(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 4 119 296 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
18.01.2023 Bulletin 2023/03

(21) Application number: **21207521.2**

(22) Date of filing: **10.11.2021**

(51) International Patent Classification (IPC):
B25B 11/00 *(2006.01)*

(52) Cooperative Patent Classification (CPC):
B25B 11/007

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **15.07.2021 US 202117377311**

(71) Applicant: **Nemo Power Tools Ltd.**
Central Hong Kong (HK)

(72) Inventors:
- **ROTEM, Nimrod**
  HongKong (HK)
- **JOUKOV, Oleg**
  4283500 Shaar Efraim (IL)
- **TSFASMAN, Eduard**
  4283500 Shaar Efraim (IL)

(74) Representative: **Sach, Greg Robert**
Valet Patent Services LLP
Siedlungsstrasse 4a
85253 Erdweg (DE)

(54) REMOTE CONTROL FOR PORTABLE ELECTRIC VACUUM GRIPPER

(57) A remote-control system for controlling an electric power tool with an air extraction chamber (such as a vacuum gripper) is provided that includes a control- receiving unit and a control-sending unit that is remote from the control-receiving unit. The control-receiving unit includes an adapter, solenoid air valve, and a remote-control receiver. The adapter is attached to be in fluid communication with the air extraction chamber from which, upon powering of the tool, air is continuously extracted to develop a suction force. The control-sending unit includes a remote-control transmitter that sends a signal that is received by the control-receiving unit. When the signal is received, the air extraction chamber is vented to the atmosphere via the solenoid air valve.

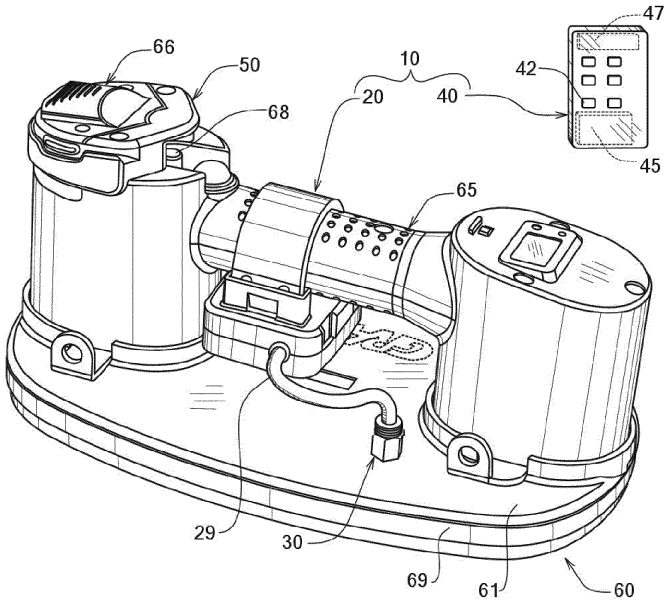

FIG. 1

EP 4 119 296 A1

Description

FIELD OF INVENTION

[0001] This invention relates generally to remote control systems, and, more particularly, to an add-on remote-control system for portable electric vacuum grippers used for lifting objects, and yet more particularly, to an air pressure release for vacuum grippers.

BACKGROUND OF THE INVENTION

[0002] Vacuum grippers (also called "vacuum lifters") are useful for lifting objects that are difficult to grip or handle, such as window glass sheets, flagstones, solar panels, and various construction materials. One type of vacuum gripper is a small, portable, battery- powered, electric vacuum active suction lifter, such as the handheld vacuum grippers sold under the trademark of GRABO.

[0003] To use a handheld, portable vacuum gripper, the operator places it adjacent to a surface of an object to be carried and manually switches on the air extraction member (such as by turning or depressing a power knob or button on the gripper handle) to actuate the vacuum. The force of atmospheric pressure urges the tool body toward the object as the peripheral gasket-type vacuum seal member forms a seal between the gripper and the object. Thus, the vacuum gripper grips the object surface so that the handle of the gripper can be used as a convenient handle to move the object and lift it into place. The operator, who is holding the vacuum gripper in his/her hand, can easily activate a manual release mechanism to release the suction on the vacuum, which results in the freeing of the object from the vacuum gripper. However, at times there is a need or desire to use a handheld vacuum gripper to lift an object to a location that is not near the operator. When the desired endpoint location is not near the operator, a portable vacuum gripper may be connected to an extension rod, frame, hoist, or crane to lift the object. But in this case, the operator is not holding the vacuum gripper in his/her hand and, therefore, cannot access and actuate the manual release mechanism on the device
itself, which creates a problem.

[0004] Vacuum grippers with a pre-integrated control system for releasing the carried object can be incorporated into large robotic lifting machines or industrial crane type lifters used for large lifting jobs, such as lifting objects onto high places that are far from the operator. However, these are costly solutions, and often the cost is not warranted if there is only one or are a limited number of objects to be lifted. It would be desirable to allow the operator to use the less costly handheld vacuum gripper for these smaller jobs.

[0005] Accordingly, there is a need for a system that allows remote release of the vacuum on a small, portable, handheld vacuum gripper when the operator cannot readily access the manual release mechanism.

BRIEF SUMMARY OF THE INVENTION

[0006] The present invention is directed to a remote-control system that serves as an accessory to an electrically powered vacuum gripper power tool. The remote-control system includes a control-receiving unit that is attachable to the vacuum gripper and a separate remote-control sending unit that wirelessly sends control signals to the control- receiving unit. The control-receiving unit and the control-sending unit function together to provide the tool operator with a means and method to remotely control at least the release of the suction of the vacuum gripper power tool. In a further aspect of the invention, the remote-control system allows the operator to remotely control power to the vacuum gripper. In yet another aspect of the invention, the remote-control system enables transmission of data (such as battery life and other vacuum gripper status data) from the control-receiving unit to the control-sending unit and display of this data to the operator.

[0007] The vacuum gripper is operational with or without the control-receiving unit attached. When the control-receiving unit is detached, the operator may use the vacuum gripper as a standard handheld unit without remote control, thus reducing the weight and retaining a smaller size and shape. When the control-receiving unit is attached, the operator receives the advantage of remote-control functionality, which allows remote release of the lifted object - even when the operator does not have access to the manual release mechanism.

[0008] The handheld remote-control sending unit includes a remote-control transmitter that communicates with a remote-control receiver of the control-receiving unit. The operator inputs selections into the handheld control-sending unit to activate this communication.

[0009] The control-receiving unit includes an adapter, a solenoid valve, an electronic system (for example, circuit board, microprocessor, circuitry), and a remote-control receiver. The adapter is attached to the upper side of the base of a portable or handheld vacuum gripper and is fluidly connected to the vacuum chamber disposed on the lower side of the base. After the initial attachment, this adapter remains connected to the base. The main portion of the control-receiving unit (the control-receiving unit minus the adapter and any adapter fittings) is attachable to the adapter (via a mechanical adapter fitting) when remote functionality is needed and otherwise detachable to reduce weight and bulk.

[0010] When the main portion of the control-receiving unit is attached, the solenoid air valve is in fluid communication with the vacuum chamber of the vacuum gripper through the adapter. Upon receipt by the remote-control receiver of a signal from the remote-control transmitter, the circuit board activates the solenoid valve to open to let air rush into the vacuum chamber. Thus, although the air extraction member (such as an air pump) of the vacuum gripper will continue to pump air, a vacuum cannot be formed, and any carried object will be released, though

remote from the operator.

[0011] In one aspect of the invention, the adapter is an add-on, which can be installed onto an existing vacuum gripper to retrofit one that was not originally designed to be remotely controlled.

[0012] In another aspect of the invention, the adapter is installed during the manufacturing of the vacuum gripper.

[0013] In a further aspect of the invention, the remote-control system is functional to release the suction of the vacuum gripper to release the carried object.

[0014] In an additional aspect of the invention, the remote-control system is functional to both control the power to the vacuum gripper and to release the suction of the vacuum gripper.

[0015] In a further aspect of the invention, the remote-control system is functional to deliver vacuum gripper status data via the control-receiving unit to the control-sending unit for display by the control-sending unit of the status data.

[0016] In another aspect of the invention, the control-receiving unit is battery powered.

[0017] In an additional aspect of the invention, the control-receiving unit receives power from the battery of the vacuum gripper.

[0018] In a further aspect of the invention, the control-receiving unit receives power from the battery of the vacuum gripper and the remote-control system further comprises a battery auxiliary member.

[0019] In another aspect of the invention, the main portion of the control-receiving unit is attachable via the adapter to the base of the vacuum gripper.

[0020] In an additional aspect of the invention, the main portion of the control-receiving unit is attachable via the adapter to the handle of the vacuum gripper.

[0021] In a further aspect of the invention, the attachable and detachable control- receiving unit is usable with both a first vacuum gripper and with additional vacuum gripper units.

[0022] The present invention is an improvement over what currently exists as it allows remote control of a portable or handheld vacuum gripper - whether it was originally designed to be remotely controlled or not. It solves the problem that occurs when a carried object is situated into the desired release position and needs to be released, but the operator is not holding the vacuum gripper in his/her hand and so cannot access the manual release mechanism to release the suction. Thus, the remote-control system of the present invention allows the gripped object to be released from a distance.

[0023] These and other objects, features, and advantages of the present invention will become more readily apparent from the attached drawings and from the detailed description of the preferred embodiments which follow.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0024] The preferred embodiments of the invention will hereinafter be described in conjunction with the appended drawings, provided to illustrate and not to limit the invention, where like designations denote like elements.

FIG. 1 is a perspective view of a first embodiment of the remote-control system of the present invention for use with vacuum gripper.

FIG. 2 is a perspective view of the main portion of the control-receiving unit of the first embodiment of the remote-control system of the present invention.

FIG. 3 is a left side view of the control-receiving unit with the adapter of first embodiment of the remote-control system of the present invention.

FIG. 4 is a right-side view of the control-receiving unit with the adapter of the first embodiment of the remote-control system of the present invention.

FIG. 5 is a front view of the main portion of the control-receiving unit of the first embodiment of the remote-control system of the present invention.

FIG. 6 is a back view of the main portion of the control-receiving unit of the first embodiment of the remote-control system of the present invention.

FIG. 7 is a bottom view of the main portion of the control-receiving unit of the first embodiment of the remote-control system of the present invention.

FIG. 8 is a top view of the main portion of the control-receiving unit of the first embodiment of the remote-control system of the present invention.

FIG. 9 is a perspective view of a battery auxiliary fixture of an embodiment of the remote-control system present invention.

FIG. 10 is a perspective view of a second embodiment of the remote-control system of the present invention.

FIG. 11 is a perspective view of the control-receiving unit of the second embodiment of the remote-control system of the present invention.

FIG. 12 is a perspective view of a third embodiment of the remote-control system of the present invention.

FIG. 13 is a cut view taken from lines 13-13 of FIG. 12 of the remote-control system of the present in-

vention.

FIG. 14 is a sectional view taken from lines 14-14 of FIG. 12 of the remote-control system of the present invention.

FIG. 15 is a side view of control-receiving unit of the first embodiment of the remote-control system of the present invention shown on a second type of vacuum gripper.

FIG. 16 is a top view of vacuum gripper of the present invention with an adapter portion of the control-receiving unit connected to the vacuum gripper.

FIG. 17 is a diagram of components of the of the remote-control system of the present invention.

[0025] Like reference numerals refer to like parts throughout the several views of the drawings.

DETAILED DESCRIPTION OF THE INVENTION

[0026] Shown throughout the figures, the present invention provides a remote-control system that serves as an accessory to an electrical vacuum gripper power tool.

[0027] Referring now to FIG. 1, the remote-control system, shown generally as reference number **10**, is illustrated in accordance with a first embodiment of the present invention. As shown, the remote-control system **10** comprises a control-receiving unit **20** attachable to the vacuum gripper **60** via an adapter **30** and a control-sending unit **40** remote from the vacuum gripper **60.** In a preferred aspect, the control-sending unit **40** is remote and handheld or portable.

[0028] As seen in FIGS. 1, 17, the control-sending unit **40** comprises a user input interface **42,** electronic system **43,** a remote-control transmitter **45**, a sending unit housing **46**, a battery or power source **47**. The power source **47** powers the control-sending unit **40**. The user input interface **42** allows an operator to cause the remote-control transmitter **45** to transmit a signal to the control-receiving unit **20** through the functionality provided by the electronic system **43**. The sending unit housing **46** provides an encasement that fully or partially encloses the other sending unit components.

[0029] The control-receiving unit **20** comprises an adapter **30**, a battery or power source **21**, electronic system **23**, a valve **24**, a remote-control receiver **25**, a control-receiving unit housing **26**, and a solenoid-adapter connector/fitting **29**.

[0030] The adapter **30** is a mechanical device installed onto the vacuum gripper **60** that serves as an air inlet and as a holder/attachment location for the remainder of the control-receiving unit **20**. The adapter **30** is preferably a threaded tube that can mechanically support the control-receiving unit **20** as well as to allow air to flow though it when the solenoid air valve is open. The adapter **30** is installed to be in fluid communication with the vacuum chamber (defined by the lower central area **63** and the exterior surface of the object to be carried) of the vacuum gripper **60.** Once installed, the adapter **30** remains attached to the vacuum gripper to allow the control-receiving unit **20** to be mechanically attached to, and detached from, the vacuum gripper **60.** When the control-receiving unit **20** is attached to the vacuum gripper **60,** the adapter **30** is installed to be in fluid communication with both the valve **24** (preferably a solenoid air valve) of the control-receiving unit **20** and the vacuum chamber of the vacuum gripper **60.** The adapter may be installed by the operator when the remote-control system **10** is an add- on after-market accessory or may be installed by the factory during fabrication of the vacuum gripper in the case in which the remote-control system **10** is a pre-installed accessory.

[0031] The remote-control receiver **25** is operable to receive the signal from the remote- control transmitter **45**. Triggered by the signal received by the remote-control receiver

25, the electronic system **23** actuates the solenoid air valve **24** to open to allow air to rush

out of the vacuum chamber, thus releasing the carried object from the vacuum gripper.

[0032] The vacuum gripper **60** (to which the control-receiving unit **20** will be connected
via the adapter **30**) comprises a rigid base element **61** and a loop-shaped, gasket-type vacuum seal element **69**. The vacuum seal element **69** is attached at least indirectly to the bottom side of the base element **61** and protrudes downwardly and peripherally therefrom. The seal element **69** comprises a seal contact surface that at least partially contacts with the object to be lifted and a vacuum chamber encircling surface **63** extending inwardly from the seal contact surface so as to define a vacuum chamber. The seal element **69** is elastically deformable at the contact surface to enable conforming to the object surface when pressed thereagainst. The vacuum gripper **60** comprises an air- extraction member **67** (FIG. 13), such as an impeller or a pump, which is mounted to the base upper side, but is in fluid communication with the vacuum chamber **63** through the base element **61** and which is configured to continuously extract air from the vacuum chamber **63** (when the vacuum gripper is in the active state). This causes (when the contact surface is pressed against the surface of the object) the force of the atmospheric pressure to urge the base element **61** toward the to-be-lifted object as the peripheral vacuum seal element **69** forms a tight seal between the gripper and the object.

[0033] In the first embodiment of FIGS. 1-8, the control-receiving unit **20** includes a handle-attachable portion **22** (FIGS. 2-4) that allows the housing **26** to be attached to the handle **65** of the vacuum gripper **60.** The handle-

attachable portion **22** has a partial- cylindrical open frame that is sized and configured to fit around the vacuum gripper handle **65**. The housing **26** is attached to at least one end of the handle-attachable portion **22**. The handle-attachable portion **22** includes an opening mechanism to allow it to be fitted onto the handle **65** and to be locked shut during use, which holds the housing **26** securely onto the handle **65**.

[0034] In the second embodiment of FIGS. 10-11 and in the third embodiment of FIGS. 12- 13, the control-receiving unit **20** is disposed on the upper side of the base **61** of the vacuum gripper **60.**

[0035] In one aspect of the invention, as seen in FIGS. 11, 17, the power source for the control-receiving unit **20** is a battery **21** disposed within control-receiving unit housing **26**. The battery **21** powers the solenoid air valve **24**, the electronic system **23**, and the remote-control receiver **25**. The battery **21** may be housed in a battery housing and may be rechargeable or disposable.

[0036] In another aspect of the invention, as seen in FIG. 1, the power source for the control-receiving unit **20** is the battery **62** (FIG. 13) of the vacuum gripper. In the aspect in which the control-receiving unit **20** is installed by fabricator, the power connection between the control-receiving unit **20** and the vacuum gripper battery **62** may also be installed by the fabricator. But to retrofit a vacuum gripper that did not initially have remote-control functionality, the remote-control system **10** of this aspect, additionally comprises of battery auxiliary fixture **50** that allows the control-receiving unit **20** to draw power from, or to control the power to, the battery of the vacuum gripper **60.** As best seen in FIG. 9, the battery auxiliary fixture **50** has an interior cavity **55** defined by outer walls **53**. The interior cavity **55** is sized, shaped, and configured to receive the battery of the vacuum gripper **60.** The outer walls **53** are sized, shaped, and configured to fit into the interior walls of the standard battery. In this aspect of the invention, a connector connects the battery with the main portion of the remote-control sending unit **40**.

[0037] In another aspect of the invention in which the control-sending unit **40** is functional to send a power shut-off signal to the control-receiving unit **20**, an electric switch connected to the power and a specialized electric adapter are provided. The electrical adapter connects to the terminals of the vacuum gripper battery and can connect or disconnect the electrical connection of the vacuum gripper via the electrical switch. Thus, the control-receiving unit **20** is electrically connected to the electric adapter and is operable to disconnect the power to the air extraction member. This may be accomplished through use of the battery auxiliary fixture **50**.

[0038] The remote-control sending unit **40**, seen in FIGS. 1, 10, 17 includes a battery or power source **47** that powers the user input interface **42**, electronic system **43**, and the remote-control transmitter **45.** The battery **41** may be housed in a battery housing and may be rechargeable or disposable.

[0039] The electronic system **43** and the electronic system **23** may include a circuit board and/or a microprocessor, associated circuitry, and other conventional components that mechanically support and electrically connect electronic components.

[0040] The user input interface **42** may include mechanical or electronic inputs, such as buttons, knobs, or switches, or may include a screen, which is preferably touch enabled, but may be non-touch enabled. The user input interface **42** allows the input of at least one instruction and, optionally, may allow an operator to indicate more than one more possible instruction. The user input into the user input interface **42** actuates the transmission of one or more signals via the remote-control transmitter **45**. In a preferred aspect of the invention, the signal is a radio frequency (RF) signal, but other types of wireless technology may alternatively be used, such as Bluetooth, Wi-Fi, Infrared, Wi- SUN, or the like.

[0041] In one aspect of the invention, the signal transmitted from the remote-control transmitter **45** to the remote-control receiver **25** of the control-sending unit **40** is a signal that actuates the solenoid air valve **24** to allow the ingress of air into the enclosed vacuum chamber of the vacuum gripper. The pressure in the enclosed chamber increases to atmospheric pressure and the vacuum gripper is released from the external surface of the carried object. In this aspect, the air-extraction member **67** (FIG. 13) continues to operate, but no vacuum is created.

[0042] In an additional aspect of the invention, a second signal transmitted from the remote-control transmitter **45** to the remote-control receiver **25** actuates the on/off power circuit of the vacuum gripper and turns the power off to the gripper tool. This is preferably used in combination with the aspect in which the solenoid air valve **24** is actuated, so that the operator can both release the pressure in the enclosed vacuum chamber to release the carried object and turn off the air-extraction member **67** of the gripper tool, such as to conserve the vacuum gripper's
battery.

[0043] In another aspect of the invention, the remote-control receiver **25** comprises a receiver/transmitter and communicates wirelessly with the remote-control transmitter **45**, which also comprises a receiver/transmitter. In this aspect, the user input interface **42** may show status updates, such as battery life, with the status data received from the remote-control receiver **25** and displayed on a display screen of the control-sending unit **40.**

[0044] In a further aspect of the invention the control-receiving unit **20** does not use the adapter **30** but is instead built into a replacement seal assembly, thus removing the need to drill a hole into the vacuum chamber to install an adapter **30**. The replacement seal assembly serves as the housing **26** for the components of the main portion of the control- receiving unit **20**.

[0045] The second embodiment of FIGS. 10-11 and in the third embodiment of FIGS. 12-13 show the control-receiving unit **20** in different housings **26**, which are suitable for coupling onto the vacuum gripper's upper base

61.

[0046] To use the remote-control system **10**, the adapter **10** is installed onto the rigid base **61** to be in fluid communication with the central encircling surface **63** (FIG. 14) of the lower side of the vacuum gripper **60,** which, when the vacuum gripper is activated defines the upper portion of the vacuum chamber with the lower portion of the vacuum chamber defined by the carried object. This installation can be done during fabrication or, optionally, by the operator to increase the functionality of a vacuum gripper that was not initially fabricated with a remote-control option. When installed by the operator, a hole is drilled through the base into the central encircling surface **63**. The adapter **30** prevents venting of the vacuum chamber to the atmosphere when the control-receiving unit **20** is not installed and when the control-receiving unit **20** is installed - until receipt of a release signal from the remote-control transmitter **45**. An adapter fitting allows mechanical connection of the main portion of the control-receiving unit **20** to the adapter **30**. In the aspect in which the power can be shut off to the vacuum gripper, an electrical connection will also be installed; if the remote-control system is an aftermarket add-on, this may be done through use of the battery auxiliary fixture **50**.

[0047] Until the need arises for remote control, a vacuum gripper **60** with an installed adapter **30** and without a connected control-receiving unit **20**, as shown in FIG. 16, may be used as a handheld tool to pick up, support, hold, place, and release items such as boxes, pieces of furniture, panels and other heavy, bulky, fragile, or difficult to grip items.

[0048] When the release mechanism **68** will not be accessible at the desired location of release (such as when a difficult to grip object is to be lifted onto a roof) thus necessitating the remote-control functionality, the operator connects the control-receiving unit 20 to the fitting of the adapter **30**, which creates a fluid communication path **29** between the solenoid valve and the adapter **30**. The fluid communication path **29** may be quite short when the control-receiving unit **20** is installed directly onto the base **61**, as seen in FIGS. 1-12, 14, or may be longer, as seen in FIG. 1.

[0049] The operator securely connects the vacuum gripper **60** to an extension rod, frame, hoist, or crane to lift the object and turns it on to initiate or activate the air-extraction member **67** (FIG. 13), which creates a vacuum in the vacuum chamber defined between the exterior surface of the object and the lower side central encircling surface **63** of the vacuum gripper. The extension rod, frame, hoist, or crane lifts the gripper **60** gripping the carried object and is used to position the carried object for release.

[0050] When the object is directly above the desired release location, the operator uses the user input interface **42** to cause the transmitter **45** to transmit a wireless signal to the receiver **25**. The receiver **25** actuates the solenoid valve **24** to allow ingress of air with the air extraction chamber vented to the atmosphere. This causes loss of vacuum, loss of grip, and separation of the vacuum gripper 60 from the external surface of the item, though the air-extraction member **67** remains operating.

[0051] In the aspect in which the remote-control sending unit **40** has the additional functionality to send a power-off signal, the operator may use the user input interface to activate the transmitter **45** to transmit a power-off wireless signal to the receiver **25**. After receipt of the power-off signal, the control-receiving unit **20** (which during installation was connected to the gripper power circuit) interrupts the power to the gripper, such as via a relay or solid-state switch. In this aspect, though the carried object has already been released, the vacuum gripper is now also turned off to conserve the vacuum gripper's battery. Though this feature is not mandatory when the remote-control system is used with most vacuum grippers, it is highly preferred when the remote-control system is used with high-flow vacuum grippers, because the onboard air extraction member **67** may be powerful enough to maintain the vacuum even when the solenoid valve is opened.

[0052] After use of the control-receiving unit **20** with a first vacuum gripper, the control- receiving unit **20** may be physically decoupled from the adapter on the first vacuum gripper and physically coupled to another adapter that has been previously installed onto another vacuum gripper. In this manner, a single control-receiving unit **20** (with multiple adapters) may be used on any of a number of types of vacuum grippers that may be accessible to the operator. In contrast to FIG. 1, which shows the control-receiving unit **20** attached to a standard vacuum gripper, FIG. 15 shows the control-receiving unit **20** attached to a high-flow vacuum gripper.

[0053] Accordingly, the remote-control system **10** allows the operator both to use a vacuum gripper **60** as a standard handheld tool without the main portion of the control- receiving unit **20**, thus saving weight and keeping the shape and size of the tool, or to use the remote-control feature by coupling the control-receiving unit **20** to the adapter **30** on the vacuum gripper **60** and using the control-sending unit **40**.

[0054] Since many modifications, variations, and changes in detail can be made to the described preferred embodiments of the invention, it is intended that all matters in the foregoing description and shown in the accompanying drawings be interpreted as illustrative and not in a limiting sense. Thus, the scope of the invention should be determined by the appended claims and their legal equivalents.

Claims

1. A remote-control system for use with a vacuum gripper tool, comprising:

a control-sending unit comprising a remote-control transmitter operable to transmit a first signal;

and
a control-receiving unit comprising: an air valve; a remote-control receiver operable to receive said first signal from said remote-control transmitter to control said air valve; and
a first adapter in fluid communication with a vacuum chamber defined by a lower portion of said vacuum gripper tool and a contact surface of an object to be lifted; wherein said vacuum chamber is in fluid communication with an air-extraction member that is operable to develop a suction force within said vacuum chamber; wherein a main portion of said remote-control receiver is coupled to said first adapter; and wherein, when said first signal is received by said control-receiving unit, said air valve allows an ingress of air into said vacuum chamber.

2. The remote-control system for use with a vacuum gripper tool, as recited in claim 1, wherein said remote-control transmitter is further operable to transmit a second signal; wherein said remote-control receiver is further operable to receive said second signal from said remote-control transmitter to control the power to said vacuum gripper tool.

3. The remote-control system for use with a vacuum gripper tool, as recited in claim 1, wherein said control-sending unit further comprises a display screen; wherein said remote-control transmitter is further operable to receive a status signal containing status data; wherein said remote-control receiver is further operable to transmit said status signal to said remote-control transmitter; and wherein said display screen is further operable to display a status of said control-receiving unit based on said status data.

4. The remote-control system for use with a vacuum gripper tool, as recited in claim 1, wherein at least a portion of said control-receiving unit is attachable to the base of said vacuum gripper tool, or said vacuum gripper tool further comprises a handle and said control- receiving unit further comprises a handle-attachable portion; wherein said handle- attachable portion is attachable to said handle of said vacuum gripper tool.

5. The remote-control system for use with a vacuum gripper tool, as recited in claim 1, wherein said first adapter is configured to be installed during fabrication of said vacuum gripper tool or as an after-market accessory for said vacuum gripper tool.

6. A control-receiving unit for attachment to vacuum gripper tools, said control-receiving unit comprising:

a first adapter attachable to a first vacuum gripper of said vacuum gripper tools;
wherein, when said vacuum gripper tool is powered, air is continuously extracted from a vacuum chamber to develop a suction force within said vacuum chamber; wherein said vacuum chamber is defined by a lower portion of said vacuum gripper tool and a surface of an object to be lifted; an air valve; and a remote-control receiver operable to receive a first signal from a remote- control transmitter to control said air valve;
wherein, when said first signal is received by said remote-control receiver, said air valve allows an ingress of air into said vacuum chamber.

7. The control-receiving unit for attachment to a vacuum gripper tool, as recited in claim 6, wherein said control-receiving unit further comprises a handle-attachable portion; and wherein said handle-attachable portion is attachable to a handle of said vacuum gripper tool, or at least a portion of said control-receiving unit is attachable to the base of said vacuum gripper tool.

8. The control-receiving unit for attachment to a vacuum gripper tool, as recited in claim 6, wherein said remote-control receiver is operable to receive a second signal from a remote-control transmitter to control power to said vacuum gripper tool.

9. The control-receiving unit for attachment to a vacuum gripper tool, as recited in claim 6, wherein said remote-control receiver is operable to transmit a status signal containing status data to said remote-control transmitter.

10. The control-receiving unit for attachment to a vacuum gripper tool, as recited in claim 6, further comprising a second adapter that is coupled to a second vacuum gripper tool.

11. A method to provide remote communication to vacuum gripper tools, comprising:

obtaining a control-receiving unit comprising a first adapter, an air valve, and a remote-control receiver; obtaining a control-sending unit comprising a remote-control transmitter; physically coupling said first adapter to a first vacuum gripper of said vacuum gripper tools in a manner to be in fluid communication with a vacuum chamber defined by a lower portion of said first vacuum gripper and a surface of an object to be lifted; wherein, when said first vacuum gripper tool is powered, an air-extraction member continuously extracts air from said vacuum chamber; physically coupling a main portion of said control-receiving unit to said first adapter; and
transmitting, based on input from an operator

through a user input interface, a first signal from said remote-control transmitter of said control-sending unit to said remote-control receiver; wherein, when said first signal is received by said remote-control receiver, said air valve allows an ingress of air into said vacuum chamber.

12. The method to provide remote communication to vacuum gripper tools, as recited in claim 11, further comprising:
transmitting, based on input from an operator through a user input interface, a second signal from said remote-control transmitter of said control-sending unit to said remote-control receiver; wherein, when said second signal is received by said remote-control receiver, said the power is shut off to said vacuum gripper tool.

13. The method to provide remote communication to vacuum gripper tools, as recited in claim 11, further comprising:
transmitting a status signal containing status data from said remote-control receiver to said remote-control transmitter

14. The method to provide remote communication to vacuum gripper tools, as recited in claim 11, wherein said control-receiving unit further comprises a second adapter; the method further comprising:
physically decoupling said main portion of said control-receiving unit from said first adapter; and physically coupling said main portion of said control-receiving unit to said second adapter.

15. The method to provide remote communication to vacuum gripper tools, as recited in claim 11, wherein physically coupling said first adapter to a first vacuum gripper comprises coupling a handle-attachable portion of said control-receiving unit to a handle of said first vacuum gripper.

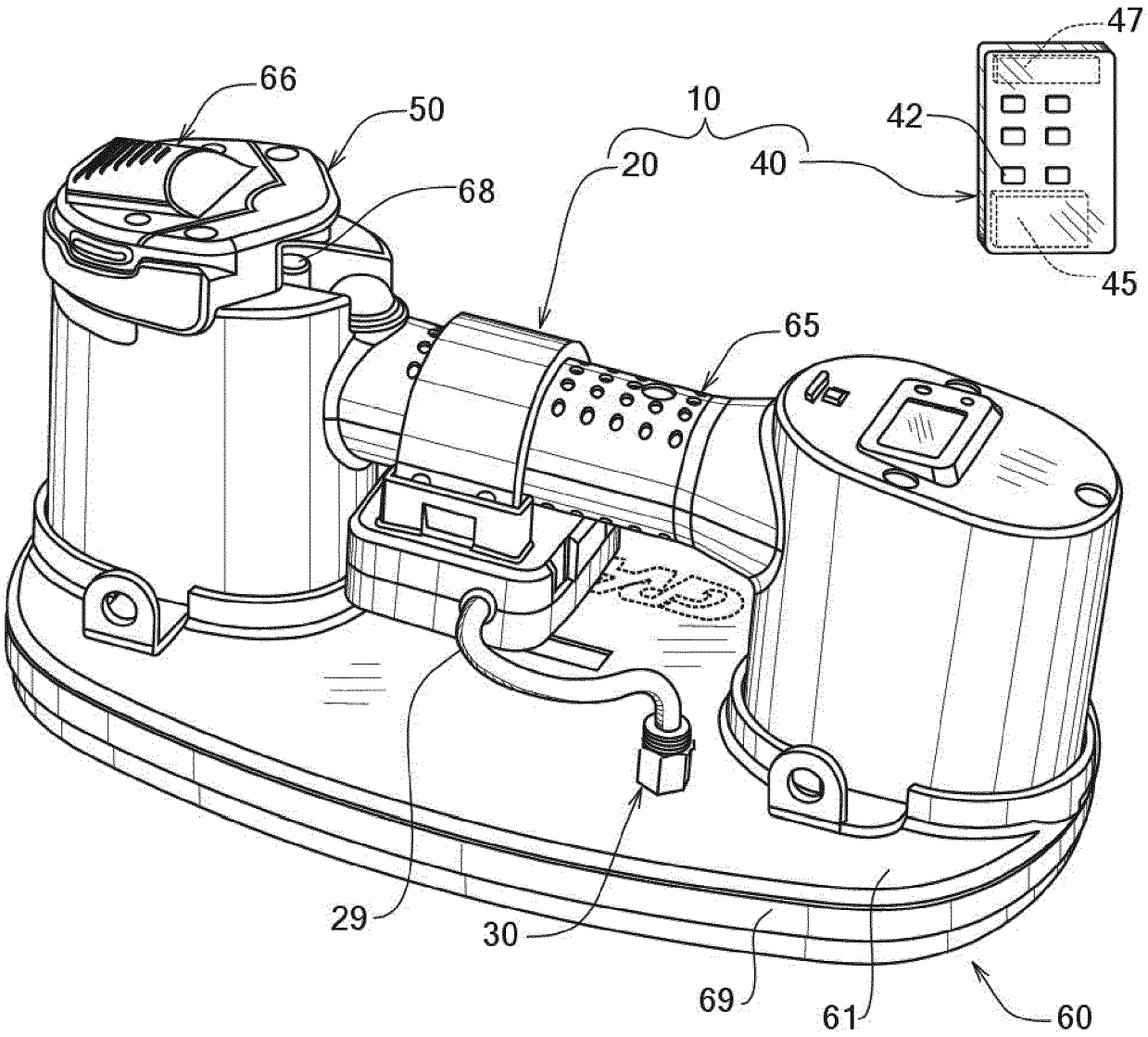

FIG. 1

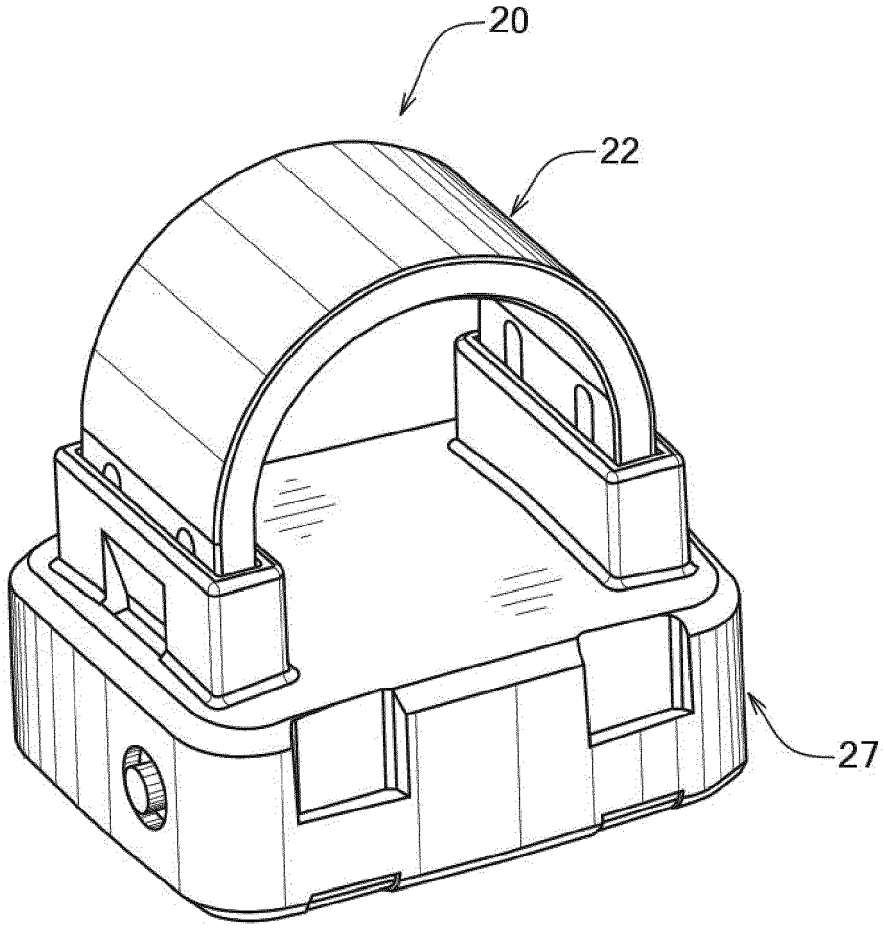

FIG. 2

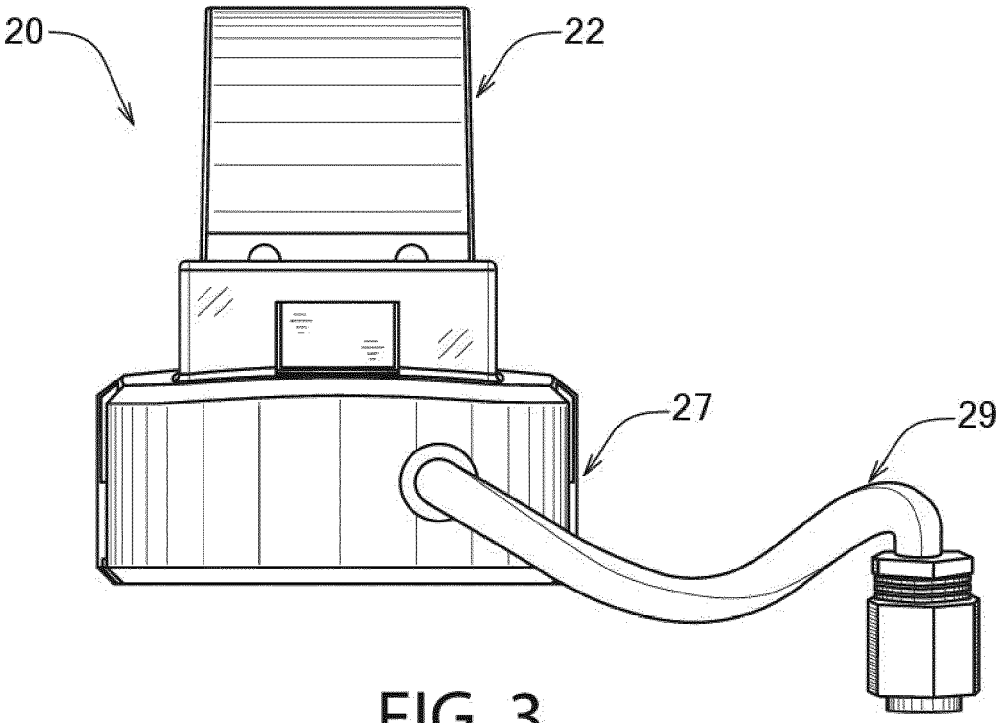

FIG. 3

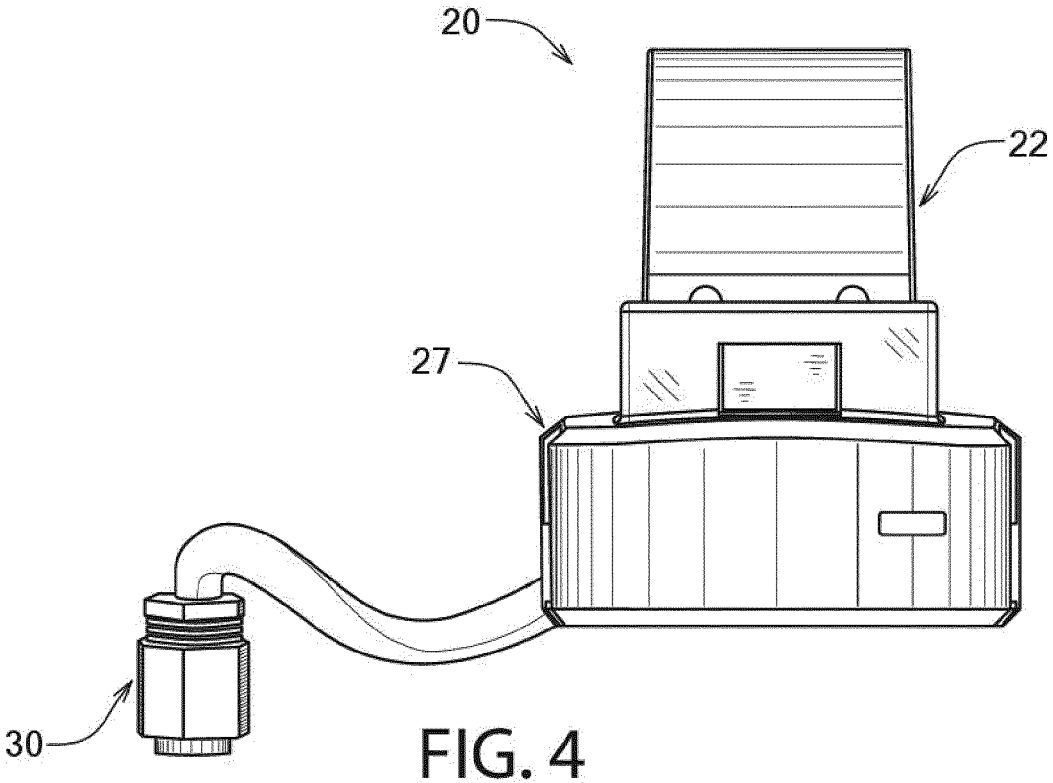

FIG. 4

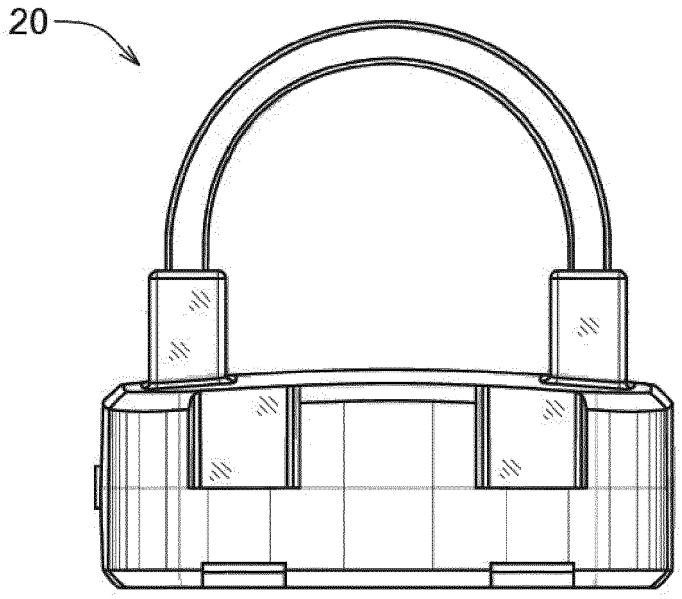

FIG. 5

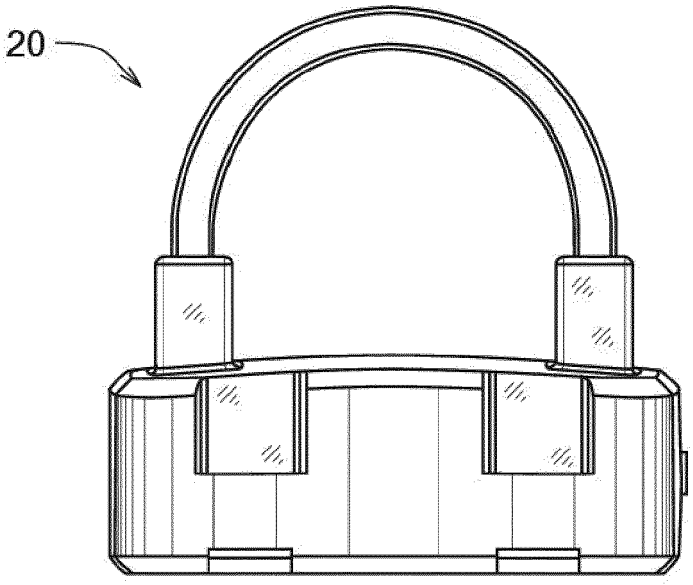

FIG. 6

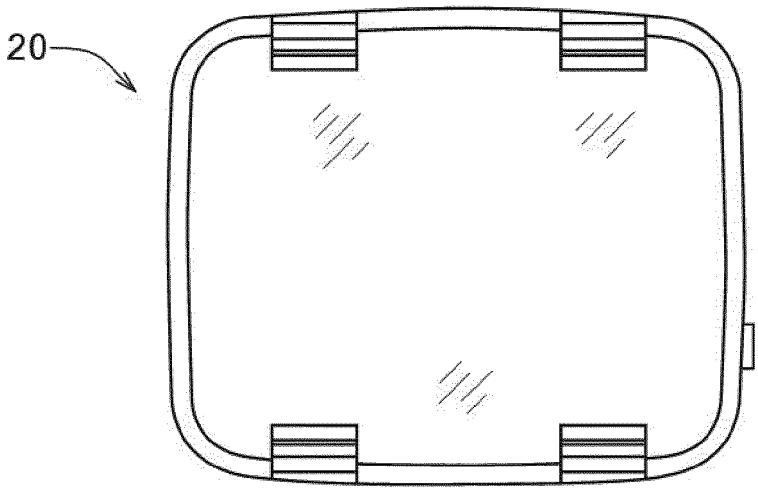

FIG. 7

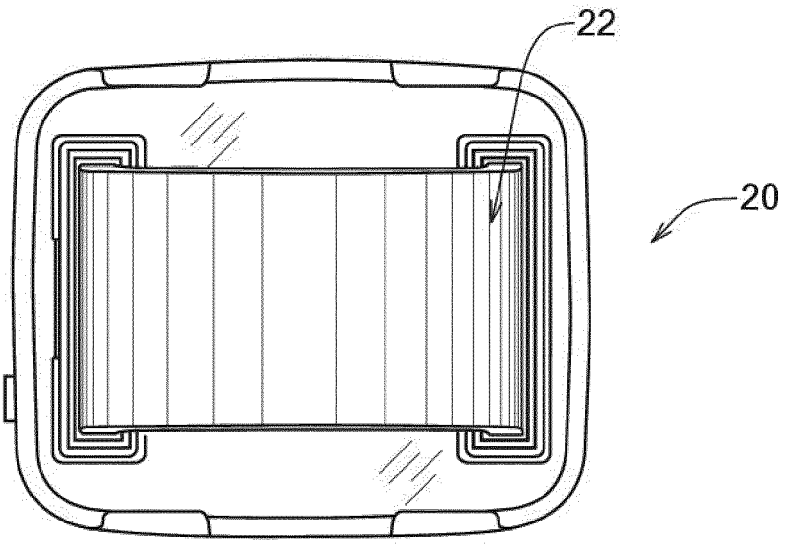

FIG. 8

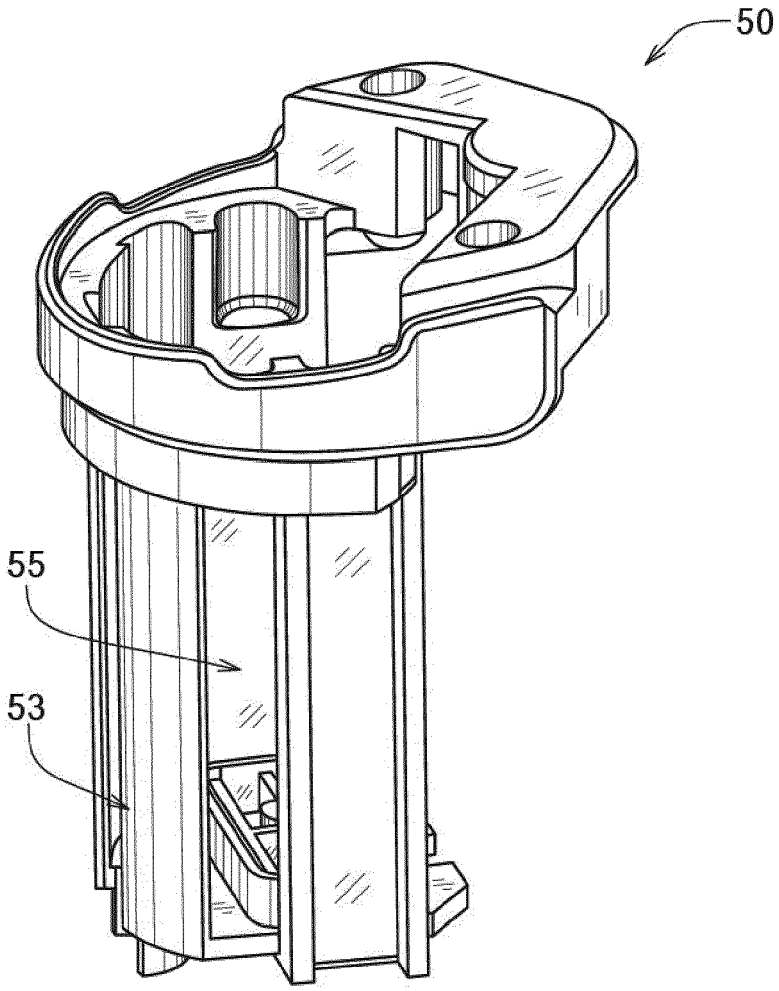

FIG. 9

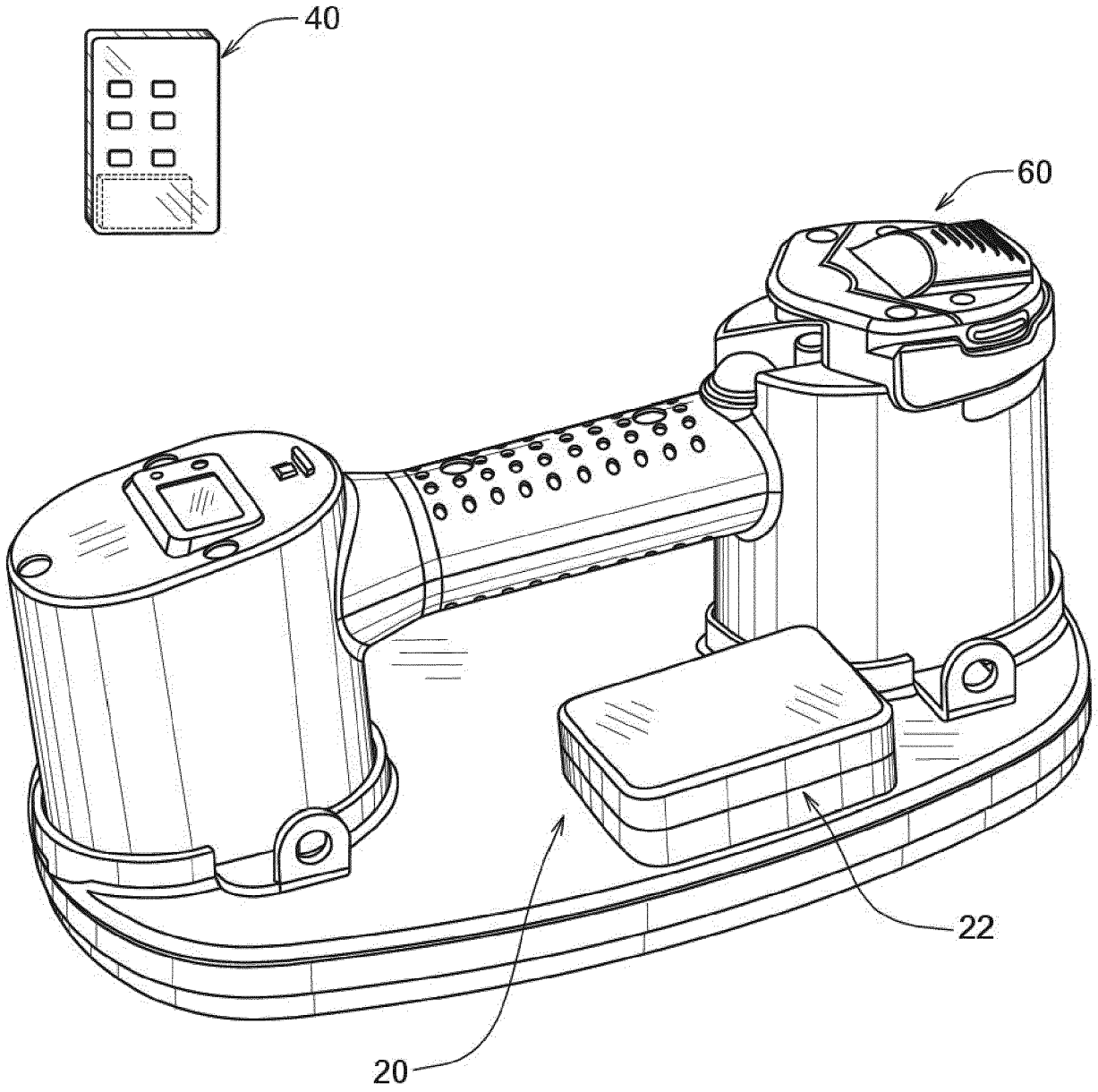

FIG. 10

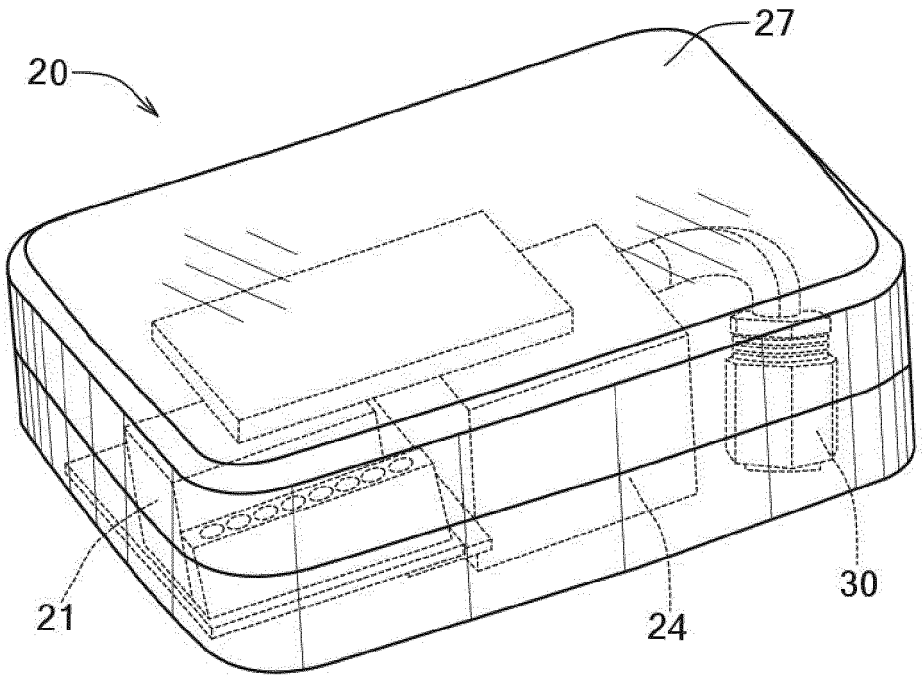

FIG. 11

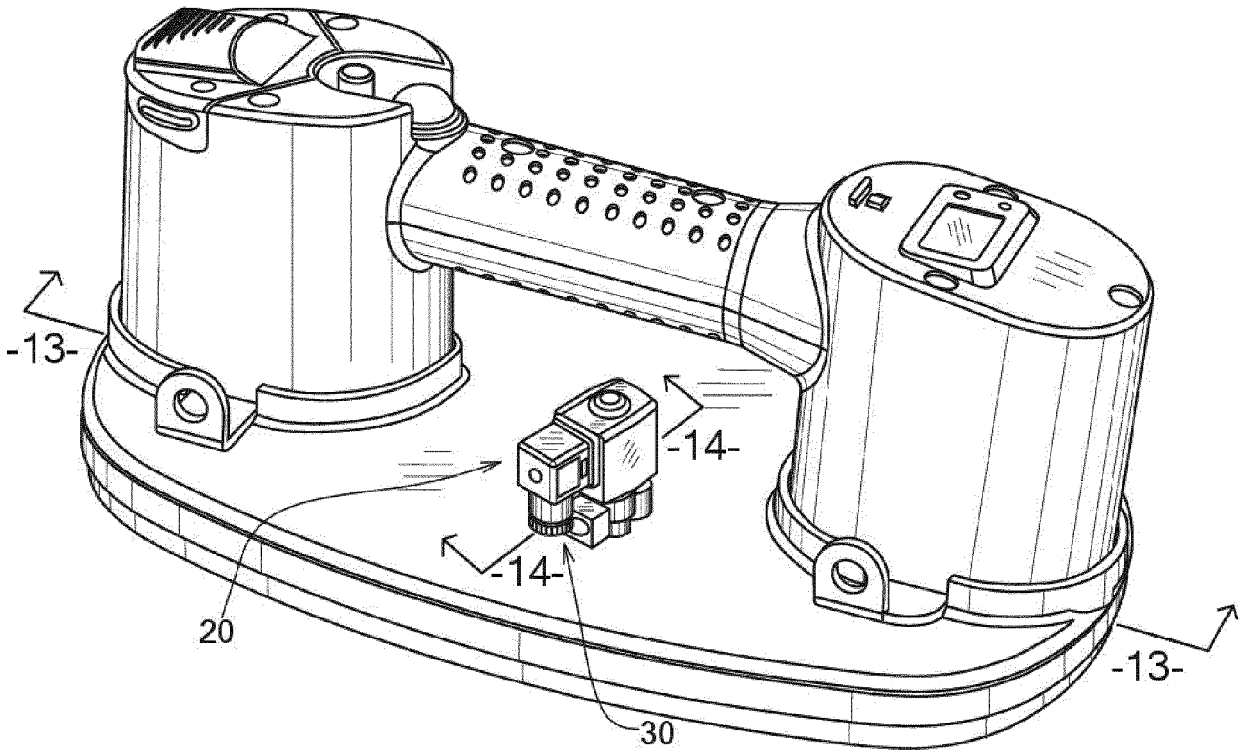

FIG. 12

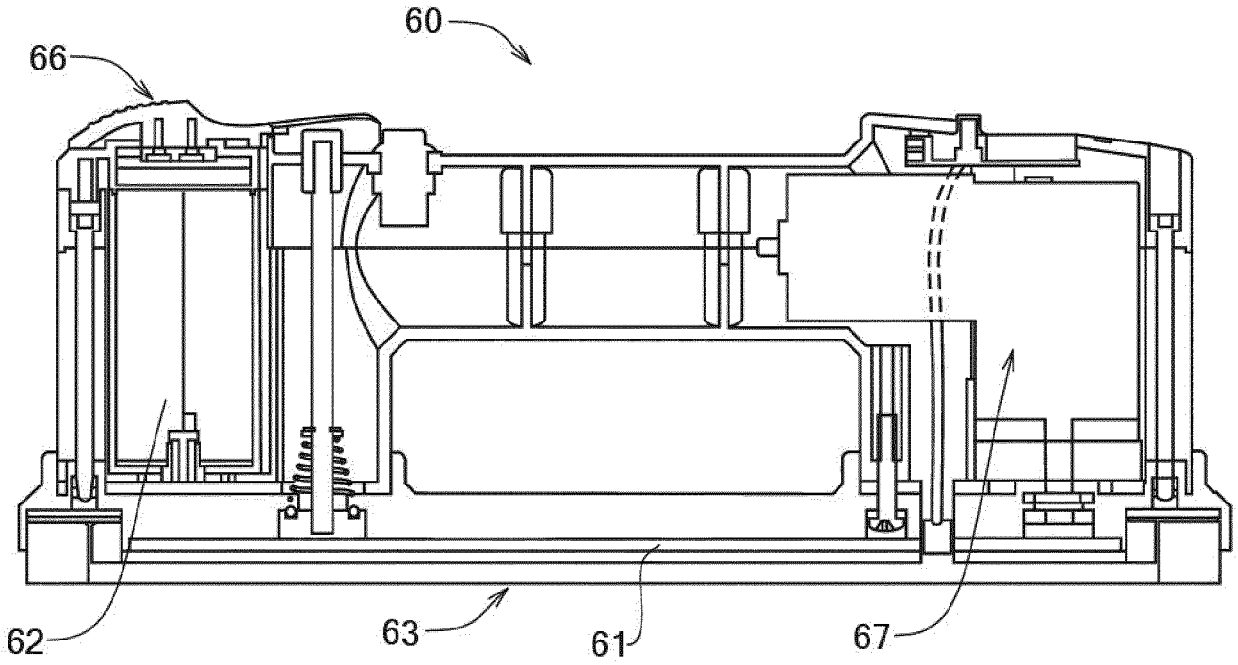

FIG. 13

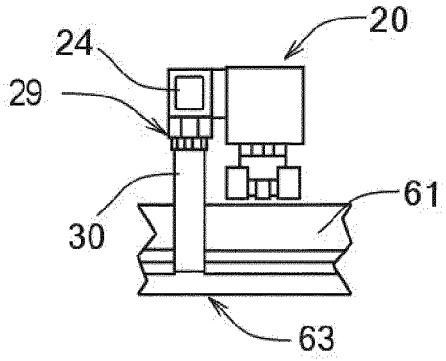

FIG. 14

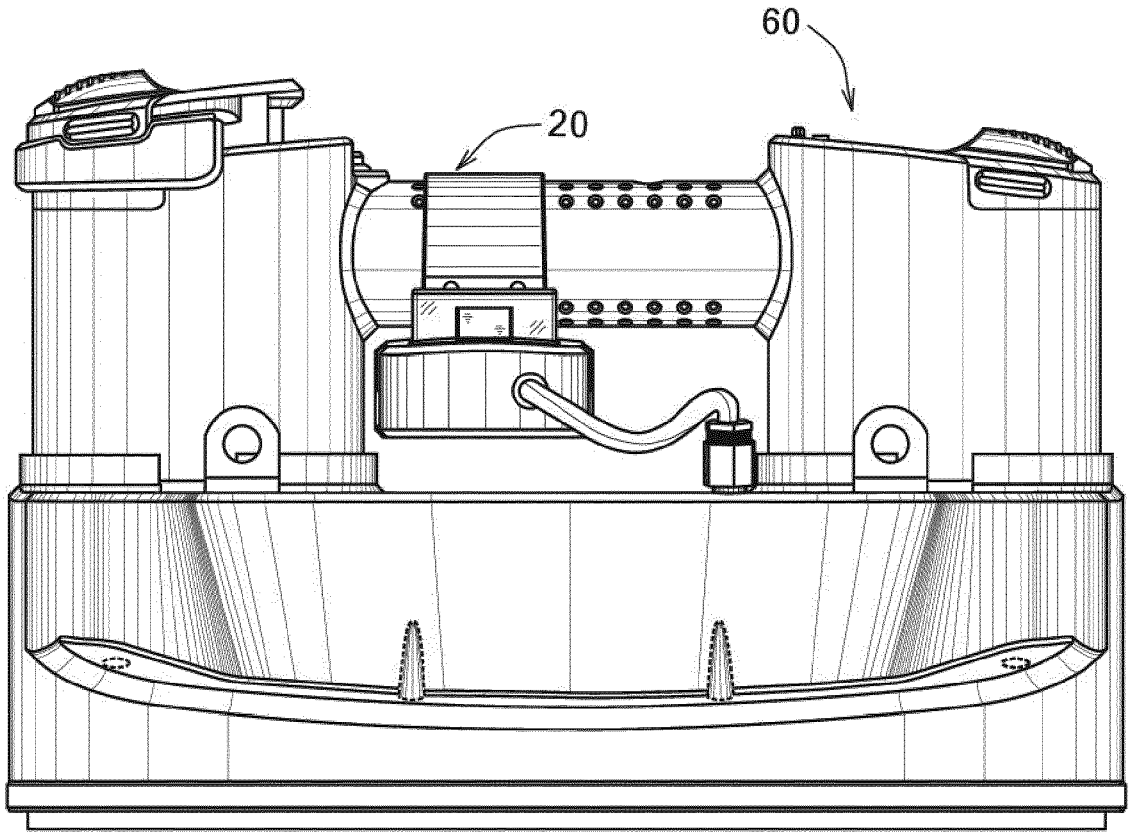

FIG. 15

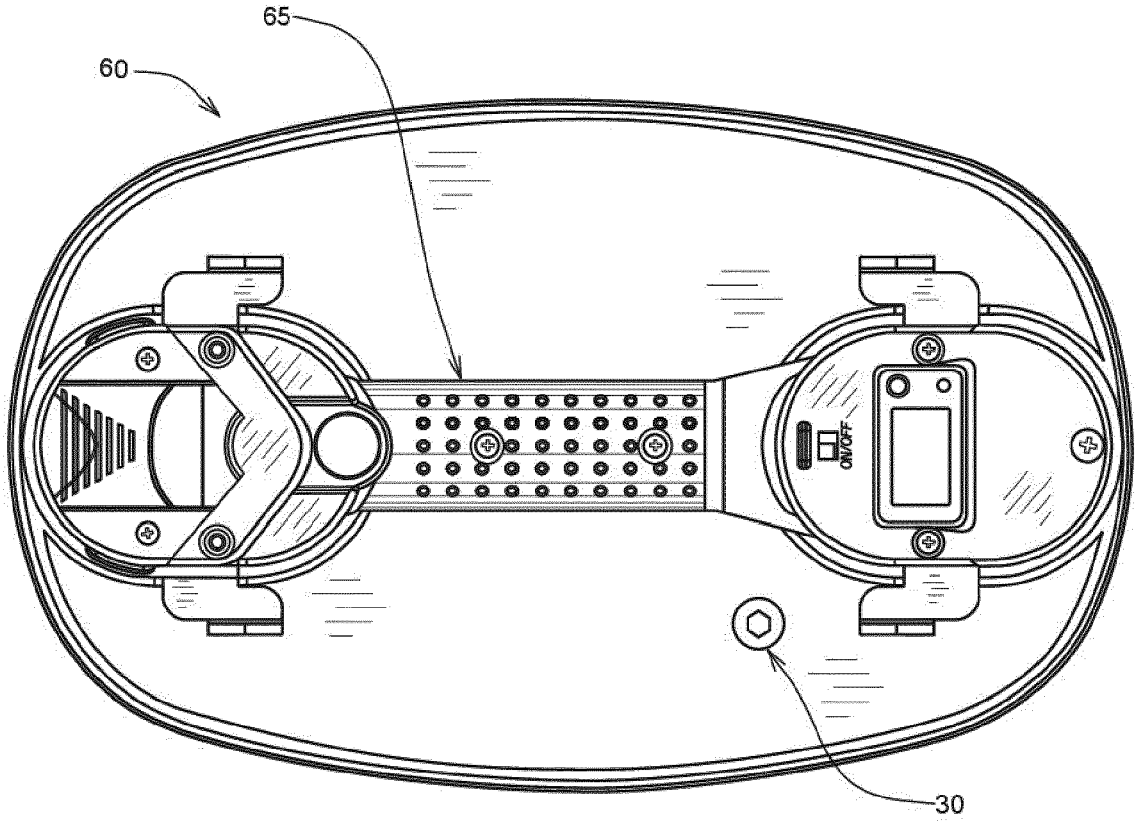

FIG. 16

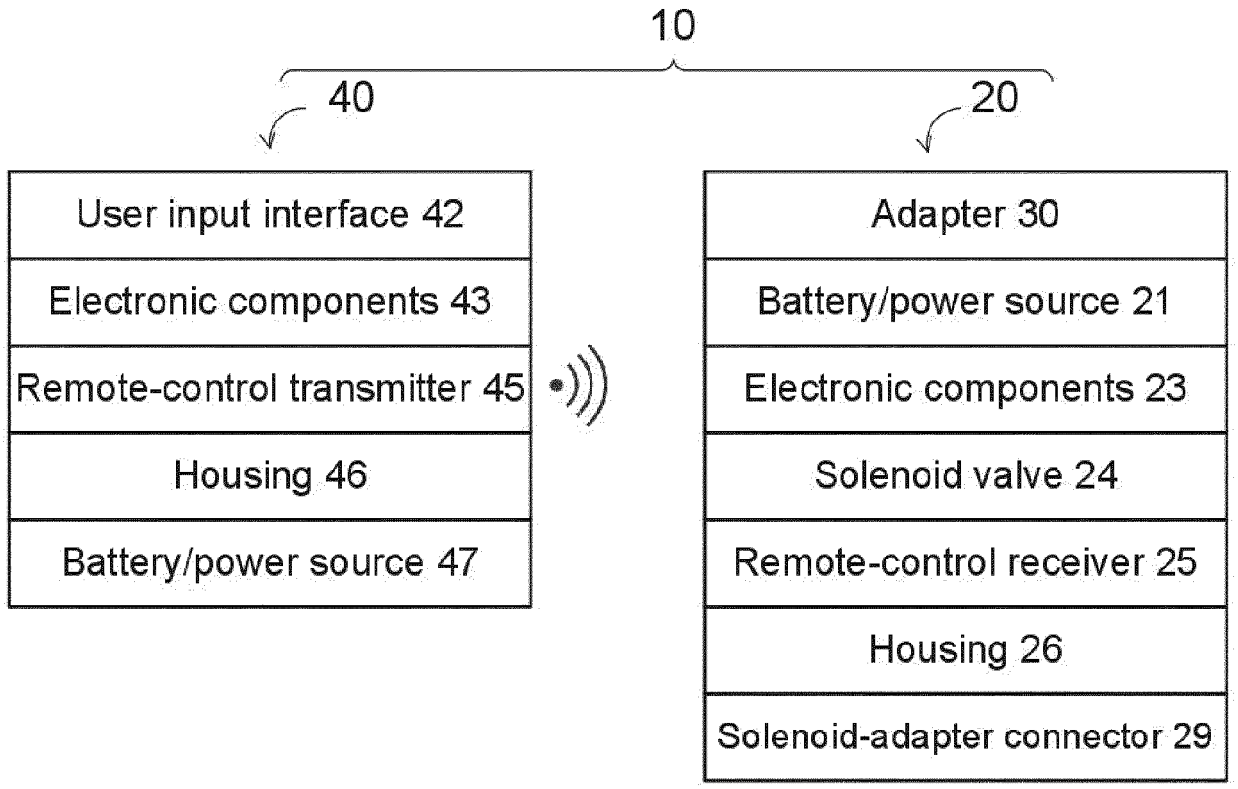
10
40
20
User input interface 42
Electronic components 43
Remote-control transmitter 45
Housing 46
Battery/power source 47
Adapter 30
Battery/power source 21
Electronic components 23
Solenoid valve 24
Remote-control receiver 25
Housing 26
Solenoid-adapter connector 29

FIG. 17

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 21 20 7521

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	DE 101 51 883 A1 (SCHMALZ J GMBH [DE]) 8 May 2003 (2003-05-08) * paragraphs [0023] - [0041]; figures 1,2 * -----	1-9,12, 13,15 10,14	INV. B25B11/00
X	US 2003/038491 A1 (SCHMALZ KURT [DE] ET AL) 27 February 2003 (2003-02-27) * paragraphs [0016] - [0030]; figure 1 * -----	1	
Y	EP 1 775 243 A2 (TRUMPF MASCHINEN AUSTRIA GMBH [AT]) 18 April 2007 (2007-04-18) * paragraphs [0037] - [0056]; figures 1-3 * -----	10,14	
A	US 2019/375604 A1 (KUO PING-YUAN [TW]) 12 December 2019 (2019-12-12) * paragraphs [0047] - [0063]; figures 1-4 * -----	1-15	
A	DE 20 2017 105131 U1 (PROBST GMBH [DE]) 13 September 2017 (2017-09-13) * paragraphs [0027] - [0043]; figures 2,4-8 * -----	1-15	TECHNICAL FIELDS SEARCHED (IPC) B25B
A	DE 10 2010 016244 A1 (WINDEN UND MASCHB GRESBACH GMBH [DE]) 18 August 2011 (2011-08-18) * paragraphs [0032] - [0049]; figures 1-4 * -----	1-15	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 March 2022	Pastramas, Nikolaos

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
.....
& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 21 20 7521

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-03-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 10151883 A1	08-05-2003	NONE	
US 2003038491 A1	27-02-2003	DE 10140248 A1	13-03-2003
		JP 2003103486 A	08-04-2003
		US 2003038491 A1	27-02-2003
EP 1775243 A2	18-04-2007	AT 502563 A1	15-04-2007
		AT 537093 T	15-12-2011
		EP 1775243 A2	18-04-2007
US 2019375604 A1	12-12-2019	JP 6822695 B2	27-01-2021
		JP 2019214117 A	19-12-2019
		TW 202000558 A	01-01-2020
		US 2019375604 A1	12-12-2019
DE 202017105131 U1	13-09-2017	NONE	
DE 102010016244 A1	18-08-2011	DE 102010016244 A1	18-08-2011
		DE 202009004659 U1	19-08-2010

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82