

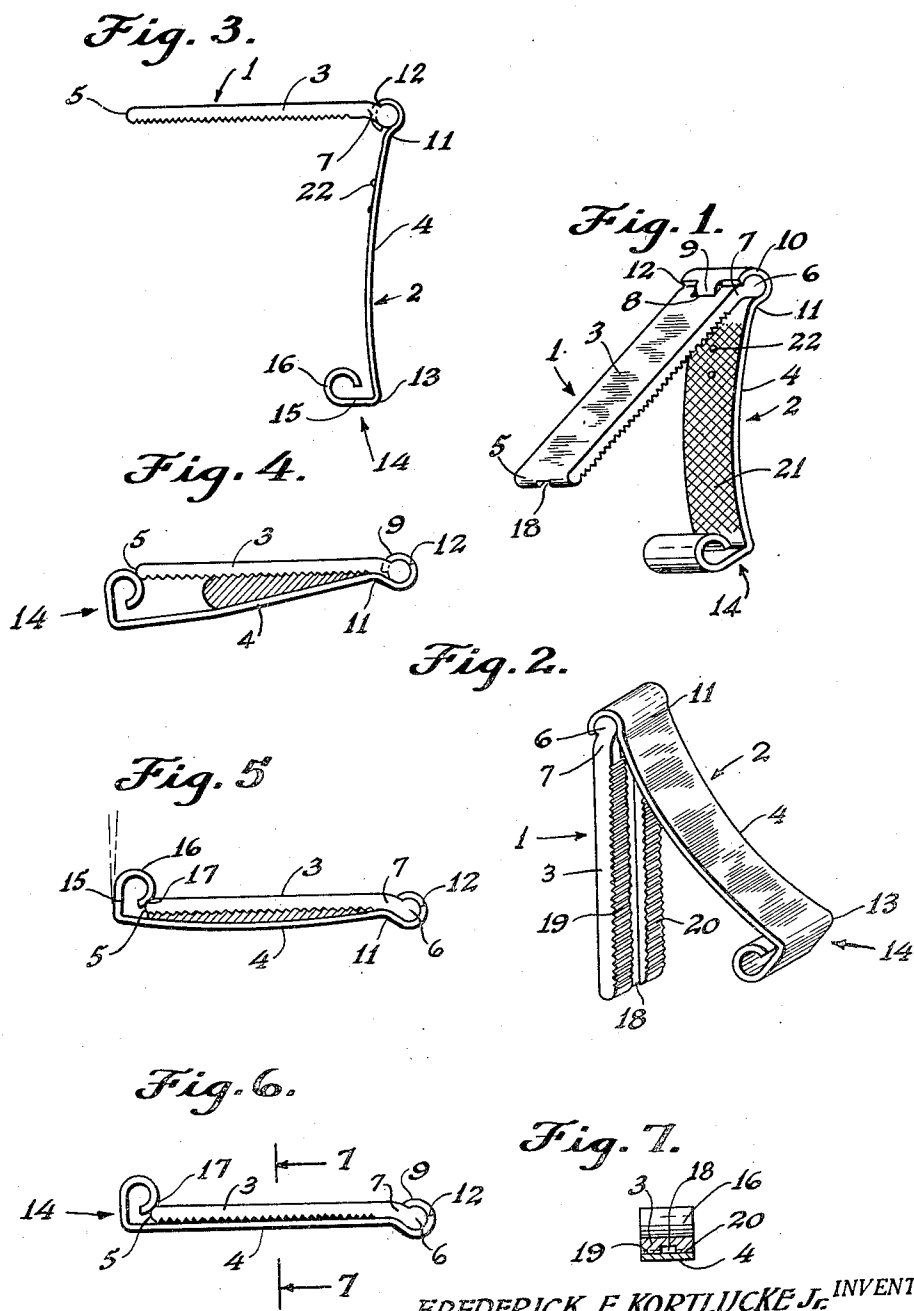
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CLAMPING DEVICE

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CLAMPING DEVICE

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This invention relates to clamping devices, and more particularly to such devices for use in the surgical field as an umbilical cord clamp, and in other fields where the same type of holding action is desired.

Clamps heretofore devised for such purposes as clamping the umbilical cord, have either been ineffective or too cumbersome to be applied with the necessary facility. In other words, they have either required at least two hands for their application, or, if made for one hand application, have neither had sufficient clamping force, nor sufficient insurance against accidental displacement, for the exacting requirements of this use. The need for an effective clamp which can be simply applied and will do the job properly, has particularly impressed itself upon us through our knowledge of obstetrics. Not being able to find one that properly met the requirements, we set about devising one that would be suitable and have succeeded in doing so as hereinafter described.

The clamp of our invention, though suitable for general application, will be described from the point of view of its use in the clamping of umbilical cords, since such use is a most exacting one, and is believed to include at least all the factors that would be met in other uses to which the clamp might be put. The limitations of the prior art clamps have precluded general surgical acceptance of clamps, as against the time honored ligating technique, despite the long recognized inconveniences and insecurity of that technique. Rarely would one have both hands available to operate a two handed clamp, while the single handed clamps of the prior art had various defects. They would not open wide enough to be easily applied, they had a closing action which tended to force the cord out of the clamp, and, when closed, they did not maintain sufficient sustained clamping action to be effective. In addition, the locking means on the prior art single handed clamps were either awkward to engage with one hand, or did not lock tight enough to give positive assurance that the clamp would not fly open. Finally, the removal of the prior art clamps was often difficult, if they operated so as to clamp effectively, and they were difficult to sterilize and particularly to clean properly.

The clamp of our invention is believed to overcome the prior art difficulties and eliminate their shortcomings so completely, that general surgical acceptance of the clamps of our invention is clearly indicated. Our clamp is of light weight

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construction and is so designed that it can be applied with one hand, and without danger of lacerating the obstetrician's gloves. It opens wide enough to be quickly and conveniently applied over cords of any of the sizes encountered. Our clamp will not lacerate the cord, but still will enable the effective clamping of it without slippage. Considering the clamp as one to be applied to cords of a range of different sizes, it is important to note that the clamping action is not diminished, but rather the contrary, in proportion to the volume of material being clamped. Similarly, the holding power of the locking means of our clamp is increased, rather than diminished, in direct relation to the volume of the material clamped. This locking means, however, can be readily disengaged with one hand, and the clamp, when opened up, can be easily cleaned and effectively sterilized. Hence, it can be used over and over again, as provided for by its sturdy, reliable construction. Other improvements incorporated in our clamp will become apparent as the detailed description of our invention unfolds.

It is accordingly a principal object of our invention to provide a clamp of the type indicated, which can be easily and speedily applied, and will provide a reliable clamping action.

Another object of the invention is to provide such a clamp which can be easily applied and removed with one hand.

Still another object of the invention is to provide such a clamp which maintains a continuous pressure on the material clamped, and can be locked in place with a locking force which is increased in direct relation to the thickness of the material being clamped.

A further object of the invention is to provide such a clamp which is so sturdy and durable that it can be re-used any number of times, and is so simple that it can be easily sterilized for such re-use.

Still further objects of the invention concern the gradual, and increasing flattening action, provided for in the closing of the clamp, the continuous pressure exerted by the clamp when closed, and the prevention against materials slipping out of the clamp as it is closed.

Other and more detailed objects of the invention will become apparent as the description of the accompanying drawing proceeds. In that drawing:

Figure 1 is a perspective view of the clamp of our invention, showing the same in open position, with the inside face of the resilient arm thereof visible.

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Figure 2 is a similar view, looking from the opposite direction, to show the inner face of the rigid arm of the clamp.

Figure 3 is a side elevation showing the clamp in full open position.

Figure 4 is another side elevation showing material within the clamp, and with the clamp approaching closed position.

Figure 5 is a view similar to Figure 4, but showing the clamp after it has been fully closed and locked.

Figure 6 is a view similar to Figure 5 but illustrating the position taken by the arms and locking means of the clamp, when the same is closed, and locked, without any material clamped therein, and

Figure 7 is a section taken on line 7-7 of Figure 6 looking in the direction of the arrows.

Considering the drawing in detail, it will be seen that the clamp of our invention consists of two principal parts, or arms, as shown generally at 1 and 2 in the drawing. The body part of the arm 1, as indicated at 3, is shown as substantially thicker, than the body part 4 of the arm 2. This showing is indicative of a rigid construction, as against the resilient one of the part 4. Obviously, however, the relative thicknesses will vary in accordance with the characteristics of the materials out of which the parts are made. Fundamentally the arm 1 should have its body part 3 made of rigid material sufficiently thick to prevent its bending when material is secured in the clamp. The part 3 terminates at one end in a somewhat rounded portion 5, and at its other end in a hinge pintle 6. The pintle 6 extends throughout the width of the body part but is slightly offset from the longitudinal extent thereof, by means of inclined portion 7.

The inclined portion 7, as best shown in Figure 1, is perforated rectangularly centrally of its width, as seen at 8, to receive the tongue, or tab, 9 extending centrally from the free edge of the hinge barrel 10 provided at one end of the resilient arm 2. In the normal relaxed position of the resilient arm 2, its body part 4 extends directly into the beginning of the hinge barrel 10, without any more than the slight off-set shown at the joining portion 11. Nevertheless, the hinge barrel 10 embraces sufficient of the pintle 6 to furnish a strong bearing relationship. The extent of the surface of the pintle 6 engaged by the barrel 10 is necessarily limited so that the arm 2 can swing out at approximately a 90° angle with respect to the arm 1 before the free edge 12 of the barrel 10 engages the portion 7. This wide opening of the clamp is a substantial improvement over prior art constructions. It greatly facilitates the application of the clamp to an umbilical cord, or to any other material being clamped therein, enables the clamp to be easily applied with one hand and enables the removal of the clamp in like manner.

Considering the showing in Figures 1, 2 and 3, it will be clearly apparent therefrom that the body part 4 of the resilient arm 2 is bowed inwardly, i. e. towards the arm 1, longitudinally thereof. This inward bowing is in the form of a smooth, though somewhat flat, curve from portion 11 to the opposite extent 13 of the part 4. This bowing enhances the spring action of the arm 2, since it must be overcome to the extent of flattening the part 4 even though the clamp is closed when empty, as shown in Figure 6. The reversing of the curve of this bowing when material of substantial thickness is to be secured, being

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against the natural set of the spring arm, creates a reaction in the spring. This reaction causes a continuous pressure to be exerted on the material secured in the clamp. Thus, if the material in the clamp dries out and shrinks, the spring arm 2 will follow it and continue to press it against the arm 1.

The cantilever means for locking the free ends of the clamp together is shown generally at 14. This locking means commences at the terminal end 13 of the body part 4, where the portion 15 extends generally laterally from said body. The portion 15 extends some distance away from the body 4 and terminates in an inward curl 16 which is directed back towards that body. The flexibility of the portion 15 and of the curl 16 enables the locking means to be snapped into closed, locking position. That position is well maintained, for the position and radius of the curl 16 are such that its innermost extent well overlies part of the body portion 3, inward of the end 5. Hence the actual engagement of the curl 16 with the body portion 3 takes place at the position 17, well around beyond the innermost extent of that curl. Strong resistance is accordingly set up to any unintentional disengagement of the locking means.

The position 17 shifts downward along the curl 16 as increasing thicknesses of material are secured in the clamp. This is due to the fact that as the body part 4 is bowed outwardly in response to material held in the clamp, the arm 15 is tilted inwardly with respect to the end 5 of the body 3. Hence the curl 16 "creeps" further over the upper surface of the body 3 and the engaging position 17 is further under the curl. Clearly the more the curl 16 overlies the body 3 the more secure will be the locking action of the member 14. This feature is illustrated by the different locations of the line 17 in Figures 5 and 6 and by the angle of inward tilt of 15 shown diagrammatically in Figure 5.

Intentional disengagement of the locking means 14 can easily be accomplished with one hand by merely pushing outward on the curl 16. Once this curl is pushed outward far enough for its innermost face to clear the outermost portion of the face 5, the clamp will normally spring itself open through the tendency of the body 4 to resume its original inwardly bowed shape.

A clamp having the gripping characteristics just described, would be effective for most clamping operations, even though the inner surfaces of the arms 1 and 2 were perfectly plain and smooth. In the clamping of umbilical cords, however, one is dealing with slippery, jelly-filled members, which may vary in diameter from one-fourth of an inch to one inch. Being so constituted, the cords have a tendency to slide or squeeze out of the clamp, as the clamp is closed, or at least to squeeze down into position where part of the cord extends out the open end and blocks the action of the locking member. This undesirable possibility is guarded against in the clamp of our invention, by particular formations applied to the opposing faces of the arms 1 and 2. The inside of the arm 1 is formed with a center channel 18 extending throughout the length of its body 3 and separating the inner face of that body into portions 19 and 20. The portions 19 and 20 have their outer faces serrated transversely throughout their length with means such as surgical teeth, or have them provided with a medium knurl. Hence, the edging of the channel 18 prevents transverse slippage of the cord while

longitudinal slippage is guarded against by the facing of portions 19 and 20.

The inner surface of the body portion 4 is formed to cooperate with the formations on the inner face of the body 3 just described. As a general safeguard that surface is knurled or otherwise uniformly roughened as shown at 21, to cooperate with the serrations on the portions 19 and 20. As a special feature to catch and hold umbilical cords, however, the inner surface of the arm 2 is also provided with one or more upstanding projections 22. These projections are aligned with the channel 18 formed in the arm 1 and are of a size to fit within it. No matter how slippery the cord, the action of the projections 22 pressing into it, and in turn forcing portions of it into the channel 18, is just what is needed to hold the cord from tending to slip out of the clamp, while the same is being closed. Here again, is additional assurance that the clamp can be effectively applied with one hand by a straight forward squeezing action.

From the foregoing description of the structure and operation of the clamp of our invention, its adaptability to a variety of clamping operations will be readily appreciated. A description of it, as related to the clamping of umbilical cords, is believed to show its adequacy for meeting the most severe tests, such cords being extremely slippery on the outside, being filled with a jelly-like substance, and being readily subject to fracture and abrasion. Furthermore, they must clamp effectively when applied and maintain their effectiveness as long as they remain on. Inasmuch as the clamp of the invention meets all of the requirements in this exacting field, it is believed obvious that the use of it in less critical situations is clearly indicated. Furthermore, though we have merely shown and described a preferred example of the invention it is to be understood that such changes in detail as may occur to one skilled in the art may be resorted to without departing from the spirit of the invention or the scope of the claims which follow.

Having described our invention what we claim as new and desire to obtain Letters Patent for is:

1. A clamp of the character described, comprising a pair of overlying arms, one of said arms being rigid and non-yielding, and the other of said arms being resilient, one of said arms being bowed toward the other arm longitudinally thereof, means connecting said pair of arms together at one end thereof, and means carried by said resilient arm to releasably inter-engage said arms at the other end thereof said inter-engaging means including a laterally extending projection on said other end of said resilient arm, said projection extending towards said rigid arm, said projection terminating in an inwardly extending resilient element, said resilient element engaging the free side of the other end of said rigid arm when the clamp is in closed position.

2. A clamp of the character described, comprising a pair of elongated members arranged to overlie each other longitudinally, pivotal means inter-engaging a pair of ends of said respective members, one of said members being rigid and non-yielding, the other of said members being longer than said rigid member and being resilient and bowed concavely throughout its length toward said rigid member, and an integral resilient catch extending from the free end of said resilient member to engage the free end of said rigid member past the longitudinal center line thereof when said resilient member is flattened out against said

rigid member, whereby as the effective length of said resilient member is decreased on outward bowing thereof said catch will engage said rigid member further beyond said longitudinal center line and the holding power of said catch will thus be increased.

3. A clamp of the character described comprising, a pair of overlying arms, one pair of ends of said arms being hinged together for swingable movement of the arms towards and away from each other, one of said arms being thick and rigid, the other of said arms being formed of resilient material, said resilient arm being bowed throughout its length towards said rigid arm, said resilient arm being longer than said rigid arm and being formed on its free end with a laterally extending clip to receive and overlie the free end of said rigid arm, said laterally extending clip including an inwardly curled resilient portion, said resilient portion terminating in a position spaced from the body of said resilient arm to a sufficient extent to partially overlie the end of said rigid arm when said catch is in closed position.

4. A clamp of the character described, comprising a pair of elongated members, one of said members being formed of rigid, non-yielding material, the other of said members being formed of resilient material, hinge means connecting the inner end of said rigid member with the inner end of said resilient member together to provide swinging movement of said members toward and away from each other, said resilient member being longer than said rigid member and when in relaxed position being bowed throughout its length toward said rigid member, a catch element on the outer end of said resilient member, said catch element extending away from said resilient member in the same direction as the bow therein, said catch element including an upstanding base portion and an intumed resilient curled portion, the inner end of said curled portion being spaced from the body of said resilient member a slightly shorter distance than the thickness of said rigid member, said catch member, when said resilient member is straightened out overlying the end of said rigid member and said curled portion extending over the remote inner edge of the outer end of said rigid member, whereby as the bowing of said rigid member is reversed due to the clamping of material between said rigid and resilient members, said curl will creep further around the free end of said rigid member to increase the clamping effect of said catch member.

5. In a clamp of the character described, a pair of elongated arms, one of said arms being rigid and the other being resilient, one end of each of said arms being hinged together so that said arms will swing toward and away from each other, said resilient arm when in relaxed position being bowed longitudinally toward said rigid arm, a laterally extending projection on the free end of said resilient arm and terminating in an inwardly extending resilient deformable portion, said laterally extending projection being formed to embrace the free end of said rigid arm and said laterally extending projection inclining progressively inwardly toward the hinged ends of said arms as said resilient arm is changed from a bowing towards said resilient arm to a bowing away therefrom.

6. A clamp of the character described comprising, a pair of overlying arms, one of said arms being rigid and the other being resilient, and one end of each of said arms being hinged together so that they may swing toward and away from

each other, said resilient arm being substantially longer than said rigid arm and when in relaxed position being longitudinally bowed toward said rigid arm, an automatically operable resilient latch on the free end of said resilient arm, said rigid arm and a resilient curled portion at the end of said extending portion, said curled portion extending in the direction of said hinge, said curled portion being spaced from the body of said resilient arm a sufficient distance to receive the free end of said rigid arm therebetween, said curled portion approaching said hinged end as said resilient portion is straightened out and bowed reversely whereby the inclusion of material between said rigid arm and said resilient arm will increase the holding action of said curled portion in relation to the outward bowing of said resilient arm caused by such material.

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Certificate of Correction

Patent No. 2,498,372

February 21, 1950

FREDERICK F. KORTLUCKE, JR., ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

~~Column 6~~, line 33, for the words "longer that" read *longer than*;
and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 20th day of June, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.