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STRING FOR MARKING INTERNAL BLEEDING AND METHOD OF MAKING SAME

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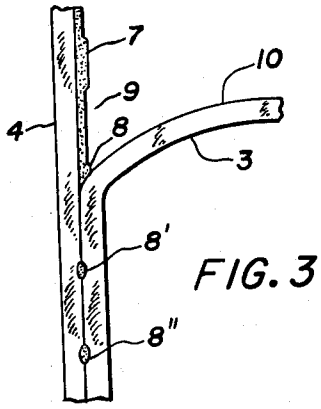


FIG. 3

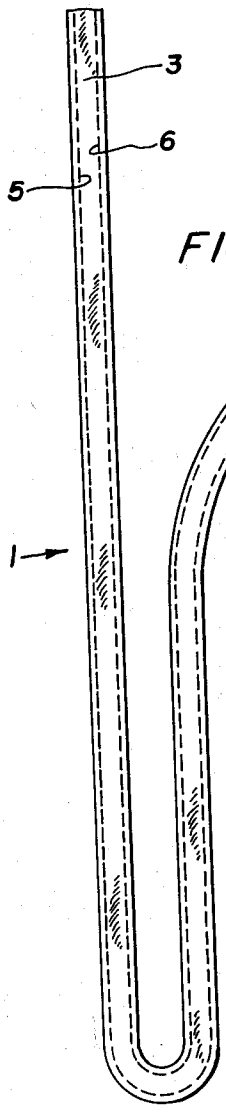


FIG. 1

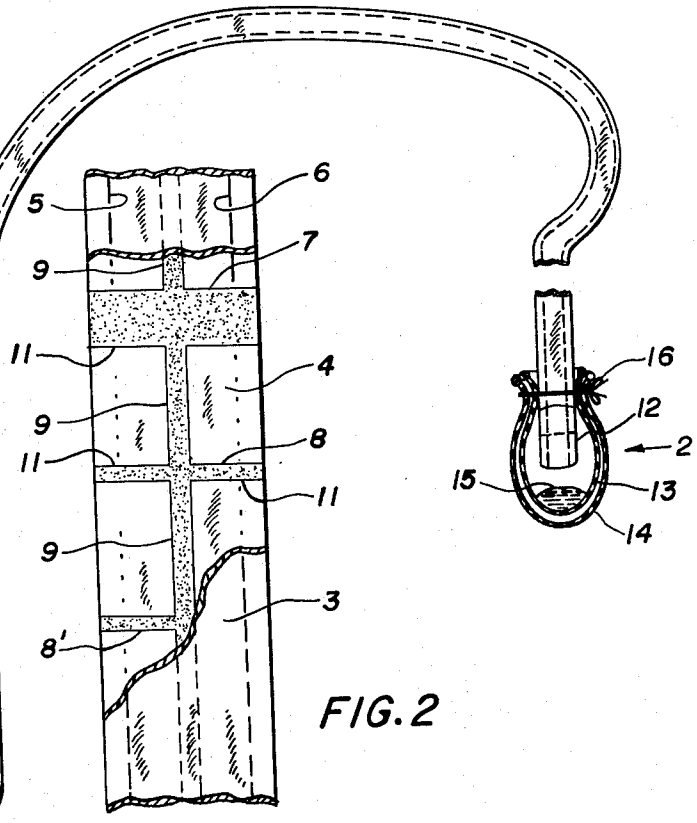


FIG. 2

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STRING FOR MARKING INTERNAL BLEEDING AND METHOD OF MAKING SAME

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This invention relates to a weighted string or tape which is swallowed and is employed for indicating the location of bleeding in the gastro-intestinal tract. More specifically, it relates to a tape carrying radio-opaque markers and, designed to absorb fluorescein-injected blood at the bleeding source.

Patients, such as those reporting in hospitals because of passage of blood through the gastro-intestinal tract, are often difficult to diagnose as to the actual situs of bleeding. Conventional methods also take considerable time, particularly when it is desired to locate active bleeding. Despite the use of barium studies and endoscopy, it is frequently impossible to locate a bleeding site in many patients with upper gastro-intestinal tract hemorrhage. In some, two or more suspicious sites are demonstrated on the routine gastro-intestinal tract X-ray studies. Patients with cirrhosis of the liver who have upper gastro-intestinal tract hemorrhage often present a difficult problem in diagnosis. The bleeding may be due to esophageal varices or another source distal to the esophagus, that is, peptic disease or alcoholic gastritis. Most methods hereinbefore used to locate bleeding in such cases either are dangerous or difficult for the average physician to perform (endoscopy) or give only indirect information (measurement of Bromosulphalein retention or blood ammonia concentration). The practice of passing the Blakemore esophageal balloon in the patients entails definite risks especially when varices have not been proved and the existence of portal hypertension is in doubt.

In recent years, there has been developed the so-called Einhorn string test which was improved upon by the Traphagen fluorescein string test. In the latter, there was involved the difficulty of reading the tape distance and, also, since the radio-opaque markers were attached to one side of the single tape, there was danger of rubbing off or loosening of the markers which were applied thereon.

The present invention avoids the difficulties experienced with previous testing strings and eliminates the disadvantages and limitations in use. According to the present invention, the fabric tape, which is non-fluorescing under ultra-violet light, is provided on both sides of the radio-opaque markers, thereby offering better blood absorption at the bleeding site and eliminating the possibility of marker removal by encasing the markers completely within the tape. Also, secondary markers are provided, in addition to the primary markers, so as to enable a safe and rapid location of the bleeding site in cases of upper gastro-intestinal hemorrhage. Other novel features will become apparent from the discussion which is to follow.

The invention will be more readily understood by reference to the accompanying drawing in which a preferred embodiment is described, and in which FIGURE 1 illustrates a front view of a tape or string made in accordance with the present invention, a portion of which is cut away, and a portion of which is shown in cross-section. FIGURE 2 is enlarged front view of a portion of the string of FIGURE 1, with the front half of the string cut away to show the radio-opaque markers. FIGURE 3 depicts an enlarged side view of a portion of the string of FIGURE 1, one tape of the string being torn away from the other to expose the radio-opaque markers. Similar numerals refer to similar parts in the various figures.

Referring again to the drawing, numeral **1** indicates

generally the tape portion of the string, while numeral **2** designates the weight portion generally. String **1** consists of two 5-ft. lengths **3** and **4** of cotton tape, such as umbilical tape, one-fourth inch wide and sewn together lengthwise at the sides at **5** and **6**.

Marker strips **7**, **8**, **8′**, **8″** and **9** are thin strips of thermoplastic monofilament, such as polyvinyl chloride, polyethylene, polystyrene, or the like, loaded with barium sulfate filler which appears opaque in X-ray photographs. These marker strips are preferably colored black to enable seeing the strips through the tape and to facilitate assembly.

Centrally-disposed narrow vertical marker strip **9** is continuous monofilament of about 0.01″ diameter, heat-sealed for the entire length of the tape and is employed to enable following the location of the tape in the X-ray photographs of the gastro-intestinal tract. The horizontal strips **8**, **8′** and **8″** are disposed two inches apart for the length of the tape, and they are used to enable measurement of the distance within the gastro-intestinal tract whereat bleeding occurs.

The horizontal marker strips are preferably of monofilaments of about 0.01″ diameter, heat-sealed or glued at 2-inch intervals onto one length of tape **4** of string **1**. Every sixth horizontal strip **7** is wider than the other horizontal strips **8**, **8′**, **8″**, to designate foot lengths, so that, whereas the narrow horizontal two-inch markers **8**, **8′**, **8″** are of a single monofilament strip, the foot markers **7** consist of four filament strips laid side-by-side, thus making every foot of length easily distinguishable from the 2-inch length markers.

After the marker strips have been heat-sealed onto one tape **4**, as in FIGURE 3, the second tape **3** is coated on one side **10** with a water-soluble glue, such as an aqueous solution of polyvinyl alcohol marketed commercially as "Elmer's Glue," and the tape **3** is stuck onto the marker strips and over tape **4** to hold the assembly together during the sewing operation.

Thereafter, the sides of string **1** are sewn at **5** and **6**. Since horizontal marker strips **7**, **8**, **8′**, and **8″** extend the entire width of the tapes **3** and **4**, the sewing operation also sews these marker strips at points **11** so that they are firmly anchored onto the tape and would be practically impossible to dislodge in use. The water-soluble glue is readily removed by water during the sterilizing operation.

The bottom end **12** of the string is doubled over and sewn to form a knob onto which may be attached weight **2**. This preferably consists of two milliliters of mercury **15** encased in rubber finger cots **13** and **14** (for safety precaution), both cots being tied over knob **12** by means of surgical silk **16**.

Prior to use, the string is soaked in ice water for a few minutes. Then the patient, who had not taken any thing by mouth for 2 hours before, is instructed to swallow the mercury weight portion **2** with string attached, with the aid of sips of water. Once the bag is in the stomach, the patient is instructed to continue to swallow segments of the string. Usually, the bag and attached tape **1** progress to the region of the ligament of Trietz within 2 to 3 hours. A roentgenogram of the upper abdomen then is taken and it clearly outlines the characteristic "C loop" of the duodenum. While the patient is lying on the X-ray table, 20 ml. fluorescein is injected into an antecubital vein. The dye is allowed to circulate for 4 minutes before the string is removed from the patient's mouth. Gloves are worn prior to withdrawal of the string in order to reduce the danger of dye-contaminated fingers touching it. After the string is removed, it is examined for fluorescence under ultraviolet light. If the patient had been bleeding actively at the time of the test, both blood and dye will be readily found on the

tape. The dye is visible as a yellow spot of fluorescence on the tape when examined under ultraviolet light.

The monofilament marker nearest the dye on the tape is noted by counting back the number of inches from the mercury bag **14**. The comparable marker is found on the roentgenogram by counting back the same number of inches from the bag, the wider foot markers **7** being of considerable aid at this point. Use of the string of the present invention enables location of the bleeding site within an error of not more than one or two inches.

Use of the string of the present invention not only permits location of the bleeding site, but also indicates whether or not there is active bleeding in the area traversed by the string at the time of the test. Also, any gross abnormality of the upper gastro-intestinal tract that may be present is likely to become apparent when the roentgenogram of the abdomen (taken routinely as a part of the procedure) is examined. The use of cotton tape on both sides of the marker strips provides adequate absorbent material for absorption of any blood present and eliminates the possibiliy of rubbing off or away any of the marker strips.

We claim:

1. In a blood-absorbent tape string taken orally for locating bleeding in the gastro-intestinal tract, as described, and provided with vertical and horizontal radio-opaque marking strips adhered thereon, the improvement comprising a length of first tape onto which said marking strips are attached, said marking strips comprising primary horizontal equally-spaced length-marking strips of one width and secondary horizontal greater length marking strips of greater width applied on one side of said first tape, and a second tape of the same length as the first, superimposed over the marked side of said first tape in attached relation thereto.

2. A method for making a blood-absorbent tape string taken orally for locating bleeding in the gastro-intestinal tract, as described, and provided with vertical and horizontal radio-opaque marking strips adhered thereon, comprising applying to a face of a cotton tape a thin centrally-disposed vertical continuous radio-opaque plastic strip, applying a thin horizontal plastic strip at every two inches of length and a wider horizontal plastic strip at very foot of length, said horizontal plastic strips being extended over the entire width of the tape, coating a face of another tape with a water-soluble glue, superimposing the other tape of the same size as the aforesaid tape over the marking strips of the first tape in gluing relation, and sewing both tapes lengthwise at each edge so as to incorporate the horizontal strips within the sewn portion.

3. A method for making a blood-absorbent tape string taken orally for locating bleeding in the gastro-intestinal tract, as described, and provided with vertical and horizontal radio-opaque marking strips adhered thereon, comprising applying to a face of a cotton tape a thin centrally-disposed vertical continuous radio-opaque plastic strip, applying a thin horizontal plastic strip at every two inches of length and a wider horizontal plastic strip at every foot of length, said horizontal strips being extended over the entire width of the tape, coating said face with a water-soluble glue, superimposing another tape of the same size as the aforesaid tape over the glued face, and sewing both tapes lengthwise at each edge so as to incorporate the horizontal strips within the sewn portion.

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