Sept. 16, 1969 P. E. LEBECH ET AL 3,467,087

INTRAUTERINE DEVICE

Filed Sept. 23, 1966

Fig.1

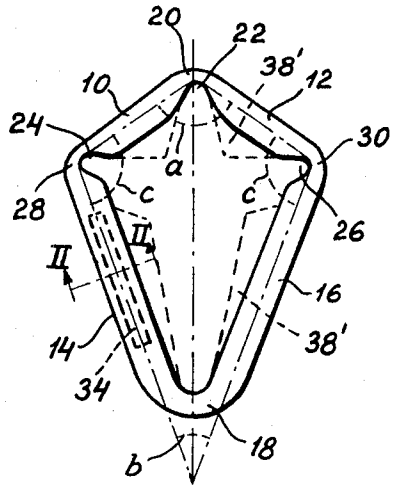
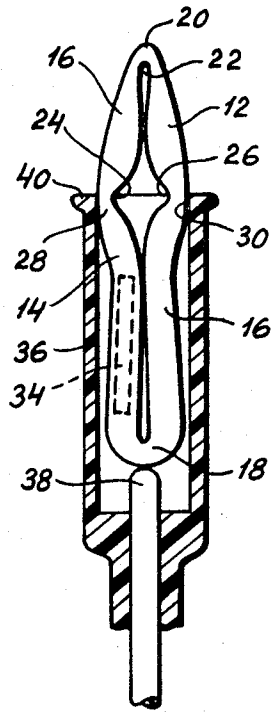




Fig.2

Fig.3



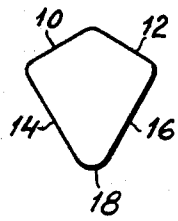


Fig.4

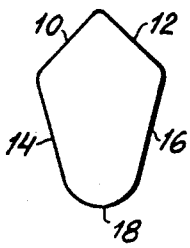


Fig.5

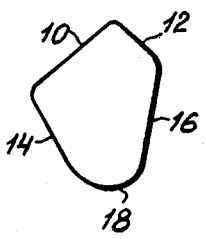


Fig.6

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INTRAUTERINE DEVICE

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U.S. Cl. 128—130 7 Claims

ABSTRACT OF THE DISCLOSURE

An intrauterine device is composed of a plastic rod in the shape of a closed polygonal figure, the corner joints of which form resilient hinges.

This invention relates to an intrauterine device consisting of a closed figure of a rod shaped nontissue-irritating, elastically pliable plastic material, for example polyethylene.

Intrauterine devices have been known for centuries, and they serve after insertion into the uterus to prevent unwanted pregnancy.

Several shapes of intrauterine devices are known. Best known at present is the so-called "spiral" consisting of a zigzag shaped almost bandlike rod. Other known intrauterine devices consist of a closed rod configuration, the most popular of which have circle form or oval form.

Common to all known intrauterine devices is the fact that in many cases they are expelled from the uterus, normally during one of the first three menstruation periods after the insertion of the device.

This expulsion is especially unfortunate because it is very difficult for a woman to recognize whether the device is in place or not.

In order to facilitate such a recognition it is known to furnish intrauterine devices with a piece of wire or a little pin which extends out from the uterus into the vagina, however, this arrangement inheres the danger of infection and injuries.

In addition the known intrauterine devices can be inserted only by means of a special, normally pipe shaped introducer which is passed through the cervical channel up into the uterus, whereupon the intrauterine device is pushed into position by means of a rod. This process may make a predilatation of the cervical channel necessary.

An object of this invention is to provide an intrauterine device which readily accommodates itself to the shape of the uterus, which is comfortable for the woman and noninjurious.

Another object of this invention is to provide such an intrauterine device which, when inserted into the uterus, has no or very little tendency of being expelled from the uterus.

A further object of this invention is to provide an intrauterine device which can easily be put into position by a medical practitioner or any specialized person without the woman feeling pain and without dilatation of the cervical channel being necessary.

Still another object of this invention is to provide an intrauterine device provided with means making it possible from the outside of the human body to verify whether the intrauterine device is in place or not.

A still further object of this invention is to provide an intrauterine device of the type mentioned above which even after having been inserted in the uterus of a woman for a long time does not take up an unintended shape and thus even after having been used for a long time is noninjurious.

In the intrauterine device according to the present invention the rod figure includes an upper portion comprising two joining upper shanks, which between them form an inner angle of 90 to 125°, and a lower portion comprising two lower shanks each of which is at one end joining an end each of the upper shanks forming an inner angle of 90 to 125° therewith and which lower shanks form between them an inner angle of 25 to 75°, and are at their lower ends interconnected by means of a transverse rod, and that the joint between the upper shanks and the joints between each upper shank and its adjoining lower shank is of such a shape, that the resistance of the rod figure against being bent is less at these joints than in the shanks themselves.

Hereby it is obtained that when the lower shanks are being pressed towards each other, for example by means of a pair of tongs, or by being inserted in a tube, also the upper shanks are pushed towards each other, and as a result the device will assume the shape of a probe which is easily inserted into the uterus without it being necessary to stick the pair of tongs or the tube into the cervical channel, and when then the pair of tongs or the tube is removed, the device will expand again and assume its normal form to be retained by the uterus. Furthermore, when, for example during the menstruation periods, the walls of the uterus exercise pulsating movements running from the inner part of the uterus towards the outer parts, the pulsation wave will first hit the upper shanks of the device tending to push it downwards, however, owing to the easy bending of the device at the joints the result will be that the lower shanks expand more than normal in lateral direction, and, consequently, the device will be wedged stronger inside the uterus so that it cannot be expelled.

The intrauterine device can also easily be removed by means of a hook which is inserted into the uterus and grips the lower transverse rod, since a pull in this rod will force the rest of the device to adapt an oblong shape, and then the device will easily slide out through the cervical channel.

It is quite possible to give the shanks more or less curved forms curving outwardly or inwardly. It is proved, however, to be most appropriate that each shank has an approximately linear form, so that the device may be compressed most possible and takes up a minimum of space during the insertion into the uterus.

It may also be advantageous that the configuration of the device is symmetrical on an axis extending through the upper joint of the upper shanks and through the middle of the transverse rods. It is possible by means of a nonsymmetrical shape to adapt the body more closely to the inner shape of the uterus, however, this would demand the device to be inserted in a quite definite position which it is difficult to practice.

In order to give the device the best chances for being retained by the uterus it may be suitable that the device is so proportioned that in its normal shape at maximum height is from 1.0 to 1.7 times its maximal width.

The relatively long linear shanks of the device make it possible to embed a rod or pin shaped piece of magnetizable material either in one of the shanks or in the transverse rod. Thereby, it will be possible by means of a suitable instrument from the outside to verify whether the device is in fact lodged in the uterus. Most advantageously said inserted piece consists of a permanent magnet which makes it possible to locate the intrauterine device for example by means of a compass.

Details about the action of any intrauterine device are generally unknown, but it is known that the effect of such devices does depend on the lateral contact areas. It has been proved that the device according to the invention provides the necessary contact area, however, if it is desired this area can be further extended by means of fins

which from one or more of the shanks extend inwardly towards the center of the device.

Other aspects, objects, and the several advantages of this invention will be apparent from a study of this disclosure, the accompanying drawings, and the appended claims.

In the drawings:

FIG. 1 is an enlarged plan view of a preferred embodiment of the invention,

FIG. 2 is a sectional view taken on line II—II of FIG. 1,

FIG. 3 is a partial sectional view of an introducer in which the device shown in FIG. 1 is inserted in compressed state, and

FIGS. 4 to 6 are schematically plan views of three further embodiments of the invention.

The intrauterine device shown in FIGS. 1 to 3 comprises two upper shanks **10** and **12** forming between them an inner angle *a* of approximately 110°, and two lower shanks **14** and **16** forming between them an inner angle *b* of approximately 40° and each of which together with the corresponding one of the upper shanks **10** and **12** forms an inner angle *c* of about 105°.

The lower ends of the lower shanks **14** and **16** merge into and are interconnected by means of a transverse rod **18** having approximately the shape of a circular arc. The sectional area of this transverse rod is smaller at the middle thereof than the sectional area of the lower shanks **14** and **16**, whereas it gradually increases from the middle and outwardly in both directions. The upper shanks **10** and **12** as well as the lower shanks **14** and **16** have, as appears from FIG. 2, a somewhat oblong cross section so that they will rather bend in the plane of the resulting approximately polygon-shaped device than at an angle to said plane.

At the joint **20** between the upper shanks **10** and **12** the sectional areas of said two shanks are reduced by means of an inwardly arched recess **22** and so that at the joint **20** a particularly flexible region or hinge is provided. In the same manner the joint **28** between the upper shank **10** and the lower shank **14** and the joint **30** between the upper shank **12** and the lower shank **16** are by means of recesses **24** and **26** respectively formed like a kind of hinges.

These hinges **20**, **28** and **30** cause that in case any of the upper shanks **10** and **12** or both of them are acted upon in downwards direction the whole device will tend to expand laterally and, therefore, when the device is located in the uterus, it will wedge itself still more firmly in position than before the occurrence of such an action.

Further, as appears from FIG. 3 it is possible by pressing the shanks **10** and **14** at the one side of the device towards the shanks **12** and **16** at the other side to give the device a probelike shape so that it may be inserted in the outer end of a tube-shaped introducer **36** from which it may be pushed out by means of a manually operated plunger **38**. The introducer **36** is provided at its outer end with a collar **40** ensuring that during insertion of the intrauterine device into the uterus the introducer **36** remains outside the portion and only the device and the tip of the plunger **38** passes into the cervical channel. Thus the device may be inserted into the uterus without dilatation of the cervical channel which is an important advantage.

A little permanent magnet **34** is embedded in the lower shank **14**. Therefore, if a compass is held against the body of the woman opposite the uterus and she is carrying an intrauterine device as described the correct positioning of the device will be indicated by the compass needle.

Instead of the permanent magnet **34** a pin can be used provided it is of magnetizable material so that it reacts to magnetic influences from the outside.

It should be noted that the presence of a pin **14**, it being either magnetizable or a magnet, gives the medical practitioner the possibility by means of suitable instruments, not only to ascertain the presence of the device in the uterus, but also to ascertain its exact positioning.

FIG. 1 further illustrates that the shanks **10–16** can be furnished with inwardly extending fins **38'** to increase the contact area of the device.

FIGS. 4–6 show three further examples of polygonal shapes that can be given to the intrauterine device according to the present invention.

We claim:

1. An intrauterine device comprising a closed polygonal figure of a rod-shaped, non-tissue-irritating, elastically pliable plastic material; said closed figure including an upper portion and a lower portion; said upper portion comprising a first and a second upper shank joining each other at their upper ends at a first joint and forming between them an inner angle of 90° to 125°; said lower portion comprising a first and a second lower shank, said two lower shanks converging in direction away from said upper portion; said first lower shank joining at its upper end the lower end of said first upper shank at a second joint forming with said first upper shank an inner angle of 90° to 125°; said second lower shank joining at its upper end the lower end of said second upper shank at a third joint forming with said second upper shank an inner angle of 90° to 125°; said two lower shanks forming between them an inner angle of 25° to 75°, a transverse rod interconnecting said two lower shanks at their lower ends; said three joints having each a thickness, measured in the plane of the said figure, smaller than the thickness of said shanks measured in said plane, said joints thereby providing resilient hinges so that the resistance of said closed rod figure against being bent or deformed is less at said three joints than in the shanks themselves.

2. An intrauterine device as defined in claim **1**; each said shank having an oblong cross-sectional shape being thinnest in the plane of said closed figure.

3. An intrauterine device as defined in claim **1**, said transverse rod being arch shaped; said two lower shanks merging at their lower ends gradually into one end each of said arch shaped transverse rod.

4. An intrauterine device as defined in claim **1**, said transverse rod being at its middle part thinner than said shanks measured in the plane of said closed figure.

5. An intrauterine device as defined in claim **1**, a pin of a magnetizable material being embedded in one of said shanks.

6. An intrauterine device as defined in claim **5**, said pin being a permanent magnet.

7. An intrauterine device as defined in claim **1**, one of said shanks being provided with a fin oriented in the plane of said polygonal closed figure and extending into the inner of said closed figure.

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ADELE M. EAGER, Primary Examiner

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,467,087 September 16, 1969

Paul Erik Lebech et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

In the heading to the printed specification, after line 6, insert -- Claims priority, application Denmark, September 27, 1965, 4970/65 --.

Signed and sealed this 27th day of October 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents