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Suction device with a suction device transmitter and external communication device for same

The invention relates to a suction device for the separation of particles from a suction flow, according to the preamble of claim 1.

A suction device of this kind is known for example from US 2010/0199453 A1.

A suction device according to DE 10 2009 015 642 A1 sucks up particles through a suction hose, wherein the suction hose for its part may be connected to an electrical hand-operated power tool, in order to suck up dust or particles generated by this hand-operated power tool in the course of workpiece machining, for example sawing or drilling.

Usually a suction device hears, as it were, if its power is required. For example a power cable of the hand-operated power tool may be plugged into a socket of the suction device. A current sensor measures whether the hand-operated power tool orders power through the socket, which indicates operation of the hand-operated power tool. The suction device then switches on. In this way, therefore the hand-operated power tool can influence operation of the suction device. In practice, though, there are problems from time to time, if for example a filter of the suction device becomes so blocked or clogged that suction of the particles generated by the hand-operated power tool is no longer satisfactory.

It is therefore the problem of the present invention to improve the usability of a suction device.

To solve the problem, a suction device according to the technical teaching of claim 1 is provided.

The external communication device according to the invention or interaction with a hand-operated power tool and communication with the suction device communication facility of the suction device according to the invention forms part of the hand-operated power tool or a module which may be connected to the hand-operated power tool and is designed according to the technical teaching of claim 8.

The external communication device may also for example be a fan assembly at an end of a suction hose away from a housing of the suction device. The suction hose is connected to the hand-operated power tool, so that the external communication device, e.g. in module form, is thus also connected to the hand-operated power tool. By way of example it may be provided that the external communication device and the suction device communication facility

communicate with one another by wireless or cordless means. Between the external communication device and the hand-operated power tool, for example its control unit, a lead and/or a further wireless communication means may be provided.

It is a basic concept of the present invention that the suction device as it were influences the hand-operated power tool, which for this purpose has an external communication device, for example outputting there a report on a current operating status of the suction device and/or directly controlling the external device, i.e. the hand-operated power tool.

So it is for example possible that the control signal switches off the hand-operated power tool or reduces its power if the output of the suction device drops below a certain limit value, for example because a filter of the suction device is blocked or the like.

The status signal is suitable for activating output means onboard the external communication device and/or the hand-operated power tool, in order to indicate an operating status of the suction device. If therefore by way of example the suction power is insufficient, then for example an indicator light, in particular an LED, may be activated. If the operating status of the suction device is suitable for safe operation and/or proper suction of the particles in the working area of the hand-operated power tool, then for example a green LED lights up, otherwise a red LED. If the operating status of the suction device is critical, a yellow LED may light up.

A preferred embodiment of the invention provides that the suction device communication facility can also receive messages or signals from the external communication device. Consequently, not only can the suction device influence the hand-operated power tool or send messages to it, but also in reverse the hand-operated power tool has influence on the suction device, for example driving the latter to output information regarding the hand-operated power tool and/or to influence an operating status of the suction device. For example the hand-operated power tool can raise or lower suction power or the like.

The external communication device communicates expediently directly with a control unit of the hand-operated power tool or forms part of such a control unit. Thus for example the communication can provide that signals or information received from the control unit of the hand-operated power tool are sent by the external communication device to the suction device. In the opposite direction, the external communication device directs information, reports, signals or the like, received from the suction device, onwards in the direction of the

control unit, and/or activates the control unit directly, for example to raise or lower the speed of a drive motor of the hand-operated power tool, to block the drive motor when the suction power of the suction device is too low, or the like.

An advantageous procedure provides that the suction device communication facility sends at least one identification code and/or one operating parameter to the external communication device, and/or receives at least one identification code and/or one operating parameter from the external communication device, and that the suction device and/or the hand-operated power tool carry out at least one function with the aid of the respectively received identification code or codes and/or the respectively received operating parameter.

Here the basic concept is that the hand-operated power tool registers with the suction device and/or vice-versa, and in this connection sends an identification code and/or an operating parameter to the respective other device. With the aid of this information, an initialisation is possible in such a way that for example the suction device subsequently sets its operating mode so that it matches the hand-operated power tool. If therefore for example the tool is a handsaw, which produces a large quantity of particles during sawing into a workpiece, the suction device sets a corresponding higher suction power. Cleaning of a filter of the suction device may then take place more frequently, i.e. a cleaning interval for example for a circular saw is much smaller than for example for a jig saw, which generates fewer particles during operation. At this point it should be noted that the hand-operated power tool may naturally vary in form, including for example a drill, a saw, in particular a circular saw, plunge-cut saw or the like.

It is possible that the device receiving an operating parameter or an identification code, i.e. the suction device or the hand-operated power tool, sets its subsequent mode of operation with the aid of the received identification code and/or of the received operating parameter, so that for example the suction device adjusts itself to the hand-operated power tool and accordingly for example does not allow the suction power to fall below a minimum level or to rise above a maximum. If the hand-operated power tool, for example a grinding or polishing machine, will be used for example to machine suitably sensitive surfaces, then too much suction power can be an obstacle. On the other hand, too little suction power, a blocked filter or the like on the part of the suction device, can also lead to undesired harm to the environment, i.e. the suction device does not adequately suck up particles from the working area. This may lead to damage to the health of the user. The invention can provide a remedy

here, in that the suction device recognises as it were which hand-operated power tool is connected, setting its operating or working parameters accordingly.

The measures of the dependent claims proposed in connection with the method according to the invention may also of course be reflected in corresponding design of the suction device, the suction device communication facility and the external communication device. For example these devices have suitable operating means to implement the respective steps, for example a microprocessor and suitable programs or the like.

A number of these steps according to the invention are explained below;

An advantageous measure provides that the suction device or the hand-operated power tool determine, with the aid of the received operating parameter and/or the identification code, whether or under what conditions, operation of the pairing comprised of suction device and hand-operated power tool is possible according to at least one criterion. The criterion may for example involve a safety criterion, an environmental criterion, a health and safety criterion or the like. If therefore the suction device is unable to suck up particles to an adequate extent, it is possible that the suction device and/or the hand-operated power tool will block subsequent operation. The user is thereby protected.

The suction device and/or the hand-operated power tool expediently have one or several output means, in order to output for example at least one operating parameter and/or at least one identification code and/or the above criterion or criteria. At the output means it may of course also advantageously be stated whether or under what conditions, operation of the pairing comprised of suction device and hand-operated power tool according to at least one criterion is possible. The operator thus obtains feedback on what data are exchanged and/or how subsequent operation is possible. If for example the suction device and the hand-operated power tool match one another, then for example a green indicator light or the like may be activated as an optical output means. Such output means may be provided on the hand-operated power tool and/or the suction device, for example on the suction device communication facility and/or on the external communication device.

A preferred embodiment of the invention provides that the suction device and/or the hand-operated power tool are so designed that they block operation of the respective other device if the criterion or criteria cannot be satisfied. If therefore the suction device recognises that the hand-operated power tool would produce too many particles, which cannot be sucked up,

then the suction device can block its operation. The hand-operated power tool can also block operation if the criterion is not met or cannot be met.

If operation of suction device and hand-operated power tool is indeed possible, but this requires certain operating or functional parameters for optimal operation to be possible, it is advantageous if the suction device and/or the hand-operated power tool are so designed that they can set one or more parameters for a function of the suction device or the hand-operated power tool according to the criterion or criteria. Thus for example the suction device may match its suction power to the hand-operated power tool. The hand-operated power tool too is advantageously so designed that it may be used only in such a speed range or working area that the suction device is still able to suck up particles to an extent conforming to the criterion. Naturally a cleaning function for cleaning a filter of the suction device may also be set with the aid of an operating parameter, so that the criterion or criteria is or are satisfied.

At this point it may be noted that an embodiment of the invention provides that the hand-operated power tool, with the aid of data obtained from the suction device, sets its own operating parameters, i.e. for example defines a speed range, or the suction device, with the aid of the data obtained from the hand-operated power tool, sets its own operating parameters, for example cleaning intervals, suction power and the like. It is however also possible that one device modifies the operating parameters of the other device and/or sends corresponding control signals. Consequently, therefore, the suction device may send operating parameters to the hand-operated power tool, which it presets for the hand-operated power tool with the aid of the received identification code of the hand-operated power tool or the received operating parameters of the hand-operated power tool.

The identification code may be designed as such an identification code that it in each case clearly identifies the suction device or the hand-operated power tool so that, from the identification code, operating data of the hand-operated power tool or suction device, for example performance data, power requirements or the like, may be derived. By way of example, the identification code may specify the respective type of suction device or hand-operated power tool. But also a unique code, as it were occurring only once worldwide, is also possible. Naturally the identification code may also be multi-part, so that it comprises for example on the one hand a type code of the respective device, also on the other hand a unique serial code or serial number.

With regard to the operating parameter or parameters it is possible that it or they is or are a machine tool operating parameter or parameters of the hand-operated power tool, representing a possible or actual operating status in operation of the hand-operated power tool. For example, the operating parameter represents a particle volume which is typical or actually occurs in operation of the hand-operated power tool, a typical nature of the particles, or the like.

An operating parameter assigned to the suction device expediently forms a suction device operating parameter, which represents an operating status currently or possibly occurring in operation of the suction device. The suction device operating parameter or the suction device identification code may for example specify a suction power of the suction motor and/or a maximum size of suction flow and/or a still remaining storage capacity for particles in the dust collection chamber or in a filter within the dust collection chamber.

The suction device is expediently designed for setting at least one function of the suction device and/or the hand-operated power tool with the aid of the identification code or codes and/or the operating parameter. This may involve an identification code which has been received or is to be sent and/or a received or sent operating parameter.

By way of example, the suction device is designed, with the aid of the operating parameter or the identification code received from the hand-operated power tool, to set an independent function on the suction device itself, for example a suction power of the suction motor, a size of suction flow, a cleaning function for cleaning a filter.

The suction device is advantageously designed as the device controlling the hand-operated power tool. The suction device communication facility is for example designed for sending a control signal and/or status signal, formed with the aid of the received operating parameter and/or with the aid of the received identification code, to the external communication device, which is connected to the hand-operated power tool or forms part of the hand-operated power tool. With the aid of the control signal, a function of the hand-operated power tool may for example be controlled, for example the drive motor of the hand-operated power tool. The status signal is suitable for example for outputting information determined by the suction device communication facility or the suction device, for example a warning indication. For this purpose the aforementioned audible and/or visible output means are expedient.

The suction device expediently has output means, provided namely on the suction device, for example its housing, or onboard the suction device communication facility, to output information determined with the aid of the received operating parameter and/or the received identification code. By way of example, the suction device can indicate audibly or visibly if the hand-operated power tool may be operated together with the suction device. Naturally, other information may also be output.

The external communication device may be designed for example as part of the hand-operated power tool or as a module which can be connected to the hand-operated power tool. By way of example, the hand-operated power tool has a module shaft, into which the external communication device can be inserted. The external communication device may for example also be part of an energy storage module, for example a storage battery module, for the electrical power supply of the hand-operated power tool.

The external communication device is expediently designed for setting at least one function of the suction device or the hand-operated power tool or both with the aid of the identification code or codes or of the operating parameter or both. The external communication device is able to set the function for example with the aid of an operating parameter received or onboard the hand-operated power tool, similarly with the aid of an identification code received from the suction device or the identification code of the hand-operated power tool.

The external communication device is expediently designed for sending a control signal, formed with the aid of the received operating parameter or the received identification code, for setting at least one function of the suction device, for example for setting the suction power of the suction motor, the size of the suction flow or volume flow, intervals of cleaning, operation of the suction device or the like. It is also advantageous if the external communication device is designed for sending a status signal to the suction device communication facility to output information, for example an indication. This information is determined for example by the external communication device or the suction device or both, in cooperation with one another.

The external communication device is advantageously designed to receive an identification code or the operating parameter from a control unit of the hand-operated power tool. The control unit therefore determines the code or the operating parameter and sends these to the external communication device for further processing. In the reverse direction too it is possible for the external communication device to communicate to the control unit of the

hand-operated power tool, i.e. that it is passing on to the control unit of the hand-operated power tool an identification code received from the suction device or an operating parameter received from the suction device.

The suction device according to the invention is expediently a mobile suction device. The suction device preferably has rollers for moving over the ground. Naturally the suction device could also be a portable suction device, with or without rollers. The suction device according to the invention is not designed as a self-sufficient suction device, working in the manner of a robot. The operator may take the suction device with him and use it on site. In addition, a suction hose may be connected expediently to the suction device.

It is preferred if no cable connection is necessary between the suction device and the external communication device. The external communication device and the suction device communication facility can accordingly transmit one or more operating parameters and/or one or more identification codes and/or control signals and/or status signals or the like, cordlessly, from the suction device to the hand-operated power tool and/or vice-versa.

The term cordless is to be understood as meaning that no electrical or optical line is needed between the communication devices. In another formulation one could also say wireless. Corded can accordingly also be understood as wired, if for example there is an electrical wired connection between the communication devices. An optical line is also possible as a line. The line or lines between the communication devices may be provided on or in a suction hose between the hand-operated power tool and the suction device.

It is possible that, between the hand-operated power tool and the external communication device and suction device communication facility, there is provided a line interface, which is used only in the context of an identification procedure, in which the two devices as it were adjust to one another or free up operation with one another, with the wired interface then being separated again, so that the hand-operated power tool may be moved free from the suction device.

A cable connection between the suction device and the hand-operated power tool may for example run in a suction hose, which connects the two devices to one another.

With the cordless communication, the external communication device may be moved freely, for example to switch the suction device on or off or to control its power, for example to increase or reduce its suction power. Also the transfer of messages is simplified by cordless

means. The cordless transmission concept is possible from the external communication device to the suction device or vice-versa or both. It goes without saying that in one direction, corded transmission between suction device and external communication device is also possible.

A control signal or status signal may for example be just a single electrical or optical pulse, for example a switch-on signal and a switch-off signal, but also a pulse train or the like. Preferably such a signal also covers more complex messages or telegrams, which may also include more extensive information, for example configuration data, parameterisation data, identification data, operating parameters or the like.

The information which is or may be transmitted cordlessly, for example the identification code or the operating parameter, the control signals and/or status signals, involves for example radio signals or optical signals or both. By way of example, the communication means of the suction device communication facility and the external communication device may for example include optical communication means or radio communication means. The communications interface of the suction device communication facility and/or the external communication device may for example comprise a WLAN. Thus for example infrared signals are possible. Visual contact is however not necessary if the cordless status signals and/or control signals are or include radio signals. It is preferred if the radio signals can be received only in a close range of up to 2 – 8 m maximum from the suction device, so that interference from other external communication devices need not be feared. Generally, such a close range is sufficient, since the suction device is also needed at the point of the external communication device, where dust particles occur.

The suction device communication facility may be designed for cordless and/or corded communication with other components of the suction device. The suction device communication facility receives, for example from a control unit of the suction device, information which it sends as a status signal or control signal to the external communication device. It is also possible that the suction device communication facility passes on, by cordless and/or corded means, status signals and/or control signals received from the external communication device, to other components such as the aforementioned control unit of the suction device. Naturally the suction device communication facility may also have further-reaching intelligence or other components, for example at least one electrical control or

switching element for control or switching for example of the suction motor and/or at least one sensor or a measuring device for detecting an operating status of the suction device.

The suction device communication facility may form an integral part of the suction device.

Preferably the suction device communication facility forms a suction device communication module or includes a suction device communication module, in which e.g. the suction device receiver and/or the suction device transmitter are or is located. Expediently provided on the suction device housing is a module holder for the suction device communication module, with which the suction device communication module may be releasably connected. By way of example this involves a module shaft in which the suction device communication module may be inserted.

The module holder expediently includes module contacts for electrical connection of the suction device communication module with electrical components of the suction device located in the suction device housing. It is however also possible for the suction device communication module to communicate cordlessly with the other components inside the suction device housing. Expediently provided in this embodiment are cordless communication means, by which the suction device communication module communicates with one or more electrical components of the suction device communication facility located in the suction device housing. By way of example, the suction device communication module transmits the control signals, which it has for its part received cordlessly from the control unit, to the electrical component located in the suction device housing, or generates a suction device communication signal therefrom. This electrical component involves for example an electrical switch, a power controller or the like.

The suction device according to the invention expediently includes a charging device for charging up an electrical energy storage module of a hand-operated power tool. The charging device has electrical charging contacts to provide a charging voltage for the electrical energy storage module.

The suction device communication facility expediently forms part of the charging device.

Preferred is a so-called learn function, in which the external communication device and the suction device communication facility of the suction device communicate with one another to form a transmitter-receiver pair. In the course of this learning process, also described as a teaching process, it is ensured that only external transmitters and suction device receivers or

external receivers and suction device transmitters assigned to one another communicate with one another. By way of example, the suction device communication facility and the external communication device, as part of an application procedure, communicate transmission parameters and/or authentication parameters and/or access codes or the like. It is for example possible that an operator presses on a key on the external communication device and/or the suction device communication facility, so that these enter into a communicating relationship in an essentially known manner.

The suction device expediently forms part of a system which also includes the external communication device. The external communication device may however also be a separate external communication device, already for example installed ex-works in a hand-operated power tool or its energy storage module.

The following remarks relate to an external communication device, forming for example part of a system which, alongside the suction device, also includes the external communication device, or is also provided on an external communication device which is designed as a separate communication module, for example for retrofitting an energy storage module or a hand-operated power tool or for fitting to a suction hose. The external communication device may also form an integral part of a hand-operated power tool or an energy storage module. It may also be in the form of an intermediate module for fitting between an energy storage module and a hand-operated power tool.

Preferably the external communication device has at least one sensor and is designed for sending control signals to the controller, for example to switch on or switch off the suction motor, depending on sensor signals from the sensor.

There are many options in the choice of sensor:

By way of example the sensor or sensors is or are formed by or include a position sensor, which is suitable for detecting a position of the external communication device. In the event of a change of position, the position sensor can for example send a suitable start signal, whereupon the external communication device sends the cordless control signals to switch on the suction motor.

It is also possible that the sensor or sensors includes or include a movement sensor to detect any movement of the external communication device.

An electrical sensor to detect an electrical current flow to an electrical device operated together with the suction device, and/or a voltage sensor to detect an electrical supply voltage applied to the device, are also advantageous. Consequently, the external communication device therefore generates, when the external communication device vibrates (for example when the hand-operated power tool is running), a control signal to switch on the suction motor. Also if a working area light is switched on, and its current flow is detected by the current sensor, then the suction motor can be switched on in this way.

The suction device is expediently provided for interaction with a hand-operated power tool, which has a drive motor for driving a tool. The drive motor is for example a pneumatic motor or an electric motor. The suction device is provided to suck up particles produced during operation of the hand-operated power tool. The sensor or sensors is or are designed to detect operation of the drive motor or the hand-operated power tool. The suction device forms for example a component of such a system, which includes the suction device and the hand-operated power tool.

In connection with such a hand-operated power tool it is advantageous if the sensor or sensor includes or include a current sensor to detect an electrical current flow to an electrical load of the hand-operated power tool, when this is in operation, for example to the drive motor of the hand-operated power tool or a work area light of the hand-operated power tool, and/or a voltage sensor to detect a supply voltage applied in each case to the electrical load active in operation of the hand-operated power tool. If therefore the drive motor is in operation, this is recognised by the sensor and accordingly the external communication device generates cordless control signals to switch on or increase the power of the suction motor.

Naturally a speed sensor may also be provided, to detect a speed of the drive motor. If the drive motor is not turning, the external communication device sends a corresponding control signal, whereupon the suction device communication facility and/or the suction device receiver or the suction device switching facility onboard the suction device switch off the suction motor. A power-dependent control is also possible. If therefore for example the drive motor of the hand-operated power tool rotates more quickly, the tool operates correspondingly faster, so that more particles need to be removed. The suction device communication facility then advantageously triggers the suction motor of the suction device to produce more power. It is however also possible that precisely the reverse takes place, i.e. that for example if there is a drop in speed the power of the suction motor is increased, since

then a correspondingly higher chip removal or other similar higher production of particles at the point of work is to be feared, and the suction device should therefore deliver more suction power.

It is also possible that the sensor which is onboard the hand-operated power tool detects a magnetic field of the drive motor, i.e. comprises a magnetic sensor. The magnetic sensor may also be provided to detect a switch position of a switch of the hand-operated power tool, with which the drive motor may be switched or its power controlled.

The external communication device may also include an electrical contact or a position sensor to detect a switch position of a switch of the hand-operated power tool, for example a pressure switch, for switching or power control of the drive motor.

The external communication device is expediently in the form of an intermediate module which may be located between a housing of the hand-operated power tool and an energy storage module for the electrical power supply of the hand-operated power tool. Thus there is provided an especially simple embodiment in which an essentially known hand-operated power tool may be used together with a similarly known energy storage module, but the interposed external communication device detects a current flow between the energy storage module and the hand-operated power tool, and accordingly generates the cordless control signal to switch on, switch off or control the power of the suction motor. Naturally, in this embodiment, another type of sensor detection of operation of the hand-operated power tool may also be used, for example detection of a vibration, a movement, a change in position or the like. An intermediate module of this kind may for example be inserted between existing contacts of the hand-operated power tool and the energy storage module, and have a separate intermediate module housing. Preferably the intermediate module is provided with form-fit contours or push-in connection means, which correspond with or match corresponding form-fit contours or push-in connection means of the hand-operated power tool and the energy storage module respectively.

In another preferred embodiment it is provided that the external communication device forms an integral part of a hand-operated power tool or an energy storage module for the electrical supply of a hand-operated power tool.

It is however also possible that the external communication device is retrofitted to an external device, for example an energy storage module as cited above, or also for example to the

suction hose of the suction device. For this purpose the external communication device preferably has fastening means, for example one or more bands, magnetic fastening means, snap-in connection means or the like.

It goes without saying that the external communication device may also be for example screwed and/or glued on to another component, for example the hand-operated power tool or an energy storage module for its electrical power supply.

The external communication device may also be in the form of an attachment, which is put on a pressure switch of a hand-operated power tool, or may have such an attachment.

The external communication device preferably has an interface for cordless and/or corded communication with the hand-operated power tool, in particular with its control unit and/or a switching device for switching an electrical supply voltage of the hand-operated power tool. Consequently the communication device can as it were switch off, switch on or control the power supply, alternatively also a compressed air supply, of the hand-operated power tool. This variant is in particular advantageous when the communication device is located onboard the energy storage module. The hand-operated power tool and the external communication device communicate with one another for example over matching wireless interfaces, for example radio interfaces, and/or have matching module contacts, so that wired or corded communication is possible.

For self-sufficient operation of the external communication device it is advantageous if it has an electrical energy store, for example a battery, a storage battery or the like. It is also advantageous if it has a power generation unit, for example an electrical generator which may be driven by the suction flow, by movements of the external communication device or the like.

Typical embodiments of the invention are explained below with the aid of the drawing, which shows in:

Figure 1 a perspective view of a system comprising a suction device together with a hand-operated power tool in the form of a saw, in particular a jig saw, and provided with an electrical energy storage module

Figure 2 a perspective angled view on an upper part of a suction device housing of the suction device according to Figure 1, which has a charging device

Figure 3 the suction device housing according to Figure 2, but without the charging device, so that the module holder is visible, corresponding roughly to a detail A in Figure 2

Figure 4 the charging device according to Figure 2, but removed from the suction device

Figure 5 module contacts of the charging device according to Figure 4, corresponding a detail B in Figure 4

Figure 6 a view corresponding roughly to the view according to Figure 2, but with an energy storage module mounted on the charging device, which in

Figure 7 is shown at an angle from above and in

Figure 8 is mounted on a hand-operated power tool in the form of a screwdriver or drill

Figure 9 an electrical circuit diagram to clarify cordless control of the suction device according to Figure 1 and

Figure 10 an electrical circuit diagram to clarify a charging concept for charging an electrical energy storage module with the aid of the suction device according to Figure 1, which has a charging device according to Figure 2.

A suction device 10 has a suction device housing 11. The suction device housing 11 comprises a lower part 12 and an upper part 13 which may be connected releasably to the lower part 12. Fitted to the suction device housing 11 are rollers 14, of which the front rollers 14 in Figure 1 are castors. Provided in the suction device housing 11 is a dust collection chamber 15, for example a collecting trough. In the dust collection chamber 15, a filter sack may for example be provided, while the suction device 10 may also be used without a filter sack. The dust collection chamber 15 is provided in the lower part 12. Provided on a front panel 16 of the suction device housing 11 is a suction inlet 17, at which a suction hose 18 may be connected. The suction inlet 17 leads into the dust collection chamber 15.

The electrical components of the suction device 10 are accommodated, protected, in the suction device housing 11. Preferably the electrical components are mounted in the upper part 13, for example a suction motor 19, by which a suction flow 20 may be generated. The

suction motor 19 includes for example a fan assembly, not described in detail, to generate the suction flow 20.

The suction device 10 may be operated in an essentially known manner for example by control elements 21, which are located on a control panel 22 provided above the front panel 16. Provided there for example are a main switch 23 to switch on or switch off the suction motor 19, or a control switch 24 for setting the suction power of the suction device 10. Also provided is a socket 25, into which a power cable of an electrical load, for example a hand-operated power tool which is not shown, may be plugged.

The suction device 10 may be supplied with electrical power via a schematically shown internal energy store 26, for example a fuel cell or an electrical storage battery, and/or connected to an electrical power supply network N, by way of example 110 V to 230 V a.c. voltage, for which purpose a connection cable 27 is provided. When not in use, the connection cable 27 and the suction hose 18 may be inserted in a holder 28 on the top 29 of the suction device housing 11.

The suction hose 18 has a housing end 30, designed as the insertion end, and which may be plugged into or onto the suction inlet 17 in an essentially known manner. Its other end forms a suction end 31 and has a suction opening 32 to which for example a rigid suction tube, a brush or the like may be connected or, as shown in Figure 1, by way of example a hand-operated power tool 80. The hand-operated power tool 80 is for example a jig saw, while alternatively other saws, e.g. a circular saw or milling machines or the like are possible.

While the hand-operated power tool 80 is indeed an electrical machine, i.e. it has an electrical drive motor 81, but with regard to the cordless control concept and/or status concept explained further below, other drive concepts for a hand-operated power tool are also readily possible with for example a pneumatic motor in connection in particular with a polishing tool or a grinding tool.

The drive motor 81 drives a tool 82, for example a saw blade, with which a workpiece W may be machined. For example the hand-operated power tool 80 is used to make a saw cut S in the workpiece W. This results in dust, which is sucked away from the suction device 10.

The drive motor 81 is located in a machine housing 83 of the hand-operated power tool 80. Located in a rear section of the machine housing 83 is a mounting 84, for holding the energy storage module 90, by which it is concealed in the drawing. The mounting 84 also has

electrical contacts 85 (indicated schematically) for the electrical connection of the energy storage module 90 with the electrical components inside the machine housing 83. At any rate, the energy storage module 90 supplies the hand-operated power tool 80 with electrical power, so that it may be operated freely without connection to an electrical power supply network, for example the power supply network N.

The hand-operated power tool 80 has a dust extraction port 86, for example a connection nozzle, which may be connected to the suction end 31 of the suction hose 18. Consequently, therefore, the suction device 10 is able to suck up directly the dust occurring during operation of the hand-operated power tool 80.

Operation and use of the hand-operated power tool 80 is facilitated in many ways through interaction with the suction device 10. On the one hand the suction device 10, by means of a cordless control concept, may be switched without a cable connection, so that for example the suction motor 19 runs or does not run if the hand-operated power tool 80 is used or not used. On the other hand, the suction device 10 facilitates convenient charging up of the energy storage module 90.

Firstly, the cordless control will be explained:

Located at the suction end 31 of the suction hose 18, for example, is an external communication device 50, with which cordless control signals 51, for controlling the suction device 10, in particular for switching on and switching off the suction motor 19, may be generated. The external communication device 50 is for example fastened to the suction hose 18 by Velcro tape or other fastening means 52. It would also be possible for the suction hose 18 to have a pocket or other holder, in which the external communication device 50 is located. It is also possible that the external communication device 50 is encapsulated by the material, for example plastic, of the suction hose 18.

The external communication device 50 includes for example a movement sensor 53, which reacts to movements of the suction hose 18. If therefore the suction hose 18 is moved in the area of its suction end 31, for example vibrating during operation of the hand-operated power tool 80, the movement sensor 53 generates a sensor signal 54. With the aid of the sensor signal 54, an external transmitter 55s generates the control signal 51, here a radio signal, which the external communication device 50 transmits via an aerial 56.

The external communication device 50 expediently has a local energy store 57, for example a battery and/or a storage capacitor and/or a generator 58 to generate electrical energy. The generator 58 may be for example a generator which can be charged cordlessly by means of a charging device 33, operating in particular inductively, which is mounted on or in the suction device housing 11, as indicated by an arrow PL. The generator 58 may also be actuated for example by movements. At any rate it is preferred if no cable connection is needed between the suction device housing 11 and the external communication device 50, while for example a cable connection for the electrical power supply is in principle also possible. Thus for example, alternatively or in addition to the charging device 33, electrical charging contacts 133 may be provided for charging an external communication device according to the invention. The charging device 33 and the charging contacts 133 form charging means 233. E.g. a schematically shown charging bay or charging cradle 355 with the charging contacts 133 and/or the charging device 33 is provided on the top 29 of the suction device housing 11.

The suction device 10 has an electrical suction device communication facility 40 with a suction device receiver 41r to receive the control signals 51 transmitted by the external communication device 50. The suction device communication facility 40 includes for example a suction device communication module 42 which is accommodated in a module holder 34 on the suction device housing 11.

The suction device receiver 41r receives the control signals 51, e.g. via an aerial 46. The aerial 46 may e.g. protrude from a housing of the suction device communication module 42, or be integrated in it or the like.

The module holder 34 has for example a plug-in socket 35, into which a plug-in projection 43, described in more detail in connection with a charging module 60, may be plugged.

Provided on the plug-in projection 43 are for example module contacts 44, which are able to make electrical connection with module contacts 36 of the module holder 34. The module contacts 44 are provided e.g. on a contact support 45 which is preferably in the form of a plug-in projection and is provided for plugging into a plug-in socket 39 of the module holder 34. The module contacts 36, 44 are expediently proprietary contacts, i.e. not for example protective contacts such as those of the plug fitted to the connection cable 27. The module contacts 36, 44 serve to transmit electrical energy and/or for the transmission of control signals and/or status signals.

The module holder 34 has for example a substantially rectangular cross-sectional contour and is in the form of a recess.

The suction device communication module 42 sends, for example over its module contacts 44, switching signals 47 to a control unit 37, which for its part in turn controls the suction motor 19, e.g. via suitable power switches, semiconductors or the like. If therefore the suction device receiver 41r receives from the external communication device 50 a control signal 51 which serves to switch on the suction motor 19, the suction device communication module 42 correspondingly activates the control unit 37, which for its part in turn switches the suction motor 19 on or off or adjusts its output, for example reducing or increasing its speed, as indicated by an arrow 48.

It goes without saying that such control means, switches or the like may also be directly onboard the suction device communication module 42, so that interposition of the control unit 37 is not necessary.

Moreover, a variant of the invention may provide that the control unit of a suction device has an integral cordless interface, so that a separate suction device communication module, such as for example the suction device communication module 42, is not necessary. The suction device receiver 41r could by way of example form part of the control unit 37.

It goes without saying that the aforementioned modular concept is advantageous, but it is also possible that the suction device communication facility 40 forms e.g. a fixed part of the suction device 10. The suction device communication facility 40 may e.g. form part of the control unit 37.

Instead of or in addition to the module contacts 36, 44, a cordless interface (radio interface or optical interface) could also be provided between the suction device communication facility 40 and the control unit 37.

Preferred at any rate is a potential-free coupling between the suction device communication facility 40 and the other electrical components of the suction device 10, which may be achieved for example by means of optocouplers.

In another concept it is provided that, onboard the hand-operated power tool 80 an external communication device 150 or onboard the energy storage module 90 an external

communication device 250 are located, and can communicate with the suction device communication facility 40 by cordless means.

The external communication devices 150 and 250 may be integral parts of the energy storage module 90 or the hand-operated power tool 80. However, a modular concept is also possible, i.e. for example on the hand-operated power tool 80 and/or the energy storage module 90 there is provided a module holder into which the suitably modular, for example in the form of push-in parts, external communication devices 150 or 250, may be fitted. Moreover the external communication devices 150 and/or 250 may also be retrofitted to the energy storage module 90 or the hand-operated power tool 80 by fastening means, for example adhesives, snap-in connection means or the like. Retrofitting is therefore possible.

The external communication device 150 includes for example a movement sensor 153, which detects a respective speed of the drive motor 81. If therefore the drive motor 81 and thus the hand-operated power tool 80 are operated, the speed sensor 153 controls an external transmitter 155s, which for example comprises a Bluetooth transmitter, to transmit control signals 151 via an aerial 156, which for example is integrated in the machine housing 83, whereupon the suction device communication facility 40 switches on the suction motor 19 or sends a switch-on signal to the control unit 37. If the speed of the drive motor 81 rises, i.e. the tool 82 is generating even more dust in machining the workpiece W, the external communication device 150 can trigger the suction device communication facility 40 to increase the speed of the suction motor 19. If the hand-operated power tool 80 is switched off, the external communication device 150 triggers switch off of the suction motor 19.

Instead of or in addition to the speed sensor 153, a magnetic sensor, a Hall sensor or the like could for example also be provided. Naturally a current sensor may also be provided onboard the hand-operated power tool 80 to detect the current flow to the drive motor 81 or work area lighting, not shown, of the hand-operated power tool 80, which lights up during operation of the latter, so that the external communication device 150 accordingly generates a control signal 151 to activate the suction device communication facility 40. Instead of or in addition to the current sensor, a voltage sensor may also be provided, to measure a supply voltage applied to the drive motor 81 or the work area lighting.

A schematically indicated embodiment provides that, on a switch 87, which serves for switching on and off the drive motor 81 of the hand-operated power tool 80, for example a position sensor and/or a magnetic sensor and/or an electrical switch contact or other similar

sensor 153' is mounted, and detects the position of the switch 87 or, depending on its position, may be actuated, so that the external communication device 150, depending on a position of the switch 87, generated the control signals 51 and so, with the aid of the suction device communication facility 40, switches the suction motor 19 on and/or off and/or adjusts its power level.

In this connection, reference may also be made to a redundant detection concept, i.e. that an external communication device may of course also have several sensors, switch contacts and the like, so that it generates the control signal on the basis of at least two sensor signals or signals of switch contacts. For example, the external communication device 150 evaluates the sensor signals of the sensors 153 and 153', and only sends the control signal 51 to switch on the suction motor 19, if both sensors 153 and 153' report that the drive motor 81 of the hand-operated power tool 80 is running.

It is advantageous if the suction device 10 continues running for a fixed follow-up time, or preferably a time for which parameters may be set, i.e. the suction motor 19 is shut down only after a certain time, when the hand-operated power tool 80 is already switched off. Consequently, dust which is still in the suction hose 18 or also dust in the vicinity of the tool 82 can also be sucked up, even if the hand-operated power tool 80 is already switched off.

Immediate switching-on of the suction motor 19 when the control signal 51 indicates switch-on is also not always advantageous. For example there may be an operating error or the hand-operated power tool is not yet in engagement with the workpiece W. Accordingly it may be advantageous if the suction device communication facility 40 also has a switch-on delay time which may be fixed or else set by parameters, so that the facility only switches on the suction motor 19 after the switch-on delay time, when it is activated by the control signal 51 to switch on the suction motor 19.

The external communication device 250 forms part of the energy storage module 90 and includes a current sensor 253 which detects a current flow from the energy storage module 90 to the hand-operated power tool 80, in particular its drive motor 81. If the current sensor 253 detects a current flow, an external transmitter 255s generates a suitable control signal 251 to trigger the suction device communication facility 40, so that the latter switches on the suction motor 19. When the hand-operated power tool 80 is switched off, the external communication device 250 sends a suitable switch-off control signal 251, whereupon the suction device communication facility 40 switches off the suction motor 19.

The external communication device 250 is located in an energy storage housing of the energy storage module 90. Naturally it would also be possible to provide as it were an intermediate module 100, which is connected between connection contacts 92 of the energy storage module 90 and the contacts 85 of the hand-operated power tool 80, in order to detect the current flow from the energy storage module 90 to the hand-operated power tool 80 and the drive motor 81 respectively, and to generate a suitable control signal 251. The intermediate module 100 is indicated.

A preferred embodiment provides that a suction device communication facility and an external communication device, which have cordless communication with one another, can as it were learn in the context of a learning process, e.g. a so-called teaching function. Consequently, for example, any misuse or operating error may be prevented. For example the external communication device 50 transmits in the course of a start procedure, firstly a communications code 59 to the suction device receiver 41r which in turn, for its part, verifies whether or not the communications code 59 entitles the external communication device 50 to send the control signals 51. If therefore for example several craftsmen are working on a building site and, with their hand-operated power tools according to the invention are switching suction devices on and off cordlessly, it is possible to prevent disturbances from occurring.

It is also possible that the suction device communication facility 40, by pressing an electrical contact of the suction device communication facility 40 not shown in the drawing, is ready to receive the communications code 59, thus recognising the external communication device 50, 150, 250 as an entitled external communication device, and subsequently then accepting the control signals 51, 151, 251 received from it.

The charging module 60 may also have or form a suction device communication facility according to the invention, for example a suction device communication facility 140.

Described so far has been communication in the direction from the external communication device 50, 150, 250 to the suction device communication facility 40, 140 for the purpose of control of the suction device 10 by the external communication device 50, 150, 250.

In the communication direction from the hand-operated power tool to the suction device, reports may of course also be made, so that for example an operating status of the hand-operated power tool 80 may be indicated onboard the suction device 10. By way of example,

the external communication device 150 can report a functional fault of the hand-operated power tool 80, by means of an external transmitter 155s, as a status signal 101 to the suction device communication facility 40,which for its part then receives the status signal 101 via a suction device receiver 41r and for example activates optical display 102, e.g. an LED, to display the status signal 101.

Also between the external communication device 250, which is for example onboard the energy storage module 90, and the charging module 60, which includes the suction device communication facility 140, cordless communication is expedient. So for example the external communication device 250 is able to report via an external transmitter 255s to the charging module 60, i.e. the charging device 61, the state of charge of the energy storage module 90 by means of a status signal 201. The suction device communication facility 140 receives the status signal via a suction device receiver 141r. By way of example a visual and/or audible display 103 may be provided onboard the charging device 61 to display the state of charge of the energy storage module 90 operated on the hand-operated power tool 80.

It is also possible that for example the charging device 61 controls the charging of the currently to be charged energy storage module 90 on the basis of the status signal 201, for example accelerating the electrical charging of this energy storage module 90 to be charged if the energy storage module 90 operated on the hand-operated power tool 80 quickly loses charge, i.e. must soon be replaced. The external communication device 250 includes for example a measuring device 257 to detect the state of charge of the energy storage module 90 and to generate the status signal 201 reporting the state of charge.

Naturally, the aforementioned cordless concept may also be applied in the reverse direction, i.e. the suction device communication facility 40, 140 sends messages or signals to the external communication devices 50, 150, 250.

Provided onboard the suction device communication facilities 40 and/or the suction device communication facilities 140 are for example suction device transmitters 41s and 141s, which are designed to send control signals and status signals to the external communication devices 50, 150, 250.

If for example the control unit 37 of the suction device 10 signals to the suction device communication facility 40 by means of an internal signal 147 that the dust collection chamber 15 is almost full, i.e. can hold no more particles, then the suction device transmitter 41s can

send a status signal 105 to the external communication device 50, which outputs the content of the status signal 105 by visual or audible means 106, including e.g. an LED. The operator can recognise, with the aid of this signal output, effected directly on the spot, at the hand-operated power tool 80, that he must for example empty the collection chamber of the suction device 10.

The control unit 37 can therefore generate a status signal 105 or a message with the aid of the suction device communication facility 40, which the latter sends via the suction device transmitter 41s to one or more of the external communication devices 50, 150, 250. The status signal 105 which, as indicated, may also be a more complex message containing more information, or may also comprise several messages separate from one another, contains by way of example information over the size of the suction flow 20 and/or the suction power of the suction motor 19 and/or information over the filling level of the dust collection chamber 15.

The external communication devices 50, 150 or 250 may output one or more pieces of information from the status signal 105, for example to output means 106, which comprise for example an indicator light, for example LED, and/or a display and/or a loudspeaker or other audible output means. If then for example the status signal 105 signals that the dust collection chamber 15 and/or a filter fitted therein, not shown in the drawing, are or is completely full and dirty, an indicator light 107 of the external communication device 50 in the form of a warning LED can for example indicate this situation.

The external communication device 150 or 250 located onboard the energy storage module 90 or the intermediate module 100 or the hand-operated power tool 80 may in addition for example also include a tactile display, a vibration display or the like, in order to output the status signal 105. By way of example, as output means onboard the hand-operated power tool 80, there may be provided a visible and/or audible display 104 and/or a vibration element 109 which, with a critical filling level in the dust collection chamber 15 and/or lower suction power of the suction device 10, which is signalled by the status signal 105, vibrates and so indicates to the operator that he should attend to the suction device 10 so that it provides the suction power desired from it.

A function which goes even further is represented by the suction device 10 and/or the suction device communication facility 40 or 140 having direct influence on the functioning of the hand-operated power tool 80, with the aid of a control signal 108. For example the control

unit 37, if there is a failure of the suction device 10, or a suitably critical lower suction power of the suction device 10, can send information 147 to the suction device communication facility 40 or 140, which from this generates the control signal 108 and sends it to the external communication devices 50, 150, 250. The external communication devices 150 or 250 may then directly influence operation of the hand-operated power tool 80. If for example the suction power of the suction device 10 is not available, or only to a reduced extent, then the control signal 108 may instruct that the power of the drive motor 81 should be reduced, or that the latter should be shut down altogether. By this means it is possible to avoid, for example, that the user suffers health damage from particles swirling around, if the suction device 10 is no longer able to suck up adequately the particles generated by the hand-operated power tool 80.

The external communication device 250 provided onboard the energy storage module 90 is able for example to switch the current flow to the hand-operated power tool 80 off and on by means of a switching device 258, e.g. after activation by the control signal 108.

The external communication device 250 may also have e.g. a wired or preferably wireless interface 259, e.g. a radio interface, for communication with the hand-operated power tool 80, in particular its controller 88, e.g. in order to pass on the control signal 108 and/or to communicate the operating parameters 450, 400 and/or the identification codes 410, 460. A wired interface 259 may provide e.g. that data is digitally transmitted and/or modulated over the supply lines to the hand-operated power tool 80.

The external communication device 150 is directly connected to the controller, for example onboard electronics, of the hand-operated power tool 80, or forms a part of the same, so that it may in this way have direct influence on the operation of the drive motor 81, is therefore able for example to switch the latter off. Of course it is advantageous if a warning can be given in advance, so that the operator is not surprised by the aforementioned forced shutdown.

It is advantageous if the suction device communication facilities 40, 140 and/or the external communication devices 50, 150, 250 have for example a microprocessor and/or are suited for the execution of software modules, with which the functions explained above or below may be realised. For example, the external communication device 50 has a microprocessor 70 which, using a program module 71, evaluates the sensor signals 54 and for example activates

or realises the external transmitter 55s and/or the external receiver 55r. The program module 71 is like the communications code 59 expediently stored in a memory 72.

In one function, the charging module 60 is provided to charge the energy storage module 90 or other energy storage modules, not shown in the drawing, for hand-operated power tools, for example the hand-operated power tool 80 or a hand-operated power tool 180 shown in Figure 8 in the form of a cordless screwdriver or drill. The charging module 60 forms a charging device 61 for charging the electrical energy storage module 90.

The charging module 60 has on its charger housing 62 a mounting 63 for holding the energy storage module 90. The mounting 63 includes for example a plug-in projection 64, which may be plugged into a plug-in socket 93 of the energy storage housing 91 or of the energy storage module 90.

The mounting 63 also includes a plug-in socket or holding location 68, in which a plug-in projection 94 may engage on a top 95 of the energy storage housing 91. The mounting 63 corresponds to the mounting 84 of the hand-operated power tool 80 or 180, i.e. it is designed for form-fitting location of the energy storage housing 91.

Provided in the area of the plug-in projection 64 are electrical charging contacts 65 for provision of a charging voltage L for the electrical energy storage module 90.

The charging voltage L is for example a d.c. voltage in a range from 5 V to 25 V. In this connection it is advantageous if the charging module 60 has recognition means 66 to determine the particular type of energy storage module 90 and accordingly to set the charging voltage L. If therefore for example a 12 V energy storage module is connected, the charging voltage L is set correspondingly lower, whereas with an energy storage module with a rated voltage of 18 V, a correspondingly higher charging voltage L is set. The recognition means 66 comprise for example electrical means, optical means, or the like. It is also possible that the recognition means 66 comprise for example a bus interface, in order to communicate with a bus coupler onboard the energy storage module 90 and so to detect data of the energy storage module 90, for example its state of charge, rated voltage or the like.

With the aid of electrical adjustment means 67, which for example comprise an electrical transformer and/or a rectifier or the like, the charging device 61 can convert a supply voltage V provided for example by the supply network N to the charging voltage L.

Also provided advantageously are monitoring means 75 for monitoring the charging voltage L and/or for monitoring a state of charge of the energy storage module 90, so that the latter may be optimally charged.

The monitoring means 75 and/or recognition means 66 and/or adjustment means 67 comprise for example a microprocessor 76, which executes program code of software modules, for example a software module 78 stored in a memory 77. Realisation of the monitoring means 75 and/or recognition means 66 and/or adjustment means 67 in hardware is readily possible.

The charger housing 62 is partly similar in design to the suction device communication module 42, therefore also has a plug-in projection 43, on which are provided module contacts 44 to create an electrical connection with the module contacts 36 of the module holder 34. Consequently, the adjustment means 67 located inside the charger housing 62 may be supplied with electrical energy by the suction device 10, i.e. for example over the connection cable 27, in order to provide the charging voltage L.

Additional fixing of the charging module 60 to the suction device housing 11 or the module holder 34 may be effected for example by screws, which may be screwed into corresponding screw holes 38 of the module holder 34. A magnetic hold, an engagement or the like of the charging module 60 with the suction device housing 11 is readily possible, but not shown in the drawing. The suction device communication module 42 may also expediently have suitable holding means (screws, magnets, latching means) in order to provide a secure hold in the module holder 34.

It is also expedient, but not shown in the drawing, for the charging module 60 and charging device 61 respectively to form an integral part of the suction device 10, i.e. that for example the charger housing 62 and the suction device housing 11 are in one piece.

Naturally, a mounting in the manner of the mounting 63 and charging contacts in the manner of the charging contacts 65 may also be provided at another point on the suction device housing 11, for example at the top in the area of the holder 28, where the energy storage module to be charged may be accommodated so as to be protected, i.e. less exposed than in the area of the control panel 22.

The suction device communication facility 140 formed by the charging module 60 has for example a suction device receiver 141r. Via the module contacts 36, the charging module 60 is supplied with electrical energy, for example a supply voltage V. A current sensor 49

onboard the suction device 10, for example as part of or in conjunction with the control unit 37, detects for example whether an electrical current is flowing through the module contacts 36.

When he charging module 60 receives, via its suction device receiver 141r and an aerial 146 for example integrated in the charger housing 62, a control signal 51, 151, 251 to switch on the suction motor 19, it starts up the process of charging the energy storage module 90, i.e. generating from the supply voltage V the charging voltage L, so that a charging current I flows. An input current E required to produce the charging current I is detected by the current sensor 49. The suction device 10 recognises therefore that an electrical load needs current and thereupon switches on the suction motor 19 in an essentially known manner.

When control signals 51, 151, 251 instruct the suction motor 19 to switch off or reduce its power, then the suction device communication facility 140 or the charging module 60 cut back the current supply to the energy storage module 90 or switch the charging process off so that, on the input side (supply voltage V), no input current E detectable by the current sensor 49 or an input current E lying below a detection threshold flows, and therefore for example the control unit 37 shuts down the suction motor 19. Consequently, therefore, the charging module 60 can as it were simulate a wired hand-operated power tool supplied with electrical power via the suction device 10 – which actually, however, is not the case.

It is also possible that the charging device 61 is supplied with electrical power from the energy store 26 onboard the suction device 10. For example the control unit 37 controls the provision of electrical energy to the module contacts 36. Preferably it is provided here that the control unit 37 for example lowers the power output to the module contacts 36 when the suction motor 19 is running, and then raises it again. This reduces the load, for example, on a power supply unit of the suction device 10 which provides the charging voltage L.

The suction device communication facilities 40 and/or 140 and the external communication devices 50, 150, 250, mounted on or connected to the suction device 10, are also suitable for an application procedure in which the suction device 10 sends at least one operating parameter 400 and/or at least one identification code 410 to the external device, for example the hand-operated power tool 80 and/or its energy storage module 90, and/or in the reverse direction the device to be connected to the suction device 10, for example the hand-operated power tool 80 or its energy storage module 90, send at least one operating parameter 450 and/or at least one identification code 460 to the suction device 10, so that only pairs of

suction device and hand-operated power tool which match one another are used and/or the operating parameters of the suction device 10 and the hand-operated power tool 80 or 180 are so set that optimal operation of the respective hand-operated power tool 80 or 180 on the suction device 10 is possible.

If for example the suction power of the suction device 10 is not sufficient for operation of the hand-operated power tool, it is possible with the aid of the procedure described in detail below to prevent the suction device 10 being used in conjunction with the hand-operated power tool 80. If however the suction power is adequate for example for the hand-operated power tool 180, then the suction device 10 and the hand-operated power tool 180 may be used together.

Furthermore it is advantageously possible that the suction device 10 and the respectively connected hand-operated power tool 80 or 180 match their respective outputs to one another, by means of one device applying to the other device or vice-versa.

At this point it may be noted that, while cordless communication between the hand-operated power tool 80 and 180 on the one hand and the suction device 10, in particular its suction device communication facilities 40, 140, is expedient, this does not rule out that corded communication, in particular for the application procedure or identification procedure described below, but also for the transmission of status signals and/or control signals, at least in one direction (from suction device to hand-operated power tool or vice-versa), lies within the scope of the invention. In other words, for example in one direction, by way of example from suction device to hand-operated power tool, communication may be corded, and in the other direction it may be cordless, or also vice-versa.

For example there runs in the suction hose 18 for this purpose at least one communication line 300, for example an electrical line and/or an optical line, to which are connected at one end for example the suction device communication facilities 40 and/or the control unit 37 or also another component onboard the suction device 10, in order to communicate with the hand-operated power tool 80 or 180. On the part of the hand-operated power tool 80 or 180, for example the external communication device 150 or 250 may be connected to the communication line or lines 300.

By way of example, the external communication device 150 or 250 transmits the identification code 460 identifying the hand-operated power tool 80 to the suction device 10.

The suction device communication facility 40 receives the identification code 460 and passes this on for example to the control unit 37 which, with the aid of the identification code 460, recognises for example the type of hand-operated power tool 80, for example the volume of particles to be expected from this hand-operated power tool 80, what suction power the suction device 10 accordingly needs to provide or the like.

The control unit 37 accordingly sets the function of the suction device 10, for example so that the suction power of the suction motor 19 may be set at the control switch 24, but not below a limit value which allows reliable suction of the particles generated by the hand-operated power tool 80.

It is also possible that the control unit 37 checks whether operation of the hand-operated power tool 80 with the suction device 10 is possible at all, so at least one criterion is met. If for example it is to be noted that the suction device 10, in conjunction with the relevant hand-operated power tool, should provide explosion protection and/or at least a predetermined suction power of the suction device 10 is necessary, for the criterion or criteria to be met, then the control unit 37 may determine whether the identification code 460 is given in a table 430 which contains several identification codes. If this is the case, the control unit 37 releases the suction device 10 for operation with the hand-operated power tool 80.

Depending on the tool 82 used on the hand-operated power tool 80, the type of particle may also vary, comprising for example larger chips or smaller chips. Accordingly it is expedient if the hand-operated power tool 80 sends to the suction device communication facilities 40 or 140, for example as an operating parameter 450, information on the tool 82 used. Depending on the nature of the particles which the operating parameter 450 then represents, the control unit 37 may for example set cleaning intervals of a cleaning device 9 which cleans a filter 8 mounted ahead of the suction motor 19.

Also on the part of the hand-operated power tool 80 it is advantageous when the suction device 10 as it were applies before the start of operation. Thus, for example the suction device communication facility 40 sends an identification code 410 of the suction device 10 and/or at least one operating parameter 400 to the hand-operated power tool 80.

A controller 88 onboard the hand-operated power tool 80 checks for example with the aid of a check list whether the identification code 410 so classifies the suction device 10 that it may be used together with the hand-operated power tool 80. Only then does the controller 88

release the drive motor 81. Otherwise the controller 88 blocks the drive motor 81 so that for example damage to the health of a user of the hand-operated power tool 80 due to particles not sucked away may be avoided.

With the aid of the operating parameter 400, the suction device 10 can for example inform the hand-operated power tool 80 what suction power is available. The hand-operated power tool 80 then reduces for example a maximum speed of the drive motor 81, so that even with a speed of the drive motor 81 which is the maximum which can be set at the switch 87, the suction power of the suction device 10 is sufficient to suck up reliably all particles which occur, or at least substantially all particles, from the work area of the hand-operated power tool 80.

Furthermore, the external communication devices 150 or 250 and/or the suction device communication facilities 40 or140 may with the aid of the respectively received identification code 410, 460 and/or the received operating parameter 400, 450 immediately generate control signals and/or status signals and send these to the respective other communication devices.

If for example the identification code 410 assigns the suction device 10 a specific power class, the external communication devices 150 and/or 250 may for example determine with the aid of the identification code 410 that the suction device 10 must provide a specific output and accordingly send a control signal 351 which instructs the suction device 10 to set a certain power stage as a minimum power stage for setting at the control switch 24. Naturally, instead of the control signal 351, a status signal 352 may also be generated, and shown for example by the display 102.

The suction device 10 and the suction device communication facilities 40, 140 respectively may also be designed in this manner. For example the suction device communication facilities 40, 140 and/or the suction device 10, for example the control unit 37, determine with the aid of the identification code 460 or the operating parameter 450, what speeds of the drive motor 81 of the hand-operated power tool 80 are to be set or may be set, and accordingly send a control signal 353 and/or a status signal 354 to the external communication devices 150 or 250. The control signal 353 instructs the latter, for example to inform the controller 88 what power stages of the drive motor 81 may be set at the switch 87. The information of the status signal 354 is shown for example on the display 104 so that the operator knows which power ranges on the hand-operated power tool 80 are preferably to be set and/or which tools may be used, or the like.

Patentkrav

1. Sugeindretning (10) til udskillelse af partikler fra en sugestrøm (20), med en sugemotor (19) til generering af sugestrømmen (20) og med et sugerhus (11), hvori sugemotoren (19) og et støvopsamlingsrum (15) er anbragt til opsamling af partikler, der udskilles fra sugestrømmen (20), hvor sugeindretningen (10) er tilvejebragt til udsugning af partikler, der fremkommer ved drift af en håndværktøjsmaskine (80), der omfatter en drivmotor (81) til at drive et værktøj (82), hvor den omfatter en sugeindretning-kommunikationsindretning (40; 140) til kommunikation med en ekstern kommunikationsindretning (50; 150; 250), der skal drives i en afstand til sugerhuset (11) i sammenhæng med håndværktøjsmaskinen (80) og især udgør en del af håndværktøjsmaskinen (80), og hvor sugeindretning-kommunikationsindretningen (40; 140) omfatter en sugeindretningssender (41s, 141s) til at sende mindst et styresignal (108) og/eller et meldesignal (105) til den eksterne kommunikationsindretning (50; 150; 250), **kendetegnet ved, at** sugeindretning-kommunikationsindretningen (40; 140) er udformet til at sende et styresignal, der ændrer en driftstilstand af håndværktøjsmaskinen (80).

2. Sugeindretning (10) ifølge krav 1, **kendetegnet ved, at** sugeindretning-kommunikationsindretningen (40; 140) omfatter en sugeindretning-modtager (41r, 141r) til modtagelse af styresignaler (51; 151, 251) og/eller meldesignaler (101, 201), der sendes ved hjælp af den eksterne kommunikationsindretning (50; 150; 250).

3. Sugeindretning (10) ifølge krav 1 eller 2, **kendetegnet ved, at** sugeindretning-kommunikationsindretningen (40; 140) er udformet til ledningsfri og/eller ledningsbundet kommunikation med den eksterne kommunikationsindretning (50; 150; 250).

4. Sugeindretning (10) ifølge et af de foregående krav, **kendetegnet ved, at** sugeindretning-kommunikationsindretningen (40; 140) er udformet til at sende et advarselssignal til den eksterne kommunikationsindretning (50; 150; 250).

5. Sugeindretning (10) ifølge et af de foregående krav, **kendetegnet ved, at** sugeindretning-kommunikationsindretningen (40; 140) er udformet til at sende og/eller modtage mindst et identifikationskendetegn (410, 460) og/eller et driftsparameter (400, 450) til eller fra den eksterne kommunikationsindretning (50; 150; 250).

6. Sugeindretning (10) ifølge krav 5, **kendetegnet ved, at** den er udformet til indstilling af mindst en funktion af sugeindretningen (10) og/eller håndværktøjsmaskinen (80) ved hjælp af det mindst ene identifikationskendetegn (410, 460) og/eller driftsparameteret (400, 450).

7. Sugeindretning (10) ifølge krav 5 eller 6, **kendetegnet ved, at** sugeindretning-kommunikationsindretningen (40; 140) er udformet til at sende et styresignal (351, 353) og/eller meldesignal (352, 354), der dannes ved hjælp af det modtagne driftsparameter (400, 450) og/eller det modtagne identifikationskendetegn (410, 460) til den eksterne kommunikationsindretning (50; 150; 250), hvor styresignalet (351, 353) hensigtsmæssigt er tilvejebragt til indstilling af mindst en funktion af håndværktøjsmaskinen (80), især til styring af håndværktøjsmaskinens (80) drivmotor (81), og/eller meldesignalet (352, 354) fordelagtigt er tilvejebragt til afgivelse af information, især en advarselsmelding, som fastlægges af sugeindretning-kommunikationsindretningen (40; 140) eller sugeindretningen (10).

8. Ekstern kommunikationsindretning (50; 150; 250) til at samarbejde med en håndværktøjsmaskine (80) og til kommunikation med en sugeindretning-kommunikationsindretning (40; 140) af en sugeindretning (10) ifølge et af de foregående krav, hvor den eksterne kommunikationsindretning (50; 150; 250) udgør en del af håndværktøjsmaskinen (80) eller er et modul, der kan forbindes med håndværktøjsmaskinen (80), og hvor den omfatter en ekstern modtager (55r, 155r, 255r) til at modtage styresignalet (108) og/eller meldesignalet (105) fra sugeindretning-kommunikationsindretningen (40; 140) og/eller en ekstern sender (55s, 155s, 255s) til at sende mindst et ledningsfrit styresignal (51, 151, 251) og/eller meldesignal (101, 201) til sugeindretning-kommunikationsindret-

ningen (40; 140), **kendetegnet ved, at** den er udformet til styring af håndværktøjsmaskinen (80), især en styreindretning (88) af håndværktøjsmaskinen (80), ved hjælp af styresignalet (108), der modtages af sugeindretning-kommunikationsindretningen (40; 140).

9. Ekstern kommunikationsindretning (50; 150; 250) ifølge krav 8, **kendetegnet ved, at** den omfatter et elektrisk energilager (57) og/eller en energigenereringsenhed, der især omfatter en elektrisk generator (58), der kan drives af bevægelser af den eksterne kommunikationsindretning (50; 150; 250) eller af sugestrømmen (20), således at den er udformet autarkisk, uden ekstern strømtilførsel, til at sende og/eller modtage det mindst ene styresignal (51; 151, 251) eller meldesignal.

10. Ekstern kommunikationsindretning ifølge et af kravene 8 til 9, **kendetegnet ved, at** den er udformet som et mellemmodul (100), der kan anbringes mellem et hus af en håndværktøjsmaskine (80) og et energilagermodul (90) til elektrisk strømforsyning af håndværktøjsmaskinen (80), og eller at den udgør en del, der især er udformet som modul, af en håndværktøjsmaskine (80) eller et energilagermodul (90) til elektrisk forsyning af en håndværktøjsmaskine (80), og/eller at den har en grænseflade (259) til især trådløs kommunikation med håndværktøjsmaskinen (80), især dens styreindretning (88), og/eller at den omfatter en koblingsindretning (258) til at omskiftning af en elektrisk forsyningsspænding eller trykluftforsyning af håndværktøjsmaskinen (80).

11. Ekstern kommunikationsindretning ifølge et af kravene 8 til 10, **kendetegnet ved, at** den er udformet til at sende og/eller modtage mindst et identifikationskendetegn (410, 460) og/eller et driftsparameter (400, 450) til sugeindretning-kommunikationsindretningen (40; 140) eller fra sugeindretning-kommunikationsindretningen (40; 140).

12. Ekstern kommunikationsindretning ifølge krav 11, **kendetegnet ved, at** den er udformet til indstilling af mindst en funktion af sugeindretningen (10)

og/eller håndværktøjsmaskinen (80) ved hjælp af det mindst ene identifikationskendetegn (410, 460) og/eller driftsparameteret (400, 450).

13. Ekstern kommunikationsindretning ifølge krav 11 eller 12, **kendetegnet ved, at** den er udformet til at modtage det mindst ene identifikationskendetegn (410, 460) eller driftsparameteret (400, 450) eller begge fra en styreindretning (88) af håndværktøjsmaskinen (80) og/eller til at sende det mindst ene identifikationskendetegn (410, 460) og/eller driftsparameter (400, 450) til håndværktøjsmaskinens (80) styreindretning (88).

14. Ekstern kommunikationsindretning ifølge et af kravene 8 til 13, **kendetegnet ved, at** den er udformet til at kommunikere med håndværktøjsmaskinen (80), især dens styreindretning (88), ved hjælp af styresignalet (108) og/eller meldesignalet (105), der modtages af sugeindretning-kommunikationsindretningen (40; 140), og/eller at den kan styres til at sende styresignalet (51, 151, 251) og/eller meldesignalet (101, 201) til sugeindretning-kommunikationsindretningen (40; 140) ved hjælp af håndværktøjsmaskinen (80), især dens styreindretning (88).

15. Ekstern kommunikationsindretning ifølge et af kravene 8 til 14, **kendetegnet ved, at** den omfatter et især akustisk og/eller optisk afgivelsesmiddel til afgivelse af information, der modtages af sugeindretning-kommunikationsindretningen (40; 140), især styresignalet (108) og/eller meldesignalet (105).

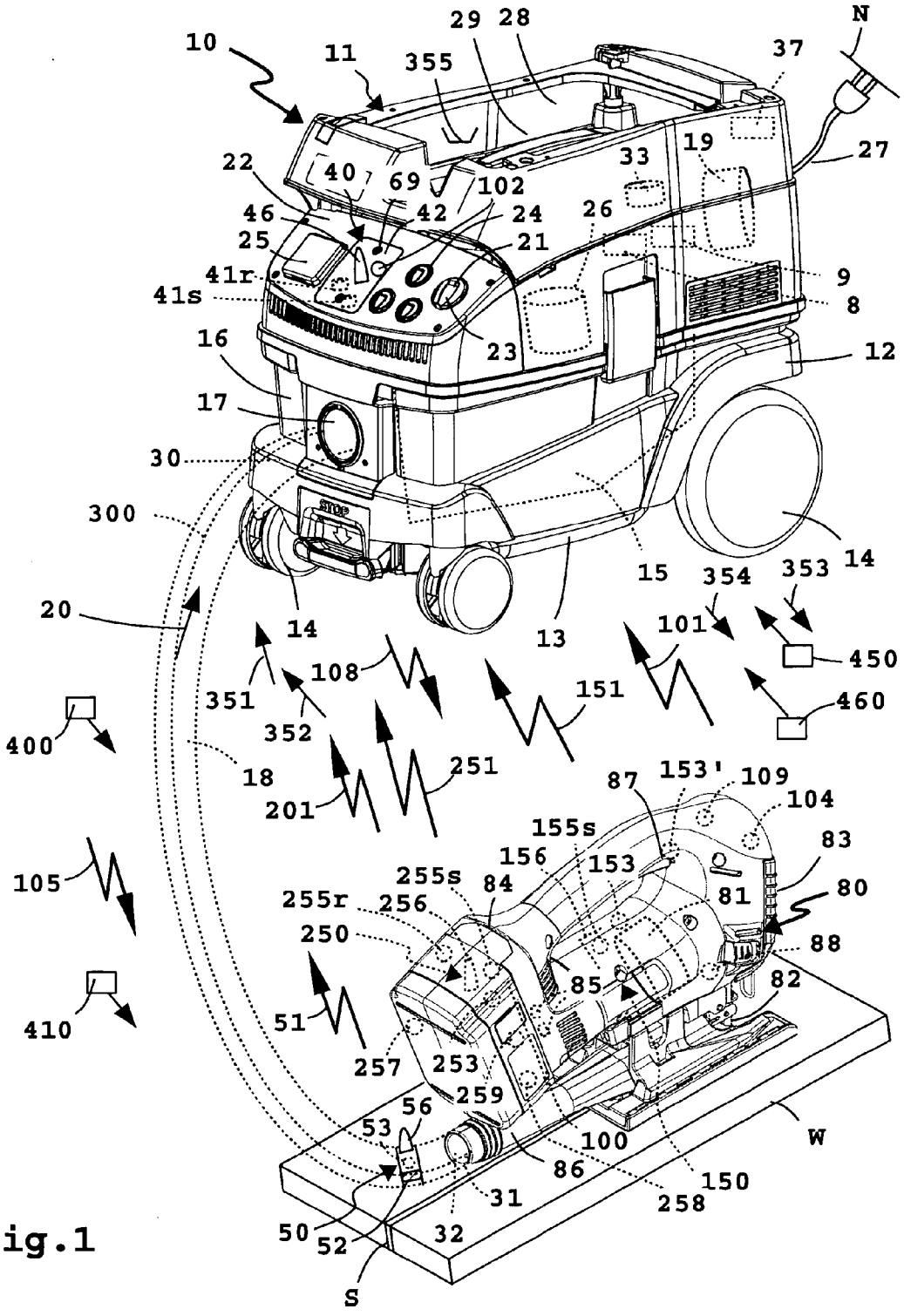
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Fig.1

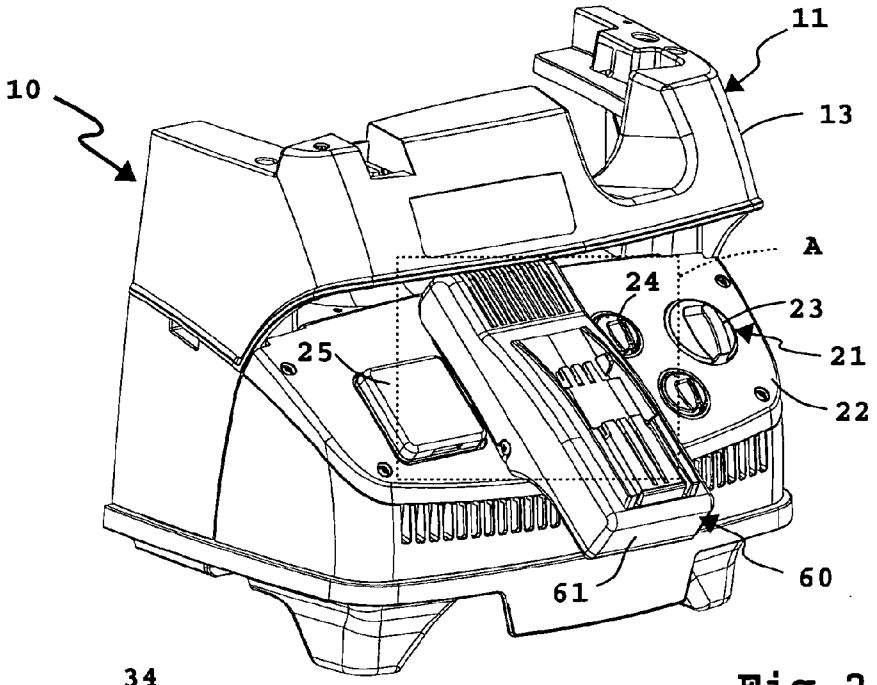


Fig.2

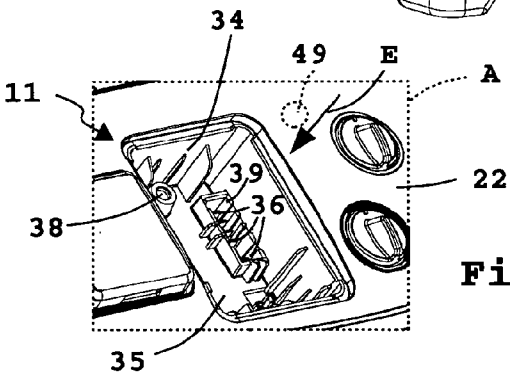


Fig.3

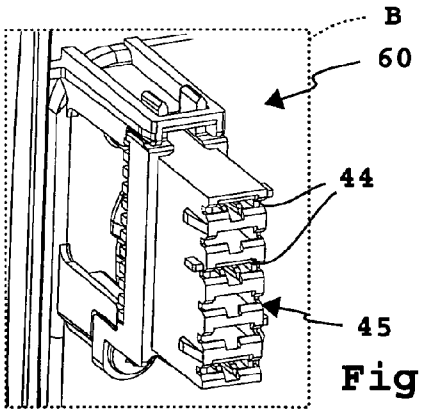
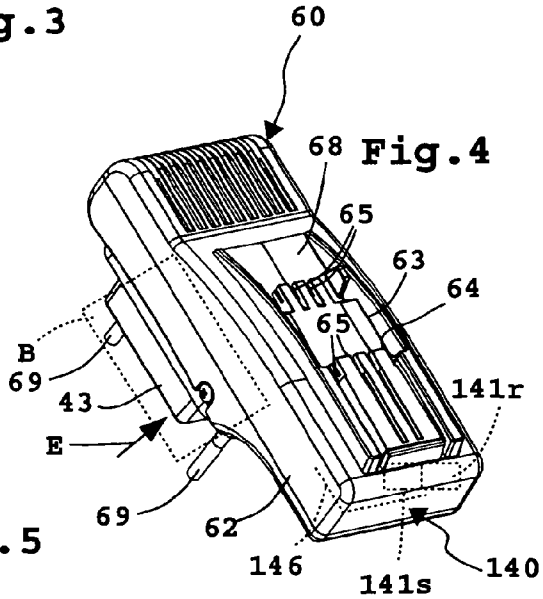


Fig.5



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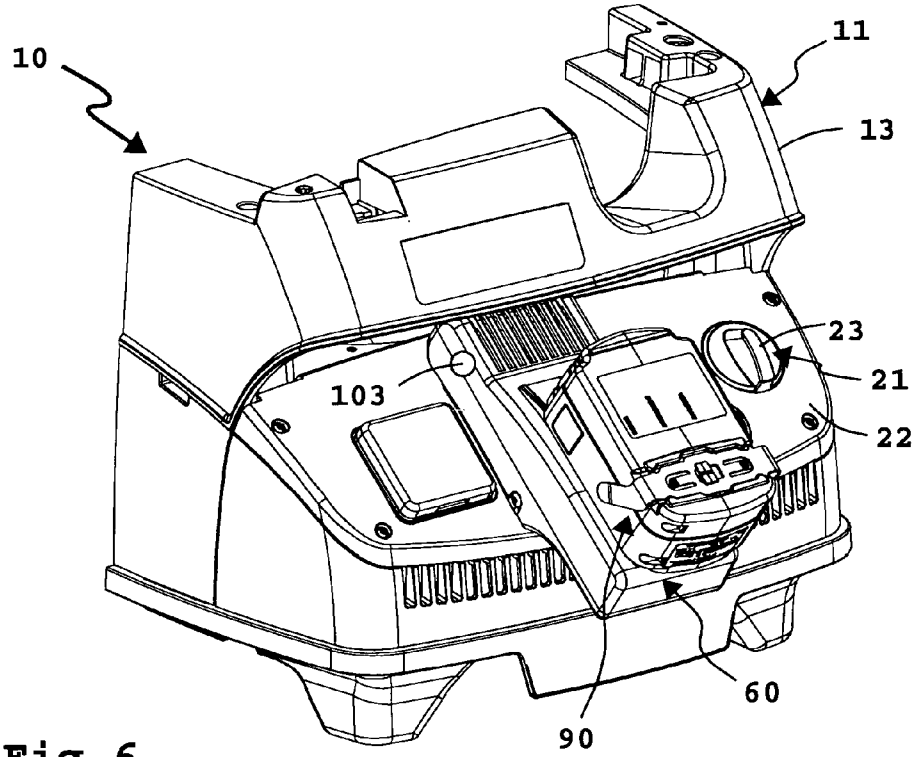

Fig.6

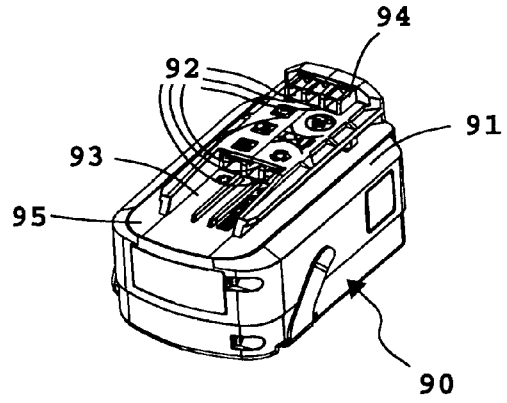

Fig.7

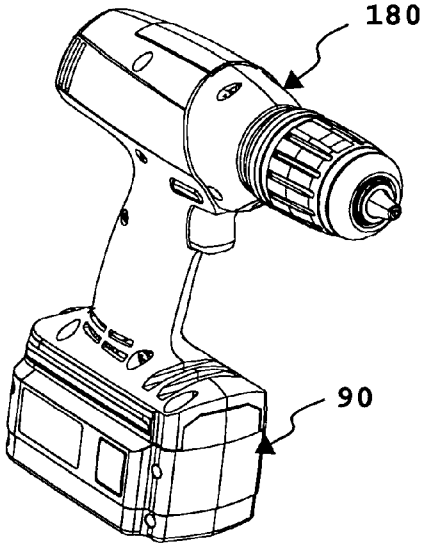

Fig.8

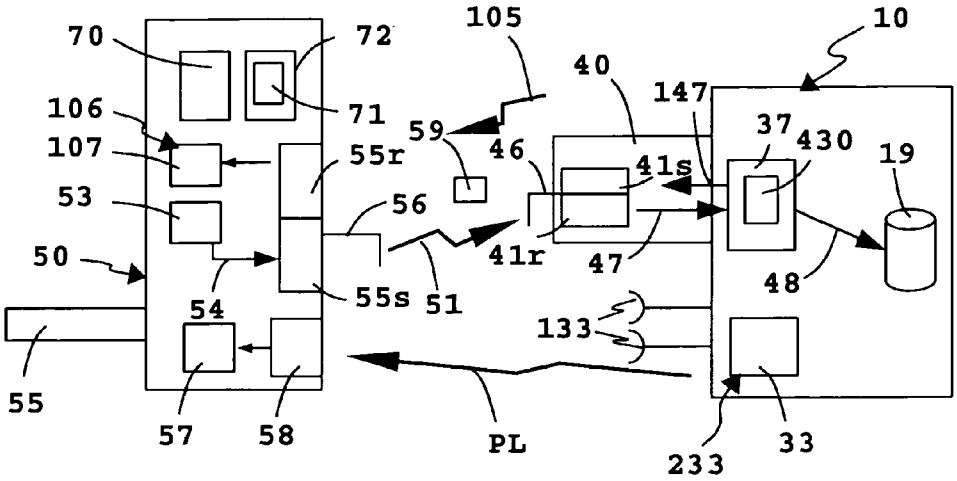
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Fig.9

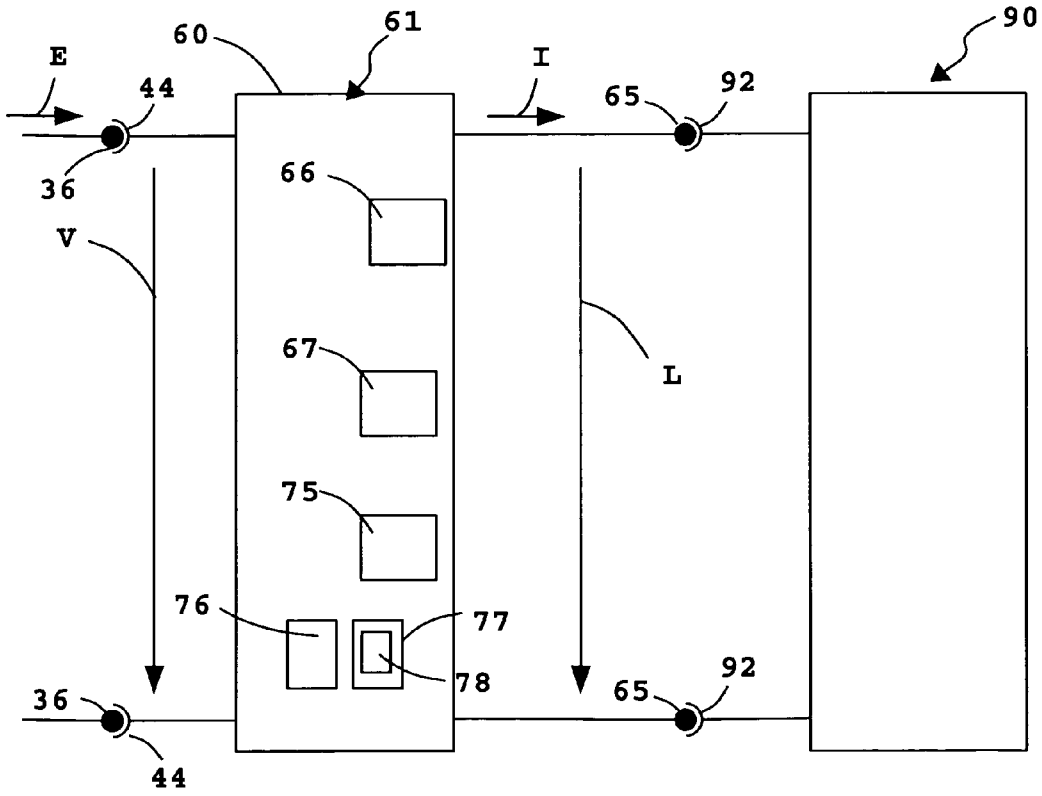
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Fig.10