructed in accordance with the instant invention; and

FIG. 2 is a diagrammatic view showing the instant device operatively positioned in the gastro-intestinal tract of a patient.

Referring now to the drawings, and more particularly to FIG. 1 thereof, there is shown generally at 10 an impregnation device constructed in accordance with the instant invention. More specifically, the impregnation device 10 comprises an inner core 12 of any suitable highly flexible material, although we have found that it is preferable to use a solid extruded rubber core. It is conceivable, however, that the core could be of other flexible materials, and also that the core could be tubular rather than solid. Whether the core is solid or tubular, it will be noted that its outer diameter is relatively substantial, and in practice it has been found that a core having an outer diameter in the neighborhood of $\frac{3}{32}$ " is actually quite feasible. The core 12 is made radiopaque, preferably by barium impregnation of the core. Suitable techniques exist for barium impregnating a solid extruded rubber core, and this is one of the reasons why a solid extruded rubber core is preferred. In any event, it is important that the core 12 be radiopaque throughout its length, and it has been found that this objective is nicely achieved by barium impregnation thereof.

At longitudinally spaced intervals along the length of

the core 12 there is provided a plurality of radiopaque markers 14. The markers 14 are preferably of any suitable radiopaque metallic material and are in the form of circular collars which encircle and grip the core 12 at the desired spaced intervals. As will be clearly seen in FIG. 1, the collars 14 compress core 12 so that the outer diameter of the collars is only slightly greater than the diameter of core 12 in its relaxed state.

Surrounding the core 12 throughout its length is an absorbent sheath 16, preferably constructed of a braided woven or knitted soft fabric, such as cotton. It will be noted that the sheath 16 snugly encompasses core 12 and the spaced markers 14 located thereon throughout the length of the core 12. Adjacent the proximal end 18 of the core 12, the sheath 16 is tightly secured thereto such as by tightly winding a suitable thread 20 around the sheath to cause it to tightly grip the core. As will be noted, the sheath 20 extends proximally beyond the end 18 of the core 12 and receives a string 22 which is knotted as at 24. The string 22 is securely attached to the sheath 16 by tightly binding suitable threads 26 around the sheath so as to cause the latter to tightly grip the string 22, as will be obvious in FIG. 1. The knot 24 will, of course, prevent string 22 from being withdrawn from the proximal end of sheath 16, thus securing the string 22 to the cored sheath so as to form an axial extension of the latter, the purpose of which will hereinafter be described. It will be understood that the string 22 can be constructed of any suitable material, and even rubber could be used, in which event the rubber core 12 could continue outwardly from the sheath to function as the string.

At the distal end of the device 10 there is provided a weight shown generally at 28. As will be noted, the weight 28 comprises a cylindrical metallic housing 30 having a reduced aperture 32 at its proximal end and being open at its distal end as at 34. Adjacent its distal open end, the housing 30 is internally threaded as at 36 so as to threadably receive the threaded shank 38 of end cap 40. It will be seen that the aperture 32 is of sufficient size to snugly receive therethrough the cored sheath with the distal end of the latter being knotted as at 42 so as to prevent the cored sheath from being withdrawn through the aperture 32.

In assembling the cored sheath to the weight 28, it is simply necessary to thread the former through aperture 32 sufficiently so that it extends through open end 34. The cored sheath is then knotted, after which the housing 30 is slid downwardly along the cored sheath until the knot is engaged, as illustrated in FIG. 1. The open end of the housing 30 is then covered by threadably inserting the end cap 40. It will be seen that the weight 28 is of a smooth elliptical configuration and that the end cap 40 comprises a smooth continuation of the contour of the weight 28, so as to insure that there are no sharp corners or edges such as might cause internal damage to the patient and so as to facilitate swallowing of the weight by the patient.

As illustrated in FIG. 2, the cored sheath 16 is of sufficient length so as to extend through the patient's stomach 44 and duodenum 46 without extending appreciably into the patient's esophagus 48. String 22 in turn is of sufficient length to extend through the patient's esophagus 48, throat 50 and out through the patient's mouth 52.

For reasons hereinafter to be made apparent, the core 12 is preferably white.

In use, the patient swallows the weight 28, which, due to its smooth elongated configuration, is relatively easy to swallow. The weight passes through the patient's esophagus, stomach and duodenum until the sheathed core assumes the general position illustrated in FIG. 2. It will be noted that very little of the sheathed core is in the patient's esophagus, and it will be further noted that the string 22 extends through the patient's esophagus and throat, and the outer end of said string is at all times maintained outside of the patient's mouth. With the device

10 in this position, an X-ray is taken of the patient; and due to the fact that the core 12 is barium impregnated, and due further to the fact that it is of relatively substantial outer diameter, the entire length of the core will show clearly in the X-ray and will be easily traceable thereon, no matter what convolutions or loops the core may have assumed within the patient's stomach. At the same time, the spaced radiopaque markers 14 are clearly visible in the X-ray, due first of all to the fact that the markers 14 are somewhat larger in diameter than the core 12, and also due to the fact that the metallic construction of the markers renders them radiopaque to a greater degree than the barium impregnated rubber.

The device 10 is allowed to remain in the patient for a sufficient length of time, which in many cases involves several hours and sometimes the better part of a day or more. After sufficient time has elapsed, the device 10 is removed by withdrawing it through the patient's mouth; and the absorbent sheath 16 is then inspected for blood stains. The fact that the rubber core 12 is preferably white enables the blood stains to be more dramatically visible, particularly where the sheath 16 is of somewhat loose weave. Expressed differently, if the core 12 were of a conventional rubber red color, the red color might possibly show through a loosely woven sheath 16 and be mistaken for blood stains. In any event, once blood stains have been located on the sheath 16, it is a simple matter to correlate the location of the blood stain with the closest markers and then go to the X-ray; and by determining the location of those same markers in the X-ray, it is then an easy matter to determine the actual situs of the internal bleeding in the patient.

The fact that when in use the portion of the device 10 that is in the patient's esophagus and throat is the relatively thin and soft string 22 results in minimal irritation and discomfort to the patient. Expressed differently, it has been found that where an impregnation device is of substantial body, as is the cored sheath portion of the instant invention, for example, and where such a relatively substantial device extends through the patient's esophagus and throat, in many cases extreme irritation and discomfort result. The instant invention has neatly overcome this problem by providing the string 22 at the proximal end of the cored sheath, whereupon the relatively bulky cored sheath is never in the patient's esophagus and throat for any extended period of time. At the same time, the cored sheath is positioned in the areas where internal bleeding is likely to be located.

The weight 28, although of simple construction, has proven to be highly effective, both from the standpoint of being relatively easy to swallow and of performing its desired weight function, but also due to its ease of assembly to the cored sheath, as aforesaid. Likewise, the barium impregnated rubber core 12 has been found in practice to represent a decided advance and improvement over prior art radiopaque cores due to the fact that the instant core is so much more easily visible and traceable in an X-ray picture than are the radiopaque cores of prior art devices presently in use.

While there is shown and described herein certain specific structure embodying the invention, it will be manifest to those skilled in the art that various modifications and rearrangements of the parts may be made without departing from the spirit and scope of the underlying invention concept and that the same is not limited to the particular forms herein shown and described except insofar as indicated by the scope of the appended claim.

What is claimed is:

1. An impregnation device consisting of an elongated rubber core impregnated with a material making the core radiopaque throughout its length, a plurality of longitudinally spaced metallic collars surrounding said core in clamping relation thereto, said collars compressing said core at the locations on the latter where said collars are secured, said collars being of sufficiently thin metal stock

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so that the outer diameter of the collars, when attached to the core, is only slightly greater than the outer diameter of the relaxed core, a soft absorbent sheath snugly encircling said core and collar assembly, said sheath being knotted just beyond the distal end of said core, a weight at the distal end of said core, said weight comprising a metallic housing having an aperture through which said sheathed core extends, said knot being located within said housing and preventing removal of the weight from the sheathed core, and a flexible mouthpiece portion of lesser diameter than said sheathed core extending axially from the proximal end of said sheathed core, said mouthpiece portion being of a length as to extend through the mouth and esophagus of a patient, and said sheathed core being of a length as to extend through the patient's stomach and duodenum.

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