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(54) **Dryer device for car body paints**

(57) Device (1) for drying paint applied on a body (4), comprising at least one support frame (2) carrying one or more infrared-ray emission units (3) directed against

the said body (4) on which the paint is applied, and at least one group (5) for the movement of said frame (2) around at least part of said body (4).

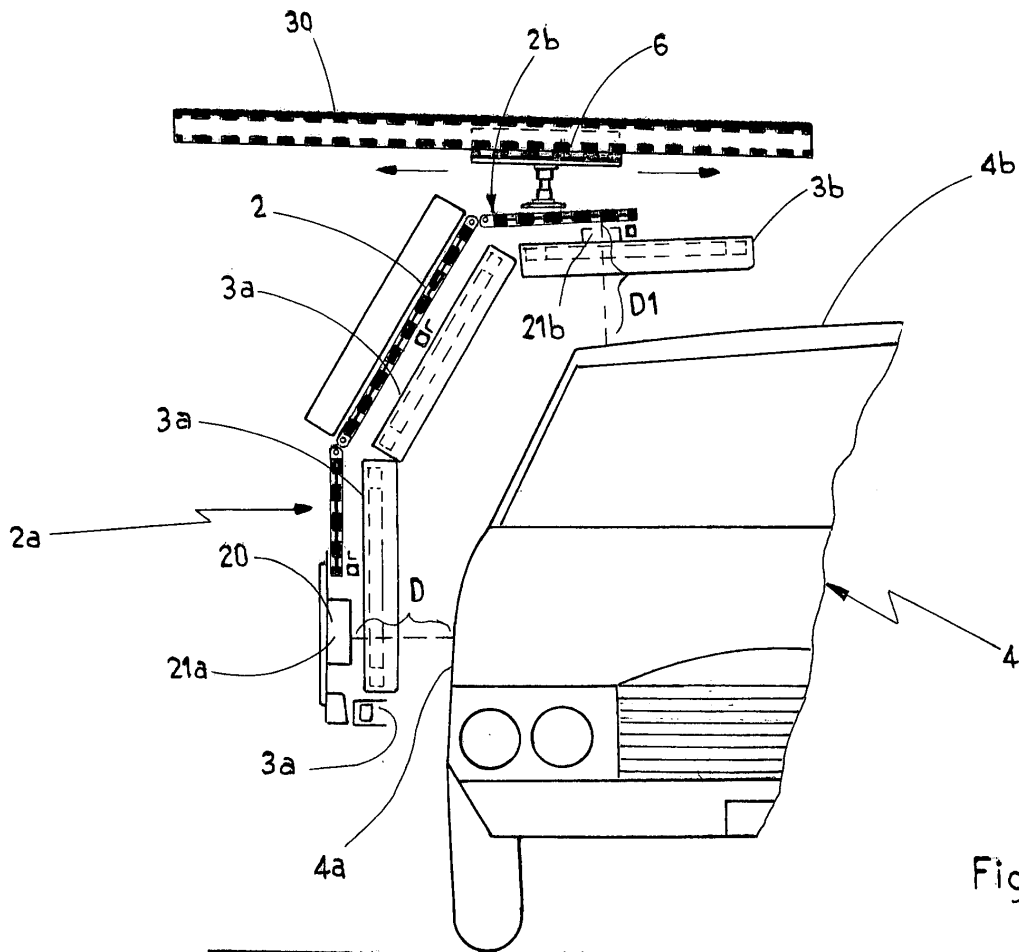


Fig. 5

## Description

**[0001]** The present invention relates to a device for drying paint. In particular, the device is used preferably for drying paint - particularly water-based paint - applied to bodies, preferably metal, such as, for instance, the body of a vehicle (e.g. a car) or similar. Furthermore, the device according to the invention can be adapted to work both in preparation and/or rubbing areas for vehicle bodywork, and inside painting chambers. As will become clear to those skilled in the art, although the generic body on which the paint is applied in what follows is understood to be a vehicle body, different bodies, for instance, furniture, decorative objects, etc., both in metal and in plastic, could equally be cited without leaving for this reason the scope of protection of the present invention.

**[0002]** Devices are known which dry paint applied on a vehicle, by the use of one or more units for the emission of infrared rays directed against the same surface of the vehicle. Normally such devices are of the tunnel type, or rather arch-shaped, with an extension equal to, or longer than, the length of the vehicle or the body on which the paint is applied. Such devices are thus able to contain within their own interior any body to subject it to the drying phase, once paint has been applied.

**[0003]** In US 5282145 a drying tunnel device and related method for drying paint applied on the body of a vehicle is described, that comprises a set of panels for the emission of infrared rays located both alongside and above the vehicle, thus forming a drying tunnel. These panels operate on the basis of various information preset by the operator. In fact, besides being able to choose which of the panels constituting the tunnel to operate when only a limited portion of the body of the vehicle is being painted, the operator can set, on the basis of the type and color of the paint, the maximum temperature that can be reached by the surface of the vehicle. Such parameters are controlled by the use of an optic pyrometer, which, on the basis of the information that it receives from the surface of the body of the vehicle, controls the infrared emission power of the panels. Furthermore, the device includes means of ventilating the tunnel during the phases of operation of the panels for the emission of infrared rays, to speed up the paint drying process.

**[0004]** Such types of drying devices, although able to fulfill their appointed function of speeding up the drying process without damaging either the body, or to the applied paint - which must polymerize according to suitable times and methods - are not without drawbacks.

**[0005]** In fact, drying devices are rather bulky and don't allow the phases of painting of the body and drying of the same to be carried out in the same work area. Furthermore, not all portions of the surfaces of the body can be reached with the necessary precision, except by suitably fine-tuning the power of the infrared unit. For example, the bonnet of the vehicle or all the surfaces located on the upper part of the vehicle and are not at the same distance from the infrared emission unit.

**[0006]** Furthermore, it should be noted that the means of controlling the power of the infrared rays, normally an optic pyrometer, has a rather slow dynamic response and therefore aren't able to detect quickly sudden variations in temperature of the surface of a body; neither can it measure correctly the temperature of the surface of a vehicle in movement relative to the measuring device.

**[0007]** For such reasons, it is not possible to set up a drying tunnel in movement along the automobile, or vice versa, even if it was wanted to dedicate a single operational zone first to the painting and, subsequently, to drying the paint applied on the vehicle.

**[0008]** The purpose of the present invention is to produce a device for drying paint that is structurally simple and not cumbersome from a dimensional point of view and is furthermore able to produce in a controlled and automated way drying of the paint applied on a body, in particular, of a vehicle. A further purpose of the invention is to allow both the painting and drying of the paint applied on a body in the same operational work area.

**[0009]** Again, a purpose of the present invention is to allow the regulation of the power of emission of infrared rays against the painted surface of a body, both when the device is stationary in front of the surface of the body to be heated, and during the movement of the drying device and vehicle relative to each other.

**[0010]** These and other purposes are achieved by the present invention for drying paint applied on a body, preferably a vehicle, comprising at least one support frame carrying one or more units for the emission of infrared rays directed against the said body on which the paint is applied, and at least one group for moving said frame around at least part of said body.

**[0011]** According to a particular aspect of the invention, the said group includes a trolley to which said frame is fixed, and at least one first guide rail along which said trolley runs to move said frame around at least part of said body on which the paint is applied.

**[0012]** The first guide rail could be for instance, a closed ring and so allow the frame to reach all the external surfaces of the body on which the paint is applied.

**[0013]** Furthermore, the first guide rail is able to move along at least one second guide rail located orthogonally to the first. In this case the two guide rails are linear and located in orthogonal positions.

**[0014]** The frame, preferably in the form of semi-arch, is fixed in a rotatable way to the said trolley and can rotate 180° clockwise and 180° anti-clockwise relative to the latter.

**[0015]** According to a further embodiment, the group can include a third guide rail along which the said second guide rail runs to guarantee the movement of the frame in a vertical sense.

**[0016]** According to a particular aspect of the invention, the group for the movement of the frame, as well as the frame itself are located above the body on which the paint is applied. In this way, due to the three guide rails and the trolley, the frame can be moved around the vehicle

to cover, in practice, all the possible external surfaces of the body.

**[0017]** With the purpose of guaranteeing automated movement of the frame around the body, the device comprises one or more electric motors to move on command the frame in rotation in relation to the trolley, the trolley along the first guide rail or the second guide rail along the third guide rail.

**[0018]** According to a particular aspect of the invention the device includes means of controlling the distance between said frame and said body on which the paint is applied.

**[0019]** Such means includes at least one device for the transmission and reception of ultrasound, and/or of frequency-modulated electromagnetic signals directed against the body on which the paint is applied, and selected respectively from sonars and/or radars.

**[0020]** In this way, during the movement of the frame around at least part of said body not only any collision is prevented between the frame and the body, but the distance between the frame and the body can be controlled with extreme precision so as to be maintained constant during the operation of the device.

**[0021]** The number of transmission/reception devices is three, of which, two are fixed to the lower portion of the frame, and directed against the body to be heated, in such a way as to allow the frame, during its movement, to avoid collision with the external surface of the same body, and one fitted to the upper portion of the frame to monitor the distance from the upper portions of the body on which the paint is applied by the frame.

**[0022]** According to a particular form of the invention, the two transmission/reception devices are located orthogonally to the third device fitted on the upper portion of the frame, in such a way as to control both the lateral and vertical distance variations between frame and body. In the case of vehicles, in fact, the control of the power of emission of the infrared rays is particularly difficult and critical when the distance between the roof and the bonnet of the vehicle has to be measured without risking reaching an unsuitable temperature for drying the paint, or spoiling the bodywork, or using excessive time for drying the same paint.

**[0023]** Furthermore, the drying device includes at least one data processing unit that controls the power of emission of said infrared rays according to the distance detected by the said transmission/reception devices, as well as on the basis of the color and/or of the type of paint applied. Furthermore, the said data processing unit controls the movement of the said frame around at least part of said body based on the dimensions of the body.

**[0024]** Advantageously, from what has been already stated, the paint can be applied on the body in the same operational work area in which it is dried. Subsequently, the frame is positioned in a controlled way, either manually or in automatically, in proximity of the body on which the paint is applied in such a way that the infrared ray emission units are directed against the said body. Finally,

the means are operated for controlling the distance between the said frame and the said body so that the frame can be moved around the body, or to at least part of it, without bumping into it. Finally, according to a particular aspect of the invention, the distance between the body and the frame can be pre-set by the operator so that the frame is maintained at the same distance from the body for the whole period of operation. The same power of emission of the infrared rays is controlled based on the color and/or the type of paint applied and/or the dimensions of the body and/or of the distance between the body and the said frame.

**[0025]** The Applicant, furthermore, has found by experiment that the transmission/reception device used for the measurement of the distance between the frame and the body on which the paint is applied, for example, a sonar type device, can also be used advantageously, for instance, inside the aforementioned drying tunnels. In fact, bodies of different lengths and widths are introduced into such drying tunnels and therefore the power of emission of the infrared rays always has to be suitably controlled for the purpose of achieving perfect drying of the paint. In these drying tunnels the sonar, directed against the surface on which the paint is applied, detects the distance from the body and on the basis of such information it controls the power of the infrared emission.

**[0026]** Some particular embodiments of the present invention will now be described, by way of illustration only and not limiting, with reference to the attached drawings, in which:

Figure 1 is a view in perspective of the frame carrying one or more units for the emission of infrared rays, fixed to a first guide rail;

Figure 2 is a view in perspective of the device of figure 1, fixed to a second guide rail;

Figure 3 is a view in perspective of the device of figure 1, fixed to a third guide rail;

Figure 4 is a side view of the device of Figure 2;

Figure 5 is a frontal view of the device according to the invention.

**[0027]** With particular reference to such figures the generic device for drying paint, according to the invention is indicated by 1.

**[0028]** The device 1 includes a support frame 2, substantially shaped as a semi-arch, carrying four infrared-ray emission units 3 directed against the said body 4, represented here by a vehicle, on which the paint is applied and at least one group 5 for moving said frame 2 around at least part of the vehicle 4.

**[0029]** The group 5 includes a trolley 6 to which said support frame 2 is fixed in a rotatable way, a first guide rail 30 along which the trolley 6 runs, and a second guide rail 7 along which the first guide rail runs, to move the frame 2 around the vehicle 4 on which the paint is applied. It should be noted that such embodiment, although preferred, can be alternatively replaced by an embodiment

(not shown here) that provides for only one guide rail 30, substantially in the form of a ring, that allows the frame 2 to occupy the operational work area 100 and to turn around the vehicle 4 to cover all the surfaces of the body 4 that are potentially paintable.

**[0030]** According to the preferred form of realization the first guide rail 30 translates along the second guide rail 7, that is set orthogonally to the first guide rail 30, in a plane 8 substantially parallel to the support surface 9 for said vehicle 4. The same frame 2 is carried by the trolley 6 and by the first guide rail 3 around the vehicle 4. Furthermore, as already described above, the frame 2 is provided with a further degree of freedom: in fact it is fixed rotatably with respect to the trolley 3 around a pivot 60, in such a way as to effect a rotation of 360° about itself, and in particular 180° clockwise and 180° anti-clockwise.

**[0031]** The semi-arch form of the frame is particularly advantageous because the infrared emission units 3, for instance infrared lamps that are controlled by a train of impulses, are positioned on the frame 2 so as to be able to cover both the upper portion 4b of the vehicle 4 and the side portion 4a of the vehicle 4.

**[0032]** According to a further embodiment of the invention, the second guide rail 7 moves along a third guide rail 13 located vertically. In this way, the frame 3 is also allowed to move vertically, in the case for instance, of particularly low bodies 4 to be dried.

**[0033]** In practice, therefore, the group 5 and the frame 2 are preferably located above the said body 4, and the frame 2 rotates not only about itself, but according to the embodiment selected, can slide (i.e. run) in a plane 8 substantially parallel to the support surface 9 of the body 4, or also along a vertical plane 120.

**[0034]** With the purpose of guaranteeing automated movement of the frame 2 around the body 4, the device 1 comprises one or more electric motor (not shown here) to move on command the frame 2 in rotation with respect to the trolley 6, the trolley 6 along the first guide rail 30 or the second guide rail 7 along the third guide rail 13.

**[0035]** According to a particular aspect of the invention the device includes means 20 of controlling the distance D between said frame 2 and said body 4 on which the paint is applied.

**[0036]** Such means 20 of controlling the distance comprises a plurality of devices 21 for the transmission and reception of a frequency-modulated acoustic signal, directed against the body 4 on which the paint is applied. Such transmission/reception devices 21 are either sonar or radar.

**[0037]** In this way, during the movement of the frame 2 around at least part of said body 4, not only is collision between frame 2 and body 4 prevented, but the distance D between frame 2 and body 4 can be controlled with extreme precision, for instance maintaining such distance D constant during the whole period of operation of the device 1. This obviously offers the possibility of controlling the power of the infrared-ray emission units 3,

that so they operate within power range that are chosen on the basis of the distance of the frame 2 from the body 4.

**[0038]** According to the embodiment shown here, the number of the of transmission/ reception devices 21 is at least three. Two 21 a of these three devices 21 are mounted on the lower portion 2a of the frame 2, and directed against the body to be heated, to prevent the frame 2 bumping into the external surface 4a of the body 4 during its movement around the same body 4, and one 21 b is mounted on the upper portion 2b of the frame 2, to monitor the distance D1 of the upper portions 4b of the body 4 from the frame 2. The first two devices of transmission/reception 21a (only one shown) are also used to control the power of emission of the infrared units 3a that are located corresponding to the side portion 2a of the frame 2, while the transmission/reception device 21 b is used for controlling the power of emission of the infrared units 3b located facing out on the upper portion 2b of the frame 2. Furthermore, the first two transmission/reception devices 21 a can also be used advantageously to maintain the same distance D between the frame 2 and the body 4.

**[0039]** According to a particular form of the invention shown here, the two transmission/reception devices 21 a are substantially located in orthogonal position with respect to the third device 21 b, that is mounted on the upper portion 2b of the frame 2, in such a way as to control both the lateral (D) and the vertical (D1) distance variations between frame 2 and body 4. In the case of vehicles, in fact, the modulation of the infrared-ray emission power is particularly difficult and critical when the distance between the top and the bonnet of the vehicle has to be measured without risking reaching an unsuitable temperature for drying the paint, or spoiling the bodywork, or using excessive time for drying the same paint.

**[0040]** It should be mentioned that the four infrared-ray emission units 3 are each controlled independently of the others as has already been described above; by increasing the number of transmission/reception devices 21 in this way it is possible to get a more precise control of the process of drying the paint applied on any point of the body 4.

**[0041]** The Applicant has, furthermore, also found by experimenting that the transmission/reception device 21 for measuring the distance D between the frame 2 and the body 4, and the sonar in particular, can also be advantageously used inside the already cited drying tunnels by directing it against the body 4 on which the paint is applied. In fact, in this case the control of the power of emission of the infrared rays is effected based on the distance detected by the transmission/reception device 21, rather than based on the temperature detected by the optic pyrometer.

**[0042]** Furthermore, the device 1 includes at least one information (i.e. data) processing unit 200 that as well as controlling the power of emission of said infrared rays on the basis of the distance D and/or D1 detected by the said transmission/reception devices 21, also modulates

it as a function of the color and/or the type of paint applied.

**[0043]** Furthermore, the said data processing unit 200 controls the movement of the said frame 2 around at least part of said body based on the dimensions of the body pre-set by the operator during the positioning of the frame 2 in proximity of the body 4.

**[0044]** Advantageously, from what has been already stated, the paint can be applied on the body 4 in the same operational zone 100 in which it will be dried. Furthermore, the frame 2 is positioned in proximity of the body 4 on which the paint is applied in a controlled way, either manually or automatically, so that the infrared-ray emission units 3 are directed against the said body 4.

**[0045]** Finally, the means 20 for the control of the distance D and D1 between the said frame 2 and the said body 4 are operated by the operator so as to put the frame 2 in movement around the body, or to at least part of it, without bumping into the same body.

**[0046]** The distance D between the body 4 and the frame 2 can be pre-set by the operator so that the frame 2 is maintained at the same distance D from the body 2 for the whole period of operation. The same power of emission of the infrared rays is based on the color and/or the type of paint applied and/or of the distance between the body and the said frame 2.

#### Claims

1. Device (1) for drying paint applied on a body (4), comprising at least one support frame (2) carrying one or more units (3) for the emission of infrared rays directed against the said body (4) on which the paint is applied, and at least one group (5) for the movement of said frame (2) around at least part of said body (4).
2. Device according to Claim 1, **characterized by** said group (5) comprising a trolley (6) to which said frame (2) is fixed, and at least one first guide rail (30) along which said trolley (6) runs to move said frame (2) around at least part of said body (4) on which the paint is applied.
3. Device according to Claim 2, **characterized by** said at least one first guide rail translating along at least one second guide rail.
4. Device according to Claim 3, **characterized by** said first guide rail being located orthogonally to said second guide rail.
5. Device according to Claims from 2 to 4, **characterized by** said frame being fixed in a rotatable way with respect to said trolley.
6. Device according to Claim 5, **characterized by** said frame rotating 180° clockwise and 180° anti-clockwise.
7. Device according to Claims from 2 to 6, **characterized by** said frame being semi-arch in form.
8. Device according to Claims from 3 to 7, **characterized by** said second guide rail moving along a vertically-located third guide rail.
9. Device according to Claims from 2 to 8, **characterized by** said group for the movement and said frame being located above said body.
10. Device according to Claims from 2 to 11, **characterized by** said group for the movement comprising one or more electric motors serving to move said frame, said trolley and/or said first guide rail and/or said second guide rail on command.
11. Device according to any of the preceding Claims, **characterized by** comprising means of controlling the distance between said frame and said body on which the paint is applied.
12. Device according to Claim 11, **characterized by** said means comprising at least one device for the transmission and reception of an ultrasound signal electromagnetic and/or modulated in frequency, directed against the body on which the paint is applied.
13. Device according to Claim 12, **characterized by** said at least one transmission/reception device being either a sonar or a radar.
14. Device according to Claims from 11 to 13, **characterized by** comprising at least one first transmission/reception device located on the lower portion of the said frame and at least one transmission/reception device located on the upper portion of said support frame, respectively directed against at least one side portion and at least one upper portion of the said body on which the paint is applied.
15. Device according to Claim 14, **characterized by** said at least first transmission/reception device and said at least second transmission/reception device being located in mutually orthogonal positions.
16. Device according to Claims from 11 to 15, **characterized by** comprising at least one data processing unit connected functionally to said at least one transmission/reception device.
17. Device according to Claim 16, **characterized by** said at least one data processing unit controlling the power of emission of said infrared rays according to the distance detected by said means of controlling the distance

18. Device according to Claim 17, **characterized by** said at least one control unit modulating the power of emission of said infrared rays according to the color and/or to the type of paint applied. 5
19. Device according to Claim 17 and 18, **characterized by** said at least one data processing unit controlling the run of the said frame around at least part of said body as a function of the dimensions of said body detected by said at least one transmission/reception device. 10
20. Device according to one any of the preceding claims, **characterized by** said body on which the paint is applied being a vehicle. 15
21. Method for drying paint applied on a body, by a device according to Claims from 1 to 20, comprising the phase of positioning the said frame in a controlled way in correspondence of the said body on which the paint is applied and of directing the said one or more units for the emission of infrared rays against the said body, **characterized by** operating said means for the control of the distance between the said frame and the said body and by moving said frame in a controlled way around at least part of said body on which the paint is applied. 20  
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22. Method according to Claim 21, **characterized by** the distance between said frame and said body being maintained constant during the movement of said frame around at least part of said body. 30
23. Method according to Claims 21 and 22, **characterized by** the power of emission of the infrared rays being controlled based on the color and/or of the type of paint applied and/or of the distance between the body and the said frame. 35
24. Method according to Claims from 21 to 23, **characterized by** said frame being moved around said body. 40
25. Use of a transmission/reception device for measuring the distance between an infrared device for drying paint applied on a body and the same body. 45

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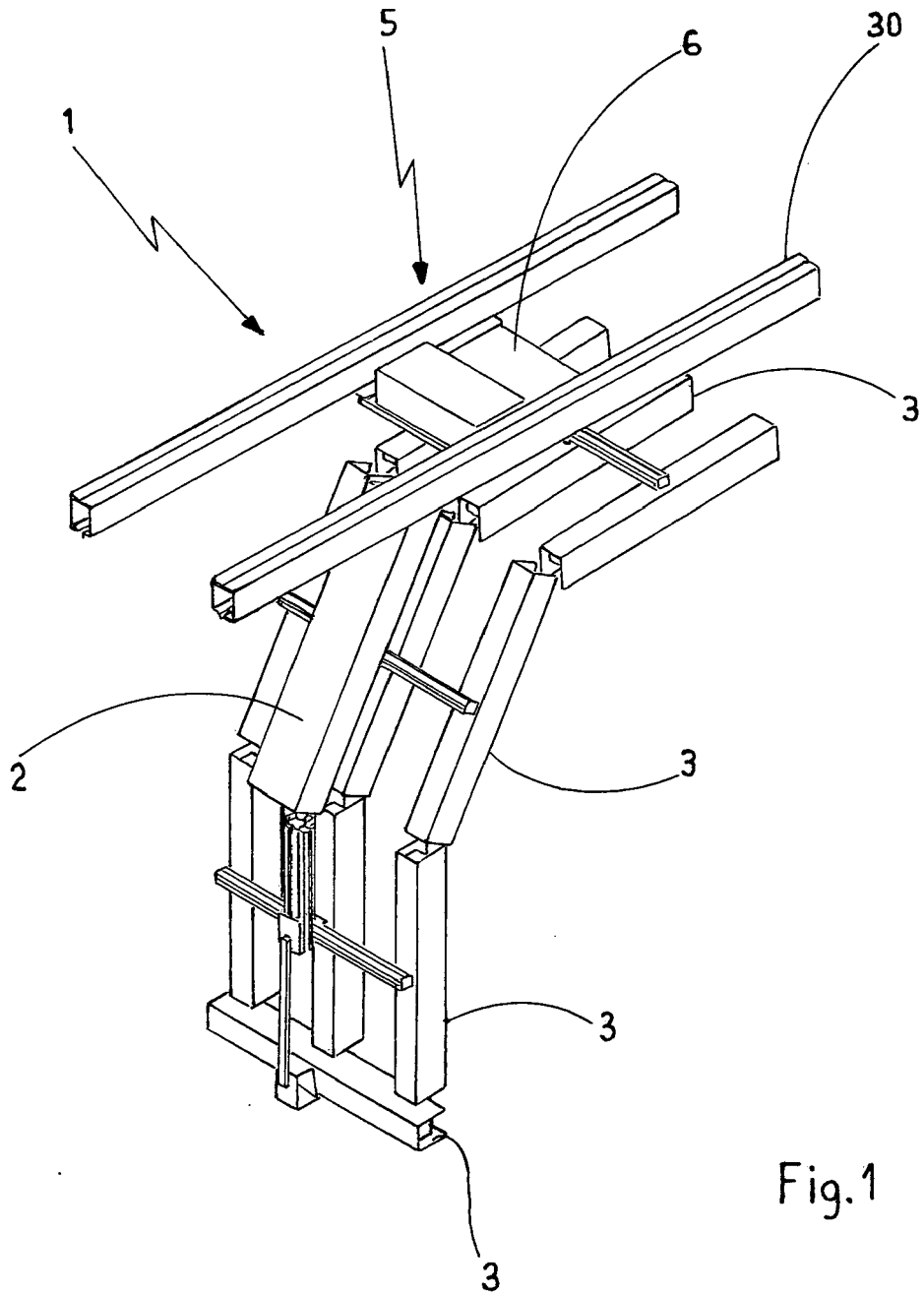


Fig.1

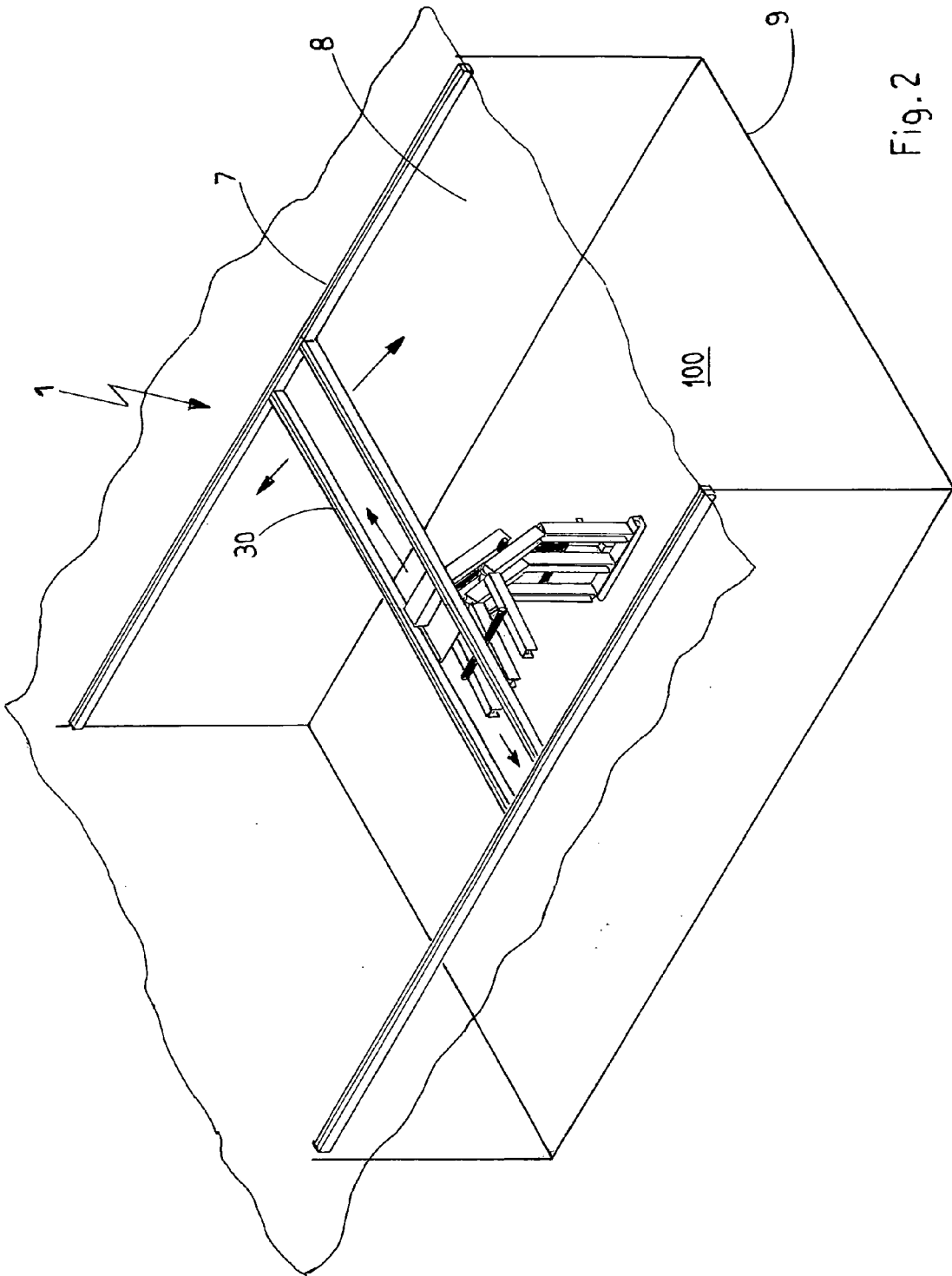


Fig. 2

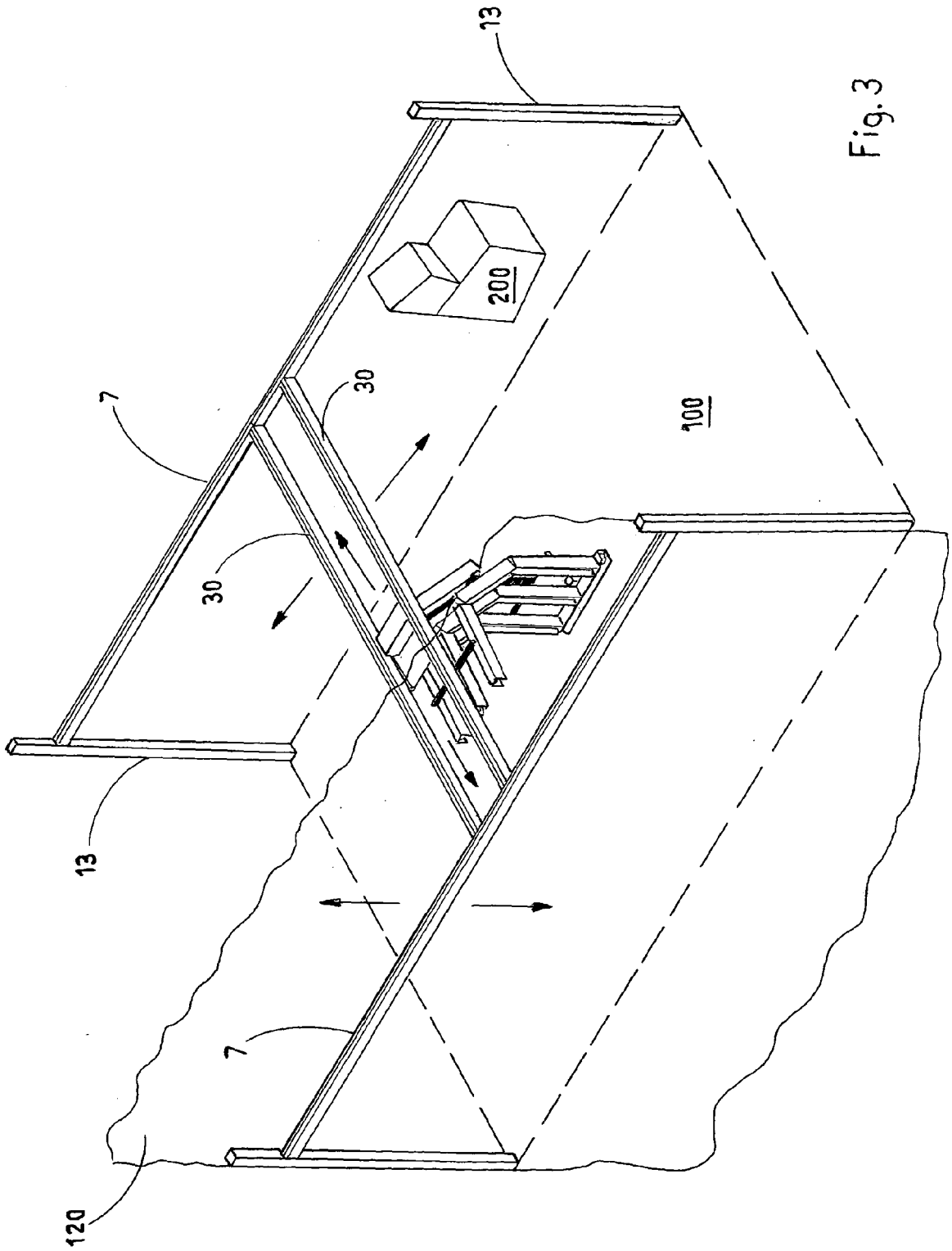


Fig. 3







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EPO FORM 1503 03/02 (P04C01)



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ANNEX TO THE EUROPEAN SEARCH REPORT  
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The members are as contained in the European Patent Office EDP file on  
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