SPECIFICATION

Improvements in or relating to electrically-driven floor-care appliances

This invention relates to electrically-driven floor-care appliances and more particularly to a device for indicating the length that bristles of a bristle roller project from a housing of such an appliance.

It is an object of the invention to make it easier for the user of a floor-care appliance, for example, an electric carpet sweeper, to adjust the bristle roller so that the correct length of bristles projects from the housing of the appliance.

With known floor-care appliances having bristle rollers driven by an electric motor, as for example electric carpet sweepers, it is difficult to adjust the length of bristles projecting from the appliance housing so that the length, i.e. the length which is available for brusing or sweeping purposes, is correct for optimal operation. An exact adjustment of the correct length for the bristles projecting from the appliance housing is, however, particularly important, since when the length of bristles is too short, the cleaning effect decreases considerably or is almost completely lost, whereas when the length of bristles too great, the driving torque increases considerably, so that the electric motor, together with transmission elements (as for example driving belts) are heavily loaded. In addition, bristles which project too far may injure the fabric of the carpet or other surface to be cleaned.

According to the present invention, there is provided an electrically-driven floor-care appliance having a device for indicating the length that bristles of a bristle roller project from a housing of the appliance, said device including means for detecting, in use, the torque of an electric driving motor for the bristle roller, said means relying on a voltage difference derived from the motor current and including a threshold value switch responsive to the voltage difference to provide the indication of bristle length as a function of motor torque.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawing, in which:-

Figure 1 is a schematic cut-away view of part of a floor care appliance in the form of an electric carpet sweeper,

Figure 2 is a circuit diagram illustrating one form of device for indicating the length that bristles of a bristle roller project from a housing of an electrically-driven floor-care appliance, and

Figure 3 is a circuit diagram illustrating another form of such a device.

Figure 1 simply shows an electric carpet sweeper 15 in which an electric motor 16 drives a bristle roller 18 through a belt 17. The bristle roller 18 is provided on its circumference with tufts of bristles 19. The length of bristles H projecting from a housing 20 of the appliance can be critical to the cleaning operation. It is possible to establish by tests that only a quite specific length H of the bristles produces the best possible cleaning effect. This specific bristle length H can be checked and adjusted by means of the circuit arrangements which are shown in Figures 2 and 3.

The arrangement shown in Figure 2 operates only with semi-conductor diodes. The motor (marked M) corresponds to the electric motor 16 in Figure 1 and is represented with its stator coils 9 and is connected at points 21 and 22 to its working voltage. In the Example shown, an additional resistance 1 is arranged in the motor circuit. A voltage drop is produced, in use, across this resistance 1 by means of the motor current flowing through it. This voltage is fed by means of electrical conductors 2 by way of a rectifying diode 23 to points 3 and 4. An adjusting or variable resistance 24 is arranged in parallel with the resistance 1.

A threshold value switch 5 is connected across the points 3 and 4, this switch 5 being responsive to the voltage difference derived from the motor current to provide an indication of bristle length as a function of motor torque.

In the Example shown in Figure 2, the threshold value switch 5 consists of three circuits in parallel. The circuit I consists of a luminous diode 6, the circuit II of a series connection of a Zener diode 8 and a luminous diode 6 and the circuit III of only one Zener diode 8.

The method of operation is as follows. If a length H of bristles projecting from the appliance housing is too short, the electric motor 16 operates almost under no load conditions. The torque is therefore very small and thus so is also the motor current. There is only a very small voltage drop through the resistance 1, and this may also be varied by the variable resistance 24 for the particular purpose of use. This voltage is so adjusted (perhaps by the resistance 24) that it is unable to exceed the threshold voltages of the luminous diodes 6. Consequently, both luminous diodes 6 remain dark.

Should now the length of bristles H projecting from the housing 20 of the appliance be of a value which is correct for the best possible operation, the torque of the electric motor 16 increases and so also does the motor current, as well ws the voltage drop across the resistance 1. The threshold voltage of the luminous diode 6 in the circuit I becomes exceeded and so this diode 6 becomes luminous. The luminous diode 6 which is arranged in circuit II does not light up, since it is connected in series with a Zener diode 8 and the voltage still does not exceed the additional value of the two threshold voltages combined.

Should the length H of the bristles be too great, then the torque and hence the motor current and also the voltage drop across the resistance 1 increases still further. The total value of the threshold voltage of the circuit II, provided by the Zener diode 8 and the luminous diode 6, is then exceeded and thus the second luminous diode 6 (in the circuit II) likewise lights up.

The circuit III also includes a Zener diode 8, which has a threshold voltage which is somewhat above that of the circuit II and is incorporated as a protection for the circuits I and II.

The luminous diode 6 in the circuit I could, for

example, light up with a green colour and the luminous diode 6 in the circuit II with a red colour. Thus, the following picture would be produced for the user of the appliance.

1. If the bristle length H is too short, then neither of the two luminous diodes light up.
2. If the bristle length H is correct for the best possible operation, then the green diode lights up.
3. If the bristle length H is too long, then the green and also the red diodes light up.

A circuit providing a simpler indication for the user is shown in Figure 3.

As with Figure 2, the electric motor 16 of Figure 1 is shown with its stator coils 9 and the resistance 1. A voltage drop is also here tapped either side of the resistance 1 and supplied to the points 3 and 4, between which is arranged the threshold value switch 5. In the same way as the arrangement shown in Figure 2, a rectifying diode 23 and a variable resistance 24 are provided. In addition, a charging capacitor 25 is provided across the lines 3 and 4.

In the embodiment shown in Figure 3, the threshold switch 5 consists of only two circuits, namely the circuits Ia and IIa.

Two normal or Zener diodes 7 and a luminous diode 6 are provided in the circuit Ia, the diode 6 being connected in series with the diodes 7. The circuit IIa is arranged in parallel with the circuit Ia part of the two circuits being common to one another, the circuit IIa having a bridging rectifier 11 arranged between the point 3 and an additional line 26, which is connected between one of the stator coils 9 and the rotor of the motor 16. A transistor 12 is arranged on the direct voltage side of the bridge rectifier 11, which transistor is connected in parallel with a luminous diode 13. The base terminal or contact 14 of the transistor 12 is led by way of a resistance 27, which limits the current, to the point 4, which is on the side of the diodes 7 that is remote from the common part of the two circuits. In practice, as many normal diodes 7 are connected in series with the luminous diode 6 as are required by the addition of their threshold voltages to determine the actual switching point of the threshold switch 5.

The arrangement shown in Figure 3 functions as follows. If the bristle length H is too short, then the electric motor 16 rotates practically under no-load conditions and only a small motor current is flowing. As before, there is thus only a small voltage drop across the resistance 1, which is adjusted so that it is not greater than the threshold voltages of the diodes 7 and of the luminous diode 6 in the circuit Ia. As a result, the luminous diode 6 in the circuit Ia remains dark. However, the voltage at one stator coil 9 is so high that, being rectified through the bridge-connected rectifier 11, the luminous diode 13 is able to light up.

Should the bristle length H be correct for best possible operation, the voltage drop at the resistance 1 increases (as explained in connection with Figure 2) and it is so adjusted by means of the resistance 24 that it still does not exceed the threshold voltages of the diodes 7 and of the luminous diode 6 in the circuit Ia, but allows the transistor 12 in the circuit IIa to become conducting by way of the connection to point 4 and resistance 27.

The transistor 12 thus short-circuits the luminous diode 13 and extinguishes the latter.

If the length H of the bristles is too great, then the voltage drop at the resistance 1 increases still further, as also described in connection with Figure 2, and the additional value of the threshold voltages of the diodes 7 and of the luminous diode 6 in the circuit Ia is exceeded so that the luminous diode in the circuit Ia starts to light up.

The following picture is thus provided for the user, which differs from that of Figure 2.

1. If the length of bristles H projecting from the housing 20 of the appliance is too small for best possible operation, then the luminous diode 13 in the circuit IIa lights up. It could, for example, be provided with an inscription such as "too short".
2. If the bristle length H is correct, then neither the luminous diode 6 nor the luminous diode 13 lights up.
3. If the bristle length H is too long, then the luminous diode 6 in the circuit Ia lights up. It could, for example, be provided with an inscription such as "too long".

This circuit arrangement thus provides an even more simple co-ordination or interpretation of operation than that shown in Figure 2. In either case, the user is able to react to the visual indication to adjust the length projecting from the housing of the appliance to achieve the length which is best for brushing or sweeping purposes. Also, the circuits described are incorporated in the electric motor circuit without requiring any additional voltage supply.

CLAIMS

1. An electrically-driven floor care appliance having a device for indicating the length that bristles of a bristle roller project from a housing of the appliance, said device including means for detecting, in use, the torque of an electric driving motor for the bristle roller, said means relying on a voltage difference derived from the motor current and including a threshold value switch responsive to the voltage difference to provide the indication of bristle length as a function of motor torque.
2. An appliance as claimed in claim 1, wherein said threshold value switch includes means to provide an optical indication of bristle length as a function of motor torque.
3. An appliance as claimed in claim 1 or 2, wherein said threshold value switch is connected across a resistance in the motor circuit.
4. An appliance as claimed in claim 1, 2 or 3, wherein said threshold value switch includes semi-conductor devices whose threshold voltages are utilised to provide said indication.
5. An appliance as claimed in claim 4, wherein said threshold value switch includes two circuits in parallel with one another, one of these circuits having a luminous diode in it and the other circuit having a luminous diode connected in series with a Zener diode.

example, light up with a green colour and the luminous diode 6 in the circuit II with a red colour. Thus, the following picture would be produced for the user of the appliance.

1. If the bristle length H is too short, then neither of the two luminous diodes light up.
2. If the bristle length H is correct for the best possible operation, then the green diode lights up.
3. If the bristle length H is too long, then the green and also the red diodes light up.

A circuit providing a simpler indication for the user is shown in Figure 3.

As with Figure 2, the electric motor 16 of Figure 1 is shown with its stator coils 9 and the resistance 1. A voltage drop is also here tapped either side of the resistance 1 and supplied to the points 3 and 4, between which is arranged the threshold value switch 5. In the same way as the arrangement shown in Figure 2, a rectifying diode 23 and a variable resistance 24 are provided. In addition, a charging capacitor 25 is provided across the lines 3 and 4.

In the embodiment shown in Figure 3, the threshold switch 5 consists of only two circuits, namely the circuits Ia and IIa.

Two normal or Zener diodes 7 and a luminous diode 6 are provided in the circuit Ia, the diode 6 being connected in series with the diodes 7. The circuit IIa is arranged in parallel with the circuit Ia part of the two circuits being common to one another, the circuit IIa having a bridging rectifier 11 arranged between the point 3 and an additional line 26, which is connected between one of the stator coils 9 and the rotor of the motor 16. A transistor 12 is arranged on the direct voltage side of the bridge rectifier 11, which transistor is connected in parallel with a luminous diode 13. The base terminal or contact 14 of the transistor 12 is led by way of a resistance 27, which limits the current, to the point 4, which is on the side of the diodes 7 that is remote from the common part of the two circuits. In practice, as many normal diodes 7 are connected in series with the luminous diode 6 as are required by the addition of their threshold voltages to determine the actual switching point of the threshold switch 5.

The arrangement shown in Figure 3 functions as follows. If the bristle length H is too short, then the electric motor 16 rotates practically under no-load conditions and only a small motor current is flowing. As before, there is thus only a small voltage drop across the resistance 1, which is adjusted so that it is not greater than the threshold voltages of the diodes 7 and of the luminous diode 6 in the circuit Ia. As a result, the luminous diode 6 in the circuit Ia remains dark. However, the voltage at one stator coil 9 is so high that, being rectified through the bridge-connected rectifier 11, the luminous diode 13 is able to light up.

Should the bristle length H be correct for best possible operation, the voltage drop at the resistance 1 increases (as explained in connection with Figure 2) and it is so adjusted by means of the resistance 24 that it still does not exceed the threshold voltages of the diodes 7 and of the luminous diode 6 in the circuit Ia, but allows the transistor 12 in the circuit IIa to become conducting by way of the connection to point 4 and resistance 27.

The transistor 12 thus short-circuits the luminous diode 13 and extinguishes the latter.

If the length H of the bristles is too great, then the voltage drop at the resistance 1 increases still further, as also described in connection with Figure 2, and the additional value of the threshold voltages of the diodes 7 and of the luminous diode 6 in the circuit Ia is exceeded so that the luminous diode in the circuit Ia starts to light up.

The following picture is thus provided for the user, which differs from that of Figure 2.

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3. If the bristle length H is too long, then the luminous diode 6 in the circuit Ia lights up. It could, for example, be provided with an inscription such as "too long".

This circuit arrangement thus provides an even more simple co-ordination or interpretation of operation than that shown in Figure 2. In either case, the user is able to react to the visual indication to adjust the length projecting from the housing of the appliance to achieve the length which is best for brushing or sweeping purposes. Also, the circuits described are incorporated in the electric motor circuit without requiring any additional voltage supply.

CLAIMS

1. An electrically-driven floor care appliance having a device for indicating the length that bristles of a bristle roller project from a housing of the appliance, said device including means for detecting, in use, the torque of an electric driving motor for the bristle roller, said means relying on a voltage difference derived from the motor current and including a threshold value switch responsive to the voltage difference to provide the indication of bristle length as a function of motor torque.
2. An appliance as claimed in claim 1, wherein said threshold value switch includes means to provide an optical indication of bristle length as a function of motor torque.
3. An appliance as claimed in claim 1 or 2, wherein said threshold value switch is connected across a resistance in the motor circuit.
4. An appliance as claimed in claim 1, 2 or 3, wherein said threshold value switch includes semi-conductor devices whose threshold voltages are utilised to provide said indication.
5. An appliance as claimed in claim 4, wherein said threshold value switch includes two circuits in parallel with one another, one of these circuits having a luminous diode in it and the other circuit having a luminous diode connected in series with a Zener diode.

6. An appliance as claimed in claim 5, wherein said threshold value switch has a third circuit connected in parallel with the first two circuits, this third circuit having a Zener diode in it.

7. An appliance as claimed in claim 4, wherein said threshold value switch includes a first circuit containing normal diodes or Zener diodes and a luminous diode connected in series with one another and a second circuit which is connected across a stator of said motor and which comprises a rectifier and a transistor arranged on the direct-voltage side of said rectifier, part of the two circuits being common to one another, and there being a luminous diode connected in parallel with said transistor, and the base terminal of said transistor being connected to said first circuit on the side of the diodes in said first circuit that is remote from said common part of the circuits.

8. An appliance as claimed in any one of claims 5 to 7, wherein as many normal diodes are connected in series with a said luminous diode as are required by the addition of their threshold voltages to determine the actual switching point of the threshold switch.

9. An appliance as claimed in any one of the preceding claims, wherein a variable resistance is provided to adjust the voltage available to said threshold value switch and thereby effectively to vary the range of bristle length for which said threshold value switch is to provide said indication.

10. An electrically-driven floor-care appliance, substantially as hereinbefore described with reference to Figures 1 and 2 or Figures 1 and 3 of the accompanying drawing.

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