

[54] CLIP APPLICATOR

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29/211 R

[56]

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Primary Examiner—Thomas H. Eager

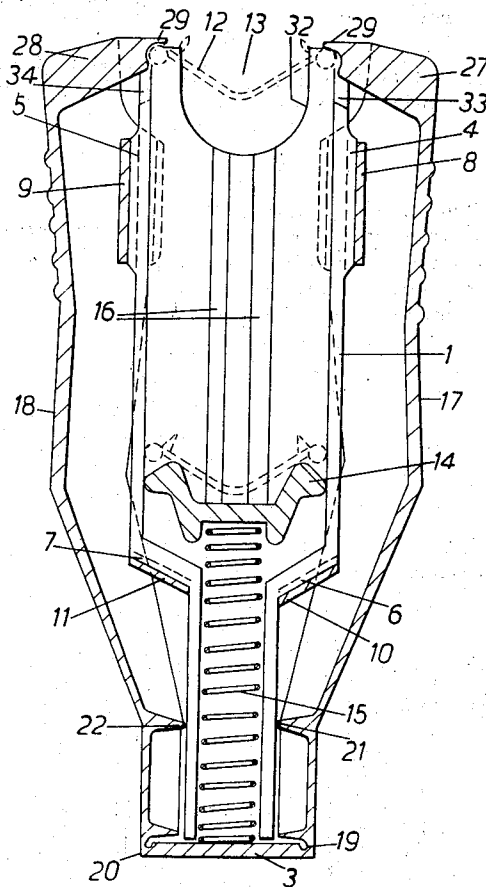
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[57]

ABSTRACT

A wound clip applicator comprising a magazine for wound clips and forceps jaws, which may be squeezed together to bend a clip into a desired position across a wound and release the clip from the magazine, in which the magazine and forceps jaws are composed of a single piece of plastics material.

9 Claims, 4 Drawing Figures



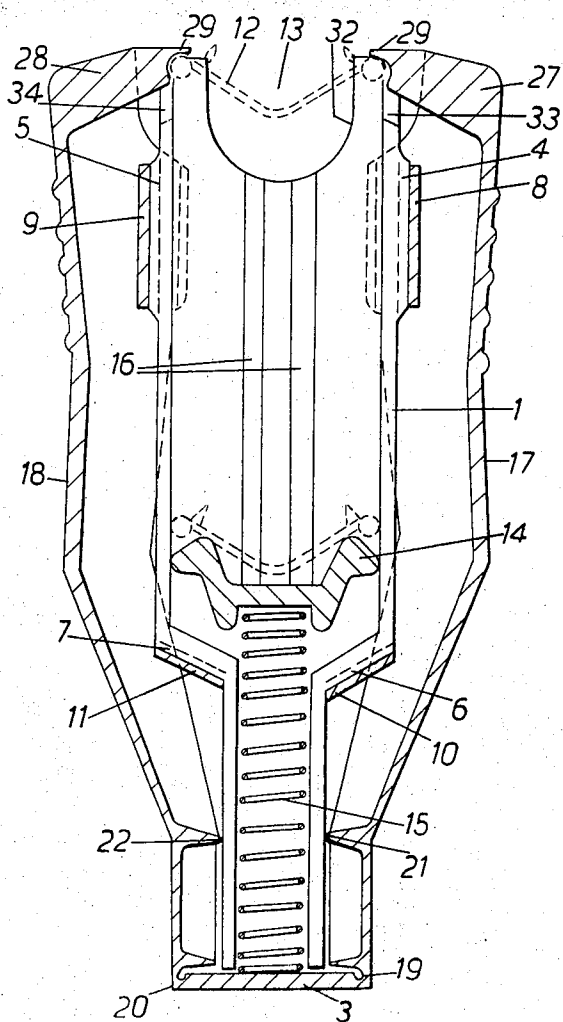


FIG. I

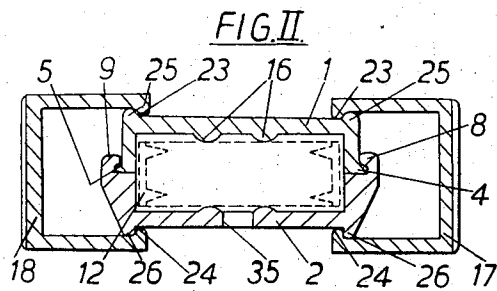


FIG. II

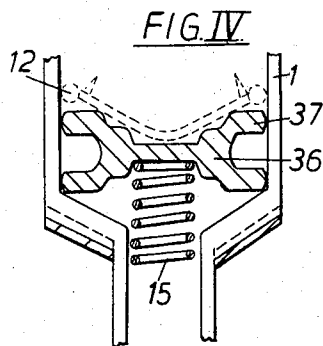
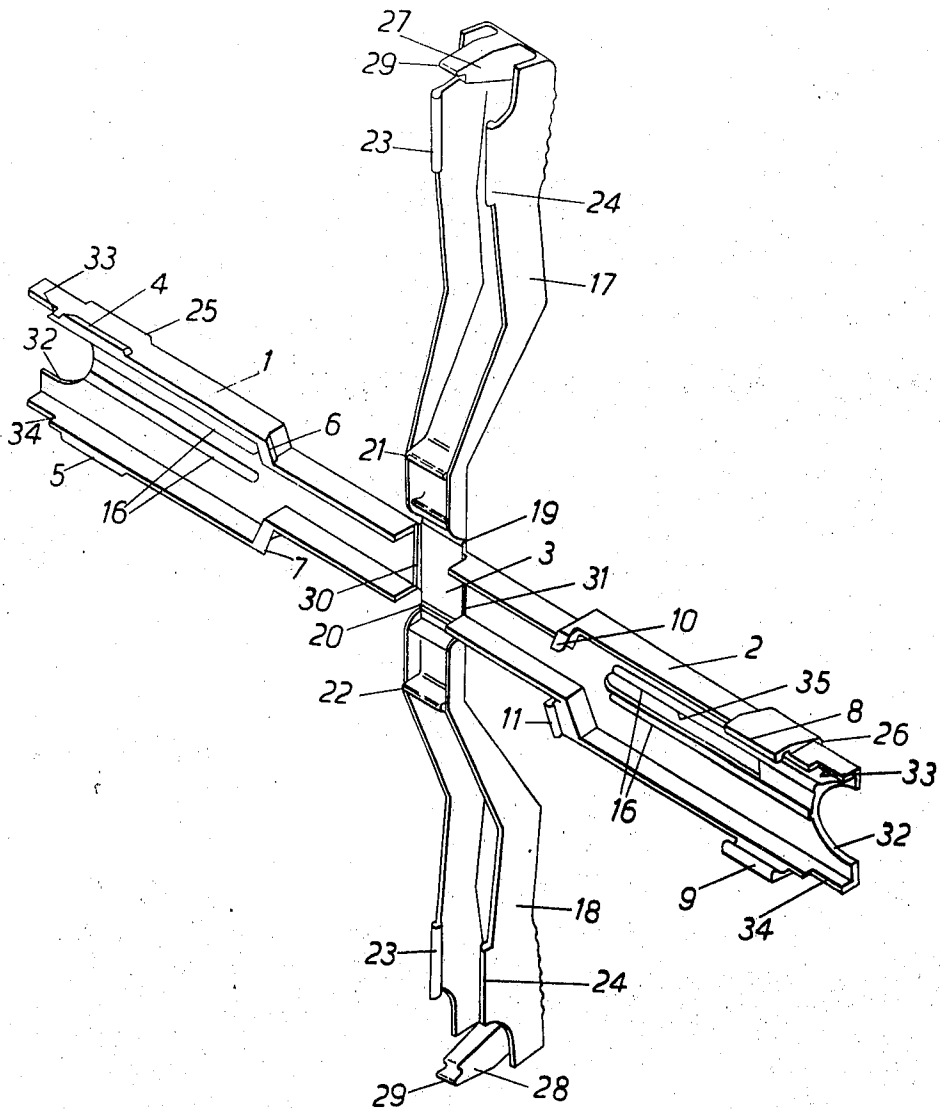


FIG. IV

FIG. III



CLIP APPLICATOR

This invention relates to a clip applicator and in particular it relates to a wound clip applicator.

In surgical practice, a wound may be closed either by stitching or by the use of a metal clip secured across the gathered edges of the wound. Such clips can be inserted individually by using a pair of forceps, but they are more conveniently and rapidly inserted by the use of an applicator. In such an applicator, a plurality of wound clips are retained in a spring loaded magazine provided with forceps jaws which may be squeezed together to bend a clip into the desired position across a wound. The magazine is loaded from the base and is provided with lugs for retaining the clips when the forceps jaws are in the open position and yet permitting discharge of the clip being applied. While an applicator of this type operates satisfactorily to secure wound clips in position it does suffer from a number of disadvantages. Thus the structure, composed of a number of metal parts secured together, is relatively expensive to produce and since such an applicator as well as the clips must be sterile before use, the applicator must be re-sterilised before each occasion it is to be used. Re-sterilisation of surgical instruments is a time-consuming and therefore expensive operation. Also, the applicator must be re-loaded with wound clips, and this operation again requires manual dexterity and time.

There is therefore a need for a cheap wound clip applicator which can be supplied loaded with clips and pre-sterilised. Such an applicator should be sufficiently cheap so that it can be discarded after its supply of clips has been exhausted, and purchase of a new pre-sterilised applicator is preferable to re-loading and re-sterilisation of the original applicator. One method of producing articles cheaply is to manufacture them by injection moulding from plastics material, and an object of the present invention is to produce a device equivalent in operation to the known complex metal structure in which a substantial part of the device can be manufactured by a one-shot injection moulding. This problem has been solved by moulding the essential parts of the device in the form of a cross with the four arms hinged to a centre piece and then folding the arms together to interlock and form an applicator.

According to the invention there is provided a wound clip applicator comprising an elongated housing composed of two elongated sections providing a magazine for receiving a plurality of wound clips in stacked relationship, the housing having a base, an opening for discharging the clips and containing a plunger for urging the clips towards the opening, and a pair of forceps arms swingably mounted at opposite sides of the housing and biased outwardly into a normal but limiting position, the forceps arms being provided with inwardly directed jaws to engage with the ends of the leading clip and including means for limiting the forward movement of the clips, such that upon compression of the forceps arms, the jaws drive the clip ends inwardly and effect closure of the clip and its removal from the magazine, wherein the two elongated sections forming the housing and the two forceps arms including the jaws constitute an integral structure in a single piece of thermoplastic material in which the two elongated sections and the two forceps arms are hinged to the base of the housing and are provided with means and for interlock-

ing the two elongated sections to form the housing and for interlocking the forceps to the housing.

The wound clip applicator of the invention may be manufactured by moulding the two sections forming the housing and the two forceps arms, including the jaws and outward biasing means, in a single injection moulding operation by using a mould in which the two housing sections and the two forceps arms are attached to a rectangular member by integral hinges so that the housing sections and forceps arms are in opposed relationship, that is in an essentially flat, cruciform arrangement. The opposed housing sections are provided with projections to interlock on assembly, and also with projections to interlock with projections on the forceps arms to limit the outward movement of the forceps arms when the applicator is assembled. The plunger for urging the clips towards the discharge opening in the housing is inserted into the housing after the housing sections have been folded along their hinges and interlocked, and the clips are inserted with the forceps arms in the unlocked position but usually folded position.

A mould of the above type, a moulding in thermoplastic material and a method of manufacture of the wound clip applicator are each provided as features of the invention.

While the applicator of the invention may be constructed in any thermoplastic material having sufficient resilience to permit individual parts to be interlocked by a "snap action," the choice of material depends upon the stress imposed on the hinges which in turn depends upon the precise type of clip to be applied. In general, polyethylene, polypropylene and their copolymers, polyamides such as nylon, polyesters such as polyethylene terephthalate, polycarbonate or polyacetal are suitable, but if nylon or polyacetal is used, the hinges are preferably incorporated by localised compression of the polymer in the region of the hinge. A preferred thermoplastic material is polycarbonate, nylon, polypropylene or polypropylene filled with talc or glass fibre.

In order that the invention may be more readily understood, one preferred embodiment of the wound clip applicator will be described, by way of example only, with reference to the accompanying drawings of which:

FIG. I is a vertical cross section of the assembled applicator together with a stack of clips.

FIG. II is a section along the line A—A of FIG. I.

FIG. III is an isometric view of the moulding used to form the applicator apart from the plunger.

FIG. IV is a modification of the seat 14 in FIG. I.

Referring to FIGS. I and II, a wound clip applicator of the invention as illustrated comprises a vertical elongated housing composed of two trough-shaped sections 1 and 2 of uniform cross section over most of their length, but narrowing to a smaller but uniform cross section towards a base 3. These sections 1 and 2 interlock by means of projections 4, 5, 6 and 7 on the outer surface of section 1 and adjacent to the rim of the trough engaging with hook-like projections 8, 9, 10 and 11 on the outer surface of section 2 and also adjacent to the rim of the trough. The sections 1 and 2 are joined to the base 3 by integral hinges 30 and 31 (FIG. III) in the plane of the bottom of the trough. The total structure thus produces a housing which acts as a magazine for a vertical stack of wound clips 12. The housing is closed at the base 3, but has an opening 13 at the top being a cross-section of the housing and of a size

slightly greater than the size of clip 12 to be accommodated. At the opening 13, the bottom of the trough of each section 1 and 2 is cut away 32 to expose the upper three or four clips 12 in the stack. A slot 35 along the centre of the bottom of the trough of section 2 (FIG. III) serves to give a visual indication of the number of clips in the stack. A plunger in the form of a seat 14 and a helical spring 15 acting under compression between the seat 14 and the base 3 of the housing, bears on the lowermost clip of the stack, and a guideway in the form of ridges 16 along, and preferably integral with, the internal surface of the wider part of the housing serve to retain the spring 15 in alignment when under minimal compression. Forceps arms 17 and 18, of approximately the same length as the housing and essentially trough-shaped in cross sections, are located at opposite sides of the housing and are able to swing about integral hinges 19 and 20 between the lower ends of the forceps arms 17 and 18 and the sides of the base 3 of the housing which project beyond the housing itself. The forceps arms 17 and 18 taper towards the integral hinges 19 and 20, being of the same width as the base 3 at their points of attachment but being wide enough at the top for the sides of the trough to overlap the housing (FIG. II). Pivot points 21 and 22, located a short distance from the hinges 19 and 20, stand proud of the sides of the trough-shaped forceps arms 17 and 18 and bear on the external sides of the narrow part of the housing across the opposed rims of sections 1 and 2. The forceps arms 17 and 18 are also provided with two integral hook-like projections 23 and 24 on the rim of the trough wall of each arm which interlock with integral projections 25 and 26 on the outer surface of the sections 1 and 2 at the bottom of the trough wall of the sections. Inwardly directed jaws 27 and 28 are integral with the tops of the forceps arms 17 and 18 and these jaws engage the leading i.e. uppermost clip 12 passing through slots 33 and 34 in the housing adjacent to the opening 13 and extending a short distance along the junction of sections 1 and 2. The surface of each jaw is asymmetric having an upper lip 29 which projects over the end of the clip 12 towards the prongs of the clip 12.

In operation, when the applicator is to be used to insert wound clips, the loaded, sterilised applicator is removed from its pack and is in the condition illustrated in FIG. I. The clips 12 are retained in the housing only by the lips 29 which cannot be displaced outwardly by the clip 12 since the forceps arms 17 and 18 are in a limiting position by virtue of the interlock of hooks 23 and 24 on the arms and projections 25 and 26 on the housing. The open part of the leading clip 12 is placed across the edges of the wound to be closed, and the forceps arms 17 and 18 compressed together between the thumb and forefinger of the operating hand. The leading clip 12 is then bent into position across the wound, and the cut away portion 32 of the housing ensures that the wound is not trapped by the applicator itself. On release of the pressure on the forceps arms 17 and 18, the clip remains in position and the forceps arms 17 and 18 return to their normal or original position by virtue of the natural resilience of the material acting at the pivot points 21 and 22 biasing the forceps arms 17 and 18 into the normal position. During the return movement of the forceps arms 17 and 18, the action of the helical spring 15 on the seat 14 causes the now leading clip 12 to be urged into the opening 13 between jaws 27 and

28 where it is retained by the lips 29 until applied in the same way as the previous clip. When all the clips have been applied, the seat 14 is urged against the jaws 27 and 28, but it cannot be ejected since on compression of the forceps arms 17 and 18, the jaws 27 and 28 engage the sloping upper surfaces of the sides of the seat and, instead of deforming the seat, push it back into the housing. The shape of the upper surface of seat 14 can thus provide a useful design feature.

Referring to FIG. III showing a one-shot moulding of the main parts of the applicator, the sections 1 and 2 of the housing and the forceps arms 17 and 18, each together with their associated projections etc., are integrally hinged (hinges 30, 31, 19 and 20) to the base 3 of the housing to give a cruciform structure which has been moulded in a single operation by injection of thermoplastic material, especially polycarbonate, via the reverse side of the base 3. The moulding is then folded about the hinges 30 and 31 so that sections 1 and 2 can be brought together and interlocked to form the housing. The helical spring 15 and the seat 14 are inserted into the housing via the opening 13 at the upper end of the housing, and then the moulding is folded about hinges 19 and 20 to bring the forceps arms 17 and 18 into the (essentially) vertical position. The stack of clips 12 is then loaded into the housing through the opening 13 with their prongs pointing towards the opening 13 after loading. A removable wire spring (not shown) passing through the center of a stack of clips 12 may be used to assist the loading. Finally, the forceps arms 17 and 18 are locked into position by engagement of the hook-like projections 23 and 24 on the forceps arms 17 and 18 with the projections 25 and 26 on the housing. The clips 12 are now retained in the housing only by the action of the lips 29 on the forceps jaws 27 and 28. The resilience of the plastics material makes it possible to disconnect the parts of the applicator, and to re-load the applicator with more clips. However, it is not the intention that this should be done as a routine practice.

As an alternative to the design of seat 14 illustrated in FIG. I, that shown as 36 in FIG. IV may be employed. In this latter case, the seat 36 acts in the same way as seat 14 to urge the clips 12 towards the opening 13 in the housing, but when all of the clips 12 have been applied, the seat 36, instead of being pushed back into the housing by the action of jaws 27 and 28, becomes wedged between the jaws 27 and 28 with the uppermost flanges 37 of the seat 36 engaging with the recesses below the tips 29 of the jaws 27 and 28.

What we claim is:

1. A wound clip applicator comprising
 - a. an elongated housing composed of a base and two elongated sections integrally hinged to said base, providing a magazine for receiving a plurality of wound clips in stacked relationship and having an opening for discharging said wound clips,
 - b. integral locking means on said elongated sections for interlocking said elongated sections to form said elongated housing,
 - c. a plunger contained within said elongated housing for urging said wound clips towards said opening,
 - d. a pair of forceps arms integrally hinged to said base at opposite sides of said elongated housing,
 - e. integral locking means on said forceps arms and on said elongated housing for interlocking said forceps

arms to said elongated housing and for limiting the outward movement of said forceps arms,

f. biasing means for biasing said forceps arms outwardly into a position at the outward limit permitted by said locking means on said forceps arms,

g. inwardly directed jaws at the ends of said forceps arms for engaging with the ends of the leading member of said wound clips,

h. movement limiting means on said forceps arms for limiting the forward movement of said wound clips, whereby on compression of said forceps arms, said inwardly directed jaws drive the clip ends of said leading member of said wound clips inwardly and effect closure of said clip and its removal from said magazine.

2. The wound clip applicator 1 in which the integral locking means on said elongated sections comprises a projection on one section and a hook-like projection on the other section being mutually interlocking.

3. The wound clip applicator of claim 1 in which the plunger comprises a seat and a compression spring acting between said seat and the base of the elongated housing.

4. The wound clip applicator of claim 3 in which the seat is provided with flanges for engaging with the forceps jaws when all the wound clips are discharged and wedging said seat between said forceps jaws.

5. The wound clip applicator of claim 1 in which the integral locking means on said forceps arms and on said elongated housing comprises a hook-like projection on said forceps arm and a projection on said elongated

housing being mutually interlocking.

6. The wound clip applicator of claim 1 in which the biasing means comprises a pivot point bearing upon the housing and located on the forceps arm between the jaw and the hinge connecting the forceps arm to the base.

7. The wound clip applicator of claim 1 in which the movement limiting means on said forceps arms comprises two lips, one on each forceps jaw, located to project over the ends of the leading member of said wound clips when said forceps arms are in a position at the outward limit permitted by the locking means on said forceps arms.

8. A moulding in a single piece of thermoplastic material for a wound clip applicator as claimed in claim 1 comprising a rectangular member serving as a base for said applicator, two elongated sections including integral locking means as set out in claim 1 hinged to opposite sides of said rectangular member by thin webs of thermoplastic material, and two forceps arms including integral locking means, biasing means, inwardly directed jaws and movement limiting means as set out in claim 1 hinged to the remaining two sides of said rectangular member not occupied by said elongated sections by thin webs of thermoplastic material.

9. The moulding of claim 8 in which the thermoplastic material is polycarbonate, nylon, polypropylene, glass-fibre-filled polypropylene or talc-filled polypropylene.

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