United States Patent

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[54] **APPARATUS FOR MOVING TAPE INCREMENTALLY PAST A RECORDING HEAD**
6 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **242/206,** 226/120, 226/188
[51] **Int. Cl.** **B11b 15/32,** G03b 1/04
[50] **Field of Search** 242/206, 210; 226/120, 126, 152, 157; 179/100.2

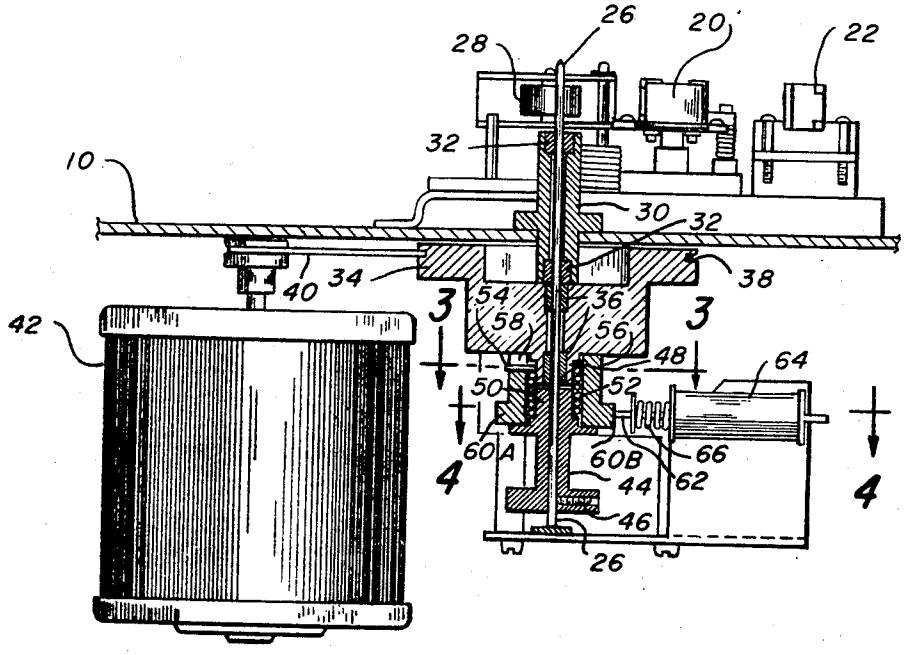
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ABSTRACT: This invention relates to an incremental data recording apparatus for moving tape incrementally past a recording head for recording data on the tape. More particularly, the invention relates to an incremental tape recording apparatus having a rotatable capstan shaft against which tape is pressed, the rotation of the capstan shaft serving to advance the tape, a continuously rotated flywheel supported about the capstan the shaft, a drive collar affixed to the capstan shaft and adjacent the flywheel, both the drive collar and flywheel having a reduced diameter shoulder portion coaxial with the capstan shaft and adjacent each other, a coil spring received about the shoulder portions of the drive collar and flywheel, the spring being wound such that the direction of rotation of the flywheel tends to wind the spring tight about the flywheel shoulder and drive collar shoulder to rotate the drive shaft, the spring having a radially extending tang at one end, a tubular ratchet member received about the spring having a notch therein receiving the tang, the ratchet member having a dog extending from the external surface, and a ratchet release bar normally engaging the ratchet member dog to prevent the rotation of the spring, the ratchet release bar being movable out of contact with the ratched dog whereby the rotation of the flywheel rotates the spring and thereby the drive collar and capstan shaft, the capstan shaft rotating until the ratchet release bar is repositioned to engage the ratchet member dog.



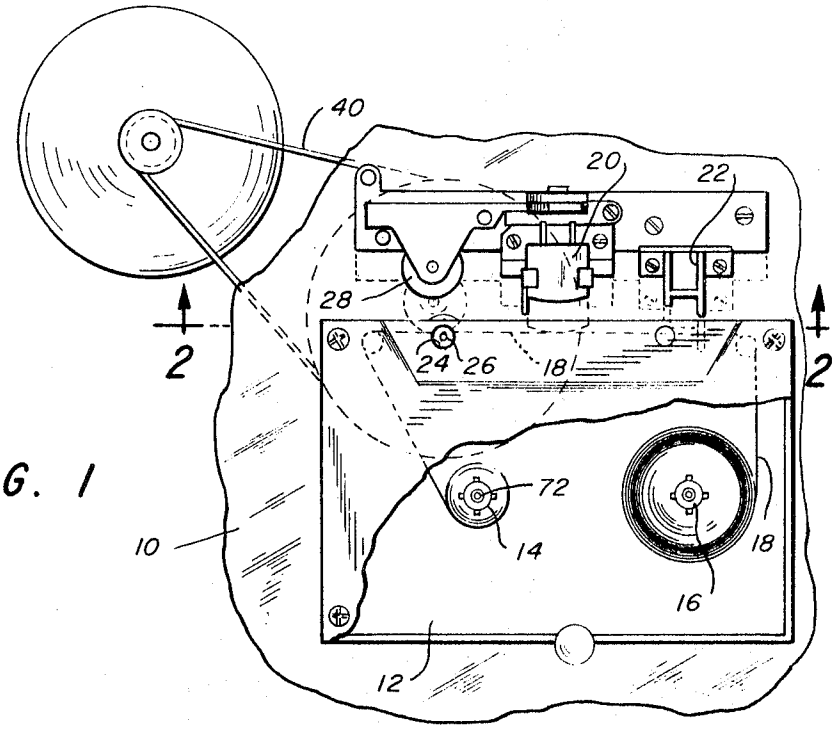


FIG. 1

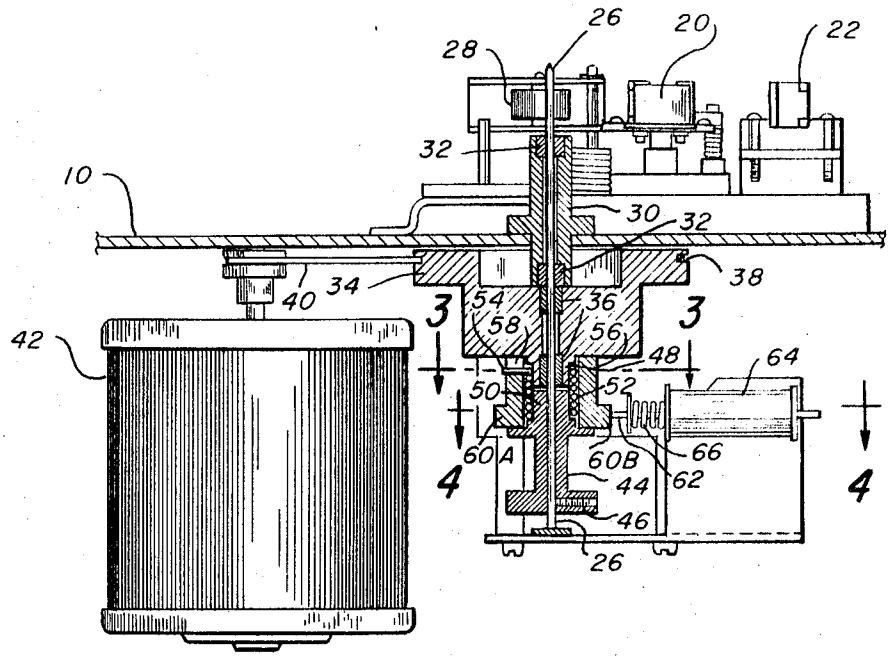


FIG. 2

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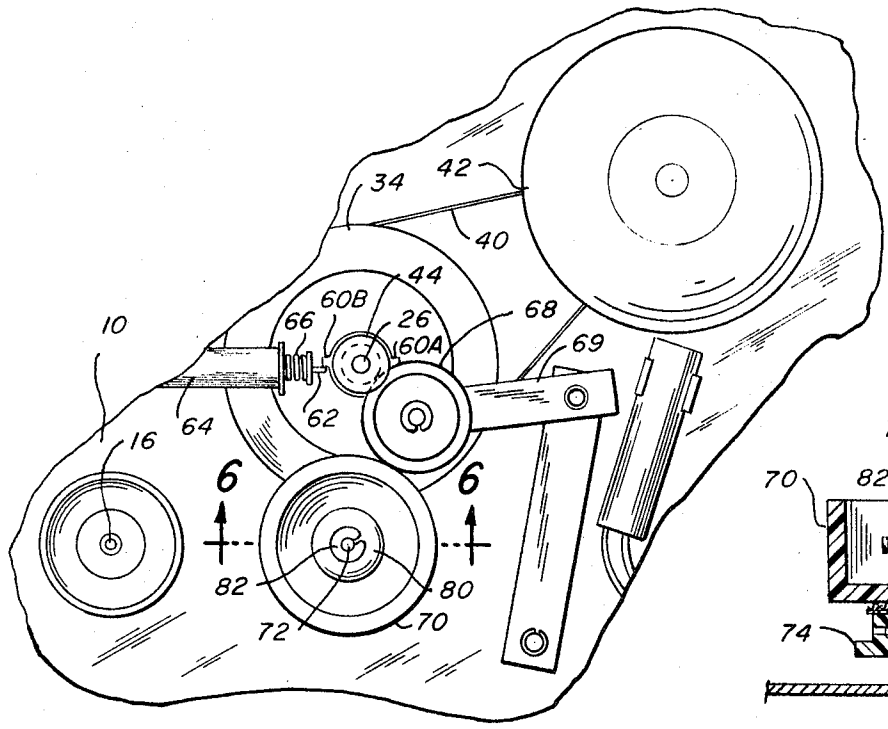


FIG. 5

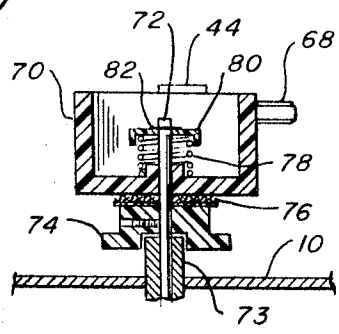


FIG. 6

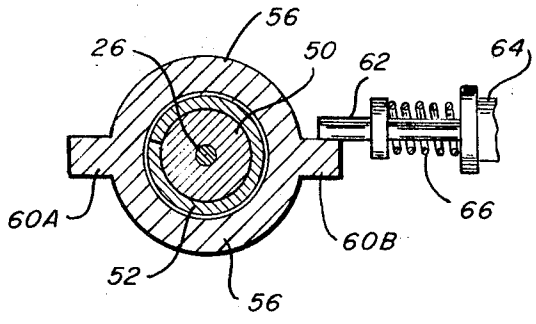


FIG. 4

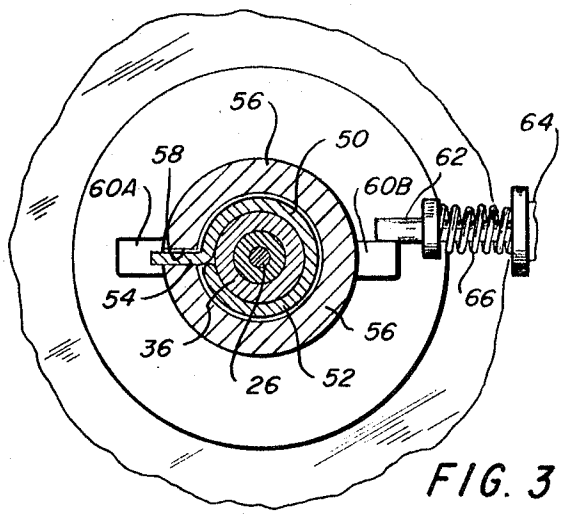


FIG. 3

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APPARATUS FOR MOVING TAPE INCREMENTALLY PAST A RECORDING HEAD

CROSS-REFERENCE

This disclosure is not related to any pending United States or foreign patent application.

BACKGROUND AND OBJECTS OF THE INVENTION

Magnetic tape systems are frequently used today to store data for subsequent use. A tape data storage system consists basically of a magnetic tape, record and playback heads, or a combination record-playback head, and means of moving the tape past the record-playback head. A typical system includes the arrangement wherein the tape is moved by a rotating capstan against which the tape is pressed, such as by means of a pinch roller. As long as the capstan is rotating the tape is moved past the recording head.

It is sometimes necessary to store data on a tape in which the data is not presented at a continuous rate, such as when the data is in the form of time spaced multibit character signals. A continuously moving tape results in much of the tape not being used for data storage since much tape travel occurs between the receipt of individual data characters. When the tape is played back there may also be a substantial time loss, and the length of tape necessary to record and playback a given amount of data will, in such cases, be excessive.

This invention provides an incremental recording apparatus utilized to record and playback data in either digital or analog form. The invention is particularly useful in recording data signals received in multibit form such as those generated by a teletypewriter or similar device. These signals are typically generated in serial or parallel groups of bits to form individual characters. The recorder to be described includes arrangement for recording such data in incremental form, one increment of tape moving for each character recorded, with the tape remaining stationary during the interval between recording increments.

It is therefore an object of this invention to provide an incremental tape recording apparatus.

More particularly, an object of this invention is to provide an incremental recording apparatus for moving tape past a recording head for recording data thereon, the tape being moved in incremental steps.

A more particular object of this invention is to provide a mechanism for incrementally moving tape, the mechanism including a coil spring normally retained in a nonrotated position and, upon release of the coil spring, motion is transmitted from a continuously rotating flywheel to a capstan drive shaft.

These objects, as well as other objects of the invention, will be understood by reference to the description and claims taken in conjunction with the drawings.

DESCRIPTION OF THE VIEWS

FIG. **1** is a top view of a portion of a tape recording apparatus.

FIG. **2** is a cross-sectional view taken along the line **2–2** of FIG. **1**, disclosing the details of the incremental tape recording apparatus of this invention.

FIG. **3** is a cross-sectional view taken along the line **3–3** of FIG. **2**.

FIG. **4** is a cross-sectional view taken along the line **4–4** of FIG. **2**.

FIG. **5** is a partial bottom view of the incremental tape recorder of this invention showing the portions thereof which wind the tape as data is incrementally recorded.

FIG. **6** is a cross-sectional view taken along the line **6–6** of FIG. **5**.

DETAILED DESCRIPTION

Referring to the drawings and first to FIGS. **1** and **2**, the numeral **10** indicates a baseplate upon which the major portion of the elements making up the invention are supported. The baseplate **10** includes means to receive a tape cassette **12** thereon, the cassette being of standard design well known in the industry. The tape cassette **12** includes a wind spool **14** and a rewind spool **16** which receive a magnetic tape **18** thereon.

Positioned on the baseplate **10** is a record-playback head **20** which, when the mechanism is in the operating mode, is in contact with magnetic tape **18**. A guide **22** insures proper alignment of tape **18** with head **20**. An opening **24** in cassette **12** receives a capstan shaft **26** against which tape **18** is pressed by means of a pinch roller **28**. The rotation of capstan shaft **26** causes movement of the tape **18** past record-playback head **20** when the apparatus is in record or playback mode. The mechanism shown in FIG. **1** is not unlike that of a typical cassette-type tape recorder in which capstan shaft **26** is continuously rotated in the record mode to move tape **18** past head **20**.

FIG. **2** shows details of the invention including means whereby the capstan shaft **26**, rather than being rotated continuously as in the typical tape recorder, is rotated incrementally so that tape **18** is moved only as data, in multibit character form, is actually recorded. FIG. **2** is shown without the cassette **12**. A bearing block **30** having an opening therethrough and a bearing **32** at each end is affixed to the base plate **10** and rotatably supports the capstan shaft **26**. Rotatably supported on the capstan shaft **26** is a flywheel **34** having an opening therethrough receiving shaft **26** and having bearings **36** which insure low-frictional relationship between the flywheel **34** and the shaft **26**. Flywheel **34** includes a groove **38** in the exterior periphery which receives a belt **40** driven by motor **42**. When motor **42** is energized flywheel **34** rotates continuously about the capstan shaft **26**.

Affixed to the capstan shaft **26** is a drive collar **44** held to the shaft by setscrew **46**. Flywheel **34** includes an integral reduced diameter shoulder portion **48** at one end and in like manner the guide collar **44** includes a reduced diameter shoulder portion **50** at the end adjacent the flywheel. The shoulder portions **48** and **50** are of approximately the same external diameter and both are coaxial about shaft **26**. In the preferred arrangement the diameter of shoulder portion **50** is 0.001 inch to 0.003 inch larger than the diameter of shoulder portion **48**.

Positioned on shoulder portions **48** and **50** is a coiled spring **52**. The spring **52** has, at the end thereof adjacent the flywheel **34**, a radially extending tang portion **54**. The spring **52** is coiled in the direction such that the rotation of flywheel **34** tends to wrap the spring more tightly about the shoulder portion **48** of the flywheel and shoulder portion **50** of the drive collar. Spring **52** has a normal internal diameter slightly less than the external diameter of the shoulder portions **48** and **50** so that frictional relationship between these components normally exists.

Received about spring **52** is a tubular ratchet member **56**, the interior diameter of the ratchet member being slightly larger than the exterior diameter of spring **52**. A notch **58** in the ratchet member receives the tang **54** of spring **52**.

The exterior of drive collar **44** has at least one integral radially dog portion extending from the exterior circumferential surface. In the illustrated arrangement there are two of such dogs, **60A** and **60B**, spaced 180° relative to each other on the ratchet member circumferential surface. (See FIGS. **3** and **4**.) Supported adjacent the ratchet member **56** is a movable ratchet release bar. In the illustrated arrangement the ratchet release bar is in the form of a plunger **62** of a solenoid **64**. A spring **66** normally retains the ratchet release bar, or plunger **62**, in position to engage dogs **60A** and **60B** as the ratchet member **56** rotates, the plunger **62** being withdrawn and out of contact when solenoid **64** is energized.

Referring to FIG. 5, a bottom view of the incremental tape mechanism of this invention means is shown whereby the tape is wound as it is moved in steps by incremental rotation of the capstan shaft **26**. When the mechanism is in the record mode, an idler wheel **68**, supported on an arm **69** engages drive collar **44** and at the same time contacts the periphery of a wind spool drive wheel **70**. A tape wind shaft **72** supports wind spool **14** (see FIG. 1) and the wind spool drive wheel **70**. Thus when drive collar **44** and thereby capstan shaft **26** is rotated, whether in incremental steps or continuously, idler wheel **68** transfers such rotary motion to wind spool drive wheel **70** and shaft **72** to thereby rotate the wind spool **14**. Arm **69** moves idler wheel **68** into engagement with drive collar **44** and wind spool drive wheel **70** when the apparatus is in the record mode by mechanical linkage mechanism not shown and not a part of the invention.

Since the diameter of the tape wound on wind spool **14** varies with the quantity of tape wound on the spool, the amount of rotation of wind spool **14** is not constant relative to the rotation of capstan shaft **26**. For this reason a slip clutch arrangement is required so that the rotation of wind spool drive wheel **70** will apply a controlled torque to the rotation of wind spool **14** but in a manner such that there is no positive interconnection between the rotation of capstan drive shaft **26** and wind spool **14**. This is best shown in the cross-sectional view of FIG. **6**. Wind spool drive wheel **70** is rotatably supported about the wind spool shaft **72** which rotates in bearing **73**. Affixed to the wind spool shaft **72** is a wind spool drive collar **74**. Between the surface of drive collar **74** and wind spool drive wheel **70** is a felt washer **76**. A spring **78** held in place by a cap **80** and retaining ring **82** applies a constant frictional engagement of the wind spool drive wheel **70** to felt washer **76** and drive collar **74**. Thus as the drive wheel **70** is rotated by idler wheel **68** as the capstan shaft **26** is incrementally stepped, such rotation is applied through the slip arrangement of the felt washer **76** to the wind spool drive shaft **72** applying a rotational torque so that tape advanced by the rotation of capstan shaft **26** is wound on the wind spool **14**.

DESCRIPTION OF OPERATION

When the apparatus is in the record mode tape cassette **12** is positioned such that magnetic tape **18** engages recording head **20** and is held against capstan shaft **26** by the pinch roller **28**. Data, such as in the form of teletypewriter transmission, may be incrementally recorded and the use of the apparatus for such purpose will now be described, it being understood that the invention is not limited only to use for this purpose. Each character coming out of the standard teletypewriter transmission system is approximately 100 milliseconds long with individual code bits equally spaced. Each teletypewriter character includes a start bit, seven character bits, a parity bit, and two stop bits. By circuitry which is not a part of this invention, the start bit of each character energizes solenoid **64**, withdrawing plunger **62**. Continuously rotating flywheel **34** transmits frictional torque to spring **52** which is normally held in nonrotated condition by ratchet **56**. When dog **60B** of ratchet **56** is released, by the withdrawal of plunger **62**, spring **52** immediately tightens about shoulder **48** of the flywheel and shoulder **50** of the drive collar, transmitting rotational torque to drive collar **44**. Capstan shaft **26** is rotated and at the same time idler wheel **68** and takeup wheel **70** is rotated by the apparatus previously described. Drive collar **14** continues to rotate until ratchet **46** is stopped. Solenoid **64** is energized by the start bit of the character to be received only for a length of time sufficient to allow dog **60B** on the ratchet member **56** to pass and plunger **62** immediately returns to its extended position. Thus, the ratchet member **56** will rotate until the next dog strikes plunger **62**. When two dogs **60A** and **60B** are utilized, as shown best in FIGS. **3** and **4**, ratchet member **56** and thereby capstan shaft **26**, will rotate 180°. During this 180° rotation of capstan shaft **26** the tape **18** is advanced a length equal to one-half the circumference of the capstan shaft **26** at the area at which it is engaged by the tape. This incremental advancement permits the subsequent character data bits of the teletypewriter character to be recorded on tape **18**. The tape then stops and remains in the stopped position until the next character is received, the first bit of which is the start bit which results in the function being repeated. In this manner the tape is incrementally advanced only during receipt and recording of a character.

When it is desired to play back the tape it may be played back at a continuous rate thereby transforming the recorded data into electrical signals at a rate much more rapidly than the rate at which the information was incrementally recorded.

It can be seen that the invention may be practiced utilizing a variety of obvious alternate embodiments. As an example, any means of selectably controlling the rotation of ratchet member **56** is within the purview of the invention. Instead of including dog portions **60A** and **60B** ratchet member **56** may be cylindrical on the exterior surface with plunger **62** having a brake pad on the outer end which engages and stops the rotation of the ratchet member while permitting it to rotate when the plunger is withdrawn.

While the invention has been described with a certain degree of particularity it is manifest that many changes may be made in the details of construction and the arrangement of components. It is understood that the invention is not to be limited to the specific embodiment set forth herein by way of exemplifying the invention, but the invention is to be limited only by the scope of the attached claim or claims, including the full range of equivalency to which each element or step thereof is entitled.

What I claim:

1. An incremental recording apparatus for moving tape incrementally past a recording head, comprising:

a rotatable capstan shaft against which tape is pressed, the rotation of the capstan shaft serving to advance the tape;

a continuously rotated flywheel supported about said capstan shaft, said flywheel having, at one end thereof, a reduced diameter shoulder portion coaxial with said capstan shaft;

a drive collar affixed to said capstan shaft and having a reduced diameter shoulder portion coaxial with said capstan shaft, said flywheel shoulder and drive collar shoulder being of substantially the same diameter and adjacent each other;

a coiled spring coaxially received about said capstan shoulder and said drive collar shoulder, the normal internal diameter of the spring being slightly smaller than the external diameter of said flywheel shoulder and said drive collar shoulder, the direction of rotation of said flywheel tending to tighten said spring about said flywheel shoulder and said drive collar shoulder, said spring having a radially extending tang at the end thereof received on said flywheel shoulder;

a tubular ratchet member coaxially received about and externally of said spring, the interior diameter of said ratchet member being slightly larger than the external diameter of said spring, said ratchet member having a slot therein receiving said tang of said spring whereby said spring and said ratchet member are rotationally interlocked;

a ratchet release bar movably supported adjacent said ratchet member and movable between a first and a second position, and arranged such that in said first position said release bar engages said ratchet member preventing the rotation thereof, and in said second position said release bar is removed from said ratchet member and permits the rotation of said ratchet member; and

means of selectably moving said ratchet release bar between said first and second positions.

2. An incremental recording apparatus for moving a tape incrementally past a recording head according to claim **1** wherein said ratchet member has a dog portion extending radially from the exterior surface thereof, and wherein said

ratchet release bar, in said first position, extends adjacent the exterior surface of said ratchet member and is engaged by said dog portion of said ratchet member preventing the rotation of said ratchet member and in said second position said release bar is removed from adjacent said ratchet member and permits the rotation of said ratchet member.

3. An incremental recording apparatus for moving a tape incrementally past a recording head according to claim 2 wherein:

said ratchet release bar and means of selectably moving said ratchet release bar includes a solenoid having a plunger extending therefrom, said solenoid being supported adjacent said ratchet means, said solenoid plunger being positioned between a first and second position according to the energization of said solenoid, in said first position said plunger engaging said ratchet dog and in said second position said ratchet dog passing said plunger as said ratchet rotates.

4. An incremental recording apparatus for moving a tape incrementally past a recording head for recording data on the tape according to claim 1 including:

a tape winding spindle for receiving tape thereon after said tape has been moved past said recording head by the rotation of said capstan shaft, said tape winding spindle being rotatably supported parallel to said capstan shaft; and

means of rotating said tape winding spindle upon the rotation of said capstan shaft.

5. An incremental recording apparatus for moving a tape incrementally past a recording head according to claim 4 wherein said means of rotating said tape wind spindle upon the rotation of said capstan shaft includes:

a drive wheel affixed to said tape wind spindle, said drive wheel being spaced from said drive collar; and

an idler wheel engaging said drive collar and said drive wheel to rotate said drive wheel, and thereby said tape winding spindle, when said drive collar is rotated.

6. An incremental recording apparatus for moving a tape incrementally past a recording head according to claim 5 including:

a slip clutch means between said drive wheel and said tape winding spindle.