

For the drive of a head drum, e.g. in the case of video recorders, servo-controlled motors are known which are equipped with one or more tacho-generators according to the preamble of claim 1. The meander-shaped windings and also the associated pairs of poles in the rotor are aligned radially. During the rotation there is generated in the coil formed by the meander-shaped arrangement of the individual windings a signal with a frequency dependent on the speed. Said signal is processed in the servo system of the unit in order to derive from it a follow-up control for controlling the speed of the motor. In addition, known systems comprise a so-called pick-up-pulse generator, by means of which one or more switching pulses are generated at each rotor rotation. Said pulses are used for synchronous control between the recorded signal and the sequence control in the unit. EP-A-0 149 360 and US-A-4 410 853 describe such tacho-generators.

The aim of the invention is to generate the required control signals with only one generator arrangement.

This aim is achieved according to the invention by the features given in claim 1 or 2. Developments of the invention are characterised in the dependent sub-claims.

In the case of the tacho-generator according to the invention there are in principle generated according to claim 1 by the effect of azimuth angles - both in the stator part and in the rotor part - different signals with only one generator. While in the one generator part, in which the meander-shaped windings of a first coil are inclined e.g. by $+45^\circ$ relative to a point on the coil diameter, a frequency is generated for the regulation of the motor speed, the pick-up pulses may be generated in a second coil whose meander-shaped windings are inclined e.g. by -45° . Both coils exhibit the same mean winding diameter.

The arrangement of the pairs of poles in the rotating part, i.e. their number and direction, must conform to the arrangement of the coils. This is achieved in the case of a magnetising step of the magnetic disc by a single pair of poles, which may be suitably positioned by means of a rotary adjusting device. In this way, for example, first of all the magnetisation is carried out for the speed regulation, i.e. for the frequency generator, in which pairs of poles are remagnetised with $+45^\circ$ over the whole circumference. In a second magnetising step with the single pair of poles aligned to -45° the existing magnetisation is overwritten at particular intervals which correspond to the arrangement of the meanders of the second coil.

The invention according to claim 1 and the associated sub-claims will be explained in detail below by means of an exemplifying embodiment:

- Fig. 1 shows an arrangement of the meander-shaped windings in a plane for two coils with azimuth angle offsetting,
- Fig. 2 shows an arrangement according to Fig. 1 for a higher frequency generator amplitude,
- Fig. 3 shows an arrangement for magnetisation of the magnetic disc in accordance with Fig. 1,

Fig. 4 shows the lay out in space of the meander-shaped windings relative to the magnetic disc,
 Fig. 5 shows in a cutout the pattern of the signals generated in the coils.

Fig. 1 shows an arrangement of the meander-shaped windings in a plane for two coils with azimuth angle offsetting. On a common baseplate 1 the coils 2 and 3 are constructed circular in shape, e.g. as printed conductor tracks. The coils are nested in one another and have a common connection point A. The coil 2 serves as frequency generator. Its meander-shaped windings are constructed at an angle $+$, referred to a point on the centre line 4. The individual windings are connected in series. The connection for said coil is formed by the point S2. The coil 3 is provided for the generation of pick-up signals. The individual meander-shaped windings are constructed at an angle of $-$. The connection point for said coil is S3. In the present example two coils nested in one another are shown. It is also possible, however, to arrange further coils, e.g. for the generation of further pick-up signals, on the circumference of the circle.

Fig. 2 shows an arrangement according to Fig. 1. A higher frequency generator amplitude is obtained by means of a modified coil 2. A plurality of individual pulses may be picked off at the connections B1 to B10 of coil 3.

In another embodiment (not shown) with a double-faced circuit board, which should be as thin as possible, it is possible to construct the coil 2 continuous on one side of the board, i.e. without interruption by coil 3, while the coil 3 is located on the other side of the board.

Fig. 3 shows an arrangement for the magnetisation of the magnetic disc in accordance with Fig. 1. The magnetic disc 5 is constructed as a circular ring. It is connected to the rotating part of the motor by a connection (not shown). The magnetic disc 5 is - as shown in Fig. 4 - arranged centrally at a short distance from the stationary circuit board, in order to generate the greatest possible signal level in the coils on the rotation of the disc. The incorporated pairs of poles N, S, correspond in their geometrical arrangement to the arrangement of the windings of Fig. 1. The majority of the pairs of poles are arranged at an angle of $+$, while 5 pairs of poles exhibit the angle of $-$. When the rotor rotates, the 5 pairs of magnetic poles and the associated meander-shaped windings of coil 3 lie directly opposite one another once per rotation. In each of said windings individual voltages are induced according to the induction law, so that 5 times the voltage of an individual winding is obtained at connection S3 of coil 3. On further rotation of the rotor or of the magnetic disc there is on the other hand induced in coil 3 due to the pairs of poles provided with azimuth for the frequency generator only a small voltage, with which the desired pick-up pulses are clearly contrasted.

The pattern of the signals generated in the coils 2 and 3 is shown in Fig. 5. Fig. 5a shows over the time t the voltage U of the signals of the frequency generator, i.e. of coil 2, while in Fig. 5b are shown the pick-up signals generated in coil 3.

A further possible method of generating both frequency generator signals and also pick-up signals by means of coils of equal coil diameter nested in one another, with identical alignment of the individual meander-shaped windings, consists in arranging the windings for the pick-up coil and their associated pairs of magnetic poles with varying divisions within the frequency generator coil together with associated pairs of magnetic poles. The division for the pick-up coil is selected so that with an equal number of windings one half of the windings exhibit the division of the frequency generator, while the second half exhibit an arrangement offset by half a division. It is thereby brought about that with a particular position of the magnetic disc relative to the pick-up coil equal-phase voltages are induced by the associated pairs of magnetic poles in the individual windings, which generate by addition one pulse per rotation. Since the division in the frequency generator is constant, there are generated by the pairs of magnetic poles of the frequency generator in the windings of the pick-up coil an identical number of equal-phase and antiphase voltages, which contrast with one another in their addition. It is also possible by setting of the arrangement of the pairs of magnetic poles to generate in the pick-up coil two or more pulses during one rotation.

Said manner of generating signals will be described below by means of an exemplifying embodiment.

Figure 6 shows an arrangement of the meander-shaped windings in a plane together with associated magnetic disc for two coils without azimuth offsetting.

Figure 7 shows in a cutout the allocation of the pairs of magnetic poles to the windings of the coils 6 and 7.

Figure 6 shows on the left an arrangement of the meander-shaped windings in a plane for two coils with identical coil diameter without azimuth offsetting. On a common baseplate 1 the coils 6 and 7 are constructed circular in shape, e.g. as a printed conductor track. The coils are nested in one another and have a common connection point A. The coil 6 serves as frequency generator. Its meander-shaped windings are connected in series and exhibit recesses in which the coil 7 is arranged. The connection for coil 6 is formed by the point S2. The coil 7 is provided for the generation of pick-up signals. The connection point for said coil is S3. Whereas coil 6 exhibits for the frequency generator many windings with a constant division, the division for the six windings of the coil 7 is constructed differently. The individual windings are labelled 7a to 7f in a clockwise direction. It will be seen that the windings of said coil are placed so that the divisions of the windings 7a, 7c and 7e coincide with the divisions of the windings for the frequency generator, while the windings 7b, 7d and 7f are offset by half a division. Said arrangement means that the pairs of magnetic poles of the frequency generator induce in the individual windings of the pick-up coil winding voltages which are mutually contrasted in their addition. No voltage is therefore generated

in the coil 7 by the pairs of magnetic poles of the frequency generator. Conversely, the pairs of magnetic poles for the pick-up generator, as shown on the right in Figure 6, which are associated in their arrangement with the windings of the pick-up coil, also comprise three pairs of magnetic poles offset by half a division, so that with a pre-determined position of the magnetic disc there are induced during one rotation in all six windings of the pick-up coil equal-phase voltages which produce in their addition a pick-up pulse of large amplitude.

Figure 7 shows in a cutout the allocation of the pairs of magnetic poles to the windings of the coils 6 and 7. There are shown the windings 7e and 7f of coil 7 in Figure 6. Whereas the pair of magnetic pairs shown opposite winding 7e lies, like the winding 7e, in the ambit of the division tfg of the frequency generator, the winding 7f with the associated pair of magnetic poles is offset by half a division = $tfg + tfg:2$. The position shown for the magnetic disc therefore corresponds to the state in which all six pairs of pick-up magnetic poles stand opposite the associated meander windings of coil 7. The individual winding voltages are therefore equal-phase and add up to form a pick-up pulse.

Claims

1. Tacho-generator for a servo-controlled motor, with a stationary, flat coil arrangement (2, 3) arranged in a circular ring and comprising meander-shaped windings and with a magnetic disc (5) rotating at a short distance centrally above the coil arrangement and comprising pairs of magnetic poles, characterised in that:
 - a) the majority of the windings form a first coil (2) exhibiting a mean coil diameter, whose meander-shaped windings are aligned at a first angle with respect to the circle diameter (4) with uniform division, and that a first number of pairs of poles (N, S) of the magnetic disc (5) which are associated with the division and the number of the meanders are aligned in the direction of said meanders;
 - b) a winding or several windings distributed over the circle circumference with the same mean diameter as the first coil (2) form a second coil (3) whose meander-shaped windings are aligned at a second angle with respect to the circle diameter (4) and that a second number of pairs of poles of the magnetic disc (5) which are associated with the number and division of the windings of the second coil (3) are aligned in the direction of these meanders, the distribution of the second pairs of poles at the circumference being arranged in such a way that at a pre-determined point of the magnetic disc (5), during a rotation, voltages are induced in the individual windings of the second coil (3) by the second pairs of poles.



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Figure 7 shows in a cutout the allocation of the pairs of magnetic poles to the windings of the coils 6 and 7. There are shown the windings 7e and 7f of coil 7 in Figure 6. Whereas the pair of magnetic pairs shown opposite winding 7e lies, like the winding 7e, in the ambit of the division tfg of the frequency generator, the winding 7f with the associated pair of magnetic poles is offset by half a division = $tfg + tfg:2$. The position shown for the magnetic disc therefore corresponds to the state in which all six pairs of pick-up magnetic poles stand opposite the associated meander windings of coil 7. The individual winding voltages are therefore equal-phase and add up to form a pick-up pulse.

Claims

1. Tacho-generator for a servo-controlled motor, with a stationary, flat coil arrangement (2, 3) arranged in a circular ring and comprising meander-shaped windings and with a magnetic disc (5) rotating at a short distance centrally above the coil arrangement and comprising pairs of magnetic poles, characterised in that:
 - a) the majority of the windings form a first coil (2) exhibiting a mean coil diameter, whose meander-shaped windings are aligned at a first angle with respect to the circle diameter (4) with uniform division, and that a first number of pairs of poles (N, S) of the magnetic disc (5) which are associated with the division and the number of the meanders are aligned in the direction of said meanders;
 - b) a winding or several windings distributed over the circle circumference with the same mean diameter as the first coil (2) form a second coil (3) whose meander-shaped windings are aligned at a second angle with respect to the circle diameter (4) and that a second number of pairs of poles of the magnetic disc (5) which are associated with the number and division of the windings of the second coil (3) are aligned in the direction of these meanders, the distribution of the second pairs of poles at the circumference being arranged in such a way that at a pre-determined point of the magnetic disc (5), during a rotation, voltages are induced in the individual windings of the second coil (3) by the second pairs of poles.



2. Tacho-generator for a servo-controlled motor, with a stationary, flat coil arrangement (6, 7) arranged in a circular ring and comprising meander-shaped windings and with a magnetic disc (8) rotating at a short distance centrally above the coil arrangement and comprising pairs of magnetic poles, characterised in that:
 - a) the majority of the windings form a first coil (6) exhibiting a mean coil diameter, whose meander-shaped windings are aligned at a first angle with respect to the circle diameter (4) with uniform division, and that a first number of pairs of poles (N, S) of the magnetic disc (8) are associated with the division and number of the meanders and are aligned in the direction of said meanders;
 - b) several windings distributed over a circle circumference according to a pre-determined arrangement, with the same mean coil diameter as the first coil (6), form a second coil (7) whose meander-shaped windings are aligned at the angle of the first coil (6) with respect to the circle diameter (4), and that a second number of pairs of poles of the magnetic disc (5) associated with the number of windings of the second coil (7) are aligned in the direction of these meanders, the distribution of the windings of the second coil (7) together with associated pairs of poles being arranged in such a way that at a pre-determined point of the magnetic disc (8), during a rotation, voltages are induced in individual windings of the second coil (7) by the second pairs of poles in the same direction (in the same phase).
3. Tacho-generator according to claim 1, characterised in that the meanders of the first coil (2) are aligned at a positive angle and the meanders of the second coil (3) are aligned at a negative angle with respect to the circle diameter (4).
4. Tacho-generator according to claim 3, characterised in that the two angles are of equal size.
5. Tacho-generator according to claim 4, characterised in that the angles come to 45°.
6. Tacho-generator according to any one of claims 1 or 2, characterised in that the coils (2, 3, 6, 7) are arranged nested in one another on a printed circuit board side (1).
7. Tacho-generator according to any one of claims 1 or 2, characterised in that the coils (2, 3, 6, 7) are arranged separately from one another on a double-faced printed circuit board.



8. Tacho-generator according to any one of claims 1 or 2, characterised in that the pairs of magnetic poles of the magnetic disc (5, 8) are nested in one another.
9. Tacho-generator according to any one of claims 1 or 2, characterised in that the second number of pairs of poles (N, S) corresponds to the number of associated meanders.
10. Tacho-generator according to any one of claims 1 or 2, characterised in that more than two coils are nested in one another.
11. Tacho-generator according to any one of claims 1 or 2, characterised in that the arrangement of the second coils (3, 7) or of the corresponding pairs of magnetic poles is selected so that one or more pulses are generated per rotation.
12. Tacho-generator according to claim 2, characterised in that the number of windings of the second coil (7) is an even number.