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(71) Applicant: **Rogai, Luca**
50013 Campi Bisenzio (FI) (IT)

(72) Inventor: **Rogai, Luca**
50013 Campi Bisenzio (FI) (IT)

(74) Representative: **Mannucci, Michele et al**
Ufficio Tecnico
Ing. A. Mannucci S.r.l.
Via della Scala, 4
50123 Firenze (IT)

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(54) **PORTABLE DRYING DEVICE FOR PAINTING PLANTS**

(57) Portable drying device to be used in painting plants, able to be positioned close to the part to be dried, comprising

- a load-bearing structure,
- a blower supported by the load-bearing structure,
- at least one nozzle for ejecting operating fluid, having a shape of the type adapted to generate an air blade, operatively connected with said blower,
- at least one pipe adapted to operatively connect said blower to said at least one nozzle,
- at least one articulated arm carrying said nozzle, fixed to said load-bearing structure, said at least one arm being of the self-supporting type, so that said at least one nozzle is maintained in operating position by said arm.

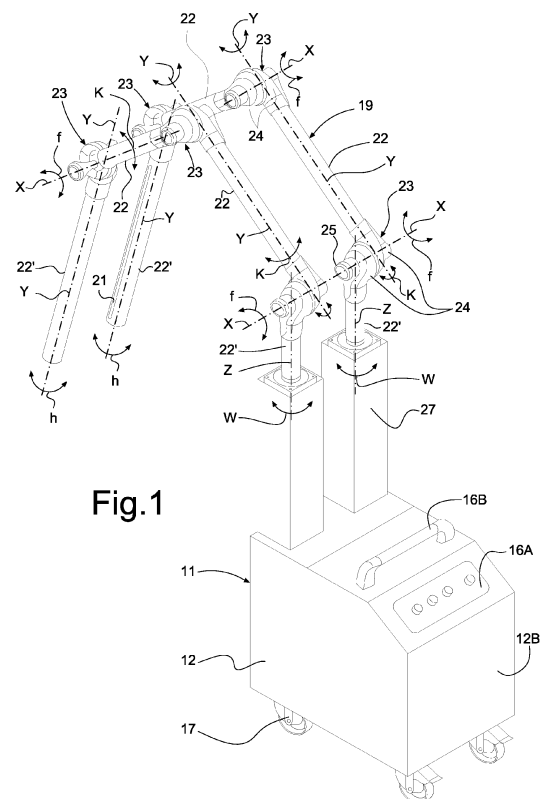


Fig.1

Description

Technical field

[0001] The present invention mainly concerns the field of vehicle painting operations, and more in particular relates to a drying device for painting plants, which uses one or more flows of air or other inert fluid. The same device can be used, according to the invention, to dry or clean types of products other than vehicles, such as to dry, in general on objects, liquids, condensates, galvanic treatments, etc..

Background art

[0002] As is known, vehicle painting plants require booths or drying ovens, in which the vehicle, or a part thereof, are inserted, in order to dry the paint. These booths or ovens are generally heated by electric heating elements.

[0003] In car washing plants, drying devices are known. Those drying devices are very big and static, and they are not adaptable to be used in painting plants. In EP1420985, an example of car washing drying device is shown.

[0004] To speed up drying, the vehicle is subjected to a flow of air generated by large fans.

[0005] When the painted part is small, the flow of air can be generated by a Venturi effect gun connected to a compressor.

[0006] However, neither of the solutions indicated here are optimal.

[0007] In fact, fans are very noisy and create a moderate amount of noise pollution in the area around the paint booth. Moreover, fans create a vortex effect that tends to move any particles of dirt present in the booth toward the painted part, to the detriment of the quality of the paint.

[0008] Instead, guns necessarily require an operator, who must remain for a certain amount of time inside the booth, with all the complications linked to an environment charged with emissions from the paint.

[0009] Moreover, as guns are connected to a compressor, they tend also to convey in the flow of air oil particles associated with compressor lubrication. Therefore, there is the risk of some of these particles coming into contact with the painted surface, compromising uniform distribution of the paint thereon.

[0010] Moreover, if the flow of the gun is not managed correctly by the operator, it can create ripples on the painted surface, due to the flow of air concentrated on this surface.

[0011] Further, the compressors connected to the guns are generally very powerful and energy intensive.

Summary

[0012] Therefore, the object of the present invention is

to solve problems related to the drying of painted parts inside a drying oven.

[0013] In particular, an important object of the present invention is that of producing a drying device, particularly but not exclusively for drying ovens for vehicles or parts thereof, which allows particularly flexible use thereof.

[0014] Yet another important object of the present invention is that of producing a drying device, particularly but not exclusively for drying ovens for vehicles or parts thereof, which allows energy saving with respect to known drying plants.

[0015] Another important object of the present invention is that of producing a drying device, particularly but not exclusively for drying ovens for vehicles or parts thereof, which is silent.

[0016] One more important object of the present invention is that of producing a drying device, particularly but not exclusively for drying ovens for vehicles or parts thereof, which allows drying times to be reduced with respect to known plants.

[0017] Another important object of the present invention is that of producing a drying device, particularly but not exclusively for drying ovens for vehicles or parts thereof, which limits or reduces the possibility of contamination of the painted part being dried.

[0018] One more important object of the present invention is that of producing a drying device, particularly but not exclusively for drying ovens for vehicles or parts thereof, with which painting without surface defects can be achieved.

[0019] These and other objects, which will be more apparent below, are achieved with a portable drying device for painting plants, able to be positioned close to the part to be dried, comprising

- a load-bearing structure,
- a blower supported by the load-bearing structure,
- at least one nozzle for ejecting operating fluid, having a shape of an elongated slot, of the type adapted to generate an air blade, operatively connected with said blower,
- at least one pipe adapted to operatively connect said blower to said at least one nozzle,
- at least one articulated arm carrying said nozzle, fixed to said load-bearing structure, said at least one arm being of the self-supporting type, so that said at least one nozzle is maintained in operating position by said arm.

[0020] This drying device is a portable compact device, able to be positioned inside a drying booth close to the part to be dried without requiring an operator, as the self-supporting arm allows the air ejecting nozzle to be maintained in the area to be dried without requiring any operator, and the air blade shape of the nozzle allow a flow of air that does not cause surface defects to be achieved, at the same time maintaining a high drying power.

[0021] The term "self-supporting" means that the arm-

structure is configured in such a way that, from the fixing area of the arm to the load-bearing structure, the arm develops towards the external ambient without the need of other supports, remaining in the position (or configuration) provided by the operator.

[0022] The device can be used, according to the invention, to dry or clean types of objects other than vehicles, for example to dry, on objects in general, liquids, condensate, galvanic treatments, etc..

[0023] In practice, according to preferred embodiments, the at least one arm is an articulated arm, containing internally the pipe that conveys the drying flow from the blower to the nozzle.

[0024] Elongated slot is meant as a hole that has a size greatly prevalent in width with respect to a small size in height. For example, the width is at least 10 times the height.

[0025] According to preferred embodiments, the blower is a side channel blower (also known as regenerative blower). As is known, the side channel blower is a turbo machine capable, within a single stage, of generating high increases in pressure of the processed fluid. During operation, the impeller of the blower is rotated without sliding contacts with the surrounding parts and therefore does not require lubrication. This avoids problems linked to particles of lubricant connected to the drying air that could compromise the paint.

[0026] According to preferred embodiments, said at least one pipe is produced inside said at least one arm. In this way, the configuration of the device is particularly compact.

[0027] According to preferred embodiments the at least one arm comprises a plurality of tubes connected to one another by sealed hinges, preferably of the type with a single rotation axis. In this way the arm can assume different configurations.

[0028] Preferably, the pipes can rotate around their axis in relation to the hinges to which they are connected. The arm can be positioned in the most advantageous manner with respect to the part to be dried.

[0029] Preferably, the hinges have two sleeve portions, coupled to respective ends of respective tubes, and hinged to one another according to a single rotation axis; preferably the ends of the tubes being rotatable on the respective sleeve portions around the axes of extension of these tubes, i.e., axes orthogonal to the axis of the hinge to which they are connected.

[0030] Preferably, the hinges are of the friction type, i.e., they allow stiffening of the constraint according to requirements, maintaining the tubes in the chosen relative position. Preferably, the hinges comprise rotating knobs adapted to stiffen the parts of which they are composed, regulating the friction effect. In this way, the arm is self-supporting, maintaining the desired operating shape.

[0031] Preferably, the at least one arm comprises an initial tube hinged at the load-bearing structure and adapted to rotate around the axis of extension of this tube.

[0032] Preferably, the at least one arm with the pipe inside, extends from the upper part of the load-bearing structure.

[0033] Preferably, the end part of said arm is in the shape of rectilinear end tube, with one end closed and the opposite end open and connected to the sealed hinge; along one side of the end tube there is produced the aforesaid nozzle in the shape of a slot to define an air blade.

[0034] According to preferred embodiments, there are provided two self-supporting articulated arms with which there are associated respective pipes; preferably said pipes are produced inside the arms. In this way it is possible to dry two parts simultaneously, advantageously two adjacent parts, orientated differently.

[0035] According to preferred embodiments, there is associated with said load-bearing structure a containment case (as an example, of the box-shaped type) of the blower; preferably, the air inlet of the blower is produced on a side of the case.

[0036] Preferably, there are provided wheels for resting on the ground adapted to allow movement of the device.

[0037] According to another aspect, the invention provides for a drying method for drying a surface having to be dried in painting plants by means of a drying device according to one of the preceding claims, said method provides for

- transporting, preferably in a manual way (i.e. without motors), said drying device towards the surface to be dried,
- positioning said drying device close to a portion of the surface to be dried,
- configuring said at least one articulated arm in such a way as to position its relative nozzle to dry said portion of the surface to be dried,
- operating the blower for a time interval.

[0038] Preferably, said drying device comprises two said articulated arms, wherein, after configured the first articulated arm, the second articulated arm is configured in such a way as to position its relative nozzle to dry a portion of the surface to be dried different from the portion dried by the nozzle of the first arm.

Brief description of the drawings

[0039] The invention will be better understood by following the description and accompanying drawings, which illustrate a non-limiting example of embodiment of the invention. More in particular, in the drawing:

- Fig. 1 represents a schematic view of a drying device according to the invention;
- Fig. 2 represents an exploded schematic view of the drying device of Fig. 1.

Detailed description of embodiments

[0040] With reference to the aforesaid figures, a portable drying device for painting plants according to the invention is indicated as a whole with the number 10.

[0041] This device 10 comprises a load-bearing structure 11 with which there is associated a containment case 12 (as an example, of the box-shaped type) for a blower 13. In particular, the blower 13 is a side channel blower.

[0042] The blower 13 is fixed to the base of the load-bearing structure 11 by means of vibration damping supports 14.

[0043] The air inlet 15 of the blower 13 is produced on a side 12A of the case 12.

[0044] On the front 12B of the case 12 there is provided a control panel 16A and a handle 16B.

[0045] With the load-bearing structure 11 there are associated wheels 17 for resting on the ground adapted to allow movement of the device.

[0046] The air inlet 15 is connected to the blower 13 by means of a first duct 18.

[0047] The drying device 10 further comprises a pair of articulated arms 19, inside which there are provided respective pipes 20 that connect the inlet of the blower 13 with respective nozzles 21 for ejecting the drying air toward the area to be dried.

[0048] Each arm 19 is formed by a plurality of tubes 22, in this example with a rectilinear axis, connected to one another by internally hollow sealed hinges 23, of the type with a single rotation axis X (to rotate according to the arrow f).

[0049] Each hinge 23 has two sleeve portions 24, coupled to respective ends of respective tubes 22, and hinged to one another according to the rotation axis X. The hinge 23 is of friction type, and therefore allows stiffening of the rigidity of the hinge, preventing its rotation around X, thus allowing the arm to be self-supporting. Regulation of the rigidity of the hinge, i.e., of the friction, takes place by means of rotation of the knob 25.

[0050] The ends of the tubes 22 are constrained in a sealed manner to the respective sleeve portions 24 by means of a rotational constraint, and therefore can rotate (according to the arrow k) on the respective sleeve portions around the axes Y of extension of the tubes 22, i.e., axes orthogonal to the axis X of the hinge 23 to which they are connected.

[0051] In this way, the arms 19 can assume a varied configuration of extension, so that the nozzles can be positioned in the most advantageous manner on the part to be dried.

[0052] Each arm 19 comprises an initial tube 22', hinged at the load-bearing structure and adapted to rotate around the axis of extension of this tube, in this example a vertical axis Z (to rotate according to the arrow w). In particular, in this example, the initial tube 22' is hinged vertically to a structural duct 27 integral with the case 12, connected to the inlet of the blower 13 by means of sections inlet duct 28A and 28B.

[0053] The end part of each arm 19 is in the form of an end tube 22', preferably rectilinear, with one end closed and the opposite end open and connected to a respective hinge 23 (which allows rotation of the tube around X, according to the arrow f) by means of the rotating seal 29, which allows this end tube also to rotate around its axis of extension Y (to rotate according to the arrow h).

[0054] Along the side of the end tube 22', there is produced an elongated slot 30, preferably parallel to the axis of the end tube 22', which defines an aforesaid nozzle 21 such as to create an "air blade" flow, i.e., a flow of air that has a section of limited height and ample width.

[0055] In the example described here, the blower uses air (optionally filtered by means of a filter) collected in the area of the air inlet 15. In other examples, the suction of the inlet can be connected with an inert gas tank, so as to obtain a controlled flow of gas.

[0056] Operation of the drying device is as follows. Imagine having to dry, for example, the front side panel and the hood of a motor vehicle. The drying device is placed close to the part to be dried. One or two arms are configured to be able to position their nozzle to dry, for example, the side panel of the vehicle, while the second arm is oriented to position the second nozzle to dry the hood.

[0057] The device is activated via the control panel 16A, and operated for the time required.

[0058] In brief, the drying device is movable on small wheels, can be supplied with 3-phase or single-phase power, and has inside a side channel blower. The device is adapted to dry and clean parts, surfaces and paints, by blowing air or inert fluid without oils and condensates, filtered by means of filtration.

[0059] The fluid is distributed on the surface to be treated by means of nozzles with air blade openings. These air blades can be rotated through 360 degrees, and are mounted on arms that can also be oriented through 360 degrees of rotation.

[0060] These arms are self-supporting and can be blocked in the required position by means of a friction system, and have inside a free flow pipe for transporting air (fluid).

[0061] This device is advantageous for drying paints, liquids, condensates and galvanic treatments, reducing conventional drying times by at least four times, and with a treated surface of 2.5/3 sqm per application.

[0062] The advantages of this device are evident:

- It prevents the vortex effect, created by fans, which causes excessive movement of solid particles in the air, also due to the opposed interference of the two blades, which localize the effect only on the treated surface.
- It prevents liquid and oil particles from depositing, as it has no lubrication.
- It prevents the surface ripple effect, as the air blades

act on the product obliquely and at low pressure.

- It does not require the presence of operators in the drying booth during the drying step.
- It greatly reduces the noise level of conventional fans.
- It greatly reduces electricity consumption, making the use of Venturi effect guns, supplied by compressed air compressors with high power and considerable maintenance costs, obsolete.
- It drastically reduces the use of the drying oven, thus eliminating the energy consumption of the heating elements.
- It facilitates movement around the part to be treated due to the limited dimensions and the presence of swiveling and braking wheels.
- It facilitates and simplifies treatment and drying due to the fluid conveying system, which takes place inside the articulated arms that support the air blade nozzles.

[0063] It is understood that the foregoing only represents possible non-limiting embodiments of the invention, which can vary in forms and arrangements without departing from the concept on which the invention is based. Any reference numbers in the appended claims are provided purely to facilitate reading in the light of the foregoing description and of the accompanying drawings and do not in any way limit the scope of protection.

Claims

1. Portable drying device (10) to be used in painting plants, able to be positioned close to the part to be dried, comprising
 - a load-bearing structure (11);
 - a blower (13) supported by the load-bearing structure (11),
 - at least one nozzle (21) for ejecting operating fluid, having a shape of the type adapted to generate an air blade, operatively connected with said blower (13),
 - at least one pipe (20) adapted to operatively connect said blower (13) to said at least one nozzle (21),
 - at least one articulated arm (19) carrying said nozzle (21), fixed to said load-bearing structure (11), said at least one arm (19) being of the self-supporting type, so that said at least one nozzle (21) is maintained in operating position by said arm (19).

2. Drying device according to claim 1, wherein a containment (12) case of said blower (13) is associated with said load-bearing structure (11), said blower (13) being a side channel blower, said at least one pipe (20) being produced inside said at least one arm (19), said at least one arm (19) comprising a plurality of tubes (22) connected to one another by sealed hinges (23).
3. Drying device according to claim 1, wherein said blower (13) is a side channel blower.
4. Drying device according to claim 1 or 3, wherein said at least one pipe (20) is produced inside said at least one arm (19).
5. Drying device according to claim 4, wherein said at least one arm (19) comprises a plurality of tubes (22) connected to one another by sealed hinges (23), preferably of the type with a single rotation axis.
6. Drying device according to claim 5, wherein said hinges (23) have two sleeve portions (24), coupled to respective ends of respective tubes (22), and hinged to one another according to a single rotation axis; preferably said ends of said tubes (22) being rotatable on the respective sleeve portions (24) around the axes of extension of these tubes (22), i.e., axes orthogonal to the axis of the hinge (23) to which they are connected.
7. Drying device according to claim 5 or 6, wherein said at least one arm (19) comprises an initial tube (22') hinged at said load-bearing structure (11) and adapted to rotate around the axis of extension of this tube.
8. Drying device according to one or more of claims 5 to 7, wherein the end part of said arm (19) is in the form of a rectilinear end tube, with one end closed and the opposite end open and connected to said sealed hinge (23), along one side of said end tube there being produced said nozzle (21) in the shape of a slot to define an air blade.
9. Drying device according to one or more of the claims 3 to 8, wherein said at least one arm (19) with said pipe (20) inside extends from the upper part of said load-bearing structure (11).
10. Drying device according to one or more of claims 3 to 9, wherein there are provided two of said self-supporting articulated arms (19) with which there are associated respective said pipes (20), preferably said pipes (20) being produced inside said arms (19).
11. Drying device according to one or more of the claims 3 to 10, wherein there is associated with said load-bearing structure (11) a containment case (12) of

said blower (13); preferably, the air inlet (15) of said blower (13) is provided on a side of said case; preferably the device (10) is provided with wheels (17) for resting on the ground adapted to allow movement of the device.

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- 12.** Drying method for drying a surface having to be dried in painting plants by means of a drying device (10) according to one of the preceding claims, said method provides for

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- transporting said drying device (10) towards the surface to be dried,
- positioning said drying device close to a portion of the surface to be dried,
- configuring said at least one articulated arm (19) in such a way as to position its relative nozzle (21) to dry said portion of the surface to be dried,
- operating the blower (13) for a time interval.

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- 13.** Drying method according to claim 12, wherein said drying device comprises two said articulated arms (19), wherein, after configured the first articulated arm, the second articulated arm is configured in such a way as to position its relative nozzle to dry a portion of the surface to be dried different from the portion dried by the nozzle of the first arm.

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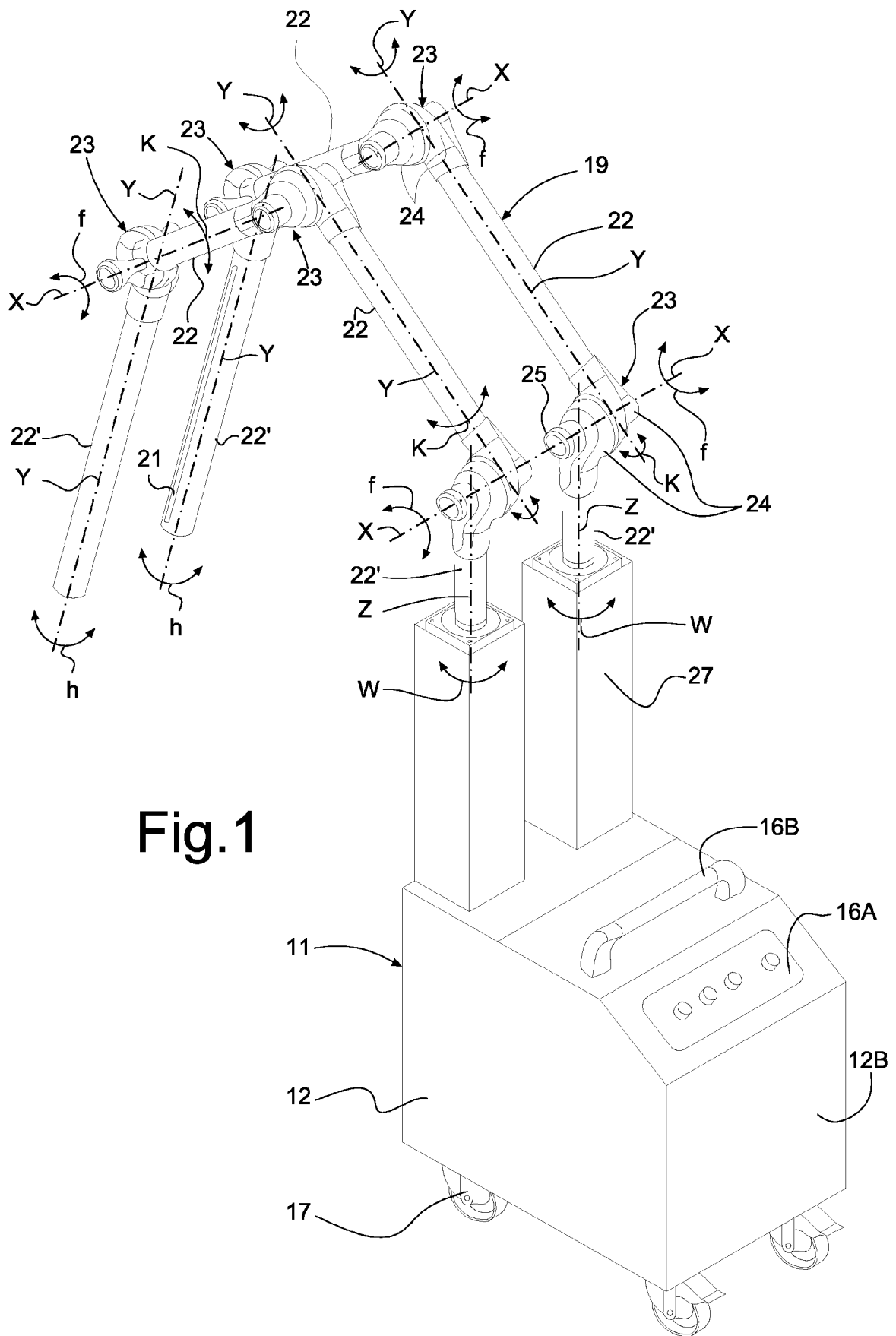
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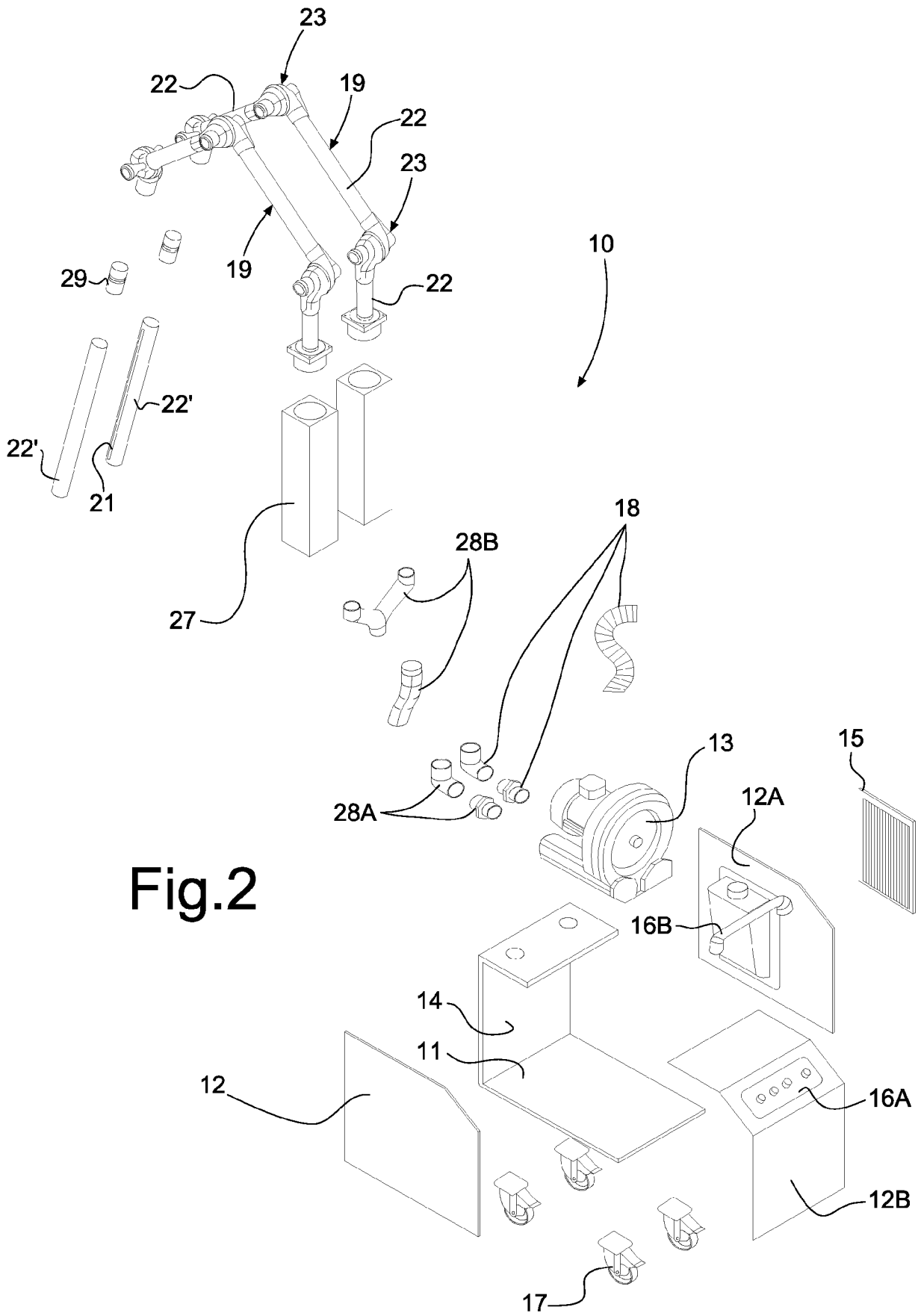


Fig.2



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Application Number
EP 20 19 0229

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Place of search The Hague		Date of completion of the search 30 October 2020	Examiner Makúch, Milan
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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