April 8, 1947. M. CAMRAS 2,418,543

MAGNETIC RECORDING OR REPRODUCING DEVICE

Filed March 29, 1944 2 Sheets-Sheet 1

Fig-1

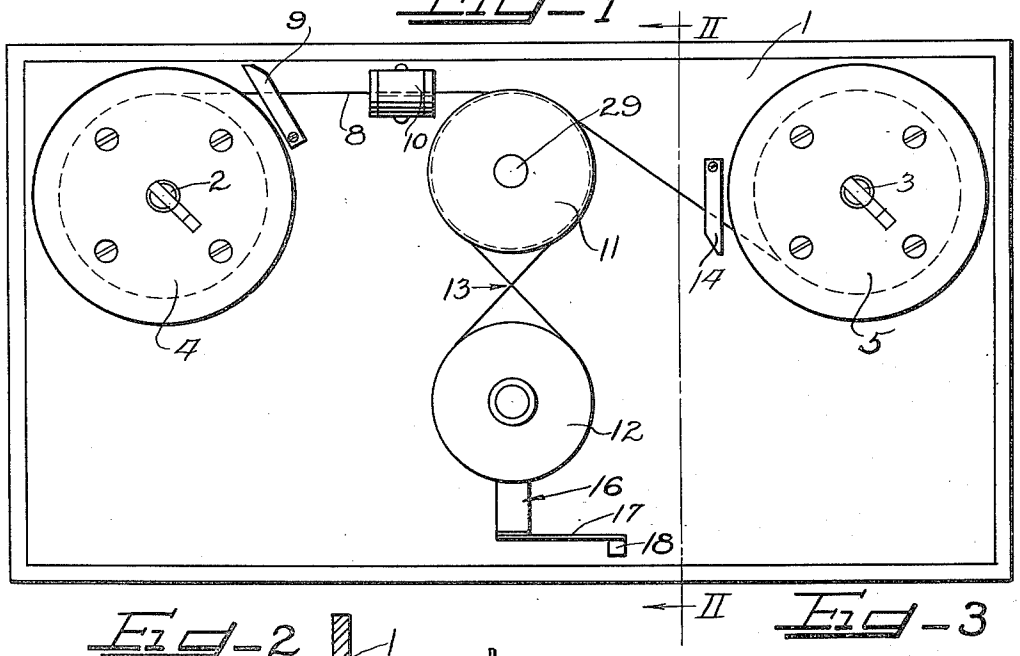


Fig-2

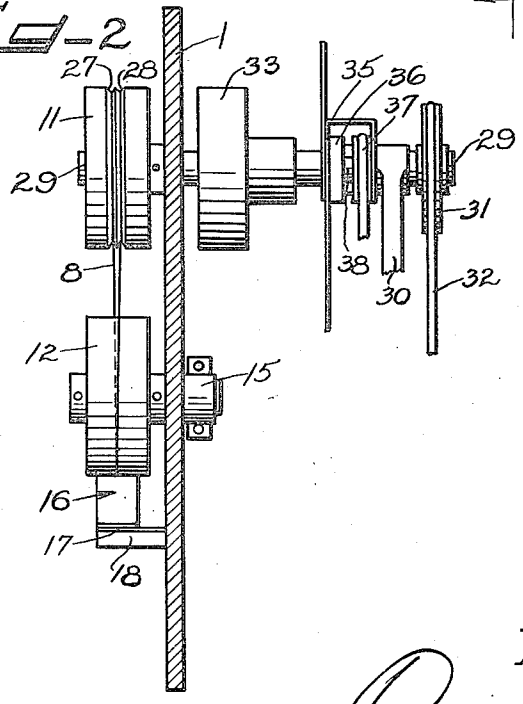


Fig-3

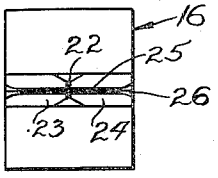
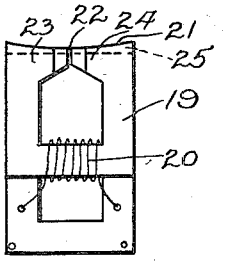


Fig-4



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MAGNETIC RECORDING OR REPRODUCING DEVICE

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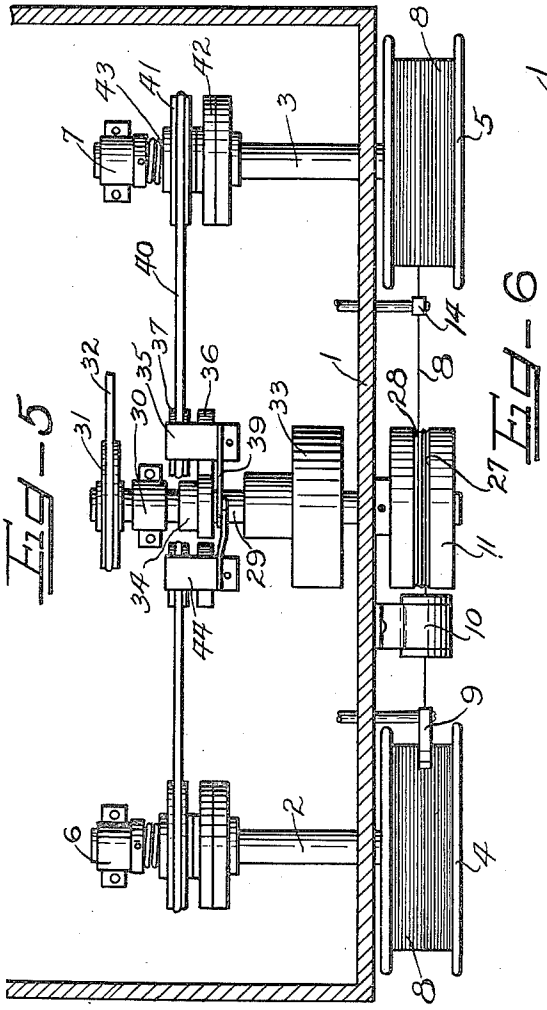


Fig-5

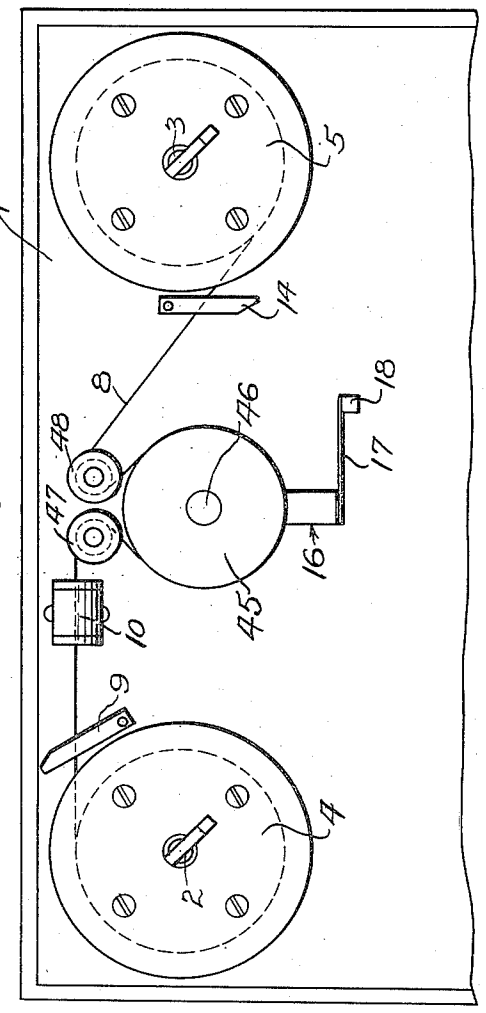


Fig-6

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MAGNETIC RECORDING OR REPRODUCING DEVICE

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6 Claims. (Cl. 179—100.2)

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This invention relates to improvements in a magnetic recording or reproducing device wherein a recording of fluctuating electrical energy is made by or reproduced from the magnetization of an elongated paramagnetic recording medium, the invention referring more specifically to an improved form of drive mechanism for moving the medium through the device as well as an improved form of recording or reproducing head for association with the medium, although the invention may have other uses and purposes as will be apparent to one skilled in the art.

In magnetic recording or reproducing devices of the type wherein a recording medium in the nature of an elongated paramagnetic element, such as a wire or tape, is utilized, it is desirable that the recording medium when passing the recording or reproducing head of the device does not fluctuate, and it is further desirable that this medium be steadily moved at a substantially constant speed. With certain magnetic recording or reproducing devices, the recording medium is wound back and forth from one to the other of a pair of spaced reels or spools and during the travel of the medium from one spool to the other the medium passes by or through salient parts of the device during which time a recording or reproduction is effected. In the event the medium during its course of travel fluctuates or vibrates relatively to the recording or reproducing apparatus, either the recording or the reproduction may be deleteriously affected. Such vibration or fluctuation of the medium is less desirable where the medium is in the nature of a relatively fine round wire, substantially the size of a human hair. Even a slight fluctuation affecting a medium when it passes a recording or reproducing head would lessen the quality of a recording or lessen the fidelity of a reproduction.

It is, therefore, desirable to hold the medium, during its travel, as steady and even as possible. With the use of some recording or reproducing heads, it is possible to splice or tie a broken medium and repeatedly use the same, the medium deflecting in its path of travel when passing the head in order to accommodate a splice or knot in the medium. In many cases, it may be desirable to still maintain such a repaired medium as steady and even in its travel as possible and not permit it to alter its path by virtue of a knot or splice therein, but to accommodate that knot or splice in some other manner.

With the foregoing in mind, it is an important object of the instant invention to provide a magnetic recording or reproducing device em-

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bodying an arrangement wherein the recording medium is driven steadily and smoothly at an intermediate point in its course of travel.

A further object of the invention resides in the provision of a magnetic recording or reproducing device wherein the recording medium is held stable and steady against fluctuation or vibration in that region where the medium passes the recording or reproducing head.

Also an object of this invention is the provision of a magnetic recording or reproducing device in which the actual drive means for moving the recording medium is arranged to provide a speed equalizing effect akin to that of a flywheel.

Still another object of the invention is the provision of a magnetic recording or reproducing device embodying a drum member for imparting motion to the recording medium, said drum member being stubstantially heavy and balanced to provide a speed equalizing effect akin to that of a flywheel.

A further feature of the invention resides in the provision of a magnetic recording or reproducing device in which the recording medium is stably held in contact with a solid surface in that region of the device wherein the medium passes the recording or reproducing head.

It is also a feature of this invention to provide a magnetic recording or reproducing device wherein the recording or reproducing head is resiliently urged toward the recording medium while the recording medium itself is held against movement except in a direction in keeping with the axis of the medium.

Still a further object of the invention resides in the provision of a magnetic recording or reproducing device in which a knotted or spliced recording medium may be utilized without permitting any fluctuation or vibration of the medium itself at the time the medium passes the recording or reproducing head.

Also an object of the invention resides in the provision of a magnetic recording or reproducing device in which a knotted or spliced recording medium may be utilized, and wherein the recording or reproducing head moves relatively to the recording medium sufficiently to permit passage of the knot or splice.

While some of the more salient features, characteristics and advantages of the instant invention have been above pointed out, others will become apparent from the following disclosures, taken in conjunction with the accompanying drawings, in which

Figure 1 is a front elevational view of a portion

of a magnetic recording or reproducing device embodying principles of the instant invention;

Figure 2 is a fragmentary vertical sectional view, with parts omitted, taken substantially as indicated by the line II—II of Figure 1, looking in the direction of the arrows;

Figure 3 is a top plan view of a portion of the structure in Figures 1 and 2, namely the recording or reproducing head;

Figure 4 is a side elevational view of the recording or reproducing head with its outside casing removed;

Figure 5 is a fragmentary top plan sectional view of the structure of Figure 1 taken just below the top of the casing; and

Figure 6 is a fragmentary front elevational view of the same character of Figure 1, but showing a magnetic recording or reproducing device embodying a somewhat different construction, also including principles of the instant invention.

As shown on the darwings:

In that illustrated embodiment of the invention seen in Figures 1 to 5, inclusive, there is shown a casing including a front panel 1 and through this panel a pair of spaced shafts 2 and 3 extend to removably support on their outer ends reels or spools 4 and 5, respectively. The inner ends of the shafts 2 and 3 may have suitable bearings or other supporting structures, which is not necessary to illustrate in the instant invention. With reference to Figure 5 it will be noted that bearings 6 and 7 are somewhat diagrammatically illustrated for the shafts.

The spools 4 and 5 carry a recording medium 8, which in the illustrated instance is in the form of a fine round paramagnetic wire. The wire usually travels from the spool 4 to the spool 5 for both recording and reproducing operations, and travels from the spool 5 to the spool 4 during a rewinding operation. With a device capable of both recording and reproducing, the wire will be wound on the spool 5 and off the spool 4 during the recording, then rewound upon the spool 4, and then again wound upon the spool 5 during the reproducing operation.

In passing from the reel 4 to the reel 5, the recording medium first goes through a level winding arrangement 9 associated with the reel 4, then through the field of an erasing head 10, then partially around a drive pulley or drum 11 around an idler pulley 12 disposed below the drive pulley 11, and then again over the drive pulley, completing a figure 8 path with a substantial central crossing as indicated at 13 between the pulleys 11 and 12. From the drive pulley 11, the medium passes through a level winding arrangement 14 associated with the reel 5, and then onto the reel 5. Each level winding arrangement is mounted on a shaft extending through the front panel 1, as seen best in Figure 5, and may be actuated by any suitable mechanism not illustrated in the drawings.

With reference to Figure 1, it will be noted that the medium preferably leaves the top of the spool 4, and is preferably received at the bottom of the spool 5, to thereby provide more traction for the drive pulley 11. The traction of this drive pulley is also increased by the figure 8 looping of the medium around the pulleys 11 and 12. The pulley 11 actually moves the medium in either direction, and while, as explained more fully later herein, the receiving reel in whichever direction the medium travels is also driven, but the driving of that reel is mainly to insure a proper winding of the medium, rather than to actually move the medium forward.

The erasing head 10 may be a coil through which high frequency current is passed so that as the medium passes through the field of this coil, the medium itself is cleaned or demagnetized. Obviously, during either a rewinding or reproducing operation the erasing head is deenergized so that it cannot remove the recording intended to be left upon the medium.

As stated above, the pulley 12 is an idler pulley, being rotated solely by virtue of the travel of the recording medium 8. This pulley is preferably mounted in the panel 1 and its shaft may be journaled as indicated at 15 in Figure 2. The pulley is preferably wide so as to adequately accommodate the upper face of a recording or reproducing head, generally indicated by numeral 16. This head 16 is preferably biased against the face of the pulley 12 by a flat spring 17 having one end fixed to a suitable stud support 18 and carrying the head 16 on its free end, as clearly seen in Figure 1. With the particular device illustrated, the head 16 functions both as a recording head to magnetize the recording medium 8 in accordance with fluctuating electrical energy of which a record is desired, and also functions as a reproducing head to act as a pick-up of the magnetization in the recording medium during reproduction.

With reference more particularly to Figures 3 and 4, it will be seen that the head 16 includes a paramagnetic core 19 around one leg of which a coil 20 is wound, which coil may be connected with any suitable energizing circuit to cause the head to magnetize the recording medium, and also may be connected with any suitable form of pick-up and amplifying circuit for reproduction purposes. The upper leg of the core 20 is preferably curved complementally to the circumferential face of the pulley 12 as indicated at 21. This upper leg is also transversely divided as indicated at 22 to provide a non-magnetic gap 22 defining a pair of confronting pole pieces 23 and 24, which pole pieces may be beveled as desired to concentrate the flux density in the region of the gap centrally of the head. This upper leg of the head is also grooved centrally and at right angles to the gap 22 as indicated at 25. This groove may be slightly wider at the top and preferably narrows to a width just sufficient to permit the passage of the recording medium therethrough. At each end thereof the walls of the groove may be flared as indicated at 26 to insure the proper entrance of the recording medium into the groove as well as to provide for smooth passage of a knot or splice in the medium. The bottom of the groove or slot 25 need not be curvate, because it is only necessary that the recording medium remain in that groove in the immediate vicinity of the non-magnetic gap 22, that is remain in the groove to as great a depth as possible.

In operation, during either a recording or a reproduction, the head 16 is held against the circumferential surface of the pulley 12 by the spring member 17. The recording medium passes through the groove or slot 25 in the head, and in the event there is a knot or splice in the medium, that enlargement will contact the flared walls 26 of the groove, and cause the head 16 to be moved away from the pulley 12 the thickness of the knot or splice against the action of the spring 17. Immediately upon the passing of the knot or splice, the head will again seat intimately

against the face of the pulley and the wire will extend to its limit in the groove 25. It is preferable that the pulley 12 be smooth-faced so as to insure as much as possible of the wire entering the groove or slot 25 in the head 16. If any guide groove is provided in the face of the pulley 12, it should be as shallow as possible.

From the foregoing it will be noted that there is no movement of the recording medium, except for its lengthwise travel, relatively to the head 16 during operation. The medium is maintained tightly against the surface of the pulley 12 in a stable condition against any fluctuation or vibration so that the head 16 has the same effect upon the medium or the medium has the same effect upon the head at all times, except for the substantially instantaneous passage of a knot or splice. Consequently, the recording should be faithful and the reproduction of great fidelity because surrounding circumstances are the same in both cases.

It is, of course, also desirable that the medium travel at substantially constant speed, especially in the vicinity of the head 16 for both recording and reproduction purposes. To this end, the pulley 11 is made the actual driving member for the medium. As seen best in Figures 2 and 5, this pulley is preferably provided with adjacent grooves 27 and 28 in its circumferential surface to prevent the recording medium from rubbing against itself at the crossing point 13 between the pulleys 11 and 12. The wire or medium 8 engages the pulley 11 in the outer groove 27 and after passing around the pulley 12 enters the inner groove 28 from which it passes to the spool 5. Thus, as seen in Figure 2, the crossing portions of the wire are always kept separated.

The drive pulley 11 is mounted on a shaft 29 extending through the panel 1, this shaft being journaled as indicated at 30 in Figure 5, to any suitable supporting structure. The inner end of the shaft carries a pulley wheel 31 or any other equivalent driving element, and a belt or the like 32 may be trained over this pulley from any suitable power source such as an electric motor, not illustrated. This shaft 29 may also carry a flywheel 33, preferably disposed behind the panel 1, in the event the drive pulley 11 is not of sufficient mass itself to provide the equalizing power of a flywheel. Consequently, this drive arrangement will resist a tendency to accelerate by virtue of its inertia, and will resist a tendency toward retardation by virtue of its momentum, so that the recording medium will be driven at all times at substantially a constant speed, and this is especially true where the medium passes the recording or reproducing head 16.

It is desirable to mechanically drive the receiving spool, and such may be either the spool 4 or the spool 5 depending upon the direction of travel of the recording medium. However, the drive of the receiving spool should not be of such character as to interfere with the actual driving of the medium by virtue of the pulley or drum 11. To this end, the shaft 29 is provided with a friction drive disk 34 keyed to the shaft. On one side of the shaft 29 a bracket arrangement 35 carries both a friction disk 36 and a pulley 37 on the same shaft 38, as seen clearly in Figures 2 and 5. This bracket arrangement is provided with an arm 39 by means of which the bracket may be moved so as to bring the disk 36 into contact with the drive disk 34. The pulley 37 is connected by means of a belt 40 to a pulley 41 floating on the shaft 3 carrying the spool 5. This shaft also carries a

slip clutch arrangement 42 comprising a fixed clutch disk and a floating clutch disk, the latter being associated with the pulley 41. The pulley and floating disk are spring biased toward the fixed disk by a coil spring 43 surrounding the shaft. With this arrangement, as the structure is viewed in Figure 5, the spool 5 will be driven through the slip clutch arrangement from the friction disk 34, and the spool 4 is merely an idler spool.

The same drive arrangement is associated with the shaft 2 carrying the spool 4, a bracket structure 44 carrying a pulley and friction disk, all as above explained. The two bracket arrangements 35 and 44 are preferably interconnected so that only one of them is in operative association with the drive disk 34 when movement of the recording medium in one direction is desired. Both friction drive arrangements may operatively engage the drive disk 34 when it is desired to stop operation, and thus these arrangements will function as a brake. The slip clutch on each of the shafts 2 and 3, permits either of the spools 4 and 5 to be driven without interfering with the drive of the pulley 11. If the driven spool accelerates beyond the speed of the pulley 11, a slippage will result, and if it decelerates below the speed of the pulley 11, a temporary slacking in the recording medium will occur, but in either event the movement of the medium itself will be constant and steady in the vicinity of the recording or reproducing head 16.

In Figure 6, I have illustrated a slightly different arrangement of the instant invention. In the showing in this figure, the same general construction is utilized including the spools 4 and 5, the erasing head, the level winding arrangements, and the recording or reproducing head 16, all as above described. In this instance, however, the actual drive of the recording medium 8 is effected by a pulley or drum 45 carried by a shaft 46, and this pulley or drum if not in itself sufficiently heavy to perform the equalizing powers of a flywheel may have a flywheel associated with it as above described. All of the operating mechanism above described in connection with the shaft 29 may be carried by the shaft 46 and the drive means to the respective spools 4 and 5 from this shaft may also be like those explained in connection with Figure 5.

In this instance, the pulley 45 is not grooved as the pulley 11, but preferably has a plain circumferential face or if some guide means for the recording medium are deemed necessary, this face may be grooved very shallowly. Upon leaving the erasing head the recording medium passes over an idler guide pulley 47, thence around the drive pulley 45, then over another guide pulley 48 and on to the reel 5. The guide pulleys 47 and 48 are preferably disposed closely together so that there is substantially a reversal of direction of the recording medium around each of these pulleys, thus increasing the length of contact between the medium and the pulley 45 so the pulley will have sufficient traction to actually drive the medium. The recording or reproducing head 16 functions in the same way in association with the pulley 45 as above described in connection with the pulley 12. By the means of Figure 6, there is also provided a substantially constant speed for the recording medium, and the recording medium is held stable against fluctuation or vibration in the region of the head 16.

It will be appreciated that while the structure

of the head 16 as above explained is preferable, satisfactory results may be obtained with the head grooved so shallowly that it contacts only the medium 8 and does not touch the pulley 12 or the drive pulley 45. This structure may be more desirable with a tape medium and is, of course, within the purview of this invention and the scope of the appended claims.

It will be appreciated that the instant invention is relatively simple in construction, and economical both to make and use. The invention may be readily installed in a magnetic recording device already constructed, or easily built into a device at the time of manufacture.

As the expression "recording head" shall hereafter be used it refers to a head which is either employed in recording or reproducing or both.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as follows:

1. In a device of the character described, a pair of spaced spools, a recording medium carried by said spools and windable upon either spool from the other, a rotary drive element intermediate said spools around which said medium is looped, and a recording head in operative association with a portion of said medium around and on said element.

2. In a device of the character described, a pair of spaced spools, a recording medium carried by said spools and windable upon either spool from the other, a rotary drive element intermediate said spools around which said medium is looped, and a recording head in operative association with a portion of said medium around said element, said recording head having a face curved complementally to said element and a groove in said face to receive said medium.

3. In a device of the character described, a pair of spaced spools, a recording medium carried by said spools and windable upon either spool from the other, a rotary drive element intermediate said spools around which said medium is looped, a recording head in operative association with a portion of said medium around said element, and resilient means urging said head against said element, said head having a groove in a face thereof to receive said medium.

4. In a device of the character described, a pair of spaced spools, a recording medium carried by said spools and windable upon either spool from the other, a rotary drive element intermediate said spools around which said medium is looped, a recording head in operative association with a portion of said medium around said element, resilient means urging said head toward said element, and said head having a face curved complementally to said element with a groove in said face to receive said medium, the walls of said groove being flared at each end to insure a seating of the medium within the groove.

5. In a device of the character described, a pair of spaced spools, a recording medium carried by said spools and windable upon either spool from the other, a rotary drive element intermediate said spools at least partially around which said medium extends, and a recording head in operative association with a portion of said medium around and on said element.

6. In a device of the character described, a recording medium, a magnetic head having portions of said recording medium extended on each side thereof, means for carrying the portions of said recording medium on each side of the head, and a rotary stabilizing element between said carrying means having said recording medium in drive contact therewith, said magnetic head having operative association with a portion of said recording medium as it passes in contact with said stabilizing element.

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