United States Patent [19]

Wilder et al.

[11] **3,729,006**

[45] **Apr. 24, 1973**

[54] **DISPOSABLE SURGICAL RETRACTORS**

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[22] Filed: **May 27, 1971**

[21] Appl. No.: **147,387**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 802,343, Feb. 26, 1969, abandoned.

[52] **U.S. Cl.** ..... **128/303 R**

[51] **Int. Cl.** **A61b 17/02**

[58] **Field of Search** 128/20, 303

[56] **References Cited**

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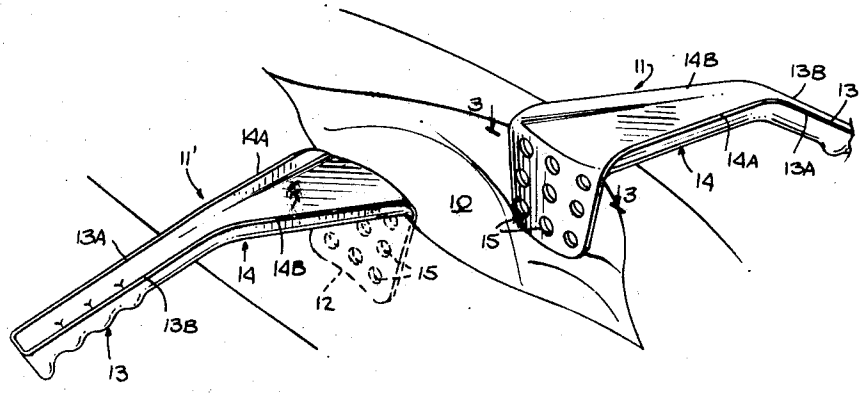
[57] **ABSTRACT**

A hand-held surgical retractor fabricated of resilient plastic material, the retractor being light-weight, glare-free and functionally superior to existing metallic instruments. The retractor includes a non-skid blade whose inner surface is slightly concave, the blade having an array of circular apertures therein whereby when the blade is pressed against tissue, the tissue bellies into the blade to provide a contact therebetween which resists displacement even when low pulling forces are exerted on the retractor.

6 Claims, 6 Drawing Figures



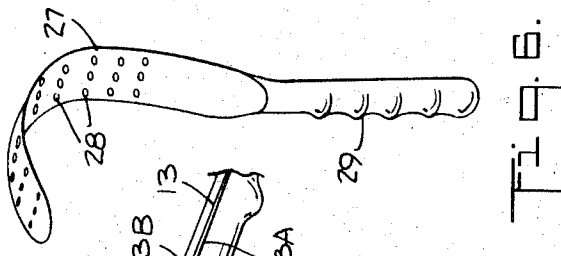


Fig. 6.

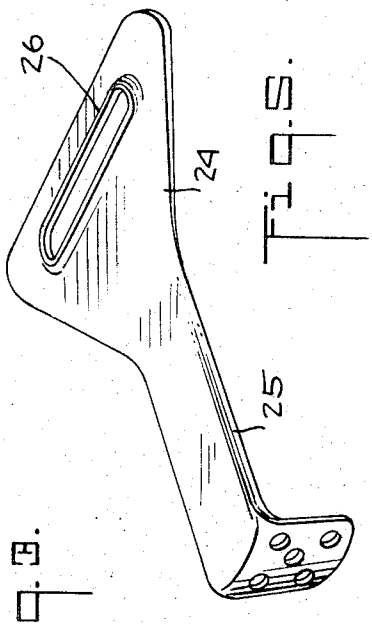


Fig. 5.

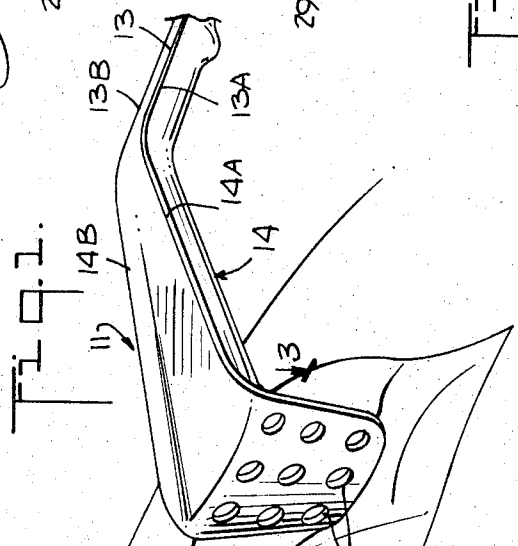


Fig. 1.

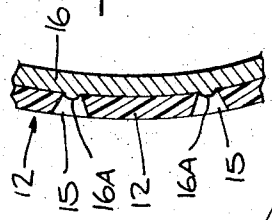


Fig. 3.

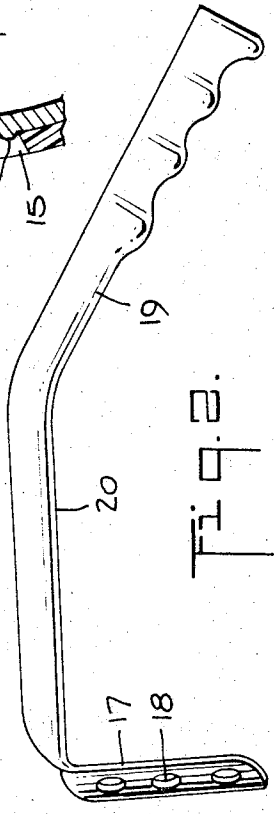


Fig. 2.

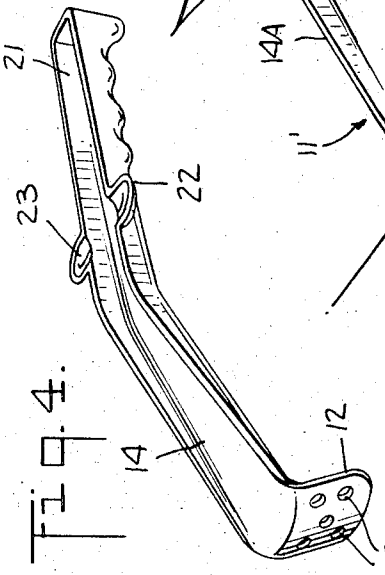
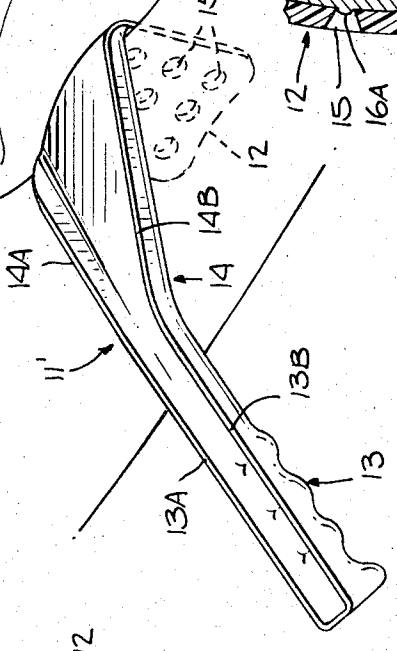


Fig. 4.



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DISPOSABLE SURGICAL RETRACTORS

RELATED APPLICATION

This application is a continuation in-part of application Ser. No. 802,343, filed Feb. 26, 1969, and now abandoned.

This invention relates generally to hand-held retractors for surgery, and more particularly to an improved retractor fabricated of resilient, glare-free plastic material, the retractor being light-weight and functionally superior to existing instruments.

In modern surgical procedures, adequate anatomical retraction is of primary importance in carrying out safe and successful surgery. In practice, a difficult technique may be facilitated by adequate exposure, whereas poor exposure may give rise to excessive trauma to the tissues, blind dissection, and possible injury to vital structures. The lack or loss of exposure is the most common cause for disruption of an operating procedure.

The factors which make for good exposure are proper incision, anatomical mobilization of specific organs, and well-directed retraction. The first two factors depend in large part on the skill of the operating surgeon, while the third factor is determined not only by the competence of the surgical assistants handling the retractors, but also on the inherent functional characteristics of the retractors in use.

The basic components of a hand-held retractor are a blade which engages the tissue, a handle, and a shank connecting the handle to the blade. The shape and contour of the blade are dictated by the intended function of the retractor and depend on the particular organ, system or area of the body on which surgery is to be performed. Thus a blade designed for an abdominal operation is generally larger than and somewhat differently shaped from one intended for a more superficial operation.

A retractor must be adapted to protect tissue adjacent the operative site from injury, and to enable the surgeon to direct his attention to the particular structures undergoing surgical removal or repair. The surfaces of the retractor blade should therefore be smooth and free of sharp edges to avoid damage to the delicate tissues in contact therewith. At the same time, the blade should offer resistance to displacement so that its position will be maintained without having to exert excessive pressure thereon.

Existing metal retractors fail to meet both requirements, in that while their smooth blade surfaces are free of sharp edges, they are subject to slippage. Moreover, existing blades usually have a curvature which bends outwardly with respect to the tissue, so that the limited area of contact therebetween is rounded and does not encompass the entire blade surface.

The correct use of a retractor requires that it be held by its handle to effect maximum leverage, steady retraction, and good exposure. Yet many assistants tend to grasp a retractor along its shank, this grip resulting in poor exposure as well as tissue injury and devitalization. Ideally, the handle of a retractor should be designed to afford a firm and comfortable grip, giving a controlled pull without undue muscular tension. In this way the assistant is able to maintain retraction for prolonged periods without relaxing the position and with little fatigue.

But standard retractors fall far short of this ideal, for being made of stainless steel, their weight and balance are such that they are hard to manipulate and hold without fatigue. Consequently, the assistant, in an attempt to lighten his load, will grasp the retractor by the shank, despite the loss of good blade contact and the mechanical disadvantages occasioned by such grip.

The use of stainless steel gives the retractor a heaviness and strength entirely out of proportion to the simple mechanical function it is called upon to perform, but it also makes possible effective sterilization. Retractors of stainless steel, because of their excessive weight, cannot be made in large sizes, as some sites require, for such sizes are too unwieldy and are difficult to handle. When, therefore, the area of exposure is very large, it becomes necessary to employ several metal retractors, and this in turn calls for several assistants, thereby crowding the operating table, and to some extent impairing the efficiency of the surgical procedure.

Another serious drawback of stainless steel retractors is that they have a highly reflective surface which produces glare under high-level illumination. Since surgical procedures are carried out under intense light, the resultant glare is disturbing to the surgeon, and as he changes position in the course of an operation, he may be distracted by sudden flashes of reflected light from the retractors. Moreover, stainless steel is thermally highly conductive and quickly absorbs heat from the tissue in contact therewith, thereby adversely affecting the tissue temperature and possibly causing thermal shock.

Because stainless steel retractors are costly, the typical hospital facility cannot afford to maintain a large inventory thereof, and where the hospital has many operating rooms which share the existing inventory, it is not an uncommon experience to find that when most of the operating rooms are in concurrent use, the supply of retractors is insufficient. Moreover, since such retractors require careful sterilization, this further delays the re-use of available instruments.

In view of the foregoing, it is the main object of this invention to provide a hand-held surgical retractor which overcomes the drawbacks incident to standard retractors, and which is well-balanced, light-weight, and functionally superior to existing instruments of the same type.

More specifically, it is an object of this invention to provide a retractor formed of sterile, moldable plastic material whose surface is smooth and yet of very low reflectivity, thereby avoiding glare, the retractor having a non-skid blade that firmly engages tissue at the operative site and affords protection therefor without injury.

A significant feature of a retractor in accordance with the invention, is that because it is both strong and light-weight, it may be made in much larger sizes than heretofore feasible with standard instruments, so that fewer assistants are required in a surgical procedure for effecting adequate exposure.

A salient advantage of the present retractor is that being fabricated of inexpensive plastic material, it is disposable and therefore needs no re-sterilization. One may, therefore, at low cost, equip a surgery with a large inventory of retractors in sterile condition for immediate use, and sufficient to meet heavy or unexpected demands. Another advantage of a plastic as against a metal retractor, is the absence of thermal shock.

Also an object of the invention is to provide a plastic retractor with a handle in the form of a pistol grip, which facilitates a firm grasp of the retractor with optimum leverage for prolonged periods, without undue fatigue or tension.

Briefly stated, these objects are accomplished in a retractor whose blade, shank and handle are integrally formed of sterile, resilient plastic material of high strength, the surface of the material having a matte finish to minimize glare. The blade is generally rectangular in form and is inwardly curved with respect to the tissue to be engaged thereby, the blade having an array of circular apertures formed therein whereby when pressed against the tissue, the tissue bellies into the blade, small knobs of tissue being forced into the apertures to provide contact therebetween offering high resistance to displacement.

For a better understanding of the invention, as well as other objects and further features thereof, reference is made to the following detailed description to be read in conjunction with the annexed drawing, wherein:

FIG. 1 is a perspective view of an operative site which is adequately exposed by means of a pair of plastic retractors in accordance with the invention;

FIG. 2 is a perspective view of another embodiment of a plastic retractor according to the invention;

FIG. 3 is a section taken in the plane indicated by line 3—3 in FIG. 1;

FIG. 4 is still another embodiment of a plastic retractor;

FIG. 5 is yet another embodiment of a plastic retractor; and

FIG. 6 shows an embodiment of a plastic refractor having a curved blade.

Referring now to FIG. 1, there is shown a surgical site **10** produced by an incision. Exposure is effected by a pair of retractors **11** and **11'**, whose blades engage the tissue along opposing walls of the site, the retractors being handled by surgical assistants under the direction of the surgeon.

Each retractor **11** is formed by three components which are integral with each other and are fabricated of a moldable plastic of high-strength, resilient material, such as nylon,polyethylene, or polycarbonates having high impact strength. Polycarbonates have the greatest resistance to deformation under load of any thermoplastic material currently known. The three components are a blade **12**, a handle **13**, and a shank **14**, connecting the handle to the blade. Formed in blade **12** is an array of circular apertures **15**. The entire structure may be made by well-known injection molding techniques.

Blade **12** is generally rectangular in form, the lower corners thereof being rounded to avoid sharp edges. The blade is slightly curved inwardly with respect to the tissue engaged thereby, whereby, as shown in FIG. **3**, the tissue **16** bellies into the concave inner surface of the blade to make contact therewith throughout the entire area of the blade. Since pulling pressure is applied, small knobs **16A** of tissue enter the apertures **15**, whose walls are preferably tapered outwardly toward the exterior surface of the blade to permit the knobs to expand somewhat within the aperture. As a consequence, a skid-resistant engagement is effected between the blade and tissue, which prevents slippage or displacement of the blade, even with relatively low pulling pressure. Because the apertures are circular, they are free of sharp corners or discontinuities, and in no way damage delicate tissue.

Shank **14** is at right angles to blade **12**, and is provided with raised reinforcing ribs **14A** and **14B** extending along the longitudinal sides thereof, the ribs at one end merging into the corresponding edges of the blade **12**, and at the other end merging into the reinforcing ribs **13A** and **13B** of handle **13**.

The undersurface of handle **13** is corrugated to form a finger grip. The handle is inclined downwardly with respect to shank **14** at an angle comparable to that of a pistol grip. The angular relationship is such that when the handle is grasped by the fingers of the hand, the shank then extends in the horizontal plane above the hand, and the blade lies in the vertical plane, which is the optimum posture for retraction.

Because of reinforcing ribs **13A** and **13B**, a long channel is formed in the upper surface of the grip, into which one may place the thumb of the hand to thereby maintain the proper orientation of the retractor and resist angular displacement. The outer surface of the plastic is provided with a matte finish to avoid reflectivity. To further reduce reflectivity, color may be added to the plastic, the choice of color depending on the light source used for surgery. Thus where the source is rich in the blue region, the color of the plastic may be yellow to absorb rather than to reflect incident light.

When pulling on the retractor, the maximum bending stress is imposed at the junction of the blade **12** and shank **14**, in a direction seeking to deflect the blade upwardly toward the horizontal plane. But since the junction is curved inwardly rather than straight, and terminates in shank ribs **14A** and **14B**, the bending stress is not concentrated, but is distributed so that there are lateral as well as vertical vectors of force. Consequently, even though the retractor is made of lightweight plastic, it would take forces far beyond that normally exerted in retraction to break off the blade at the shank.

The retractor shown in FIG. **2** is essentially the same as that illustrated in FIG. **1**, and functions in the same manner, except that the blade **17** is longer and thinner, the array of apertures **18** therein consisting of a vertical row of only three holes. In FIG. **1**, the shank is wedge-shaped and converges from the relatively broad blade to the narrower handle. But in FIG. **2**, the width of the blade **17** is no greater than handle **19** so that the interconnecting shank **20** is untapered.

In FIG. **4**, the retractor structure is similar to that in FIG. **1**, save that the handle **21** is provided with a pair of laterally-extending ears **22** and **23** which serve as thumb rests for the left or right hand, whichever is in use. These rests prevent rotational movement of the retractor.

In the above embodiments, the weight of the handle is made close to that of the blade, this being readily accomplished, since the handle is hollow rather than solid. This makes possible a balanced structure and facilitates handling.

In FIG. **5**, the retractor handle **24** has a triangular configuration whose apex portion merges into shank **25**. An elongated opening **26** is formed adjacent the base of the handle to admit the fingers of the hand. The

advantage of this alternative design for a handle, is that it not only affords a comfortable grip, but by its very nature resists rotation. In a grip as shown in FIG. 1, the fingers surround the grip and thereby form a socket within which it may be possible to rotate the retractor. But in the FIG. 5 construction, the only rotation permitted is that allowed by the wrist of the hand.

In the embodiment shown in FIG. 6, the retractor blade 27 is curved, as is required for certain techniques, and is provided with an array of holes 28, the handle 29 being generally of the type shown in FIG. 1. It is to be noted that the blade shape in a retractor according to the invention, need not be rectangular, but may be oval or in any other appropriate configuration.

While circular apertures represent the preferred form, other shapes may be used, such as oval or elliptical, but in all instances the walls of the apertures should flare outwardly so that the inner edge of the aperture in contact with the tissue forms a gripping lip to resist displacement. Rectangular apertures are objectionable because of their sharp corners. In practice, a gauze pad may be interposed between the blade and tissue, in which event the gause will be forced into the apertures to resist displacement.

Because of the side walls on the shank and handle, these components are effectively hollow, and it becomes possible by proper complementary shaping of the retractors to fit one within another for stacking purposes. This facilitates storage and shipping of retractor supplies.

SUMMARY OF FEATURES

Feature A. Absence of Siding:

Because the retractor blade has an array of apertures formed therein, when the blade is manually pulled against a bone-free tissue surface, the tissue bellies into the blade to form a contact therebetween which resists lateral or vertical sliding. Such sliding is experienced with conventional blades and causes trauma, as well as attendant frustration to the surgeon.

Feature B. Yieldability and Light Weight:

A plastic retractor blade in accordance with the invention is relatively flexible, yielding as necessary to muscle resistance of the patient, while softly holding the tissues. Rigid steel retractor blades of the type in present use give rise to tissue damage. Moreover, the light-weight polymer of which the retractor is formed makes it possible to hold the retractor in place for a prolonged period with fatigue. Also, it makes it feasible to manipulate a single large-scale retractor, whereas with steel retractors, larger sizes produce excessive weight, making handling very difficult.

Feature C. Absence of Glare:

Reflective light, traditionally beamed from stainless-steel retractors and distracting to the surgeon, is reduced below an annoyance threshold with the use of a retractor in accordance with the invention, having a light-absorbing, glare-free finish.

Feature D. Improved Leverage:

With the pistol-grip handle in which the down angle between the handle and the shaft is preferably 30°, the retractor in accordance with the invention is held with the wrist in a mechanically balanced position of a radial deviation rather than ulnar. Due to the synergistic action of the forearm muscles, finger flexion is stronger when the wrist is deviated radially. The leverage thus established means less effort is required to maintain a comfortable, yet firm hold. Maximum poise and comfort are therefore derived from the structure of the hand grip itself.

While there have been shown and described, preferred embodiments of displsable surgical retractors in accordance with the invention, it will be appreciated that many changes and modifications may be made therein without, however, departing from the essential spirit of the invention.

We claim:

1. A light-weight, glare-free, hand-held surgical retractor adapted securely to engage a bone-free tissue surface without injury thereto, said retractor comprising the following components: a blade, a handle, and a shank interconnecting the handle to the blade, all of the components being formed integrally of a resilient, high-strength, opaque polymeric plastic material having a non-reflective surface to prevent glare from light impinging thereon, the blade having a generally rectangular shape, said shank being attached to the blade adjacent the center of one the long edges thereof and extending at approximately a right angle from the general plane of the blade, said rectangular blade being slightly concave with respect to tissue engageable thereby, and having an array of apertures formed therein, whereby when the blade is manually pulled against the bone-free tissue surface, the tissue bellies into the blade to form a contact therebetween which resists displacement.

2. A retractor as set forth in claim 1, wherein said shank is formed along its sides with raised reinforcing ribs which merge into the edges of the blade.

3. A retractor as set forth in claim 2, wherein said handle is in the form of a pistol grip which extends at an angle of about 30° with respect to said shank on the same side thereof as the blade, whereby when the handle is held by the fingers of a hand to place the blade in the vertical plane, the shank lies in a horizontal plane above the hand.

4. A retractor as set forth in claim 1, wherein the walls of said apertures are tapered to flare from the to the surface of the blade opposite the shank.

5. A retractor as set forth in claim 1, wherein said shank is provided with a pair of lateral ears to serve as thumb rests.

6. A retractor as set forth in claim 1, wherein said handle has a flat triangular configuration and is provided with an elongated opening parallel to the base thereof.

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