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(54) **Strain relief apparatus for probe and method of manufacturing the same**

Strangfreigabevorrichtung für eine Sonde und Herstellungsverfahren dafür

Appareil de réduction de tension pour sonde et son procédé de fabrication

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(73) Proprietor: **MEDISON CO., LTD.**
Kangwon-do 250-875 (KR)

(72) Inventors:
- **Woo, Kyeong Gu**
  Gyeonggi-do (KR)
- **Lee, Sun Ki**
  Seoul (KR)

(74) Representative: **Schmid, Wolfgang**
Lorenz & Kollegen
Patentanwälte Partnerschaftsgesellschaft
Alte Ulmer Strasse 2
89522 Heidenheim (DE)

(56) References cited:
US-A- 5 630 419 **US-A- 5 678 551**
US-A- 6 142 947

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a strain relief apparatus and, more particularly, to a strain relief apparatus for a probe and a method of manufacturing the same.

2. Description of the Related Art

[0002] Generally, an ultrasonic diagnostic apparatus refers to a non- invasive apparatus that irradiates an ultrasound signal from a surface of a patient body towards a target internal organ beneath the body surface and obtains an image of a monolayer or blood flow in soft tissue from information in the reflected ultrasound signal (ultrasound echo- signal) . The ultrasonic diagnostic apparatus has been widely used for diagnosis of the heart, the abdomen, the urinary organs, and in obstetrics and gynecology due to various merits thereof such as small size, low price, real- time image display, and high stability through elimination of radiation exposure, as compared with other image diagnostic systems, such as X- ray diagnostic systems, computerized tomography scanners (CT scanners) , magnetic resonance imagers (MRIs) , nuclear medicine diagnostic apparatuses, and the like.

[0003] Particularly, the ultrasonic diagnostic apparatus includes a probe which transmits an ultrasound signal to a target and receives the ultrasound echo- signal reflected therefrom to obtain an ultrasound internal image of the target.

[0004] The probe includes a transducer. The transducer transmits an ultrasound signal to the target and receives the ultrasound echo-signal reflected therefrom using a piezoelectric layer in which a piezoelectric material converts electrical signals into sound signals or vice versa through vibration thereof.

[0005] When using the apparatus for ultrasound diagnosis of a target, an operator moves or rotates the probe with one hand while keeping the probe in contact with a surface of the target to obtain an ultrasound image of the target.

[0006] A cable is connected to the rear side of the probe. The probe is connected to a main body of the ultrasonic diagnostic apparatus via a cable that is connected to the main body of the ultrasonic diagnostic apparatus.

[0007] The cable connecting the probe to the main body of the apparatus is connected to a printed circuit board (PCB), which is connected to the transducer, through a case of the probe, and is bonded to the case at a contact point with the case by an adhesive or the like, so that the cable is provided to the probe.

[0008] It should be noted that the above description is provided for understanding of the background of the invention and is not a description of a conventional technique well-known in the art.

[0009] The cable provided to the probe is likely to be bent during the movement or use of the probe. Then, the bending of the cable imparts a force on the contact point between the cable and the case, causing the cable to break. Therefore, there is a need to solve such a problem.

[0010] The US 6 142 947 A discloses a repairable compact ultrasound probe which is easy to assemble and disassemble, and which has cable load transfer and heat dissipation capabilities. The transducer assembly of the probe has a heat-conductive backing board which is fastened to a yoke incorporated in the cable assembly. The cable assembly further has a strain relief element which is secured in a separate operation following attachment of the yoke to the backing board. When the strain relief element is secured, the probe handle is compressed between the strain relief and a headshell of the transducer assembly, thereby forming a housing. To disassemble the probe, the strain relief is turned counterclockwise with respect to the transducer, thereby releasing the handle and allowing access to the probe interior.

[0011] The US 5 630 419 A describes a sealable connector assembly for terminating a multiconductor cable, such as used for connecting electronic surgical instruments to devices for providing drive signals and analyzing return signals, comprising a body terminating in a flange having a planar distal edge. A cap member placed over the flange includes a planar gasket sealing to the planar edge of the flange, and secured to the connector by a locking member.

[0012] The US 5 678 551 A discloses an ultrasound probe including an electrical cable having a first end and a second end, an ultrasound transducer connected to the first end of the cable and a connector assembly connected to the second end of the cable. The connector assembly includes a connector housing having a cable opening and a mating connector opening, a connector body assembly mounted within the connector housing, a removable cover assembly sealed to the connector housing and covering the mating connector opening, and a strain relief assembly for sealing the cable opening between the cable and the connector housing. When the removable cover assembly is sealed to the connector housing, the connector assembly is immersible in a liquid, such as a sterilization fluid. The cover assembly is removed from the connector housing for operation of the ultrasound probe with an imaging system.

SUMMARY OF THE INVENTION

[0013] The present invention is conceived to solve the problem of the related art, and an aspect of the invention is to provide a strain relief apparatus of a probe and a method of manufacturing the same that can reduce influence by bending of a cable.

[0014] In accordance with one aspect of the invention, a strain relief apparatus of a probe includes: an insert

part mounted on a probe switch box and having an insertion recess at an inner side thereof; a ferrite core mounted on the insertion recess; and a rubber part provided to the insert part by injection molding.

[0015] The insert part includes an extension portion extending towards the rubber part to define the insertion recess inside the extension portion.

[0016] The extension portion is formed with an injection groove and the rubber part is formed on the extension portion and the injection groove by insert-injection molding.

[0017] The rubber part may be provided to the insert part without a step therebetween by the injection molding.

[0018] The apparatus may further include a D-cut portion formed on one side of the insert part to prevent rotation of the insert part mounted on the probe switch box.

[0019] In accordance with another aspect of the invention, a method of manufacturing a strain relief apparatus of a probe includes: preparing an insert part; inserting a ferrite core into the insert part; and insert-injection molding a rubber part to the insert part with the ferrite core inserted therein.

[0020] The preparation of an insert part includes forming an injection groove to which the rubber part is formed by the insert-injection molding.

[0021] The preparation of an insert part may include forming a D-cut portion on the insert part.

[0022] According to one embodiment of the invention, the strain relief apparatus protects a cable of an ultrasonic diagnostic apparatus from impact exerted on the cable and suppresses influence on a contact point between a probe switch box and the cable by bending of the cable, thereby preventing damage of the cable.

[0023] Further, according to the embodiment, the rubber part is formed by insert- injection molding to the insert part with the ferrite core inserted into the insert part, so that the number of components is reduced and separate assembly operation is eliminated, thereby facilitating the fabrication of the apparatus and reducing manufacturing costs.

[0024] Moreover, according to the embodiment, the insert part is prevented from rotating on the probe switch box and the rubber part is prevented from rotating on the insert part, thereby preventing abrasion or damage of the strain relief apparatus caused by rotation and friction between the probe switch box, insert part and rubber part.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The above and other aspects, features and advantages of the invention will become apparent from the following description of embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 is an exploded perspective view of a strain relief apparatus of a probe in accordance with one embodiment of the present invention;

Fig. 2 is a cross-sectional view of the strain relief apparatus in accordance with the embodiment of the present invention; and

Fig. 3 is a flowchart of a method of manufacturing a strain relief apparatus of a probe in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENT

[0026] Embodiments of the invention will now be described in detail with reference to the accompanying drawings. It should be noted that the drawings are not to precise scale and may be exaggerated in thickness of lines or size of components for descriptive convenience and clarity only. Furthermore, terms used herein are defined by taking functions of the invention into account and can be changed according to the custom or intention of users or operators. Therefore, definition of the terms should be made according to overall disclosures set forth herein.

[0027] Fig. 1 is an exploded perspective view of a strain relief apparatus of a probe in accordance with one embodiment of the invention, and Fig. 2 is a cross-sectional view of the strain relief apparatus in accordance with the embodiment of the invention.

[0028] Referring to Figs. 1 and 2, a strain relief apparatus of a probe according to one embodiment includes an insert part 110, a ferrite core 120, and a rubber part 130.

[0029] The insert part 110 is mounted on a probe switch box 10. In this embodiment, the insert part 110 has a cylindrical shape with an outer surface bulging outward and is formed therein with a through-hole (reference numeral omitted). The insert part 110 is mounted at one side thereof on the probe switch box 10 and connected at the other side thereof to the rubber part 130.

[0030] In this embodiment, the insert part 110 includes an extension portion 111. The extension portion 111 is located at the other side of the insert part 110 and extends towards the rubber part 130. The extension portion 111 has smaller inner and outer diameters than other portions of the insert part 110. As a result, steps are formed at inner and outer borders of the extension portion 111 to the other portions of the insertion part 110.

[0031] Moreover, the insert part 110 has an insertion recess 112 at an inner side thereof. The insertion recess 112 is formed inside the insert part 110 having the through- hole to be defined inside the extension portion 111. In this embodiment, the insertion recess 112 is formed by the step, which is formed at the inner border of the extension portion 111, and is open towards the rubber part 130.

[0032] A D-cut portion 115 for preventing rotation of the insert part 110 is formed on the insert part 110, that is, on one side of the insert part 110 that will be disposed on the probe switch box 10. In this embodiment, the D-cut portion 115 is depressively formed on an outer circumferential surface of the one side of the insert part 110 and a rear side of the probe switch box 10 coupled to the

one side of the insert part 110 has a shape corresponding to that of the outer circumferential surface of the one side of the insert part 110 on which the D-cut portion 115 is formed.

[0033] The D-cut portion 115 defines a linear section on the outer circumferential surface of the insert part 110 to prevent the insert part 110 disposed on the probe switch box 10 from rotating on the probe switch box 10.

[0034] The ferrite core 120 is mounted on the insertion recess 112. The ferrite core 120 serves to shield electronic-wave noise from escaping a cable (not shown). Since details and operation of the ferrite core 120 are apparent to those skilled in the art, a detailed description thereof will be omitted herein.

[0035] According to this embodiment, the ferrite core 120 has a shape corresponding to the shape of the insertion recess 112 and is formed therein with a through-hole (reference numeral omitted), through which the cable can pass. By mounting the ferrite core 120 on the insertion recess 112, the ferrite core 120 is inserted into the insert part 110, and the cable is inserted into the insert part 110 through the through-hole in the ferrite core 120.

[0036] The rubber part 130 is provided to the insert part 110 by injection molding. The rubber part 130 is connected to the other side of the insert part 110 by insert-injection molding the rubber part 130 to the extension portion 111. The rubber part 130 is formed by the insert-injection molding to the extension portion 111 by injecting a resin for the rubber part 130 (hereinafter, referred to as the "resin") onto inner and outer sides of the extension portion 111.

[0037] Further, the extension portion 111 is formed with an injection groove 113. The injection groove 113 is formed on a lateral side of the extension portion 111 to penetrate the inner and outer sides of the extension portion 111. The rubber part 130 is formed on the extension portion 111 and the injection groove 113 by insert- injection molding.

[0038] According to this embodiment, upon injection of the rubber part 130, an outer surface of the extension portion 111 and the injection groove 113 are covered and filled with the resin. The rubber part 130 formed by covering the outer surface of the extension portion 111 and the injection groove 113 with the resin has an increased contact area with the extension portion 111, so that the rubber part 130 is bonded to the insert part 110 with a strong bonding force and is thus prevented from rotating on the insert part 110.

[0039] The rubber part 130 is provided to the insert part 110 by insert-injection molding so that a step is not formed on the outer border of the rubber part 130 to the insert part 110. Thus, the insert part 110 and the rubber part 130 are formed such that the outer surfaces thereof provide a single continuous line as seen from a side section view of the strain relief apparatus.

[0040] Moreover, the rubber part 130 is formed with a through- hole (reference numeral omitted) . A cable connected to a main body of an ultrasonic diagnostic apparatus (not shown) is inserted into the probe switch box 10 through the rubber part 130, ferrite core 120 and insert part 110, all of which have the through- holes therein.

[0041] The rubber part 130 may have elasticity to absorb external impact and is made of a flexible material that can be freely bent. The rubber part 130 protects the cable from external impact applied to the cable, and suppresses influence by bending of the cable on a contact point between the probe switch box 10 and the cable.

[0042] Fig. 3 is a flowchart of a method of manufacturing a strain relief apparatus of a probe in accordance with one embodiment of the invention.

[0043] Next, a method of manufacturing a strain relief apparatus of a probe according to one embodiment will be described with reference to Figs. 1 to 3.

[0044] Referring to Figs. 1 to 3, to manufacture a strain relief apparatus 100 according to one embodiment, first, an insert part 110 is prepared in S10. The insert part 110 has a hollow cylindrical shape with an outer surface bulging outward and is formed therein with a through-hole.

[0045] The insert part 110 has a D-cut portion 115 depressively formed on one side thereof, and an extension portion 111 at the other side thereof. The extension portion 111 is formed at an inner side thereof with an insertion recess 112 into which a ferrite core 120 will be inserted, and is formed at a lateral side thereof with an injection groove 113 through which a rubber part 130 is provided to the insert part 110 by insert-injection molding.

[0046] After the insert part 110 is prepared as above, the ferrite core 120 is inserted into the insert part 110. According to this embodiment, the ferrite core 120 is inserted into the insert part 110 by mounting the ferrite core 120 on the insertion recess 112 defined inside the extension portion 111, in S20.

[0047] Then, the rubber part 130 is provided to the insert part 110 by insert- injection molding with the ferrite core 120 inserted into the insert part 110, in S30. The rubber part 130 may be provided to the insert part 110 through insert- injection molding by injecting a resin so as to cover the extension portion 111 and fill in the injection groove 113. When provided to the insert part 110 by the insert- injection molding, the rubber part 130 is bonded to the insert part 110 with a strong bonding force and is thus prevented from rotating on the insert part 110.

[0048] The strain relief apparatus 100 according to this embodiment manufactured as above protects a cable of an ultrasonic diagnostic apparatus from impact applied to the cable and suppresses influence by bending of the cable on a contact point between a probe switch box and the cable, thereby preventing damage of the cable.

[0049] Further, in the strain relief apparatus 100 according to the embodiment, the rubber part 130 is formed to the insert part 110 by insert- injection molding with the ferrite core 120 inserted into the insert part 110, so that the number of components is reduced and separate assembly operation is eliminated, thereby facilitating the fabrication of the apparatus and reducing manufacturing costs.

[0050] Further, in the strain relief apparatus 100 according to the embodiment, the insert part 110 is prevented from rotating on the probe switch box 10 and the rubber part 130 is prevented from rotating on the insert part 130, thereby preventing abrasion or damage of the strain relief apparatus 100 caused by rotation and friction between the probe switch box 10, insert part 110 and rubber part 130.

[0051] Although some embodiments have been provided to illustrate the invention in conjunction with the drawings, it will be apparent to those skilled in the art that the embodiments are given by way of illustration only, and that various modifications and equivalent embodiments can be made without departing from the scope of the invention. The scope of the invention should be limited only by the accompanying claims.

Claims

1. A strain relief apparatus (100) of an ultrasound probe, comprising:

   an insert part (110) mounted on a probe switch box (10) and having an insertion recess (112) at an inner side thereof;
   a ferrite core (120) mounted on the insertion recess (112); and
   a rubber part (130) provided to the insert part (110),

   characterized in that the insert part (110) comprises an extension portion (111) extending towards the rubber part (130) to define the insertion recess (112) inside the extension portion (111) and the extension portion (111) is formed with an injection groove (113) formed on a lateral side of the extension portion (111) to penetrate the inner and outer sides of the extension portion (111) and the rubber part (130) is formed on the extension portion (111) and the injection groove (113) by insert injection molding.

2. The strain relief apparatus (100) according to any one of claim 1, **characterized in that** the rubber part (130) is provided to the insert part (110) without a step there between by the injection molding.

3. The strain relief apparatus (100) according to any one of claims 1 to 2, **characterized by** further comprising:

   a D-cut portion (115) formed on one side of the insert part (110) to prevent rotation of the insert part (110) mounted on the probe switch box (10).

4. A method of manufacturing a strain relief apparatus (100) of an ultrasound probe, **characterized by** comprising:

   preparing an insert part (110);
   inserting a ferrite core (120) into the insert part (110); and
   insert-injection molding a rubber part (130) to the insert part (110) with the ferrite core (120) inserted therein,

   characterized in that the preparation of an insert part (110) comprises forming an injection groove (113) formed on a lateral side of the extension portion (111) to penetrate the inner and outer sides of the extension portion (111) to which the rubber part (130) is formed by the insert-injection molding.

5. The method according to claim 4, **characterized in that** the preparation of an insert part (110) comprises forming a D-cut portion (115) on the insert part (110).

Patentansprüche

1. Zugentlastungsvorrichtung (100) für eine Ultraschallsonde, welche folgendes aufweist:

   ein Einlegeteil (110), das auf einem Sondenschaltkasten (10) montiert ist und eine Einführausnehmung (112) an einer inneren Seite desselben aufweist;
   einen Ferritkern (120), der auf der Einführausnehmung (112) montiert ist; und
   ein Gummiteil (130), das an dem Einlegeteil (110) vorgesehen ist,

   dadurch gekennzeichnet, dass
   das Einlegeteil (110) einen Verlängerungsabschnitt (111) aufweist, der sich in Richtung des Gummiteils (130) erstreckt, um die Einführausnehmung (112) innerhalb des Verlängerungsabschnitts (111) festzulegen, und dass der Verlängerungsabschnitt (111) mit einer Einspritznut (113) ausgebildet ist, die auf einer Seite des Verlängerungsabschnitts (111) ausgebildet ist, um die inneren und äußeren Seiten des Verlängerungsabschnitts (111) zu durchdringen, und dass das Gummiteil (130) auf dem Verlängerungsabschnitt (111) und der Einspritznut (113) mittels Spritzgießen gebildet ist.

2. Zugentlastungsvorrrichtung (100) nach Anspruch 1, **dadurch gekennzeichnet, dass**
   das Gummiteil (130) an dem Einlegeteil (110) ohne einen dazwischen liegenden Schritt mittels des Spritzgießens gebildet ist.

3. Zugentlastungsvorrrichtung (100) nach Anspruch 1 oder 2,
   gekennzeichnet durch
   einen D-Ausschnitts-Abschnitt (115), der auf einer Seite des Einlegeteils (110) vorgesehen ist, um die

Rotation des auf dem Sondenschaltkasten (10) montierten Einlegeteils (110) zu verhindern.

4. Verfahren zur Herstellung einer Zugentlastungsvorrichtung (100) für eine Ultraschallprobe, welches folgendes aufweist:

Herstellen eines Einlegeteils (110);
Einführen eines Ferritkerns (120) in das Einlegeteil (110); und
Einlagespritzgießen eines Gummiteils (130) in das Einlegeteil (110) mit dem darin eingeführten Ferritkern (120),

dadurch gekennzeichnet, dass
das Herstellen eines Einlegeteils (110) das bilden einer Einspritznut (113) beinhaltet, die auf einer Seite des Verlängerungsabschnitts (111) gebildet ist, um die inneren und äußeren Seiten des Verlängerungsabschnitts (111) zu durchdringen, an welchem das Gummiteil (130) mittels Einlagespritzgießen angeformt wird.

5. Verfahren nach Anspruch 4,
dadurch gekennzeichnet, dass
die Herstellung eines Einlegeteils (110) das Bilden eines D-Ausschnitts-Abschnitts (115) an dem Einlegeteil (110) beinhaltet.

Revendications

1. Appareil (100) pour réduire la tension d'une sonde ultrasonique comportant :

un élément d'entrée (110) monté sur un boîtier de commutation pour sonde (10) ayant un embout d'insertion (112) ménagé à l'intérieur ;
un noyau en ferrite (120) monté sur l'embout d'insertion (112) ; et
une pièce en caoutchouc (130) fixée à l'élément d'entrée (110),

caractérisé en ce que l'élément d'entrée (110) comprend une extension (111) s'étendant en direction de la pièce en caoutchouc (130) pour définir l'embout d'insertion (112) à l'intérieur de l'extension (111) et l'extension (111) est pourvue d'une gorge d'injection (113) formée sur un côté latéral de l'extension (111) pour entrer dans les côtés intérieur et extérieur de l'extension (111) et la pièce en caoutchouc (130) est constituée de l'extension (111) et de la gorge d'injection (113) par surmoulage par injection de l'insert.

2. Appareil (100) pour réduire la tension d'une sonde selon la revendication 1, **caractérisé en ce que** la pièce en caoutchouc (130) est produite sur l'élément d'entrée (110) sans phase intermédiaire, par surmoulage par injection.

3. Appareil (100) pour réduire la tension d'une sonde selon l'une quelconque des revendications 1 à 2, **caractérisé en ce qu'**il comprend en outre :

une découpe d'angle (115) formée sur un côté de l'élément d'entrée (110) pour éviter la rotation de l'élément d'entrée (110) monté sur le boîtier de commutation pour sonde (10).

4. Procédé pour fabriquer un appareil (100) pour réduire la tension d'une sonde ultrasonique, **caractérisé en ce qu'**il comprend :

la préparation d'un élément d'entrée (110) ;
l'insertion d'un noyau de ferrite (120) dans l'élément d'entrée (110) ; et
le surmoulage par injection d'une pièce en caoutchouc (130) sur l'élément d'entrée (110), le noyau de ferrite (120) y étant inséré ;

caractérisé en ce que la préparation d'un élément d'entrée (110) comprend la formation d'une gorge d'injection (113) ménagée sur un côté latéral de l'extension (111) pour pénétrer dans les côtés intérieur et extérieur de l'extension (111) sur laquelle la pièce en caoutchouc (130) est formée par surmoulage par injection.

5. Procédé selon la revendication 4, **caractérisé en ce que** la préparation d'un élément d'entrée (110) comporte la formation d'une découpe d'angle (115) d'un élément d'entrée (110).

Fig. 1

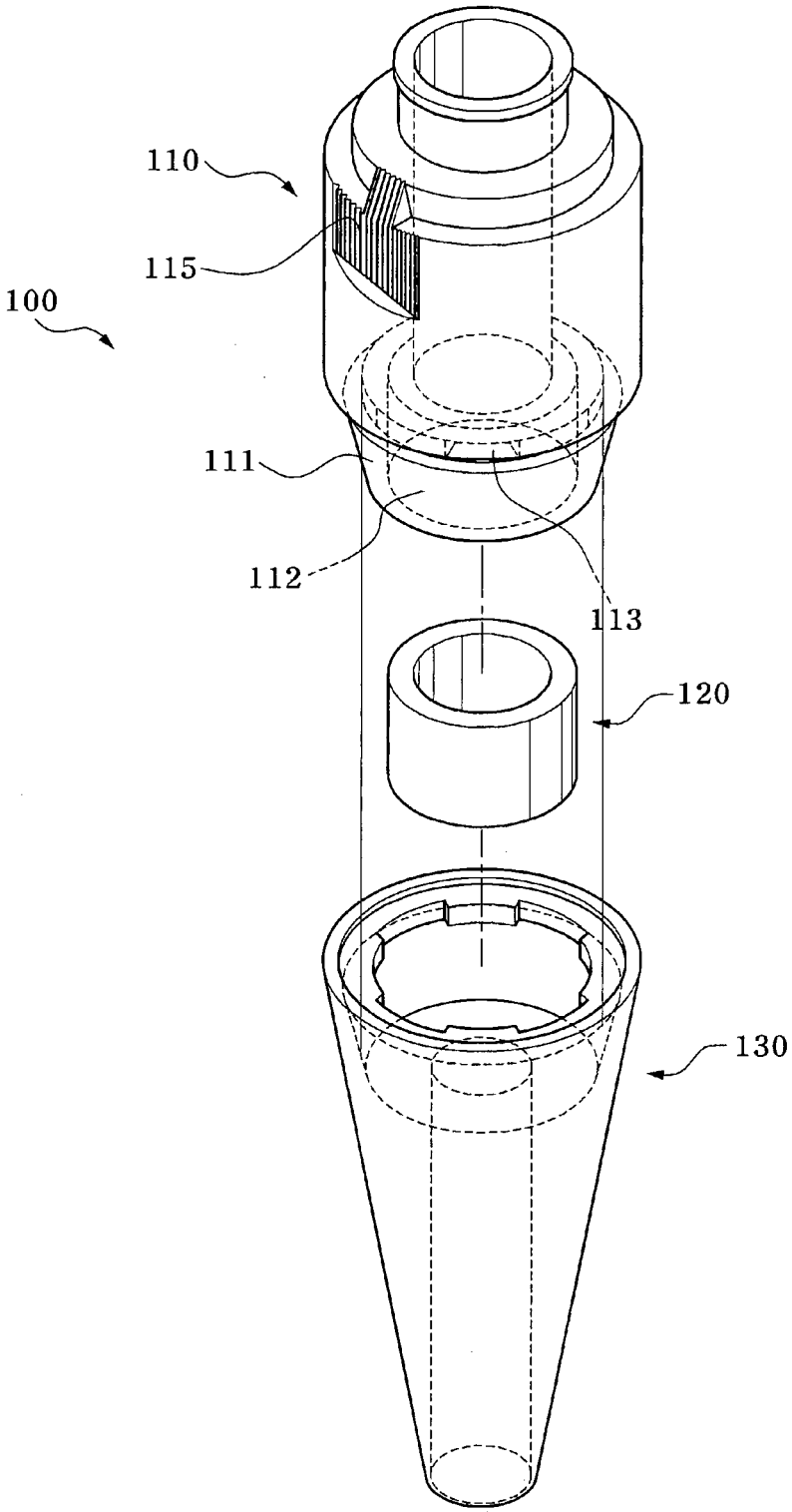


Fig. 2

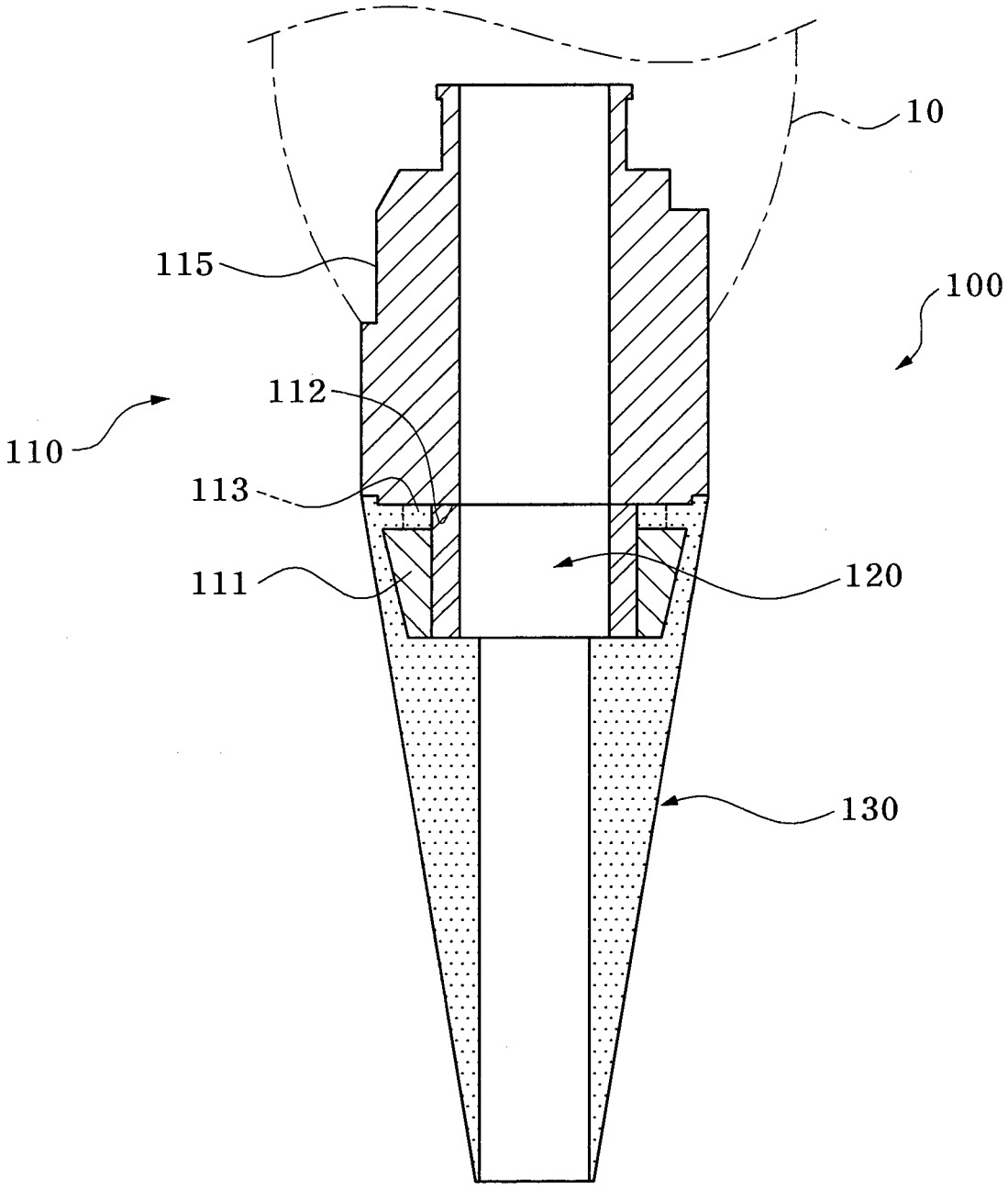
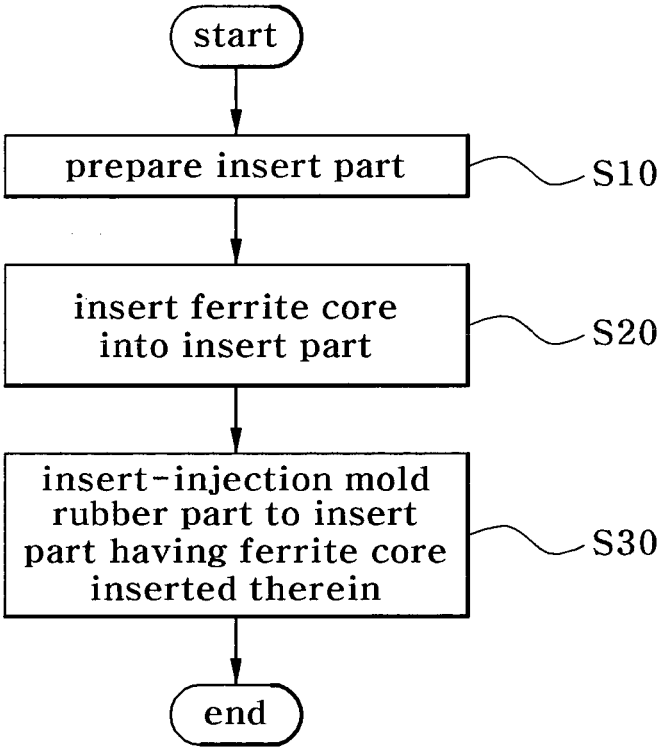


Fig. 3


start
prepare insert part
S10
insert ferrite core into insert part
S20
insert-injection mold rubber part to insert part having ferrite core inserted therein
S30
end

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6142947 A **[0010]**
- US 5630419 A **[0011]**
- US 5678551 A **[0012]**

专利名称(译)	用于探针的应变消除装置及其制造方法		
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[标]发明人	WOO KYEONG GU LEE SUN KI		
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摘要(译)

公开了一种探针的应变消除装置（100）及其制造方法。应变减轻装置（100）包括安装在探针开关盒（10）上并且在其内侧具有插入凹槽（112）的插入部分（110），安装在插入凹槽（112）上的铁氧体磁芯（120）。 ）和通过注射成型设置到插入部分（110）的橡胶部分（130）。应变减轻装置（100）保护超声波诊断装置的电缆免受施加在电缆上的冲击，并通过弯曲电缆来抑制对探针开关盒和电缆之间的接触点的影响，从而防止电缆的损坏。