United States Patent

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[54] **SURGICAL TYPE SCRUBBING SPONGE**
4 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **128/269,** 128/156, 128/260
[51] **Int. Cl.** **A61m 7/00**
[50] **Field of Search** 128/267, 268, 269, 157, 155, 156, 298, 260; 156/306; 19/145.3

[56] **References Cited**

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ABSTRACT: A medical swab having an essentially lint-free characteristic. The swab is formed from a nonwoven cotton material. Forming apparatus forms a strand of such material into an essentially rectangular cross section and bonds it to an applicator stick.

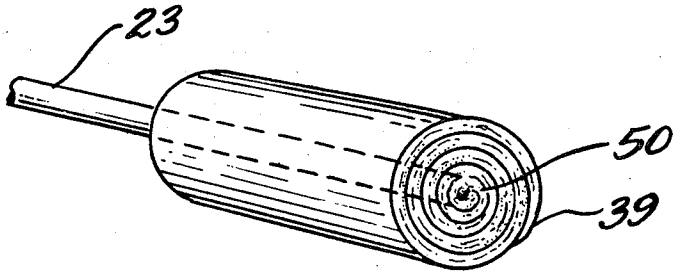
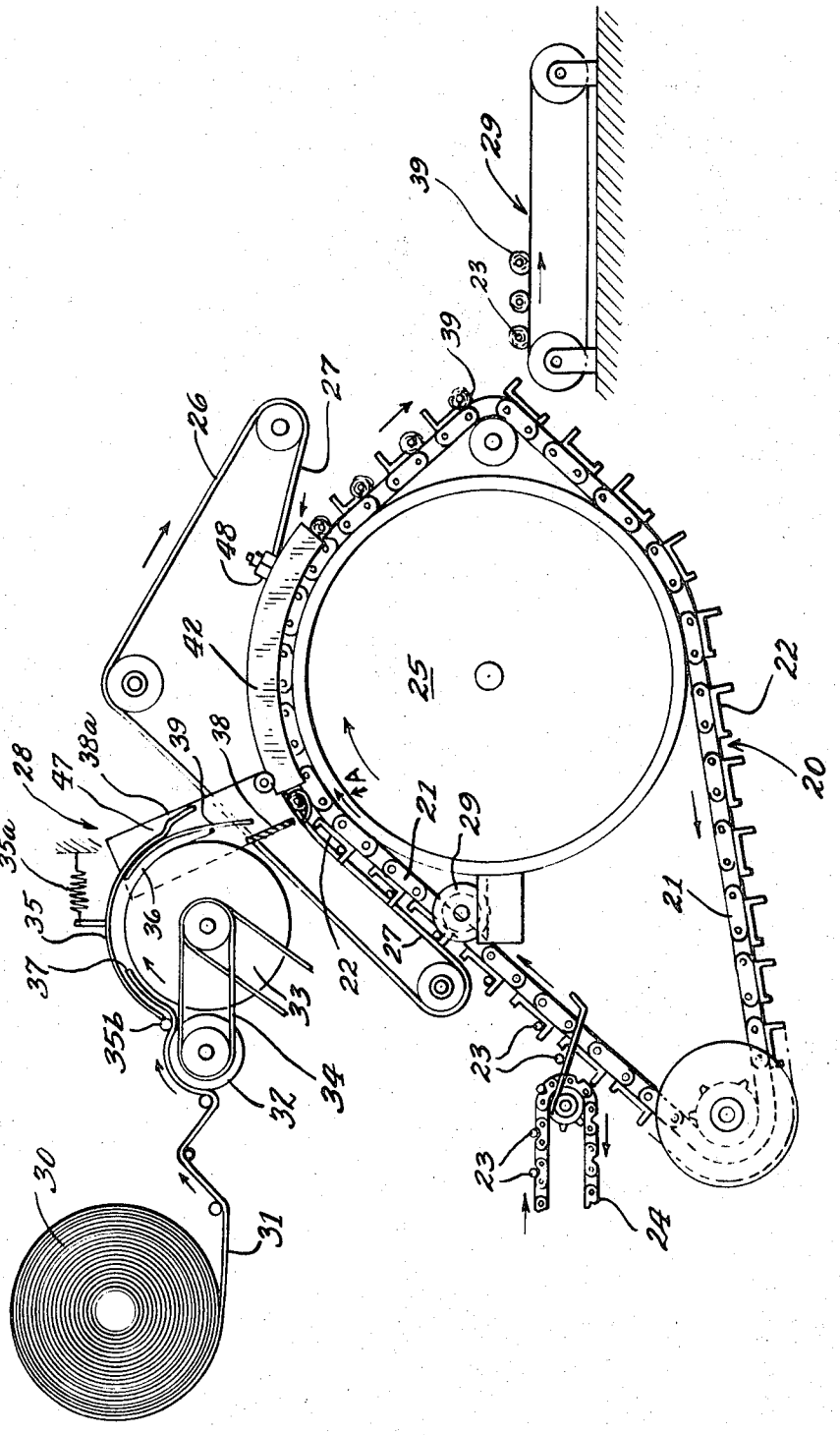


Fig. 1.



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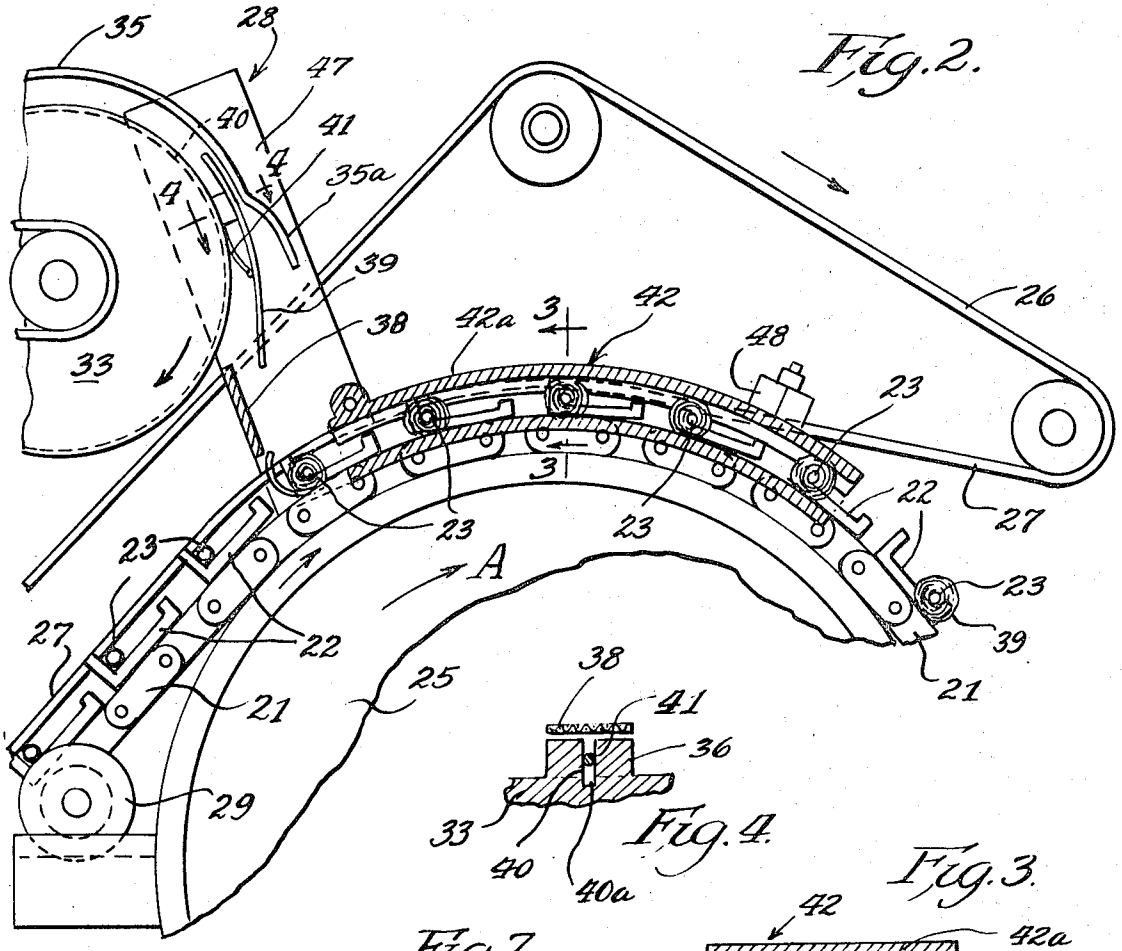


Fig. 2.

Fig. 4.

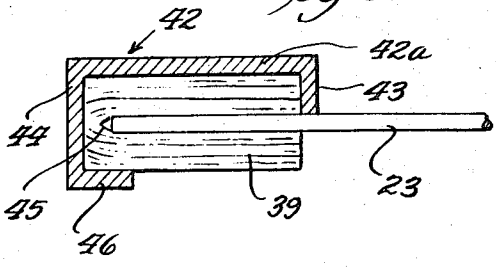


Fig. 3.

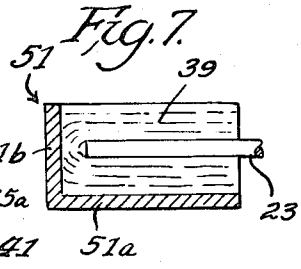


Fig. 7.

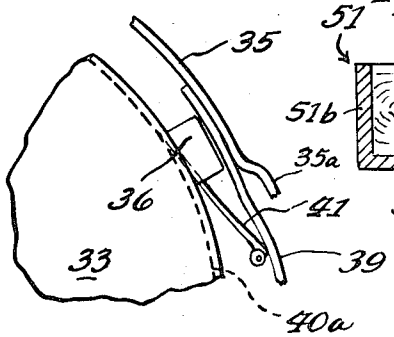


Fig. 5.

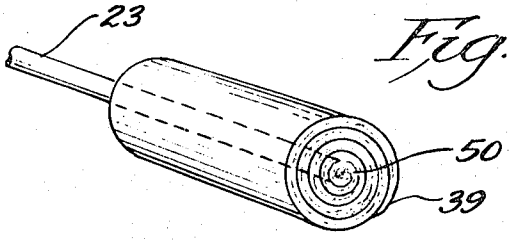


Fig. 6.

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SURGICAL TYPE SCRUBBING SPONGE

The present invention is directed to new and useful improvements in medical type swabs and is particularly directed to the formation of such swabs with new and useful characteristics in such swabs.

Medical type swabs have been known for many years. They are produced by winding either cotton or synthetic fibers spirally on the ends of applicator sticks, while the innermost layer of the fiber material is bonded as by means of an adhesive to the stick. While swabs as heretofore known are entirely satisfactory for many uses, they are not altogether satisfactory where a lint-free characteristic of the swab is desired. If swabs are used for heavy scrubbing duty or in situations where a liquid carried by the swab tends to cause disengagement of the fibers in the wad of the swab, the fibers may be disengaged and this is unsatisfactory in may circumstances. For example, when using a swab to cleanse a wound it is undesirable that any fibers should become dislodged from the swab and be left in the wound. Accordingly, the primary purpose of the present invention is to form a medical type swab having moisture or liquid retention characteristics equivalent to the known swabs and at the same time have an essentially lint-free characteristic in the swab. A related purpose of the invention is to provide method and apparatus for making such lint-free swabs in a satisfactory manner.

These and other purposes will become more apparent in the course of the ensuing specification and claims when taken with the accompanying drawings, in which:

FIG. 1 is a diagrammatic view of a machine for producing swabs in accordance with the present invention;

FIG. 2 is an enlarged diagrammatic view of a portion of the apparatus illustrated in FIG. 1 and particularly illustrating strand feeding and forming mechanism utilized in the invention;

FIG. 3 is an enlarged cross-sectional view of the apparatus illustrated in FIG. 2 and taken on the section lines 3–3 of FIG. 2;

FIG. 4 is a diagrammatic view of certain elements used in the apparatus of FIG. 2;

FIG. 5 is another view of the elements illustrated in FIG. 4;

FIG. 6 is a perspective view of a swab formed in accordance with the present invention; and

FIG. 7 is a sectional view of a modified form of swab forming shoe.

Like elements are designated by like characters throughout the specification and drawings.

Referring specifically now to the drawings and in the first instance to FIG. 1, the numeral 20 generally designates a swab stick conveying mechanism which, as shown, is in the form of an endless chain 21 having a series of spaced brackets 22 thereon for purposes of receiving applicator sticks 23 from any suitable stick feeding mechanism represented by the chain 24 and for delivering the sticks to the brackets 22. The chain passes over an enlarged drum or wheel 25. An endless belt 26 overlies the sticks as they pass over the top portion of the drum. The drum is rotated in one direction, as for example clockwise as in FIG. 1, while the overlying stick spinning belt 26 has the lower stick engaging run 27 thereof moving in the opposite direction so that the sticks are spun by the engagement of the overlying belt 27. Web feeding apparatus is generally designated at 28 and is adapted to deliver a predetermined length of material to each stick as it passes around the drum. An adhesive applicating roller 29 is positioned to engage each stick as it passes toward the web feeding mechanism. Preferably the sticks are plastic and the roller 29 carries a solvent for making the ends of the applicator sticks 23 tacky prior to the time that they reach the web feeding mechanism 28. The operation of the endless conveyor chain 21, drum 25, stick spinning belt 26, and stick feeding mechanism 24 may be essentially as described in my U.S. Pat. No. 3,263,280, issued Aug. 2, 1966, and the disclosure of that patent is incorporated herein by reference in so far as the operation of the stick spinning belt, drum 25, stick feeding mechanism, and stick carrying chain are concerned. After

passage over the drum, the completed swabs are transferred to a conveyor belt 29 where the completed swabs may be packed in boxes.

The sticks 23 are preferably formed of a nontoxic plastic material, such as high-impact styrene. The sticks are preferably tubular with a diameter on the order of three thirty-seconds to five thirty-seconds of an inch. The sticks may have a length ranging from several inches to 8 inches and in some cases longer. The transfer roller 29 applies a free flowing, highly volatile solventlike material to the end portions of the sticks which are to carry the swab material and in such amount as to cause the surface of that portion of the stick to become tacky without causing any material change in the cross section or shape of that end portion. The solvent used should be one which leaves no trace of toxicity in the finished swab. In practice, the amount of the solvent applied should make the swab carrying portion of the stick appear wet to the eye. When this is done the surface of the stick is plasticized slightly so that the wet material of the stick may flow around the fibers which are applied to it and thereafter solidify.

Preferably a mixture of 98.2 percent by volume "Shell" toluene and methylene chloride 1.8 percent or a "Shell" GL-100 solvent or the equivalent is used with sticks of high impact styrene. The contact with a transfer roller as the stick is spun by the belt 26 is sufficient to make the end of the stick tacky. Other solvents such as perchloroethylene, ethylene dichloride, methylene chloride, a material known in the trade as "Comsolve 0100", methyl ethyl ketone, and acetone, may also be used to moisten the stick. After the sticks are wetted by the transfer roller 29, they must be supplied to the web feeding mechanism 28 within a time interval such that the stick is still tacky and also such that the stick has become tacky by the time that it reaches the web feeding mechanism. In this regard, a stick may lose its tackiness within 15 or 20 seconds or so, depending upon the solvent used, after the stick is wetted. Also, some time interval must pass before the sticks are made tacky by the solvent. As examples of this, sticks wetted with "Shell" GL-100 solvent are usually tacky within about one second after application of the solvent. On the other hand, the same sticks wetted with acetone require several seconds or more after wetting before they are sufficiently tacky to pick up any web material for adhesion thereto. The time interval represented by the length of the conveyor chain between the solvent applying transfer roller 29 and the web feeding mechanism 28 is sufficient as long as the conveyor speed is such that a time interval of at least one second elapses between the application of the solvent to the stick and the point marked "A" in FIG. 1. The speed of the conveyor chain 20 should be regulated so that at least one second elapses and preferably several seconds elapse between the passage of a stick from the transfer roller 29 to the point "A" when using the "Shell" GL-100 solvent. When faster conveying speeds are desired, transfer roller 29 may be moved to a position farther down the conveyor chain, or in some instances it may be placed along stick transfer chain 24 so that the sticks may be wetted prior to the time that they are delivered to the conveyor chain.

In further accordance with the invention, a web of fibrous material having a rectangular cross section and a substantially constant thickness is used to make the swabs of the sticks. Preferably a material equivalent to that sold under the trade name "Webril" is used. This is a nonwoven, self-clinging cotton fibrous material. This material retains its abrasive powers when wetted with a liquid and it does not deform easily. This material is highly absorbent, it has high liquid retention characteristics, it is readily comformable and essentially lint-free. No binder is used in making webs of material of this sort. Material of this general type may be produced by a needle felting process as generally described in U.S. Pat. Nos. 2,528,793 (now expired) and 2,625,733. The thickness of the web may be on the order of 0.025 inch to 0.050 inch with a weight on the order of 60 to 90 or more grams per square yard. This material is to be distinguished from fibrous swab materials

utilized in the past which are either cotton or synthetic fibers (such as rayon) produced by other processes. The web utilized in the invention is preferably such that it has a well defined rectangular cross-sectional shape. As a typical example of web used and of the thickness in the range specified, a web having a width on the order of 1¼ inches may be used in producing a typical swab.

The feeding mechanism **28** illustrated in FIG. **1** includes a reel **30** which carries an elongated strand of the web material **31** thereon and this web of material is continuously fed by a feed roller **32** to a second feeding and tearing roller **33**. The rollers **32** and **33** may be driven at the same rotational speed in which case the roller **33** is larger than roller **32** so that its peripheral speed is faster than that of roller **32**. They may be driven one from the other as diagrammatically represented by the chain **34** in FIG. **1**, in which case one or the other of the shafts of the sprockets of the chain is driven by power from the machine and in synchronized relation to the movement of the conveyor chain **21**. A guide shoe **35** overlies the upper portion of the roller **33** and is spaced therefrom. It is preferred to have shoe biased by a spring **35***a* and pivoted at the web entrance end thereof as at **35***b*. A web gripping and tearing lug **36** is carried by the roller **33** and is adapted to grip the web material and press it against shoe **35** as appears in FIG. **2** and, since it moves faster than the feed of the material from roller **32**, it will tear a predetermined length of material from the remainder of the elongated web and pass it around the shoe **35** while leaving the free end of the remainder of the material as indicated at **37**. When lug **36** passes from an opposed relation to shoe **35**, spring **35***a* may bias the discharge end of the shoe against the web to press the forward end of the web against roller **33** just prior to the time that the lug **36** again engages the web. This helps the feeding action. A guide plate **38** is positioned at the discharge side of the roller **33** and is positioned beneath the inner surface of the discharge end of the guide shoe **35** as indicated in FIG. **2** so that the free end of the torn web portion is received over the guide plate **38**. Guide plate **38** extends across and above the conveyor chain **21**. The lower end of the guide plate is positioned so that it just clears the brackets **22**. Plate **38** may be carried between spaced and parallel side plates **38***a*. The side plates may help to guide the web material. The torn length is fed at a position such that a minor portion of the web is positioned laterally of the end of the stick. This minor portion may be on the order of ⅛ inch. Thus the torn length of web material **39** is passed into contact with the tacky end portion of the sticks **23**. The speed of movement of the roller **33** is preselected with relation to the speed of movement of the conveyor chain **21** so that the lower end of the torn length of web material is passed into contact with the tacky end portions of the stick just as the sticks pass the lower end of the guide plate **38**. Each stick receives its predetermined length of web material.

To insure that the torn length **39** of the web material does not stick to the lug **36** or roller **33**, the lug **36** may have a groove **40** cut through the middle thereof. A groove **40***a* is formed peripherally of roller **33** and aligned with groove **40**. A pickoff wire **41** may be held in a fixed position on the machine (as by side plates **38***a*) so that the end thereof rides in groove **40***a* and through groove **40** in the lug **36** as lug **36** passes it. Wire **41** forcibly causes the torn length **39** of web material to ride thereover as indicated in FIG. **5**.

In order to form the web material on the end portion of the stick, a guide shoe **42** overlies the sticks for a predetermined length of the conveyor run after the stick receives the torn length of web material. Guide shoe **42** may be in the form of a plate which has a length such that it overlies approximately six stick-holding brackets as indicated in FIG. **2**. The plate has a depending flange **43** at the inner side thereof which is adapted to extend close to the periphery of the stick as indicated in FIG. **3**. The plate **42** has an upper wall **42***a* which is essentially linear in form and an end wall **44** which extends transversely to the axis of the sticks. End wall **44** is spaced from the end of the sticks **23** to leave a space on the order of approximately ⅛ of an inch therebetween, as indicated at **45**. A lower wall of short extent **46** may be joined to the end wall **44** and extends generally parallel to the top wall **42***a*. The lower wall may be omitted if desired or extended for the full length of the swab. The forming shoe **42** thus conforms the web material on the end portion of the stick to an essentially rectangular cross section taken parallel to the axis of the stick.

The spinning speed of the stick spinning belt **26** is preferably such that the entire predetermined length of web material is wound about the stick at or about the time of passage within the forming plate **42** so that the major part of the action of the forming plate is that of conforming the shape of the swab defined by the spirally wound web material to the shape illustrated. As an aid in securing compactness and conformation to the desired shape, plate **42** is preferably pivoted to some portion of the machine as, for example, the plate structure **47** which also carries guide plate **38**. The free end of the plate **42** may carry a suitable weight **48** so that the weight **48** tends to compact the swabs to a smaller diameter by the time they pass out from under the end of plate **42**. In other words, by the pivoted action of the forming plate **42**, the space for the swab between the top wall **42***a* and the stick may be larger at the entrance end and smaller at the discharge end while the forming space progressively decreases somewhat in size so as to aid in compacting the swab to a neat disposition.

The action of the forming plate **42** is such as to bend and compress the layers of web material over the end of the stick so that a neat and distinct pad of material is presented at the end of the stick as indicated in the circular area designated **50** in FIG. **6**. This pad may be approximately ¼ of an inch in length and may range from about ⅛ to ⅜ of an inch. Thus, the end portion of the swab is amply padded while the swab still retains its essentially rectangular cross section.

Swabs formed in accordance with the present invention will absorb up to eight times the weight of the web material in liquid. The osmosis character is high. The liquid carried by the web material will not squeeze out with light pressure exerted on it. It is essentially nondripping. It can be squeezed out of the web with heavier pressure. The abrasive character of the webbing material is retained even though the material is wetted. This makes the material highly suitable for use in a scrubbing type of sponge.

A typical size of swab is about one and ⅜ inch in length and about nine-sixteenths of an inch in diameter.

Because of the essentially lint-free characteristic of the material, the swab may be used as a sponge to absorb liquid or blood during a dental or other type of operation.

In lieu of a forming plate overlying the swabs, a forming plate **51** may be pivotally mounted with a surface **51***a* underlying the swabs and an end surface extending transversely to the axis of the swabs as shown in FIG. **7**. In this event, the forming shoe is biased as by spring pressure so that the bias provides confinement of the web material in a manner similar to shoe **42**. The shoe **51** is pivoted close to the plate **38** in underlying relation to the sticks **23** and with the free end of the shoe biased upwardly toward the sticks so as to shape the swabs into the form illustrated in FIG. **6**.

Whereas I have shown and described an operative form of the invention, it should be understood that this showing and description thereof should be taken in an illustrative or diagrammatic sense only. There are modifications to the invention which will fall within the scope and spirit thereof and which will be apparent to those skilled in the art. The scope of the invention should be measured only by the scope of the hereinafter appended claims.

I claim:

1. A medical swab including an elongated stick, and a swab defining mass bonded to an end portion of the stick, said mass being defined by a plurality of spirally wound layers of nonwoven web material, said web material being substantially rectangular in cross section and of the type produced by a needle felting process.

2. A swab as defined in claim 1 wherein the cross section of the swab defining mass, taken parallel to the longitudinal axis of the stick, is essentially rectangular in outline.

3. A swab as defined in claim 2 wherein the layers of material extend partially beyond the extreme end of the stick and are compressed so that the end of the stick is shielded from the exterior by a pad of said material which is aligned with the end of said stick.

4. A swab as defined in claim 3 wherein the fibers of the inner layer of web material are imbedded in the stick proper while the cross section of the stick end portion underlying said layers of material is essentially the same as the remainder of the stick cross section.