

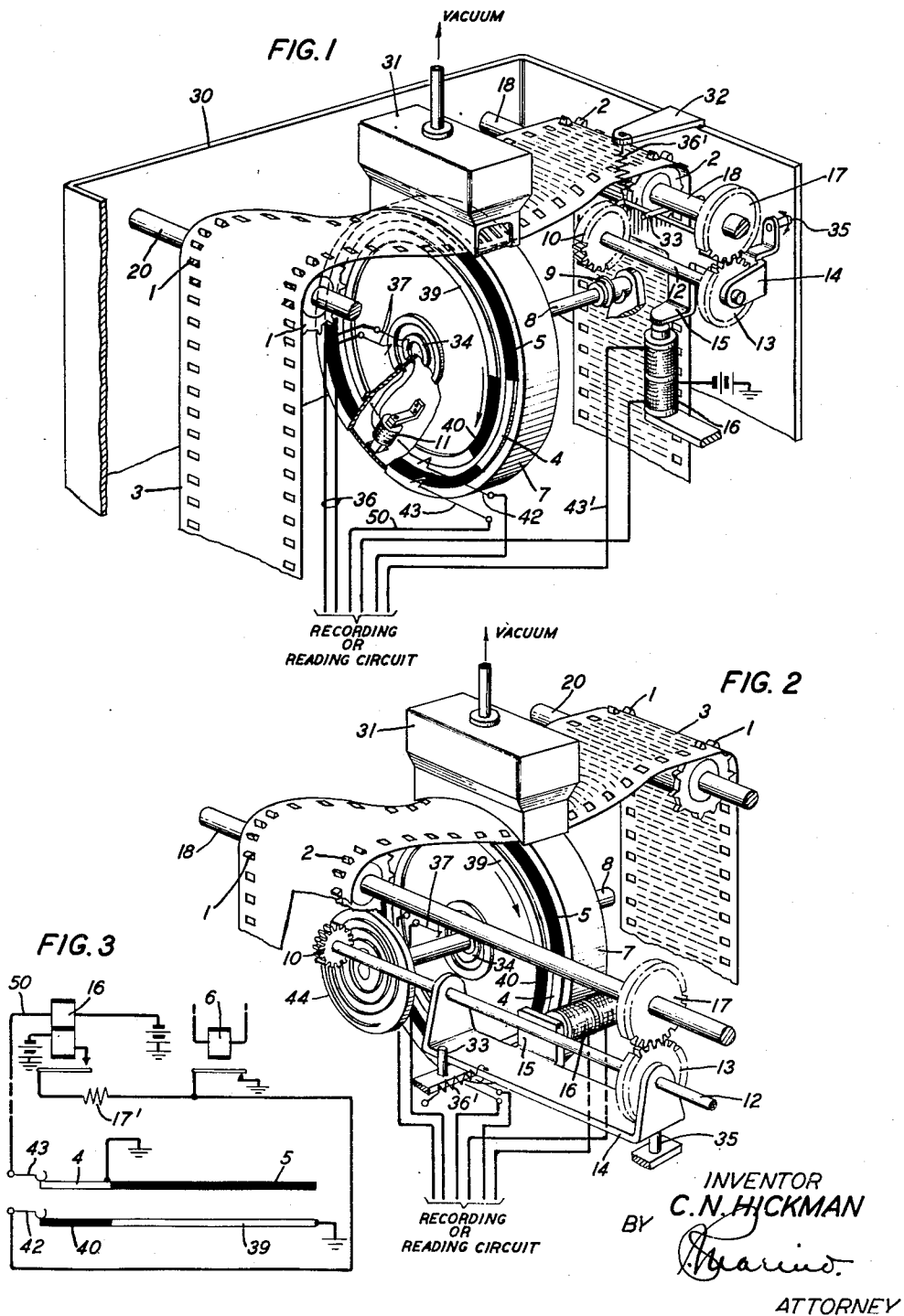
Aug. 11, 1953

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2,648,589

MAGNETIC RECORDER

Filed July 19, 1949



UNITED STATES PATENT OFFICE

2,648,589

MAGNETIC RECORDER

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Application July 19, 1949, Serial No. 105,542

5 Claims. (Cl. 346—74)

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The present invention relates to electromagnetic apparatus, and more particularly to an apparatus for either recording or reading data across an elongated magnetizable element instead of lengthwise thereof.

In certain applications of magnetic recording such as, for example, in telephone message accounting, it is desirable when reproducing a record or any portion thereof from one magnetic medium to another, to have the information recorded across the original medium. To this end I have devised an apparatus one of whose features is an arrangement of parts and a control circuit therefor for moving the medium lengthwise of the movement of the recording or reading magnet, but periodically stopping the medium while the magnet moves across the medium for recording or other purposes.

This and other features of the invention will be more clearly understood from the following description, attached claims and appended drawing in which:

Fig. 1 shows an isometric view of one form of the apparatus, with parts of the enclosing frame cut away to expose the elements of the arrangement;

Fig. 2 shows a modified form of the apparatus, while

Fig. 3 shows schematically portions of the controlling circuit, including certain elements not disclosed in but forming a part of the apparatus shown in Fig. 1 and Fig. 2.

Referring to Fig. 1, the magnetic element or medium 3, which may be a magnetically coated paper or plastic film or other suitable magnetizable material, is supported upon two pairs of sprocket wheels, one pair of driving wheels 2 fixed on the shaft 18 rotatably secured to frame 30, and a pair of idler wheels 1 fixed on the shaft 20 also rotatably secured to frame 30. The sprocket wheels on both shafts are suitably spaced and aligned to cause the teeth thereof to pass through feed holes provided along both edges of the medium 3. Between its two supports, said medium 3 passes over the drum 7 and is made to conform to the surface of the latter by the superposed pneumatic chamber 31 or other suitable means. The drum 7 is mounted upon shaft 8 and is constantly rotated by a motor (not shown) or by any other suitable source of power. A variable pitch worm 9 is also mounted on shaft 8 in engageable relation with the worm wheel as described below. The thread of the worm 9 is divided into four sectors, namely, a zero pitch sector, a constant acceleration pitch sector, a

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constant velocity pitch sector, and a constant deceleration pitch sector.

Mounted at the left end of shaft 12 in engageable relation to the worm 9 is the worm wheel 10, while at the right end of said shaft is mounted the gear wheel 13 in constant mesh with gear wheel 17 mounted at the forward end of shaft 18 upon which, as previously stated, is also mounted the pair of driving sprocket wheels 2 in spaced relation to pass through the feed holes of the medium 3. Shaft 12, together with worm wheel 10 and gear wheel 13, are mounted on the bracket 14 which is pivoted about the pin 35 in the plane of the gears 13 and 17. Bracket 14 is provided with a lip 15 of magnetic material which acts as an armature for the double-wound relay 16, the latter being mounted upon a support secured to the frame 30. The bracket 14 is supported at its other end by retractile spring 35' hooked to the extension piece 32 secured to or forming a part of the frame 30. The rod 33 is also secured to the frame 30 and is lodged under but clear of the shaft 18 to support the upper end of bracket 14 against the tension of spring 36.

When relay 16 is energized as subsequently described, the bracket 14 pivots to the left about the pin 35, that is, moves counterclockwise, enabling worm wheel 10 to engage the worm 9. As previously stated, the worm 9 has a variable pitch thread divided into four sectors. One sector has a zero pitch, and the purpose thereof is to impart no motion to the wheel 10 when the latter engages the worm during the length of this sector as subsequently to be described. Assuming that the shaft 8 is rotating clockwise as indicated, this zero pitch sector is followed by another pitch sector which imparts constant acceleration to the wheel 10 if the worm is in gear therewith. The constant acceleration sector is then followed by another pitch sector that imparts a constant velocity to the wheel 10 if in gear with the worm, and the last-mentioned sector is then followed by still another sector that imparts constant deceleration to the wheel 10 if in gear with the worm. Thus the zero pitch sector is followed by the constant acceleration pitch sector and preceded by the constant deceleration pitch sector.

These different pitch sectors on the worm 9 control the amount and character of the rotation imparted to the wheel 10 when the latter is engaged with the worm 9. It is obvious that when the worm and the wheel are traversing through the zero pitch sector of the worm, no

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motion will be imparted to the wheel. When, however, the rotation of the worm has advanced to the point where the constant acceleration pitch sector of its thread engages the wheel, accelerated motion will be imparted to the wheel for the length of the sector, bringing the wheel up to a velocity that will be maintained for the duration of its engagement with the worm through the latter's constant velocity pitch sector that follows. Since this sector is followed by the constant deceleration pitch sector, the engagement of the wheel with the worm during the latter's rotation through the last-mentioned sector will reduce the speed of the wheel to zero, which is the quantity of rotation imparted to the wheel during the rotation of the worm 9 through the succeeding zero velocity pitch sector. In other words, during the rotation of the worm 9 through its zero pitch sector while meshed with the wheel 10, the latter will remain stationary.

Supported within the drum 7 is the magnet 11. This magnet is adapted either to record signals or respond to signals recorded on medium 3, and the worm 9 is so mounted upon the shaft 8 in relation to the magnet 11 that the zero pitch sector of the worm will be underneath two teeth of the gear wheel 10 during the time that the magnet 11, on the rotation of the drum 7, traverses the undersurface of the medium 3. The pole face of the magnet lies preferably within a window cut in the rim of the drum to effect a magnetic engagement with the medium 3. If the drum 7 is made of non-magnetic material and its rim is sufficiently thin, the window may be dispensed with and the pole face abutted against the inner side of the rim. The conductors of the coil of the magnet 11 are connected to the slip rings 34 which engage the brushes 37 connecting with conductors 36 of the recording or reading circuit, the latter being the means by which the magnet 11 is rendered electrically operative to record or read the instant that the pole face engages the medium 3. A suitable recording or reading circuit is not disclosed herein, it being evident that there are many circuits of the kind in the art that may be used for the purpose by connecting the signaling conductors 36 to said circuit and also the controllable conductor 50 for operating relay 16 in the manner hereinafter described.

On one of the faces of the drum 7 there is provided a commutator which comprises an inner ring composed of a conducting segment 39 arcuately aligned in position relative to all pitch sectors of the worm 9 except the zero pitch sector, and a non-conducting segment 40 arcuately aligned in position relative to the zero pitch sector; an outer ring composed of a conducting segment 4 arcuately aligned in position relative to said zero pitch sector and a non-conducting segment 5 arcuately aligned in position relative to all other pitch sectors.

The inner ring is engaged by the brush 42 which, as shown in Fig. 3, connects with an armature of relay 6 and, through a resistor 17, with one of a pair of contacts on relay 16, actuated either by the armature 15 or another armature. The outer ring is engaged by brush 43 which, as shown in Fig. 3, connects with the operate winding of relay 16 through a suitable control point in the recording or reading circuit by way of conductor 50, the other terminal of said winding being connected to battery. One terminal of the hold winding of said relay 16 is connected to battery while the other is connected

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to the other of said pair of contacts on said relay 16.

In operation, and assuming that the apparatus is to be used for recording on the medium 3, the magnetic lines which are to constitute the record to be made upon said medium may be placed thereon either as straight lines or curved lines depending upon the pitch of the worm 9 during the period when the pole face of the magnet 11 is passing across the medium. Since it has been stated that the worm 9 has a zero pitch sector, said lines will be straight lines as presently described.

The medium 3 is normally stationary. The drum 7, on the other hand, is in constant rotation by the power applied to the shaft 8, thus causing the pole face of magnet 11 to sweep across the medium 3 during each revolution of the drum. If the magnet 11 is energized by a signal current over conductor 36 from the recording circuit during the time that the pole face of the magnet traverses the medium, a magnetic track will be left thereon indicative of the signal. The same result will obtain, of course, if the magnet is used for reading a signal already in the track if, during the time that the magnet is traversing the medium, the reading circuit is prepared for response thereto. Assuming, however, that the apparatus is to be used for recording upon the medium 3, one point of the circuit of magnet 16 is then closed via conductor 50 by any suitable means in the recording circuit. When the rotation of the shaft 8 reaches the point where the beginning of the zero pitch sector of worm 9 is beneath two teeth of wheel 10, brush 43 will be engaging the grounded conducting segment 4 of the inner ring of the commutator (it being assumed that the drum 7 is metallic and that the conducting segments of the commutator, being metallicity joined to the drum are, therefore, also grounded) whereupon, as indicated in Fig. 3, relay 16 will operate and close its locking circuit to ground on the contacts of relay 6. At this time, however, and because of the interrelation of the pitch sectors of the worm 9, the segments of the commutator and the position of magnet 11 as previously described, the pole face of said magnet 11 is at the farther edge of the medium 3. The operation of relay 16 causes lip 15 to be attracted, thereby causing bracket 14 to be pivoted to the left, bringing worm wheel 10 into engagement with the worm 9. Since gear wheels 13 and 17 are permanently meshed, motion would thereby be imparted to the shaft 12 except for the fact that worm 9 is, at this time, rotating through its zero pitch sector and, therefore, imparting no rotation to the wheel 10. This period of no rotation will persist for the duration of the engagement of zero pitch sector with wheel 10, which is the period during which the magnet 11 will be traversing the medium 3 and operating to leave thereacross a magnetic track derived from the signal current transmitted from the recording circuit over conductor 36.

When the magnet 11 has traversed the medium, the worm 9 will have advanced to its constant acceleration pitch sector. Since relay 16 is locked to ground under the control of relay 6, wheel 10 will remain meshed with the worm 9 and since the latter is now traversing its constant acceleration sector, accelerated motion is thereby imparted to the wheel 10, which motion, through the gear train of wheels 13 and 17, is communicated to the shaft 18 and to the driving sprocket

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wheels 2 mounted thereon, causing said sprocket wheels to propel the medium 3 forward across the surface of the drum 7. For the time that the worm is rotating through its constant acceleration pitch sector, the wheel 10 is brought up to the required constant speed by the end of the sector, which speed, being communicated to the sprocket wheels 2, accelerates the movement of the medium 3 by a like amount, causing it to traverse the surface of the drum 7 at a constant velocity for the period that the wheel 10 engages the constant velocity pitch sector that follows the constant acceleration pitch sector.

During the time that the medium 3 is moving across the surface of drum 7 at a constant velocity, the drum will be rotating to bring the magnet 11 back into engagement with the medium. When the worm 9 reaches the end of the constant velocity pitch sector, drum 7 will have rotated to a point where the pole face of the magnet 11 will be slightly distant from the remote edge of the medium. It is at this point that the worm will begin rotating through its constant deceleration pitch sector, causing decelerated motion to be imparted to wheel 10 and hence to the sprocket wheels 2, thus slowing down the movement of the medium to a stop by the time that the worm has fully traversed the length of its deceleration pitch sector, at which time, further, the magnet 11 will have been advanced into coincidence, or near coincidence, with the next track in the medium. Since the deceleration pitch sector is followed by the zero velocity pitch sector, it follows that during the traversal of said last-mentioned sector, the medium will remain stationary while the magnet 11 sweeps transversely across the succeeding track of the medium to record a signal thereon.

Since the intermittent movement of the medium 3 across the surface of the drum 7 depends upon maintaining wheel 10 meshed with the worm 9, and since this meshing depends upon the continued energization of relay 16 as above described, the above cycle of operations will be repeated as long as relay 16 remains operated.

When recording (or reading) operations are completed and it is desired to stop the operation of the device, relay 6 is operated in any suitable manner, which thereupon opens the locking circuit of relay 16. However, if relay 6 is operated at a time when the worm 9 is meshed with wheel 10 through any of its pitch sectors except the zero pitch sector, relay 16 will not release since, at this time, brush 42 will be sweeping over the conducting segment 39 of the commutator, supplying a supplementary locking circuit for relay 16 over a path traced from ground on segment 39, brush 42, resistor 17', contacts of relay 16, locking winding thereof to battery. This circuit will hold relay 16 operated which, in turn, will maintain the worm 9 meshed with wheel 10 and cause the medium 3 to be advanced across the surface of the drum until the magnet 11 will again be in coincidence, or near coincidence, with the next track on the medium, by which time the worm will have advanced to its zero pitch sector and brush 42 will have reached the insulating segment 40 of the commutator. The locking circuit of relay 16 will then be opened, releasing said relay. Upon the release of the relay, bracket 14 tilts upward about the pivot 35, spring 36 lifting the bracket to disengage the wheel 10 from the worm 9 until said bracket comes to rest under pin 33. Thus in the operation of the device, the arrangement described is

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such that wheel 10 will always engage the worm 9 on its zero velocity pitch sector, thereby insuring against the loss of recording (or reading) any signal in the medium 3 since, if relay 16 is operated to clutch the wheel 10 with the worm on this sector, the clutching takes place at the time that the pole face of magnet 11 is in position to record or read at the beginning of a track.

In the modification of the device shown in Fig. 2, the worm 9 is replaced by the disc 44 and certain parts of the device identified by the same numerals as in Fig. 1 are slightly modified and rearranged. The disc 44 carries a variable pitch thread divided, as is the thread of worm 10, into a zero pitch, constant velocity, constant deceleration and constant acceleration pitch sectors, and in the same order as described for the worm 10. Normally the wheel 10 is not in engagement with the thread on the disc 44, but when relay 16 is operated in the manner described, the armature 15 is attracted to pivot the bracket 14 clockwise about the pin 35, bringing the wheel 10 into mesh with the zero pitch sector of the thread on the disc, thereby causing motion to be imparted to the gear wheels 13 and 17 and to sprocket wheels 2 in accordance with the pitch of the four sectors of the thread.

While I have illustrated my invention in its application to two embodiments thereof, it is not limited to such application nor to the specific arrangements disclosed herein. It will be evident to one skilled in the art that many applications, arrangements, and modifications, other than those herein disclosed, are within the scope of the invention.

Further, the terms and expressions which I have used in reference to the invention and its elements are used as terms of description and not of limitation, and I have no intention by the use of said terms and expressions of excluding thereby equivalents of the features shown and described or portions thereof but, on the contrary, intend to include therein any and all equivalents and modifications which may be employed without departing from the spirit of the invention.

What is claimed is:

1. Apparatus for moving a magnetic body successively across a plurality of tracks on a magnetic medium, comprising in combination with said medium a movable support therefor, rotating means mounting thereupon a magnetic body, a variable pitch worm, means permanently connected with said movable support and engageable with said worm, and means operative only at times to produce an engagement of said last-mentioned means with said worm, whereby unidirectional variable motion is imparted by said last-mentioned means to said movable support for advancing said medium one track.

2. Apparatus for recording signals on or reading signals from a magnetic medium, comprising in combination with a magnetic medium in a stationary position, a continuously rotating member, a magnet mounted upon said member adapted to move across said medium for recording or reading during one portion of the rotary movement of said magnet, a variable pitch device mounted upon said member, and means engageable only at times with said device for advancing said medium longitudinally during another portion of the rotary movement of said magnet.

3. Apparatus for recording signals on or read-

ing signals from a magnetic medium, comprising in combination with a magnetic medium in a stationary position, a continuously rotating shaft, a magnet mounted upon said shaft adapted to move across said medium for recording or reading during a portion of the rotary movement of said magnet, a worm device mounted upon said shaft having a variable pitch thread divided into a zero pitch sector, a constant velocity pitch sector, a constant acceleration pitch sector, and a constant deceleration pitch sector, and means engageable with said worm for controlling the longitudinal movement of said medium, whereby no movement is imparted to said medium when said means engage the zero pitch sector of said worm, constant acceleration is imparted to said medium when said means engage the constant acceleration pitch sector of said worm, constant velocity is imparted to said medium when said means engage the constant velocity pitch sector of said worm and constant deceleration is imparted to said medium when said means engage the constant deceleration pitch sector of said worm, said worm being so mounted upon said shaft that its zero velocity pitch sector is in engageable relation with said last-mentioned means coincident with said magnet traversing said medium, whereby said medium remains in a stationary position during the movement of said magnet thereacross.

4. Apparatus for recording signals on or reading signals from a magnetic medium comprising in combination a constantly rotating shaft, a variable pitch worm on said shaft, a drum mounted on said shaft, a supported magnetic medium adapted for longitudinal passage over a portion of the rim of said drum, an arcuate pneumatic device secured in spaced relation over the portion of the rim of said drum traversed by said medium, whereby said pneumatic device conforms the portion of said medium thereunder to the shape of said rim, a magnet interiorly secured to said rim for recording or reading signals on said medium when said magnet traverses said medium, and means controlled from the variable pitch worm on said shaft for imparting longitudinal movement to said medium during that portion of the rotation of the magnet when

said magnet is not in magnetic engagement with said medium.

5. Apparatus for recording signals on or reading signals from a magnetic medium, comprising in combination with a magnetic medium in a stationary position, a continuously rotating member, a magnet mounted upon said member adapted to move across said medium for recording or reading during one portion of the rotation of said magnet, a variable pitch device mounted upon said member, and means engageable with said variable pitch device for advancing said medium longitudinally during another portion of the rotation of said magnet, said last-mentioned means comprising a pivoted gear mechanism including a gear engageable with said variable pitch device in one pitch sector of its thread, a relay having an armature integral with said mechanism, whereby upon the operation of said relay said gear mechanism is pivoted to bring said gear into physical relation with said variable pitch device, and circuit means for operating said relay, said means including a commutator for completing the circuit of said relay only when said one pitch sector of said variable pitch device is in engageable relation with said gear, whereby said gear engages said variable pitch device.

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