

[54] **ARRANGEMENT FOR DETECTING THE POSITION OF THE SEWING NEEDLE IN A SEWING MACHINE**

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[51] Int. Cl..... **D05b 69/22**

[58] Field of Search..... 112/219 A, 219 R, 220, 112/218 R, 67, 87

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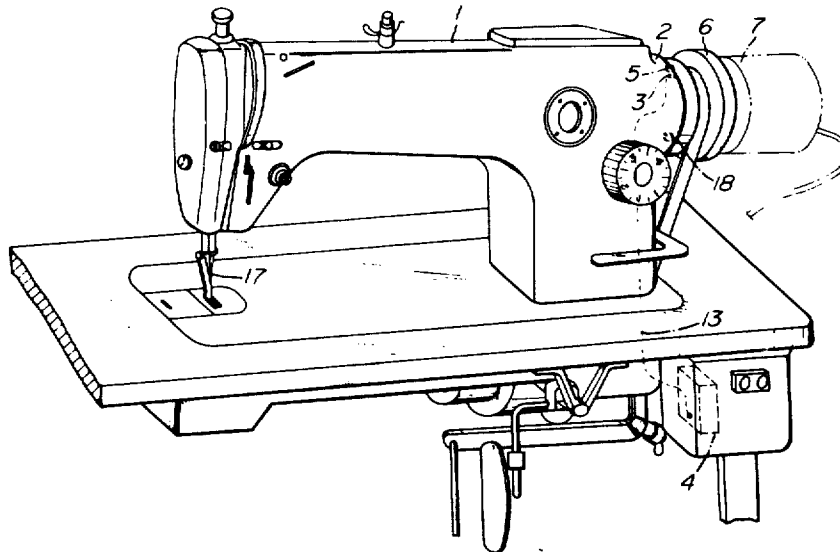
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[57] **ABSTRACT**

A sewing machine has a sewing needle longitudinally reciprocated to effect sewing. The sewing machine includes a rotary member rotating in synchronism with the reciprocation of the sewing needle. At least one magnet is mounted on the rotary member for rotation therewith. At least one Hall generator unit is mounted stationarily with such an orientation relative to the path of the magnet that when the rotary member assumes a predetermined angular orientation corresponding to a predetermined position of the sewing needle a Hall voltage is induced in the Hall generator unit.

9 Claims, 15 Drawing Figures



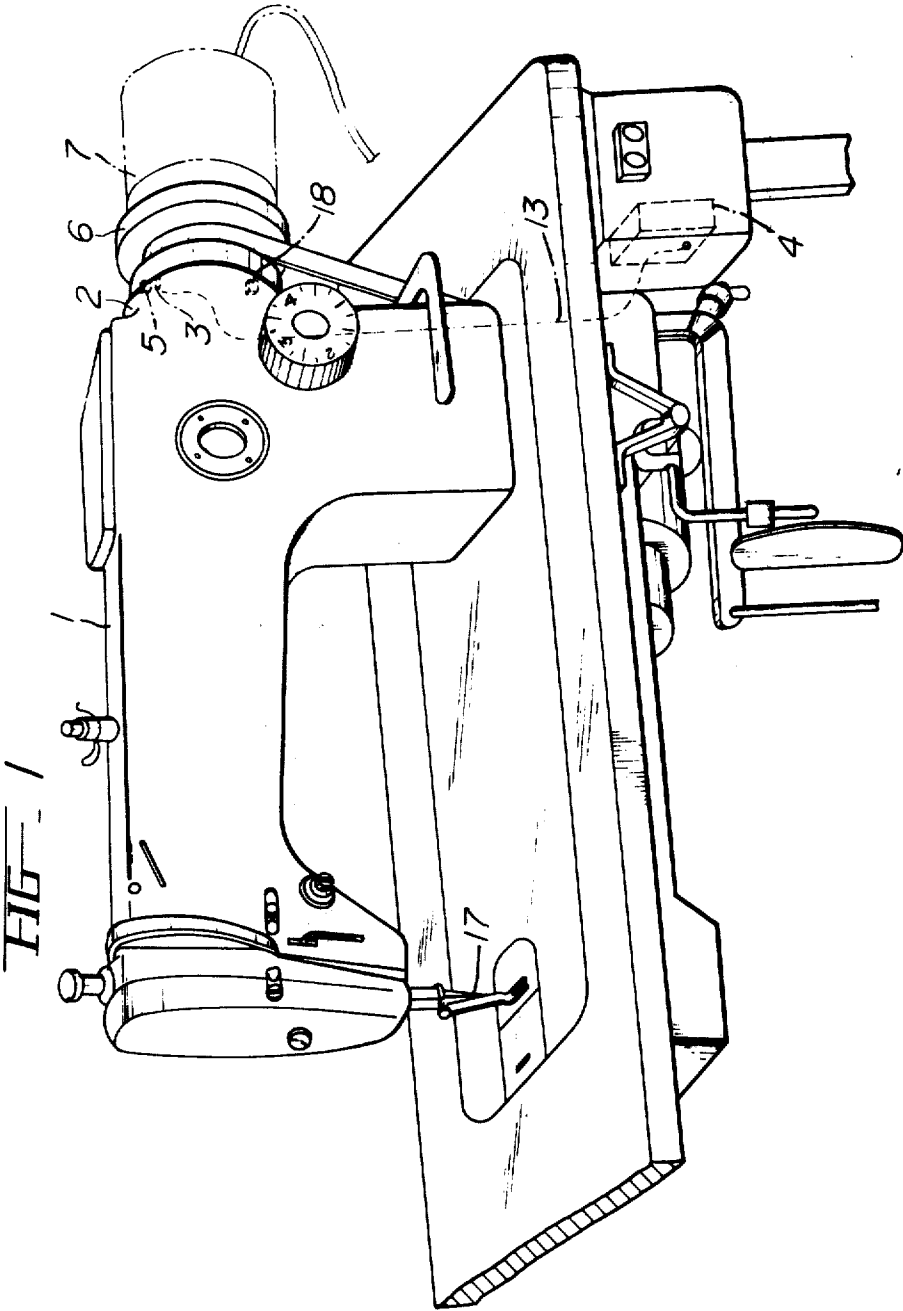


FIG. 2

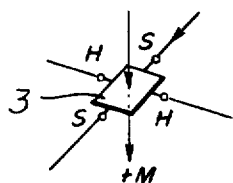


FIG. 4

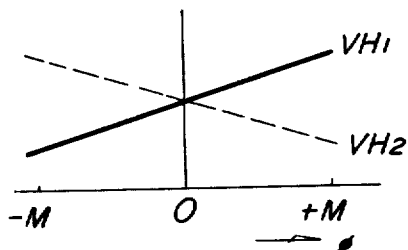


FIG. 3

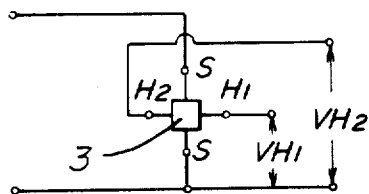


FIG. 5

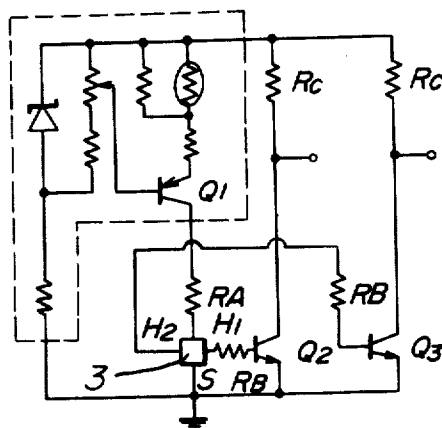


FIG. 6

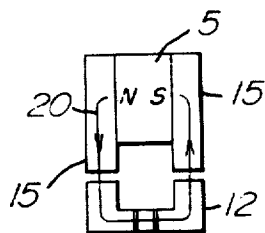


FIG. 7

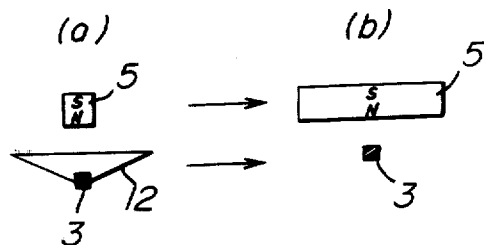


FIG. 8

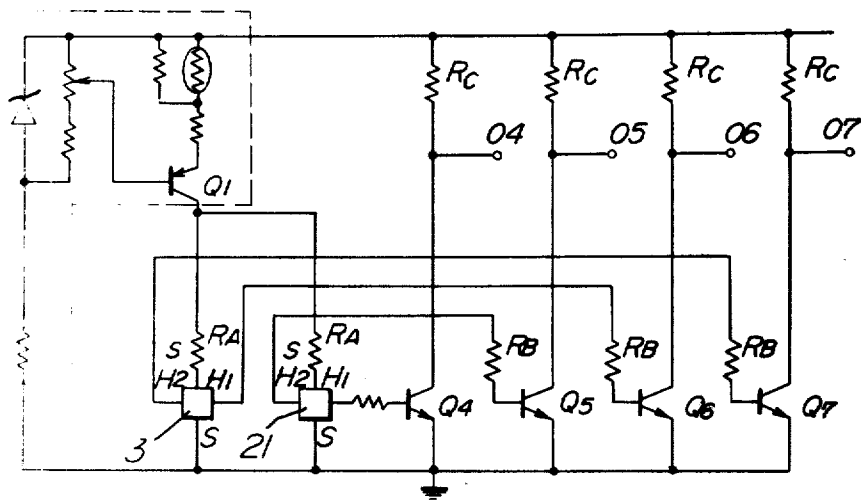


FIG. 11

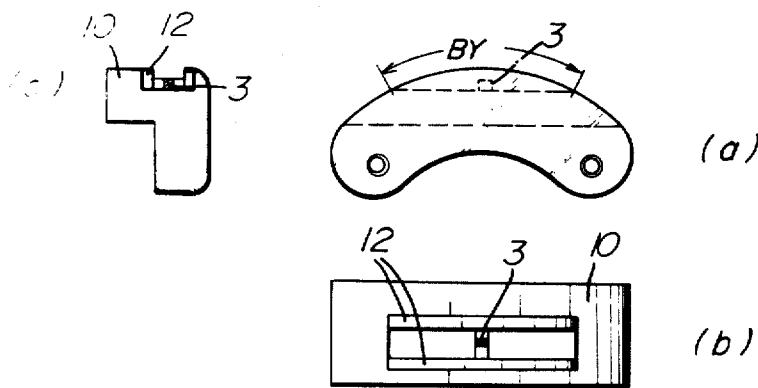


FIG. 9

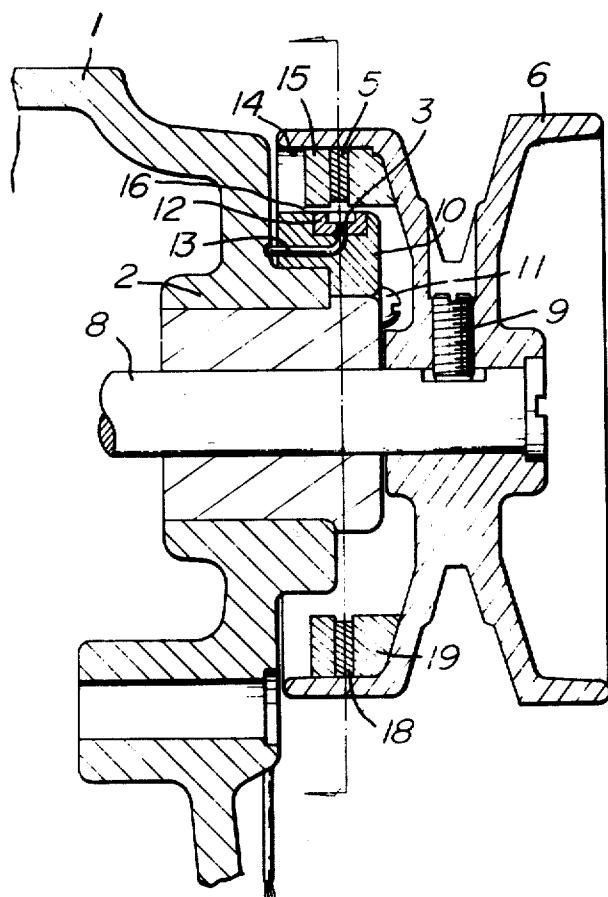


FIG. 10

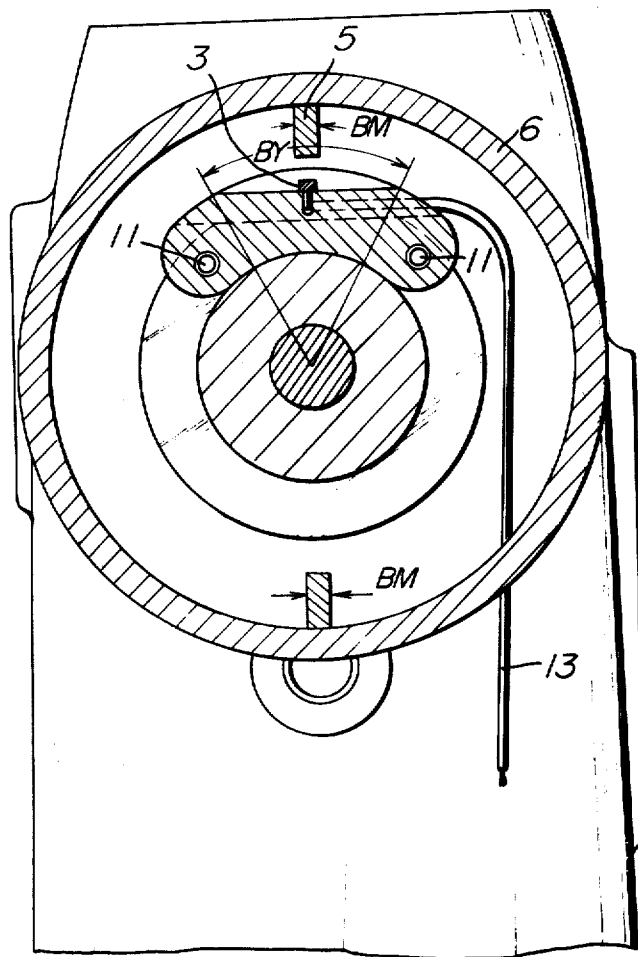


FIG. 12

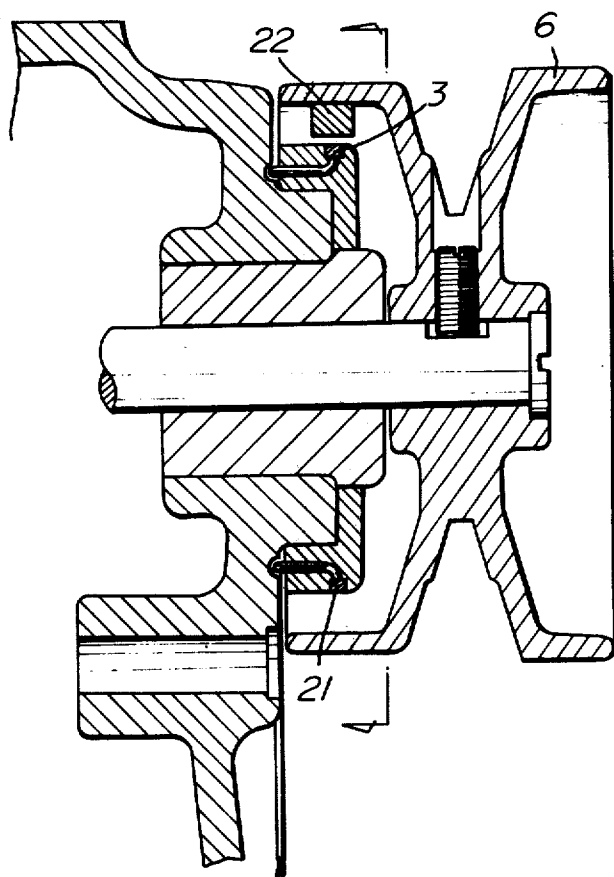


FIG. 13

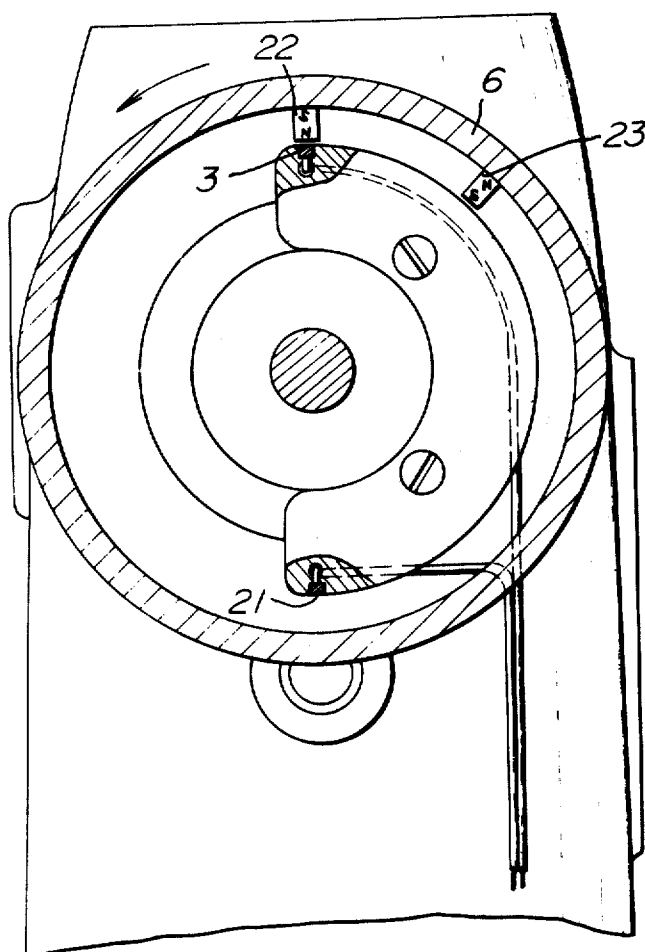


FIG. 14

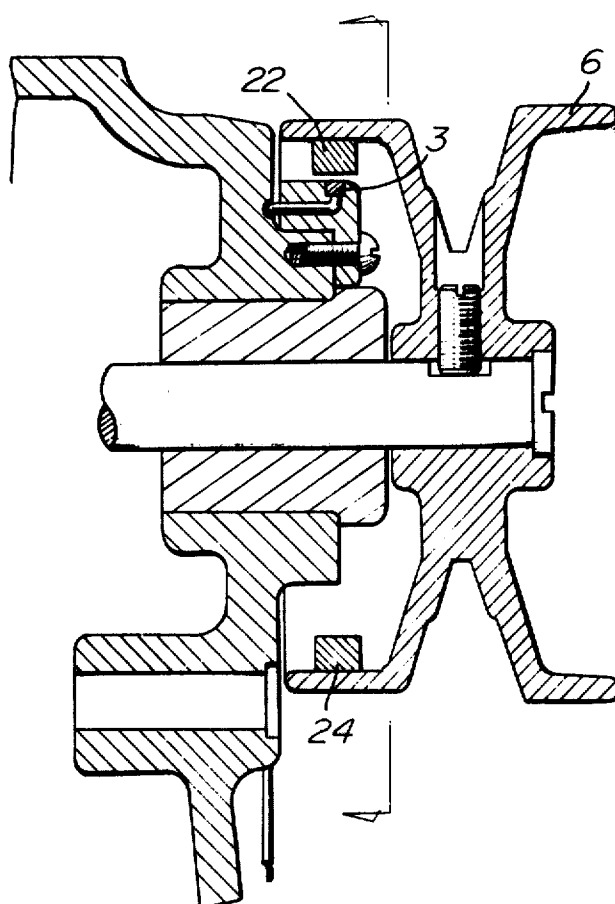
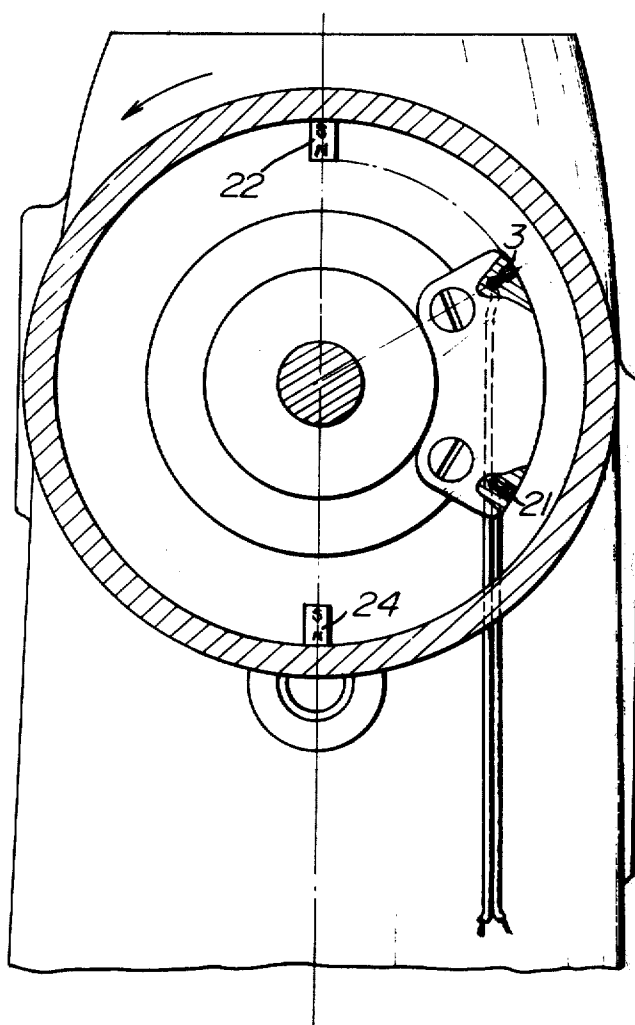


FIG. 15



ARRANGEMENT FOR DETECTING THE POSITION OF THE SEWING NEEDLE IN A SEWING MACHINE

BACKGROUND OF THE INVENTION

The present invention relates exclusively to sewing machines of the type provided with a longitudinally reciprocated sewing needle and having at least one rotary member rotating in synchronism with the longitudinal reciprocation of the sewing needle.

More specifically, the invention relates to the detection of the position of the sewing needle.

It is already known to detect the position of the sewing needle of a sewing machine, and in particular to detect when the sewing needle is in its lowermost and uppermost end positions.

The known arrangements employ a position-detecting arrangement which is annexed to the sewing machine by mounting on the sewing machine housing and coupling the position-detecting arrangement to a rotating part of the sewing machine. A disadvantage of this construction is that it is very unaesthetic in appearance, can interfere with the freedom of movement of the operator or the placement of the sewing machine, and can interfere with access to the components of the sewing machine when repair or inspection is required. Also, the known arrangements for detecting the position of the sewing machine needle are detrimentally effected by prolonged use, temperature, and furthermore create objectionable noise and vibrations.

In the prior-art arrangements for detecting the position of the sewing needle, it was customary to employ a slip ring element rotatable in synchronism with the longitudinal reciprocation of the sewing needle. A stationary brush engaged the rotating slip ring during the rotation of the latter to form a closed electrical circuit. The slip ring was provided with one or more circumferentially discrete non-conductive portions, and when the slip ring rotated into an angular orientation at which the brush contacted only the non-conductive portion of the slip ring, the control circuit was interrupted, indicating that the sewing needle had reached a predetermined position, for instance its uppermost or lowermost position. When the non-conductive portion was contacted by the brush, a braking mechanism was activated, to cause the sewing machine needle to stop in the predetermined position. This known arrangement is disadvantageous from many points of view. The running of the stationary brush over the conductive and non-conductive portions of the slip ring often causes noise and vibration, and of course prolonged use of such an arrangement results in wearing away of the brush and/or the slip ring, causing erratic performance necessitating replacement of the worn parts. In addition, the brush and/or slip ring sometimes become damaged in a manner resulting in short-circuiting of the non-conductive portion of the slip ring, rendering the position-detecting arrangement entirely inoperative for its intended purpose. Moreover, in the known arrangements for detecting the position of the sewing needle, the slip ring and brush are generally mounted on the outside of the drive-belt pulley of the sewing machine, this drive-belt pulley being the large wheel rigidly connected with the main shaft of the sewing machine and serving to transmit the force from the motor to the reciprocator for the sewing needle. This is done to facilitate access to the position-detecting arrangement, par-

ticularly for the troublesome replacement of worn parts alluded to earlier. However, such provision of the position-detecting arrangements adds to the bulk of the machine and is objectionable.

It has also been proposed to couple the position-detecting arrangement not to the main drive shaft of the sewing machine but rather to the motor output shaft around whose pulley the drive belt is also trained. This has created additional problems, because where the position-detecting unit is to be provided as an attachment, installation is sometimes made difficult by the different transmission ratios between the motor shaft and the main shaft of the sewing machine.

SUMMARY OF THE INVENTION

It is the general object of the invention to provide an arrangement for detecting the position of the sewing needle is a sewing machine which does not exhibit the disadvantages of the prior-art arrangements for this purpose.

This general object, and others which will become more understandable from the following description, can be met according to the invention by providing, in a sewing machine of the type including a sewing needle and means for longitudinally reciprocating the sewing needle to effect sewing and including at least one rotary member rotating in synchronism with such longitudinal reciprocation, an arrangement comprising magnet means mounted on the rotary member for rotation therewith, flux-responsive means, and mounting means mounting the Hall generator means stationarily and with such an orientation relative to the path of motion of the magnet means that, when the rotary member assumes a predetermined angular orientation corresponding to a predetermined position of the sewing needle, a Hall voltage is induced in the Hall generator means.

According to one advantageous concept of the invention, the position-detecting device includes a needle-position detecting element, such as a Hall generator, and an element whose position is to be detected, such as a permanent magnet, accommodated within the structure of the main drive pulley of the sewing machine, so that the overall dimensions of a sewing machine provided with the inventive arrangement will be smaller than hertofore, with the position-detecting arrangement additionally being so positioned within the structure of the main drive pulley that it will not hinder access to the components of the sewing machine, when inspection or repair is required.

A further object of the invention is to provide an arrangement for detecting the position of the sewing needle so designed that there is no contact between parts that are in relative motion, as was the case with the prior-art slip-ring-and-brush arrangements. According to the invention, the problem of inoperativeness resulting from frictional wearing away of the components of the arrangement is entirely eliminated. Also, according to the invention, it is desired to provide an arrangement which creates no noise during operation and which does not cause the sewing machine to vibrate in the objectionable manner inherent in the prior-art devices for this purpose.

According to one advantageous concept of the invention, the inventive arrangement makes use of stationarily mounted Hall generator means and rotatably mounted magnets, particularly permanent magnets. It

is an object of the invention to provide an arrangement in which the number of Hall generators and/or magnets employed is kept very low.

It is another object of the invention to generate position-indicating signals of relatively long duration.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a sewing machine;

FIG. 2 is a perspective view of a Hall semiconductor element located in a magnetic field;

FIG. 3 illustrates conductors connected to the four electrodes of the Hall semiconductor element of FIG. 2;

FIG. 4 is a graph depicting the voltages which can be generated in response to magnetic field strength;

FIG. 5 is a circuit diagram of one circuit in which the Hall generator of the position-detecting arrangement may be incorporated;

FIG. 6 is a schematic diagram of a magnetic circuit formed by the stationary and moving parts of the position-detecting arrangement;

FIGS. 7a and 7b depict two possible configurations for the stationary and moving parts of the arrangement;

FIG. 8 is a circuit diagram of another circuit employed when two Hall semiconductor elements are used in the position-detecting arrangement;

FIG. 9 is an axial section through a portion of the sewing machine of FIG. 1, illustrating a first embodiment of the position-detecting arrangement employing a single Hall semiconductor element and associated with the circuit shown in FIG. 5;

FIG. 10 is a transverse section through the sewing machine of FIG. 9, taken on the section line shown in FIG. 9;

FIGS. 11a, 11b and 11c depict a stationary portion of the position detecting arrangement, as seen from three mutually perpendicular directions;

FIG. 12 is an axial section through a sewing machine provided with a second embodiment of the position-detector according to the invention; including two Hall generators and used in conjunction with the circuit of FIG. 8;

FIG. 13 is a transverse section through the second embodiment shown in FIG. 12, taken on the section line indicated in FIG. 12;

FIG. 14 is an axial section through a sewing machine provided with a third embodiment of the position-detector of the invention; and

FIG. 15 is a transverse section through the arrangement shown in FIG. 14, taken on the section line indicated in FIG. 14.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

FIG. 1 illustrates in perspective view one sewing machine of the type with which the present invention is concerned. The machine has a housing 1 on which is mounted a Hall generator 3 and an electric control circuit 4 connected to the Hall generator 3 by means of

electrical conductors. The sewing machine has a conventional drive pulley 6 about which is trained a drive belt driven by a non-illustrated electric motor. Within the structure of the drive pulley 6 there is mounted for rotation with the pulley 6 a permanent magnet 5. The Hall generator 3 is so oriented relative to the circular path of motion of the permanent magnet 5 that when the drive pulley 6 assumes a predetermined angular orientation corresponding to a predetermined position of the longitudinally reciprocated sewing needle 17, the permanent magnet 5 will be located close enough to the Hall generator 6 as to induce in the latter a Hall voltage indicating that the needle has reached the predetermined position.

Axial sections through the sewing machine are shown in FIGS. 9, 12 and 14. The sewing machine structure in these three Figures is the same, the only difference being in the structure of the position-detecting means. The sewing machine structure shown in FIGS. 9, 12 and 14 corresponds to the structure of the sewing machine depicted in FIG. 1.

With reference to FIG. 9, for example, reference numeral 8 designates the main shaft of the sewing machine. The drive pulley 6 is rigidly mounted at the right-hand end of the main shaft 8 by means of a mounting screw 9. As can be seen from FIG. 9, the right-hand end of the main shaft 8 projects outwardly from the housing 1 of the sewing machine. Reference numeral 10 designates a mounting seat for a Hall generator unit, this mounting seat 10 being itself mounted on right-hand portion 2 of the machine housing 1 by means of a mounting screw 11. The mounting seat 10 holds a yoke 12 of magnetic material. The magnetic yoke 12 is formed with a cavity into which is inserted and tightly held a Hall generator semiconductor element 3 responsive to the magnetic flux emanating from the permanent magnet 5. Numeral 13 identifies an electric cable operatively connecting the Hall generator 3 to the electric control circuit 4.

The permanent magnet 5 is mounted for rotation with the drive pulley 6 and is seated in a yoke 15 of ferromagnetic material. The magnet 5 and the yoke 15 are positioned in the internal bowl-shaped concavity at the left-hand side of the pulley structure 6. The Hall generator 3 and the permanent magnet 5 are so positioned as to define between themselves, in their position of greatest proximity, a radial air gap 16. Accordingly, the stationary and moving parts, namely parts 3 and 5, of the position-detecting arrangement will never actually come into contact with each other, and no problem of the wearing away of components will exist with respect to these parts.

FIG. 6 illustrates how the Hall semiconductor element 3 with its yoke 12 and the permanent magnet 5 with its yoke 15 together form a magnetic circuit, when parts 5 and 15 move close to parts 3 and 12. The flux 20 emanating from the permanent magnet 5 passes through one portion of the moving yoke 15, crosses the radial air gap, passes through one portion of the stationary yoke 12, passes through the Hall semiconductor element 3, passes through the other portion of the yoke 12, crosses again the radial air gap and returns via yoke 15 to the south-pole end of permanent magnet 5. As will be understood by persons skilled in the art, during the entire time that this magnetic circuit exists, a Hall voltage will be generated across the Hall-voltage electrodes of Hall semiconductor element 3. This Hall

voltage accordingly constitutes an indication that the sewing needle 17 of FIG. 1 has reached a predetermined position. In the illustrated embodiment, the sewing machine is so constructed that one rotation of the drive pulley 6 effects one complete reciprocatory cycle of the sewing needle 17 — i.e., one upward movement plus one downward movement. If two permanent magnets are provided on the rotary pulley 6, located diametrically opposite each other with respect to the axis of rotation, it becomes possible, by appropriately positioning these magnets, to detect both the uppermost and lowermost positions of the sewing needle. In the first embodiment, shown in FIGS. 9 and 10, the second magnet is designated by reference numeral 18 and is provided with a respective yoke 19.

The operation of Hall generator semiconductor elements is very well known. FIG. 2 illustrates schematically one such element. The Hall element 3 has two control electrodes S and two Hall-voltage electrodes H. To make the Hall element operative a source of control current is connected across the control electrodes S, for instance so that current flows in the direction indicated by the arrow. If now the Hall element is moved into the region of a magnetic field M, a Hall voltage will be generated across the Hall-voltage terminals H.

In FIG. 3 there is depicted the manner in which the Hall element 3 can be connected so that two separately useful voltages are derived from the two Hall-voltage electrodes of the single Hall element 3. The control electrodes S are connected across a non-illustrated source of current, and the voltage at each of the two Hall-voltage electrodes H is measured with respect to the voltage at one of the control electrodes S. Conventionally, it is simply the voltage across the two Hall-voltage electrodes that is measured to determine magnetic field strength. When a circuit connection like that in FIG. 3 is employed, however, the voltage-flux relationships depicted in FIG. 4 can be established.

In FIG. 4 the voltages VH_1 and VH_2 defined in FIG. 3 are plotted with respect to magnetic field strength. When the magnetic field strength increases from a negative value to a positive value, the voltage VH_1 rises proportionally while the voltage VH_2 falls proportionally; conversely when the magnetic field strength decreases from a positive value to a negative value the voltage VH_1 decreases proportionally while the voltage VH_2 rises proportionally. The distinguishable responses of the two voltages VH_1 and VH_2 to the same changes in magnetic field strength are made use of in the embodiments described below.

An exemplary embodiment of a circuit employing the Hall element 3 in the manner shown in FIG. 3 is illustrated in FIG. 5. The portion of the circuit enclosed in dashed lines constitutes a constant-current source of conventional configuration. The operation of this source need not be discussed in detail, because it will be readily understood by those skilled in the art; it is merely noted that the illustrated Zener diode and the illustrated temperature-responsive resistor respectively stabilize the constant current against variations in the non-illustrated power supply and in the ambient temperature.

The constant current furnished by the constant-current source is passed through the control electrodes S of the Hall element 3 via a resistor R_4 . Two transistor switches Q_2 and Q_3 are provided for detecting magnetic fields of opposite polarities. It will be noted that Hall-

voltage electrode H_1 is connected via a resistor R_8 to the base of transistor Q_2 , while the Hall-voltage electrode H_2 is connected via a resistor R_9 to the base of transistor Q_3 . When the magnetic field passing through the Hall element 3 is of one polarity and of sufficient strength, transistor Q_2 is rendered conductive. When the magnetic field is of opposite polarity and of sufficient strength, transistor Q_3 is rendered conductive. The voltage changes at the collectors of the transistors Q_2 and Q_3 accordingly will constitute signals indicative of changes in the sensed magnetic field. The threshold values of the transistors can be so chosen that one or the other is turned on depending upon the polarity of the magnetic field.

Discussing now the operation of the embodiment of FIGS. 9 and 10, in conjunction with the circuit of FIG. 5, it is noted that a single Hall semiconductor element 3 and two permanent magnets 5 and 18 are employed. The magnets 5 and 18 are located diametrically opposite each other, with respect to the main shaft 8, at positions respectively corresponding to the uppermost and lowermost sewing needle positions. When the magnet 5 moves into the vicinity of the Hall element 3, as shown in FIGS. 9 and 10, the transistor Q_2 in FIG. 5 becomes conductive; this indicates that the needle is at its uppermost position. On the other hand, when magnet 18 moves into the vicinity of the Hall element 3, the transistor Q_3 in FIG. 5 becomes conductive, indicating that the needle is at its lowermost position.

As will be understood by persons skilled in the art, the conversion of rotary motion into longitudinal reciprocation has certain characteristics when the longitudinally reciprocated element is at its extreme positions. In the case of a sewing machine, the main drive shaft 8 can turn through a sizable angle without effecting much movement of the reciprocating needle, when the needle is near either of its extreme or so-called rock positions. Accordingly, for most practical purposes, a certain range of positions of the rotary element carrying the position-detecting components, can be employed for detecting the uppermost and lowermost needle positions. FIG. 10 should now be referred to.

In FIG. 10 it is shown that the yoke 12 of FIG. 1 extends in the direction of rotation for a rather considerable angle, the effective portion of which is designated B_y . When the magnet 5, corresponding to the uppermost needle position, is anywhere within the angular range B_y , the yoke 12 will cause the flux from magnet 5 to pass through the semiconductor element 3, so that transistor Q_2 will be conductive for a substantial continuous range of angular positions of the rotating drive pulley 6. In the embodiment of FIG. 10, the extent of this range of angular positions is approximately the angle B_y minus the angle B_M , where B_M is the angular extent in circumferential direction of the permanent magnet 5.

Reference should now be had to FIGS. 11a, 11b and 11c for an understanding of how the yoke configuration causes the flux from magnet 5 to pass through Hall element 3, over the entire angular range B_y minus B_M . Particularly, in FIG. 11b it is clear that the only complete path for magnetic flux extends right through the Hall element 3, so that wherever flux enters into one side of the yoke 12 must pass through the element 3 to get to the other side of the yoke 12.

In FIG. 10, the second permanent magnet 18 also has a circumferential extension B_M , and accordingly when

the lowermost needle position is detected, the duration of the detecting signal will be substantially the same as for the uppermost needle position.

Since the signals indicating the extreme needle positions will have a considerable duration, it will be appreciated that these signals can be used to activate a braking mechanism when the needle is brought near to one of its extreme positions, but possibly before such extreme position is actually reached.

As already stated, it is considered very advantageous to generate position-detecting signals of considerable duration. FIGS. 7a and 7b concisely summarize two different expedients for accomplishing this result. In FIG. 7a, the magnet 5 has a circumferential width comparable to, actually slightly greater than, that of the Hall element 3. However the yoke 12 has such a large circumferential extent, as to result in the desired generation of a prolonged signal. In FIG. 7b, the relationships are reversed, and it is the magnet 5 which has a sizable circumferential extension compared to the stationary part of the arrangement, again resulting in the desired generation of a prolonged signal. It will be also apparent that the polarities N and S of one magnet may be used as corresponding to the upper and lower dead points of the needle respectively without using two magnets for the two dead points of the needle respectively.

A second embodiment of the invention is shown in FIGS. 12 and 13, with the associated detecting circuit being shown in FIG. 8. As best seen in FIG. 13, two Hall generators designated 3 and 21 and two magnets designated 22 and 23 are provided.

In this embodiment, instead of generating prolonged signals, one for the uppermost needle position and the other for the lowermost needle position, two signals are generated for each position, one corresponding to the beginning of the prolonged signal of the previous embodiment and the other corresponding to the end thereof.

As the drive pulley 6 in FIG. 13 turns through one revolution in the direction indicated by the arrow, the following occurs. The magnet 22 moves past the Hall generator 3, briefly rendering transistor Q_6 in FIG. 8 conductive, to generate a short-lasting pulse. Next, the magnet 23 moves past Hall generator 3, and the transistor Q_7 is briefly rendered conductive, to generate a short-lasting pulse. The outputs O_6 and O_7 of transistors Q_6 and Q_7 can be respectively connected to the two inputs of a non-illustrated flip-flop. The output signal at the first output of the flip-flop will accordingly constitute the desired position-indicating signal of prolonged duration. Similarly, when magnet 22 moves past Hall generator 21, transistor Q_4 is briefly rendered conductive, and then when magnet 23 moves past Hall generator 21, transistor Q_5 is briefly rendered conductive. The outputs O_4 and O_5 can each be connected to one of the two inputs of a further flip-flop, so that the output signal of one flip-flop terminal will constitute the desired prolonged position-indicating signal.

The magnets 22 and 23 may be replaced if proper use is made of the polarity of one magnet to obtain the same effect.

A third embodiment of the invention is illustrated in FIGS. 14 and 15, and is again used in conjunction with the circuit shown in FIG. 8, although the sequence of activation of the transistors Q_4 - Q_7 will be different in this embodiment. In this third embodiment, the generation of a prolonged signal is accomplished by spacing

two Hall generators 3 and 21 in circumferential direction by a distance corresponding to the desired range of positions to be detected.

It is assumed that the outputs O_4 and O_6 are respectively connected to the inputs of one (non-illustrated) flip-flop associated with one extreme needle position, while the outputs O_5 and O_7 are respectively connected to the inputs of another (non-illustrated) flip-flop associated with the other extreme needle position.

It will be evident from FIG. 15 that, when the magnets 22 and 24 move in the direction of the arrow, the transistors Q_4 - Q_7 are successively rendered conductive in the cyclical sequence Q_4 , Q_6 , Q_5 , Q_7 . Again, the output pulse of each flip-flop will last until the resetting of the respective flip-flop, and this time interval will be determined by the rotary speed of the magnet arrangement and the angular spacing between Hall generators 3 and 21.

As explained earlier, the invention departs from the conventional practice of monitoring the voltage difference across the Hall-voltage electrodes of the Hall semiconductor element, and instead monitors the voltage difference between each Hall-voltage electrode and a third reference voltage, such as ground potential. However, according to the invention, it is also possible to instead simply monitor the voltage generated across the Hall-voltage electrodes. In that case, however, twice the number of Hall generators employed in the first and second embodiments described may become necessary, since a separate Hall generator may be required for each flux polarity sensed, whereas in the embodiments discussed earlier each single Hall generator is used to generate two distinct control voltages.

Whereas the permanent magnets have been depicted as mounted within the structure of the main drive pulley 6, they can instead be located on any rotary member of the machine rotating in synchronism with the longitudinal reciprocation of the sewing needle, for instance on the thread take-up lever crank which is rotated in synchronism with the main drive shaft, in which case the Hall generator means would be mounted on a portion of the machine housing near the thread take-up lever crank.

Also, the Hall generator elements may be replaced by magnetoresistance elements, to achieve a similar effect.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of constructions and circuits differing from the types described above.

While the invention has been illustrated and described as embodied in an arrangement for detecting the position of the sewing needle of a sewing machine, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. In a sewing machine of the type comprised of a sewing needle, a main rotating shaft, means interconnecting said needle and said shaft for converting rotational movement of said shaft into longitudinal reciprocating movement of said needle, a hollow drive pulley fixedly mounted on one end of said main shaft, and a drive arrangement for driving said main shaft including a drive belt trained around said hollow drive pulley, an arrangement comprising magnet means mounted inside said hollow drive pulley for rotation therewith; flux-responsive means; and mounting means mounting said flux-responsive means on a stationary part of the sewing machine with such an orientation relative to the path of motion of said magnet means that when said drive pulley assumes a predetermined angular orientation corresponding to a predetermined position of said needle a flux-responsive voltage is induced in said flux-responsive means, wherein said flux-responsive means comprises Hall generator means including a Hall generator semiconductor element having a pair of control electrodes and a pair of Hall-voltage electrodes; and further including current source means connected across said control electrodes for establishing flow of a control current through said Hall generator semiconductor element; and a detecting circuit comprising a pair of transistors and means so connecting the electrodes of said transistors to the electrodes of said Hall generator semiconductor element that when magnetic flux of one polarity passes through said semiconductor element one of said transistors becomes conductive whereas when magnetic flux of opposite polarity passes through said semiconductor element the other of said transistors becomes conductive.

2. In a sewing machine as defined in claim 1, wherein said current source means comprises a constant-current source.

3. In a sewing machine as defined in claim 1, wherein said magnet means comprises a permanent magnet extending in direction circumferentially with respect to the axis of rotation of said rotary member a distance several times greater than the circumferential extent of said Hall semiconductor element with respect to said axis.

4. In a sewing machine of the type comprised of a sewing needle, a main rotating shaft, means interconnecting said needle and said shaft for converting rotational movement of said shaft into longitudinal reciprocating movement of said needle, a hollow drive pulley fixedly mounted on one end of said main shaft, and a drive arrangement for driving said main shaft including a drive belt trained around said hollow drive pulley, an arrangement comprising magnet means mounted inside said hollow drive pulley for rotation therewith; flux-responsive means; and mounting means mounting said flux-responsive means on a stationary part of the sewing machine with such an orientation relative to the path of motion of said magnet means that when said drive pulley assumes a predetermined angular orientation corresponding to a predetermined position of said needle a flux-responsive voltage is induced in said flux-responsive means, wherein said flux-responsive means comprises Hall generator means including a Hall semiconductor element and magnetic yoke means positioned adjacent said Hall semiconductor element, said magnetic yoke means extending in direction circumfer-

entially of the axis of rotation of said rotary member and serving to form a magnetic circuit with said magnet means when said magnet means rotates into the vicinity of said yoke means, said yoke means being so configured and oriented with respect to said Hall semiconductor element as to effect passage through the latter of the flux originating from said magnet means when the angular orientation of said rotary member lies within a predetermined range corresponding to the circumferential extension of said yoke means, to induce in said Hall semiconductor element a Hall voltage indicating when the angular rotation of said rotary member lies within said predetermined range.

5. In a sewing machine of the type comprised of a sewing needle, a main rotating shaft, means interconnecting said needle and said shaft for converting rotational movement of said shaft into longitudinal reciprocating movement of said needle, a hollow drive pulley fixedly mounted on one end of said main shaft, and a drive arrangement for driving said main shaft including a drive belt trained around said hollow drive pulley, an arrangement comprising magnet means mounted inside said hollow drive pulley for rotation therewith; flux-responsive means; and mounting means mounting said flux-responsive means on a stationary part of the sewing machine with such an orientation relative to the path of motion of said magnet means that when said drive pulley assumes a predetermined angular orientation corresponding to a predetermined position of said needle a flux-responsive voltage is induced in said flux-responsive means, wherein said flux-responsive means comprises Hall generator means, and wherein said magnet means comprises two permanent magnets each mounted on said rotary member for rotation therewith but spaced from each other in direction circumferentially of the axis of rotation of said rotary member, the polarization of said two permanent magnets differing in such a manner that when one of the magnets passes by said Hall generator means a first Hall voltage is generated whereas when the other of the magnets passes by said Hall generator means a second Hall voltage distinguishable from said first Hall voltage is generated.

6. In a sewing machine as defined in claim 5, wherein said magnet means comprises two permanent magnets each mounted on said rotary member for rotation therewith but spaced from each other in direction circumferentially of the axis of rotation of said rotary member, and wherein said Hall generator means comprises two Hall generator units spaced from each other in direction circumferentially of the axis of rotation of said rotary member.

7. In a sewing machine as defined in claim 6, wherein each of said two magnets extends in direction circumferentially with respect to said axis a distance greater than the distance through which each of said Hall generator units extends in circumferential direction.

8. In a sewing machine as defined in claim 6, wherein each of said two magnets extends in direction circumferentially with respect to said axis a distance less than the distance through which said Hall generator units extend in circumferential direction.

9. In a sewing machine of the type comprised of a sewing needle, a main rotating shaft, means interconnecting said needle and said shaft for converting rotational movement of said shaft into longitudinal reciprocating movement of said needle, a hollow drive pulley

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fixedly mounted on one end of said main shaft, and a drive arrangement for driving said main shaft including a drive belt trained around said hollow drive pulley, an arrangement comprising magnet means mounted inside said hollow drive pulley for rotation therewith; flux-responsive means; and mounting means mounting said flux-responsive means on a stationary part of the sewing machine with such an orientation relative to the path of motion of said magnet means that when said drive pulley assumes a predetermined angular orientation corresponding to a predetermined position of said needle a flux-responsive voltage is induced in said flux-responsive means, wherein said flux-responsive means comprises a Hall generator semiconductor element having a pair of control electrodes and a pair of Hall-voltage electrodes; and further including means connected across said control electrodes for establishing a flow of control current through said Hall generator semiconductor element; and circuit means including a

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first electronic switch element having a control input connected between one of said Hall-voltage electrodes and one of said control electrodes of said Hall generator semiconductor element, and a second electronic switch element having a control input connected between the other of said Hall-voltage electrodes and said one of said control electrodes of said Hall generator semiconductor element, and wherein said magnet means comprises two permanent magnets mounted inside said hollow drive pulley member and angularly offset from each other and having respective orientations such that when one of said magnets passes said Hall generator semiconductor element magnetic flux of one polarity penetrates the latter, whereas when the other of said magnets passes said Hall generator semiconductor element magnetic flux of opposite polarity penetrates the latter.

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