73-633 SR
XR 3,369,415
CROSS REFERENCE SEARCH ROOM

Feb. 20, 1968 S. M. SLAWSKY 3,369,415

MECHANISM FOR PRODUCING PIVOTAL MOVEMENT OF AN ARM

Filed July 1, 1965 4 Sheets-Sheet 1

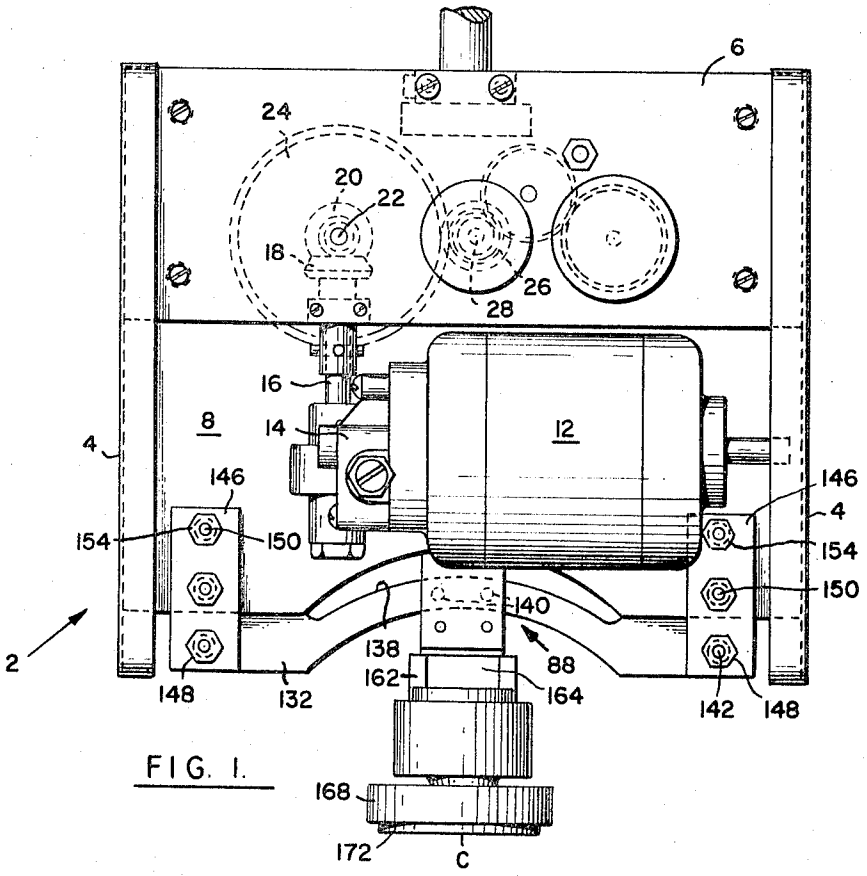

FIG. 1.

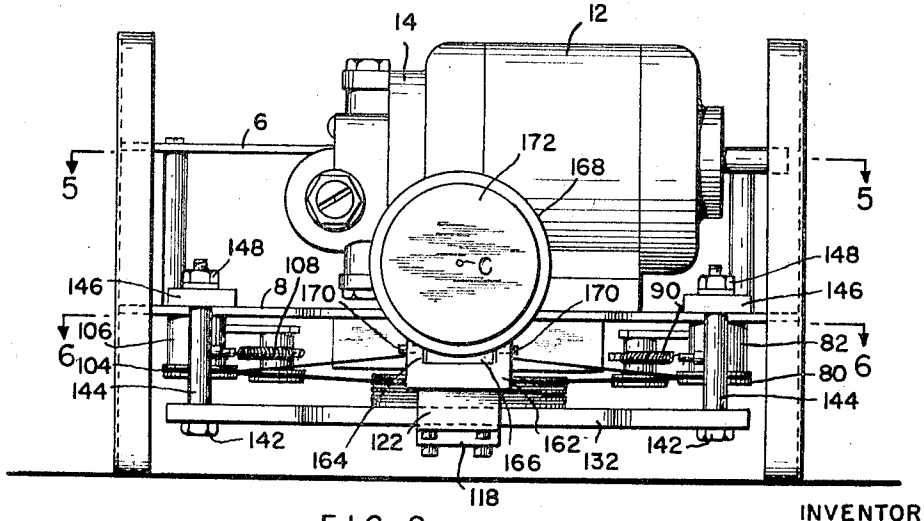

FIG. 2.

INVENTOR
STANLEY M. SLAWSKY
BY
Arseo Smith & Hardy
ATTORNEYS

3369415
OR IN 74/89.22

MECHANISM FOR PRODUCING PIVOTAL MOVEMENT OF AN ARM

Filed July 1, 1965 4 Sheets-Sheet 2

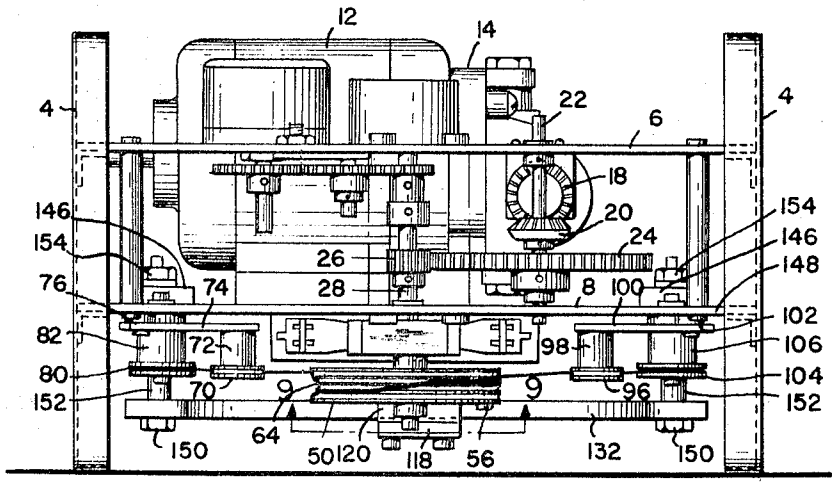

FIG. 3.

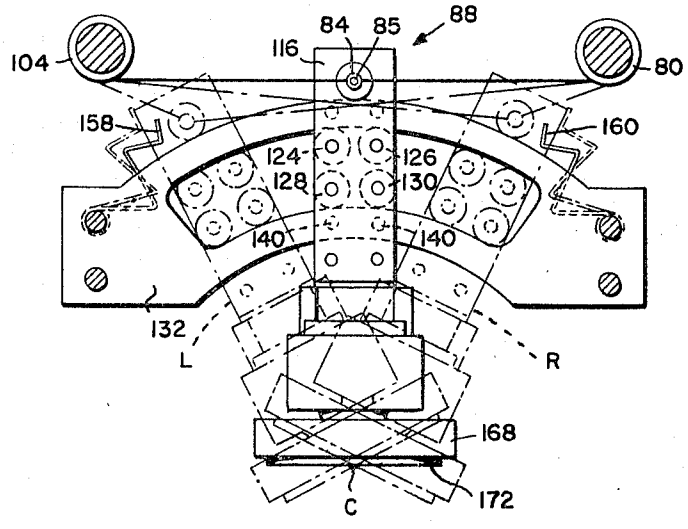

FIG. 4.

INVENTOR
STANLEY M. SLAWSKY
BY Bosse Smith & Harding
ATTORNEYS

Feb. 20, 1968 S. M. SLAWSKY 3,369,415

MECHANISM FOR PRODUCING PIVOTAL MOVEMENT OF AN ARM

Filed July 1, 1965 4 Sheets-Sheet 3

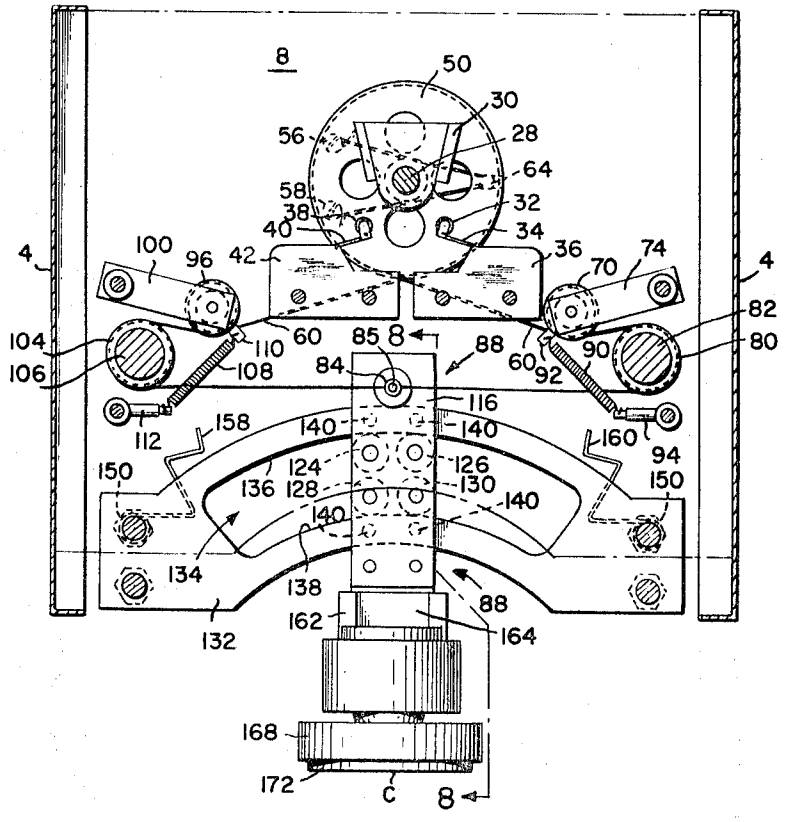

FIG. 6.

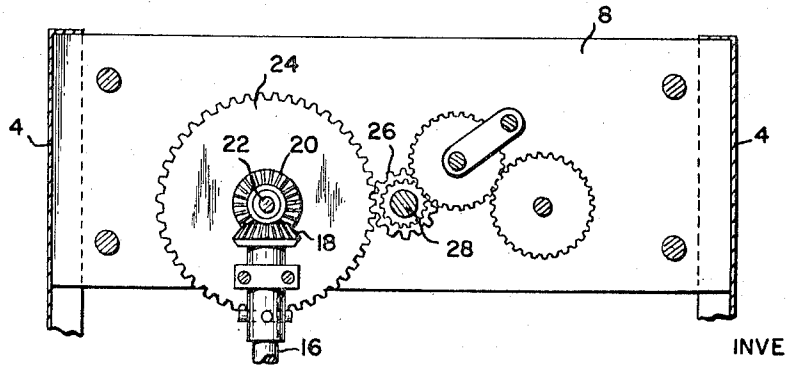

FIG. 5.

INVENTOR

STANLEY M. SLAWSKY

BY

Bissell Smith & Harding

ATTORNEYS

Feb. 20, 1968 S. M. SLAWSKY 3,369,415

MECHANISM FOR PRODUCING PIVOTAL MOVEMENT OF AN ARM

Filed July 1, 1965 4 Sheets-Sheet 4

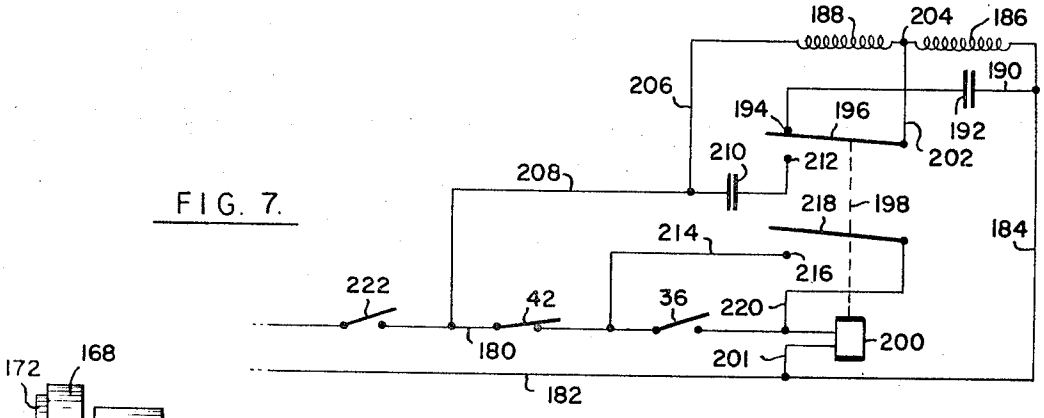

FIG. 7.

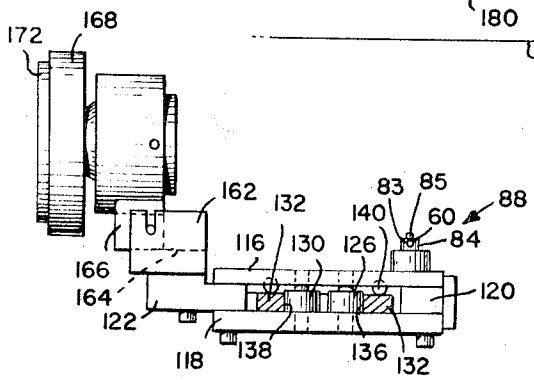

FIG. 8.

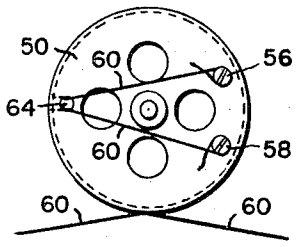

FIG. 9

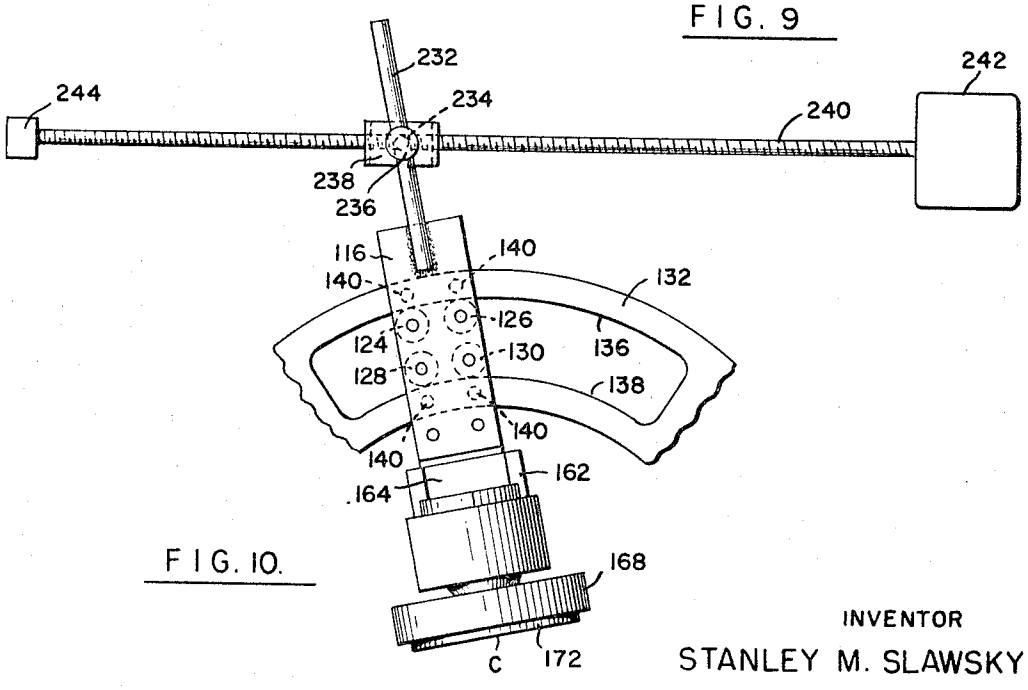

FIG. 10.

INVENTOR
STANLEY M. SLAWSKY
BY Brisco Smith & Harding
ATTORNEYS

United States Patent Office

3,369,415

Patented Feb. 20, 1968

3,369,415

MECHANISM FOR PRODUCING PIVOTAL MOVEMENT OF AN ARM

Stanley M. Slawsky, Rydal, Pa., assignor to Smith Kline & French Laboratories, Philadelphia, Pa., a corporation of Pennsylvania

Filed July 1, 1965, Ser. No. 468,702

8 Claims. (Cl. 74—89.22)

ABSTRACT OF THE DISCLOSURE

An arm is mounted by means spaced inwardly from the outer end of the arm to provide for pivotal movement of the arm about a point on the arm intermediate the mounting means and the outer end of the arm and is provided with means to oscillate the arm about said point.

This invention relates to a mechanism for producing pivotal movement of an arm. More particularly, it relates to such a mechanism wherein the arm pivots about a point substantially at the outer end thereof and is mounted for movement by means spaced inwardly from the outer end of the arm.

It is frequently desired to oscillate or rock an arm about a point located at the outer end of the arm while still having the outer end of the arm free from any mounting mechanism. A typical application is an ultrasonic transducer scanning arm which is to be applied against the patient's skin. If the center of rotation of the transducer arm is other than at a point adjacent the patient's skin and the outer face of the transducer, the transducer has an objectionable sliding action relative to the patient's skin. Since an ultrasonic transducer scanning arm application is a typical one, it will be used hereinafter in describing the invention and it will be understood that the invention is not limited to such an application.

In accordance with this invention, there is provided means spaced inwardly from the outer end of the transducer arm mounting the arm for pivotal movement about a point at or substantially at the outer face of the transducer.

The invention will be fully understood from a reading of the following description in conjunction with the drawings in which:

FIGURE 1 is a plan view of apparatus embodying the invention;

FIGURE 2 is a front elevation of the apparatus of FIGURE 1;

FIGURE 3 is a rear elevation of the apparatus of FIGURE 1;

FIGURE 4 is a simplified horizontal section of a portion of the apparatus illustrating various positions assumed by the transducer arm;

FIGURE 5 is a horizontal section partially broken away taken on the plane indicated by the line 5—5 in FIGURE 2;

FIGURE 6 is a horizontal section taken on the plane indicated by the line 6—6 in FIGURE 2;

FIGURE 7 is a wiring diagram of a circuit for reversing the motor of the apparatus in FIGURE 1;

FIGURE 8 is a view taken on the plane indicated by the line 8—8 in FIGURE 6;

FIGURE 9 is a view taken on the plane indicated by the line 9—9 in FIGURE 3; and

FIGURE 10 is a diagrammatic view illustrating an alternative embodiment of the invention.

Referring first to FIGURE 1, an ultrasonic scanning apparatus 2 has a frame 4 provided with transverse plates 6 and 8. A two-phase AC motor is mounted on plate 8 and is provided with a reduction gear section 14 which drives an output shaft 16. A bevel gear 18 secured to shaft 16 drives bevel gear 20 secured to shaft 22. Shaft 22 is mounted for rotation between plates 6 and 8 and has secured thereto a gear 24 which drives a gear 26 secured to shaft 28 which is mounted for rotation between plates 6 and 8.

Shaft 28 has secured thereto a cam member 30 (FIGURE 6) which is adapted to engage roller 32 on arm 34 of limit switch 36 and roller 38 on arm 40 of limit switch 42.

A drum 50 is fixedly secured to shaft 28 and has a plurality of peripheral groves 52 (FIGURE 3). A pair of screws 56 (FIGURE 9) and 58 respectively secure the free ends of a cord 60 to drum 50. The part of cord 60 secured by screw 56 passes through opening 64 in drum 50 to the uppermost groove 52 and then passes counterclockwise about drum 50 as viewed in FIGURE 6 to a pulley 70 mounted on a support member 72 secured to an arm 74 pivotally mounted on plate 8 as indicated at 76. This portion of the cord 60 then passes about pulley 80 mounted on a support member 82 secured to plate 8, and passes through an opening 83 in securing member 84 secured to a plate 88 and is held by a screw 85. Arm 74 is biased counterclockwise as viewed in FIGURE 6 by an extension coil spring 90 which is secured to support member 72 by member 92 and secured to member 94 which in turn is secured to plate 8.

The portion of cord 60 which is secured to drum 50 by screw 58 passes out through opening 64 in drum 50 to the lowermost groove 52 and thence to pulley 96 mounted on support member 98 which is secured to arm 100 which in turn is pivotally mounted on plate 8 as indicated at 102. This portion of the cord then passes around pulley 104 mounted on support member 106 which is secured to plate 8 and then passes to securing member 84 to which it is attached as indicated above. Arm 100 is biased clockwise as viewed in FIGURE 6 by an extension coil spring 108 secured to arm 100 by a member 110 and is secured to a member 112 which is in turn secured to plate 8.

Arm 88 (FIGURE 8) has an upper plate 116 and a lower plate 118 spaced apart by a rear spacer bar 120 and a front spacer bar 122 to which the upper and lower plates are secured as by screws. Rollers 124, 126, 128 and 130 lie between plates 116 and 118 and are journalled therein (FIGURE 6). Plates 116 and 118 embrace a guide plate 132 having an annulus 134 having an arcuate surface 136 which is engaged by rolers 124 and 126 and an arcuate surface 138 engaged by rollers 128 and 130. The surfaces 136 and 138 are concentric and the rollers 124, 126, 128 and 130 function to keep the center line of arm 88 perpendicular to surfaces 136 and 138. Ball bearings 140 in plates 116 and 118 engage plate 132.

Guide plate **132** is mounted on plate **8** by means of bolts **142**, **142** (FIGURE 2) which pass through spacer members **144**, **144** between guide plate **132** and bars **146**, **146** and are secured by nuts **148**, **148** as best seen in FIGURE 2. As best seen in FIGURE 3, bolts **150**, **150** pass through guide plate **132**, spacer members **152**, **152**, plate **8**, bars **146**, **146** and are secured by nuts **154**, **154**. As best seen in FIGURE 6, a buffer spring **158** is secured to guide plate **132** by one of the bolts **150** and a second buffer spring **160** is secured to guide plate **132** by a second bolt **150**, the buffer spring **158** and **160** acting to engage arm **88** near the limit of its travel at either end to minimize dead time during reversal of motor **12** and to provide a torque aid while motor **12** is accelerating to running speed by unloading said motor.

A block **162** (FIGURE 8) is fixedly secured to spacer member **122** and is provided with a groove **164** for the reception of a base **166** of an ultrasonic transducer shown at **168**. Pins **170**, **170** engage grooves in block **162** to hold base **166** in the desired position. The optimum position of the ultrasonic transducer **168** is with the vertical center line of the outer face **172** passing through the center of the arc forming the surfaces **136** and **138** and indicated at C in FIGURE 4.

Referring now to FIGURE 7, there is diagrammatically shown a circuit for reversing the motor **12**. There is provided a pair of power lines **180** and **182**. Power line **182** by a line **184** is connected to a field winding **186** of motor **12**. Field winding **186** is connected to field winding **188**. A line **190** containing a capacitor **192** is connected to line **184** and to switch contact **194** which is adapted to be contacted by switch arm **196** connected to actuating arm **198** of relay **200** which is connected to power line **180** and also connected to power line **182** by a line **201**. Switch arm **196** is connected by a line **202** to a center tap indicated at **204** between field coils **186** and **188**. A line **206** connects field coil **188** to line **208** which in turn is connected to power line **180**. Line **208** contains a capacitor **210** and is connected to a switch contact **212** which is adapted to be contacted by switch arm **196**. A holding circuit for relay **200** comprises a line **214** connected to power **180** and to switch contact **216** which is adapted to be contacted by switch arm **218** connected to operating arm **198** of relay **200**. A line **220** connects switch arm **218** to power line **180**. A starting switch **222** is provided in line **180** along with normally closed switch **42** and normally open switch **36**.

OPERATION

Assuming the parts to be in the position shown in the drawings, starting switch **222** is closed causing field windings **186** and **188** to be energized with the relay **200** deenergized and switch arm **196** in contact with contact **194** to which line **190** is connected thus causing the motor to operate to rotate shaft **28** clockwise as viewed in FIGURE 6 which through cord **60** causes arm **88** to be pivoted clockwise about the point C shown in FIGURE 4, springs **90** and **108** acting to take up slack in cord **60** and rollers **124**, **126**, **128** and **130** moving in annulus **134** to control the pivoting about the point C by keeping the center line of arm **88** perpendicular to the arcuate surfaces **136** and **138**.

When arm **88** reaches the position indicated at R in FIGURE 4, cam **30** has engaged roller **32** to close switch **36** which energizes relay **200** causing switch arm **196** to contact contact **212** to connect line **202** to line **208** and reverse the motor **12**. Switch arm **218** is also brought into contact with contact **216**. Thus when cam **30** by the reversal of motor **12** is carried away from roller **32** to permit switch **36** to reopen, the relay **200** remains energized being connected to line **180** through line **214**, switch arm **218** and line **220**. When arm **88** reaches the position indicated at L in FIGURE 4, cam **30** has contacter roller **38** causing the movement of switch arm **40** to open switch **42** and thus de-energize relay **200** causing switch arm **218** to move away from contact **216** and switch arm **196** to contact **194** causing motor **12** to reverse direction. The operation is then repeated causing arm **88** to oscillate as indicated in FIGURE 4 with the center line of the outer face of the arm's ultrasonic transducer **158** being pivoted about the point C.

An alternative embodiment is shown in FIGURE 10. This embodiment is identical with the above described embodiment but has a modified driving means. Here a rod **232** is welded to upper plate **116** of arm **88** and passes freely through an opening **234** in a swivel **236** mounted on a nut **238** which is driven by a screw **240**. A reversible motor **242** drives screw **240** which is mounted for rotation in bearing **244**. Motor **242** can be controlled in the same manner as motor **12**. As nut **238** travels back and forth, arm **88** will be moved about pivot point C.

Since ultrasonic scanning devices employing transducers are well known to the art as illustrated, for example by T. G. Brown Patent No. 3,086,390, issued Apr. 23, 1963, it is not deemed necessary in order to illustrate the invention, since they may be those conventionally used heretofore, to give any details herein with respect to the ultrasonic transmitting and receiving apparatus associated with the above described embodiments.

It will be understood that the above described embodiments of the invention are illustrative and are not intended to be limiting.

What is claimed is:

1. A mechanism comprising means having a pair of opposed concentric walls,
an arm including a pair of opposed plates embracing said means,
a plurality of rollers mounted between said plates and engaging said walls to maintain the center line of the arm substantially perpendicular to the walls,
the center of each of the arcs on which said walls lie being substantially at the outer end of said arm and means to oscillate the arm.

2. A mechanism comprising an arm,
means spaced inwardly from the outer end of the arm mounting the arm for pivotal movement about a point substantially at the outer end of the arm, said means including a pair of opposed concentric walls defining a sector of an annulus,
a plurality of rollers mounted on the arm and engaging the walls to maintain the center line of the arm substantially perpendicular to the walls; and
means to oscillate the arm.

3. A mechanism comprising an arm,
means spaced inwardly from the outer end of the arm mounting the arm for pivotal movement about a point substantially at the outer end of the arm; and
means to oscillate the arm, comprising a cord wound on a drum and having oppositely extending reaches secured to the arm and reversible motor means connected to the drum.

4. A mechanism comprising an arm,
means spaced inwardly from the outer end of the arm mounting the arm for pivotal movement about a point substantially at the outer end of the arm, said means including a pair of opposed concentric walls defining a sector of an annulus,
a plurality of rollers mounted on the arm and engaging the walls to maintain the center line of the arm substantially perpendicular to the walls; and
means to oscillate the arm, comprising a cord wound on a drum and having oppositely extending reaches secured to the arm and reversible motor means connected to the drum.

5. A mechanism comprising an arm having an inner and an unsupported outer end,
an ultrasonic transducer mounted adjacent the outer end of the arm,
means connected to the arm at a location spaced inwardly from the outer end of the arm and from the

transducer and mounting the arm for pivotal movement about an unsupported point substantially coincident with the outer face of the transducer; and

means to oscillate the arm with respect to said mounting means.

6. A mechanism in accordance with claim 5 in which the mounting means has a pair of opposed concentric walls and the arm is provided with means engaging the said walls to maintain the center line of the arm substantially perpendicular to the walls.

7. A mechanism in accordance with claim 5 in which the mounting means has a pair of opposed concentric walls defining a sector of an annulus and the arm is provided with means engaging the said walls to maintain the center line of the arm substantially perpendicular to the walls.

8. A mechanism in accordance with claim 5 in which the means to oscillate the arm comprises a rod fixedly secured to the arm,

a traveling nut,

swivel means attached to the nut and having an opening slidably engaged by the rod,

a screw engaged by the nut; and

means to rotate the screw in two directions.

References Cited

UNITED STATES PATENTS

2,828,635	4/1958	Johnson et al.	74—89.22
2,940,305	6/1960	Williams et al.	73—67.8

FOREIGN PATENTS

630,466	11/1961	Canada.

FRED C. MATTERN, JR., *Primary Examiner.*

W. S. RATLIFF, *Assistant Examiner.*