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(11) Publication number:

0 430 478 A1

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: **90312311.5**

(51) Int. Cl.⁵: **A47L 7/00, A47L 9/28**

(22) Date of filing: **12.11.90**

(30) Priority: **23.11.89 GB 8926502**

(43) Date of publication of application:
05.06.91 Bulletin 91/23

(84) Designated Contracting States:
AT BE CH DE DK ES FR GB GR IT LI LU NL SE
Bulletin

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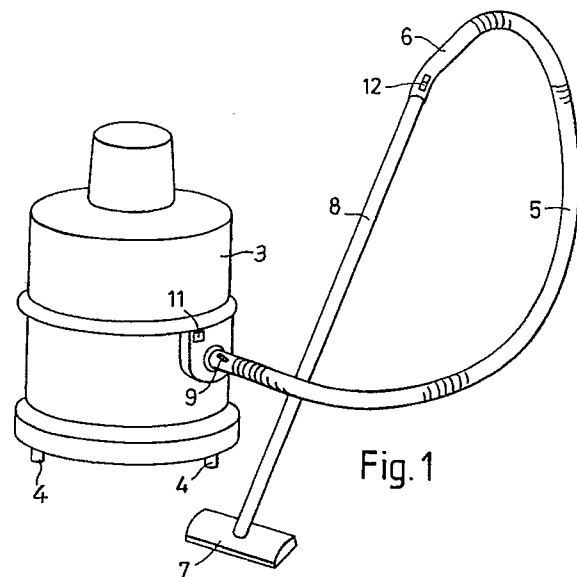
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(54) **Improved vacuum cleaner.**

(57) A vacuum cleaner which has enhanced flexibility of operation and greater safety, especially in wet-cleaning uses, than many listing vacuum cleaners comprises a main vacuum unit (3) incorporating an electric motor to generate the required vacuum, an operating handle (6) and an air-tight flexible hose (5) which links the operating handle (6) to the vacuum unit (3) and incorporates electric wires extending throughout the length of the hose. The cleaner also includes a low-voltage electric power source connected to the wires, a signal transmitter (9) also connected to the wires at the vacuum unit end, and a signal receiver electrically connected to the motor-operating circuit.



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IMPROVED VACUUM CLEANER.

The present mention is an improved vacuum cleaner which displays a greater flexibility of operation combined with greater safety, especially in wet-cleaning uses, than is available in many existing vacuum cleaners.

Vacuum cleaners usually comprise a main vacuum unit incorporating an electric motor to generate the required vacuum, together with an operating handle connected to the vacuum unit by an air-tight flexible hose. The operating handle is usually connected to the actual cleaning head by a rigid pipe, although in some situations and for some uses the cleaning head may be linked directly to the operating handle. Conventionally the electric operating controls for the vacuum cleaner are mounted upon the main vacuum unit, which of course is separated from the operating handle by the length of the flexible hose. The only control conventionally provided on the operating handle is a vacuum control which enables the degree of suction to be modified by the simple expedient of opening and closing a vent. It would be desirable to provide further controls, for example an emergency on/off switch for the motor or a motor speed control, on the operating handle but it has until recently been impossible to do that without providing an electrical cable linking the vacuum unit to the operating handle. Such additional separate links are at best an inconvenience and at worst a physical or electrical hazard to the operator.

An innovation which has recently become available is a modified form of flexible vacuum hose which incorporates electric wires within the hose structure. This new product makes a separate electric cable link from the vacuum unit to the operating handle unnecessary and therefore makes feasible the provision of electrical controls on the operating handle. However, it then becomes necessary to provide an electrical link at the vacuum unit end of the hose, between the wires in the hose and the electrical circuitry within the unit. That electrical link may be an unsightly addition to an otherwise well-designed vacuum cleaner and also involves an extra act necessarily performed by the user before the cleaner can be used. A more important disadvantage is that such links result in mains power being introduced to the wires in the hose, which gives rise to an electrical hazard to the operator and others in the vicinity.

In the case of wet-operating vacuum cleaners, that is vacuum cleaners which may be used for cleaning carpets, upholstery and the like using a liquid cleaning agent, safety requirements make it essential that the relatively high-voltage power of mains electricity be effectively isolated from those

areas of the machine in which liquid may be present. It is believed that no vacuum cleaner capable of wet operation is available in which electrical controls are provided on the operating handle; the problem of mains power in potentially wet areas is a probable reason.

It is an object of the present invention to provide an improved vacuum cleaner, which makes available electrical operating controls on the operating handle and which may be operated for either dry or wet cleaning purposes.

The vacuum cleaner according to the present invention comprises a main vacuum unit incorporating an electric motor to generate a vacuum, an operating handle remote from the main vacuum unit, an air-tight flexible hose linking the operating handle to the main vacuum unit and incorporating electric wires extending throughout the length of the hose, a source of low-voltage electrical power electrically connected to said wires, a signal transmitter electrically connected to said wires at the end thereof which is nearer to the main vacuum unit, and a receiver for signals from said transmitter, electrically connected to the motor-operating circuit of the main vacuum unit.

By means of the low-voltage power source associated with the operating handle and hose, signals initiated by operation of controls mounted upon the operating handle may be transmitted from the hose to the motor-operating circuit without there being any direct electrical connection from the hose to that circuit, and the motor may thereby be safely controlled from the operating handle.

The main vacuum unit itself may be any available such unit, for sample of the upright or horizontal type, but the benefits of the invention are particularly achieved when the unit is of the industrial or heavy domestic type. Typical suitable units are those which are housed in an upright cylindrical housing on wheels or castors. The flexible hose linking the vacuum unit to the operating handle and incorporating electric wires may advantageously be of the type sold by the company Plastiflex Ltd., in which type a pair of wires are incorporated in the windings of the hose and extend continuously throughout the length of the hose.

Associated with the operating handle and the hose and electrically connected to the wires in the latter is a source of low voltage electrical power. While it is possible to connect in the power source at any point along the length of the wires, for example adjacent to the signal transmitter, it is much preferred for the power source to be housed in or adjacent to the operating handle. Very conveniently the power source is in the form of one or

more batteries, for example of the dry-cell or rechargeable type. The voltage generated by the power source will be substantially lower than normal mains voltage, for example of the general order of 3 to 12 volts.

The signal transmitter is operated by electrical power from the power source, switched by means of controls mounted on the operating handle. The controls may at their simplest comprise only an on/off switch but it is preferred that they be designed to send a continuous electrical signal or a succession of pulses of power to the transmitter, for example in response to pressure applied to one or more push-buttons or similar controls. Such signals may, for example, make it possible for the speed of rotation of the vacuum-producing electric motor to be progressively increased or decreased. Very preferably, an automatic switch-off device is associated with the operating controls so that, even if a push-button for example is held continuously depressed, the signal is transmitted for only a very short time. In this way, the operating life of the low-voltage power source may be prolonged significantly.

The signal transmitter may take various forms. Thus, for example, it may be a radio transmitter or means to transmit light in the visible or infra-red spectrum. In another form it may be a transmitter of ultrasonic signals. Whatever form the transmitter takes, it enables a signal to be transferred from the hose line to the vacuum unit without any direct electrical contact between the two components.

The nature of the signal receiver will depend upon the type of signal transmitted by the signal transmitter. The receiver may therefore be designed to respond to radio or slight signals or to ultrasound. The relative positions of transmitter and receiver will preferably be such that the signal can pass unimpeded from the transmitter to the receiver. Thus, particularly in the case of a signal in the visible or infra-red spectrum or in ultrasound, it is preferred to provide a clear line of sight from the transmitter to the receiver. To this end, these two units are preferably located within a short distance, for example not exceeding 10cm, of each other. The receiver is preferably located within the housing of the vacuum unit and an aperture or window may then be provided in the housing to permit the signals to pass to the receiver unimpeded by the housing.

Among the possible forms of signal to be transmitted, it is particularly preferred to use an infra-red signal, especially a signal in the near infra-red range, for example having a wavelength in the range from 750 to 2500 nm.

As will be apparent, the vacuum cleaner according to the present invention may be of the wet-operating or dry-operating type. The invention is of

particular value when the cleaner may be used alternatively for either wet or dry operation as desired, since conversion from one form of operation to the other may be carried out without any effect on the operating controls.

The invention will now be further described, by way of example only, with reference to the accompanying drawings, which illustrate one embodiment of the vacuum cleaner according to the invention and wherein:-

Fig. 1 is a perspective view of the vacuum cleaner; and

Fig. 2 shows, to a larger scale, a detail of the vacuum cleaner of Fig. 1.

The illustrated vacuum cleaner comprises a main vacuum unit contained in a housing 3 mounted upon wheels or castors 4. The vacuum unit is linked by a flexible hose 5 to an operating handle 6, which enables manipulation of a cleaning head 7 at the end of a rigid tubular pipe 8. Thus vacuum generated by a motor (not shown) within the housing 3 is applied via the cleaning head 7 to the carpet or other upholstery being cleaned.

Within the structure of the hose 5 are incorporated two electric wires (not visible in the drawings), which run continuously throughout the length of the hose and are connected at one end to a 9-volt battery (not shown) within the operating handle 6. At the other end, the wires within the hose 5 are connected to a small infra-red transmitter 9, mounted upon the outside of the hosing connector 10. The transmitter 9 is so orientated as to direct an infra-red signal through an aperture 11 in the housing 3, towards a receiver (not shown) within the housing. Typically, the infrared signal may be at a wavelength of the order of 940 nm.

The receiver is incorporated in the electric circuit within the housing 3 by means of which the vacuum motor is controlled. The signal from the transmitter 9 is switched by a control switch 12 mounted upon the operating handle 6. Thus operation of the switch 12 causes an infra-red signal to be despatched by the transmitter 9 and received within the control circuit of the vacuum motor, thereby enabling the motor to be operated from the handle 6.

Claims

1. A vacuum cleaner comprising a main vacuum unit (3) incorporating an electric motor to generate a vacuum, an operating handle (6) remote from the main vacuum unit, and an air-tight flexible hose (5) linking the operating handle to the main vacuum unit and incorporating electric wires extending throughout the length of the hose, characterised in that said vacuum cleaner further comprises a

source of low-voltage electrical power electrically connected to said wires, a signal transmitter (9) electrically connected to said wires at the end thereof which is nearer to the main vacuum unit (3), and a receiver for signals from said transmitter, electrically connected to the motor operating circuit of the main vacuum unit.

2. A vacuum cleaner according to claim 1, characterised in that the source of low-voltage electrical power is housed in or adjacent to the operating handle (6).

3. A vacuum cleaner according to either of the preceding claims, characterised in that the source of low-voltage electrical power comprises one or more batteries.

4. A vacuum cleaner according to any of the preceding claims, characterised in that the low-voltage electrical power is at a voltage of the general order of 3 to 12 volts.

5. A vacuum cleaner according to any of the preceding claims, characterised in that the operating handle (6) includes controls (12) to send an electrical signal from the low-voltage power source to the transmitter.

6. A vacuum cleaner according to claims, characterised in that said controls (12) enable the speed of rotation of the vacuum-generating electric motor to be progressively increased or decreased.

7. A vacuum cleaner according to any of the preceding claims, characterised in that the signal transmitter (9) is a radio transmitter or a transmitter of visible light or of ultrasonic signals.

8. A vacuum cleaner according to any of claims 1 to 6, characterised in that the signal transmitter (9) is a transmitter of infra-red signals.

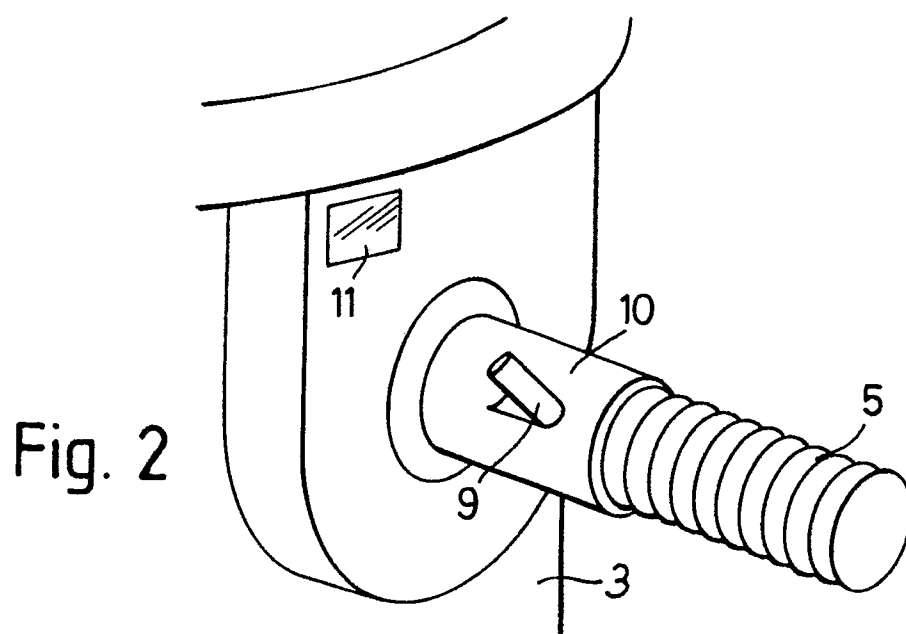
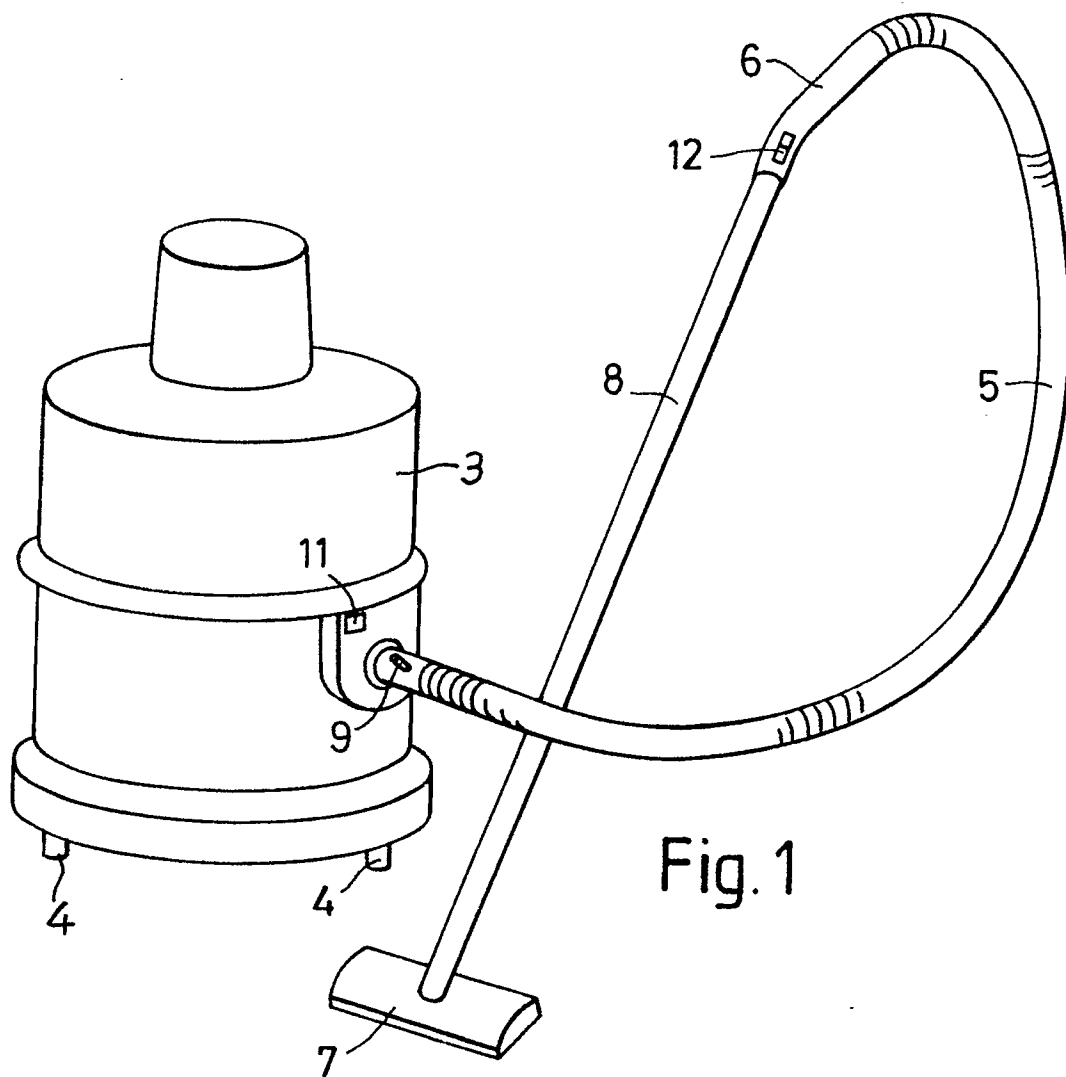
9. A vacuum cleaner according to claim 8, characterised in that said infra-red signals have a wavelength in the range from 750 to 2500 nm.

10. A vacuum cleaner according to any of the preceding claims, characterised in that the transmitter (9) and receiver are so placed as to provide a clear line of sight from the transmitter (9) to the receiver.

11. A vacuum cleaner according to any of the preceding claims, characterised in that the receiver is located within the housing of the vacuum unit and an aperture or window (11) is provided in the housing (3) to permit passage of signals to the receiver.

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EUROPEAN SEARCH REPORT

Application Number

EP 90 31 2311

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-3 382 524 (C.L. SANDSTROM) * column 3, line 43 - column 4, line 17; figures 1, 3 * - - - -	1-6,8-11	A 47 L 7/00 A 47 L 9/28
Y	US-A-4 371 814 (J.R. HANNAS) * column 1, line 29 - column 4, line 40 * - - - -	1-6,8-11	
A	GB-A-2 174 222 (P.S. PHILLIPS) * the whole document * - - - -	7	
A	FR-A-2 515 899 (LEGRAND SA) * pages 1 - 2, line 28 * - - - -	1	
A	DE-A-3 511 666 (SIEMENS AG) * the whole document * - - - -	1	
A	US-A-3 112 004 (A.W. NEAVILLE) - - - - -		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			A 47 L G 08 C
Place of search		Date of completion of search	Examiner
The Hague		14 February 91	VANMOL M.A.J.G.
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