

Nov. 16, 1965

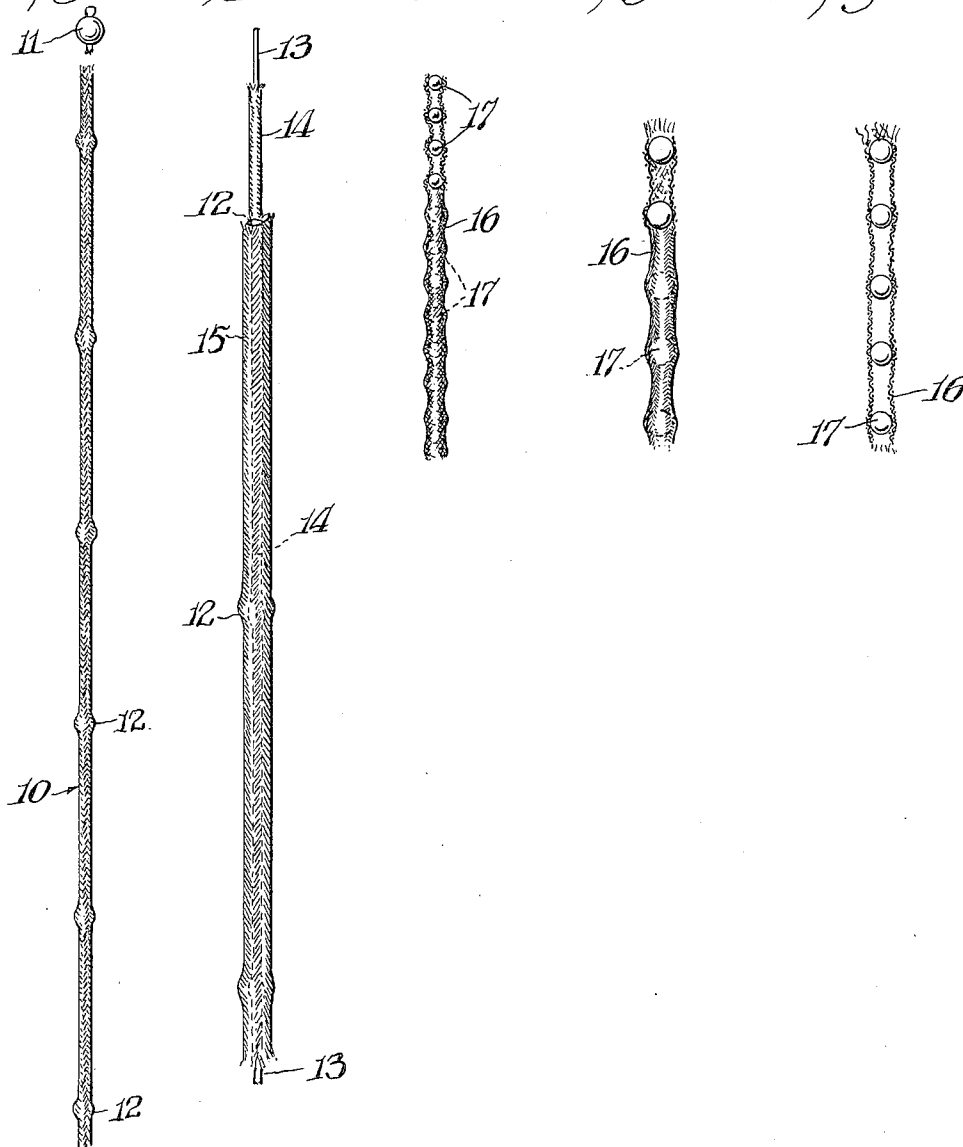
O. B. BILLINGS

3,217,705

DEVICE FOR TESTING INTERNAL BLEEDING

Filed May 2, 1962

Fig.1 *Fig.2* *Fig.3.* *Fig.4.* *Fig.5.*



Inventor
Orman B. Billings

By C. H. Morrison

Attorney

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3,217,705

DEVICE FOR TESTING INTERNAL BLEEDING
Orman B. Billings, 618 Silverside Road, Brandywine
Hundred, Wilmington, Del.
Filed May 2, 1962, Ser. No. 191,816
10 Claims. (Cl. 128—2)

This invention relates to a device for the determination of bleeding sites within the body. More particularly, this invention relates to a device for rapidly locating the sites of bleeding in upper gastrointestinal tract hemorrhages.

Recently there have appeared certain devices for locating the bleeding in upper gastrointestinal tract hemorrhages as an aid to the surgeon who is operating. One such device is made up of a cotton tape having markings each sealed to the tape at various or regular intervals. Another device is made up of two cotton tapes sewed together with the markings that are to be used in the locating sewed between the two tapes. Generally, a weight is fastened to the end of the device of either construction and the patient swallows this followed by swallowing the string a little bit at a time. Preferably a throat spray is applied or the patient sips water to assist in the swallowing. The patient is examined by X-ray in order to determine when the device is in place and to get a picture of its position, and at that time an injection of a fluorescein solution is made into the antecubital vein. Several minutes after that injection the test string is withdrawn and examined. Of course, the location of gross blood spots will be noted immediately and the ultra-violet examination of the device will show the fluorescence that has come onto the device from the blood stream coming from the bleeding area. The operator will compare the test device with the roentgenogram, and by such comparison he can locate the place of bleeding very accurately. While these cotton tapes are useful, they are quite costly and have other disadvantages. A structure which is simply made and which is swallowed with ease by the patient is desired.

Accordingly, an object of this invention is the provision of a device for testing internal bleeding which device is easily constructed. Another purpose is the provision of devices made from low cost materials by existing techniques. These and other objectives will appear hereinafter.

FIGURE 1 is an actual size view in elevation of one form of a device of this invention;

FIGURE 2 is an enlarged, similar view of the device of FIGURE 1 with several of the component elements separately exposed;

FIGURE 3 is an actual size side elevation of another form of a device of this invention;

FIGURE 4 is an enlarged view of FIGURE 3; and

FIGURE 5 is an enlarged sectional view of FIGURE 4.

With reference to the figures, which are given for illustrative purposes and are not limitative, it will be noted that the devices of this invention are tubular or round objects. This is in contrast to the devices of the prior art which are flat tapes. Being cylindrical in cross-section the devices of this invention are much more readily swallowed by the patient than flat tapes. Further, the objects of this invention are readily produced on conventional equipment.

As can be seen in FIGURE 1, the test device comprises a long string-like object 10 which has affixed, as by tying, at one end thereof a weight 11 and positioned at intervals bulges 12 of radio-opaque material. In looking at this device more closely in FIGURE 2, it will be appreciated that a radio-opaque thread 13 runs continuously

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throughout the length of the device. Braided, woven or knitted around this thread or cord 13 is the inner cover 14 which is preferably made of an absorbent material and then at spaced intervals are the radio-opaque bulges or materials 12. These are formed in any convenient manner including wrapping, tying or adhesively fixing the opaque material 12 to the inner cover 14. One simple way is to tie small pieces of string impregnated with a radio-opaque material to the braided assembly comprising the inner string 13 and cover 14 as it comes from the braiding machine or as it goes to the next braiding machine for formation of the outer cover 15. The small knots that are formed lead to the bulges 12 and they are fixed in position by cover 15.

It will be appreciated that in the swallowing of a device of this invention considerable folding, turning, doubling over and the like of the device can occur. Thus, the operator will need to know exactly what particular bulges 12 correspond to the bulges shown on the X-ray picture taken while the device was in position. After removal, it is a simple matter to count the bulges on the device ahead of a particular bleeding site and to determine between which bulges bleeding or fluorescence appears. Knowing this, the operator traces the device on the X-ray picture counting the bulges appropriately, and by so doing he can determine with accuracy where the internal bleeding is occurring. Thus, he can make his necessary incision with rapidity and confidence that he will arrive at the location of the trouble.

While the device described in FIGURES 1 and 2 is most satisfactory and does satisfy the objects of this invention, it has been found possible to achieve even greater simplicity. This has been done by the provision of the device shown in the remaining figures. FIGURE 3 is an actual size of a device of this invention which comprises one cover 16 and a plurality of radio-opaque sites 17. FIGURE 4 shows this structure in an enlarged view and FIGURE 5 shows it in section. From these figures it will be noted that this embodiment of this invention does not have a continuous radio-opaque string 13. However, the sites 17 are very numerous and they lie close together so that in effect a continuous radio-opaque line runs from one end of the device to the other. The sites 17 may even touch but it is preferred to space them. In any event, there is no difficulty in tracing; the location of trouble spots is done quickly and accurately as before.

An outstanding advantage of this embodiment stems from the ease of its manufacture. While the absorbent sheath may be woven, knitted or braided, it is preferred to use a conventional braiding machine. At intervals a lead pellet or a ball of other radio-opaque material is dropped into the braider so that the multiple threads are braided around the pellet. The material used for opacity may be chosen from a large number of materials such as lead or barium sulfate or similar salts held together by a binder. Any heavy metal or a salt of a heavy metal may be used, it being recognized, of course, that it be non-toxic, insoluble and opaque to X-rays. Barium sulfate is the accepted standard. The material may be in any shape that can be swallowed easily and will show up well on an X-ray film and there may be periodic variations in shape to afford a pattern change that helps in counting. Generally, it is desired that the pellets be spherical or rounded as such objects are easier to swallow and do not involve sharp or flat edges.

The spacing of the radio-opaque materials need not be precisely as shown for it is possible to use almost any pattern, regular or irregular, provided, however, that the running length of the device swallowed by the patient can be traced by an effective line of opacity which is either unbroken or has only minor breaks that do not break the continuity needed for the tracing. Generally, a reg-

ular pattern such as has been shown and described is preferred.

The materials used in the cloth coverings may include cotton, rayon, acetate or other absorbent materials. Obviously, the material should be non-fluorescent of itself and non-toxic; and it should be resistant to attack by body fluids, such as stomach acids, so that it is not disintegrated thereby, for it may be left in place for considerable time periods. A soft, non-irritating and non-abrasive material is generally used to make swallowing easier.

The devices of this invention are useful in locating bleeding in the upper stomach in instances of hiatal hernias or of gastric ulcers, in the lower esophagus and in duodenum and duodenal bulb. Multiple sites of bleeding can be determined readily. The use of complicated tubes is avoided. Further, the devices of this invention may be readily prepared from low cost materials without the need of expensive time consuming steps, for conventional machinery can be employed in their manufacture.

While the invention has been disclosed herein in connection with certain embodiments and certain compositional and procedural details, it is clear that changes, modifications or equivalents can be used by those skilled in the art; accordingly, such changes within the principles of this invention are intended to be included within the scope of the claims below.

I claim:

1. A tubular device adapted to be partially swallowed by a human patient in a test to locate internal bleeding which device comprises a length of an absorbent, flexible, tube; inside said tube a radio-opaque material substantially continuous and uniform throughout the length of said tube; and concentrated amounts of radio-opaque material periodically placed in fixed positions along the length of said tube affording a counting means.

2. A device in accordance with claim 1 in which the said material is a continuous string.

3. A tubular device comprising a length of an absorbent, flexible tube and inside said tube a radio-opaque material substantially continuous throughout the length of said tube, the said material being a plurality of pellets

placed at closely spaced intervals to form a substantially continuous line of radio-opaque material.

4. A device in accordance with claim 1 in which said tube is a braided tube.

5. A tubular device comprising a centrally located string-like object impregnated with a radio-opaque material; about said string-like object a cover; radio-opaque material fixed at intervals on the outside of said cover; and over the resultant assembly an outer absorbent cover.

6. A device in accordance with claim 5 in which the cover surrounding the centrally located string-like object is made of an absorbent material.

7. A device in accordance with claim 5 in which said radio-opaque material fixed to the outside of said cover surrounding the centrally located string-like object is fixed thereto in a rounded form.

8. A tubular device adapted to be partially swallowed by a human patient in a test to locate internal bleeding which device comprises a length of an absorbent material in tubular form and located therein in fixed positions a plurality of radio-opaque particles spaced slightly apart from adjacent particles yet effecting a continuing line of radio-opacity throughout the length of said device.

9. A device in accordance with claim 8 in which said radio-opaque particles have a rounded shape.

10. A tubular device comprising a length of an absorbent material in tubular form and positioned therein a plurality of radio-opaque particles effecting a continuing line of radio-opacity throughout the length of said device, the said radio-opaque particles being in spaced, countable relationship.

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RICHARD A. GAUDET, *Primary Examiner*.

JORDAN FRANKLIN, LOUIS R. PRINCE, *Examiners*.