United States Patent

Skei

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[54] RECORDING APPARATUS FOR SONAR AND ECHO SOUNDING SYSTEMS

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[52] **U.S. Cl.** **242/192,** 242/67.5, 242/75.1

[51] **Int. Cl.** **G11b 15/32,** B65h 17/08

[58] **Field of Search**.....242/192, 195, 201, 202, 203, 242/204, 206, 208, 209, 207, 210, 67.1, 67.3, 67.4, 67.5, 75.1, 75.41, 75.5, 54.1, 78.1, 78.6

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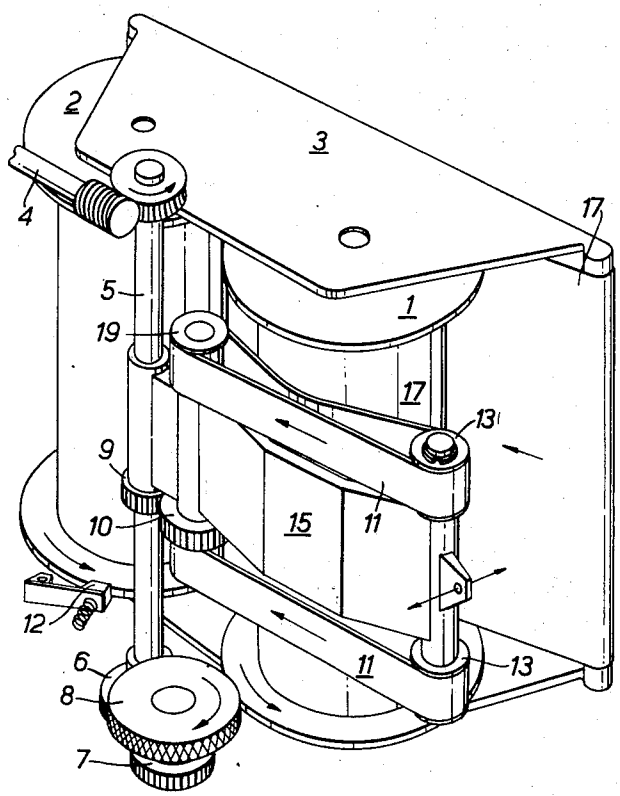
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[57] **ABSTRACT**

The present invention relates to a recording apparatus for sonar and echo sounding systems, wherein a recording strip runs with constant linear velocity from an unwinding spool to a rewinding spool. The paper feed is preferably driven by driving means slipably coupled to the rewinding spool, the constant linear velocity of the paper being set by second driving means which are frictionally, but non-slipably, coupled to the recording strip roll formed on the rewinding spool.

This driving arrangement allows both spools to be mounted in a common cartridge, which may be rapidly and easily inserted in and removed from the apparatus by means of a few simple, uncritical manual operations, the spools being preferably disposed symmetrically and with parallel axes in said replaceable cartridge, to allow an easy interchange of positions and working functions of the spools by simply turning the cartridge half a revolution.

6 Claims, 4 Drawing Figures

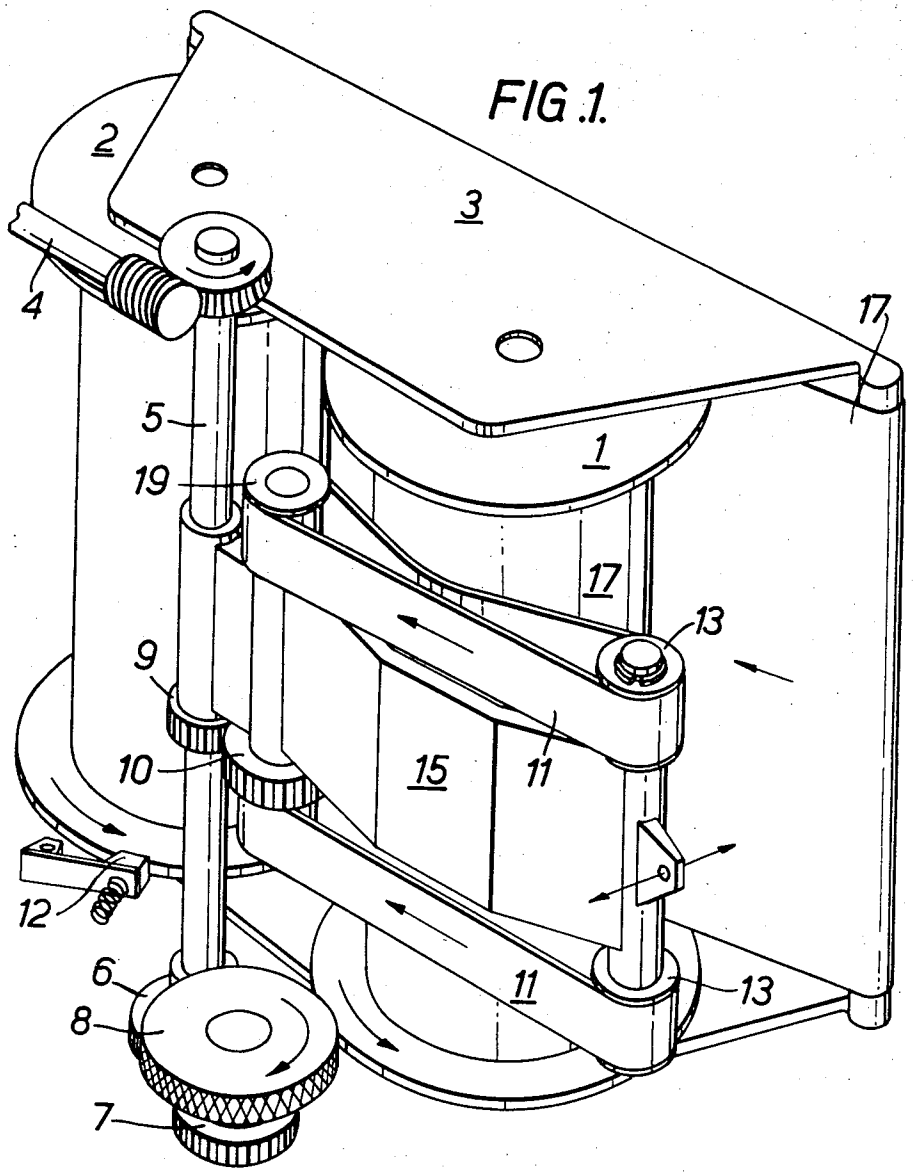


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SHEET 1 OF 3

FIG. 1.



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FIG. 2.

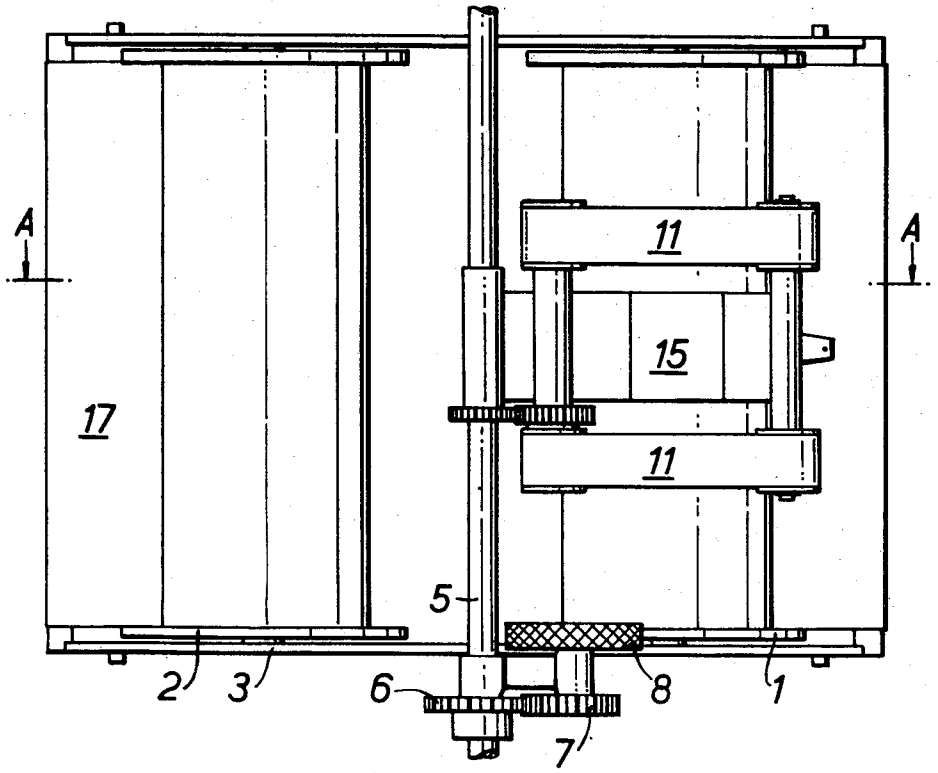
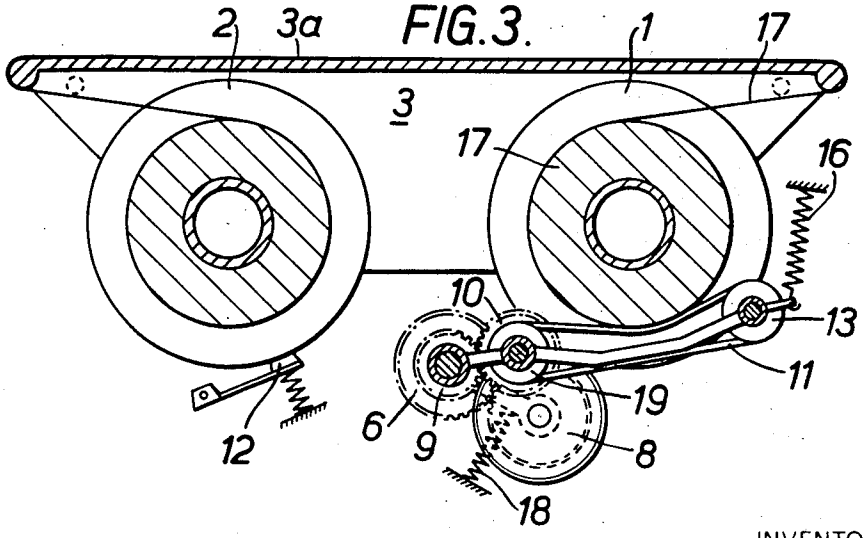


FIG. 3.



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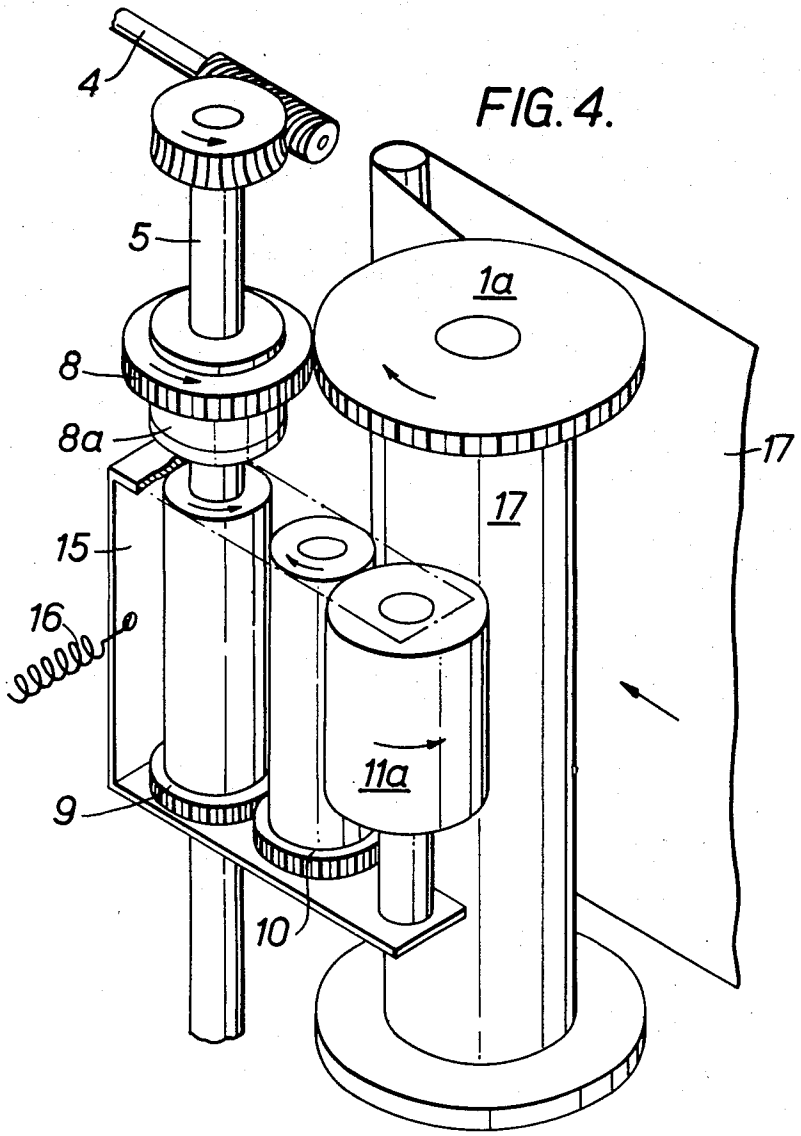


FIG. 4.

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RECORDING APPARATUS FOR SONAR AND ECHO SOUNDING SYSTEMS

The invention relates to recording apparatus for sonar and echo sounding systems, where a recording strip of paper or similar material is unwound from a first spool and rewound on a second spool with predetermined constant linear velocity of the strip.

In conventional apparatus of the above type the strip is usually driven by means of two rollers rotating in opposite direction, the strip being pressed between said rollers. Alternatively the strip may be perforated and driven by means of at least one pinion, engaging the perforation.

Such strip driving means, however, usually necessitates time consuming preliminary work, as the strip must be threaded between rollers or arranged in engagement with pinions or the like. This work must be done accurately and carefully to avoid tearing or folding of the paper as a consequence of uneven paper feed.

Also in recording apparatus for sonar and echo sounding it is desirable to utilize the same recording strip for several subsequent recording sequences, preferably with alternate directions of motion. To reverse the direction of motion of the strip in the above conventional apparatus the whole length of the strip must be rewound on said second spool in the course of a recording sequence and thereafter transferred back to the first spool, to allow the paper to be inserted in the driving means, as described above. It will be evident that this procedure is rather lengthy and cumbersome.

Thus, the main object of the present invention is to provide a recording apparatus where the insertion of recording paper is considerably facilitated and simplified, and the process of reversing the motional direction of the recording strip is reduced to a few simple, uncritical manual operations.

This is generally achieved by arranging the apparatus according to the invention in such a way that one of the spools is frictionally coupled to first driving means, while the strip, when being wound on the second spool, is frictionally coupled to second driving means, whereby the first, but not the second driving means, are allowed to slip so that the predetermined constant linear velocity of the strip is set by the second driving means.

Preferably said first driving means drives the second spool, said second driving means braking the strip to the predetermined constant linear velocity, but alternatively said first driving means may brake the first spool, while said second driving means is driving the strip with said predetermined constant linear velocity. In both cases, however, a tight rewinding of the strip of the second spool is achieved.

For easy and simplified manipulation of the recording strip both spools are preferably arranged in a cartridge, which easily may be manually inserted in and withdrawn from the recording apparatus. Also the two spools are preferably identical and mounted symmetrically and with parallel axes in the cartridge, in order that the position of the spools and their respective functions may be interchanged by turning the cartridge 180°.

A preferred embodiment of the invention, with two alternative driving means designs, will now be described with reference to the accompanying drawings, in which:

FIG. 1 is a perspective view of a recording apparatus according to the invention,

FIG. 2 is a plan view of the same apparatus,

FIG. 3 is a sectional view taken along line A—A in FIG. 2, and

FIG. 4 shows in perspective view an alternative driving means design.

As shown in the drawings, the recording paper strip **17** is disposed in a cartridge **3** and runs along the front face **3***a* of the same between two identical spools **1** and **2**, which are mounted with parallel axes in the cartridge. As shown in FIG. **1**, the unwinding spool is designated by **2** and the rewinding spool by **1**. The driving torque for the rewinding process is supplied over the shaft **4** and a worm gear to the driving shaft **5**, which through the pinion gear **6**, **7** drives a friction wheel **8**. This friction wheel **8** is pressed against the spool **1** by means of a spring **18** to provide a slipping friction drive of said spool **1**.

To achieve a constant linear velocity of the paper strip **17**, however, the paper feed must be controlled. Thus two endless belts **11**, which run around two parallel rollers **19** and **13**, are driven with constant linear velocity from the driving shaft **5** over a gear consisting of a pinion **9** mounted on the driving shaft and engaging a pinion **10** keyed to the roller **19**. The belts frictionally engage the paper strip roll **17** already wound on the spool **1**, without slipping, thus transferring a constant linear velocity to the paper strip.

Driven only from the friction wheel **8**, the spool **1** would obtain a constant angular velocity as in such a case the linear paper strip velocity would not be constant, but dependent on the present thickness of the paper layer wound on spool **1**.

The driving arrangement is, however, so adjusted that the angular velocity which the friction wheel **8** attempts to transfer to the spool **2** without slip, by all relevant diameters of said paper roll wound on the spool **1**, is higher than the angular velocity corresponding to said predetermined constant linear paper velocity. Thus the paper velocity will always be braked down to the desired value by means of the belts **11**, the friction wheel **8** slipping more or less. In this way a continuous tightening effect is ensured during the rewinding of the paper on spool **1**.

The cartridge **3** is moulded from an electrically nonconductive material, e.g. a plastic material, and provided with a layer of conductive material on the front face **3***a*. This conductive layer thus constitutes a return lead for the electrical signals to be recorded. These signals are applied to the paper **17** through a recording pen device or the like (not shown) to cause recording marks on the same. To secure a tightening of the paper strip along the front face **3***a* of the cartridge **3**, the unwinding spool **2** is provided with braking means **12**. The cartridge **3** with the two spools **1** and **2** is arranged to be removed from and inserted in the apparatus by simple, uncritical manual operations and symmetrically designed, so that it may be mounted in the recording apparatus in two alternative positions, whereby the spools **1** and **2** may exchange positions and working functions according to convenience.

This is a favorable feature in echo sounding or sonar installations, as it is often desireable to utilize the recording strip several times during subsequent operational sequences, preferably with alternate directions

of motion. Also, with an apparatus according to the invention, a number of cartridges may be kept in store ready for use, to be rapidly inserted in the recording apparatus whether their recording strips have been previously used or not.

The rollers **13** and **19** are mounted in supporting frame **15**, which is pivoted on the driving shaft **5**. By means of a spring **16** acting on said frame **15**, the belts **11** running around the rollers, are pressed against the rewound paper roll **17** on the spool **1**. In this way large contact surfaces may be established between said belts **11** and the paper roll **17**, in order to avoid interface slip.

Also the friction force acting on the supporting frame due to its pivoting on the rotating driving shaft **5**, will contribute to increasing the contact pressure between the belts **11** and the paper **17**, said shaft having the appropriate rotational direction for obtaining such friction force.

In FIG. **4** there is shown alternative constructions of the two driving means, the parts corresponding to counterparts in the embodiment disclosed above, having the same designation numbers as said counterparts.

In this case the spool **1** is driven by a pinion gear, **1***a*, **8**, the pinion **1***a* being keyed to the spool and engaging pinion **8**, which is frictionally journalled on the driving shaft **5** by means of a sliding clutch **8***a*.

Further, in this case the non-slipping drive of the paper **17** wound on the spool **1**, is executed by a roller **11***a*, being mounted in a supporting frame **15** and pressed against the surface of the wound paper roll **17** by means of a spring **16**.

In the same way as in the embodiment described above, the supporting frame **15** is pivotally mounted on the driving shaft **5**, and the roller **11***a* is driven from said driving shaft over the pinion gear **9**, **10**. However, in the present case the last link in the driving torque transfer between the shaft **5** and the roller **11***a*, is constituted by a non-slipping friction coupling between a roller **10***a*, integral and concentric with the pinion **10**, and the roller **11***a*.

I claim:

1. Apparatus for unwinding and winding recording material at a predetermined linear velocity in a recording apparatus, comprising:

a removable cartridge type housing for mounting in said recording apparatus;

a first reel and a second reel mounted in parallel spaced relationship within said housing, said first and second reels are identical spools each including a rim of greater diameter than the diameter of recording material thereon;

driven means frictionally coupled to the rim of said first reel for rotating said first reel to unwind recording material from said second reel at a greater linear velocity relative to said predetermined linear velocity of said recording material;

braking means frictionally and non-slippingly engaging the outermost layer of said recording material wound on said first reel for retarding the linear velocity of said recording material to said predetermined linear velocity whereby said driven means continuously slips with respect to said rim; and

primary driving means for driving said driven means and said braking means at respective constant linear velocities with said driven means rotating at a greater linear velocity than said braking means.

2. Apparatus as in claim **1** wherein said primary driving means comprises an externally driven shaft extending parallel to the axes of said first and second reels, said shaft including first and second gears mounted thereon;

said apparatus further comprising a supporting frame for mounting said braking means; said braking means including parallelly spaced shafts mounted within said supporting frame, said shafts each including a pair of parallelly spaced aligned rollers, and a pair of endless belts each respectively driven by one pair of said aligned rollers, a third gear mounted to one of said shafts and engaging said first gear for driving said pair of endless belts;

said driven means including a fourth gear engaging said second gear and means driven by said fourth gear for slippingly engaging the rim of said first reel.

3. Apparatus as in claim **2** further comprising means connecting said supporting frame to said primary driving means so that rotation thereof increases the frictional engagement of said braking means with said recording material on said first reel to maintain said predetermined linear velocity.

4. Apparatus as in claim **1** wherein said primary driving means comprises an externally driven shaft extending parallel to the axes of said first and second reels, said shaft including first and second gears mounted thereon;

said apparatus further comprising a supporting frame for mounting said braking means, said braking means including first and second parallelly spaced shafts mounted within said supporting frame, said first and second shafts each including a roller member mounted thereon and in driving engagement with one another, said first shaft including a third gear mounted thereon and engaging said first gear, said roller member of said second shaft engaging said recording material; said second gear slippingly engaging the rim of said first reel.

5. Apparatus as in claim **1** wherein said first and second reel are symmetrically mounted within said cartridge housing, whereby the unwinding of said recording material is reversed by a rotation of said cartridge housing so that the respective positions of said first and second reel are interchanged.

6. Apparatus as in claim **1** further comprising second braking means for retarding the rotation of said second reel.

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