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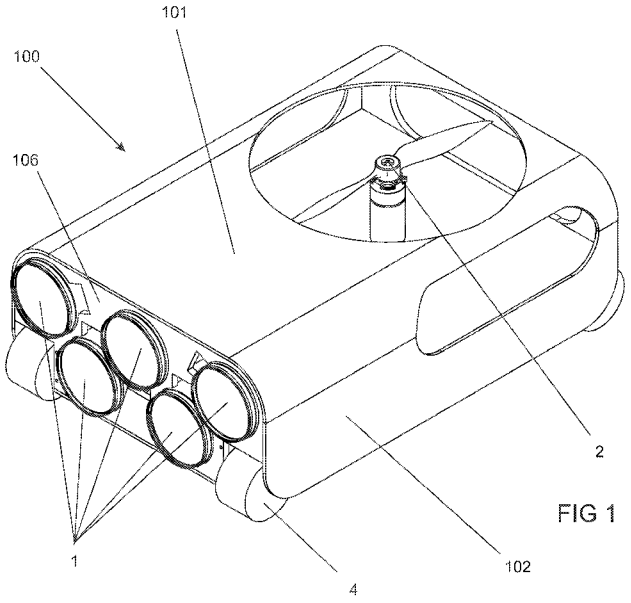

FIG 1

(57) Abstract: A mural printer (100) for printing images to upright or vertical surfaces comprises a housing forming a main frame of the mural printer where is arranged printing head (3) with nozzle unit (31) connected with wires to an electronic block (11) for controlling the mural printer printing process. Inside the housing are arranged paint reservoirs (1) connected with tubes to the printing head (3). The mural printer is equipped with means (2) to create pressure of the mural printer against the upright surface. The printing head comprises feed plate to which are connected tubes directing paint from reservoir, nozzle plate and electromagnetic valves arranged between plates.

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A mural printer and method of printing thereof

Technical field

The present invention is related with printers for printing decoration in large areas, in particular the invention is mural decoration or mural printer for painting or other work of art directly on a wall or large surface, for example exterior wall of the house or skyscraper, high buildings, chimneys etc.

Background art

Usually the decoration to the wall, mural or walls of the big building are made by artist who is painting the picture with help of brush, paint roller or using stencil and paint gun.

The inventor of present invention are previously filed patent application for a wireless application based on spray printer device for surface painting, published as WO 2017/077087, 11.05.2017 where is described a spray printer for surface painting comprising camera module and printing module. Where printing module comprises an aerosol spray paint reservoir and printing head with printing valve connected via channel to the spray paint reservoir. When the electronics for receiving signals from camera module commands the means for controlling printing valve a pixel of paint is formed to the surface. By moving the spray printing device on the wall the desired decoration will be printed pixel by pixel to said wall. To develop idea of decoration large surface the inventor of present invention proposes a new generation of mural printer which makes possible to decorate or paint large surface with significant less time.

Disclosure of the invention

To solve the problem how to paint or decorate large surfaces like mural, exterior wall of the house or skyscraper, wall of high buildings with less time the inventor proposes a mural printer comprising a printing head, means for carrying printing head across the surface to be painted or decorated, electronics for preparing image data and controlling the printing head work. In context of present invention the painting or decoration does not mean only painting the picture or art works but also any kind of printing of text, logo, photographs, ornaments, patterns etc.

The mural printer according to present invention comprises a frame with five incorporated painting reservoir holders, four wheels, on-board PLC (Programmable Logic Controller), radio receiver, hoses or tubes, “propeller assembly”, rechargeable batteries and “element array”. Four wheels are positioned in each corner of the frame

and is used to keep a constant distance between the mural printer main frame and the surface. Propeller assembly consists of propeller blade, brushless motor and ESC (Electronic Speed Controller) and is used to keep a constant force on the wheels of the mural printer and to keep the mural printer from bouncing away from the surface in case there is a bump. Hoses or tubes direct the paint from canisters (paint reservoirs) to the element array or printing head. Element array or printing head consists of a feed plate with paint channels and at least one row of “elements”, for good painting results preferably fifty elements placed in several rows are in printing head. An element is an assembly of an electromagnetic valve or piezoelectric valve and a nozzle unit.

Brief description of drawings

The present invention is described below in detail with references to accompanying drawings which are integral part of present application, where

Fig 1 is general view of a mural printer according to the present invention;

Fig 2 is a left side view (front side is where a cable mounting hook is connected) of the mural printer illustrated in fig 1;

Fig 3 is a back view of mural printer to illustrate placement of the pressurised paint reservoirs or canisters in the mural printer;

Fig 4 is a front view of mural printer to illustrate placement of the wheels to carry the mural printer across the surface to be painted and to keep printing head of the mural printer in constant distance from the surface to ensure uniform diameter of the paint dots in surface;

Fig 5 is a top view of mural printer to illustrate the means to create pressure of the mural printer against the surface;

Fig 6 is a bottom view of mural printer to illustrate the placement of the printing head and paint channels or nozzles in the printing head;

Fig 7 is a section view along the line B-B in fig 6 to illustrate the placements of the pressurised paint reservoirs, printing head and impeller in the housing of the mural printer;

Fig 8 is a section view along the line D-D in fig 7 to illustrate the placements of the pressurised paint reservoirs, printing head and control electronics in the housing of the mural printer;

Fig 9 is a general view of printing head of the mural printer according to the present invention to show the matrix of the printing elements or printing sprayer/nozzles;

Fig 10 is a side view of the printing head to illustrate the placements of electromagnetic valves;

Fig 11 is a bottom view of the printing head to illustrate the matrix of the ;

Fig 12 is a front view of the printing head; and

Fig 13 is a section view along the line A-A in fig 11.

Embodiments of the invention

The mural printer is a device that prints images for example to vertical surfaces. However it is clear from the description of the invention that the surfaces may be inclined where the mural printer is used or even curved surfaces like chimneys, curved walls etc. The images created consist of circular dots ("pixels") about 0.5-2cm, typically 1cm in diameter. Usually the pixels are arranged side by side in dot matrix pattern and these are called raster images, but the mural printer can as well by used for making "line art images" where pixels form lines. The number of different paint carried by the printing head is limited, but vast array of tones are created by optically (rather than physically) merging the dots. The end result can measure up to 100m (long edge) or more.

Mural printer consists of the "printing head" 3 and means to carry the printing head across the surface, which can be the "servo box method", "rail system" or "mixed method". "Code generator" is used to prepare the image data for the printer.

In fig 1 is shown a mural printer 100 comprising housing with top cover 101 and lower part of the housing 102. The mural printer 100 carries pressurised paint reservoirs or canisters 1 filled with spray paint. The paint reservoirs can be with the same colour or if needed all paint reservoir can be with different colours or according to need with two, three or etc colours.

The mural printer comprises a means 4, for example four wheels in each corner of the housing to carry the mural printer across the surface to be painted and to keep printing head of the mural printer in constant distance from the surface to ensure uniform diameter of the paint dots in surface when the paint is sprayed through nozzle.

To the front of the housing or main frame is fixed a cable mounting hook 5 with cable hole 51 for cables 6 for lifting and moving mural printer up and down, left to right or vice versa in the surface to be painted.

In fig 3 and 4 are illustrated the back and front view of rural printer. The housing of the rural printer is connected to the bottom 105, to the front side 107, to the rear side 106, to the left side 103 and to the right side 104 forming in this main frame of the mural printer where is arranged/placed printing head 3, electronic block for controlling 11 for controlling valves in the printing head and propeller motor where said electronic block comprises means for receiving and transmitting signals to the control unit of the mural printer, and partition walls 109, 110 for supporting paint reservoirs 1. To the main frame of the printer are connected the means 4 for carrying mural printer across the surface.

When painting large surfaces the mural printer must be forced against the surface to avoid breaking by wind. For this purpose the mural printer is equipped with means 2 to create pressure of the mural printer against the wall. For example the mural printer is equipped with impeller 206 connected via motor 207 and tower 208 to the bottom side 105 of the main frame of the mural printer. The impeller 206 is attached to the rotation axis of the motor 207. The top cover 101 of the housing has opening 205 with diameter of the impeller 206 and the centre of the opening much with rotation axis of the motor and impeller. In addition the left side 103 and right side 104 of the housing have openings 202, 203 (oval for example with the same length as diameter of the opening 205 in the top cover of the housing). Similar opening 201 is in the front side 107. The side openings are necessary to direct the air flow to impeller where air flow exits through the opening 205 in top cover 101, in this way the mural printer is pressured against the wall/surface when mural printer is working and moving across the surface.

The back side 106 has openings 108 for paint reservoirs and inside the housing are at least one main partition wall 109 supporting the front end of the paint reservoir 1. In addition to the main partition wall a supporting partition wall 110 may be arranged between the rear side 106 and main partition wall 109. For better positioning the paint reservoir into mural printer main frame and to reduce the force to the front end of the paint reservoir to the main partition wall are attached a means 45 for closing the paint reservoir cap and opening paint reservoir cap valve to release the paint from container to the paint channel of the cap 46, said means have a paint channel 44 connected to

a tube 48 directing paint from paint reservoir to the printer head printing valve paint channel and to the printing valve. The means 45 comprises for example a threaded cap to which is turned a threaded collar of the paint reservoir when paint reservoir is placed into mural printer for printing. Said threaded cap has in the other end paint channel to which is connected for example elastic tube directing paint to the printing head. When paint reservoir collar is turned into the cap the paint container nozzle is pushed down and paint container valve is opened and the paint from the container is released into the paint channel and elastic tube. The tube is made from suitable plastic material which is resistant to the chemical in the paint.

Into the housing are placed electronic block for controlling the printing process, said electronic block comprises a means for controlling the printing process, attached to the printed circuit board, the electronic block comprise programmable logic controller 7, radio receiver 10, electronic speed controller, memory devices in one printed circuit board and cables for connecting electronics with battery assemblies 9, 91, propeller assembly 2 and printing head valves controllers. All electronic elements are connected with programmable logic controller which implements software for controlling work of the mural printer assemblies – impeller motor, printing head valves, signal receivers and transmitters, i.e. receiving signal to open valves in printing head, sending location signal of mural printer etc. Reference is made here to the previous application of the authors - WO 2017/077087.

The image is printed as “stripes” that are executed in vertical orientation while moving upward from the lowest edge of the image to the highest edge. To print a stripe, the computer (not shown in the drawings, placed separately from the mural printer) commands the servo motors to pull the cables 6 so that the mural printer with printing head moves upward linearly. When printing a stripe is done, the printing head is lowered back on same route to the lower edge and then moved sideways to print next stripe. This is important not to get the wheels of the mural printer on wet pixels. In case printing a stripe and lowering the mural printer with printing head back down takes less time than needed for paint to dry, the next stripe is not printed directly next to previous, but a gap is left in between that is filled later.

A possible embodiment of printing head of the mural printer carries at least five different cans of paint, prints ten columns of 1cm pixels in a single pass. Alternatively the printing head can be bigger or smaller than above-mentioned. A single pass of this

embodiment is therefore 10cm wide and consists of up to five different coloured dots. These can be any colour but for most full colour results, it is good to use cyan, magenta, yellow, black and white. Four first colours are widely used in printing industry and as group are known as CMYK. When printing murals, we have to take in account that the printing surface might not be white, therefore white paint is added as fifth colour. When printing images that have some other dominant colour or is a grayscale image for example, other colours can be used. The paint is loaded into the printing head in pressurised canisters known as spray paint cans. However it must be noted that the industry of the pressurised paint has developed new design of the paint can where pressure inside the can is created by an internal inflatable ball or container. This reduces the use of aerosol gases for creating pressure inside the can and creates opportunity to use more environmental friendly paints.

The mural printer consists of a frame with five incorporated painting reservoir holders, four wheels, on-board PLC (Programmable Logic Controller), radio receiver, hoses or tubes, “propeller assembly”, rechargeable batteries and “element array”. Four wheels are positioned in each corner of the frame and is used to keep a constant distance between the mural printer main frame and the surface. Propeller assembly consists of propeller blade, brushless motor and ESC (Electronic Speed Controller) and is used to keep a constant force on the wheels of the mural printer and to keep the mural printer from bouncing away from the surface in case there is a bump. Hoses or tubes 48 direct the paint from canisters (paint reservoirs) to the element array or printing head 3. Element array or printing head consists of a feed plate 33 with paint channels 34 and at least one row of “elements”, for good painting results preferably fifty elements placed in several rows are in printing head. An element is an assembly of an electromagnetic valve or piezoelectric valve 32 and a nozzle unit 31. The feed plate 33 comprises the paint channels 34 which are connected with opening 43 to the valve assembly. Each main paint channels has in the other end means 47 for connecting said paint channel with tubes 48 connected in other side with paint channel 44 of the cap 46 located in the means 45 for closing the paint reservoir. Through the tubes 48 the paint from paint reservoir is directed to the feed plate 33 and thereafter to the printing valve when the mural printer is working.

Other ends 42 of the electromagnetic valves 32 are arranged into the nozzle plate 35 having cone shaped nozzles 36. The end 42 of the printing valve is inserted into the cavity in inner side of nozzle plate 35 where between printing valve and the bottom of

the cavity is arranged the seal 38 with nozzle channel 37 through which the paint under pressure is directed to the cone shaped nozzle 36 in outer surface of nozzle plate. The seal 38 between printing valve and bottom of the cavity is used to prevent leakage of the paint. The micro filter 30 is arranged into the printing valve channel 41 in the printing valve body 39. Said micro filter 30 prevents entry of tiny solid/dried paint particles into the printing valve and thereafter into the nozzle channel in seal 38 because said dry paint particles may cause clogging of the nozzle channel 37 and which thereafter will cause empty pixels in the painted surface. In addition extra maintenance is needed for mural printer and especially for printing head nozzles.

Simplest arrangement of element array (dot matrix pattern)

The simplest arrangement of element array is a dot matrix pattern with ten (10) columns and five (5) rows, spacing between elements is 1cm in both directions. Each row of elements is fed with one colour of paint.

When printing, the on-board PLC receives image data through the radio link as data packets. Each packet contains image data about ten (10) pixels and is sent by the main controller at specific timed increments. The time between data packets corresponds to 1cm of vertical shift of the mural printer. First data packet contains a number with 10 digits, different values of digits represents different colours of pixels or that nothing is to be printed. The order of digits in the number correspond to order of pixels in specific part of image. When a data packet is received, the PLC, using this data, commands the corresponding elements in first row (top row) to execute a pixel (all in same colour). When new data packet is received, same thing happens and in addition, the data in the previous packet is used to command the elements in second row. This happens continuously- all previous data is incremented by one row of elements downward each time data packet is received. After five data packets the mural printer has moved 5cm, the last row (bottom row) of elements is positioned over the pixels that were shot by the first row five data packets aback. Result is a stripe made up of five different colours of pixels in ten columns. No pixels are printed on top of each other and they are positioned in dot matrix pattern (with some deviation permitted).

Complex arrangement of element array (multiplication of dot matrix pattern)

Due to physical measurements of the elements, more complex arrangements of the element array is used to create images with better pixel density (reciprocal of pixel to pixel distance). In simple dot matrix pattern array, the pixel to pixel distance can not be

greater than element to element distance. In a method called “Multiplication of dot matrix pattern”, several dot matrix patterns are incorporated into a single array. Each dot matrix pattern is shifted to divide the pixel to pixel distance of the result.

If two dot matrix patterns are incorporated into a single array. The pixel to pixel distance is half of the element to element distance but the number of rows in this array is doubled. For each colour, two rows of elements are designated. The rows are placed in an offset that is half of element to element distance. The PLC commands these rows separately, using only the corresponding digits for each row.

Motion methods

Servo box method

Servo box is used to move the mural printer across the print surface. This is done using two high strength strings that are fed through pulley system. Pulley system consists of any number of “guide pulleys” and two “corner pulleys” that may be located horizontally but must be located vertically beyond the corners of the print area. This is because the tension in the cable approaches infinity as the angle between them approaches 180 degrees.

Servo box consists of two servo motor assemblies, the main controller, radio transmitter, DC power supply, frame, housing, pulleys and means to securely anchor the servo box. Servo motor assembly consists of a DC motor with reduced output, spool, encoder and servo driver.

Servo box can be mounted anywhere off the print area. But is usually mounted on the ground near left or right edge of the image. Both cables are first run to the top corner and then one of the cables is run to the other corner. Other setups can be used.

After the pulleys and cables are set and the servo box is securely mounted, the mural printer is hung on the two cables. Now distance between the corner pulleys and distance from the mural printer to each corner pulley is measured and entered to the main controller. Main controller uses these values to calculate the current location of the mural printer and to control the movement. The data entered into main controller is in Cartesian coordinate system not in polar coordinate system and therefore the controller converts the data by an equation, using the distance between the corner pulleys.

The data is entered to the main controller as a text file ("the code"). This file contains the image data as customized G-code. G-code is standard language to control industrial and hobby machining equipment. The code for Albert consists of linear move commands followed by desired coordinate and print commands followed by 10 digit image data. This code also includes the move commands to retract the printing head after a stripe was printed and to increment the printing head to new position.

A sample of the code with x-coordinate for up/down and y-coordinate for left/right:

G1 X0.00 Y0.00 (move command followed by coordinates of starting point)

G23 B1211111110 (print command followed by 10 decimal number containing image data)

G1 X1.00 Y0.00 (move command followed by coordinates of next print position)

G23 B5324121110

……

G1 X100.00 Y0.00 (move command with coordinate for the last row in stripe)

G23 B0000000010

G1 X0.00 Y0.00 (move command to retract the printing head)

G1 X0.00 Y20.00 (move command to increment the printing head to the left)

G23 B1111111112

G1 X1.00 Y20.00

G23 B1111111111

……

Main controller reads the file line by line and executes commands at a given feed rate. The movements are executed by servo motor assemblies by spooling the cable in and out as needed. Image data is transmitted to the printing head by radio link.

Rail system

Another method to move the printing head across the print surface, called "rail system", can be more efficient than servo box method when the surface is convex or concave or the print area is very long on horizontal direction, although setting it up is more time

consuming, there is a lot more hardware and the system is more receptive to wind than the servo box method.

Rail system consists of top and bottom rail, guide wire, “top horizontal incrementor”, “bottom horizontal incrementor” and “vertical servo assembly”. The rails are fixed to the print surface beyond top and bottom edge of the print area and horizontal incrementors are placed on these rails. Guide wire is tensioned between the two incrementors. The incrementors have means to freely slide back and forth the rails while being heavily pulled by the guidewire. They are also equipped with a servo motor that is used to move the incrementor to a specific position. Feedback mechanism in form of a string encoder or magnetic/optic linear encoder is provided to ensure position accuracy. When there is a need to move the printing head in horizontal axis, the incrementors are commanded by main controller through radio link to execute the move simultaneously. Power is provided by onboard batteries 9, 91.

The printing head is placed on the guidewire and has means to freely slide up and down the guide wire. Vertical servo assembly is mounted on one of the horizontal incrementors and has means to spool a high strength string in accurate manner. If vertical servo assembly is mounted on bottom horizontal incrementor, than the cable has to first run through a pulley on top horizontal incrementor and then the end of the cable is fixed to the printing head. If vertical servo assembly if mounted on top horizontal incrementor, then the cable can run straight to the printing head. When there is a need to move the printing head in vertical direction, the main controller that is also housed in the vertical servo assembly, commands the move.

Mixed method

The rail system, as mentioned, can be very receptive to wind. This is because there is only one guide wire that is tensioned between the horizontal incrementors and wind can affect the print quality by blowing the printing head off the right track. To overcome this problem, the mixed method can be used.

Mixed method uses a single rail mounted beyond the top edge of the print area and a single horizontal incrementor is placed on that rail. The servo box is mounted on horizontal incrementor and also two corner pulleys that are spread apart few meters. The vertical motion is created by winding the cables of the servo box but horizontal motion comes from moving the horizontal incrementor.

Code generator

The code is generated beforehand in a separate computer. Code generator is a computer program that translates image file into customized g-code file. To do that, the user first starts the program in a computer, then selects an image, then adjusts settings that include among others the width of the stripe, colour count and gap between stripes. Then the program generates a text file that contain the code that can be used to print the image using Albert.

Line art images

Line art images consists of lines rather than raster dots. In this method, the printing head is moved across the print surface in direction needed to print the specific line. This method can also be used to add lines to a previously printed raster image. The downside is that the wheels can get on wet paint and ruin your work.

The code is generated by using a vector file rather than an image file and also consists of move commands and print commands. The main controller reads the file and commands the simultaneous motion of both axis. The printing head in this method only uses a single element in the array for every colour to create the line onto the print surface.

List of details

1 – pressurised paint reservoirs or canisters

2 – means to create pressure of the mural printer against wall

3 – printing head

4 – means to carry the mural printer/wheels

5 – cable mounting hook

51 – opening for the cable

6 – cable

7 – programmable logic controller

8 – means for controlling the printing process

9, 91 – battery assembly

10 – radio receiver

11 – electronic block

31 – nozzle unit

32 – electromagnetic or piezo valve

33 – feed plate

34 – paint channel

35 – nozzle plate

36 – cone shaped nozzle

37 – nozzle channel

38 – seal

39 – valve body

40 - filter

41 – printing valve channel

42 – end of printing valve

43 – opening to valve assembly

44 – paint channel

45 – means for closing the paint reservoir

46 – cap

47 – means for connecting paint channel of printing head with tubes

48 - tubes

100 – mural printer

101 – top cover

102 - lower part of housing

103 – left side of housing

104 – right side of housing

105 – bottom side

106 – rear side

107 – front side of housing

108 – opening in the rear side

109 – main partition wall

110 – supporting partition wall

201 – opening in the front side

202 – opening in the left side

203 – opening in the right side

205 – opening in the top cover

206 – impeller

207 – motor

208 – motor tower

Claims

1. A mural printer (100) for printing images to upright surfaces, comprises a housing with top cover (101) and lower part of the housing (102), the housing of the mural printer is connected to a bottom side (105), to a front side (107), to a rear side (106), to a left side (103) and to a right side (104) forming a main frame of the mural printer where is arranged printing head (3) with nozzle unit (31) connected with wires to electronic block (11), and main partition wall (109) for supporting paint reservoirs (1), where to the main partition wall are arranged a means (45) for closing the paint reservoir cap and opening paint reservoir cap valve to release the paint, to the main frame are connected the means (4) for carrying mural printer across the surface and a means (5) for connecting the mural printer to a cables (6) for lifting and moving mural printer up and down, left to right or vice versa in the surface to be painted **characterized by** that the mural printer is equipped with means (2) to create pressure of the mural printer against the upright surface, comprising an impeller (206) connected via motor (207) and tower motor (208) to the bottom side (105) of the main frame of the mural printer, where the impeller (206) is attached to the rotation axis of the motor (207) and the top cover (101) of the housing has opening (205) with diameter of the impeller (206) and the centre of the opening much with rotation axis of the motor and impeller.
2. The mural printer according to claim 1, where the left side (103) and right side (104) of the housing have respectively openings (202, 203) with the same length as diameter of the opening 205 in the top cover (101) of the housing and the front side (107) of housing has opening (201) where openings are directing the air flow to impeller where air flow exits through the opening (205) in top cover (101) and the mural printer is pressured against the wall/surface when mural printer is working and moving across the surface.
3. The mural printer according to claim 1 where the back side (106) of the housing has openings (108) for paint reservoirs (1) and inside the housing are at least one main partition wall (109) supporting the front end of the paint reservoir 1, where to the main partition wall (109) are attached a means (45) for closing the paint reservoir cap and opening paint reservoir cap valve to release the paint from container to the paint channel of the cap (46), said means comprising a paint channel (44) connected to a tube (48) directing paint from paint reservoir

(1) to the printer head (3) printing valve paint channel (34) and to the printing valve (32).

4. The mural printer according to claim 1, where a printing head (3) of the mural printer comprises a nozzle plate (35) and a feed plate (33) between which the printing valve assembly is arranged, where the feed plate (33) comprises the main paint channels (34) which are connected in one end with opening (43) to the printing valve assembly and in other end with means (47) for connecting said main paint channel (34) with tubes (48) connected in other end with paint channel (44) of the cap (46) located in the means (45) for closing the paint reservoir (1), and the other ends (42) of the printing valves (32) are arranged into the nozzle plate (35) having cone shaped nozzles (36).
5. The mural printer according to claim 4 where the end (42) of the printing valve (32) is inserted into the cavity in the inner surface of the nozzle plate (35) where between printing valve and the bottom of the cavity is arranged the seal (38) with nozzle channel (37) through which the paint under pressure is directed to the cone shaped nozzle (36) arranged in the outer surface of the nozzle plate (33).
6. The mural printer according to claim 1 where at least five paint reservoirs are placed to the main frame, and the reservoir are supported inside the housing with a supporting partition wall (110) arranged between the rear side (106) and main partition wall (109)
7. The mural printer according to claim 1 where means for connecting mural printer to the cables is cable mounting hook (5).
8. The mural printer according to claim 1 where to the each corner of the main frame are connected the wheels (4) to carry the mural printer across the surface to be painted and to keep printing head (3) of the mural printer in constant distance from the surface to ensure uniform diameter of the paint dots in surface when the paint is sprayed through nozzle unit (31).
9. The mural printer according to claim 1 where the electronic block comprises in one printed circuit board a programmable logic controller (7), a radio receiver (10), electronic speed controller, memory devices and cables for connecting electronics with battery assemblies (9, 91), propeller assembly (2) and printing head (3) valve controllers.

10. A method for printing picture into large surface with mural printer according to claims 1-8 where a printing data is entered to the main controller as a text file ("the code") comprising the image data as customized G-code which consists of linear move commands followed by desired coordinate and print commands followed by ten digit image data.
11. The method according to claim 9 where the G-code includes the move commands to retract the printing head after a stripe was printed and to increment the printing head to new position.
12. The method according to claim 10 where a main controller reads the file line by line and executes commands at a given feed rate and the movements are executed by servo motor assemblies by spooling the cable in and out as needed.
13. The method according to claim 9 where the image data is transmitted to the printing head by radio link.

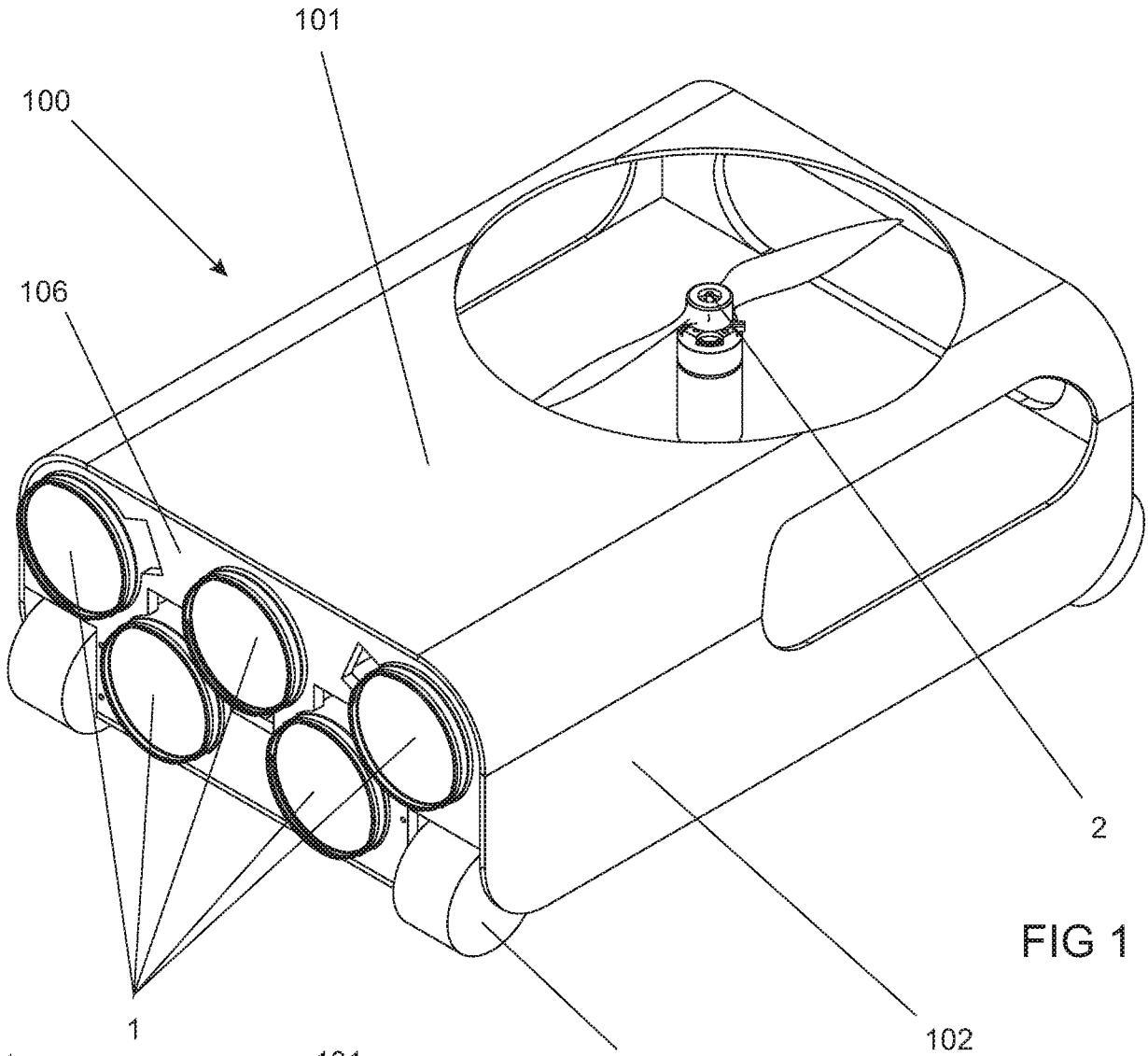


FIG 1

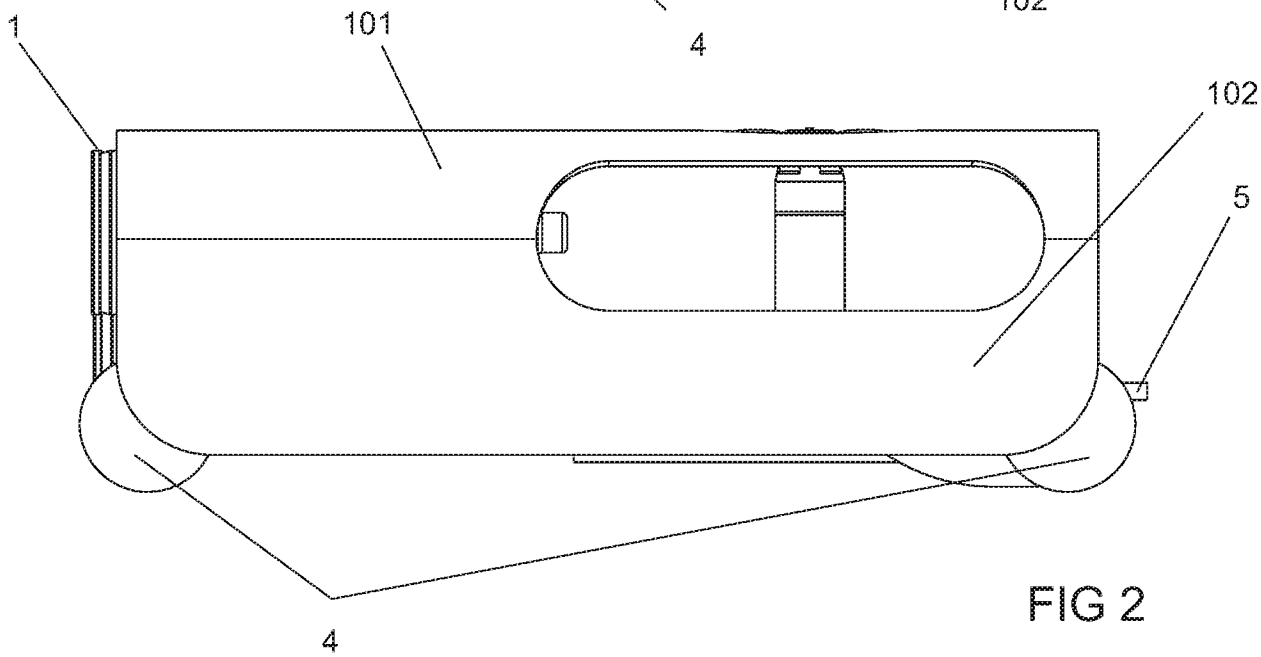


FIG 2

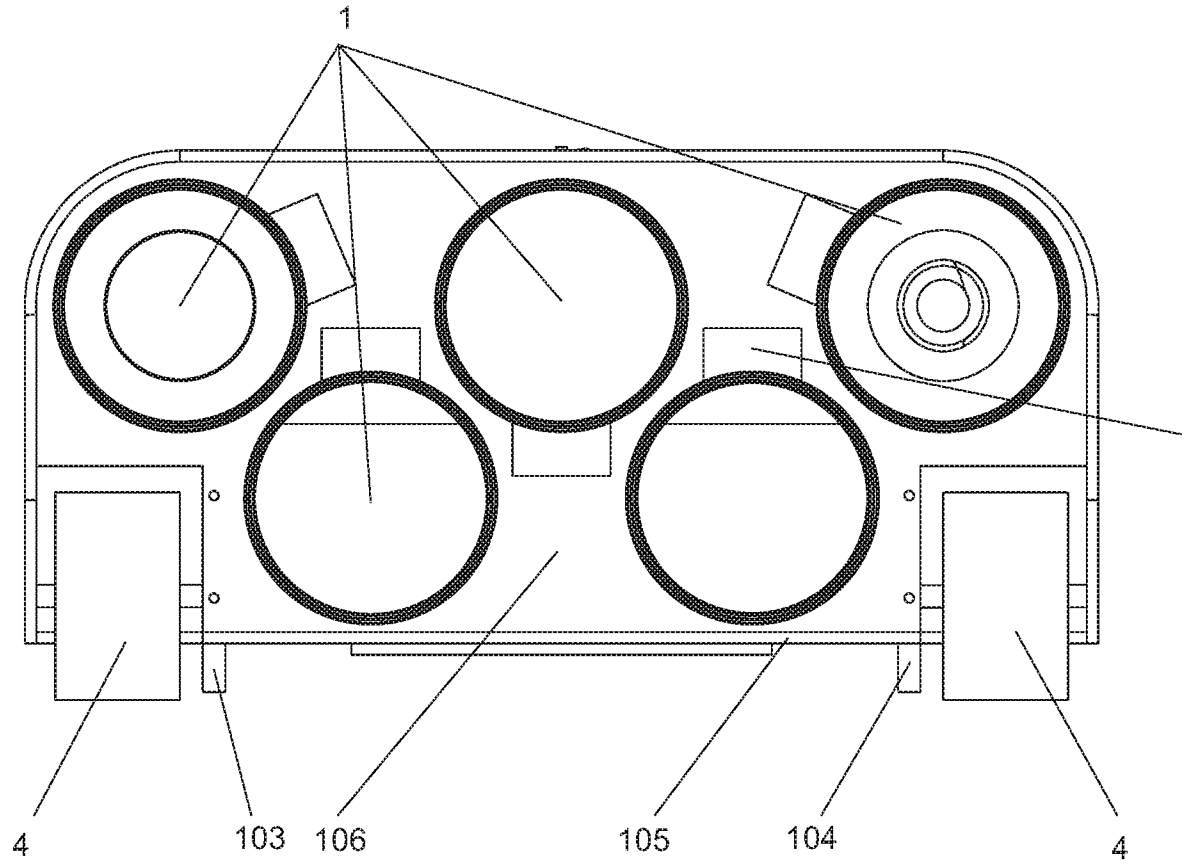


FIG 3

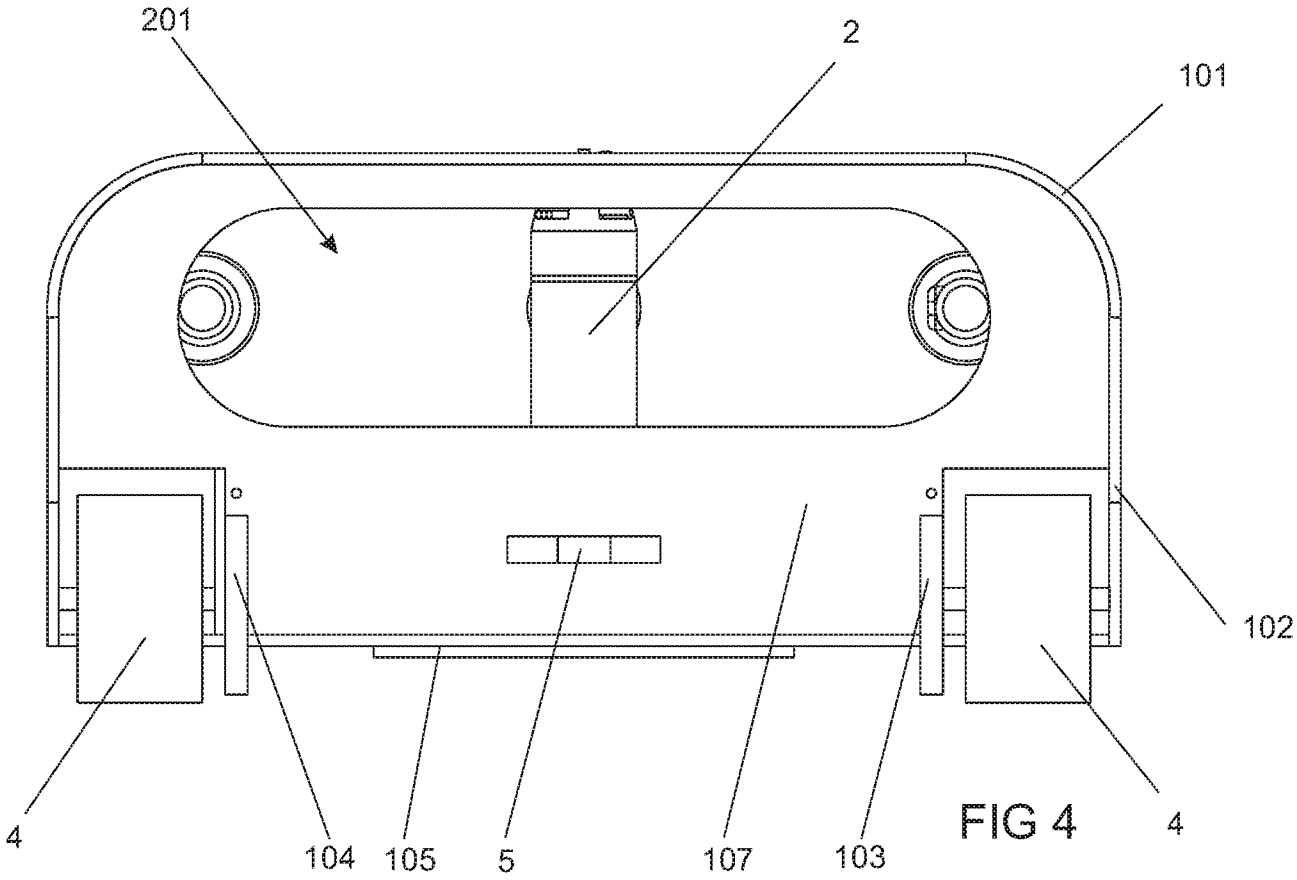


FIG 4

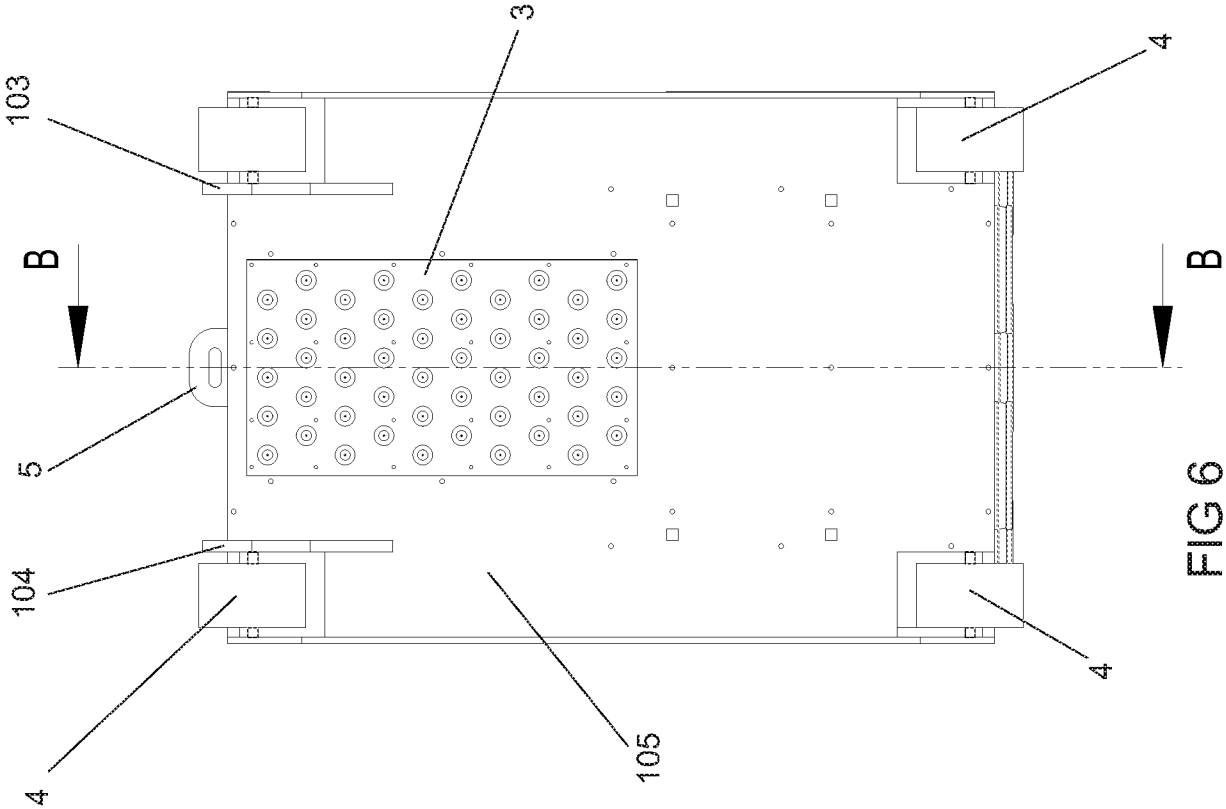


FIG 6

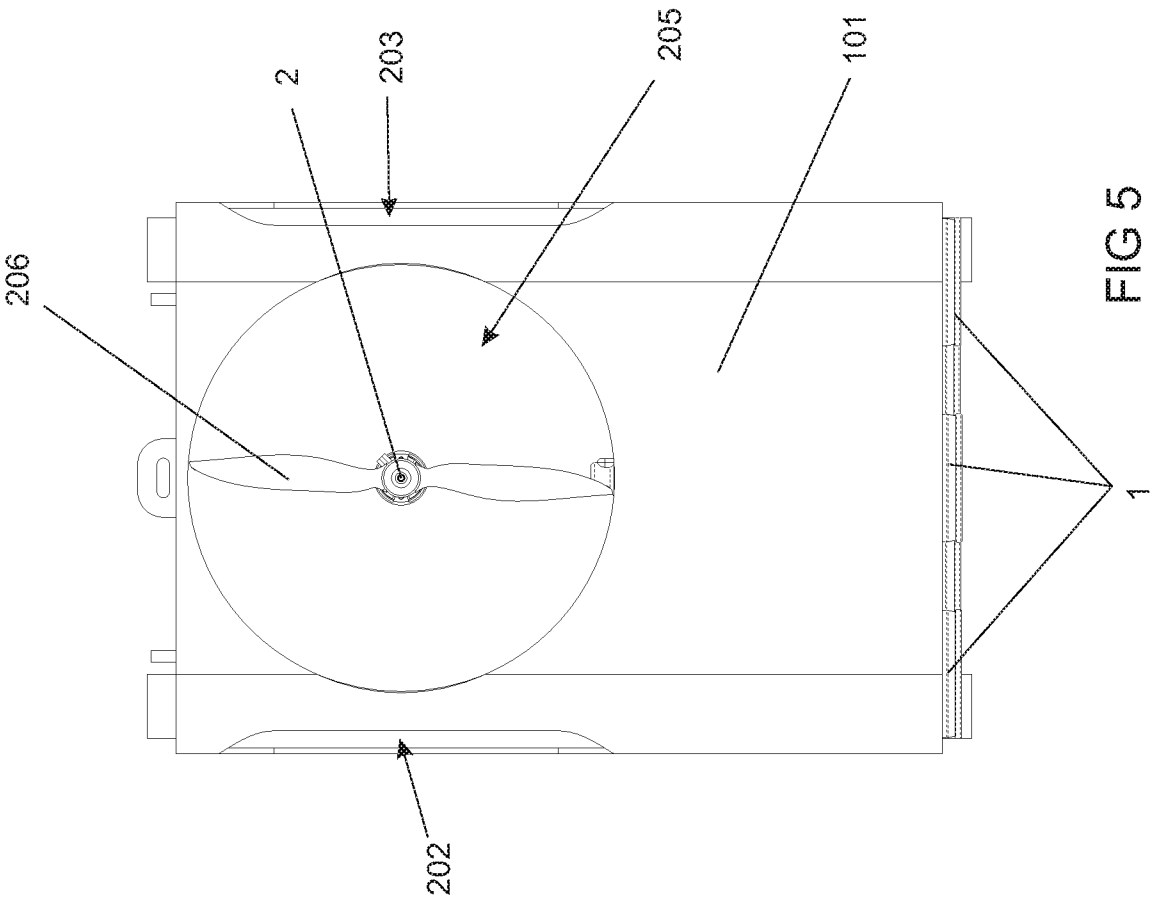
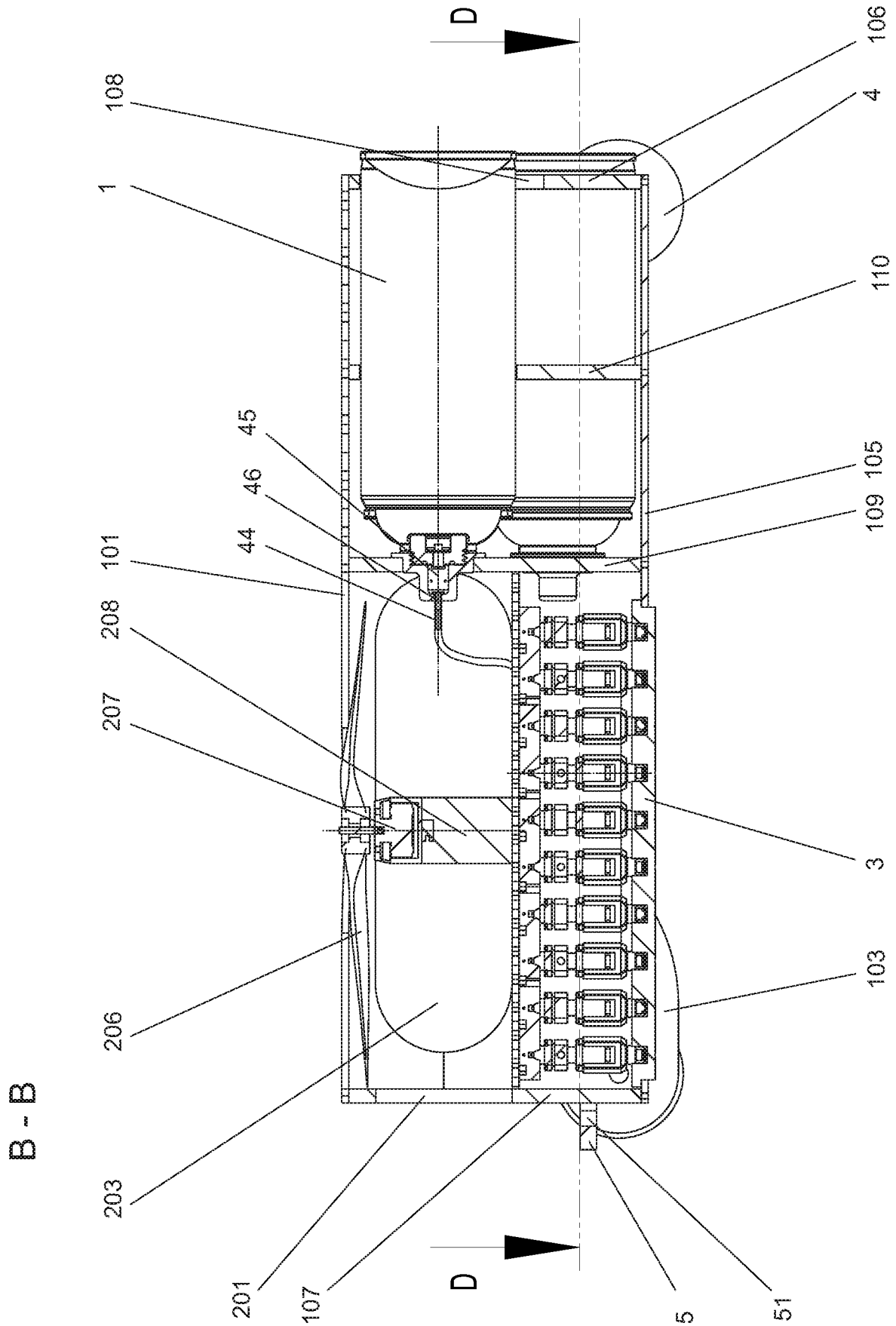


FIG 5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201
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FIG 7

D - D

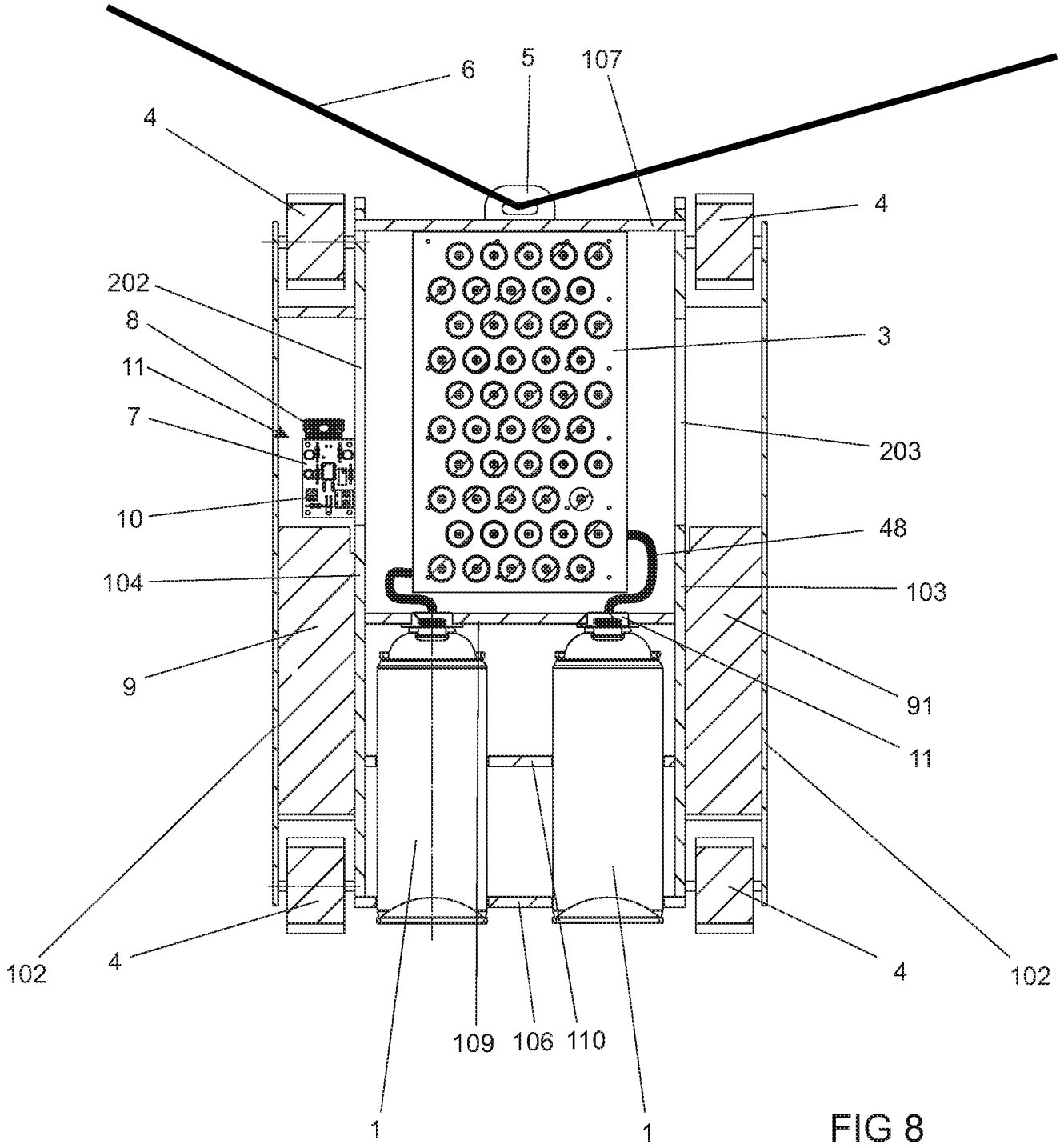
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FIG 8

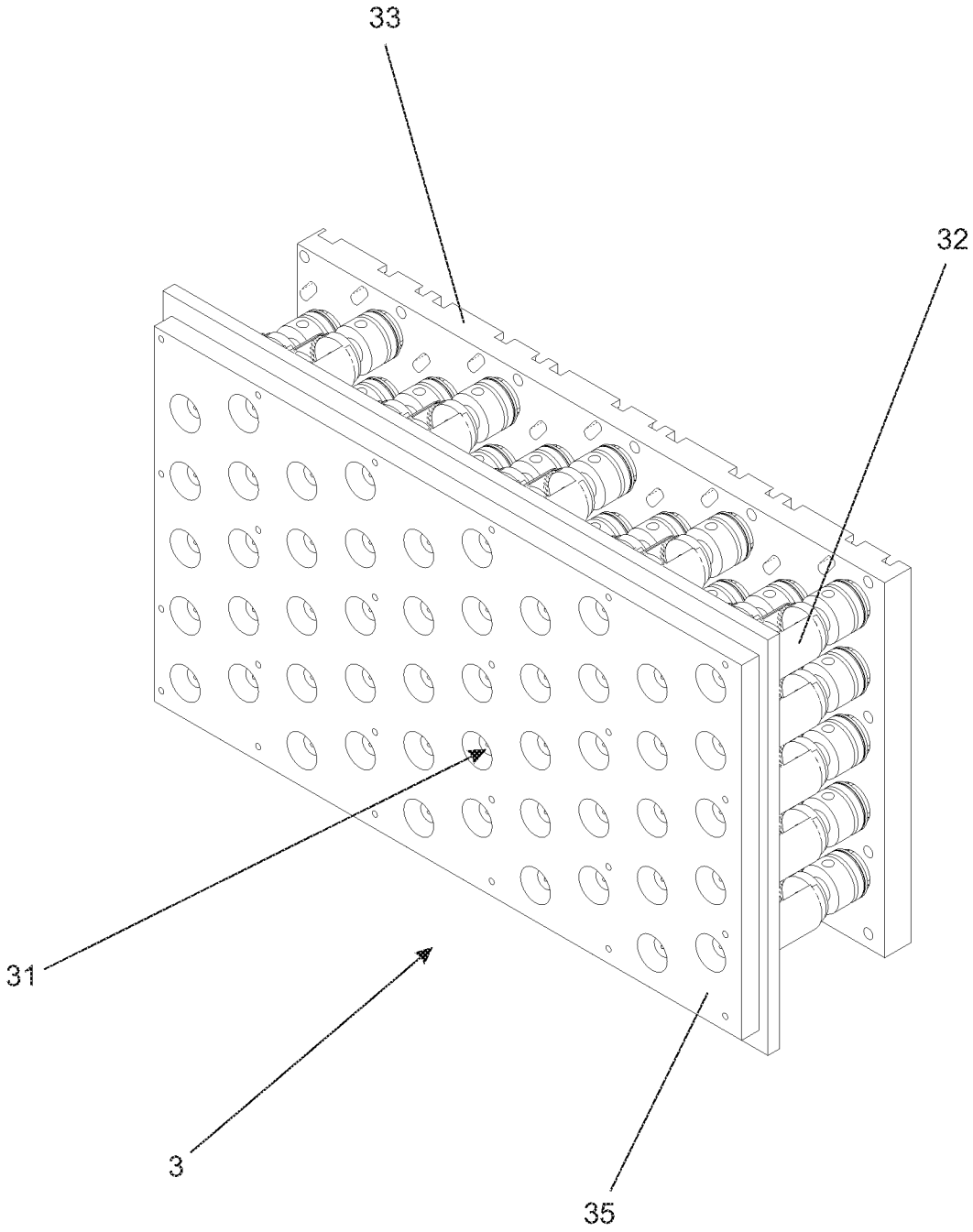

FIG 9

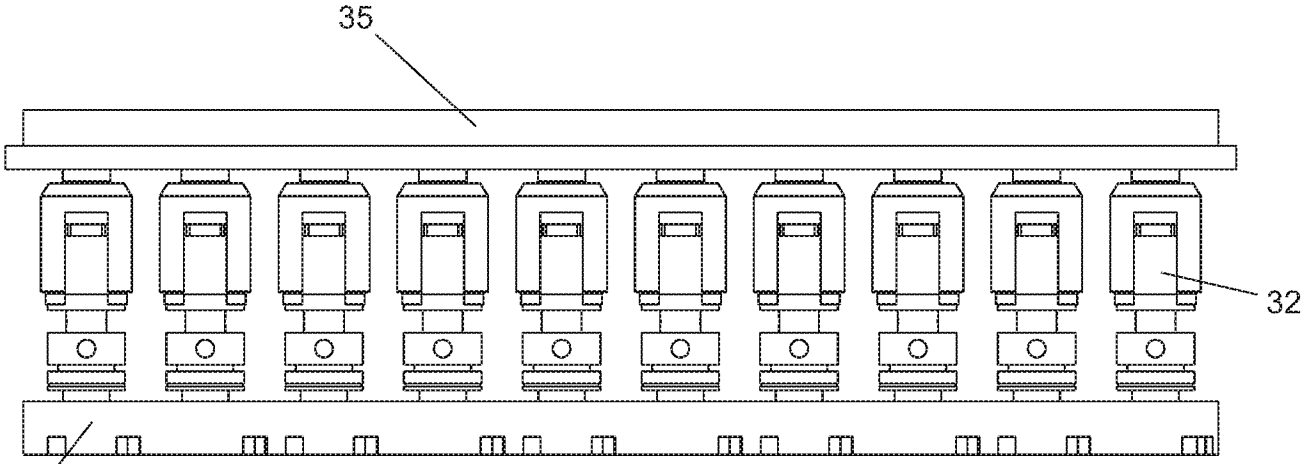

FIG 10

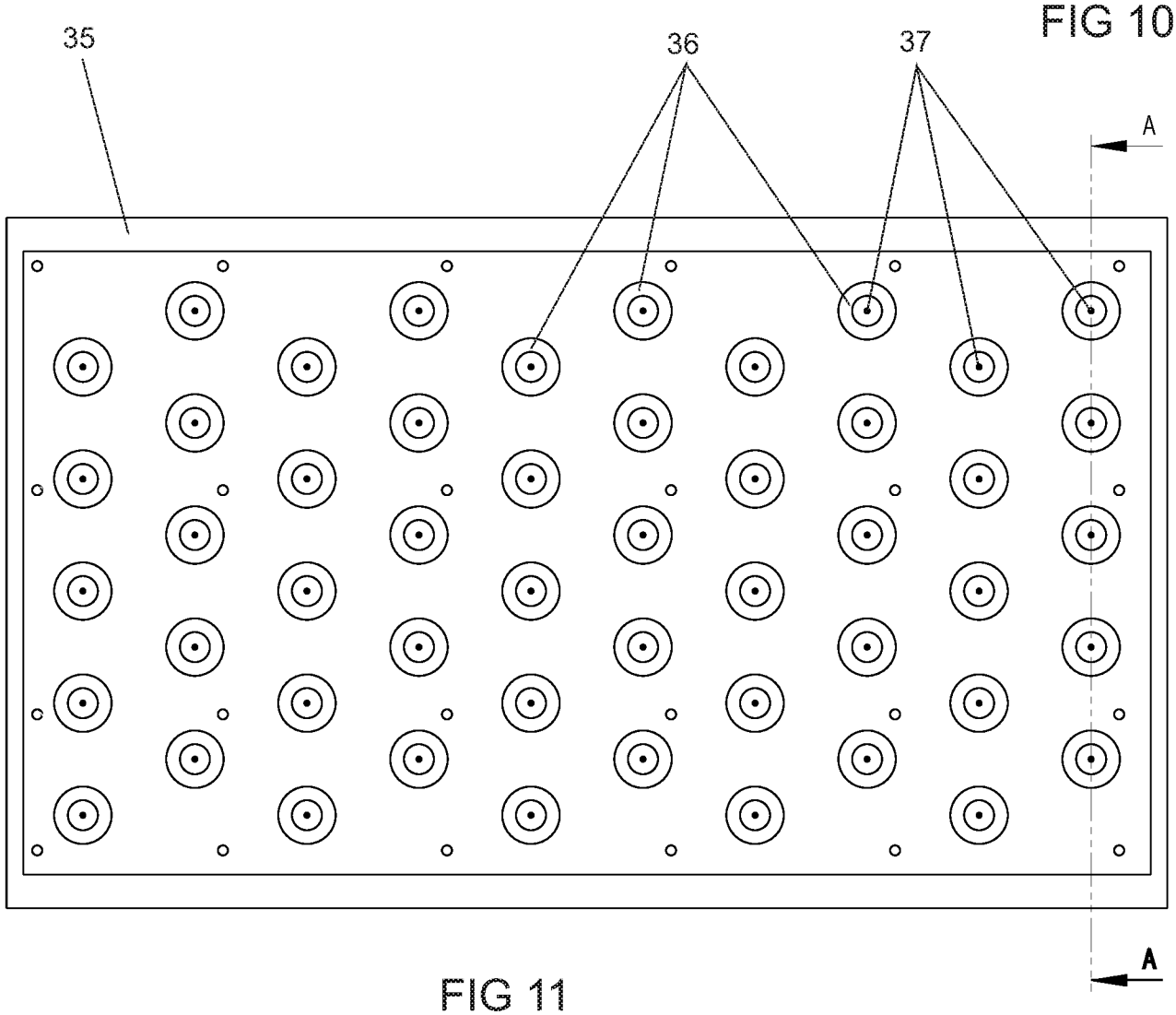

FIG 11

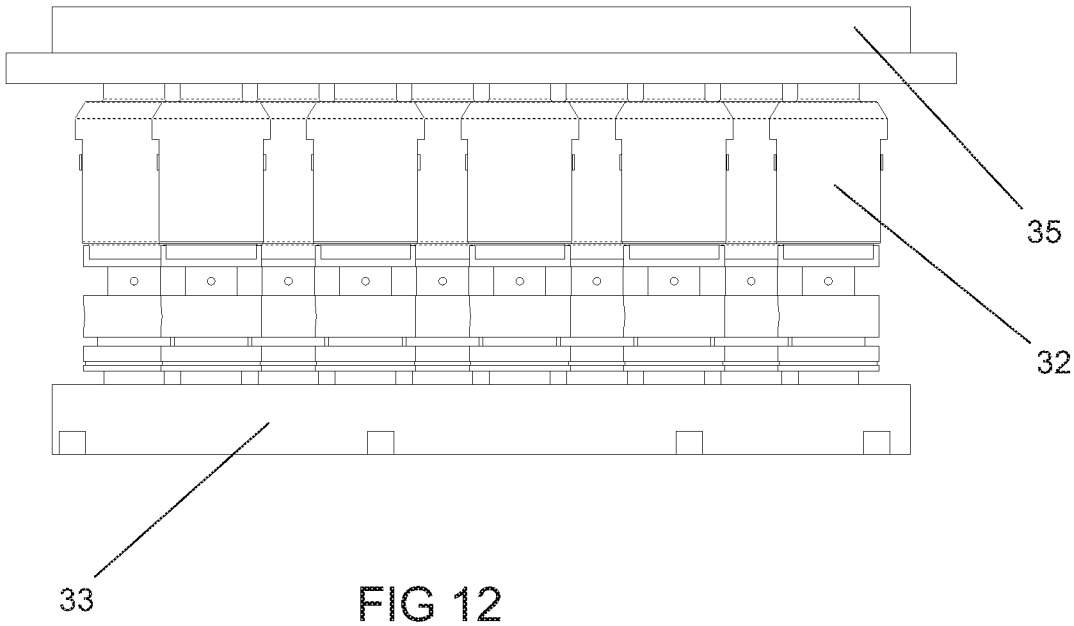
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FIG 12

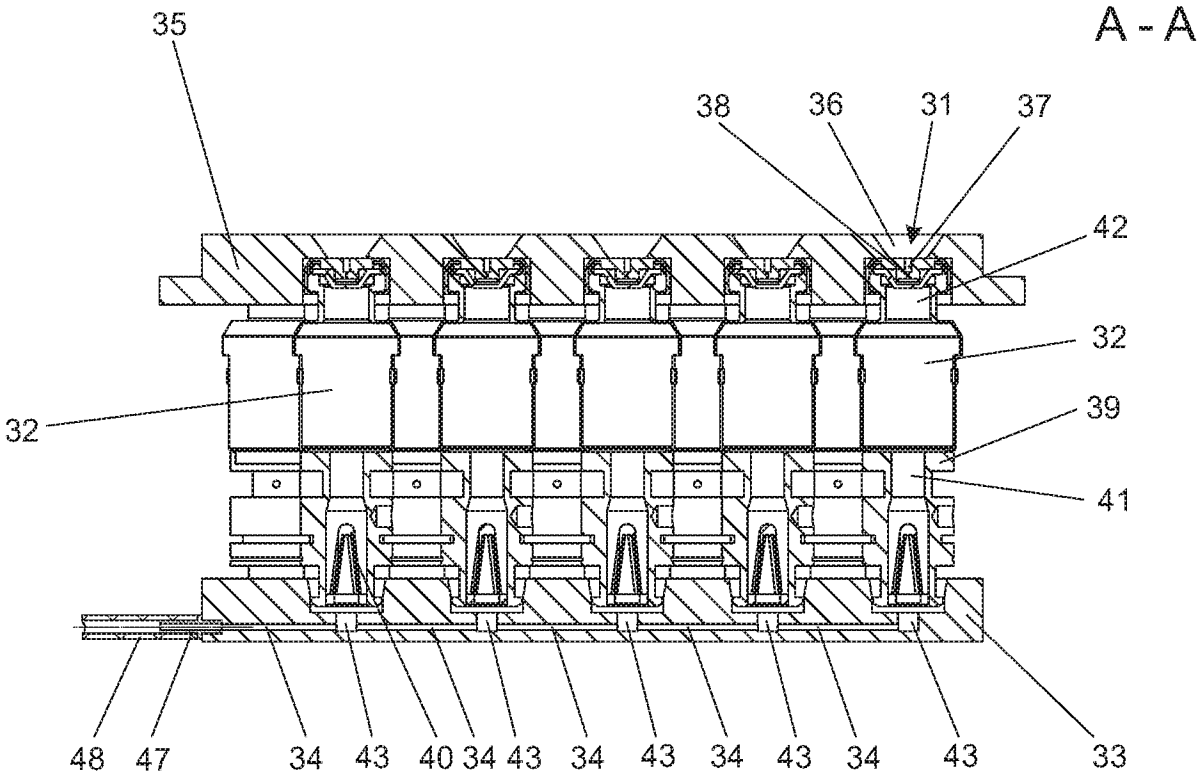
A - A
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FIG 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2018/058064

A. CLASSIFICATION OF SUBJECT MATTER
INV. B05B12/04 B05B15/62 B05B15/68 B05B13/00
ADD. B65D83/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B05B B41J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 104 742 638 A (ZHANG GANG) 1 July 2015 (2015-07-01) paragraph [0016] - paragraph [0025]; figures	1-13
A	CN 101 317 744 A (HARBIN INST OF TECHNOLOGY [CN]) 10 December 2008 (2008-12-10) page 9 - page 10; figures	1-13
A	KR 2011 0072442 A (JANG MI [KR]) 29 June 2011 (2011-06-29) paragraph [0004] - paragraph [0008]	1-13
A	JP S63 80870 A (KOBE STEEL LTD) 11 April 1988 (1988-04-11) figures 1-6	1-13

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 February 2019	27/02/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Daintith, Edward

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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2018/058064

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2017/140255 A1 (NORASAK SAM [US] ET AL) 18 May 2017 (2017-05-18) paragraph [0073] - paragraph [0080]; figures 10, 11	1-13
A	US 2002/158955 A1 (HESS JEFFERY S [US] ET AL) 31 October 2002 (2002-10-31) the whole document	1-13

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/IB2018/058064

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 104742638 A	01-07-2015	NONE	
CN 101317744 A	10-12-2008	NONE	
KR 20110072442 A	29-06-2011	NONE	
JP S6380870 A	11-04-1988	NONE	
US 2017140255 A1	18-05-2017	NONE	
US 2002158955 A1	31-10-2002	NONE	