



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.12.2009 Bulletin 2009/49

(51) Int Cl.:
B41K 3/54 (2006.01) B41K 3/56 (2006.01)

(21) Application number: **09007066.5**

(22) Date of filing: **27.05.2009**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK TR

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(30) Priority: **28.05.2008 JP 2008139425**

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(54) **Ink supply apparatus for use in pad printers**

(57) An ink supply apparatus (10) includes a first container (20) storing an ink (61) therein and a second container (30) storing a volatile solution for the ink (61). The first container (20) and the second container (30) are disposed within a cover (40) supported on a support frame (65). A pad plate (60) can move relative to the first

container (20), so that an ink receiving portion (60b) of the pad plate (60) can move into and out of a space defined within the cover (40). The first container (20) can supply the ink onto the ink receiving portion (60b) and can scrape off the ink adhered to portions of the pad plate other than the ink receiving portion (60b).

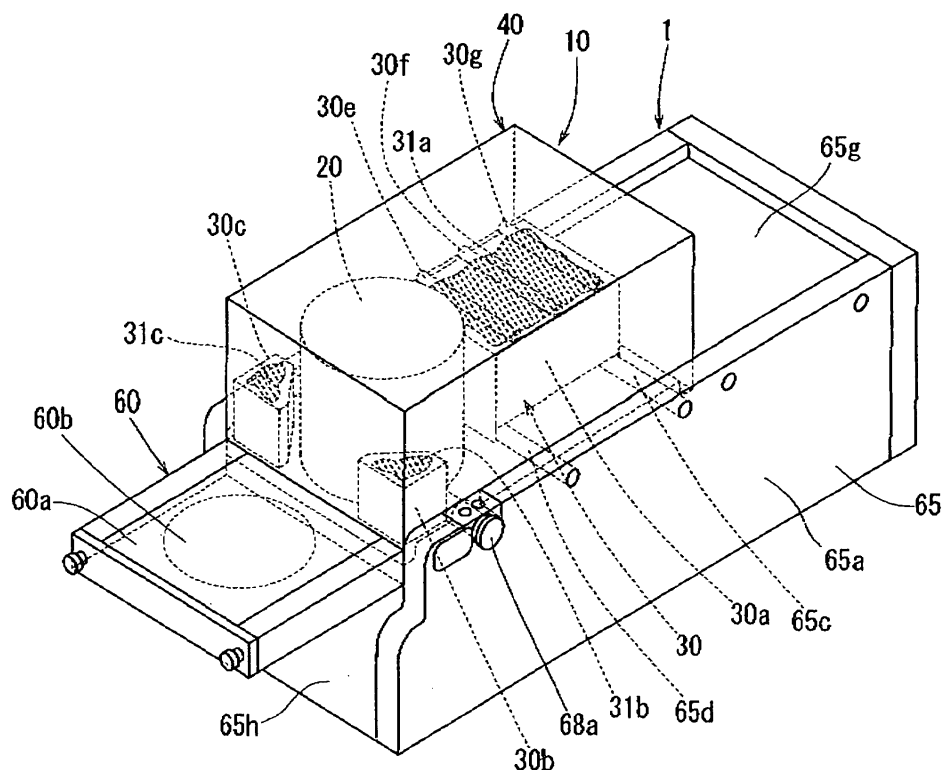


FIG. 1

Description

[0001] This application claims priority to Japanese patent application serial number 2008-137449, the contents of which are incorporated herein by reference.

[0002] The present invention relates to ink supply apparatus for use in pad printers and, in particular, to ink supply apparatus for supplying ink to pad plates of pad printers..

[0003] Japanese Laid-Open Patent Publication No. 10-272759 discloses a pad printer in which an ink chamber storing ink to be applied to a pad plate is formed within a box as a sealed chamber while allowing the pad plate to move into and out of the ink chamber. A solvent container is disposed inside the ink chamber, so that vaporized solvent can be filled within the ink chamber.

[0004] This arrangement makes it possible to suppress changes with the passing of time in the viscosity of the ink.

[0005] However, according to the pad printer of the above publication, when the printer is operated for a long period of time, some ink adheres to the box around the opening of the ink chamber and also adheres to the pad plate and solidifies thereon, resulting in deterioration in printing quality.

[0006] Therefore, there is a need in the art for an ink supply apparatus that can prevent or minimize deterioration in printing quality of a pad printer even if operated for a long period of time.

[0007] In one aspect of the present invention, an ink supply apparatus for use with a pad printer includes a support frame, a pad plate movable relative to the support frame and having an ink receiving portion, and a cover supported on the support frame and defining a space therein. The pad plate defines a bottom of the space, so that the ink receiving portion can move between a position opposed to the space and a position outside of the cover as the movement of the pad plate. A first container stores an ink therein. A second container stores a volatile solution for the ink. The first container and the second container are disposed within the cover. The first container can supply the ink onto the ink receiving portion and can scrape off the ink adhered to portions of the pad plate other than the ink receiving portion. Therefore, it is possible to prevent the ink from adhering to portions of the cover or the frame. In addition, because vapor of the solvent within the second container can be filled within the cover, the ink can be prevented from being solidified.

[0008] In another aspect of the invention, an ink supply apparatus for use with a printer includes a first container storing a printing ink, a cover, a pad plate, a second container storing a solvent for the printing ink, and a support frame. The first container and the cover are supported by the support frame. A recessed print pattern forming portion is provided on a flat upper surface of the pad plate. A first opening is formed at a bottom of the first container. A lower end portion of a side wall portion of the first container defines an edge of the first opening.

The pad plate is slidable with respect to the lower end portion of the side wall portion of the first container, with the first container being positioned thereon. The print pattern forming portion of the pad plate is slidably movable from a lower side of the first opening of the first container to a transfer position outside the cover. The lower end portion of the side wall portion is configured so as to be capable of scraping off, through sliding of the pad plate, any printing ink applied to portions other than the print pattern forming portion on the flat upper surface of the pad plate. A lower side of the cover has an opening. An edge of the opening of the cover is positioned above the pad plate. The first container and the second container are arranged inside the cover.

[0009] With this arrangement, when the print pattern forming portion of the pad plate is drawn out from under the first container, the printing ink remains on the print pattern forming portion formed on the upper surface of the pad plate, while no printing ink adheres to portions other than the print pattern forming portion on the upper surface of the pad plate. In addition, when some solvent is evaporated from the printing ink in the first container inside the first container, the resultant vapor fills the first container, and is inclined to leak to the exterior of the first container; however, the vapor of the solvent in the second container is filled within the space surrounded by the cover and the pad plate to be saturated or substantially saturated, so that evaporation of the solvent from the printing ink in the first container and from the printing ink adhering to the lower end portion of the side wall portion of the first container is suppressed, thereby making it possible to stabilize the viscosity of the printing ink in the first container and of the printing ink adhering to the lower end portion of the side wall portion of the first container. By stabilizing the viscosity of the pad printing ink, changes with the passing of time in the viscosity of the ink during pad printing operation are suppressed, whereby it is possible to maintain a fixed level of ink viscosity and to maintain the requisite printing quality. Thus, it is possible to perform a printing operation for a longer period of time without involving any deterioration in printing quality.

[0010] The ink supply apparatus may further include a third container storing a solvent for the printing ink. The third container is arranged above the printing ink within the first container. The solvent can be volatilized to produce a vapor that can be filled within the first container so as to be saturated. With this arrangement, evaporation of solvent from the printing ink is further suppressed, making it possible to further stabilize the viscosity of the printing ink. Therefore, it is possible to attain a further stabilization in pad printing quality.

[0011] The first container may be divided into a lower portion and an upper portion, and the lower portion and the upper portion may be separable from each other. With this arrangement, in the state in which the lower portion and the upper portion are separated from each other, the third container can be easily installed within the first container. Therefore, it is possible to easily con-

figure the ink supply apparatus.

[0012] The ink supply apparatus may further include a support member provided inside the upper portion and supporting the third container. The support member may include a plurality of support portions. The vapor of the solvent stored within the third container can pass between the support portions of the support member to enter the lower portion. With this arrangement, it is possible to reliably suppress evaporation of the solvent of the printing ink in the first container, making it possible to reliably stabilize the viscosity of the printing ink. Therefore, it is still easier to maintain the requisite pad printing quality.

[0013] An upper surface of the upper portion may have a second opening, and a cover may be provided for closing the second opening. With this arrangement, by opening the cover of the second opening of the upper portion of the first container, the third container can be easily put in the first container. Therefore, it is easier to configure the ink supply apparatus.

[0014] The pad plate may include a ferromagnetic material (e.g., iron or stainless steel), and a magnet may be disposed within the first container. The magnet can attract the pad plate with a magnetic force, so that the first container is attracted to the pad plate. Therefore, it is possible to smoothly perform the pad printing operation.

[0015] Additional objects, features, and advantages, of the present invention will be readily understood after reading the following detailed description together with the claims and the accompanying drawings, in which:

Fig. 1 is a perspective view showing an ink supply apparatus according to an embodiment of the present invention;

Fig. 2 is a plan view of the ink supply apparatus of Fig. 1 with a cover thereof removed;

Fig. 3 is a front view of the ink supply apparatus of Fig. 1 with the cover thereof removed;

Fig. 4 is a side view of the ink supply apparatus of Fig. 1 with the cover thereof removed;

Fig. 5 is a sectional view, taken along line A-A in Fig. 2, illustrating a first container of the ink supply apparatus and the interior thereof;

Fig. 6 is a sectional view taken along line B-B in Fig. 5;

Fig. 7 is an exploded sectional view of Fig. 5;

Fig. 8 is a partial view showing a side surface of a lower portion of the first container of Fig. 5;

Fig. 9 is a partial view of the cover of the ink supply apparatus of Fig. 1;

Fig. 10 is a partial perspective view showing the interior of the first container of Fig. 5; and

Fig. 11 is a general perspective view of a pad printer incorporating the ink supply apparatus of Fig. 1.

[0016] Each of the additional features and teachings disclosed above and below may be utilized separately or in conjunction with other features and teachings to provide ink supply apparatus and pad printers incorporating such improved ink supply apparatus. Representative ex-

amples of the present invention, which examples utilize many of these additional features and teachings both separately and in conjunction with one another, will now be described in detail with reference to the attached drawings. This detailed description is merely intended to teach a person of skill in the art further details for practicing preferred aspects of the present teachings and is not intended to limit the scope of the invention. Only the claims define the scope of the claimed invention. Therefore, combinations of features and steps disclosed in the following detailed description may not be necessary to practice the invention in the broadest sense, and are instead taught merely to particularly describe representative examples of the invention. Moreover, various features of the representative examples and the dependent claims may be combined in ways that are not specifically enumerated in order to provide additional useful embodiments of the present teachings.

[0017] In the following, an embodiment of the present invention will be described with reference to the drawings. An ink supply apparatus 10, shown in Fig. 1, is for use in a pad printer 1 shown in Fig. 11. As shown in Fig. 11, the pad printer 1 generally includes the ink supply apparatus 10, a pad 62, a pad moving device 63 for moving the pad 62, a control panel 64, a base 66 supporting the ink supply apparatus 10, and an object support 70. An object 71 for printing thereon can be set on the object support 70. The control panel 64 is configured as a sequencer for controlling the entire operation of the pad printer 1. More specifically, the control panel 64 controls the pad moving device 63 and an air cylinder 67 described below (See Fig. 3) to perform a pad printing operation.

[0018] As shown in Fig. 1, the ink supply apparatus 10 is equipped with a first container 20 for storing printing ink 61 (See Fig. 5), a cover 40, a pad plate 60, a second container 30 for storing solvent for the printing ink 61, and a support frame 65. Numeral 61a indicates the liquid level of the printing ink 61 (See Fig. 5). The pad plate 60 is formed as a flat plate and has a rectangular upper surface 60a. The pad plate 60 may be made of a flat plate formed of a ferromagnetic material, a flat plate formed of a resin containing a ferromagnetic material, or a flat resin plate whose lower surface is backed with a flat plate formed of a ferromagnetic material.

[0019] The first container 20 and the cover 40 are supported by the support frame 65. More specifically, two recesses 23b (See Fig. 8) are formed in the lower portion of the outer surface of a side wall portion 23 of the first container 20 and are opposed to each other in the diametrical direction. A first pin 68a and a second pin 68b (See Figs. 2 and 4) are threadably engaged with the support frame 65 of Fig. 2 and are engaged with the two recesses 23b, so that the first container 20 is supported by the support frame 65 via the first and second pins 68a and 68b such that the first container 20 can move vertically relative to the support frame 65 within the range of the recesses 23b but cannot move relative to the support

frame 65 in a moving direction of the pad plate 60. The first pin 68a and the second pin 68b engage with the corresponding recesses 23b at their midpoints in the vertical direction. Therefore, the first container 20 is put on the pad plate 60 by the gravity force. In addition, the first container 20 is pressed against the pad plate 60 by the magnetic force as will be explained later.

[0020] As shown in Fig. 9, the cover 40 has a lower opening 41, and, as shown in Fig. 1, a lower circumferential edge 42 defining the lower opening 41 of the cover 40 is positioned above the pad plate 60 and is supported by the support frame 65. More specifically, as shown in Fig. 9, a part of the lower circumferential edge 42 defining a lower edge of a right side wall of the cover 40 has a recesses 42a. Similarly, a part of the lower circumferential edge 42 defining a lower edge of a left side wall of the cover 40 has a recesses 42c. A front portion (left portion as viewed in Figs. 1 and 9) of the recess 42a has a semi-circular cutout 42b. Similarly, a front portion (left portion as viewed in Figs. 1 and 9) of the recess 42c has a semi-circular cutout 42d at a position opposed to the semi-circular cutout 42b. A first pin 68a is threadedly engaged with a threaded hole formed in a side wall portion 65a of the support frame 65 shown in Fig. 2. The end portion of the first pin 68a engages the cutout 42b. A second pin 68b is threadedly engaged with a threaded hole formed in a side wall portion 65b opposed to the side wall portion 65a of the support frame 65 shown in Fig. 2. The end portion of the second pin 68b engages the cutout 42d. Therefore, the front portion of the cover 40 is supported on the support frame 65 via the first and second pins 68a and 68b.

[0021] The rear portion of the cover 40 is positioned to closely contact with a top wall 65g of the support frame 65. The top wall 65g of the support frame 65 extends forwardly from the rear end (right end as viewed in Fig. 1) by a predetermined distance, so that an opening is formed the upper portion of front portion of the support frame 65. However, the upper opening of the support frame 65 is closed by the plate pad 60 even during the movement of the plate pad 60. The support frame 65 further includes a front wall 65h. The upper end of the front wall 65h and the front portion of the lower edge 42 of the cover 40 define an opening therebetween, through which the plate pad 60 extends outward. The lower portions of the right and left side walls of the cover 40 are positioned inside of the upper ends of the side walls 65a and 65b so as to closely contact therewith.

[0022] As shown in Fig. 1, an ink receiving portion or a recessed print pattern forming portion 60b is formed on the flat upper surface 60a of the pad plate 60 and may include characters, symbols, pattern, etc. that are not shown in the drawings.

[0023] As shown in Fig. 5, a first opening 22 is formed at the bottom of the first container 20, and a lower end portion 23a of a side wall portion 23 of the first container 20 defines a circumferential edge 22a of the first opening 22.

[0024] The pad plate 60 is slidable relative to the lower end portion 23a of the side wall portion 23 of the first container 20, with the first container 20 being positioned on the pad plate 60. As the pad plate 60 slidably moves, the print pattern forming portion 60b of the pad plate 60 of Fig. 1 can move to a transfer position 69 (See Fig. 3) outside the cover 40 from under the first opening 22 (the region surrounded by the lower end portion 23a of the side wall portion 23) of the first container 20 (See Fig. 5).

[0025] As shown in Fig. 5, the lower end portion 23a of the side wall portion 23 is formed so as to be capable of scraping off any printing ink 61 applied to portions other than the print pattern forming portion 60b on the flat upper surface 60a of the pad plate 60 as the pad plate 60 slidably moves. More specifically, the lower end portion 23a of the side wall portion 23 has a configuration like a knife edge, so that any printing ink 61 adhering to the upper surface 60a of the pad plate 60 can be easily scraped off.

[0026] As shown in Fig. 1, the first container 20 and the second container 30 are arranged within the cover 40. In the embodiment shown in Fig. 2, the second container 30 includes three separate container units 30a, 30b, and 30c. More specifically, lateral bars 65c and 65d extend between the opposite side wall portions 65a and 65b of the support frame 65, and the lateral bars 65c and 65d support from below the bottom of the container unit 30a of the second container 30. Further, the lateral bars 65c and 65d support the cover 40 at the rear portions of the recesses 42a and 42c of the circumferential edge 42 (See Fig. 9). Similarly, lateral bars 65e and 65f (See Fig. 3) provided on the side wall portion 65a of the support frame 65 support from below the container unit 30b of the second container 30. Further, like the container unit 30b, the container unit 30c is also supported by lateral bars (not shown) which correspond to the lateral bars 65e and 65f.

[0027] Members 31a, 31b, and 31c are soaked in the solvent and are respectively arranged in the container units 30a, 30b, and 30c. The members 31a, 31b, and 31c may be cloths, sponges or any other suitable materials. The member 31a is supported on support bars 30e, 30f, and 30g extending across the opening on the upper side of the container unit 30a,

[0028] The second container 30 stores the solvent for the printing ink 61 (See Fig. 5). The solvent stored in the second container 30 may be the same as one of volatile solvent components of the ink 61, the mixture thereof or any other solvent than the volatile solvent components of the ink 61. As the solvent in the second container 30 volatilize, vapor of the solvent fills the substantially sealed space surrounded by the cover 40 and the pad plate 60 to be saturated or substantially saturated therewithin.

[0029] Further, there is provided a third container 50 storing a solvent for the printing ink 61. The solvent stored in the third container 50 may be the same as the solvent stored within the second container 30 or may be different from that stored within the second container 30. The third container 50 is arranged above the level of the printing

ink 61 contained in the first container 20. As the solvent stored within the third container 50 volatilizes, vapor of the solvent of the third container 50 fills the interior of the first container 20 and is saturated therewithin. Arranged inside the third container 50 is a member 51 that can be soaked in the solvent. The member 51 may be a cloth, sponge, cotton or the like.

[0030] Further, the first container 20 is divided into a lower portion 21 and an upper portion 26, and the lower portion 21 and the upper portion 26 are separable from each other. A seal member 26a (e.g., an O-ring) for sealing a gap that may be formed at a connecting region between the lower portion 21 and the upper portion 26 is arranged in a groove formed in the side wall portion 23 on the side of the upper portion 26.

[0031] Further, as shown in Fig. 6, a support member 27 supporting the third container 50 is formed on the inner side of the upper portion 26. The support member 27 is composed of a plurality of (eight in the embodiment shown in Fig. 6) support portions 27a, and vapor of the solvent in the third container 50 can pass between the support portions 27a to enter the lower portion 21 (See Fig. 5). The support member 27 is formed so as to be integral with the side wall portion 23 on the side of the upper portion 26. A radially inner end of each support portion 27a is arranged on an arc 27x, and round cutouts 27b are formed between the support portions 27a.

[0032] As shown in Fig. 5, the upper end of the upper portion 26 has a second opening 28, and there is arranged a cover 29 closing the second opening 28. A seal member 29a sealing a gap that may be formed between the upper portion 26 and the cover 29 is arranged in a groove formed in the outer circumferential surface of the cover 29. The cover 29 is equipped with a knob 29b.

[0033] Further, as shown in Figs. 5 and 7, a magnet 24 is arranged within the lower portion 21. More specifically, the magnet 24 has a ring-like configuration. A collar 24c is fitted into a gap formed between the inner surface of the magnet 24 and a bolt 24d. The magnet 24 is mounted to the lower surface of a magnet mounting plate 24a by the bolt 24d. As shown in Fig. 10, the magnet mounting plate 24a has three radial extension 24b arranged at an interval of 120 degrees in the circumferential direction and supported by three magnet support portions 25. A magnet 24ba is attached to the radially outer end portion of each extension 24b.

[0034] The magnet support portions 25 are formed on the inner side of the side wall portion 23 of the lower portion 21 at an interval of 120 degrees in the circumferential direction. The magnet support portions 25 can be set to at three different levels (as measured from the lower end portion 23a of the side wall portion 23 (See Fig. 5)). Thus, by selecting between the three different levels, it is possible to adjust the mounting height of the magnet 24 as measured from the lower end portion 23a of the side wall portion 23 (See Fig. 5). Therefore, it is possible to adjust the magnetic force, by which the first container 20 and the pad plate 60 shown in Fig. 5 are attracted to

each other, to three different magnitudes.

[0035] More specifically, as shown in Fig. 10, each magnet support portion 25 includes a flat portion 25a, a first recessed portion 25b, and a second recessed portion (not shown) (which is formed to be lower than the first recessed portion 25b). A magnet 25aa is embedded in the flat portion 25a, and a magnet 25ba is embedded in the first recessed portion 25b. Further, a magnet (not shown) (which corresponds to the magnet 25ba) is embedded in the second recessed portion.

[0036] In Fig. 10, each extension 24b is positioned at the second recessed portion. Therefore, the magnet 24ba of each extension 24b and the magnet of the second recessed portion are attracted to each other, whereby each extension 24b can be positioned.

[0037] As shown in Fig. 3, the print pattern forming portion 60b of the pad plate 60 can move into and out of the cover 40 under the first container 20 by a piston 67a of the air cylinder 67 controlled by the control panel 64 (See Fig. 11), and the forward end of the pad plate 60 can move from a position indicated by the two-dot chain line to a transfer position 69 indicated by the solid line (See Fig. 3). More specifically, a locking member 67b is attached to the forward end of the piston 67a, and a mating member 60d is provided on the lower surface 60c of the pad plate 60. The locking member 67b is locked to the mating member 60d, so that the pad plate 60 can be pushed and drawn by the air cylinder 67. Whether the pad plate 60 is at the position indicated by the solid line or the position indicated by the two-dot chain line, the front portion of the circumferential edge 42 of the opening 41 of the cover 40 is positioned proximal to and above the pad plate 60.

[0038] Some amount of the printing ink 61 is carried on the print pattern forming portion 60b on the upper surface 60a of the pad plate 60 when the pad plate 60 is pushed out to the transfer position 69. Then, under the control by the control panel 64a, the moving device 63 moves a pad 62 to be pressed toward the printing ink 61 carried on the print pattern forming portion 60b, so that the printing ink 61 carried on the print pattern forming portion 60b adheres to the pad 62, whereby the characters, symbols, pattern, etc. of the print pattern forming portion 60b are transferred to the pad 62.

[0039] Thereafter, as shown in Fig. 11, the pad 62 is moved by the pad moving device 63 in the direction of an arrow 62a, so that the characters, pattern, etc. of the print pattern forming portion 60b are printed on the article 71 supported by the object support 70. In this way, a pad printing operation is performed. An air blower 72 is provided on the object support 70. The air blower 72 blows air against the article 71 and the pad 62 to thereby dry the article 71 and the pad 62.

[0040] After that, the pad 62 is restored to the transfer position 69 by the pad moving device 63, and the characters, symbols, pattern, etc. of the print pattern forming portion 60b, on which some printing ink 61 has been carried at the first container 20, are transferred to the pad 62.

[0041] The main component of the printing ink 61 (See Fig. 5) may include one or two or more of butyl glycol acetate, 4-hydroxy-4-methyl-2-pentanone, solvent naphtha, cyclohexanone, xylene, butyl glycolate, butyl acetate, benzyl alcohol, propylene glycol, methyl ether acetate, and aromatic mixed hydrocarbon. Various kinds of printing inks can be obtained through combination of these examples of the main component.

[0042] The main component of the solvent for the printing ink 61 may include one or two or more of propylene glycol monomethyl ether acetate, cyclohexane, aromatic hydrocarbon, butyl acetate, butyl acetate, and xylene. Various kinds of solvents for the printing ink 61 can be obtained through combination of these examples of the main component.

[0043] The operation of the ink supply apparatus 10 constructed as described above will now be described. As described above, the first container 20 and the cover 40 are supported on the support frame 65. The first container 20 has the first opening 22 at its bottom, and the side wall portion 23 has the lower circumferential edge 22a defining the first opening 22. The pad plate 60 is slidable with respect to the lower end portion 23a of the side wall portion 23 of the first container 20, with the first container 20 being positioned thereon. The lower end portion 23a can scrape off any surplus portion of the printing ink 61 applied to the pad plate 60 as the pad plate 60 slides from the position indicated by the two-dot chain line to the transfer position 69 (See Fig. 3). Thus, when the print pattern forming portion 60b of the pad plate 60 is drawn out from under the first container 20, the printing ink 61 remains only on the print pattern forming portion 60b formed on the upper surface 60a of the pad plate 60, and no printing ink 61 adheres to portions other than the print pattern forming portion 60b on the upper surface 60a of the pad plate 60.

[0044] Further, the lower surface of the cover 40 is formed as the opening 41, and the edge 42 of the opening 41 of the cover 40 is positioned proximal to and above the pad plate 60. The first container 20 and the second container 30 are arranged inside the cover 40. As the solvent in the second container 30 volatilizes, vapor of the solvent may be filled within the cover 40 so as to be saturated or substantially saturated.

[0045] Thus, when solvent is evaporated from the printing ink 61 stored within the first container 20 within the cover 40, the vapor may be filled within the first container 20. Because the vapor of the solvent in the second container 30 is filled within the cover 40 and saturated or substantially saturated therewithin, potential evaporation of solvent from the printing ink 61 stored within the first container 20 and potential evaporation of solvent from the printing ink 61 adhering to the lower end portion 23a of the side wall portion 23 can be suppressed. Hence the viscosity of the printing ink 61 in the first container 20 and that of the printing ink 61 adhering to the lower end portion 23a of the side wall portion 23 of the first container 20 can be maintained in stable.

[0046] Further, the third container 50 storing the solvent for the printing ink 61 is provided, and the third container 50 is arranged above the level of the printing ink 61 stored within the first container 20. Therefore, as the solvent within the third container 50 is volatilized, vapor of the solvent may be filled within the first container 20, so that potential evaporation of solvent from the printing ink 61 is further suppressed, making it possible to further stabilize the viscosity of the printing ink 61.

[0047] The side wall of the first container 20 is divided into the lower portion 21 and the upper portion 26, and the lower portion 21 and the upper portion 26 are separable from each other, so that the installment of the third container 50 within the first container 20 can be facilitated.

[0048] Further, the support member 27 supporting the third container 50 is formed on the inner side of the upper portion 26, and the support member 27 has a plurality of support portions 27a. Therefore, the vapor of the solvent stored within the third container 50 can pass between the support portions 27a to enter the lower portion 21, so that it is possible to reliably suppress evaporation of the solvent for the printing ink 61 in the first container 20, thereby reliably stabilizing the viscosity of the printing ink 61.

[0049] Further, the third container 50 can be easily put in the first container 20 by opening the cover 29 of the second opening 28 formed in the upper end of the upper portion 26 of the first container 20.

[0050] Further, because the pad plate 60 includes a ferromagnetic material (e.g., iron or stainless steel), the magnet 24 arranged inside the lower portion 21 of the first container 20 can be attracted to the pad plate 60 with a magnetic force, so that the lower portion 21 of the first container 20 is attracted to the pad plate 60.

[0051] Although in the above embodiment the first container 20 has a cylindrical outer configuration, the first container 20 may have the other outer configuration, such as a prism-like outer configuration.

[0052] Although the cover 40 has a rectangular-parallelepiped outer configuration, the cover 40 may have the other outer configuration, such as a dome-like outer configuration.

[0053] Further, although the second container 30 includes the three separate container units 30a, 30b, and 30c, the second container 30 may consist of a single container, or may include four or more container units.

[0054] The construction of providing the space surrounded by the cover 40, the pad plate 60, and the upper end portions of the opposite side wall portions 65a and 65b of the support frame 65 (arranged so as to receive the cover 40 therebetween) may cause less leakage of vapor than construction of providing a space surrounded by the cover 40 and the pad plate 60. Therefore, vapor of the solvent stored within the second container 30 can be easily saturated within the space.

[0055] Further, minimizing the size of the recesses 42a and 42c and that of the cutouts 42b and 42d of the lower

edge 42 of the cover 40 also makes vapor of the solvent in the second container 30 to be easily saturated within the space surrounded by the cover 40 and the pad plate 60.

[0056] Further, although the magnetic force is used for urging the lower circumferential edge 23a of the side wall of the first container 20 toward the pad plate 60, any other urging means can be used. For example, a spring may be used for urging the first container 20 toward the pad plate 60.

Claims

1. An ink supply apparatus (10) for use with a pad printer (1), comprising:

a support frame (65);
 a pad plate (60) movable relative to the support frame (65) and having an ink receiving portion (60b);
 a cover (40) supported on the support frame (65) and defining a space therein;
 wherein the pad plate (60) defines a bottom of the space, so that the ink receiving portion (60b) can move between a position opposed to the space and a position outside of the cover (40) as the movement of the pad plate (60);
 a first container (20) storing an ink (61) therein; and
 a second container (30) storing a volatile solution for the ink, **characterized in that:**

the first container (20) and the second container (30) are disposed within the cover (40), and
 the first container (20) can supply the ink onto the ink receiving portion (60b) and can scrape off the ink adhered to portions of the pad plate other than the ink receiving portion (60b).

2. The ink supply apparatus (10) as in claim 1, **characterized in that** the first container (20) has lower circumferential edge (23a) defining a lower opening (22) and slidably contacting with the pad plate (60).

3. The ink supply apparatus (10) as in claim 1 or 2, **characterized in that** the cover (40) is removably mounted to the support frame (65).

4. The ink supply apparatus (10) as in any one of the preceding claims, **characterized in that:**

the ink supply apparatus (10) further includes a third container (50) storing a volatile solvent for the ink and disposed adjacent to the first container (20), so that vapor of the solvent of the

third container (50) can enter the first container (20).

5. The ink supply apparatus (10) as in claim 4, wherein the third container (50) is disposed within the first container (20).

6. The ink supply apparatus (10) as in claim 5, wherein the first container (20) includes a lower portion (21) and an upper portion (26) that can be separable from each other, and the lower portion (21) receives therein the ink and the upper portion (26) receives therein the third container (50).

7. The ink supply apparatus (10) as in claim 6, further comprising a support member (27), wherein the support member is configured to enable vapor of the solvent stored within the third container (50) to flow therethrough, so that the vapor can reach the ink received within the lower portion (21).

8. The ink supply apparatus (10) as in any one of claims 5 to 7, wherein the first container (20) has an upper opening (28) closed by a removable cover (29) and a lower opening (22) closed by the pad plate (60).

9. The ink supply apparatus (10) as in any one of claims 5 to 11, wherein the solvent of the third container (50) is soaked into a member (51) disposed within the third container (50).

10. An ink supply apparatus (10) for use with a pad printer (1), comprising:

a first container (20) storing a printing ink (61),
 a cover (40), pad plate (60), a second container (30) storing a solvent for the printing ink (61),
 and a support frame (65),

characterized in that:

the first container (20) and the cover (40) are supported by the support frame (65),
 a recessed print pattern forming portion (60b) is provided on a flat upper surface of the pad plate (60),
 a first opening (22) is formed at a bottom of the first container (20),
 a lower end portion (23a) of a side wall portion (23) of the first container (20) defines an edge of the first opening (22),
 the pad plate (60) is slidable with respect to the lower end portion (23a) of the side wall portion (23) of the first container (20), with the first container (20) being positioned thereon,
 the print pattern forming portion (60b) of the pad plate (60) is slidably movable from a lower side of the first opening (22) of the first container (20)

- to a transfer position (69) outside the cover (40),
the lower end portion (23a) of the side wall portion (23) is configured so as to be capable of
scraping off, through sliding of the pad plate (60),
any printing ink (61) applied to portions other than the print pattern forming portion (60b) on
the flat upper surface of the pad plate (60),
a lower side of the cover (40) has an opening (41),
an edge (42) of the opening of the cover (40) is positioned on or above the pad plate (60), and
the first container (20) and the second container (30) are arranged inside the cover (40).
- 5
- 10
11. The ink supply apparatus (10) as in claim 10, further comprising a third container (50) storing a solvent for the printing ink (61),
wherein the third container (50) is arranged above the printing ink (61) within the first container (20), and
wherein the solvent can be volatilized to produce a vapor that can be filled within the first container (20).
- 15
- 20
12. The ink supply apparatus (10) as in claim 11, wherein the first container (20) is divided into a lower portion (21) and an upper portion (26), and
wherein the lower portion (21) and the upper portion (26) are separable from each other.
- 25
13. The ink supply apparatus (10) as in claim 12, further comprising a support member (27) provided inside the upper portion (26) and supporting the third container (50),
wherein the support member (27) includes a plurality of support portions (27a),
wherein vapor of the solvent stored within the third container (50) can pass between the support portions (27a) of the support member (27) to enter the lower portion (21).
- 30
- 35
14. The ink supply apparatus (10) as in claim 12 or 13, wherein an upper surface of the upper portion (26) has a second opening (28), and a cover (29) is provided for closing the second opening (28).
- 40
15. The ink supply apparatus (10) as in any one of claims 10 through 14, wherein the pad plate (60) includes a ferromagnetic material, wherein a magnet (24) is disposed within the first container (20), and the magnet (24) can attract the pad plate (60) with a magnetic force.
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- 50

55

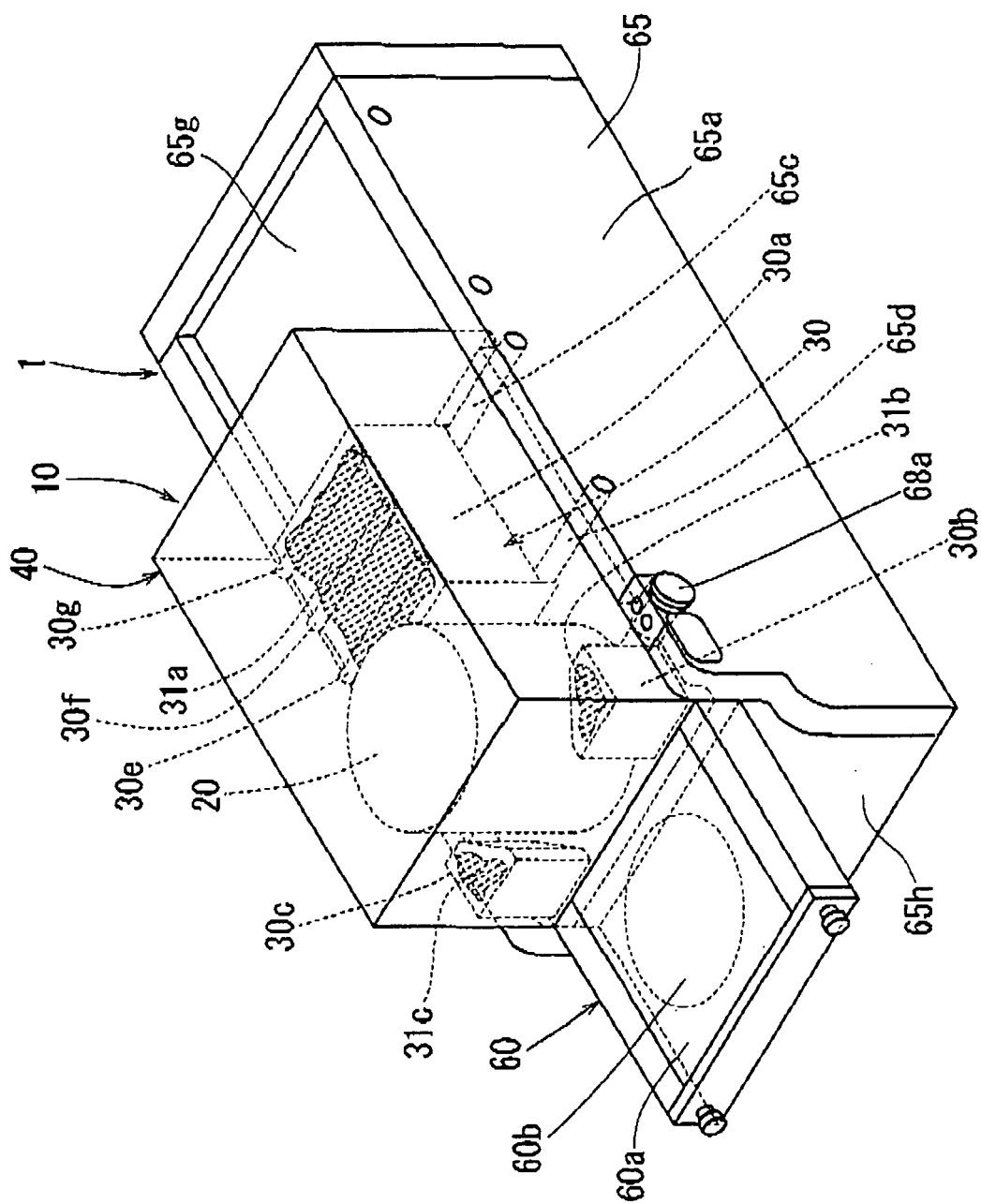


FIG. 1

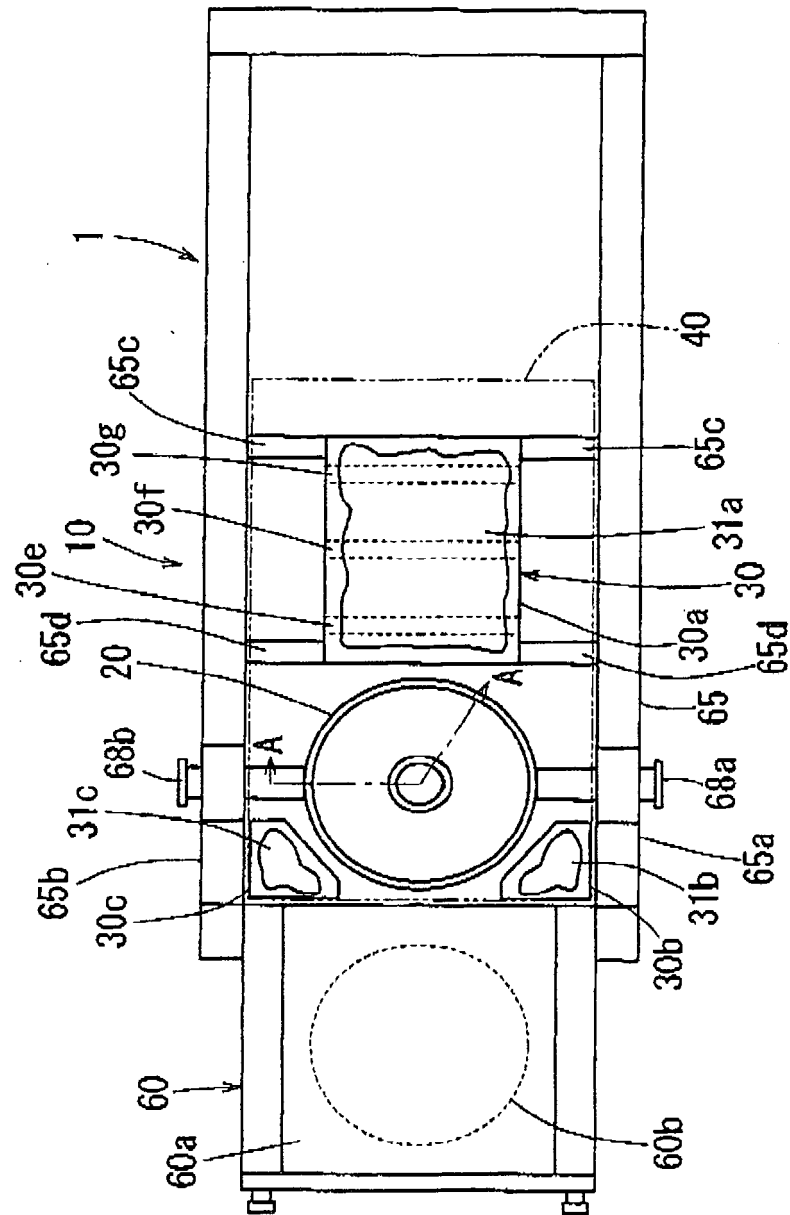


FIG. 2

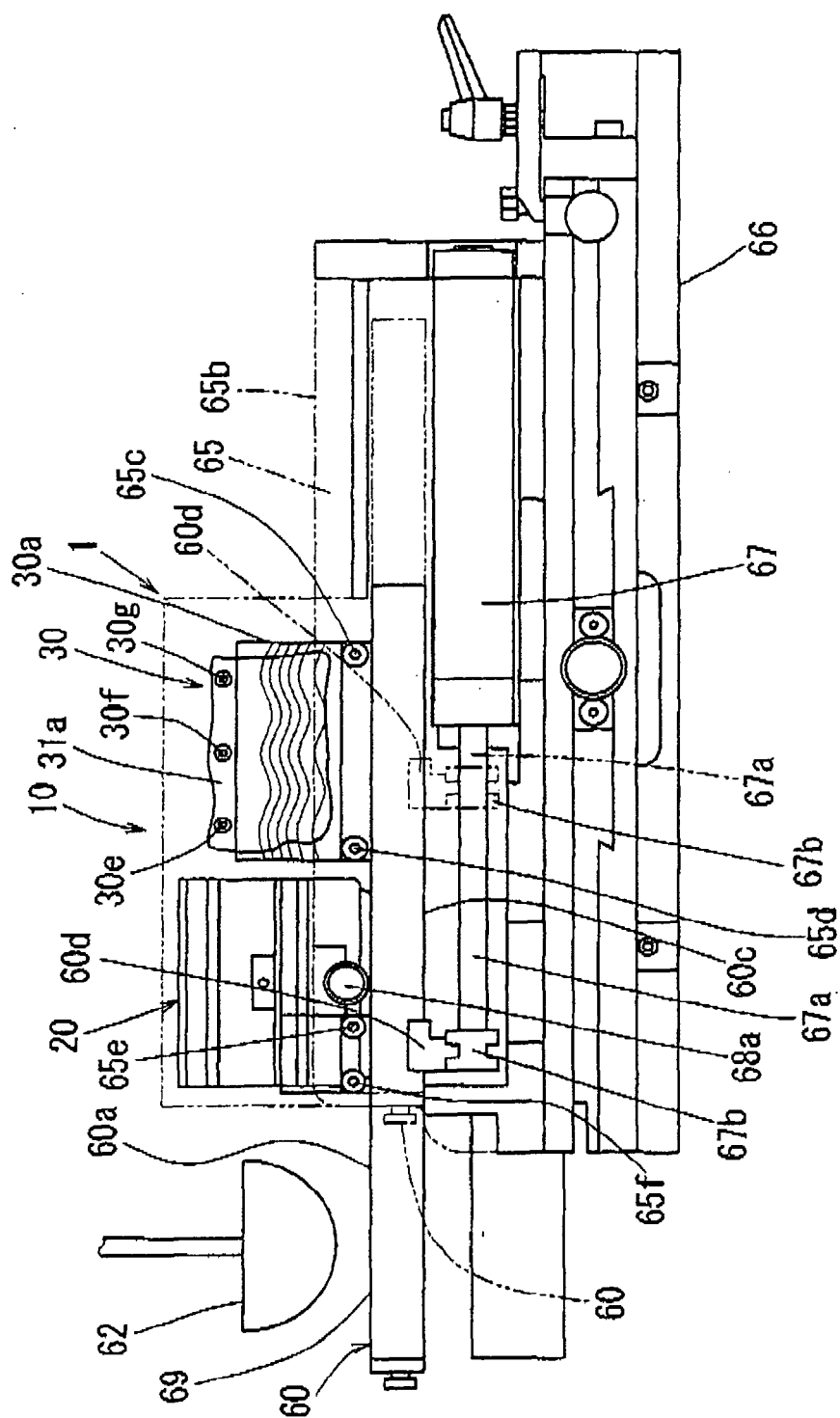


FIG. 3

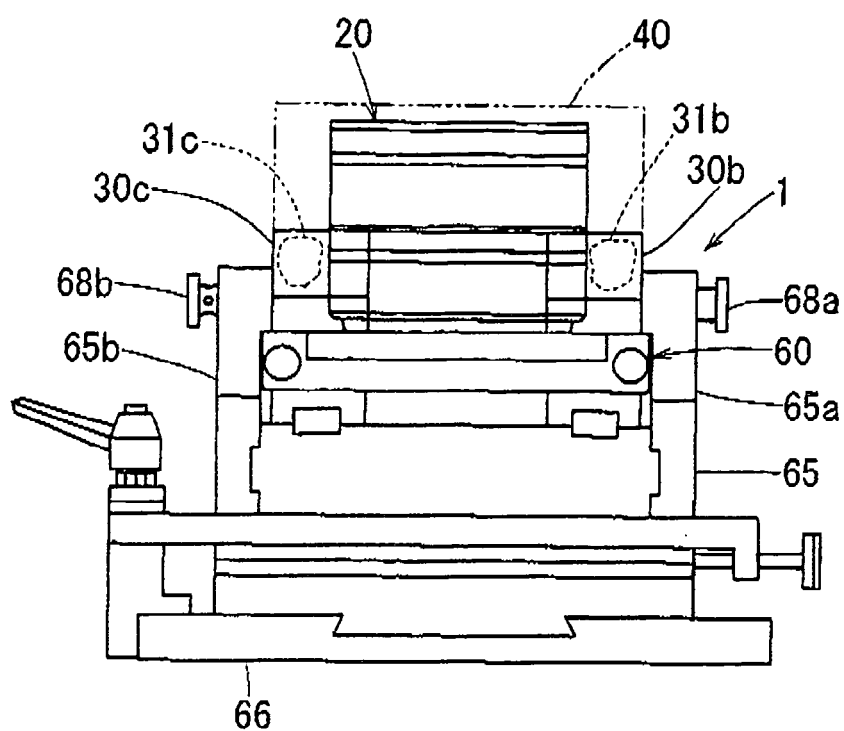


FIG. 4

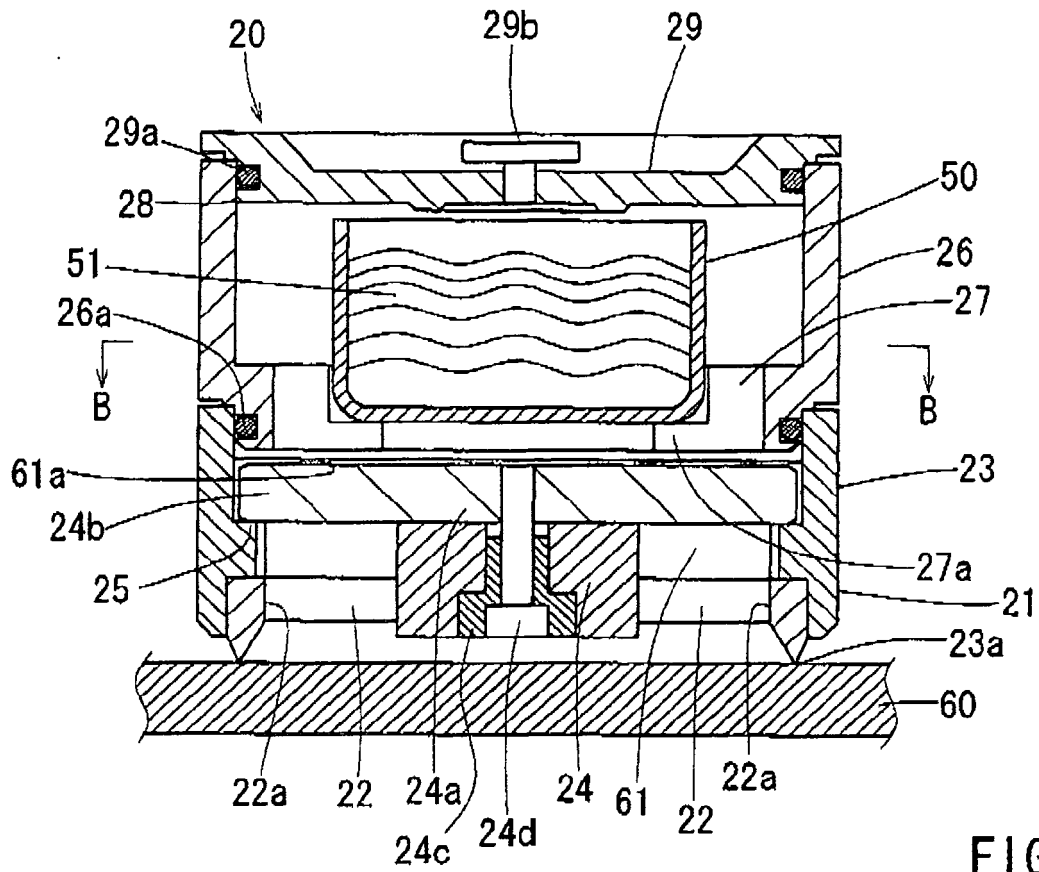


FIG. 5

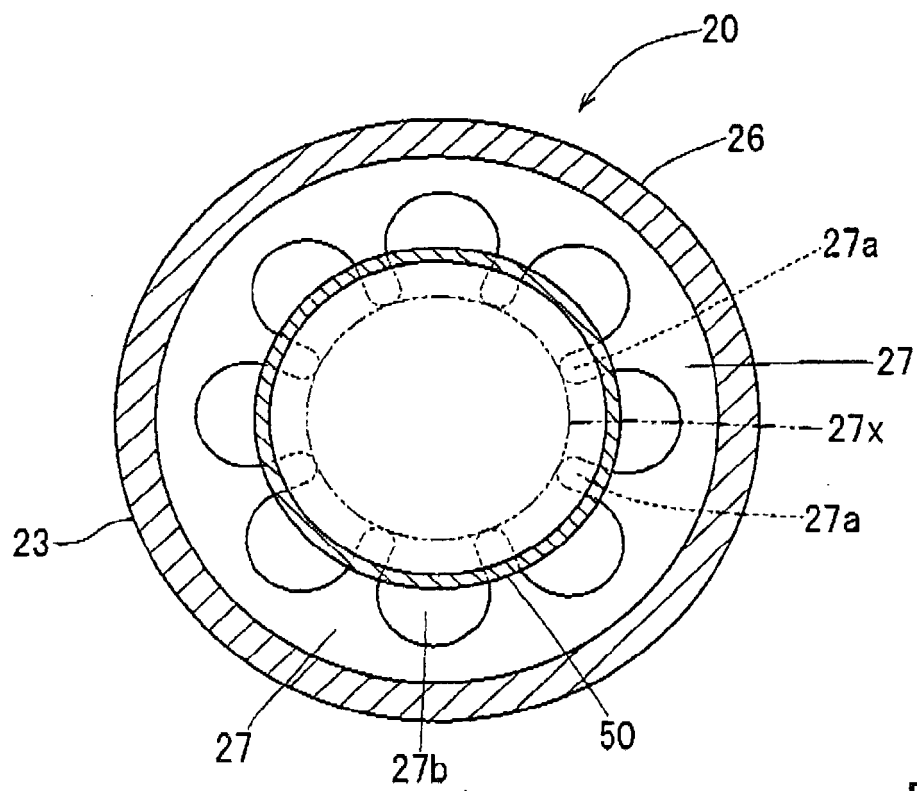


FIG. 6

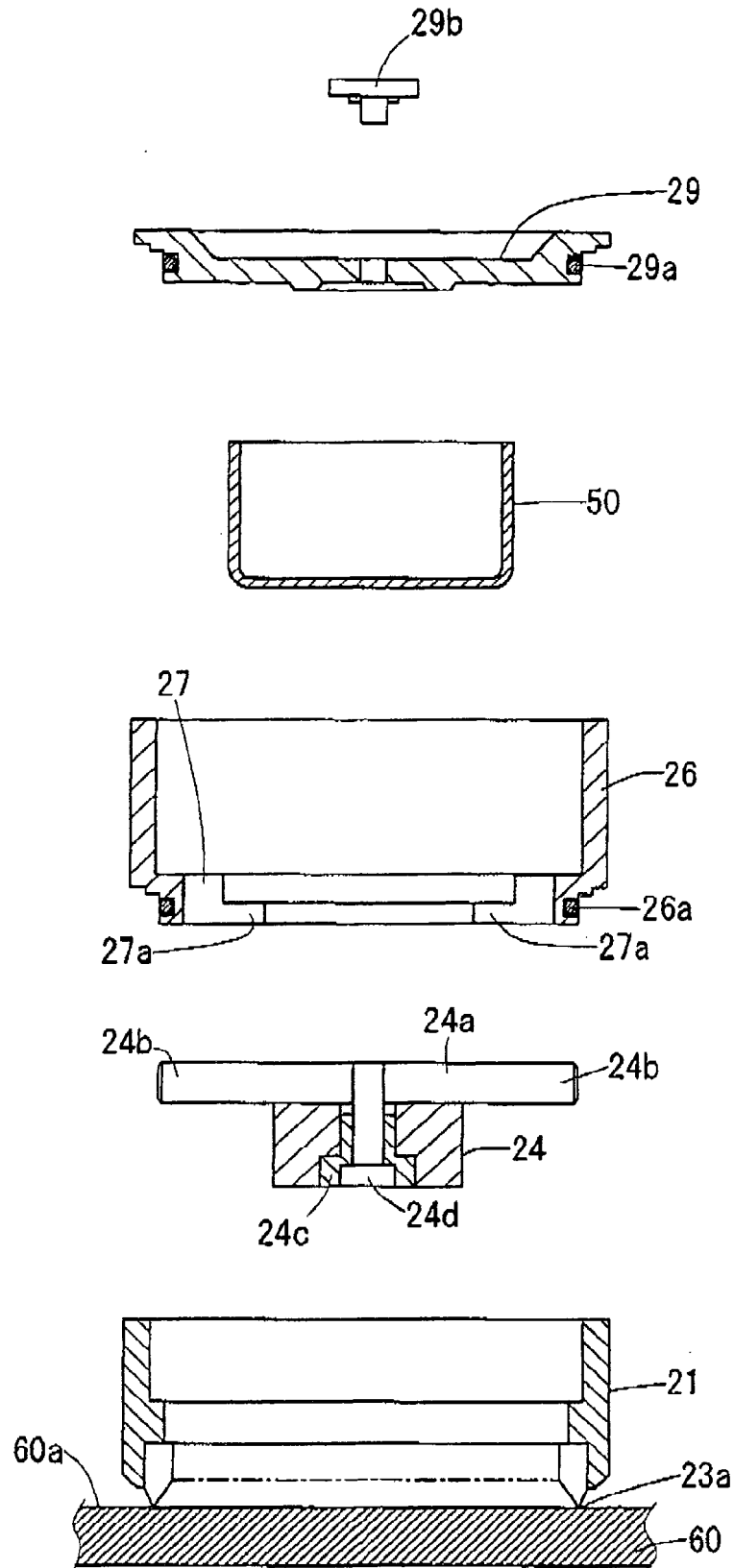


FIG. 7

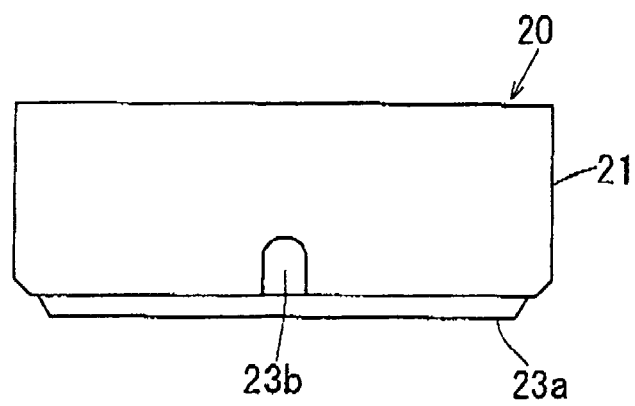


FIG. 8

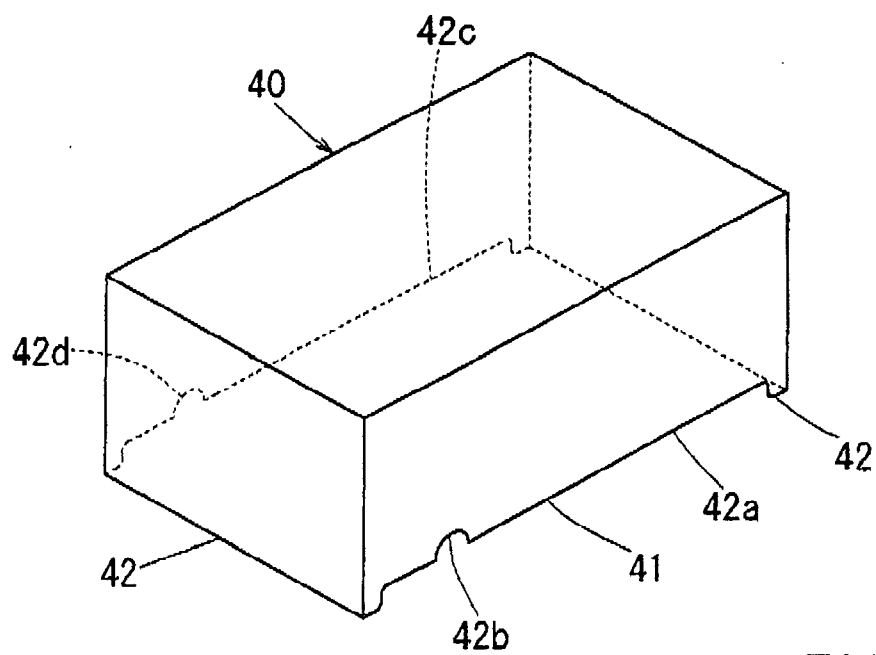


FIG. 9

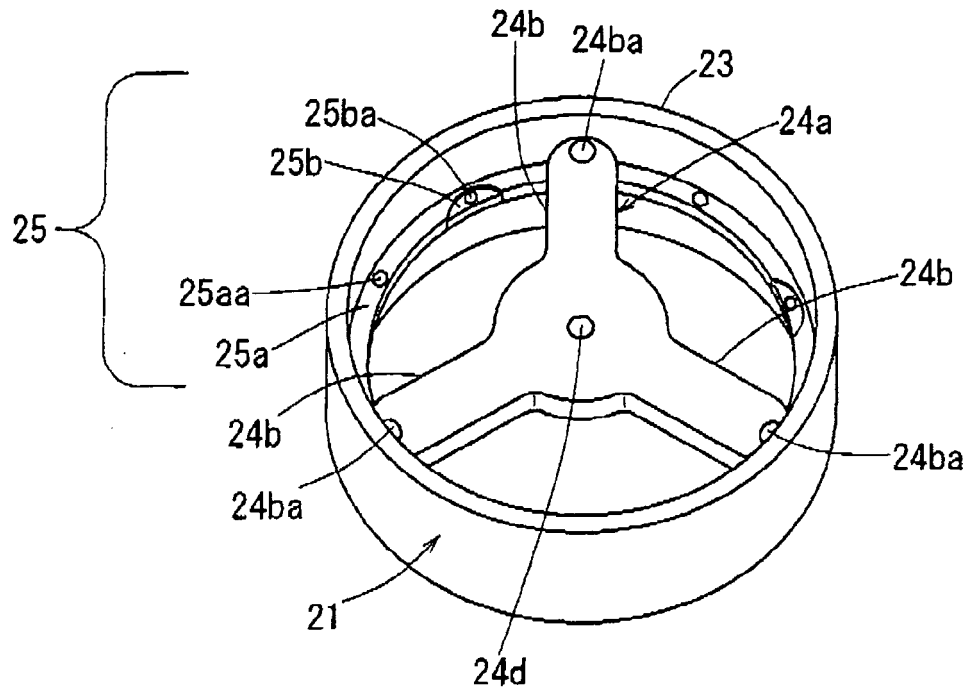


FIG. 10

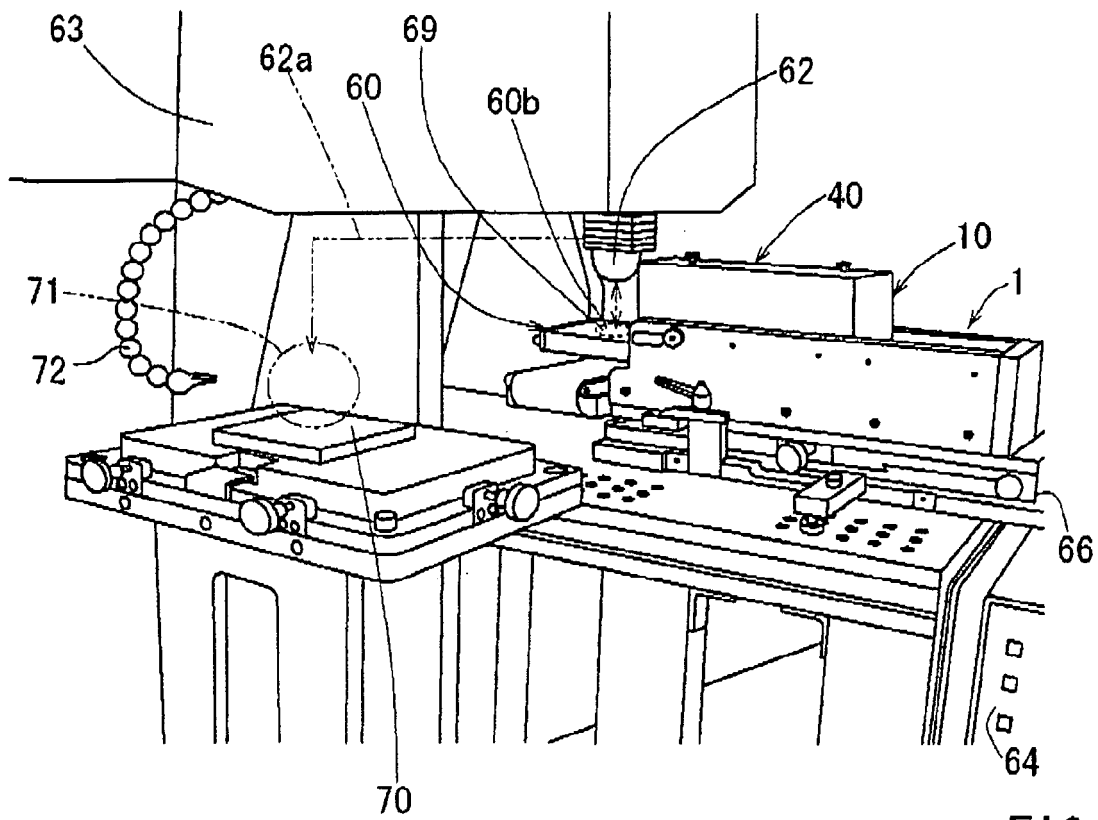


FIG. 11

REFERENCES CITED IN THE DESCRIPTION

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