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(72) Inventors:
• **NISHIMURA, Tomoki**
Akashi-shi, Hyogo (JP)
• **KITAGAWA, Tomohiro**
Akashi-shi, Hyogo (JP)

(74) Representative: **Pintz, György**
Pintz & Partners LLC
Pf. 245
1444 Budapest (HU)

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(71) Applicant: **Toyo Innovex Co., Ltd.**
Akashi-shi, Hyogo (JP)

(54) SPRAY DEVICE OF DIE CASTING MACHINE

(57) A spray device (16) of a die casting machine for spraying a mold release agent and like (R) on inner surfaces of a fixed mold (34) and a movable mold (36) of the die casting machine (10), the inner surfaces constituting a cavity (38), the spray device includes: a spray nozzle (60) configured to spray the mold release agent and like (R); a moving device (62) configured to move the

spray nozzle (60) to a predetermined position; a monitoring device (64) configured to set a moving route and a spraying position of the spray nozzle (60); and a control device (18) configured to cause the spray nozzle (60) to move based on the setting. Then, the monitoring device (64) displays the moving route to move the spray nozzle (60) for one spray process.

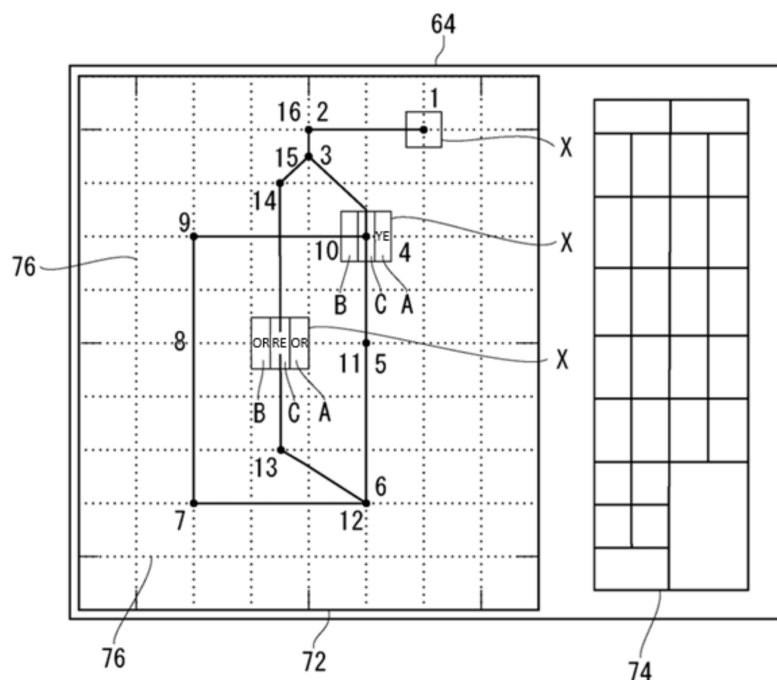


FIG. 4

Description**BACKGROUND OF THE INVENTION**Field of the Invention

[0001] The present invention relates to a spray device for spraying a mold release agent and like on an inner surface of a cavity in a die casting machine that injects molten metal into the cavity for casting cast products.

Description of the Related Art

[0002] In die casting machines used from the past, molten metal, such as an aluminum alloy, molten in a melting furnace is measured and drawn up with a ladle for each shot and the molten metal thus drawn up is poured to a pouring inlet of an injection sleeve, and then the molten metal is injected and filled into a cavity of a mold by forward movement operation of an injection plunger provided movably forward and backward in the injection sleeve, thereby casting cast products.

[0003] After the casting is completed and a cast product is ejected from the mold, a mold release agent and like are sprayed on the inner surface of the cavity using a spray device in preparation for the next injection and filling. Spraying of the mold release agent and like on the inner surface of the cavity in advance has effects of facilitating ejection of the next cast product and the like.

[0004] Such a spray device is, for example, inserted downward from above between a fixed mold and a movable mold that are opened and separated from each other and sprays a mold release agent and like on the fixed mold and the movable mold at an appropriate position in the up-down direction (e.g., PTL 1).

[0005] PTL 1: Japanese Utility Model Publication H06-083149U (1994).

SUMMARY OF THE INVENTION

[0006] However, some of the spray devices of the die casting machines in the past are developed to have, for example, spray nozzles moving to the positions not only in the up-down direction but also in the planar direction, and the increase in the positions to spray a mold release agent and like for one spray process causes problems of making it difficult to set and check the spraying positions and also having to actually operate the spray device to check whether the setting is correct.

[0007] In view of such a circumstance, one or more embodiments of the present disclosure provide a spray device of a die casting machine capable of readily setting and checking spraying positions even if the positions for spraying a mold release agent and like increase.

[0008] A spray device of a die casting machine for spraying a mold release agent and like on inner surfaces of a fixed mold and a movable mold of the die casting machine, the inner surfaces constituting a cavity, the

spray device according to an aspect of the present invention includes:

a spray nozzle configured to spray the mold release agent and like;

a moving device configured to move the spray nozzle to a predetermined position;

a monitoring device configured to set a moving route and a spraying position of the spray nozzle; and

a control device configured to cause the spray nozzle to move based on the setting, wherein the monitoring device displays the moving route to move the spray nozzle for one spray process.

[0009] It is preferred that a current position marker of the spray nozzle is displayed on the moving route.

[0010] It is preferred that only the current position marker is moved and displayed along the moving route only on the monitoring device without moving the spray nozzle by the moving device.

[0011] It is preferred that the current position marker displays details of various kinds of spraying operation of the spray nozzle at each position on the moving route.

[0012] It is preferred that a moving speed of the spray nozzle is allowed to be individually set at each position on the moving route.

[0013] The spray device of a die casting machine according to the present invention causes the moving route to move the spray nozzle for one spray process to be displayed on the monitoring device, and is thus capable of readily setting and checking the spraying positions even if the positions for spraying the mold release agent and like increase.

BRIEF DESCRIPTION OF THE DRAWINGS**[0014]**

FIG. 1 is a diagram illustrating an example of a die casting machine 10 according to an embodiment.

FIG. 2 is a diagram illustrating an example of a spray device 16 according to an embodiment

FIG. 3 is a diagram illustrating an example of a spray nozzle 60 according to an embodiment.

FIG. 4 is a diagram illustrating an example of a monitoring device 64 according to an embodiment.

DETAILED DESCRIPTION OF THE INVENTION**50 Configuration of Die Casting Machine 10**

[0015] A die casting machine 10 according to the present embodiment roughly includes, as illustrated in FIG. 1, a clamping device 12, an injection device 14, a spray device 16, and a control device 18.

[0016] The clamping device 12 is provided with a base 20, a fixed plate 22, a movable plate 24, a tailstock 26, tie bars 28, and a toggle mechanism 30.

[0017] The base 20 is a member to be a foundation of other members constituting the clamping device 12 and the injection device 14.

[0018] The fixed plate 22 is fixed on the base 20, and a fixed mold 34 constituting a mold 32 is attached to the fixed plate 22.

[0019] The movable plate 24 is a member to slide on the base 20 to be close to and away from the fixed plate 22, and a movable mold 36 constituting the mold 32 is attached to the movable plate 24. The movable mold 36 being in contact with the fixed mold 34 forms a cavity 38 to be filled with molten metal.

[0020] The tailstock 26 is a member placed on the base 20 on the opposite side to the fixed plate 22 viewed from the movable plate 24.

[0021] The tie bars 28 are members in a round bar shape, each having an end fixed to the fixed plate 22 and the other end fixed to the tailstock 26. In addition, the tie bars 28 are inserted into tie bar insertion holes 40 formed in the movable plate 24 arranged between the fixed plate 22 and the tailstock 26. The movable plate 24 is thus slidable on the base 20 in a left-right direction of FIG. 1 along the tie bars 28. It should be noted that the tie bars 28 include a plurality (e.g., four) of bars.

[0022] The toggle mechanism 30 is a mechanism to cause the movable plate 24 to be close to and away from and hold to the fixed plate 22, and a clamp driving mechanism 35 is attached to the tailstock 26.

[0023] The movable plate 24 moves along the tie bars 28 (moves in the left-right direction of FIG. 1) by transmission of a driving force of the clamp driving mechanism 35 through the toggle mechanism 30. When the movable plate 24 moves in the left direction, the movable mold 36 is separated from the fixed mold 34. Meanwhile, when the movable plate 24 moves in the right direction, the movable mold 36 abuts on the fixed mold 34 and the cavity (internal space) 38 is formed inside the mold 32. Then, when a pressure in the direction of causing the movable plate 24 to move in the right direction is further applied, the fixed mold 34 and the movable mold 36 are clamped.

[0024] In this situation, the toggle mechanism 30 gradually extends from a bent state. When the movable mold 36 is in contact with the fixed mold 34, extension of the tie bars 28 starts and a strain in proportion to the tensile stress occurs in the tie bars 28. The tension of the tie bars 28 is given to the fixed mold 34 and the movable mold 36 as a clamping force. When the toggle mechanism 30 maximally extends, the tie bars 28 also extend maximally, and when the movable mold 36 reaches a position of clamp completion, a prescribed clamping force is given to the fixed mold 34 and the movable mold 36.

[0025] The injection device 14 roughly has an injection mechanism 42 and a hydraulic operation mechanism 44.

[0026] The injection mechanism 42 has an injection sleeve 46, an injection plunger 48, an injection piston 50, and an injection cylinder 52.

[0027] The injection sleeve 46 is provided integrally to the fixed plate 22 and is a tubular member having an

upper portion formed with a pouring inlet 54 where molten metal is supplied.

[0028] The injection plunger 48 is an approximately rod-like member provided movably forward and backward in the injection sleeve 46.

[0029] The injection piston 50 is formed on a rear end side (an end opposite side to the end in contact with the molten metal) of the injection plunger 48 and is a portion pressed by an operating oil O.

[0030] The injection cylinder 52 is a tubular member where the injection piston 50 moves forward and backward, and the injection cylinder 52 is filled with the operating oil O.

[0031] The hydraulic operation mechanism 44 is a mechanism to supply the operating oil O used for an injection process of the injection plunger 48 to the injection cylinder 52 to act on the injection piston 50. In addition, supplying the pressure oil to the injection cylinder 52 gives a force in a forward movement direction to the left in FIG. 1 to the injection plunger 48.

[0032] The spray device 16 is a device to spray a mold release agent and like R on the inner surfaces of the fixed mold 34 and the movable mold 36 constituting the cavity 38, and as illustrated in FIG. 2, roughly includes a spray nozzle 60, a moving device 62, and a monitoring device 64 in the present embodiment.

[0033] The spray nozzle 60 is a nozzle for spraying the mold release agent and like R to the inner surfaces of the fixed mold 34 and the movable mold 36, and as illustrated in FIG. 3, has a mold release agent spray nozzle 66 for the fixed mold, a mold release agent spray nozzle 68 for the movable mold, and an air spray nozzle 70.

[0034] The mold release agent spray nozzle 66 for the fixed mold is a nozzle to spray the mold release agent and like R to the inner surface of the fixed mold 34, and in the present embodiment, is capable of spraying "mold release agent + compressed air" or "mold release agent remaining in the nozzle + compressed air".

[0035] The mold release agent spray nozzle 68 for the movable mold is a nozzle to spray the mold release agent and like R to the inner surface of the movable mold 36, and in the present embodiment, is capable of spraying "mold release agent + compressed air" or "mold release agent remaining in the nozzle + compressed air".

[0036] The air spray nozzle 70 is a nozzle to spray compressed air to the inner surfaces of the fixed mold 34 and the movable mold 36. Although compressed air is sprayed to both the fixed mold 34 and the movable mold 36 in the present embodiment, compressed air may be sprayed to selected one of either the fixed mold 34 or the movable mold 36.

[0037] In such a manner, "mold release agent + compressed air", "mold release agent remaining in the nozzle + compressed air", "compressed air", and the like are herein collectively referred to as the "mold release agent and like R".

[0038] Back to FIG. 2, the moving device 62 is a device with a role in moving the spray nozzle 60 to a predeter-

mined position. In the present embodiment, it is possible to move the spray nozzle 60 in the up-down direction and in the directions to be close to and away from the fixed mold 34 and the movable mold 36 between the fixed mold 34 and the movable mold 36. That is, the moving device 62 is capable of changing the position of the spray nozzle 60 on a vertically extending plane between the fixed mold 34 and the movable mold 36.

[0039] The monitoring device 64 is a device for setting a moving route and a spraying position of the spray nozzle 60 and displays, as an example, a screen as illustrated in FIG. 4.

[0040] The monitoring device 64 roughly has a moving route display section 72 and an input section 74.

[0041] The moving route display section 72 is an area to display the moving route of the spray nozzle 60 that is set, and in the present embodiment, horizontally and vertically extending dotted lines 76 indicate the coordinates representing the plane where the spray nozzle 60 moves. In the example illustrated in FIG. 4, passage points 1 through 16 to which the spray nozzle 60 moves in order are input on the coordinates via the input section 74.

[0042] Then, at a position corresponding to the current position of the spray nozzle 60 on this moving route, a current position marker X is displayed. The current position marker X may be an approximately rectangular closing line as illustrated or may be in another shape, such as a blinking dot. It should be noted that, although FIG. 4 illustrates a plurality of current position markers X for the convenience of description, the moving route display section 72 actually displays one current position marker X.

[0043] Moreover, various kinds of spraying operation by the spray nozzle 60 are input via the input section 74 at the respective passage points or at any arbitrary point(s) on lines connecting the respective passage points. The "various kinds of spraying operation" refer to, as described above, spraying the inner surfaces of the fixed mold 34 and the movable mold 36 with "mold release agent + compressed air" or "mold release agent remaining in the nozzle + compressed air" in the case of spraying from the mold release agent spray nozzle 66 for the fixed mold or the mold release agent spray nozzle 68 for the movable mold and with compressed air in the case of spraying from the air spray nozzle 70.

[0044] What kind of spraying operation to be performed may be displayed by changing the color of all or part in the current position marker X or may be displayed by changing the shape of the current position marker X. Of course, the kind of spraying operation may be indicated by displaying at another position on the monitoring device 64 and the like or may be indicated by other methods.

[0045] In the present embodiment, an inner region surrounded by an approximately rectangular closing line, which is the current position marker X, is laterally divided into three where the right region A is a region indicating

spraying to the fixed mold 34 using the mold release agent spray nozzle 66 for the fixed mold, the left region B is a region indicating spraying to the movable mold 36 using the mold release agent spray nozzle 68 for the movable mold, and the central region C is a region indicating spraying to the fixed mold 34 and the movable mold 36 using the air spray nozzle 70.

[0046] Then, the respective regions A and B displayed in "YE (meaning yellow)" refer to spraying of "mold release agent + compressed air". In addition, the respective regions A and B displayed in "OR (meaning orange)" refer to spraying of "mold release agent remaining in the nozzle + compressed air". Still in addition, the region C displayed in "RE (meaning red)" refers to spraying of "compressed air".

[0047] For example, in the moving route display section 72 illustrated in FIG. 4, the current position markers X indicated at the passage points 4 and 10 are displayed in "YE (meaning yellow)" only in the region A, and thus refer to spraying of "mold release agent + compressed air" to the fixed mold 34 using the mold release agent spray nozzle 66 for the fixed mold at the passage points 4 and 10.

[0048] Similarly, the current position marker X indicated between the passage points 13 and 14 is displayed in "OR (meaning orange)" in the respective regions A and B and displayed in "RE (meaning red)" in the region C, and thus refers to spraying of "mold release agent remaining in the nozzle + compressed air" to the fixed mold 34 using the mold release agent spray nozzle 66 for the fixed mold, spraying of "mold release agent remaining in the nozzle + compressed air" to the movable mold 36 using the mold release agent spray nozzle 68 for the movable mold, and spraying of "compressed air" to the fixed mold 34 and the movable mold 36 using the air spray nozzle 70.

[0049] It should be noted that the moving speed of the spray nozzle 60 may be set at an arbitrary position on the moving route via the input section 74. Of course, the spray nozzle 60 may move at a fixed speed on the moving route.

[0050] For performing the injection process and a process of returning the injection plunger 48, the control device 18 performs all controls for casting by the die casting machine 10 and all controls related to spraying of the mold release agent and like R by the spray device 16, in addition to a role of operating the hydraulic operation mechanism 44 while detecting position information of the injection piston 50 and the like.

Casting Procedure by Die Casting Machine 10 according to Present Embodiment

[0051] A brief description is given to a procedure for cast molding of cast products (molded articles) using the die casting machine 10 according to the present embodiment. The control device 18 causes the clamp driving mechanism 35 to operate to close the movable mold 36 to

the fixed mold 34 by the toggle mechanism 30 and further to perform clamping with a predetermined clamping force.

[0052] After that, the control device 18 causes the injection plunger 48 to move forward to inject and fill the molten metal into the cavity 38 of the mold 32. After completing solidification of the molten metal in the cavity 38, the clamp driving mechanism 35 of the clamping device 12 is operated to separate the movable mold 36 from the fixed mold 34 (mold opening) by the toggle mechanism 30 and the cast product is ejected from the cavity 38 with an ejector pin, not shown, and the like. Thus, casting of a cast product by the die casting machine 10 is completed.

[0053] When the casting is completed, in preparation for the next casting process, the spray device 16 sprays the mold release agent and like R on the inner surfaces of the fixed mold 34 and the movable mold 36 constituting the cavity 38.

Operation Setting Procedure for Spray Device 16 according to Present Embodiment

[0054] The procedure for setting the operation of the spray device 16 in the die casting machine 10 according to the present embodiment is described. At first, the moving route (i.e., from the passage point 1 to the last passage point) of the spray nozzle 60 for one spray process is input via the input section 74 of the monitoring device 64.

[0055] After that, the spraying position of the spray nozzle 60 and the kind of the spraying operation and the time length of the spraying operation at the spraying position are input at each of arbitrary positions on the moving route. In addition, if desired, the moving speed of the spray nozzle 60 at each of arbitrary positions on the moving route is set.

[0056] When the intended input operation is finished, the moving route of the spray nozzle 60, the kind of spraying operation at each spraying position, and if applicable, the moving speed of the spray nozzle 60 at each arbitrary position on the moving route are stored in a memory in the control device 18. At this stage, if "test operation" is selected via the input section 74, the current position marker X is displayed to be moved at a predetermined moving speed along the moving route only on the monitoring device 64 without moving the spray nozzle 60 by the moving device 62 and to perform the spraying operation of the predetermined kind for the predetermined time length when the current position marker X comes to the predetermined spraying position. That is, performing the "test operation" allows testing whether there are no incorrect operation and the like of the spray device 16 any number of times without actually moving the spray nozzle 60.

[0057] As just described, the spray device 16 of the die casting machine 10 according to the present embodiment causes the monitoring device 64 to display the

moving route to move the spray nozzle 60 for one spray process and the like, and it is thus possible to readily set and check the spraying positions even if the positions for spraying the mold release agent and like R increase.

Modification 1

[0058] Although the spray device 16 according to the embodiment described above has the moving device 62 to change the position (2D movement) of the spray nozzle 60 on the vertically extending plane between the fixed mold 34 and the movable mold 36 and also has the monitoring device 64 with the moving route display section 72 to display the moving route on the plane, the moving device 62 may cause the spray nozzle 60 to move in the width direction of the fixed mold 34 and the movable mold 36 in addition to above. That is, the spray nozzle 60 may three dimensionally move (3D movement) between the fixed mold 34 and the movable mold 36.

[0059] In this case, the moving route display section 72 of the monitoring device 64 is also designed to display the moving route in, for example, isometric projection to three dimensionally display the moving route.

[0060] The one or more embodiments and modifications of the present disclosure are to be considered in all respects as illustrative, and not restrictive. The scope of the present invention is indicated by the appended claims rather than by the foregoing description and is intended to include all modifications in the meaning and scope equivalent to the claims.

Claims

1. A spray device of a die casting machine for spraying a mold release agent and like on inner surfaces of a fixed mold and a movable mold of the die casting machine, the inner surfaces constituting a cavity, the spray device comprising:

a spray nozzle configured to spray the mold release agent and like;
a moving device configured to move the spray nozzle to a predetermined position;
a monitoring device configured to set a moving route and a spraying position of the spray nozzle; and
a control device configured to cause the spray nozzle to move based on the setting, wherein the monitoring device displays the moving route to move the spray nozzle for one spray process.

2. The spray device according to Claim 1, wherein a current position marker of the spray nozzle is displayed on the moving route.

3. The spray device according to Claim 2, wherein only

the current position marker is moved and displayed along the moving route only on the monitoring device without moving the spray nozzle by the moving device.

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4. The spray device according to Claim 2, wherein the current position marker displays details of various kinds of spraying operation of the spray nozzle at each position on the moving route.

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5. The spray device according to Claim 1, wherein a moving speed of the spray nozzle is allowed to be individually set at each position on the moving route.

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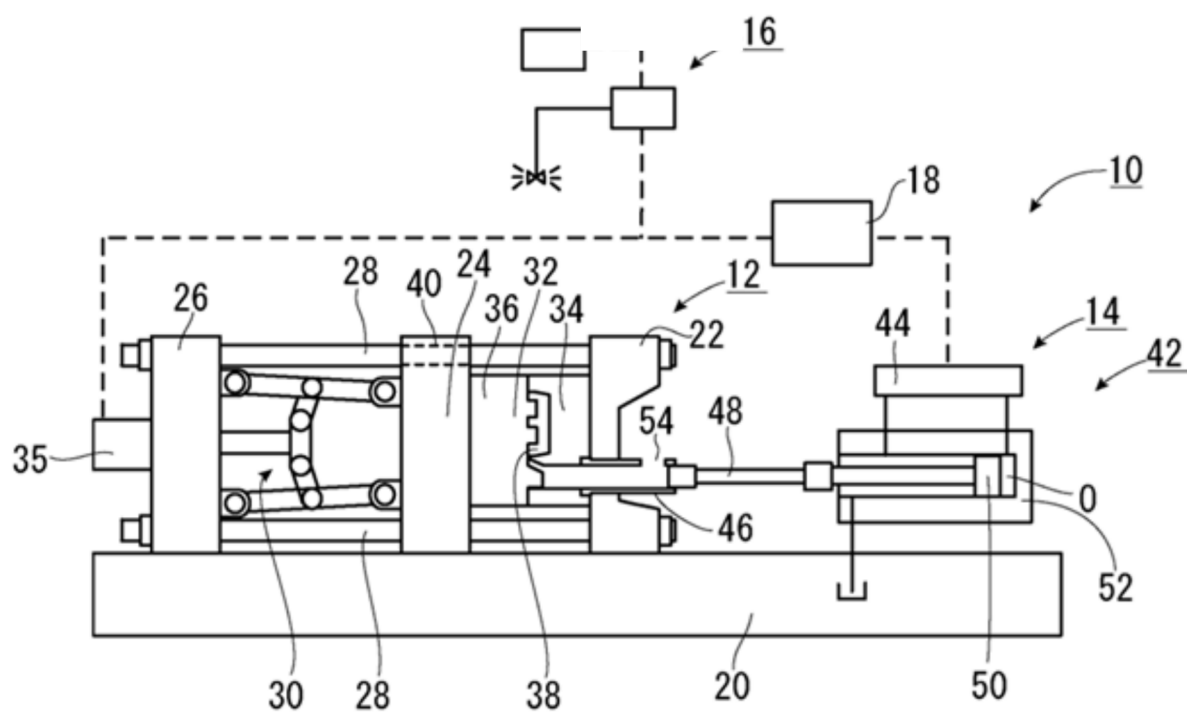


FIG. 1

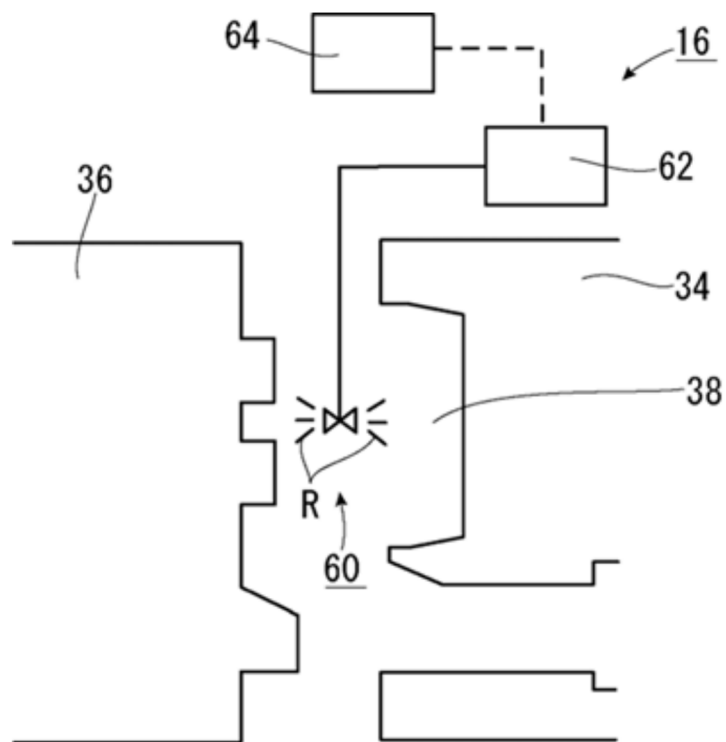


FIG. 2

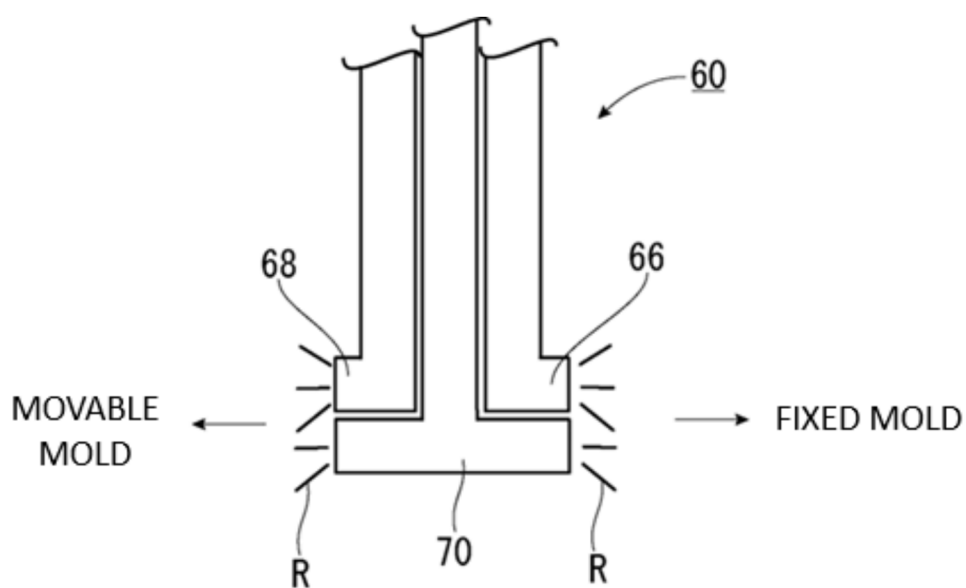


FIG. 3

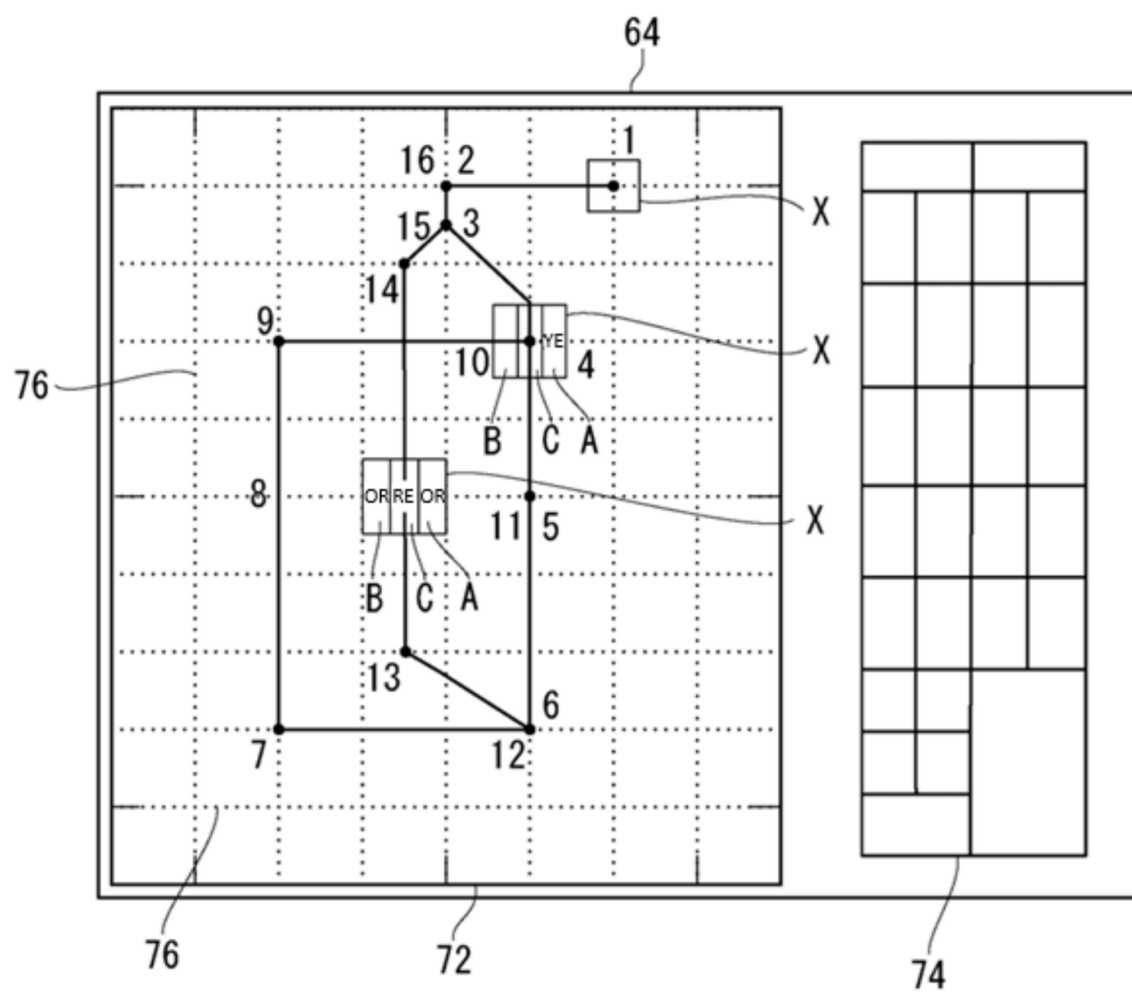


FIG. 4



EUROPEAN SEARCH REPORT

Application Number

EP 25 21 3889

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	JP 3 203305 B2 (UBE INDUSTRIES) 27 August 2001 (2001-08-27) * Machine Translation; paragraph [0007] - paragraph [0032]; claims 1-4; figures 1-12 *	1-5	INV. B22C23/02 B22D17/20
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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		9 March 2026	Desvignes, Rémi
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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