May 16, 1967 C. H. MacFARLAND 3,319,282

SAFETY SWITCH MEANS

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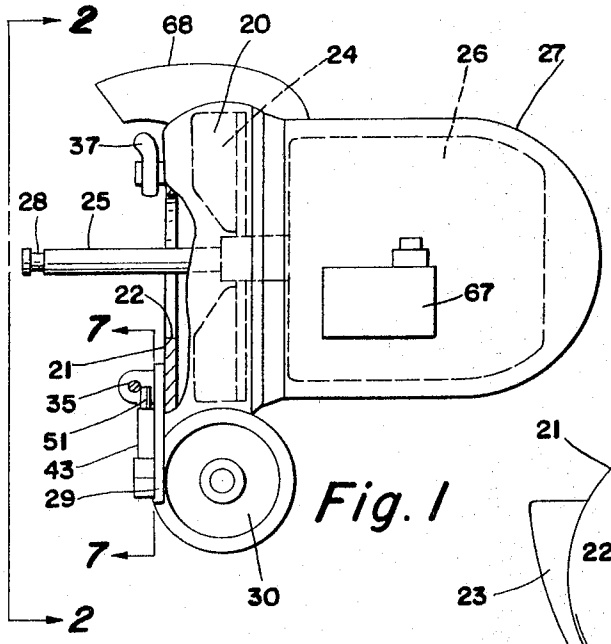


Fig. 1

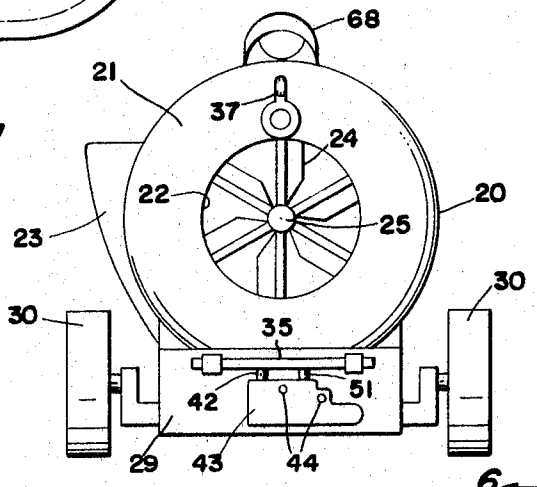


Fig. 2

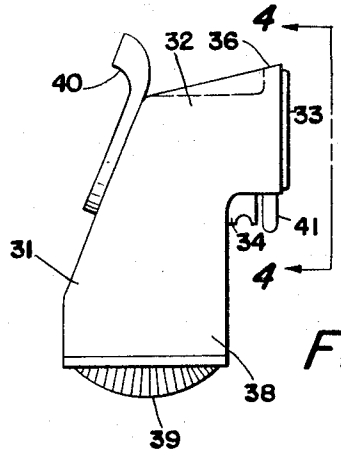


Fig. 3

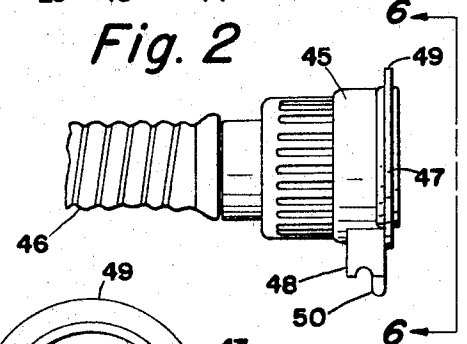


Fig. 5

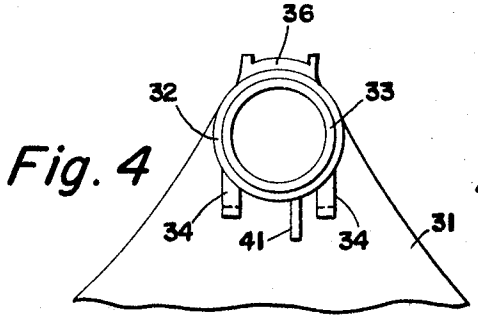


Fig. 4

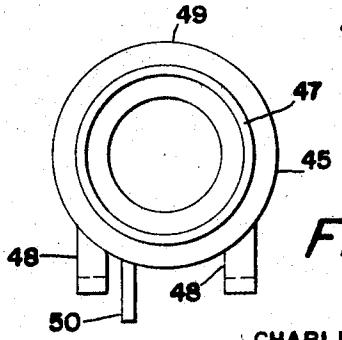


Fig. 6

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SAFETY SWITCH MEANS

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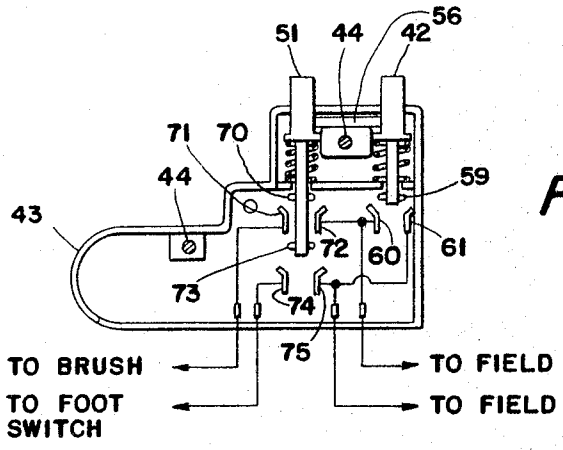


Fig. 7

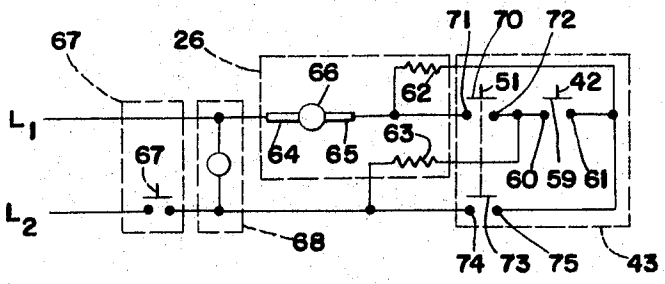


Fig. 8

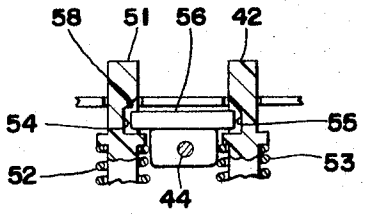


Fig. 9

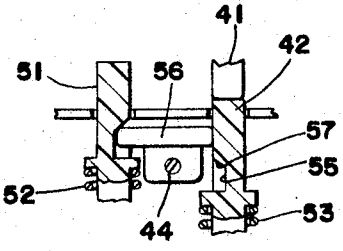


Fig. 10

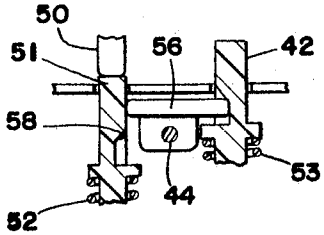


Fig. 11

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United States Patent Office

3,319,282

Patented May 16, 1967

3,319,282

SAFETY SWITCH MEANS

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Filed June 1, 1965, Ser. No. 460,198
4 Claims. (Cl. 15—319)

ABSTRACT OF THE DISCLOSURE

A safety switch for a vacuum cleaner which includes switch elements responsive to the attachment of accessories to the vacuum cleaner to change the motor speed of the vacuum cleaner according to the function of a particular accessory attached to the cleaner. An interlock is provided to prevent the simultaneous operation of the switch elements.

This invention relates to suction cleaners and, more particularly, to a safety switch for suction cleaners that automatically varies the speed of the suction cleaner motor in response to different types of attachments that are removably fixed to the body of the cleaner.

Many conventional suction cleaners employ a two-speed motor which is controlled by a manually operated switch. For cleaning rugs and carpets, a low speed is desired, since the carpet pile or rug tends to block the suction end of the cleaner and may cause a high-speed motor to run hot because of the increased load on the fan. Moreover, if the beater brush is operated at a high speed on a carpet or rug, the suction cleaner wears the carpet pile too fast and the cleaner is difficult to push. A high speed is desirable in applications where dusting attachments are connected to the sweeper, since the ends of these attachments are spaced a considerable distance from the suction fan and a pressure drop occurs along the length of the hose from the dusting nozzle to the sweeper body.

Frequently, the operator becomes confused as to the particular speed recommended for a particular attachment. Suction cleaners have been designed, therefore, to include switches which are responsive to a particular attachment. For example, in a patent to Smellie No. 2,072,690, there is disclosed a suction cleaner having a two-speed motor which is operated in response to a switch. The switch, in turn, is a two-position switch which is actuated to its first position only in response to a dusting attachment to thereby run the motor at a relatively high speed and is acuated to its second position only in response to a carpet cleaning nozzle to thereby run the motor at a relatively low speed. Prior art switches of the type shown in the Smellie patent control the motor speed by a field tap arrangement. One position of such a switch cuts out a portion of the field winding of the motor to permit the motor to run at a higher speed because of the decreased field resistance. The other position of such a switch connects the line across the entire field winding to reduce the motor speed because of the increased field resistance.

The conventional switches have met with limited commercial success because of the expense involved in field tap wiring systems. A far simpler wiring arrangement for controlling the speed of a motor is to provide a switch that will connect the field windings in series for low speed operations and that will connect the field windings in parallel for high speed operations. Such a wiring arrangement in its simplest form, however, has not been employed since the field windings are short-circuited and the current is applied directly through the armature if the high speed and low speed switches are intentionally or inadvertently closed.

According to the present invention, however, a simple wiring arrangement and switch have been devised that will alternately connect the field windings of a motor in series for low speed cleaning operations in response to low speed cleaning attachments and will connect the field windings in parallel for high speed cleaning operations in response to the provision of high speed cleaning attachments on the suction cleaner. The invention includes means to permit the alternate operation of the high speed and low speed switches, but prevents the simultaneous operation of both switches.

It is an object of the present invention, therefore, to provide a safety switch for suction cleaners that will operate a motor at a low speed by connecting the field windings of the motor in series and which will alternately connect the field windings of the motor in parallel to operate the motor at a high speed.

It is a further object of the invention to provide an interlock between switch plungers to prevent the simultaneous operation of such plungers.

The foregoing and various additional objects, features, and advantages of the invention will become apparent and more fully understood from the following detailed description, and from the accompanying drawings, in which:

FIG. 1 is a side elevation of the fan casing of a suction cleaner, a portion of the casing being broken away for clarity;

FIG. 2 is a front elevational view of the fan casing, the plane of the view being indicated by the line 2—2 in FIG. 1;

FIG. 3 is a side elevational view of a suction nozzle which may be attached to the fan casing;

FIG. 4 is a fragmentary, elevational view of the suction nozzle, the plane of the view being indicated by the line 4—4 in FIG. 3;

FIG. 5 is a fragmentary, elevational view of a hose attachment which may be connected to the fan casing;

FIG. 6 is an elevational view of the hose attachment, the plane of the view being indicated by the line 6—6 in FIG. 5;

FIG. 7 is a partly schematic, sectional view of a safety switch according to this invention, the plane of the section being indicated by the line 7—7 in FIG. 1;

FIG. 8 is a diagrammatic view of the electrical circuit of the cleaner;

FIG. 9 is a fragmentary view, partly in section, of a portion of the safety switch;

FIG. 10 is a fragmentary view, partly in section, of a portion of the safety switch showing one of the switch elements depressed; and

FIG. 11 is a fragmentary view, partly in section, of a portion of the safety switch, showing the other switch element depressed.

Referring now to the drawings, and particularly to FIGS. 1 through 6, a conventional type vacuum cleaner is shown. The cleaner includes a fan casing **20** which has a vertical front wall **21** provided with a central inlet opening **22**. The fan casing includes a tangential outlet **23**. A fan **24** is mounted therein on a shaft **25** and the shaft **25** is driven by a motor **26**. The motor **26** is mounted in a suitable housing **27** which is attached to the fan casing **20**. The fan shaft **25** projects forwardly through the opening **22** and has a forward end portion **28** formed to provide a belt pulley.

The fan casing **20** is mounted upon a suitable carriage **29** that is provided with supporting wheels **30**. A carpet or rug cleaning nozzle **31** (FIG. 3) may be removably attached to the fan casing **20** and is provided with a tubular portion **32** which receives the fan shaft **25** and which has an end portion **33** that fits within the opening **22**. The nozzle **31** has slotted lugs **34** on the underside

of the tubular portion 32 and these lugs engage a horizontal pin 35 that is carried by the fan casing. A flange 36 is provided on the upper side of the nozzle 31, and the flange 36 bears against the outer face of the front wall 21 and is locked in this position by a clamping member 37 to secure the nozzle to the fan casing.

The nozzle 31 has a downwardly flared inlet portion 38 at its lower end and a brush 39 is rotatably mounted within the portion 38. The brush 39 is driven by means of a belt (not shown) which is twisted to provide an upper loop engaging the pulley portion 28 of the shaft 25 and a lower loop which extends around the brush 39. The upper loop may be connected or disconnected from the pulley portion 28 by a belt lifter 40. The operation of such a belt lifter is conventional and is more fully set forth in my prior Patent No. 2,538,464.

The nozzle 31 is further provided with a downwardly extending finger 41. When the nozzle 31 is attached to the fan casing 20 in the manner previously indicated, the finger 41 depresses a plunger 42 which is provided on a safety switch 43. The safety switch 43 is mounted on the carriage 29 by screws 44. As will hereinafter become apparent, the depression of the plunger 42 by the finger 41 causes the motor 26 to operate the fan 24 and the shaft 25 at a relatively low speed.

Referring now to FIGS. 5 and 6, a fitting 45 is illustrated. A flexible hose 46 is connected to one end of the fitting. The remote end of the flexible hose 46 may be provided with a suitable cleaning tool (not shown) for off-the-floor cleaning operations, such as, for example, cleaning Venetian blinds or drapes. The fitting 45 is detachably secured to the fan casing 20 and includes an end portion 47 that fits within the opening 22. The fitting 45 has slotted lugs 48 on its underside and the lugs 48 engage the horizontal pin 35 carried by the fan casing. A flange 49 is provided on the fitting 45 and the flange 49 is engaged by the clamping member 37 to secure the fitting to the wall 21.

The fitting 45 further includes a downwardly extending finger 50. When the fitting 45 is attached to the fan casing in the manner previously indicated, the finger 50 depresses a plunger 51 which is provided on the safety switch 43. As will hereinafter become apparent, the depression of the plunger 51 by the finger 50 causes the motor 26 to operate the fan 24 and shaft 25 at a relatively high speed.

Referring now to FIGS. 7 through 11, the plungers 42 and 51 are each biased upwardly by springs 52 and 53. The plunger 51 and the plunger 42 are respectively provided with opposing side cavities or pockets 54 and 55. A pin 56 extends between the plungers 42 and 51 and, when both plungers are biased upwardly, the ends of the pin 56 partially project into each pocket 54 and 55 (FIG. 9). When the plunger 42 is depressed (FIG. 10), the pin 56 is pushed out of the pocket 55 by a sloping upper face 57 of the pocket 55. One end of the pin 56 is thereby freed from connection with the plunger 42 and the other end of the pin 56 is driven deeper into the pocket 54. Similarly, when the plunger 51 is depressed (FIG. 11), the pin 56 is pushed out of the pocket 54 by a sloping upper face 58 of the pocket 54. One end of the pin 56 is thereby freed from connection with the plunger 51 and the other end of the pin 56 is driven deeper into the pocket 55. When one of the plungers 42 and 51 is depressed, the other plunger may not be depressed, since the travel of the pin 56 is limited by the flat side face of the depressed plunger. Moreover, the plungers 42 and 51 may not be depressed simultaneously, since the distance between the flat side faces of the plungers 42 and 51 is less than the length of the pin 56.

When the plunger 42 is depressed, a contact 59 closes a circuit between fixed contacts 60 and 61. When the circuit is established through the contacts 60 and 61, the field windings 62 and 63 of the motor 26 are connected in series to the brushes 64 and 65 and the armature 66 of the motor 26. The motor 26 may be energized by a

suitable foot switch 67 which connects the motor 26 to a power line L_1, L_2. When the foot switch 67 is closed, the motor 26 operates at a relatively low speed, since the field resistance is relatively high when the fields are connected in series. The actuation of the foot switch 67 also connects a floor light 68 to the power line.

When the plunger 51 is depressed, an upper movable contact 70 on the plunger 51 establishes a circuit across a pair of fixed contacts 71 and 72. Similarly, a lower movable contact 73 on the plunger 51 establishes a circuit across a pair of fixed contacts 74 and 75. When the circuit is established through the contacts 71, 72, 74 and 75, and the foot switch 67 is closed, the field windings 62 and 63 are connected in parallel with the brushes 64 and 65 and the armature 66 to run the motor 26 at a relatively high speed because of the lowered field resistance.

As was previously indicated, the pin 56 prevents the simultaneous operation of the plungers 42 and 51. If both of the plungers were operated to close the contacts 71 and 72, 60 and 61, and 74 and 75, the field 62 and 63 would be shorted and the line current would be applied directly to the brushes 64 and 65 and to the armature 66.

The invention is not restricted to the slavish imitation of each and every one of the details described above, which have been set forth merely by way of example with the intent of most clearly setting forth the teaching of the invention. Obviously, devices may be provided which change, eliminate, or add certain specific structural details without departing from the invention.

What is claimed is:

1. In a suction cleaner having a motor, a body portion, and interchangeable attachments for cleaning operations requiring different motor speeds, the improvement comprising a safety switch having first and second switch means, said first switch means being responsive to a first linkage means which, in turn, is responsive to the connection of one of the attachments to the body portion of the cleaner to run the motor at a relatively low speed, said second switch means being responsive to a second linkage means which, in turn, is responsive to the connection of another attachment to the body portion of the cleaner to run the motor at a relatively high speed, and means for preventing the simultaneous operation of said first and second linkage means and, therefore, said first and second switch means.

2. In a suction cleaner having a motor, a body portion, and interchangeable attachments for cleaning operations requiring different motor speeds, the improvement comprising a safety switch having first and second plungers, said first plunger being responsive to the connection of one of the attachments to the body portion of the cleaner to run the motor at a relatively low speed, said second plunger being responsive to the connection of another attachment to the body portion of the cleaner to run the motor at a relatively high speed, opposing side cavities in each plunger, a pin extending between each plunger and extending partially into each cavity, means in each cavity to push the pin out of the cavity when the cavity and its plunger are depressed to push the pin deeper into the cavity of the plunger that is not depressed, whereby only one plunger may be depressed to prevent the simultaneous operation of both plungers.

3. In a suction cleaner having a motor, a body portion, and interchangeable attachments for cleaning operations requiring different motor speeds, the improvement comprising a safety switch having first and second switch means, said first switch means being responsive to a first linkage means which, in turn, is responsive to the connection of one of the attachments to the body portion of the cleaner to connect the field windings of the motor in series to thereby run the motor at a relatively low speed, said second switch means being responsive to a second linkage means which, in turn, is responsive to the connection of another attachment to the body portion of the cleaner to connect the field windings of the motor in parallel to

thereby run the motor at a relatively high speed, and means for preventing the simultaneous operation of said first and second linkage means and, therefore, said first and second switch means.

4. In a suction cleaner having a motor, a body portion, and interchangeable attachments for cleaning operations requiring different motor speeds, the improvement comprising a safety switch having first and second plungers, said first plunger being responsive to the connection of one of the attachments to the body portion of the cleaner to connect the field windings of the motor in series to thereby run the motor at a relatively low speed, said second plunger being responsive to the connection of another attachment to the body portion of the cleaner to connect the field windings of the motor in parallel to thereby run the motor at a relatively high speed, opposing side cavities in each plunger, a pin extending between each plunger and extending partially into each cavity, means in each cavity to push the pin out of the cavity when the cavity and its plunger are depressed to push the pin deeper into the cavity of the plunger that is not depressed, whereby only one plunger may be depressed to prevent the simultaneous operation of both plungers.

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