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Lerner

[11] **3,756,228**

[45] **Sept. 4, 1973**

[54] **INTRAUTERINE CONTRACEPTIVE DEVICE WITH LARGE APPENDAGES**

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[52] **U.S. Cl.** **128/130**

[51] **Int. Cl.** **A61f 5/46**

[58] **Field of Search**..... 128/130, 127, 128, 128/129, 260; 43/42.1, 42.13, 42.24, 42.26, 42.3; 151/35

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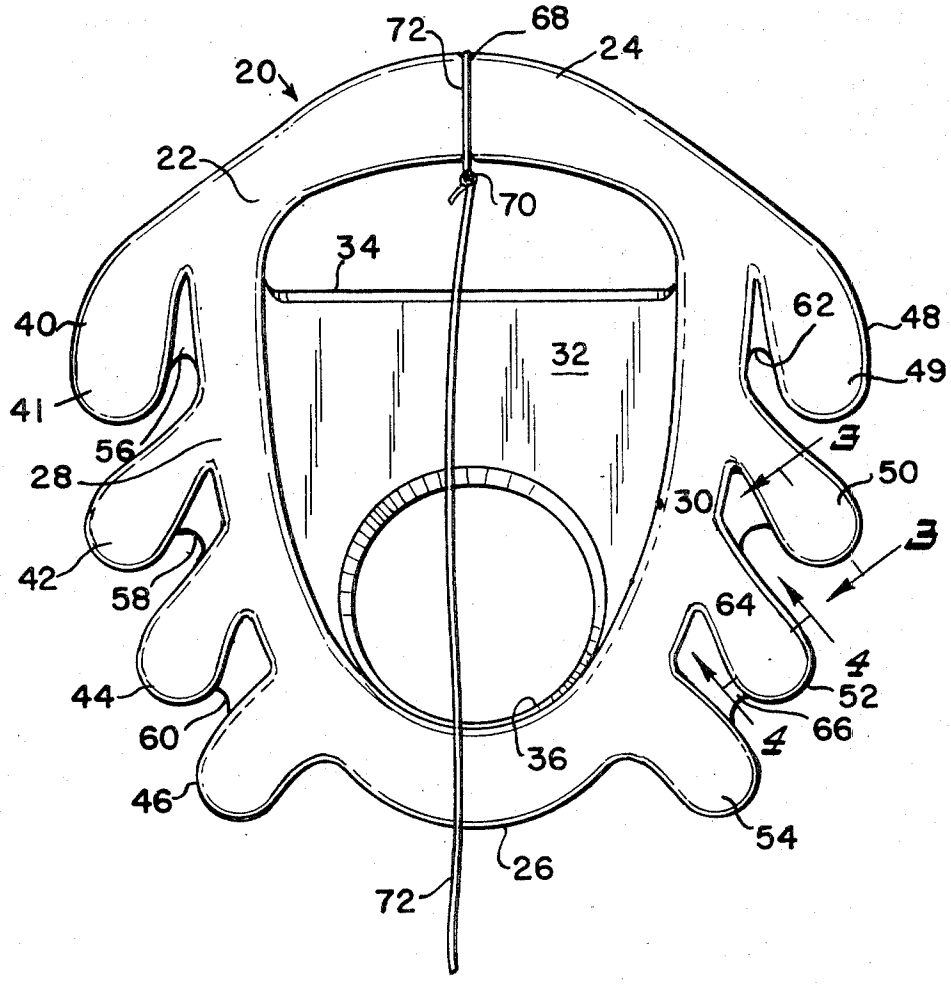
[57] **ABSTRACT**

An intrauterine contraceptive device made from plastic and having a perimetral ring with or without a central membrane and including wide paddle-shaped retrograde spurs having a tapering cross-section located on each of the outer side portions of the perimetral ring. The spurs preferably have a retrograde inclination and decreasing length from a nose portion of the perimetral ring toward the tail portion, the nose portion being slightly wider than the tail portion providing the IUD with an inverted pear shaped outline when viewed in plan. A marker and extraction string or line is preferably secured at the nose portion but can be secured to the tail portion. Between spurs, thin webs may be utilized to provide increased IUD surface area. The webs may or may not be secured to the spurs and may terminate between or beyond the spurs. Internal of the perimetral ring is preferably a membrane having openings at least adjacent the nose and the tail.

57 Claims, 7 Drawing Figures



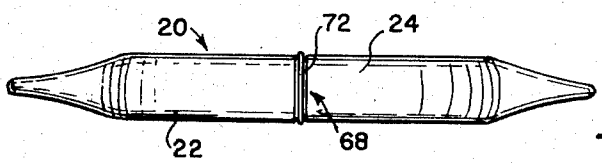


Fig. 2

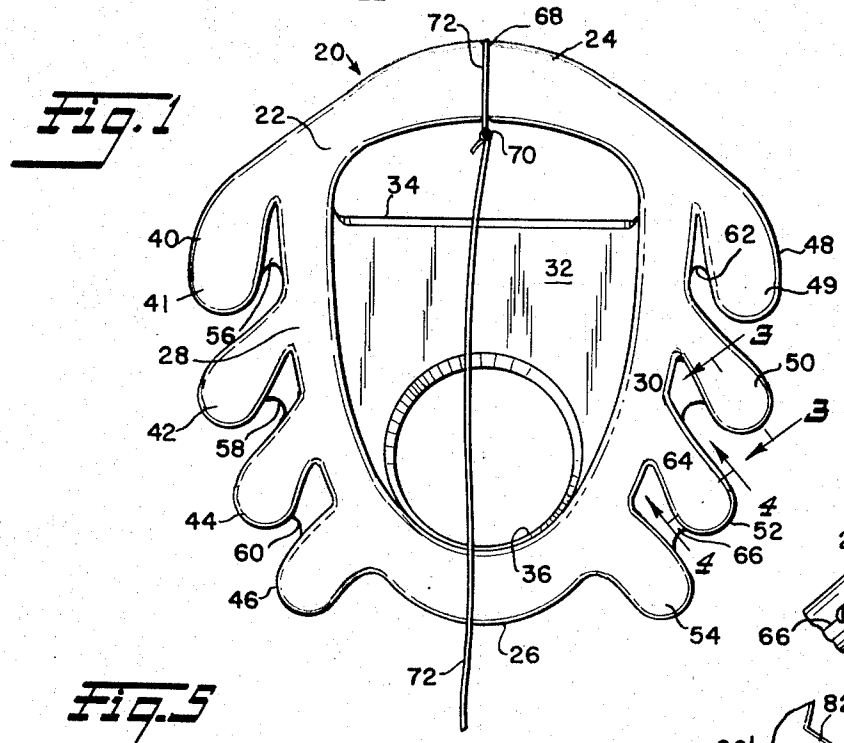


Fig. 1

Fig. 3

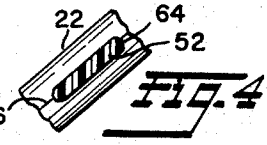


Fig. 4

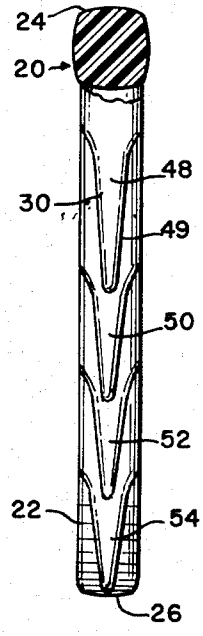


Fig. 5

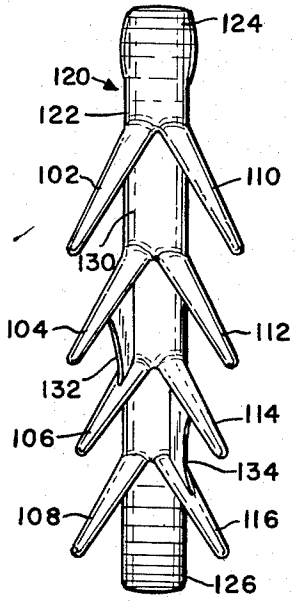


Fig. 6

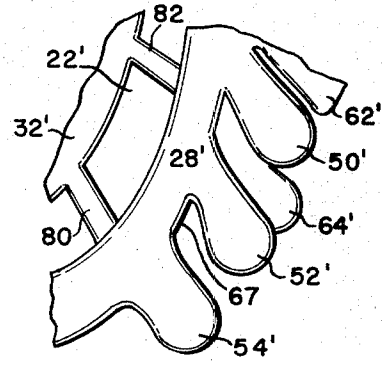


Fig. 7

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INTRAUTERINE CONTRACEPTIVE DEVICE WITH LARGE APPENDAGES

CROSS REFERENCE TO RELATED APPLICATIONS

This invention pertains to improvements in the IUD which constitutes the subject matter of and is claimed in my co-pending application Ser. No. 775,729, now U.S. Pat. No. 3,633,574, filed Nov. 14, 1968 for "INTRAUTERINE CONTRACEPTIVE DEVICE."

The IUD's herein disclosed can be inserted by using the inserter disclosed and claimed in my co-pending application Ser. No. 87,663, filed Nov. 9, 1970.

BACKGROUND OF THE INVENTION

The invention relates to contraceptive devices, particularly those designated intrauterine contraceptive devices, hereinafter referred to as IUD's. As was reiterated in the aforedescribed co-pending application, IUD's have had increased attention toward improving their characteristics in recent years because the population rate is becoming critical throughout many areas of the world. The IUD of the afore-described application introduced a new concept in effective intrauterine contraception, corresponding to the physiologic variations in the normal uterine cavity. Accommodation to variations in cavity shape and physiologic contractions was promoted by the light, flexible design and materials of exceptional resilience. The IUD, as basically taught in the afore-described application, is engineered so that expulsive contractions directed against the broad upper portion results in flaring and flexion at the apex, increasing resistance to expulsion. The high degree of flexibility of the plastic IUD device together with the central membrane and the side spurs are believed to contribute the major force of the effectiveness of applicant's IUD, and those details have been set forth clearly in the afore-described application. The central membrane assures increased endometrial surface contact, guards against embedment and against intestinal strangulation in the event of perforation as reported with closed loop designs. Those features make the IUD with central body, side spurs and central membrane well tolerated by nulliparous as well as multiparous patients, and result in enhanced use-effectiveness in professional practice. That IUD has an extremely low pregnancy rate, expulsion rate, removal for medical reasons, and personal removals.

Nevertheless, there is constant development under way to improve construction of IUD's in an attempt to obtain the ultimate which is 100 percent effectiveness in comfort, retention and contraception and the improvements of this invention are directed toward such a more effective IUD.

SUMMARY OF THE INVENTION

The present invention involves improvements, which increase the area of the IUD and that is accomplished by one or more of several structural aspects: making the spurs large by shaping them as small paddles having an outwardly tapering contour viewed from a side edge of the spur; and inserting thin webs between the side spurs. Furthermore, the external perimeter of the rim may be provided with two or more rows of fins which would diverge from the plane of the IUD perimetral portion and enable better retention and more endometrial surface contact within the uterus. Whether there are one or more rows of paddle spurs, the wide paddle shape, in plan view, provides an overall generally planar configuration to the IUD. The tissue of the uterine cavity can enfold and "grow" around the spurs, in essence grabbing and firmly locating the IUD within the uterine cavity.

Accordingly, a primary object of this invention resides in an improved intrauterine contraceptive device. In this regard the improvements include provision of larger IUD surface areas for greater endometrial surface contact including, as desired, large, somewhat flat spurs, more spurs, and webs between spurs and even extending beyond the ends of the spurs.

It is also an object to provide an improved IUD having paddle-shaped spurs and all of the benefits of the unique IUD set forth in co-pending application Ser. No. 775,729. As with that IUD, the IUD of this invention readily accommodates itself to various uterus sizes; resists expulsion through the cervical os; is easy to insert; and its shape and central membrane prevents possibilities of strangulation which can occur if an open type device should protrude or escape into the peritoneal cavity.

Another object resides in the provision of an improved IUD which includes a central body with a perimetral portion having a nose, tail and side portions with a plurality of short spurs extending outwardly from each of the side portions, the improvements consisting of improved IUD surface area configurations which can be one or any combination of: enlarged paddle-shaped spurs which can be provided in more than one row of spurs on each side portion and adding thin webs between spurs, either connected to or disconnected from the adjacent spurs and even extending beyond the ends of the spurs.

Other objects reside in providing an IUD in accord with any of the foregoing objects made from a light flexible plastic such as "ULTRATHENE," polyethylene, polypropolene, ehtylene, propylene, and other suitable plastic materials. In this conjunction the IUD's can, if desired, be treated by adding other materials in the form of powders molded with the plastic or coatings to enhance the ability to locate the IUD when placed and to enhance contraceptive effectiveness.

Further novel features and other objects of this invention will become apparent from the following detailed description, discussion and the appended claims taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

Various structural embodiments of this invention are disclosed in the accompanying drawings, in which:

FIG. 1 is an enlarged plan view of an IUD made in accord with the present invention showing the paddle-shaped spurs and webs between and interconnecting the spurs;

FIG. 2 is a top view of the IUD shown in FIG. 1 and illustrates the tapered nature of the spurs;

FIGS. 3 and 4 are transverse sections taken on lines 3—3 and 4—4, respectively, of FIG. 1 illustrating the tapered longitudinal and transverse cross-sections of a paddle spur;

FIG. 5 is an enlarge side view of the IUD in FIG. 1 partially sectioned to show the larger cross-section shape of the perimetral ring nose portion;

FIG. 6 is an enlarged side view of a modified embodiment of the IUD of FIG. 1 in which two rows of paddle spurs are located on each side of the IUD; and

FIG. 7 is an enlarged plan view of part of one side portion of another IUD embodiment to illustrate a modified membrane, absence of webs, and different sizes and extent of attachment of webs located between adjacent spurs.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1, 6 and 7 in one or more respects illustrate different features of the present invention. Many of such features from one of those Figures can be interchanged or used in conjunction with the features of other Figures but, for convenience, all such possible combinations of features have not been illustrated. For example, projected webs can be used between some or all of the adjacent spurs, whether arranged in a single row or plural rows on each side of the center portion of the IUD or the web may or may not be connected to the adjacent spurs.

With reference to FIGS. 1–5, an IUD **20** is shown which consists of a perimetral ring **22**, somewhat elongated and having a plan view like an inverted pear shape. The wider end of IUD **20** is the nose **24**, the smaller end is the tail **26** and the nose and tail are joined by two side portions **28** and **30**. A thin membrane **32** is disposed across the major central area within the inner perimeter of the ring **22** and, as shown, is attached essentially along the inner edge of the two side portions **28** and **30** to provide a first aperture **34** adjacent the nose end **24** and a second aperture **36** adjacent the tail end **26**. Either or both of apertures **34** and **36** can be circular, as is **36**, or non-circular, as is **34**. A plurality of short wide spurs **40, 42, 44** and **46** extend outwardly from ring side portion **28** and complementary spurs **48, 50, 52** and **54** extend outwardly from the opposite side portion **30**. While four spurs are disclosed, the number of spurs on each side could be a different plurality. Thin scalloped webs **56, 58** and **60** are secured to the ring side portion **28** between and attached to adjacent ones of spurs **40–46** and complementary webs **62, 64** and **66** are secured to the opposite ring side portion **30** between and attached to adjacent ones of spurs **48–54**. Centrally located on the nose **24** are small retention grooves **68** and **70** which enable a marker line or telltale string **72** to be tied at the apex of the nose. Alternatively the line could be secured at the tail portion of IUD **20**.

Although it is not necessary, it is preferred that the membrane **32** be discontinuous to provide the nose and tail apertures **34** and **36** to enable an efficient insertion with a stick type inserter **80** (FIG. 9), described structurally and functional in the afore-described copending inserter application. Other types of inserters may be used, in which case one or both of the membrane apertures may be eliminated. Alternatively, the membrane can be eliminated or made in other configurations, such as that which will be described hereinafter for FIG. **10**.

The perimetral ring **22** provides the structural frame work of device **20**, and its pear shape functions to maximize the likelihood that the IUD **20** will be retained in place after insertion in the uterus. Specifically, the ring **22** is designed to make the device flexible enough so that it yields when placed in hoop compression by the natural muscular activity of the uterus. If the device resisted such pressures unyieldingly, it might be moved in the direction of the cervical os, act as a dilating wedge, and eventually be expelled.

The cross-section of the perimetral ring portion **22** is substantially rectangular with rounded corners throughout the perimeter of the ring, but in either or both of the nose (see FIG. 5) and tail regions the ring thickness is normally made greater and the direction parallel to the plane of the ring has a dimension preferably greater than it is in the direction perpendicular to that plane.

The general cross-section of the ring has a thickness dimension of approximately 1.5 mm. perpendicular to the plane and parallel to that plane, although it may be increased, e.g., to approximately 3.0 mm. in both dimensions at either or both of the nose or tail portions. This enables a slightly stronger rim portion where the marker string **72** is attached and also when the ring **22** is subjected to hoop compression applied to the sides by the adjacent uterine walls, it will buckle first in the side regions.

One advantage of this function is that the intrauterine device **20** tends to deform in response to such compression, rather than to be cammed longitudinally relative to the uterine wall. If the ring **22** buckled first at the nose region **24**, it would be subject to a camming force tending to move it toward the cervical os, with expulsion as a possible consequence. Thus the tendency of the ring **22** to first buckle in the side regions **28** and **30** helps to prevent expulsion. A second advantage resulting from such side buckling has to do with deformation of the central membrane **32** as is discussed below. The device **20** does not suffer from the disadvantage of the "long-line" type of intrauterine devices which are so flexible that one can be deformed by uterine contractions into a linear shape and thus expelled through the cervical os by a reversal of the insertion process.

However, while the ring shape and size result in response to external forces on the perimeter by deforming the entire device in a non-planar manner, the addition of the membrane **32** also enables the desired deformation whether the ring cross-section is rectangular or round or has almost any geometric shape. When the device **20** with a central membrane **32** is subjected to external forces around its perimeter, the spurs **40–54** deflect initially in response to these forces and then transmit these forces to the ring **22**. As the ring tends to collapse, portions of the membrane **32** respond to the compressional forces by becoming non-planar and other portions of the membrane have a resultant force in tension causing the ring to deflect in a non-planar manner in the region where the membrane in tension is attached to the ring. Side forces on the device cause non-planar deformation of the device and, in particular, will cause the tail region to deflect out of the planar configuration and away from the cervical exit through the os.

Ring **22** has overall dimensions which are designed to correspond to the midrange of average uterine sizes, the uterus being in normal condition, while at the same time making sufficiently firm contact with the wall surfaces of any size uterus to be firmly retained in place. Specifically, ring **22** is of a generally elliptical (pear-shaped) configuration in that the outside dimension of the ring along the nose-to-tail axis is greater than the maximum outside dimension along an axis transverse

thereto. The preferred outside dimension of the ring **22** along the nose-to-tail or major axis is approximately 21 mm., and a preferred range of major axis outside diameters is from 19 to 31 mm. The preferred maximum dimension of the ring **22** in a direction transverse to the major axis is 16 mm. although a preferred range of outside diameter is from 12 mm. to 27 mm. The maximum transverse width of the ring **22** is reached at a location closer to the nose end of the device, region **24,** than to the tail end, region **26.** This is related to the fact that the curvature of the ring **22** at the nose of the device is more blunt, compared to the ring curvature at the tail end which is more pointed. The resulting trilobite, or buglike shape of the ring further increases the tendency of the device **20** to resist being expelled tailward through the cervical os, since, apart from any considerations of buckling, an object under sideways compression tends to be cammed toward its wider end, in this case the nose region **24.**

The outside dimensions referred to so far in this detailed description have to do with the dimensions of the ring **22** alone. The lateral dimensions of the entire intrauterine contraceptive device **22,** including the paddle spurs, are greater than those previously noted. In the embodiment of FIG. **1,** there are four such paddle spurs **40–54** on each side of the ring **22.** The longest ones **40** and **48** are located nearest to the nose end of the device, and the spurs decrease progressively in length as they approach the tail end. Moreover, the paddle spurs have a retrograde inclination, in other words, they slant toward the tail end of the device **20** so as to form an acute angle (from 90° to 15°) with the major axis of the ring. The value of that angle preferably decreases progressively from the foremost spurs **40** and **48** through the rearmost **46** and **54.** While it is preferred that the spurs extend outwardly from the perimeter of ring **22** along the general plane for which the ring is situated, that is not necessary, the spurs may project away from ring **22** inclined up or down at angles away from the general plane of the ring.

The foremost paddle spurs **40** and **48** which have a retrograde curvature in the manner of a sea turtle's front flippers, are preferably about 6.0 mm. long, measured from the outermost tip of the spur to the point at the base of the spur where its longitudinal axis intersects the extrapolated surface of the ring **22.** An approximate range for this dimension is from about 2.5 mm. to 9.0 mm. The forwardmost paddle spurs **40** and **48** are swept back at their joinder with ring **22** with preferred angles relative to the longitudinal axis of the IUD of about 50° to the major axis of device **20,** and the terminal paddle ends **41** and **49** can curve back so they are directed essentially parallel to the longitudinal axis of the IUD, thus providing a greater extent of spur paddle area. The other spurs could also be shaped in the manner of spurs **40** and **48,** if desired, and furthermore spurs **40** and **48** could have a normal paddle shape as shown for the remaining spurs **42–46** and **50–54.**

The fourth set of spurs **46** and **54,** those closest to the tail end, desirably have lengths of about 2.5 mm. A range of about 1.2 mm. to 3.7 mm. is preferred although other lengths outside of this range are useful. Spurs **46** and **54** are swept back at preferred angles of about 30° to the major axis.

The intermediate second spurs **42** and **50** and third spurs **44** and **52** have lengths and inclined angles intermediate those described for the first set and fourth set of spurs.

All of the dimensions above and hereafter set forth are merely preferred dimensions and ranges. However, wide variations in any given dimensions and in relative dimensions, even beyond the limits of the preferred ranges, may be employed, and moreover the described relative lengths of spurs **40–46** are not critical. The differences in lengths between adjacent spurs can be longer or shorter than has been shown in the drawing.

The spurs serve a number of functions. They flex to a disposition closer to the ring **22** in response to the natural muscular contractions of the uterus, and thus help the overall device **20** to yield to such contractions rather than resisting which would increase the chances of expulsion through the cervical os. The flexibility of these spurs also permits hte device **20** to fit a greater range of uterine sizes, since the spurs can either remain spread out to contact a larger uterine cavity or can flex inwardly to accommodate a smaller one, while still helping to retain the device **20** in place.

Additionally, because the spurs are resilient cantilevers, particularly in a direction along the general plane or configuration of the ring, they will yield to muscular contractions transverse to their length and by so yielding, apply a self-restoring force against the uterine wall to maintain the device in its proper position.

Most significantly, however, the spurs have a preferential retrograde direction of slant towards the tail end of the device **20** which serves to impede retrograde movement of the device **20** in the direction of the cervical os. The device is inserted nose end first; i.e., the region **24** enters the uterus first, followed by the intermediate parts and then the tail region **26.** As a result, reverse movement of device **20** goes against the "grain" (slant) of the spurs. In order to move in the reverse direction the spurs would have to be flexed outwardly from the ring **22,** which increases their spread and hence, is not easily accomplished. By resisting such deformation the spurs impede reverse movement of the device. In contrast, upon initial insertion of the device the spurs are more easily flexed rearwardly, i.e., bent in closer to the ring **22,** so that they offer considerably less resistance to movement in the direction of insertion.

FIGS. **3** and **4** illustrate the essentially flat nature of the paddle spurs **40–54,** showing a thin spur having a slight taper in cross-section thickness from its root to the tip (FIG. **3**) having a relatively thin transverse cross-section (FIG. **4**) and having smoothly contoured peripheral edges with small curvatures. The plan view of FIG. **1** clearly illustrates the paddle form of the spurs with the root or waist portions of each of spurs **40, 42, 44, 48, 50** and **52** narrower than the paddle end configuration of those spurs. The narrower waist provides a tendency for the spurs to flex somewhat toward the ring at the waist of the spur during initial insertion, while the flat paddle shaped configuration substantially increases the surface contact area of each spur thereby providing greater area for tissue contact and consequent partial tissue enfoldment by uterine cavity tissue about the IUD within the uterine cavity, but without expulsion of the IUD. At the same time, the smooth rounded edges on each paddle spur minimizes the chances for injury to the cervical canal during insertion and to the uterine cavity after placement and positioning therein.

The thin walled scalloped webs **56–60** and **62–66** between adjacent spurs on opposite sides of the perimetral ring **22** serve primarily to provide additional IUD surface area. Such webs are in the plane of membrane **32** and may be disposed wholly between and integral with the spurs, as depicted in FIG. **1** or, as shown at **62'** in FIG. **7**, the web **62'** may be disposed loose from the adjacent spurs (**62'** being shown) and integral only with the side portion **28'** of ring **22'**, or the web may extend beyond the space encompassed between adjacent spurs as do webs **62'** and **64'** (FIG. **7**) in which case they could be separated from each adjacent spur and attached only to the fillet therebetween as at **62'**. In another embodiment, the IUD may be formed with no webs between spurs as shown at **67** between spurs **52'** and **54'** (FIG. **7**).

In any event the increased size of the paddle-shaped spurs and the added areas afforded by the webs, whether joined to the spurs or not, assures increased endometrial surface engagement which enhances contraceptive effectiveness. The webs provide such function with relatively large areas of surface which helps prevent embedding of the device yet the open areas around the spurs and webs permit enfolding of such appendages by the uterus tissues to help locate and maintain location of the IUD once it is properly placed within the uterus.

Referring back to the membrane **32** (FIG. **1**), one of its functions is to block the interior of ring **22** so as to prevent intrusion of intestinal tissue thereinto in the event the device **20** should be partially or completely perforated into the peritoneal cavity. Moreover, the membrane **32** is thin enough to be very flexible, the preferred thickness being only about 0.15 mm. and the preferred range of thickness being from about 0.05 mm. to 1.5 mm. Because of such flexibility, when the ring **22** is under hoop compression by uterine muscles, the membrane has a tendency to buckle out of the plane of the ring **22** and consequently to bear against the internal wall of the uterus. This additional contact against the uterine wall is a further factor in resisting expulsion of the IUD **20** when muscular contractions take place.

In order to enable the membrane **32** to buckle more easily in this manner, it is detached from the ring **22** preferably at at least two locations **34** and **36** adjacent to the nose region **24** and tail region **26** respectively. Freeing the membrane **32** from the ring **22** at these locations increases the likelihood that it will buckle along a line roughly corresponding to the major axis of the device.

Relieving of membrane **32** at locations **24** and **26** is preferably amplified to the extent of providing the two distinct openings **24** and **26**, previously mentioned as among the general features of the IUD **20**. The nose opening **24** is useful for cooperation with certain types of uterine insertion devices, while tail opening **26** is useful for cooperation with an extracting hook. Some inserters do not require openings. However, as has been herein described, the nose and tail openings are utilized with the special inserter described in the aforedescribed co-pending inserter application.

The membrane can be continuous is desired and alternatively, as shown in FIG. **7**, the membrane **32'** can be suspended by narrow membrane strips or bridges, such as **80** and **82**, at spaced intervals around and secured to the inner perimeter of ring **22'**. Such membrane bridge connections can be secured at locations lying in the common mid-plane of ring **22'** or in any other common plane across the ring **22'** or the bridges need not lay in a common plane. The IUD with its membrane **32'** and the membrane bridges **80** and **82** as well as the spurs and webs are preferably molded as a single integral unit from plastic.

When the central membrane **32'** is made as shown in FIG. **7**, suspended by narrow thin wall membrane bridges **80** and **82**, the inner membrane body has additional flexibility which can assure disposition to provide maximum endometrial surface contact. Moreover, the opposed endometrial surface of the membrane can engage through the openings between the membrane bridges so the body tissues can grab or enfold the bridges to assure maintaining the IUD in proper location.

PLURAL ROWS OF PADDLE SPURS

The various IUD embodiments which have been hereinbefore described with reference to FIGS. **1–5** and **7** have been depicted with a single parallel row of spurs extending from each of the side portions of the perimetral ring with all spurs in a row laying in a common planar configuration with the perimetral ring. The spurs need not be formed to lay in a common plane, inasmuch as the spurs could be placed in plural rows or some of the spurs could be slanted in one or the other direction out of the planar ring configuration. Preferably, if the spurs are slanted out of the planar configuration which includes the ring, some should slant in one direction and some should slant in the other direction so the spurs will be directed essentially equal in number into primary contact with opposite inner wall surfaces of the uterine cavity to enhance the IUD retention effect caused by the spurs engaging and being enfolded by the uterus wall tissue. It is noted that the overall configurations of the IUD with plural rows of the wide paddle spurs when seen in plan view is still generally planar even though some or all of the spurs are slanted out of the planar configuration of the central ring body.

FIG. **6** illustrates one way in which two rows of spurs **102, 104, 106, 108** and **110, 112, 114, 116** can be disposed on a side portion **130** of a perimetral member **122** of an IUD **120**. The outer perimeter of the member **122** can be shaped in plan view with a pear shape similar to the outer perimeter of FIG. **1**, or it may be round, oval or other closed perimeter figure such as rounded corner rectangular shape. Seen in plan view the spurs could have lengths, inclinations and will be paddle shaped similar to those in the FIG. **1** plan view. IUD **120** can be provided with or without webs located between the spurs. In FIG. **6** the spurs in the two rows are located side by side considering a direction normal to the planar configuration of the perimetral member. Each pair of spurs, e.g., spurs **102** and **110** are slanted in retrograde inclination at the same angle from the nose **124** toward the tail end **126**, however, each spur of a pair of spurs could be provided with a different angle of retrograde inclination which would result in an effective offset relationship enabling both spurs of a pair of spurs to be engaged by both of the opposite wall endometrial surfaces in the uterus.

Again, as has been hereinbefore described relative to FIGS. **1–5** and **7**, webs shorter than the spurs (such as webs **132** and **134** in FIG. **6**) or longer than the spurs or not joined to the spurs could be included between

any adjacent spurs, within a row or between spurs in two rows.

A talisman and withdrawal cord **72** is attached to the nose **24** of the IUD **20** (FIG. **1**) for withdrawal of the IUD from the uterine cavity after use. Cord **72** may have a knot therein (not shown) which visually indicates and confirms proper insertion depth once the IUD is placed and positioned within the uterine cavity. By tying the cord to the nose one obtains greater ease of withdrawal because the IUD will invert within the uterus, thereby allowing the spurs to be in a position tapered away from the direction of withdrawal to minimize the possibility of tissue damage during the withdrawal process. However, the cord can be tied or otherwise secured to the tail portion enabling tail first withdrawal.

The material of the IUD is preferably an easily molded plastic, which is light and flexible. It preferably consists of a single piece of integrally molded plastic material mixed with a suitable amount of radio-opaque material to permit the device to be located by X-ray or fluoroscope techniques if necessary. A preferred plastic material is "Ultrathene," a copolymer of ethylene, and a vinyl monomer material, catalogue listing UE632 (UE633 is also very satisfactory) of U.S. Industries, with 12 percent by weight of barius sulfate as a radio-opaque ingredient. While the proportions just mentioned are preferred, the range of barium sulfate may be anywhere from 0 to 40 percent. Alternative plastic materials which may be employed are polyethylene, polypropylene, ethylene, propylene, copolymers, and terpolymers, e.g., EPT, polyvinyl acetate, copolymers of vinyl acetate with another ethylenically unsaturated monomer copolymerizable therewith, silicone rubber, polyfluoroethylenes, e.g., Teflon, Kel-F, etc., and the like. The molded IUD device may be provided with a thin coating of a suitable material or impregnated with a suitable material in powdered form to inhibit the deposition of calcium upon the IUD after it has been in the uterur for a period of time and to otherwise enhance its effectiveness. Such materials include gold, platinum, silver, copper, zinc, tantalum, as well as alloys and salts of these and other metals. The coating may be vapor-deposited.

Theinvention may be embodied in other specific forms without departing from the scope, spirit or essential characteristics thereof. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, the scope and spirit of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are, therefore, intended to be embraced therein.

What is claimed and desired to be secured by Letters Patent is:

1. An intrauterine contraceptive device made from material enabling flexing to conform to the uterine cavity comprising: a central body having a perimetral portion with nose, tail and side portions and encompassing an area approximating that of an average normal condition uterine cavity, and a plurality of spurs with paddle-shaped configuration having greater width than thickness extending from each of said side portions and the overall plan view configuration of the plurality of paddle-shaped spurs being generally planar with said central body.

2. A device as defined in claim **1**, wherein said paddle-shaped spurs are substantially flat.

3. A device as defined in claim **1**, wherein said paddle-shaped spurs are disposed so their large surface areas are substantially co-planar with said perimetral portion.

4. A device as defined in claim **1**, wherein at least a portion of said plurality of paddle-shaped spurs have an inclination toward the tail portion.

5. A device as defined in claim **1**, wherein all of said paddle-shaped spurs have a retrograde inclination toward the tail portion.

6. A device as defined in claim **1**, wherein the paddle-shaped spurs closest to said nose portion are longer than the spurs closest to said tail portion, and have progressively increasing retrograde inclination so their terminal portions project more directly toward said tail portion than to their waist portions.

7. A device as defined in claim **1**, wherein pull line means are secured to said intrauterine device to enable removal after insertion.

8. A device as defined in claim **7**, wherein said pull line means are secured to said nose portion.

9. A device as defined in claim **1**, wherein said paddle-shaped spurs have a slight decreasing taper cross section shape normal to the perimetral planar configuration and approaching the terminal end of said spurs.

10. A device as defined in claim **1**, wherein thin webs integral with the outer edge of said perimetral portion are disposed on each said side portion between at least two adjacent ones of said paddle-shaped spurs on each of said side portions.

11. A device as defined in claim **10**, wherein said thin webs are disposed between all adjacent pairs of said spurs on each of said side portions.

12. A device as defined in claim **10**, wherein each of said thin webs between adjacent paddle-shaped spurs is attached only to said edge of said perimetral portion and is disposed loose between said adjacent spurs.

13. A device as defined in claim **10**, wherein each of said thin webs between adjacent paddle-shaped spurs is attached to said edge of said perimetral portion and is also secured to said adjacent spurs.

14. A device as defined in claim **10**, wherein each of said thin webs is shorter than the length of said adjacent spurs.

15. A device as defined in claim **10**, wherein said thin webs integral with said edge protrude outwardly from said perimetral portion a distance greater than the length of said adjacent paddle-shaped spurs.

16. A device as defined in claim **15**, wherein said protruding thin webs are disposed between all adjacent pairs of paddle-shaped spurs on each of said side portions.

17. A device as defined in claim **15**, wherein each of said protruding thin webs between adjacent paddle-shaped spurs is attached only to said edge of said perimetral portion and is disposed loose from said adjacent spurs.

18. A device as defined in claim **1**, wherein a plurality of rows of paddle-shaped spurs are disposed on each of said side portions.

19. A device as defined in claim **18**, wherein the paddle-shaped spurs in all of said rows on each of said side portions are side by side in a direction normal to the general planar shape of the device.

20. A device as defined in claim 18, wherein at least a portion of said paddle-shaped spurs have an inclination toward the tail portion.

21. A device as defined in claim 18, wherein all of said paddle-shaped spurs have a retrograde inclination toward the tail portion.

22. A device as defined in claim 18, wherein the paddle-shaped spurs closest to said nose portion are longer than the paddle-shaped spurs closest to said tail portion.

23. A device as defined in claim 18, wherein pull line means are secured to said intrauterine device to enable removal after insertion.

24. A device as defined in claim 23, wherein said pull line means are secured to said nose portion.

25. A device as defined in claim 18, wherein thin webs integral with said perimetral portion are disposed on each side portion between at least two adjacent ones of said paddle-shaped spurs on each of said side portions.

26. A device as defined in claim 25, wherein said thin webs are disposed between all adjacent pairs of said paddle-shaped spurs in a row on each of said side portions.

27. A device as defined in claim 25, wherein each of said thin webs between paddle-shaped adjacent spurs in a row is attached only to said perimetral portion and is disposed loose between said adjacent spurs.

28. An intrauterine device as defined in claim 25, wherein each of said thin webs between adjacent paddle-shaped spurs is attached to said perimetral portion and is also secured to said adjacent spurs.

29. A device as defined in claim 25, wherein each of said thin webs is shorter than the length of said adjacent spurs.

30. A device as defined in claim 29, wherein said shorter thin webs are disposed between all adjacent pairs of paddle-shaped spurs in each row on each of said side portions.

31. A device as defined in claim 29, wherein each of said shorter thin webs between adjacent paddle-shaped spurs is attached only to said perimetral portion and is disposed loose from said adjacent spurs.

32. A device as defined in claim 29, wherein each of said shorter thin webs between adjacent paddle-shaped spurs is attached to said perimetral portion and is also secured to said adjacent spurs.

33. A device as defined in claim 25, wherein said thin webs integral with the perimetral edge portion protrude outwardly from said perimetral portion a distance greater than the length of said adjacent paddle-shaped spurs.

34. A device as defined in claim 33, wherein said protruding thin webs are disposed between all adjacent pairs of paddle-shaped spurs on each of said side portions.

35. A device as defined in claim 33, wherein each of said protruding thin webs between adjacent paddle-shaped spurs is attached only to said perimetral portion and is disposed loose from said adjacent spurs.

36. A device as defined in claim 33, wherein each of said protruding thin webs between adjacent paddle-shaped spurs is attached to said perimetral portion and is also secured to said adjacent spurs.

37. A device as defined in claim 1, wherein said central body includes a perimetral rim with membrane means across the inner diameter of said perimetral rim.

38. A device as defined in claim 37, wherein said membrane means is thinner than said perimetral portion and is connected to both side portions and provides openings adjacent said nose portion and said tail portion.

39. A device as defined in claim 38, wherein said membrane means is connected to each side portion via a plurality of narrow membrane portions.

40. A device as defined in claim 37, wherein a multiplicity of narrow spaced apart membrane portions interconnect a central portion of said membrane means to said perimetral rim.

41. A device as defined in claim 37, wherein the planar configuration of all of said plurality of paddle-shaped spurs on each side portion are disposed coplanar with said perimetral portion.

42. A device as defined in claim 37, wherein at least a portion of said paddle-shaped spurs have an inclination toward said tail portion.

43. A device as defined in claim 37, wherein all of said paddle-shaped spurs have a retrograde inclination toward the tail portion.

44. A device as defined in claim 37, wherein the paddle-shaped spurs closest to said nose portion are longer than the spurs closest to said tail portion, and have retrograde curvature toward said tail portion.

45. A device as defined in claim 37, wherein pull line means are secured to said intrauterine device to enable removal after insertion.

46. A device as defined in claim 45, wherein said pull line means are secured to said nose portion.

47. A device as defined in claim 37, wherein a plurality of rows of paddle-shaped spurs are disposed on each of said side portions.

48. A device as defined in claim 47, wherein thin webs integral with the outer edge of said perimetral portion are disposed on each side portion between at least two adjacent ones of said paddle-shaped spurs on each of said side portions.

49. A device as defined in claim 37, wherein thin webs integral with the outer edge of said perimetral portion are disposed on each side portion between at least two adjacent ones of said paddle-shaped spurs on each of said side portions.

50. A device as defined in claim 49, wherein said thin webs are disposed between all adjacent pairs of said paddle-shaped spurs on each of said side portions.

51. A device as defined in claim 49, wherein each of said thin webs between adjacent paddle-shaped spurs is attached only to said edge of said perimetral portion and is disposed loose between said adjacent spurs.

52. A device as defined in claim 49, wherein each of said thin webs between adjacent paddle-shaped spurs is attached to said edge of said perimetral portion and is also secured to said adjacent spurs.

53. A device as defined in claim 49, wherein each of said thin webs are shorter than the length of said adjacent paddle-shaped spurs.

54. A device as defined in claim 53, wherein each of said shorter thin webs between adjacent paddle-shaped spurs is attached only to said edge of said perimetral portion and is disposed loose from said adjacent spurs.

55. A device as defined in claim 53, wherein each of said shorter thin webs between adjacent paddle-shaped spurs is attached to said edge of said perimetral portion and is also secured to said adjacent spurs.

56. A device as defined in claim 52, wherein said thin webs integral with the perimetral outer edge protrude outwardly from said perimetral portion a distance greater than the length of said adjacent paddle-shaped spurs.

57. A device as defined in claim 1 made from a plastic material comprising an ethylene vinyl copolymer.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,756,228

DATED : September 4, 1973

INVENTOR(S) : Irwin S. Lerner

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

Column 3, line 54, delete "80 (FIG. 9)"

Column 3, line 61, delete "for FIG. 10".

Signed and Sealed this

twenty-eight Day of *October 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,756,228 Dated September 4,1973

Inventor(s) Irwin S. Lerner

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

Column 1, on the title page, the publication "Dalkon Shiied" should be --Dalkon Shield--.

Column 6, line 17, change "hte" to --the--.

Column 7, line 63, change "is" to --if--.

Column 9, line 41, change "uterur" to --uterus--.

Col. 9, line 46, "Theinvention" should be --The invention--.

Signed and sealed this 25th day of December 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents

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