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[54] **RADIOACTIVE SOURCE APPLICATOR FOR UTERO-VAGINAL PLESIOCURIETHERAPY ACCORDING TO THE METHOD OF NON-RADIOACTIVE PREPARATION**

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[51] **Int. Cl.** **A61n 5/00**

[58] **Field of Search** ..... 128/1.1, 2.2, 2 A, 303, 128/303.1, 323, 345; 250/106 S

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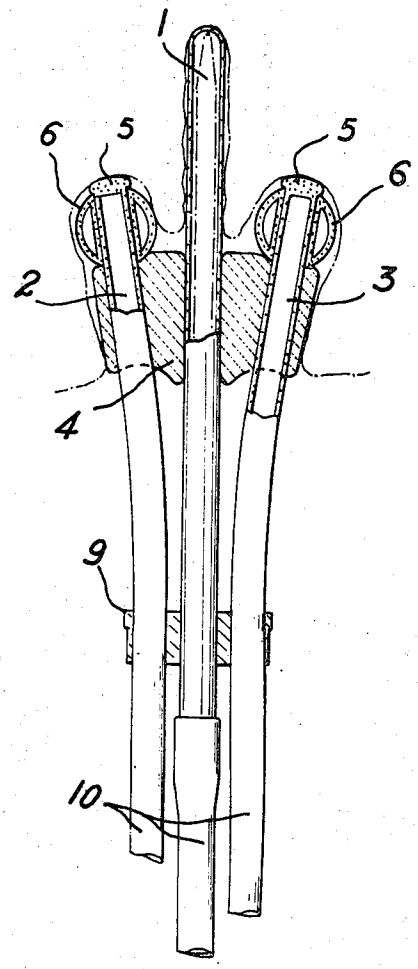
[57] **ABSTRACT**

The applicator comprises a uterine probe and two vaginal probes, a coupling member consisting of a polyhedral block having low density and transparent to X-rays, the block being provided with a central passageway for the insertion of the uterine probe and two symmetrical oblique passageways for the insertion of the two vaginal probes, two cylindrical plugs resting on the coupling member and each having a passageway for inserting the extremity of one vaginal probe. The coupling member is provided with cylindrical cups corresponding in the shape to the plugs and each located at one end of a vaginal-probe passageway. The generator-lines of the cups are inclined to the axes of the passageways of the plugs at an angle which is slightly different from 90°.

6 Claims, 2 Drawing Figures



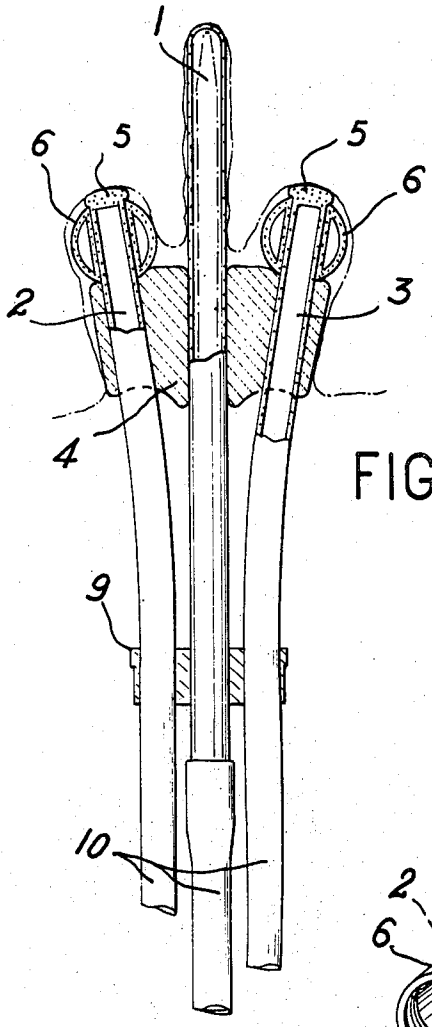
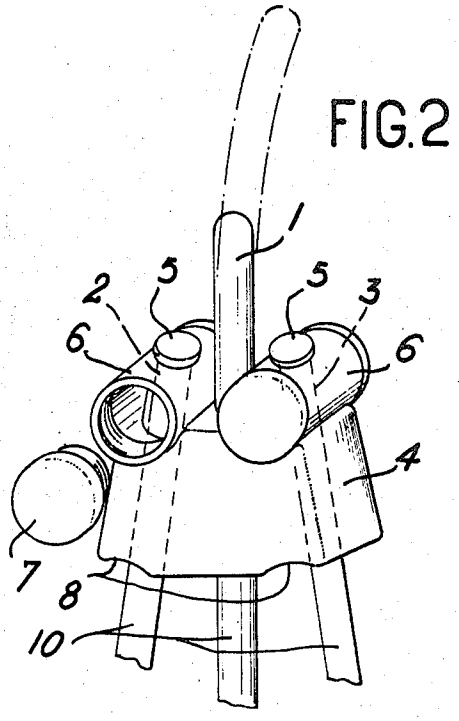


FIG. 1

FIG. 2



RADIOACTIVE SOURCE APPLICATOR FOR UTERO-VAGINAL PLESIOCURIETHERAPY ACCORDING TO THE METHOD OF NON-RADIOACTIVE PREPARATION

This invention relates to a radioactive source applicator for utero-vaginal plesiocurietherapy according to the method of non-radioactive preparation.

It is known that the majority of methods of treatment by plesiocurietherapy require the introduction of a probe in the uterus and of a colpostat in the vagina.

In the oldest methods of treatment by plesiocurietherapy, these two instruments (probe and colpostat), known as applicators, were loaded with radioactive sources before being brought into the operating room and placed in position in the patient, which gave rise to major disadvantages.

The considerable improvements made in the field of plesiocurietherapy over the past few years have led to the application of the so-called non-radioactive preparation technique which consists in dissociating the positioning of applicators (probe and colpostat) from the positioning of radioactive sources in these applicators.

In accordance with this technique of non-radioactive preparation, the following operations are performed:

1. the applicator which is fitted at the end of a so-called outer tube is inserted into the vagina;

2. the outer tube is attached to a flexible sheath which is joined to an apparatus known as a source projector, for example of the type descirbed in U.S. Pat. application Ser. No. 11,226, filed Feb. 13, 1970, now abandoned, and pseudo-sources, that is to say non-radioactive sources, are transferred by means of this projector into said outer tube, then into the applicator and the vagina;

3. the outer tube is freed from the sheath;

4. positioning of the applicator is checked by radiography or by radioscopy;

5. the projector unit is loaded with radioactive sources, the outer tube is again attached to the sheath, whereupon said radioactive sources are transferred into the outer tube, then into the applicator and the vagina.

In point of fact, the majority of applicators at present in use are metallic and have the disadvantage of being heavy, which makes it difficult to maintain them in the irradiation position throughout the period of treatment; moreover, their poor X-ray transparency does not make it possible to obtain a good control negative.

Different designs have been developed in order to overcome these disadvantages (applicators constructed in particular of light material such as plastic, rubber, neoprene, polyethylene) but these also are subject to the following disadvantages:

a. - The material of which the applicator is formed does not readily withstand sterilization, especially sterilization by radiation. This makes the applicator unsuited for pre-sterilization prior to use and for spray-jet treatment after use. As a further consequence, the applicator has to be carefully cleaned and sterilized each time before use.

Moreover, the constituent material of applicators is often delicate, is subject to ageing and therefore to a further major drawback in regard to storage stability; in addition, the projector-unit tubes which serve to place the radioactive sources in the irradiation position

are often so designed as to permit introduction only in a rectilineal position by reason of the fact that, if the outer tube containing the applicator is bent, its section becomes ovalized and thus prevents easy introduction or withdrawal of radioactive sources.

b. - That portion of the applicator which is intended to receive the vaginal sources (namely the portion known as a colpostat) is not provided with any shield for reducing the dose applied to sound radiation-sensitive tissues such as the vesical or rectal walls.

c. - In the irradiation position, the assembly consisting of uterine probe and colpostat is coupled by means of a metallic spring or else may not be coupled, which gives rise to two disadvantages.

The first disadvantage is to make it very difficult to introduce the applicator through the opening of the speculum; the second disadvantage arises from the fact that the assembly of vaginal and uterine sources cannot be maintained in a fixed position. As a result, even accurate positioning of the applicator does not give any guarantee of satisfactory position-maintenance throughout the period of treatment.

d. - The number of possible respective positions of the vaginal sources with respect to the uterine source is either too small (three, for example, with three sizes of vaginal plugs) or else may be infinite if no component is provided for adjusting and maintaining a fixed respective position. As a result, the dosimetry is either very difficult to calculate or else does not have any parameters of variation to permit adaptation both to the patient's anatomy and to the stage of development of the cancerous lesion.

The present invention relates to an applicator which is free from the disadvantages noted in the foregoing.

The precise object of the invention is to provide a radioactive source applicator for utero-vaginal plesiocurietherapy according to the method of non-radioactive preparation, said applicator being characterized in that it comprises a uterine probe and two colpostats or vaginal probes, a coupling member constituted by a polyhedral block formed of material which has low density and is transparent to X-rays, said block being provided with a central passageway which serves to insert the uterine probe and with two oblique passageways which are symmetrical with respect to said central passageway and serve to insert the two vaginal probes, and two cylindrical plugs each traversed by a passageway which serves to insert the extremity of a vaginal probe and rests on said coupling member, said member being provided with hollowed-out portions in the form of cylindrical cups corresponding in shape to said plugs and each located at one extremity of a vaginal-probe passageway, the direction of the generator-lines of said cylindrical cups being inclined to the direction of the axes of the passageways of said cylindrical plugs at an angle which is slightly different from 90°.

Further properties and advantages of the present invention will be brought out by the following description in which one embodiment of the applicator according to the invention is given by way of explanation and not in any limiting sense, reference being made to the accompanying drawings, in which:

FIG. 1 is a sectional view showing the applicator in accordance with the invention and as positioned in the patient;

FIG. 2 is a perspective view showing the same applicator alone.

The applicator according to the invention is essentially composed of a uterine probe 1 and of two vagina probes (or colpostats) 2 and 3 which are maintained in rigidly fixed relation during the application by means of a coupling member 4 and are disposed at the end of so-called outer tubes 10. The uterine probe 1 and the vaginal probes 2 and 3 are constituted by a plastic tube (for example of polyethylene) which is sterilizable under radiation. The internal diameter of the probes is chosen so as to permit ready introduction of flexible source-holders even with substantial curvatures or precurvatures of the probes. The external diameter of the probes 1 to 3 is chosen so as to leave a thickness of plastic material which is sufficient to endow the probes with compressive strength but is not too great in order to maintain flexibility of the material (thickness comprised between 15 and 20 percent of the external diameter).

Each vaginal probe is sealed by an added end-cap 5 which is bonded in the hot state, thus making the interior of the probe impervious to infiltrations and secretions and also sufficiently strong to prevent any source-holder from piercing the extremity and causing injury to the patient.

Each vaginal probe 2 or 3 supplies a plug 6, the axis of which makes an angle of approximately 100° with the axis of the corresponding vaginal probe in order to ensure better holding in place or retention within the vaginal fornices. Each plug 6 comprises two removable end-caps 7 so as to permit the insertion of discs of heavy metal (such as depleted uranium, lead, tungsten and the like) which serve to shield the highly radiation-sensitive vesical or rectal walls.

The applicator can be constructed in a number of different sizes which differ in the dimensions of the plugs 6 and of the coupling member 4.

The coupling member 4 slides along the probes and can be introduced after positioning of the uterine probe 1 and the vaginal plugs 6. Member 4 is provided with two sets of recesses or hollowed-out portions 8 having the shape of cylindrical cups which are intended to accommodate the vaginal plugs 6. The arrangement of said recesses 8 makes it possible to obtain in the case of each size of plug two respective arrangements of the vaginal probes 2 and 3, namely a convergent arrangement in one case (as shown in FIG. 2) and a divergent arrangement in the other case (as shown in FIG. 1). There can thus be obtained six fixed distances between the vaginal sources and this makes it possible on the one hand to adapt the applicator to the patient's anatomy and, on the other hand, to utilize an atlas of precalculated isodose curves (corresponding to the respective fixed positions of the radioactive sources within the interior of the probes).

The constituent material chosen for the coupling member is intended to have low density and to be transparent to X-rays (expanded polystyrene, for example).

A collar 9 serves to support the applicator assembly in a more effective manner.

The applicator in accordance with the invention, as constructed of plastic material, has the following advantages over applicators of the prior art:

a. - The constituent material of the applicator is light in weight for tolerance by the patient and retention during the period of treatment; the applicator can be sterilized in a plastic bag by radiation and permits introduction by means of curved tubes.

b. - The dimensions of the carrier tubes are such as to permit the introduction of radioactive sources in the case of all degrees of curvature of said tubes; moreover, the diameter of the uterine probe 1 is chosen so as to prevent excessive proximity of the tissues in the irradiation position (this being the case with diameters which are too small) and excessive prior expansion of the uterine duct under anaesthesia (5 to 6 mm).

c. - Each of the two vaginal plugs 6 of the colpostats is hollow in such manner as to permit X-ray detection and is additionally provided with two end-caps 7 for the introduction of discs of heavy metal (tungsten, lead, for example) which serve to shield the radiation-sensitive front and rear walls of the patient.

d. - The coupling member 4 of lightweight material which is transparent to X-rays makes it possible during the application to maintain the uterine probe 1 and the vaginal probes 2 and 3 in a strictly geometrical position.

What we claim is:

1. A radioactive source applicator for utero-vaginal plesiocurietherapy according to the method of non-radioactive preparation, wherein said applicator comprises a tubular uterine probe and two tubular vaginal probes, a coupling member constituted by a polyhedral block formed of a low density material transparent to X-rays, said block being provided with a central passageway for receiving the uterine probe and with two oblique passageways which are symmetrical with respect to said central passageway for receiving the two vaginal probes, and two cylindrical plugs each traversed by a passageway through which the vaginal probes extend, said plugs being in contact with said coupling member, said coupling member being provided with hollowed-out portions in the form of cylindrical cups corresponding in shape to said plugs and each located at one extremity of a vaginal-probe passageway, said plugs adapted to rest in said hollowed-out portions, the direction of the longitudinal axes of said cylindrical cups being inclined to the direction of the longitudinal axes of the passageways of said cylindrical plugs at an angle which is slightly different from 90°.

2. A radioactive-source applicator according to claim 1, wherein the uterine probe and the two vaginal probes are constructed of a plastic material which is sterilizable under radiation.

3. An applicator according to claim 1, wherein each vaginal probe is sealed by means of an added end-cap.

4. An applicator according to claim 1, wherein each plug includes two removable end-caps permitting the introduction of discs of heavy metal.

5. An applicator according to claim 2, wherein each plug includes two removable end-caps permitting the introduction of discs of heavy metal.

6. An applicator according to claim 3, wherein each plug includes two removable end-caps permitting the introduction of discs of heavy metal.

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