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(54) **MAGNETICALLY DRIVEN ULTRASONIC SCANNING DEVICE**

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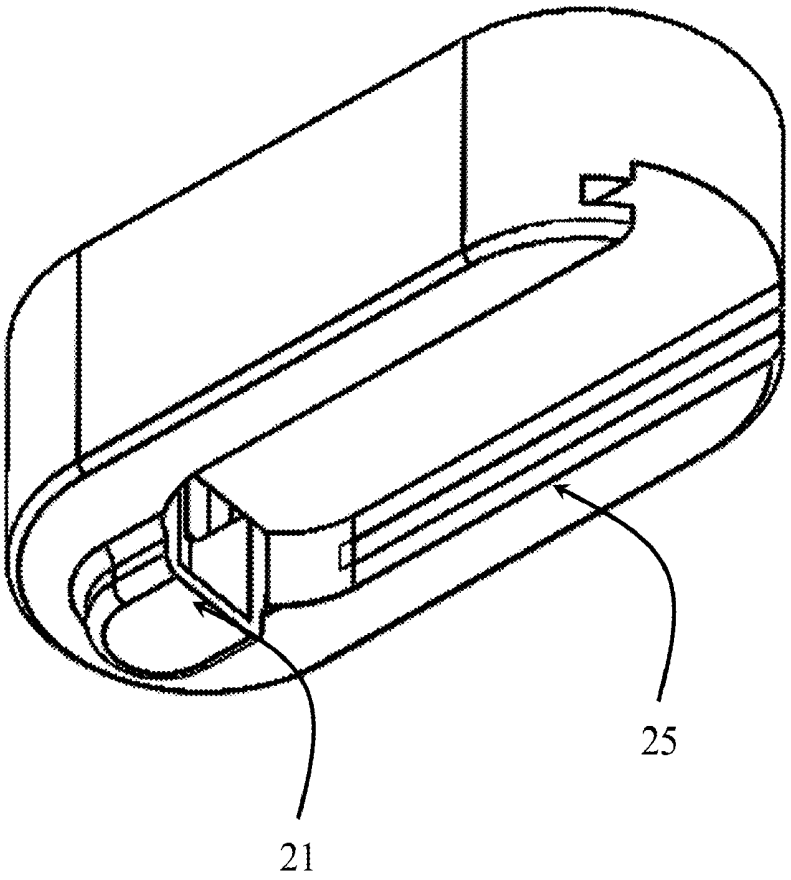
(57) **ABSTRACT**

The present invention provides an ultrasonic probe scanning device comprising: a disposable part and a fixed part. In the disposable part, an ultrasonic probe with a magnetic end attaches to a slide rail encapsulated in a water-containing closed area. Otherwise, in the fixed part, a magnetic holder attached to a track, and a motor for driving the magnetic holder to move back and forth on the track. When the disposable part and the fixed part be combined, it can drive the motion of ultrasonic scanning device by magnetic attraction force.



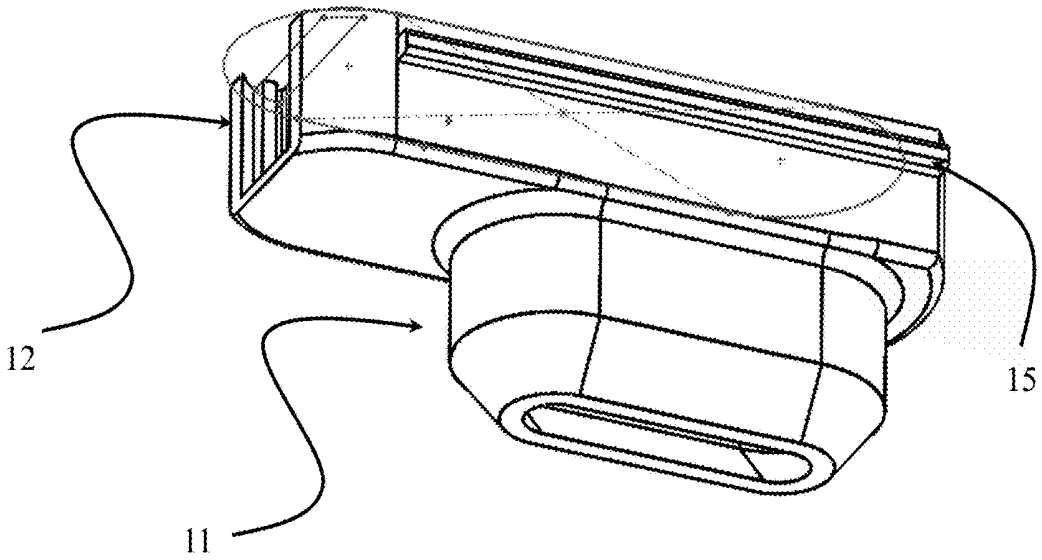


Fig 1A

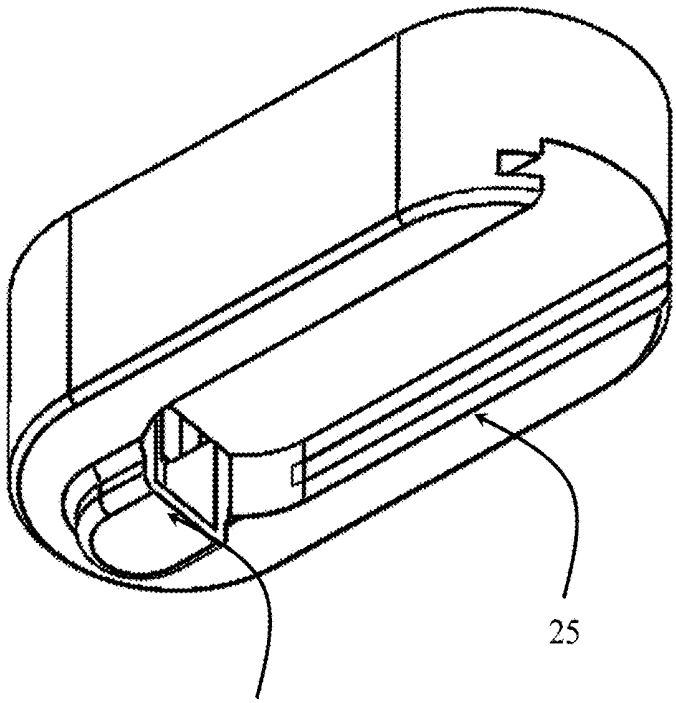


Fig 1B

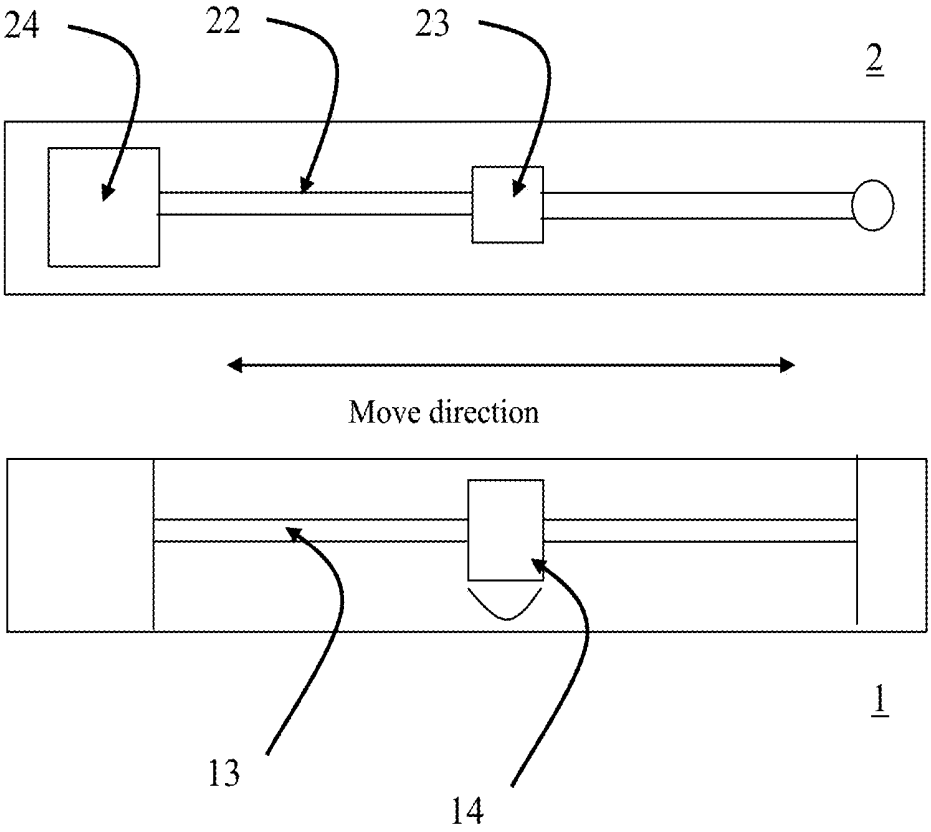


Fig 2

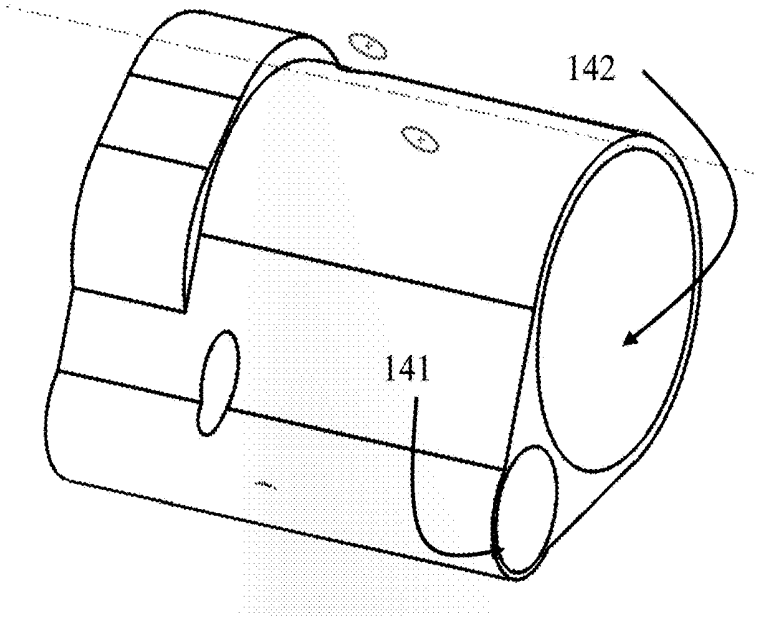


Fig 3A

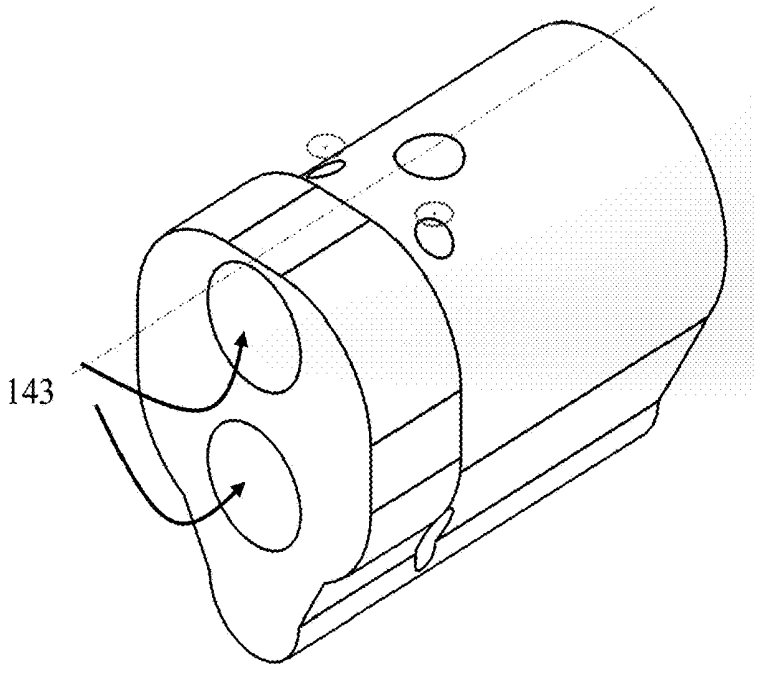


Fig 3B

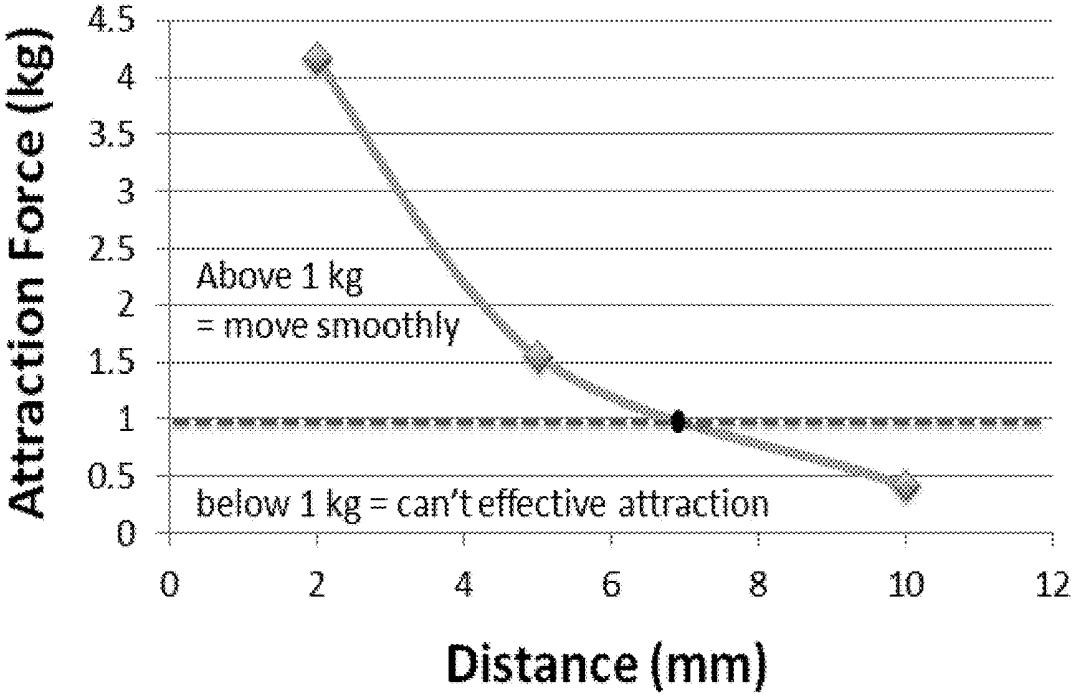

Attraction Force (kg)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
Above 1 kg
= move smoothly
below 1 kg = can't effective attraction
0
2
4
6
8
10
12
Distance (mm)

Fig 4

MAGNETICALLY DRIVEN ULTRASONIC SCANNING DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This Non-provisional application claims priority under 35 U.S.C. § 119(a) on Patent Application No(s). [106131626] filed in Taiwan, Republic of China [Sep. 14, 2017], the entire contents of which are hereby incorporated by reference.

FIELD OF THE INVENTION

[0002] The present invention s an ultrasonic scanning device being used for the skin surface image and the subcutaneous tissue. Especially, a device is with a moveable ultrasonic probe head driven by magnetic attraction force.

BACKGROUND OF THE INVENTION

[0003] Because of no-radioactivity and safety, the application of ultrasound technique in medicine is more and more widely in recent year. A part of the application is focused on the development of medical, such as obstetric ultrasound, breast ultrasound, muscle ultrasound . . . etc. In addition to diagnostic use, it can also be used for therapentic treatment, such as ultrasound scalpel, ultrasound heat treatment, ultrasound lifting and lipolysis.

[0004] In the traditional ultrasound device for skin and subcutaneous tissue use, the ultrasonic probe is in one end of the device, the linear shaft rod is in the middle to drive the device, and the linear shaft is designed as the mechanical structure, which is covered by a rubber tube. However, the rubber tube limits the movement distance during actual operation. Otherwise, the rubber tube is often a leaky spot which causes the damage of the whole product. It is difficult to maintain the quality of ultrasound device product. Moreover, the size of the linear shaft bar cannot continue to be reduced.

[0005] For solving above problem, the present invention is to replace the conventional mechanical structure with magnetic attraction force and a detachable model.

SUMMARY OF THE INVENTION

[0006] Accordingly, the present invention provides a design for driving a imaging probe and a therapy probe, having the following features:

[0007] 1. The design of Ultrasonic probe design is with high collimation;

[0008] 2. The ultrasonic probe can move stably through the magnetic attraction force;

[0009] 3. A disposable part with the probe can be separated from a fixed part with the motor, and its water seal design can also reduce the risk of water seepage.

[0010] The ultrasonic probe scanning device comprising a disposable part and a fixed part. Wherein the disposable part having: a power input port; a slide rail; and an ultrasonic probe having a magnetic end with at least a pair of magnet N and S poles, wherein the ultrasonic probe is connected to the slide rail and electrically connected to the power input port, wherein the slide rail and the ultrasonic probe are encapsulated in a water-containing closed area.

[0011] The fixed part is having: a power output slot for electrically engaging the power input port when the disposable part is combined with the fixed part; a track; a magnetic holder coupled to the track for magnetically driving the ultrasonic probe when the disposable part is combined with the fixed part; and a motor which drives the magnetic holder to move on the track.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1**A and FIG. **1**B is the exterior picture of ultrasonic probe scanning device of the present invention.

[0013] FIG. **2** is the internal structure view of ultrasonic probe scanning device of the present invention.

[0014] FIG. **3**A and FIG. **3**B show the front and back view of an ultrasonic probe of the present invention.

[0015] FIG. **4** shows the test result of magnetic attractive force.

DETAILED DESCRIPTION OF THE INVENTION

[0016] The design of this ultrasonic probe scanning device shows as FIG. **1** and FIG. **2**, which comprises: a disposable part **1** and a fixed part **2**.

[0017] The FIG. **1**A is the exterior picture of disposable part **1**, and FIG. **2** is the internal structure view of disposable portion **1** and the fixed portion **2**, wherein the disposable part **1** comprises: a power input port **12**; a slide rail **13**; and an ultrasonic probe **14** having a magnetic end having at least a pair of magnet N and S poles, wherein the ultrasonic probe **14** is connected to the slide rail **13** and electrically connected to the power input port **12**, wherein the slide rail **13** and the ultrasonic probe **14** are encapsulated in a water-containing closed area **11**;

[0018] The FIG. **1**B is the exterior picture of the fixed part **2**, wherein the fixed part **2** having: a power output slot **21** for electrically engaging the power input port **21** when the disposable part **1** is combined with the fixed part **2**; a track **22**; a magnetic holder **23** coupled to the track **22** for magnetically driving the ultrasonic probe **14** when the disposable part **1** is combined with the fixed part **2**; and a motor **24** which drives the magnetic holder **23** to move on the track **22**.

[0019] In one of the best embodiment, FIG. **3**A shows the front view of the ultrasonic probe **14**, wherein the ultrasonic probe **14** comprises a therapy probe **141**; and an imaging probe **142**, which is parallel to the irradiation direction of the therapy probe **141**. In one of the best embodiment, the therapy probe **141** may be designed in the center of the imaging probe **142** or the therapy probe **141** may be designed on the outside of the imaging probe **142**, the imaging probe **142** should have the same focal plane as the therapy probe **141**; preferably, the operating frequency of the imaging probe **142** is 5 to 20 MHz, and the operating frequency of the therapy probe **141** is 2 to 10 MHz.

[0020] The ultrasonic probe **14** further comprises a miniature brake, which is used for controlling the ultrasonic probe **14** moving perpendicularly to the slide rail **13**, when the target position is different to the preset focal plane, the user can adjust the focal plane distance of miniature brake so as to obtain a clearer image.

[0021] FIG. **3**B shows the rear view of the ultrasonic probe **14**, the fixing part **2** drives the disposable part **1** through the magnetic end **143** of the ultrasonic probe **14** in the present invention. For the ultrasonic probe **14** can cooperate with the motor **24** action. The present invention further calculates the relationship between the distance and magnetic attractive

force, please refer to the following table 1-3 and FIG. **4**, to evaluate the operational feasibility according to calculate the strength of the magnetic force.

TABLE 1

The test result of magnetic attractive force (distance is 5 mm)

magnetic base (thickness mm)	magnetic end (thickness mm)	distance (mm)	magnetic attractive force (kg)
5	10	5	1.548
5	5	5	0.774
5	2	5	0.306
5	1	5	0.1548

TABLE 2

The test result of magnetic attractive force (distance is 2 mm)

magnetic base (thickness mm)	magnetic end (thickness mm)	distance (mm)	magnetic attractive force (kg)
5	10	2	4.158
5	5	2	2.079
5	2	2	0.828
5	1	2	0.4158

TABLE 3

The test result of magnetic attractive force (distance is 10 mm)

magnetic base (thickness mm)	magnetic end (thickness mm)	distance (mm)	magnetic attractive force (kg)
5	10	10	0.414
5	5	10	0.207
5	2	10	0.0828
5	1	10	0.0414

[0022] When the thickness of the magnet is greater than 2 mm, the diameter is greater than 10 mm, and the spacing is less than 6 mm, the magnetic attractive force will be greater than 1 kg. Otherwise, the magnetic attractive force will be greater than the load of the probe holder, which is in the range of magnetic attractive force. Thus, the ultrasonic probe is drove by the motor and the magnetic base described above, and the magnetic attractive force causes the probe to automatically collimate.

[0023] In one of the best embodiment, the magnetic attraction between the magnetic end **15** and the magnetic base **23** is greater than 0.2 kg and the distance is less than 1 cm.

[0024] In the case of using the ultrasonic probe scanning device, because of the disposable part **1** is detachable, it can combine a new disposable part **1** if the disposable part needs to be cleaned or is damaged, and the power input port **12** is electrically connected to the power output slot **21**, therefore, the power output slot **21** supplies the power source of the ultrasonic probe **14** and controls the operation of the ultrasonic probe **14**. Preferably, the disposable part **1** and the fixed part **2** have an engagement groove respectively **15**, **25**.

[0025] Although the present invention has been described in terms of specific exemplary embodiments and examples, it will be appreciated that the embodiments disclosed herein are for illustrative purposes only and various modifications and alterations might be made by those skilled in the art without departing from the spirit and scope of the invention as set forth in the following claims.

SYMBOLS

[0026] disposable part **1**
[0027] closed area **11**
[0028] power input port **12**
[0029] slide rail **13**
[0030] ultrasonic probe **14**
[0031] engagement groove of disposable part **15**
[0032] therapy probe **141**
[0033] imaging probe **142**
[0034] magnetic end **143**
[0035] fixed part **2**
[0036] power output slot **21**
[0037] track **22**
[0038] magnetic base **23**
[0039] motor **24**
[0040] engagement groove of fixed part **25**

What is claimed is:

1. An ultrasonic probe scanning device comprising:

a disposable part having:

a power input port;

a slide rail: and

an ultrasonic probe having a magnetic end with at least a pair of magnet N and S poles, wherein the ultrasonic probe is connected to the slide rail and electrically connected to the power input port, wherein the slide rail and the ultrasonic probe are encapsulated in a water-containing closed area;

a fixed part having:

a power output slot for electrically engaging the power input port when the disposable part is combined with the fixed part;

a track;

a magnetic holder coupled to the track for magnetically driving the ultrasonic probe when the disposable part is combined with the fixed part; and

a motor which drives the magnetic holder to move on the track.

2. The ultrasonic probe scanning device of claim **1**, wherein the ultrasonic probe further comprises a miniature brake, which is used for controlling the ultrasonic probe moving perpendicularly to the slide rail.

3. The ultrasonic probe scanning device of claim **1**, wherein the ultrasonic probe comprises:

a therapy probe; and

an imaging probe, which is parallel to the irradiation direction of the therapy probe.

4. The ultrasonic probe scanning device of claim **3**, wherein the imaging probe has the same focal plane as the therapy probe.

5. The ultrasonic probe scanning device of claim **3**, wherein the operating frequency of the imaging probe is 5 to 20 MHz.

6. The ultrasonic probe scanning device of claim **3**, wherein the operating frequency of the therapy probe is 2 to 10 MHz.

7. The ultrasonic probe scanning device of claim **1**, wherein the suction force between the magnetic end and the magnetic base is greater than 0.2 kg and the pitch thereof is less than 1 cm.

8. The ultrasonic probe scanning device of claim **1**, wherein the disposable part and the fixed part each have a mutual engagement groove.

* * * * *

专利名称(译)	磁力驱动的超声波扫描装置		
公开(公告)号	US20190076116A1	公开(公告)日	2019-03-14
申请号	US16/130618	申请日	2018-09-13
[标]申请(专利权)人(译)	国立阳明大学		
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IPC分类号	A61B8/00 G01S7/52 B06B1/06		
CPC分类号	A61B8/4218 G01S7/52085 B06B1/0622 A61B8/4483 A61B2017/00477 A61B2090/0813 A61N7/00 A61N2007/0082 A61N2007/0091 G01S7/52079 G01S15/8945 G01S15/899 G10K11/004		
优先权	106131626 2017-09-14 TW		
外部链接	Espacenet USPTO		

摘要(译)

本发明提供一种超声波探头扫描装置，包括：一次性部分和固定部分。在一次性部件中，具有磁性端部的超声波探头附接到封装在含水封闭区域中的滑轨。否则，在固定部分中，附着在轨道上的磁性支架和用于驱动磁性支架在轨道上来回移动的电动机。当一次性部分和固定部分组合时，它可以通过磁吸引力驱动超声波扫描装置的运动。