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(54) **Apparatus of splitting a hollow product.**

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**CH-A- 345 206
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FR-A-2 271 006
FR-A-2 281 880**

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Description

The present invention relates to an apparatus for splitting a hollow product and more particularly for producing a longitudinal slit of stepped profile through the wall of the product.

The product may for example be a hollow tubular sheath manufactured from glass fibres bound together with a binder. Such sheaths can be used for insulating pipes or conduits. A method of producing a longitudinal slit through the wall of a hollow cylindrical sheath is described in French Patent Specification No. 2 271 006. In one of the embodiments described in that specification an apparatus is employed whose cutter assembly comprises two blades disposed in two substantially parallel planes spaced a small distance apart. Each of the two blades partially cuts through a portion of the wall of the sheath from the inside and outside respectively so as to create two spaced, substantially parallel, longitudinal slits in the wall. The spacing between the two slits is sufficiently small to make it possible to fracture the thickness of the material separating them. The blade which partially cuts through a portion of the inside wall is carried on a fixed cylindrical rod which passes through the centre of the hollow sheath. The rod is itself supported by a vertical supporting member fixed on a frame located external of the sheath. The vertical supporting member is aligned with the longitudinal slits formed in the sheath so that as the sheath is moved axially against and past the vertical supporting member the edge of that member, which is tapered, cuts through or fractures the material separating the slits. The resulting product is a sheath having a slit along its entire length, the slit being a straight line slit passing through the whole wall thickness of the sheath.

One of the disadvantages of the apparatus described in French Patent Specification No. 2 271 006 is that the vertical supporting member causes damage to the surfaces of the material between which the slit is defined. When the sheath is placed around a pipe or conduit it is necessary to bring those surfaces into intimate contact. Damaged surfaces, however, result in air being trapped in gaps between the surfaces and this reduces the overall insulating capability of the sheath when in use.

According to the present invention there is provided an apparatus for providing a longitudinal slit through the wall of a hollow tubular product comprising a cutter assembly with two blades each of which lies in one of a pair of spaced apart planes, the blades being arranged to make longitudinal cuts partially through the wall from the inside and the outside of the product with the inner ends of the partial cuts adjacent to one another and means to provide relative longitudinal movement between the assembly and the product characterised in that the two blades are connected together by a connecting bridge part so that the two blades act together to make the partial cuts and that means e.g. a thickened

portion forming a part of each cutting blade is provided for exerting a stress in the material of the tubular product in the region of the partial cuts and acting substantially at right angles to the planes of the partial cuts to fracture the material between the inner ends of the partial cuts to define a single longitudinal slit of stepped or Z-shaped profile through the wall and further characterised by the provision of means e.g. a tapered follower section on each blade for passing through the stepped slit to exert pressure to open up the slit to allow the connecting bridge part to pass through the slit.

The connecting part connects together the follower sections of the two blades and holds them spaced apart in a fixed relationship to one another. Conveniently the connecting part is flat and disposed in a plane substantially orthogonal to the planes in which the blades lie.

The pair of spaced planes in which each longitudinal slit lies can be either parallel or non-parallel to one another. It is convenient, however, to arrange the spaced planes to be substantially parallel to one another so that the resulting stepped slit has a Z profile.

In order that the fracture of the material between the inner ends of the longitudinal slits be made straight and smooth it is desirable that the two longitudinal slits formed, and hence the cutting sections of the blades, are level or overlap one another slightly. The degree of overlap is dependent on the material of the product to be fractured but for a laminated glass fibre product the overlap conveniently lies in the range 0 mm to 10 mm. Preferably the overlap lies within the range 0 mm to 5 mm.

Each blade may have its cutting and follower section made as separate sections or the whole blade may be made as one integral part. It is convenient, however, to make the cutting and follower sections as separate parts of different material, for example the cutting section can be made from a hardened steel whilst the follower section can be made of mild steel. The connecting part between the follower sections can then also be made of mild steel enabling the two follower sections and connecting part to be fabricated as one integral part.

Preferably a further blade is provided for producing a straight longitudinal slit partially through another portion of the inside wall of the product, substantially opposite the stepped slit, the uncut material in line with that slit serving as a hinge enabling the product to be opened and closed without the sections coming apart.

The apparatus can be used for splitting tubular hollow products having any cross section, for example circular, square, oblong or polygonal cross sections. Sheaths for pipe insulation are usually cylindrical and so have a circular cross section. When splitting sheaths having a circular cross section the stress which fractures the thickness of material between the inner ends of the longitudinal slits is a hoop stress, whilst the shearing forces which open up the stepped profile

slit act in radial directions.

The invention will now be described further, by way of example, with reference to the accompanying drawings in which:—

Fig. 1 is a perspective view of an apparatus according to the present invention,

Fig. 2 is a perspective view of the cutter assembly in Fig. 1,

Fig. 3 is a side elevational view of the cutter assembly of Fig. 2,

Fig. 4 is a section along the line I—I in Fig. 3,

Fig. 5 is a section along the line II—II in Fig. 3,

Fig. 6 is a cross section through a partially slit sheath and

Fig. 7 illustrates how radial shearing forces are applied to the material defining a slit having a Z profile.

The apparatus in figure 1 comprises a V-shaped channel 2 made from sheet metal, a section along the base of the channel 2 being cut away so as to define a longitudinal slot 4. The top of the channel 2 is bent so as to form two flat longitudinal edges 5 and each edge 5 is supported on top of a number of blocks 6 disposed at spaced intervals along one of the flat edges of a respective support 8 having a U cross section. The supports 8 are connected together at each end by a respective metal cross member 10 and are supported on a pair of spaced metal blocks 12 and 13.

A pusher arm 14 is mounted for reciprocatory movement along the slot 4 and the top of arm 14 is cut away so as to provide clearance to enable it to pass by a cutter assembly 16. The drive mechanism for pusher arm 14 is enclosed in block 12.

The cutter assembly 16 depends from a flange plate 18 which is secured to a fabricated steel block 20. The block 20 is attached to one end portion of a ram 22 the other end portion of which is slidably mounted within a hollow cylindrical housing 24. Vertical adjustment of the cutter assembly 16 is made by adjusting the position of ram 22 relative to housing 24 by means of a drive mechanism in block 13.

Referring to figures 1 and 2 the cutter assembly has three fin shaped blades 28, 30 and 32. The blade 28 is held in a blade carrier 26 attached along the bottom edge of the flange plate 18, the blade 28 being secured to the carrier 26 by a number of bolts 27. The blade 30 is connected to the blade 28 by a horizontal connecting part 29 which serves to hold the blade 30 in a fixed offset position relative to the blade 28. The blade 30 has one of its edges secured to a cylindrical bullet shaped rod 44, the diametrically opposite part of the rod 44 carrying the blade 32.

The blades 28 and 30 have two sections, a cutting section made of hardened steel and a follower section made of mild steel. The cutting sections are indicated by numerals 34 and 36 respectively and can be considered as those portions of the blades to the left of the lines S in figure 2. The follower sections are indicated by numerals 38, 40 respectively and are those portions of the blades to the right of the lines S in

figure 2. The blades 28 and 30 are fixed relative to one another so that at least a portion of their cutting sections overlap one another, best illustrated in figures 3 and 4. The extent of the overlap is very important and is adjusted in dependence on the type of product which is to be split and the spacing between the blades 28 and 30. When cutting a hollow cylindrical insulating product, for example one made from glass fibres bound together by a binder, and with the blades 28 and 30 spaced apart by a distance of approximately 12 mm, the overlap lies preferably within the range 0 to 5 mm.

Each of the cutting sections 34 and 36 have a cutting edge 46 and 48 respectively and the portion of the cutting section leading to the cutting edge is tapered, as best shown in figure 4. In figure 4 the taper is one side only, alternatively the taper could be from both sides. The remainder of the cutting section is made fairly thick, for example 3 mm, for a purpose to be described later.

The follower sections 38, 40 have a substantially uniform thickness throughout but are provided with flared or tapered edges 50 and 52 (see figure 3). The edge 50 of the follower section 38 spreads downwardly and the edge 52 spreads upwardly giving an increasing degree of overlap between the follower sections.

In operation a hollow product, for example a hollow cylindrical product having a laminar glass fibre structure, is first placed in the V-shaped channel between the pusher arm 14 and the cutter assembly 16. The pusher arm 14 is moved at a uniform speed and pushes the hollow product in an axial direction, that is in the direction of arrow A in figure 1. Initially the cutting edges of the three blades 28, 30 and 32 cut through the wall of the product as it is advanced and produce three partial cuts in the wall of the product as shown in figure 6. The cutting edge 46 of blade 28 cuts partially through the outside wall of the product to produce slit 60, the cutting edge 48 of blade 30 cuts partially through the inside wall of the product to produce slit 62, and the cutting edge of blade 32 partially cuts through the inside wall of the product to produce slit 64.

The partially slit product continues its axial movement and the thickened portion of the cutting sections 34, 36 then pass through the slits 60, 62 which have their inner ends adjacent to one another. The thickened portions of the cutting sections 34, 36 widen the slits 60, 62 and in so doing exert forces in the material in the region of the adjacent inner ends of the slits 60, 62 in a direction away from the planes of slits 60, 62 and sufficient to fracture the thickness of the material between the inner ends of the slits 60, 62 to produce an intermediate step between those ends. As the slits 60, 62 overlap only slightly so the fracture takes place along one of the laminations of the material between the inner ends of the slits 60, 62 and the resulting fracture is straight and smooth. The resulting slit now has a Z profile, and the surfaces 66, 68 of the material

overlap at the stepped portion of the slit.

The product continues along its axial path past the follower sections 38 and 40 towards the region of the connecting part 29. If the surfaces 66, 68 of the material at the intermediate step of the slit are to remain undamaged and smooth it is necessary to prevent the connecting part 29 from coming into contact with those surfaces. It is for this reason that the flared edges 50, 52 are provided and as best seen in figure 7 they exert radial shearing forces on the overlapping surfaces 66, 68 to open up the slit so as to allow the connecting part 29 to pass between the overlapping surfaces 66, 68 without causing them damage.

The resulting product has a longitudinal Z-profile slit through the whole of its wall and a longitudinal slit 64 partially through its wall. The unfractured material below the slit 64 acts like a hinge and enables the product to be opened and closed around a cylindrical pipe or conduit, the straight and smooth overlapping surfaces 66, 68 coming into intimate contact and providing an effective air seal.

It is to be understood that the cutting section and follower section of each blade can be integrated with one another or can be manufactured from separate parts. For example in figure 2 each of the blades 28, 30 can be manufactured from a respective single sheet of hardened steel, the line S merely being representative of that portion of the blade where the Z profile slit has been completely formed.

Alternatively the cutting sections 34, 36 can be made as separate hardened steel parts to that of the follower sections 38, 40 which are made of mild steel. In such an embodiment it is desirable that the end of the cutting section 34 closely abuts against the end of the follower section 38, that is along line S, whilst the end of the cutting section 36 closely abuts against the follower section 40, also being along line S. If the ends of the cutting sections 34, 36 did not abut against the ends of their follower sections 38, 40 so that they were spaced apart, then there is a danger that the Z profile slit formed by the cutting sections 34, 36 would close after formation due to the resilience of the product material, and the end of the follower sections 38, 40 would then cut its way through the center of the slit damaging the surfaces.

We have therefore provided an apparatus for splitting a hollow product in accordance with which two adjacent cutting blades make slits in the product wall from opposite sides thereof, the slits being in planes slightly spaced apart from one another with the inner ends of the slits adjacent to one another and in which means is provided for fracturing the thickness of the material between the inner ends of the slits in such a way as to make a complete slit of Z shaped profile.

Claims

1. An apparatus for providing a longitudinal slit

through the wall of a hollow tubular product comprising a cutter assembly (16) with two blades (28, 30) each of which lies in one of a pair of spaced apart planes, the blades being arranged to make longitudinal cuts (60, 62) partially through the wall from the inside and the outside of the product with the inner ends of the partial cuts (60, 62) adjacent to one another and means (e.g. 14) to provide relative longitudinal movement between the cutter assembly (16) and the product characterised in that the two blades (28, 30) are connected together by a connecting bridge part (29) so that the two blades (28, 30) act together to make the partial cuts (60, 62) and that means e.g. a thickened portion forming a part of each cutting blade is provided for exerting a stress in the material of the tubular product in the region of the partial cuts (60, 62) and acting substantially at right angles to the planes of the partial cuts (60, 62) to fracture the material between the inner ends of the partial cuts (60, 62) to define a single longitudinal slit of stepped or Z-shaped profile through the wall and further characterised by the provision of means e.g. a tapered follower section (38, 40) on each blade (28, 30) for passing through the stepped slit to exert pressure to open up the slit to allow the connecting bridge part (29) to pass through the slit.

2. An apparatus as claimed in claim 1 in which the connecting part (29) connects together the follower sections (38, 40) of the two blades (28, 30) and holds them spaced apart in a fixed relationship to one another.

3. An apparatus as claimed in claims 1 or 2 in which the connecting part (29) is flat and is disposed in a plane substantially orthogonal to the planes in which the blades (28, 30) lie.

4. An apparatus as claimed in any one of claims 1 to 3 in which the planes of the blades (28, 30) are parallel to one another.

5. An apparatus as claimed in any one of claims 1 to 3 in which the planes of the blades (28, 30) are not parallel to one another.

6. An apparatus as claimed in any one of claims 1 to 5 in which the cutting sections of the blades (28, 30) are level or overlap one another slightly e.g. by no more than 5 mm or by no more than 10 mm.

7. An apparatus as claimed in claim 1 in which the cutting and follower sections of the blades (28, 30) are made as separate sections.

8. An apparatus as claimed in any one of claims 1 to 7 in which a further blade (32) is provided for producing a straight longitudinal slit partially through another portion of the inside wall of the product substantially opposite the stepped slit.

Revendications

1. Appareil pour établir une fente longitudinale à travers la paroi d'un produit creux tubulaire comprenant un ensemble de coupe (16) avec deux lames (28, 30) dont chacune se trouve dans l'un de deux plans écartés, les lames étant disposées pour faire des coupures longitudinales (60,

62) partiellement à travers la paroi à partir de l'intérieur et de l'extérieur du produit avec les extrémités intérieures des coupes partielles (60, 62) adjacentes l'une à l'autre et un moyen (par exemple 14) pour assurer un mouvement longitudinal relatif entre l'ensemble de coupe (16) et le produit, caractérisé en ce que les deux lames (28, 30) sont reliées entre elles par une partie de liaison formant pont (29) de façon que les deux lames (28, 30) agissent ensemble pour effectuer les coupes partielles (60, 62) et qu'un moyen, par exemple une partie épaissie formant une partie de chaque lame de coupe, est prévu pour exercer une contrainte dans la matière du produit tubulaire dans la région des coupes partielles (60, 62) et pour agir pratiquement à angles droits par rapport aux plans des coupes partielles (60, 62) pour fracturer la matière entre les extrémités intérieures des coupes partielles (60, 62) afin de délimiter une seule fente longitudinale d'un profil étagé ou en forme de Z à travers la paroi et caractérisé de plus par la prévision de moyens, par exemple une section suivante effilée (38, 40) sur chaque lame (28, 30) pour passer à travers la fente étagée afin d'exercer une pression pour ouvrir la fente afin de permettre à la partie de liaison formant pont (29) de passer à travers la fente.

2. Appareil selon la revendication 1, dans lequel la partie de liaison (29) relie ensemble les sections suivantes (38, 40) des deux lames (28, 30) et les maintient écartées dans une disposition fixe l'une par rapport à l'autre.

3. Appareil selon la revendication 1 ou la revendication 2, dans lequel la partie de liaison (29) est plate et est disposée dans un plan pratiquement orthogonal aux plans dans lesquels se trouvent les lames (28, 30).

4. Appareil selon l'une quelconque des revendications 1 à 3, dans lequel les plans des lames (28, 30) sont parallèles l'un à l'autre.

5. Appareil selon l'une quelconque des revendications 1 à 3, dans lequel les plans des lames (28, 30) ne sont pas parallèles l'un à l'autre.

6. Appareil selon l'une quelconque des revendications 1 à 5, dans lequel les sections de coupe des lames (28, 30) sont de niveau ou se chevauchent légèrement par exemple sur une longueur qui ne soit pas plus de 5 mm ou pas plus de 10 mm.

7. Appareil selon la revendication 1, dans lequel les sections de coupe et les sections suivantes des lames (28, 30) sont faites comme sections séparées.

8. Appareil selon l'une quelconque des revendications 1 à 7, dans lequel une lame supplémentaire (32) est prévue pour produire une fente longitudinale rectiligne partiellement à travers une autre partie de la paroi intérieure du produit pratiquement opposée à la fente étagée.

Patentansprüche

1. Vorrichtung zum Erzeugen eines die Wand eines hohlen, rohrförmigen Gegenstandes durch-

setzenden Längsschlitzes, mit einer Schneidapparatur (16) mit zwei Klingen (28, 30), von denen jede in einer eines Paares beabstandeter Ebenen liegt, und die so angeordnet sind, daß sie von der Innenseite und der Außenseite des Gegenstandes her die Wand teilweise durchsetzende Längsschlitz (60, 62) schaffen, deren innere Enden einander benachbart sind, und mit einer Einrichtung (zW 14) zur Erzeugung einer relativen Längsbewegung zwischen der Schneidapparatur (16) und dem Gegenstand, dadurch gekennzeichnet, daß die zwei Klingen (28, 30) durch ein verbindendes Überbrückungsteil (29) derart miteinander verbunden sind, daß die beiden Klingen (28, 30) zusammenwirkend die Teilschnitte (16, 62) erzeugen, daß Mittel, z. B. ein verdickter Abschnitt als Teil jeder Schneidklinge, vorgesehen sind, um in dem Material des rohrförmigen Gegenstandes im Bereich der Teilschnitte (16, 62) eine Belastung auszuüben, die etwa unter rechten Winkeln auf die Ebenen der Teilschnitte (60, 62) einwirkt, um das Material zwischen den inneren Enden der Teilschnitte (60, 62) zu brechen, damit ein einziger, die Wand durchsetzender Längsschlitz mit abgestuftem oder Z-förmigen Profil definiert wird, und daß Mittel, z. B. ein abgeschrägter Leitabschnitt (38, 40) an jeder Klinge (28, 30), vorgesehen sind, die durch den abgestuften Schlitz laufen und Druck ausüben, um den Schlitz zu öffnen, damit das verbindende Überdrückungsteils (29) durch den Schlitz hindurchgelangen kann.

2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß das verbindende Teil (29) die Leitabschnitte (38, 40) der zwei Klingen (28, 30) verbindet und sie in einer festen relativen Lage zueinander beabstandet hält.

3. Vorrichtung nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß das verbindende Teil (29) flach ist und in einer Ebene liegt, die im wesentlichen senkrecht auf den Ebenen steht, in denen die Klingen (28, 30) liegen.

4. Vorrichtung nach einem der Ansprüche 1—3, dadurch gekennzeichnet, daß die Ebenen der Klingen (28, 30) parallel zueinander liegen.

5. Vorrichtung nach einem der Ansprüche 1—3, dadurch gekennzeichnet, daß die Ebenen der Klingen (28, 30) nicht parallel zueinander liegen.

6. Vorrichtung nach einem der Ansprüche 1—5, dadurch gekennzeichnet, daß die Schneidabschnitte der Klingen (28, 30) auf einer Höhe liegen oder einander geringfügig überlappen, z. B. nicht mehr als 5 mm oder nicht mehr als 10 mm.

7. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Schneid- und Leitabschnitte der Klingen (28, 30) als separate Abschnitte ausgebildet sind.

8. Vorrichtung nach einem der Ansprüche 1—7, dadurch gekennzeichnet, daß eine weitere Klinge (32) vorgesehen ist zur Erzeugung eines geraden Längsschlitzes, der einen anderen Bereich der Innenwand des Gegenstandes, welcher dem abgestuften Schlitz etwa gegenüber liegt, teilweise durchsetzt.

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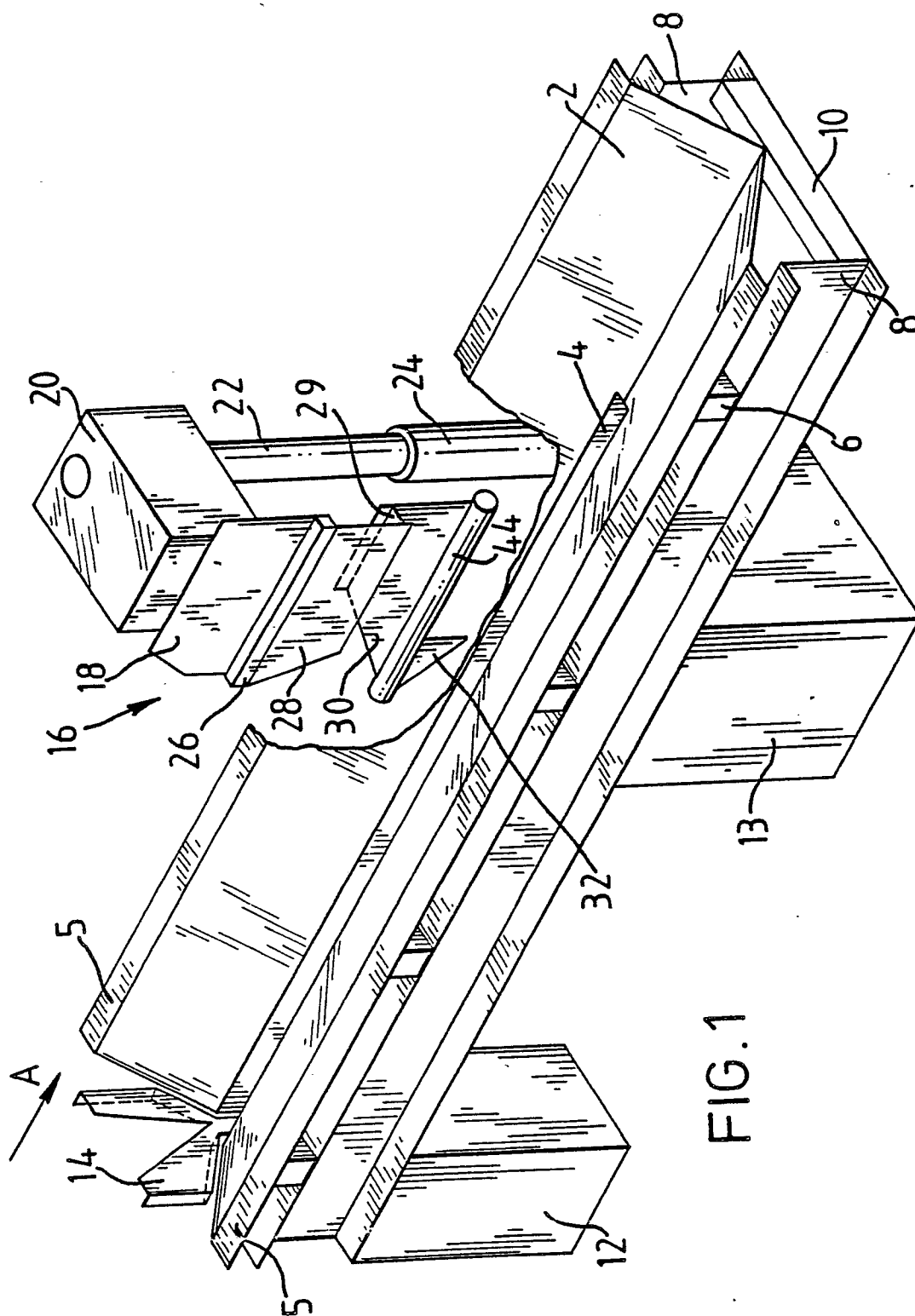
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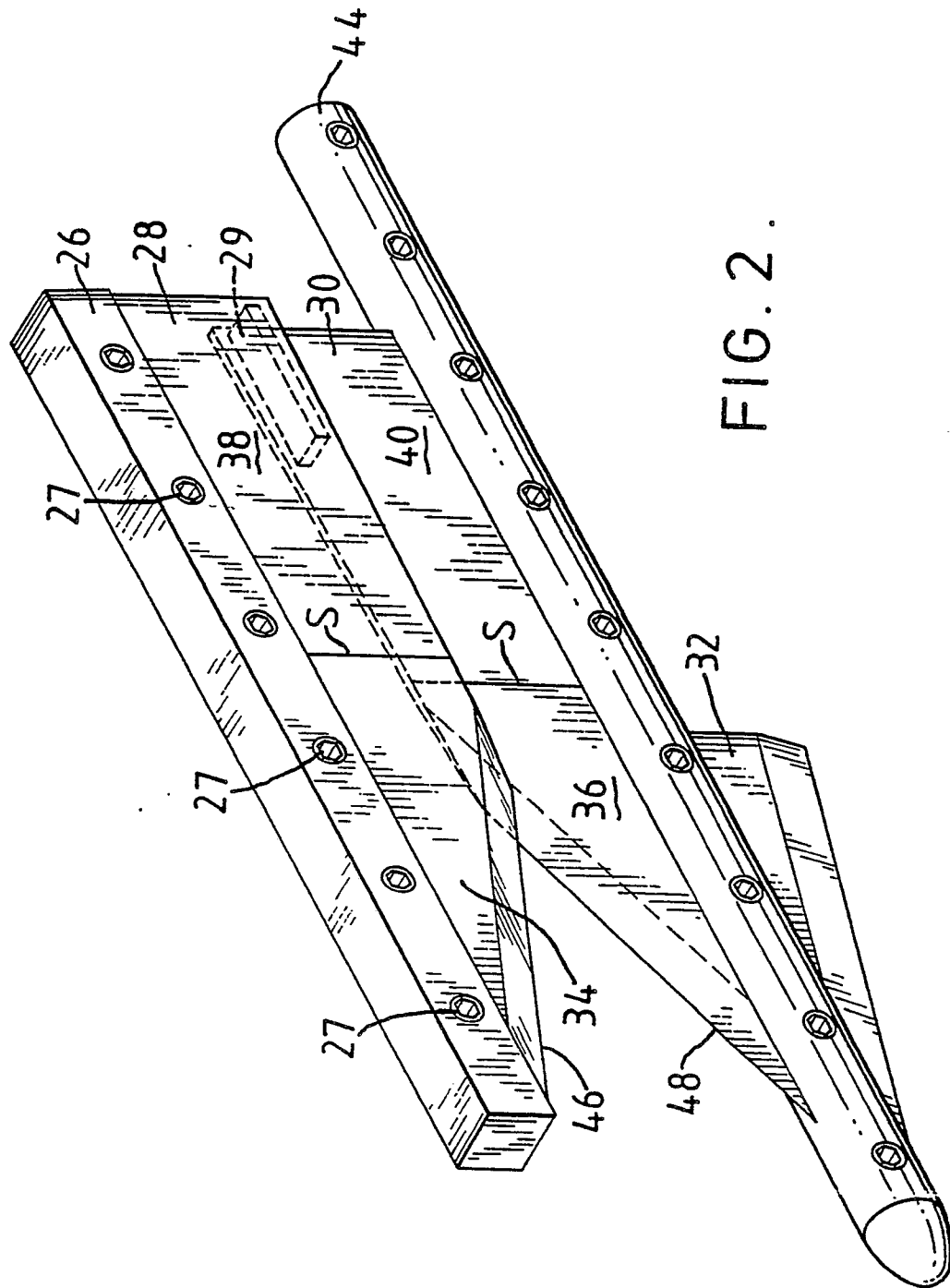
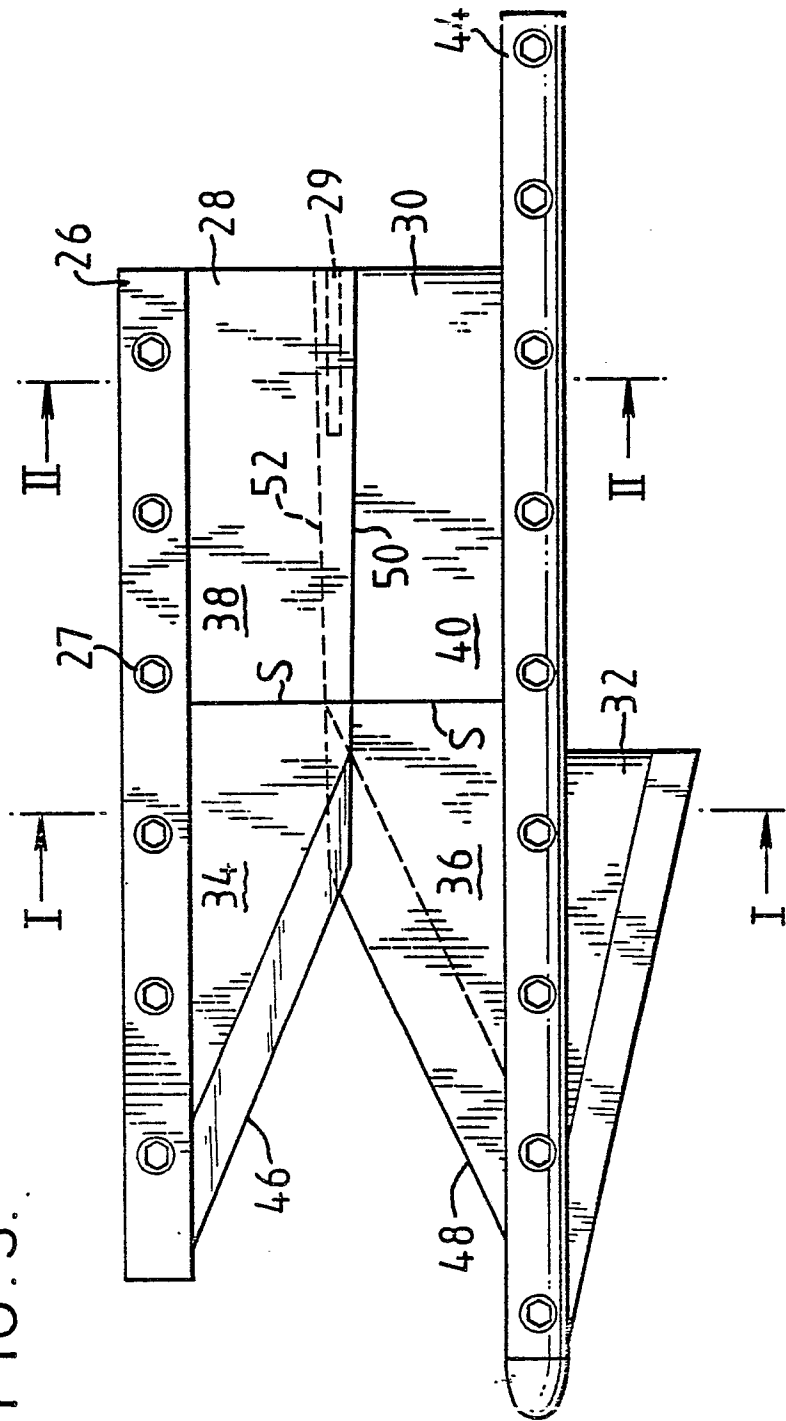


FIG. 2.

FIG. 3.



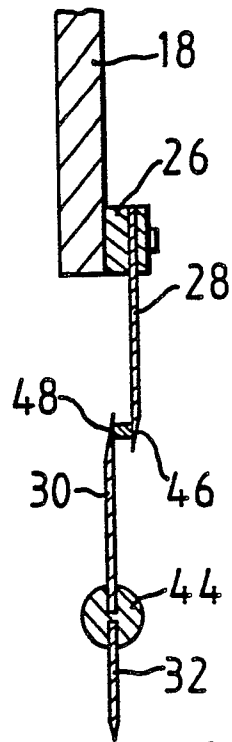


FIG. 4

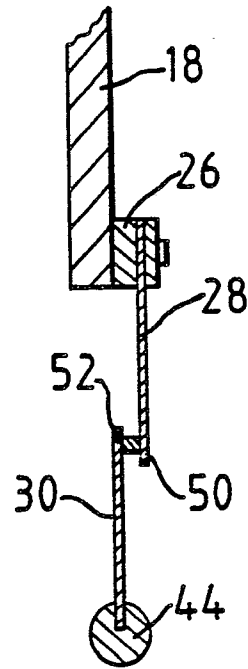


FIG. 5

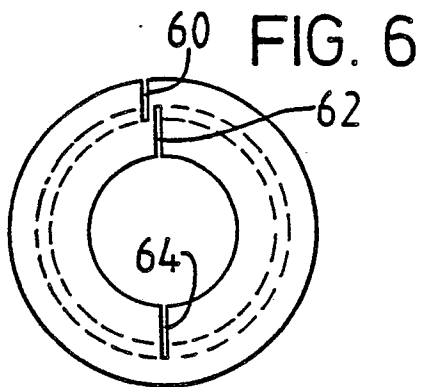


FIG. 6

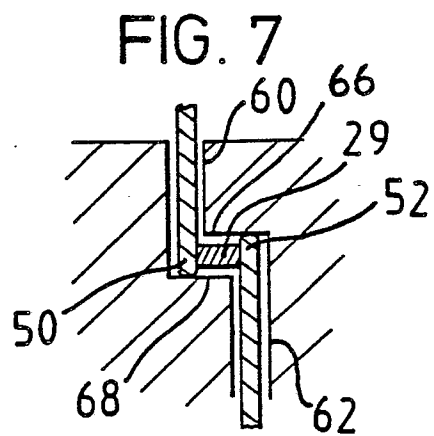


FIG. 7