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(71) Applicant: **Fujikoshi Machinery Corp.**
Nagano-shi
Nagano 381-1233 (JP)

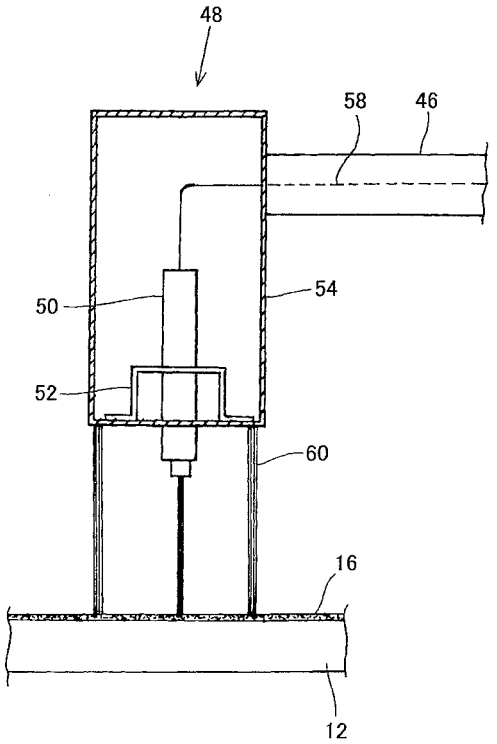
(72) Inventor: **Sakata, Kentaro**
Nagano-shi, Nagano 381-1233 (JP)

(74) Representative: **Stuart, Ian Alexander et al**
Mewburn Ellis LLP
33 Gutter Lane
London
EC2V 8AS (GB)

(54) Equipment and method for cleaning polishing cloth

(57) The equipment (34) for cleaning polishing cloth (16) is capable of increasing pressure of washing water received by the polishing cloth (16), securely removing deposits from the polishing cloth (16) and improving polishing efficiency. The equipment (34) is used in a polishing apparatus (10), in which a work piece (20) is pressed onto the polishing cloth (16) adhered on a polishing plate (12) and the work piece (20) is relatively moved with respect to the polishing plate (12) with supplying slurry to the polishing cloth (16) so as to polish the work piece (20). The equipment (34) comprises a nozzle unit (48) having a nozzle (50) capable of spraying high-pressure washing water toward the polishing cloth (16). The nozzle (50) is a straight nozzle capable of linearly spraying the washing water and perpendicularly spraying the washing water with respect to the polishing cloth (16).

FIG.4



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Description

FIELD

[0001] The present invention relates to an equipment and a method for cleaning polishing cloth.

BACKGROUND

[0002] Work pieces, e.g., semiconductor wafers, are polished, in a polishing apparatus, by the steps of: pressing the work pieces onto polishing cloth adhered on a polishing plate; relatively moving the polishing plate with respect to the work pieces; and supplying slurry to the polishing cloth while polishing the work pieces.

[0003] By the way, in case of using the polishing cloth for a long time, various kinds of deposits, e.g., abrasion dust, slurry, reaction products, gradually deposit in the polishing cloth. The deposits will cause some problems, e.g., lowering polishing efficiency, damaging work pieces. Thus, high-pressure washing water is periodically sprayed toward the polishing cloth so as to clean the polishing cloth.

[0004] One of conventional cleaning equipments is disclosed in Japanese Laid-open Patent Publication No. P7-9340A. The conventional equipment obliquely sprays high-pressure (about 50 kg/cm^2) washing water from a nozzle toward polishing cloth, so that deposits in the polishing cloth are floated and removed. Note that, the nozzle may be enclosed by brushing means so as to prevent the high-pressure washing water from splashing.

[0005] However, in the above described conventional equipment, deposits in the polishing cloth, e.g., abrasion dust, cannot be sufficiently removed, and desired polishing efficiency cannot be obtained.

[0006] Because the high-pressure washing water, which is obliquely sprayed, spreads out in a fan-like form, the deposits cannot be sufficiently removed. The inventor thinks that pressure of the washing water per unit area received by the polishing cloth is small, so this problem cannot be sufficiently solved.

[0007] These days, the polishing cloth is mainly composed of foamed polyurethane. In comparison with polishing cloth composed of unwoven cloth, it is difficult to remove deposits, by spraying washing water, from the polishing cloth composed of foamed polyurethane.

SUMMARY

[0008] A preferred embodiment of the invention may provide an equipment and a method for cleaning polishing cloth, which are capable of increasing pressure of washing water received by the polishing cloth, securely removing deposits from the polishing cloth and improving polishing efficiency.

[0009] The invention provides equipment for cleaning polishing cloth, which is used in a polishing apparatus in which a work piece is pressed onto the polishing cloth adhered on a polishing plate and the work piece is relatively moved with respect to the polishing plate with supplying slurry to the polishing cloth so as to polish the work piece, comprises a nozzle unit having a nozzle capable of spraying high-pressure washing water toward the polishing cloth so as to clean the polishing cloth, and the nozzle is a straight nozzle capable of linearly spraying the washing water and perpendicularly spraying the same with respect to the polishing cloth.

[0010] In the equipment, the nozzle unit may include a plurality of the nozzles.

[0011] The equipment may further comprise a unit for moving the nozzle unit on the polishing plate.

[0012] In a second aspect the invention provides a method for cleaning polishing cloth, which is used in a polishing apparatus in which a work piece is pressed onto the polishing cloth adhered on a polishing plate and the work piece is relatively moved with respect to the polishing plate with supplying slurry to the polishing cloth so as to polish the work piece, comprising the step of spraying high-pressure washing water, from a nozzle of a nozzle unit, toward the polishing cloth so as to clean the polishing cloth, wherein the nozzle is a straight nozzle, and the straight nozzle linearly sprays the washing water and perpendicularly sprays the same with respect to the polishing cloth.

[0013] In the method, pressure of the washing water which is received by the polishing cloth may be nearly equal to or greater than polishing load which is applied to the work piece while polishing the work piece.

[0014] For example, the pressure of the washing water which is received by the polishing cloth is 150-350 gf/cm^2.

[0015] In the method, a main material of the polishing cloth may be foamed polyurethane.

[0016] In the method, the nozzle unit may be moved on the polishing plate, with spraying the washing water from the straight nozzle, while cleaning the polishing cloth.

[0017] In the present invention, by employing the straight nozzle, the pressure of the washing water received by the polishing cloth can be increased, so that deposits, e.g., abrasion dust, in the polishing cloth can be sufficiently removed. Therefore, damaging the surface of the work piece can be highly prevented, and polishing accuracy can be improved. Further, polishing efficiency can be improved, polishing time can be shortened, and a life span of the polishing cloth can be extended.

[0018] The object and advantages of the invention will be realized and attained by means of the elements and combinations particularly pointed out in the claims.

[0019] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are not restrictive of the invention, as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Embodiments of the present invention will now be described by way of examples and with reference to the accompanying drawings, in which:

Fig. 1 is an explanation view of a polishing apparatus;
Fig. 2 is an explanation view of another example of a polishing head;
Fig. 3 is an explanation view of a cleaning equipment; and
Fig. 4 is an explanation view of a nozzle unit.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0021] Preferred embodiments of the present invention will now be described in detail with reference to the accompanying drawings.

[0022] Fig. 1 is an explanation view showing an outline of a polishing apparatus 10.

[0023] A polishing plate 12 can be rotated, in a horizontal plane, together with a rotary shaft 14. The rotary shaft 14 is rotated by a known driving mechanism (not shown), e.g., motor. Polishing cloth 16, whose main material is foamed polyurethane, is adhered on an upper face of the polishing plate 12.

[0024] A work piece 20, e.g., semiconductor wafer, is held on a bottom face of each of polishing heads 18. Each of the polishing heads 18 is rotated, together with a rotary shaft 22, by a known driving mechanism (not shown), e.g., motor. Each of the polishing heads 18 is vertically moved by a vertical driving mechanism, e.g., cylinder unit.

[0025] A slurry supply nozzle 24 supplies slurry to an upper face of the polishing cloth 16.

[0026] The work piece 20 is held on the bottom face of each of the polishing heads 18 by suitable means, e.g., surface tension of water, air suction. Each of the polishing heads 18 is moved downward so as to press the work piece 20 onto the polishing cloth 16 of the polishing plate 12, which is rotated in the horizontal plane, with a prescribed pressing force, e.g., 150 gf/cm^2. By rotating the polishing heads 18 together with the rotary shafts 22, bottom faces of the work pieces 20 can be polished. The slurry is continuously supplied to the upper face of the polishing cloth 16 while polishing the work pieces 20.

[0027] Various types of polishing heads are known, so the type of the polishing heads 18 is not limited. For example, as shown in Fig. 2, the polishing heads 18 may be rotatably held between a center roller 26, which is located at the center of the polishing plate 12, and holding rollers 28, each of which can be moved between an outer position located outside of the polishing plate 12 and an inner position located above an outer edge thereof. Each of the holding rollers 28 is held by a swing arm 32, which can be rotated about a shaft 30.

[0028] Next, Fig. 3 is an explanation view showing an embodiment of an equipment 34 for cleaning the polishing cloth 16.

[0029] The cleaning equipment 34 is located beside the polishing plate 12 of the polishing apparatus 10.

[0030] An elevating table 36 is vertically moved by a known mechanism, e.g., cylinder unit 38. A movable member 40, which can be moved to and away from the polishing plate 12, is provided on the elevating table 36. The movable member 40 is reciprocally moved by a suitable known mechanism (a moving unit). Constitution of the moving unit is not limited. For example, the movable member 40 may be reciprocally moved by a ball screw 42 or a cylinder unit, which is provided to the elevating table 36.

[0031] A pipe arm 46 is provided to the movable member 40. A nozzle unit 48 is provided to a front end of the arm 46. By reciprocally moving the movable member 40, the nozzle unit 48 can be moved, above the polishing plate 12, in the radial direction.

[0032] As shown in Fig. 4, a straight nozzle 50 is attached to the nozzle unit 48. The straight nozzle 50 is vertically fixed to a casing 54 of the nozzle unit 48 by a fixture 52. The straight nozzle 50 is capable of linearly spraying high-pressure washing water, without spreading, toward the polishing cloth 16 and perpendicularly spraying the washing water with respect to the upper face of the polishing cloth 16.

[0033] The high-pressure washing water is supplied to the straight nozzle 50 via a flexible tube 56 and a tube 58 provided in the movable member 40 and the arm 46. A brush member 60 is provided to a bottom face of the casing 54. The brush member 60 encloses an outlet of the nozzle 50, from which the high-pressure washing water is sprayed toward the polishing cloth 16, so as to prevent splash of the high-pressure washing water.

[0034] In the above described example, the moving unit moves the nozzle unit 48 linearly as described above, but the moving unit may reciprocally turn the arm 48, to which the nozzle unit 48 is provided, about a shaft 47 as shown in Fig. 2.

[0035] Further, the nozzle unit 48 may have a plurality of the nozzles 50 (not shown). In this case, for example, the nozzles 50 may be provided to and linearly arranged on the arm 46.

[0036] The brush member 60 may be omitted. Further, other splash-preventing means may be employed.

[0037] Successively, the steps of cleaning the polishing cloth 16 will be explained.

[0038] While polishing the work pieces 20, the movable member 40 has been moved backward, and the nozzle unit 48 has been located at a standby position so as not to interrupt the process of polishing the work pieces 20.

[0039] After the work pieces 20 are completely polished, the process of cleaning the polishing cloth 16 is started. Firstly, the movable member 40 is moved above the polishing plate 12, and the nozzle unit 48 is radially reciprocally moved, on the polishing cloth 16, a length of a radius of the polishing plate 12 with spraying the high-pressure washing water from the straight nozzle 50 to-

ward the polishing cloth 16. The polishing plate 12 is rotated. With this action, the entire surface of the polishing cloth 16 can be cleaned.

[0040] An experiment was performed by the cleaning equipment 34 of the shown embodiment. The straight nozzle 50 perpendicularly sprayed the washing water with respect to the surface of the polishing cloth 16. A spray angle of the washing water was zero degree, namely the washing water was nearly linearly sprayed toward the polishing cloth 16 without spreading. Pressure of the washing water sprayed from the straight nozzle 50 was 13 MPa, and an amount thereof was 1 ℓ/min. An inner diameter of the outlet of the nozzle 50 was about 4 mm, and pressure of the washing water received by the polishing cloth 16 was 270 gf/cm^2. Note that, a predetermined load, e.g., about 150 gf/cm^2, was applied from the work pieces 20 to the polishing cloth 16 while polishing the work pieces 20.

[0041] A distance between the straight nozzle 50 and the polishing cloth 16 was about 100 mm. However, the straight nozzle 50 nearly linearly sprayed the washing water, so the pressure received by the polishing cloth 16 was not influenced by the distance therebetween. Even if the distance was varied abut ±20mm, the pressure received by the polishing cloth 16 was nearly constant. Therefore, the distance between the straight nozzle 50 and the polishing cloth 16 need not be set severely.

[0042] Further, a comparable experiment too was performed. An ordinary spray nozzle perpendicularly sprayed the washing water with respect to the surface of polishing cloth. A spray angle of the washing water was 25 degrees to clean the polishing cloth. Pressure of the washing water sprayed from the nozzle was 13 MPa, and an amount thereof was 1 ℓ/min as well as the above described experiment. An inner diameter of the outlet of the nozzle was about 4 mm, and pressure of the washing water received by the polishing cloth was about 80 gf/cm^2. A predetermined load, e.g., about 150 gf/cm^2, was applied from work pieces to the polishing cloth while polishing the work pieces.

[0043] A distance between the ordinary nozzle and the polishing cloth was about 100 mm as well as the above described experiment.

[0044] According to the experiment performed in the cleaning equipment 34 of the embodiment, the pressure received by the polishing cloth 16 can be increased by using the straight nozzle 50. By increasing said pressure, deposits, e.g., abrasion dust, in the polishing cloth 16, whose main material was foamed polyurethane, could be suitably removed. In the comparable example, surfaces of the work pieces were damaged; on the other hand, in the example performed by the equipment 34 of the embodiment, deposits could be suitably removed, so that damages in the polished surfaces of the work pieces 20 could be highly reduced. In the equipment 34 of the embodiment, an occurrence rate of damage was about a half (1/2) of that of the comparable example. Therefore, polishing accuracy could be increased. Polishing efficiency (polishing time) could be improved about 10 %. Frequency of dressing the polishing cloth 16 could be reduced from one time per three batches to one time per 10 batches. Therefore, a life span of the polishing cloth 16 could be extended.

[0045] By employing the straight nozzle 50, even if the distance between the nozzle 50 and the polishing cloth 16 was varied, the pressure received by the polishing cloth 16 was nearly constant. Therefore, fine adjustment of the distance therebetween can be omitted.

[0046] Note that, by employing the straight nozzle 50, an area of spraying the washing water is small, so it takes a long time to clean the entire surface of the polishing cloth 16. However, in case that 20 % or less of the surface of the polishing cloth 16 was not cleaned, the polished surfaces of the work pieces 20 had enough quality.

[0047] If the pressure received by the polishing cloth 16 is greater, detergency is increased. However, if said pressure is too great, the polishing cloth 16 will be broken. While polishing the work pieces 20, the pressing force applied from the work pieces 20 to the polishing cloth 16 is 150-300 gf/cm^2. The pressure received by the polishing cloth 16 may be slightly greater than the pressing force. For example, the suitable pressure received by the polishing cloth 16 is 150-350 gf/cm^2.

[0048] In the above described embodiment, the polishing apparatus is a single-sided polishing apparatus, but the cleaning equipment of the present invention is capable of cleaning polishing cloth of a double-sided polishing apparatus.

[0049] All examples and conditional language recited herein are intended for pedagogical purposes to aid the reader in understanding the invention and the concepts contributed by the inventor to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions, nor does the organization of such examples in the specification relate to a showing of the superiority and inferiority of the invention. Although the embodiments of the present invention has been described in detail, it should be understood that the various changes, substitutions, and alternations could be made hereto.

Claims

1. An equipment (34) for cleaning polishing cloth (16), which is used in a polishing apparatus (10) in which a work piece (20) is pressed onto the polishing cloth (16) adhered on a polishing plate (12) and the work piece (20) is relatively moved with respect to the polishing plate (12) with supplying slurry to the polishing cloth (16) so as to polish the work piece (20), comprising a nozzle unit (48) having a nozzle (50) capable of spraying high-pressure washing water toward the polishing cloth (16) so as to clean the polishing cloth (16),

said equipment (34) is **characterized in that** the

nozzle (50) is a straight nozzle capable of linearly spraying the washing water and perpendicularly spraying the same with respect to the polishing cloth (16).

2. The equipment (34) according to claim 1, wherein the nozzle unit (48) includes a plurality of the nozzles (50).

3. The equipment (34) according to claim 1 or 2, further comprising a unit (38, 42) for moving said nozzle unit (48) on the polishing plate (12).

4. A method for cleaning polishing cloth (16), which is used in a polishing apparatus (10) in which a work piece (20) is pressed onto the polishing cloth (16) adhered on a polishing plate (12) and the work piece (20) is relatively moved with respect to the polishing plate (12) with supplying slurry to the polishing cloth (16) so as to polish the work piece (20), comprising the step of: spraying high-pressure washing water, from a nozzle (50) of a nozzle unit (48), toward the polishing cloth (16) so as to clean the polishing cloth (16),
said method is **characterized in,**
that the nozzle (50) is a straight nozzle, and
that the straight nozzle (50) linearly sprays the washing water and perpendicularly sprays the same with respect to the polishing cloth (16).

5. The method according to claim 4, wherein pressure of the washing water which is received by the polishing cloth (16) is nearly equal to or greater than polishing load which is applied to the work piece (20) while polishing the work piece (20).

6. The method according to claim 4 or 5, wherein the pressure of the washing water which is received by the polishing cloth (16) is 150-350 gf/cm^2.

7. The method according to claim 4, 5 or 6, wherein a main material of the polishing cloth (16) is foamed polyurethane.

10. The method according to claim 4, 5, 6 or 7, wherein the nozzle unit (48) is moved on the polishing plate (12), with spraying the washing water from the straight nozzle (50), while cleaning the polishing cloth (16).

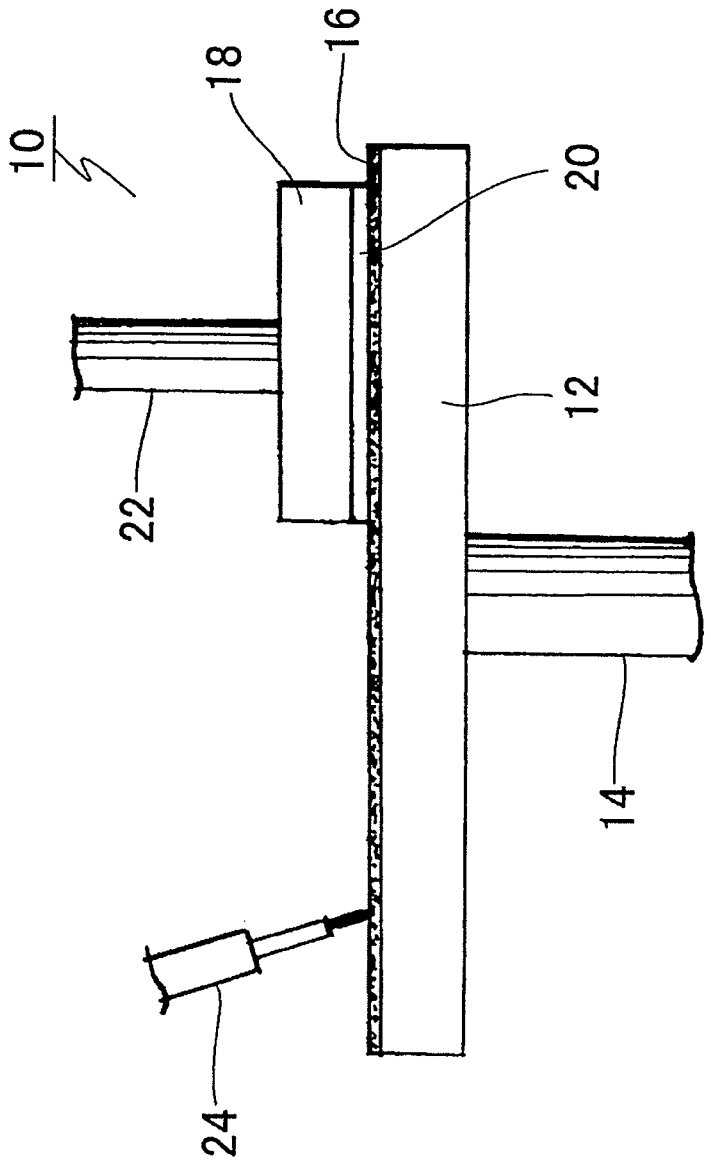


FIG.1

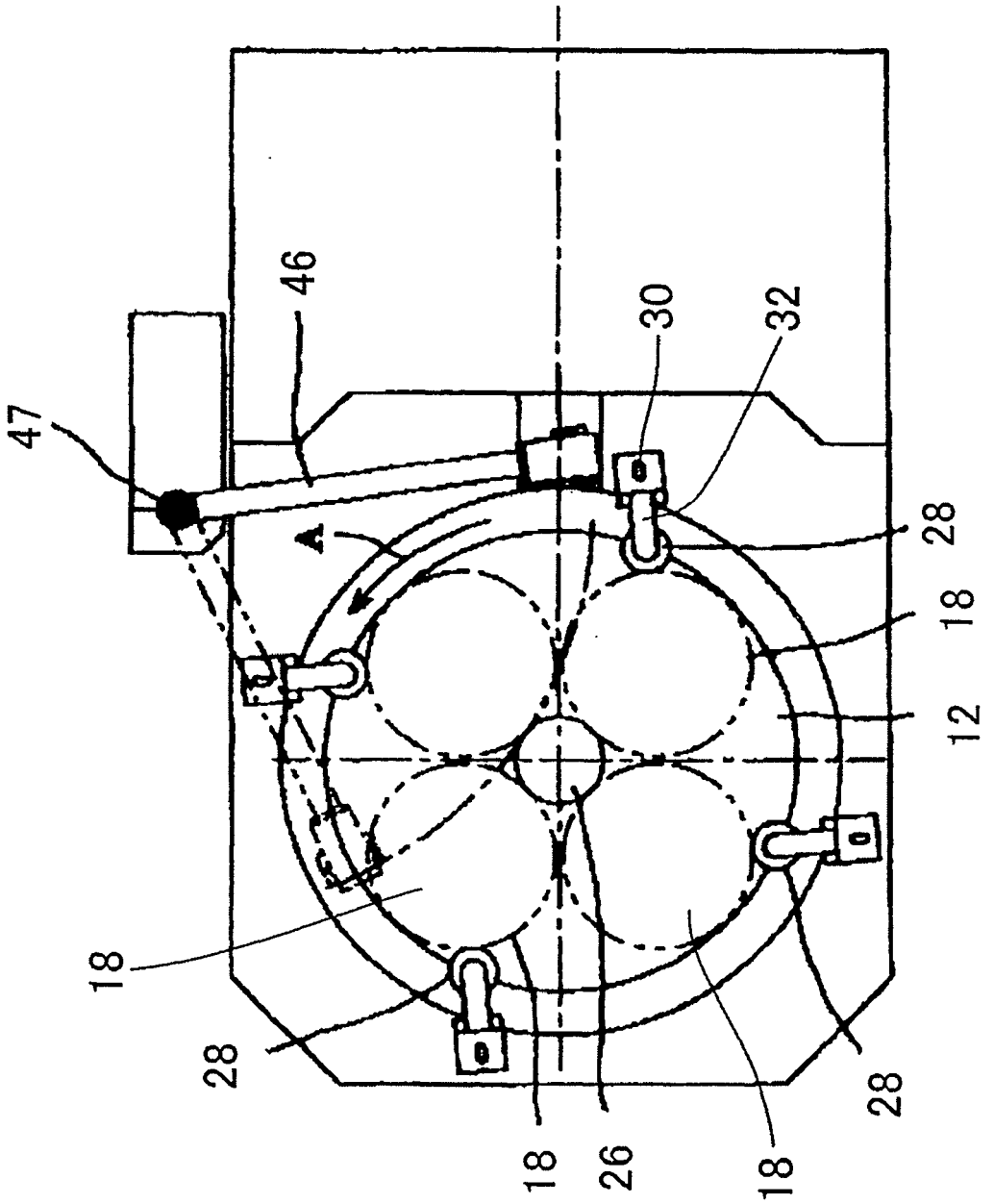


FIG.2

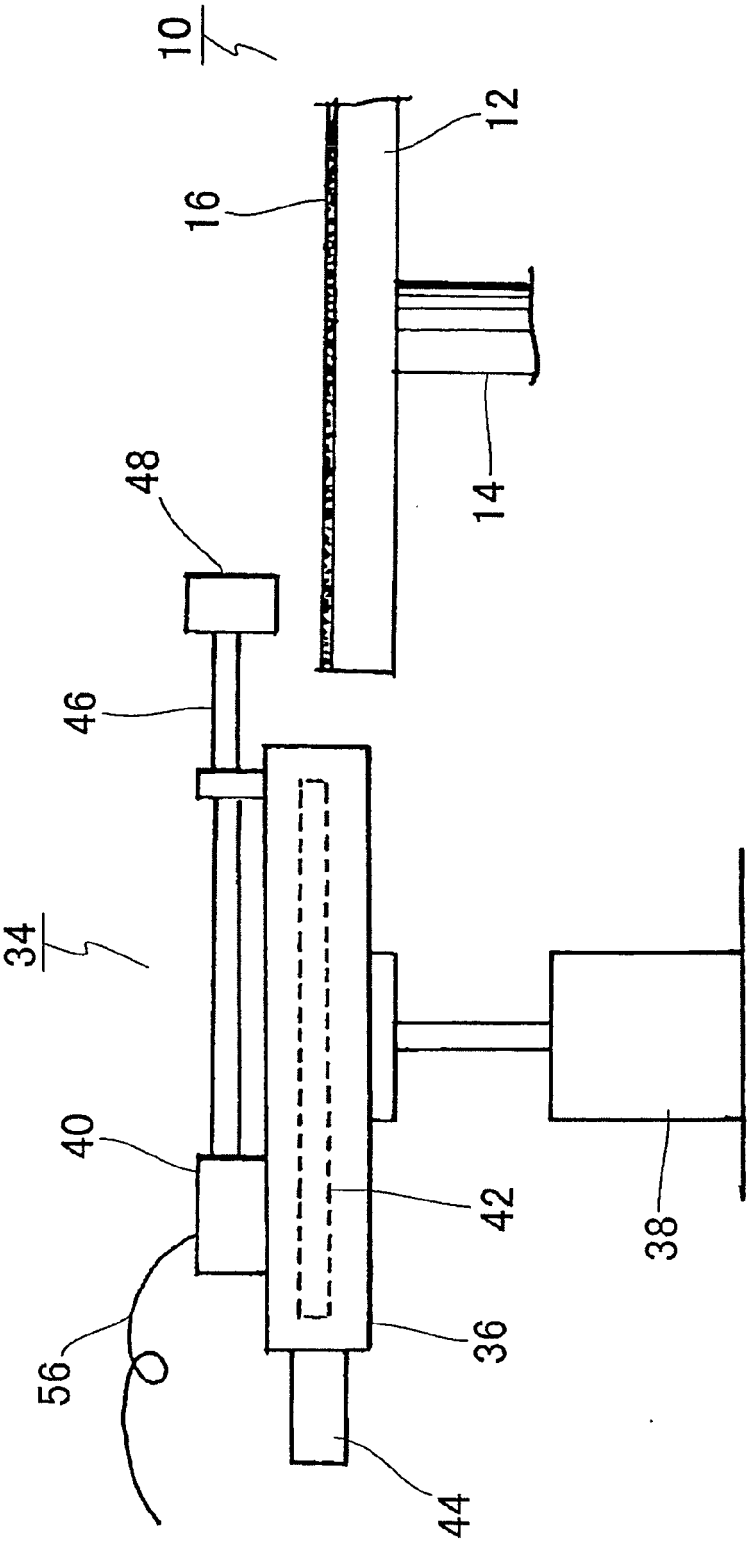
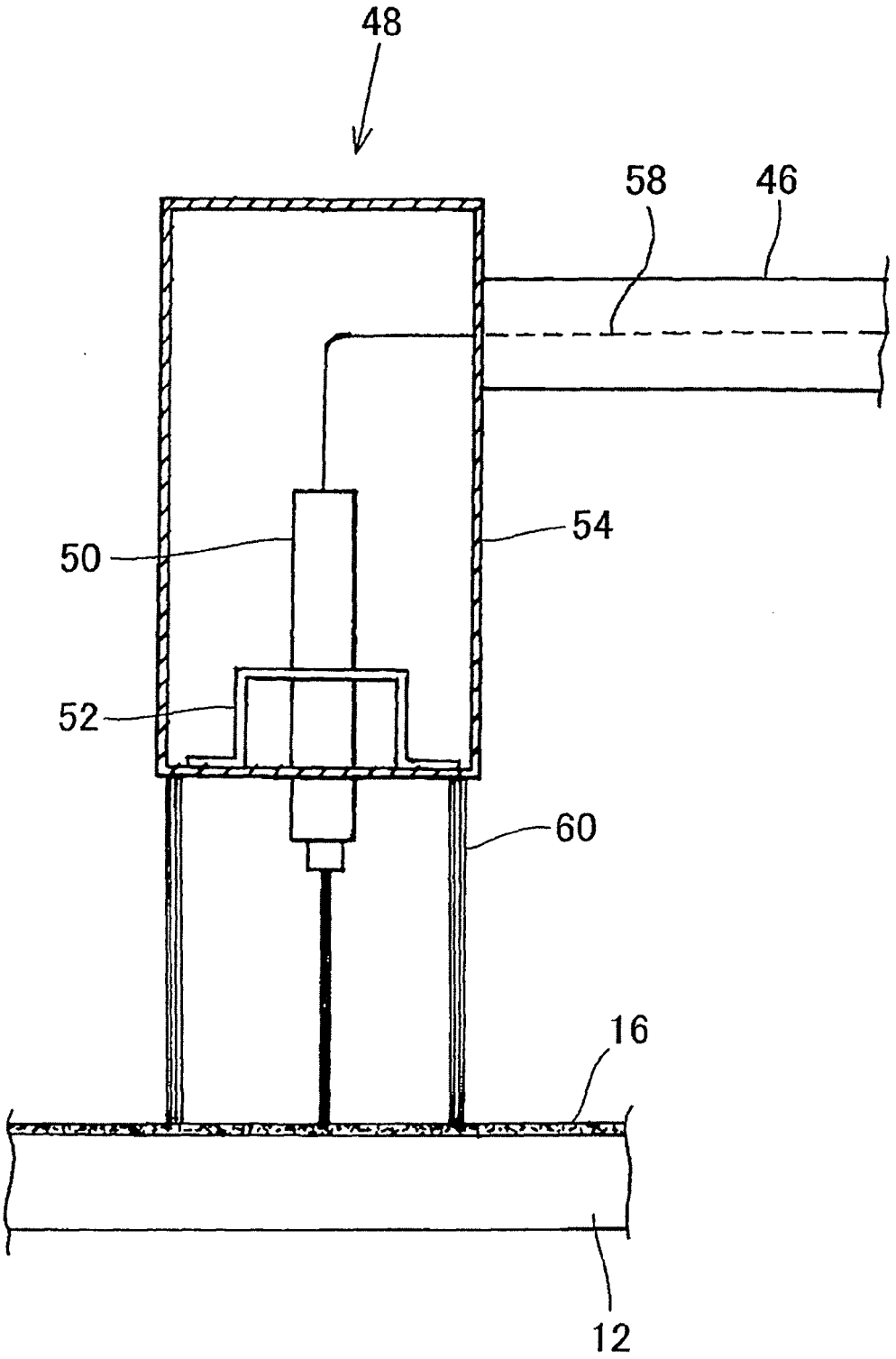


FIG.3

FIG.4



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP P79340 A **[0004]**