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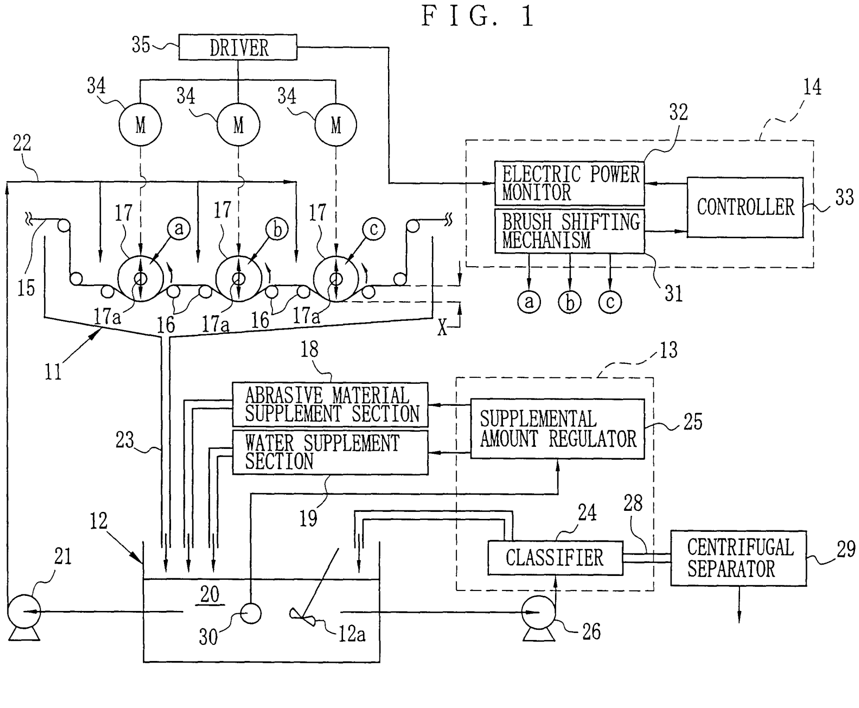
(54) Surface treatment method and apparatus for graining aluminium base for printing plates

(57) A surface treatment method and apparatus for graining a surface of an aluminum plate as a base of a printing plate, wherein graining brushes are pressed onto the aluminum plate and are turned to brush the aluminum plate to rub abrasive slurry on the aluminum plate surface.
The amount of electric power required for driving the graining brush to turn at a constant speed to brush the aluminum plate is monitored and maintained constant by changing pressing amount of the graining brush onto the aluminum plate. A classifier continually takes in a part of the abrasive slurry from a slurry supply tank, classifies abrasive particles in the abrasive slurry according to their particle diameters, and feeds back those abrasive particles with larger diameters than a predetermined particle diameter to the slurry supply tank. Those abrasive particles with smaller diameters than the predetermined particle diameter are excluded from the abrasive slurry, so the particle diameters of the abrasive materials in the abrasive slurry are maintained in a predetermined range.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a surface treatment method and a surface treatment apparatus of graining an aluminum plate as a base of a lithographic printing plate.

2. Background Arts

[0002] A lithographic printing plate, called pre-sensitized (PS) plate, has been well known and widely used in the art. The PS plate mostly uses an aluminum plate as the base. To make the PS plate, a long flat or coiled web of aluminum plate is subjected to surface treatments, including graining, anodizing and/or chemical treatments, and then the treated surface is coated with a sensitizing solution. After the sensitizing solution is dried up, the aluminum plate is cut into appropriate lengths.

[0003] Graining is for providing fine grains of uniform roughness on the surface of the plate material. Since the superficial area of the plate material increased by graining, the adhesive power of the sensitizing solution or lacquer is reinforced. Also, water retention in the non-image area is improved. Since the quality of grains has large influence on the printing effect and the plate wear, graining process needs strict control.

[0004] In general, brush-graining is adopted as a graining method on the aluminum plate. In the brush-graining process, abrasive slurry is sprayed over one surface of the aluminum plate while being conveyed continuously at a constant speed, and then rubbed on the plate surface by graining brushes. The graining brush are pressed onto the aluminum plate with its rotary axis oriented in a crosswise direction of the aluminum plate, and rotated while the aluminum plate is conveyed. In this way, grains are formed on the surface.

[0005] The abrasive slurry is made by suspending abrasive particles in a solution so that the abrasive particles have fluidity. For example, a mixture of pumice or crystalline aluminum hydroxide and water is used as the abrasive slurry, as disclosed in JPA 8-324143. The abrasive slurry after used for graining is fed back to a slurry supply tank through a circulation system, and is reused for graining.

[0006] After working continuously for a long time in the graining process, tips of bristles of the graining brush are worn off or deformed, so the pressure of the graining brush onto the aluminum plate changes with time. Also because the abrasive particles in the abrasive slurry are getting crushed into smaller particles as the slurry is reused repeatedly, the abrasive power gradually lessens. In results, roughness of the grains partially varies or gradually changes with time during the graining process.

SUMMARY OF THE INVENTION

[0007] In view of the foregoing, a prime object of the present invention is to provide a surface treatment method by which grains of uniform roughness are economically and efficiently formed on an aluminum plate to make a printing plate, and an apparatus for executing the surface treatment method of the invention.

[0008] To achieve the above object in a surface treatment method for forming grains on a surface of an aluminum plate as a base of a printing plate, wherein abrasive slurry composed of abrasive materials mixed with water is rubbed on the aluminum plate surface with a graining brush that is pressed onto the aluminum plate and is turned to brush the aluminum plate, according to the present invention, the amount of electric power required for driving the graining brush to turn at a constant speed to brush the aluminum plate is monitored and maintained constant by changing pressing amount of the graining brush onto the aluminum plate.

[0009] According to a preferred embodiment of the invention, where the abrasive slurry after being used for graining is repeatedly reused, the abrasive particles contained in the abrasive slurry are classified according to their diameters before the abrasive slurry is reused for graining, such that those abrasive particles with smaller diameters than a predetermined value are excluded from the abrasive slurry, and only those abrasive particles with larger diameters than the predetermined value are included in the abrasive slurry. As the abrasive materials, silica sand or silica abrasives are preferable.

[0010] According the present invention, a surface treatment apparatus for graining a surface of an aluminum plate as a base of a printing plate is provided with a graining brush mounted movable in a vertical direction to the surface of the aluminum plate; an electric power monitoring device for outputting a signal whose level corresponds to the amount of electric power required for driving the graining brush to turn at a constant speed while brushing the aluminum plate; a brush shifting device for shifting the graining brush in the vertical direction to change the pressing amount of the graining brush onto the aluminum plate; and a control device for controlling the amount of electric driving power to be maintained constant by decreasing the pressing amount of the graining brush onto the aluminum plate through the brush shifting device when the output signal from the electric power monitoring device is above a predetermined level, or increasing the pressing amount of the graining brush onto the aluminum plate through the brush shifting device when the output signal from the electric power monitoring device is below the predetermined level.

[0011] Where the abrasive slurry is circulated to reuse for graining, it is preferable to provide a classification device that takes in a part of the abrasive slurry from the slurry supply tank, classifies the abrasive materials in the abrasive slurry according to their particle diameters, feeds back those abrasive particles with larger diameters than a predetermined particle diameter to the slurry supply tank, and excludes those abrasive particles with smaller diameters than the predetermined particle diameter from the abrasive slurry. The abrasive slurry is continuously circulated between the slurry supply tank and the classification device, such that the particle diameters of the abrasive materials contained in the abrasive slurry are maintained in a predetermined range, preferably in a range from 5 μm to 60 μm.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The above and other objects and advantages of the present invention will become apparent from the following detailed description of the preferred embodiments when read in connection with the accompanying drawings, which are given by way of illustration only and thus are not limiting the present invention, wherein like reference numerals designate like or corresponding parts throughout the several views, and wherein:

[0013] Figure 1 is a schematic diagram illustrating a surface treatment apparatus for an aluminum printing plate according to a preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0014] Fig. 1 shows a surface treatment apparatus for a graining process for graining an aluminum plate to make a printing plate. The surface treatment apparatus is constituted of a graining bath 11, a slurry supply tank 12, a particle diameter control section 13, and a pressure control section 14. A web of aluminum plate 15 is conveyed on pass rollers 16 continuously at a constant speed through the graining bath 11 to the right in the drawing.

[0015] Three rotary graining brushes 17 are placed in the graining bath 11. The graining brushes 17 have their rotary axis 17a oriented in a crosswise direction of the aluminum plate 15. The graining brushes 17 are turned in a counterclockwise direction in the drawing at a constant speed by individual motors 34 that are driven through a driver 35. The three graining brushes 17 are also movable in a vertical direction to a surface of the aluminum plate 15, and are positioned to be pressed onto the aluminum plate 15.

[0016] The slurry supply tank 12 contains abrasive slurry 20, a mixture of abrasive particles and water, and is supplied with the abrasive particles and water respectively from an abrasive material supplement section 18 and a water supplement section 19. A stirring mill 12a is provided in the slurry supply tank 12, for stirring the abrasive slurry 20 to equalize specific gravity of the slurry 20 in the tank 12.

[0017] The abrasive slurry 20 is fed out by a supply pump 21 into a spray tube 22, and sprayed over the aluminum plate 15 in the graining bath 11, and then rubbed on the aluminum plate 15 by the graining brushes 17. Thereby, grains of predetermined roughness are formed on the surface of the aluminum plate 15. The abrasive slurry 20 after being used in the graining bath 11 is fed back to the slurry supply tank 12 through a feed back tube 23, so as to reuse for graining.

[0018] The particle diameter control section 13, consisting of a classifier 24 and a supplemental amount regulator 25, controls the diameters of the abrasive particles contained in the abrasive slurry 20 to be maintained in a predetermined range. The abrasive slurry 20 is fed out from the slurry supply tank 12 into the classifier 24 by driving a circulating pump 26. The classifier 24 classifies the abrasive particles in the abrasive slurry 20 according to the particle diameter, and feeds back those abrasive particles with larger diameters than a predetermined classification point to the slurry supply tank 12 through a feed back tube 27. Those abrasive particles with smaller diameters than the classification point are ejected through an ejection tube 28 out of the circulation system. The ejected abrasive particles with smaller diameters are separated from the water through a centrifugal separator 29, and then reused as a by-product.

[0019] The supplemental amount regulator 25 is provided with a hydrometer 30 that measures specific gravity of the abrasive slurry 20 in the slurry supply tank 12. The supplemental amount regulator 25 regulates the amount of abrasive particles supplied from the abrasive material supplement section 18 and the amount of water supplied from the water supply section 19 so as to maintain specific gravity of the abrasive slurry 20 at a set value.

[0020] Since the abrasive particles with smaller diameters are eliminated through the classifier 24 from the abrasive slurry 20 of the slurry supply tank 12, the particle diameters of the abrasive particles in the abrasive slurry 20 are maintained within the predetermined range. It is preferable to control the diameters of the abrasive particles to be included in a range from 5 μm to 60 μm, and defines the lower limit, i.e. 5 μm in this instance, as the classification point of the classifier 24.

[0021] The pressure control section 14 consists of a brush shifting mechanism 31, an electric power monitor 32, and a controller 33, and controls the pressure of the graining brush 17 onto the aluminum plate 15 to be maintained constant. The brush shifting mechanism 31 is for example a cylinder mechanism, shifts the graining brushes 17 in the vertical direction. The electric power monitor 32 monitors the amount of electric power required for driving the graining brushes 17 while the graining brushes 17 are brushing the aluminum plate 15, and outputs a signal to the controller 33. The level of the output signal of the electric power monitor 32 corresponds to the amount of electric driving power.

[0022] The electric power for driving the graining brush 17 as being in contact with the aluminum plate 15 varies depending upon the conveying speed of the aluminum plate 15, the turning speed of the graining brushes 17, and the pressure of the graining brushes 17 onto the aluminum plate 15. Since the conveying speed of the aluminum plate 15 and the turning speed of the graining brushes 17 are constant, if the electric power for driving the graining brushes 17 is constant, it means that the pressure of the graining brushes 17 onto the aluminum plate 15 is constant. By increasing the pressing amount X of the graining brushes 17 onto the aluminum plate 15, the pressure of the graining brushes 17 onto the aluminum plate 15 rises, and the amount of electric driving power increases. On the contrary, by decreasing the pressing amount X, the pressure of the graining brushes 17 onto the aluminum plate 15 lessens, and the amount of electric driving power decreases.

[0023] Therefore, based on the signal level of the electric power monitor 32, the controller 33 drives the brush shifting mechanism 31 to move the graining brushes 17 up and down so as to change the pressing amount X thereof onto the aluminum plate 15, so as to maintain the pressure of the graining brushes 17 onto the aluminum plate 15 constant. If the output signal from the electric power monitor 32 goes above a predetermined level, it means that the electric power for driving the graining brushes 17 goes above a predetermined normal amount. Then, the controller 33 lifts the graining brushes 17 through the brush shifting mechanism 31 to reduce the pressing amount X onto the aluminum plate 15. If the output signal from the electric power monitor 32 goes below the predetermined level and thus the electric driving power goes below the normal amount, the controller 33 lowers the graining brushes 17 to increase the pressuring amount X onto the aluminum plate 15.

[0024] In this way, the electric power for driving the graining brushes 17 is controlled to be the normal amount at appropriate timings, so the pressure of the graining brushes 17 onto the aluminum plate 15 is maintained constant. The normal amount of electric power is an amount necessary for driving the graining brushes 17 to rotate at the constant speed while pressing the graining brushes 17 onto the aluminum plate 15 with a desirable pressure.

[0025] Roughness of grains formed on the aluminum plate 15 is dependent on the particle diameters of the used abrasive particles, the turning speed of the graining brushes 17, and the pressure of the graining brushes 17 onto the aluminum plate 15. According to the graining process configured as above, the graining brushes 17 are rotated at the constant speed, and the pressure onto the aluminum plate 15 is controlled to be constant, and also the diameters of the abrasive particles in the abrasive slurry 20 are controlled to be maintained within the predetermined diameter range. Thus, roughness of grains formed on the aluminum plate 15 is maintained constant and uniform.

[0026] Since the pressure of the graining brushes 17 and the diameters of the abrasive particles are controlled at appropriate timings without interrupting the process, no time is lost by the control. Because only those abrasive particles whose diameters become too small for graining are excluded from the abrasive slurry 20, those abrasive particles which still have sufficiently large diameters for graining are prevented from being wasted. So the consumption of abrasive materials is reduced. With decreasing waste of abrasive materials, the cost of waste disposal is remarkably reduced.

[0027] The effects of the present invention have been proved by two example experiments and two comparative experiments.

EXAMPLE 1:

[0028] The first example experiment was carried out using the above described apparatus. The aluminum plate 15 was 1000 mm wide, and conveyed continuously at a speed of 50 m/minute. The three graining brushes 17 had bristles of 0.48 mm in diameter, and were turned at a speed of 250 rpm. The abrasive slurry 20 was produced by mixing pumice having an average diameter of 30 μm with water at a density of 200 g/*l*. The classification point of the classifier 24 was set at 15 μm, so as to control the diameters of the abrasive particles in the abrasive slurry 20 to be not less than 15 μm. The pressing amount X of the graining brushes 17 onto the aluminum plate 15 was controlled at appropriate timings such that electric power required for driving the graining brushes 17 to brush the aluminum plate 15 was maintained at 9 kW per one brush.

[0029] It was confirmed from observation on the aluminum plate surface grained through the above graining process that roughness of grains formed on the aluminum plate surface was constant and uniform, and any change in the surface roughness with time was not observed during the operation of the graining process. Since the pressure of the graining brushes onto the aluminum plate and the diameters of the abrasive particles were automatically controlled while keeping on operating the graining process, the time efficiency was remarkably improved in comparison with the conventional graining process which must be interrupted when to change the abrasive slurry.

COMPARISON 1:

[0030] As a comparison to the first example experiment, the first comparative experiment was carried out using the same construction under the same conditions as the first example except that the pressing amount X of the graining brushes 17 were not controlled but fixed. The pressing amount X was fixed at 25 mm, so the electric power required for driving the graining brushes 17 was 9 kW per one brush at the start of graining operation.

[0031] In the first comparative experiment, the graining brushes 17 were gradually worn off or deformed with time during the operation, so the pressure of the graining brushes 17 onto the aluminum plate 15 changed with time. With the change in the pressure of the graining brushes 17, roughness of grains formed on the aluminum plate surface varied so much that the variations went beyond a tolerable range after an elapse of approximately one hour. From this result, it was proved that maintaining the pressure of the graining brushes onto the aluminum plate constant is effective for forming uniform grains on the aluminum plate.

COMPARISON 2:

[0032] The second comparative experiment was carried out using the same apparatus under the same conditions as the first example except but the classifier 24 was deactivated. Change in average diameter of the abrasive particles contained in the abrasive slurry 20 and the change in surface roughness of the grained aluminum plate 15 were observed.

[0033] At the start of graining in the second comparative experiment, average diameter per unit weight of the abrasive particles was 30 μm, and surface roughness of the aluminum plate was 0.56 μm. The diameters of the abrasive particles in the abrasive slurry 20 decreased with time during the operation, and the average particle diameter came down to 20 μm after an elapse of approximately three hours. With the decreasing diameters of the abrasive particles contained in the abrasive slurry 20, the surface roughness of the aluminum plate 15 was lowered. After an elapse of approximately three hours, the surface roughness came down to 0.48 μm that is largely out of the tolerable range. Thereafter, the whole abrasive slurry 20 in the slurry supply tank 12 was changed with new one, while interrupting the graining process. Immediately after the graining process was restarted, surface roughness of the aluminum plate was 0.57 μm. From this result, it was proved that maintaining the diameters of the abrasive particles within a predetermined range in the abrasive slurry is effective for maintaining roughness of grains constant.

[0034] According to the second comparative experiment, since the whole abrasive slurry 20 in the slurry supply tank 12 was changed, even those abrasive particles having sufficient large diameters for graining went to waste, so a large amount of abrasive materials were consumed in the second comparative experiment. Moreover, it was time-consuming to interrupt the graining process in order to change the abrasive slurry in the supplement tank with new one each time the abrasive power was lowered to an intolerable level. According to a calculation, the consumption of the abrasive materials per unit area of the aluminum plate in the first example was reduced 33% to 50% in comparison with the second comparison where the classifier was deactivated. From this result, it was proved that the method of continually classifying the abrasive particles in the abrasive slurry to exclude those abrasive particles having smaller diameters than a predetermined value is not only time-saving but also effective for reducing consumption of the abrasive material. Because the waste of abrasive particles is greatly reduced, the method of the present invention cuts the cost of waste disposal.

EXAMPLE 2:

[0035] The second example experiment was carried out using the above described apparatus under the following conditions. The aluminum plate 15 was 1000 mm wide, and conveyed continuously at a speed of 50 m/minute. The three graining brushes 17 had bristles of 0.48 mm in diameter, and were turned at a speed of 200 rpm. The abrasive slurry 20 was produced by mixing silica sand or silica abrasives (SiO_2 = 97%) having an average diameter of 20 μm with water at a density of 200 g/*l*. The classification point of the classifier 24 was set at 8 μm. The pressing amount X of the graining brushes 17 onto the aluminum plate 15 was controlled at appropriate timings such that electric power required for driving the graining brushes 17 to brush the aluminum plate 15 was maintained at 7 kW per one brush.

[0036] It was apparent from observation on the aluminum plate surface grained through the graining process of the second example that grains of uniform roughness were constantly formed on the aluminum plate surface, and any change in the surface condition with time was not observed during the operation of the graining process. Since the silica sand or silica abrasives have higher abrasive power than the pumice, the pressure of the graining brushes 17 onto the aluminum plate 15 may be a smaller value as compared to the first example, so the electric power for driving the graining brush 17 was controlled to be the smaller value. In the second example, the same grain roughness as obtained in the first example was obtained by using silica sand or silica abrasives with smaller diameters than the pumice used in the first example. Accordingly, there were not any scratches on the surface that may be caused by abrasive particles of lager diameters. Since the price of silica sand or silica abrasives is 60% to 70% less than that of pumice, the graining process according to the second example cuts the purchasing cost of abrasive materials as compared to the first example.

[0037] Morever, because aluminum powders produced by the graining of the aluminum plate are mixed with the used silica sand or silica abrasives, and the mixture of aluminum powders and silica sand or silica abrasives is suitable for use as a material of light-weight cellular concrete, heat insulating medium or cement, it is possible to reuse the silica sand or silica abrasives for these products after the particle diameters decrease so much that they do not have sufficient abrasive power. Thereby, the amount of industrial waste and thus the cost of waste disposal are still more reduced.

[0038] As described so far, according to the surface treatment method of the invention, the electric power for driving the graining brushes as being in contact with the aluminum plate is monitored and maintained constant by controlling the pressing amount of the graining brushes onto the aluminum plate, so that the pressure of the graining brushes onto the aluminum plate is maintained constant even if the graining brushes are worn off or deformed. The abrasive particles contained in the abrasive slurry are classified according to the particle diameter, so that only those abrasive particles with diameters of a predetermined range are fed back to the abrasive slurry. Thereby, grains of uniform roughness are constantly formed on the aluminum plate. Because the pressure of the graining brushes and the particle diameters of the abrasive particles are controlled without interrupting the graining process, the time efficiency is improved.

[0039] Because only those abrasive particles whose diameters become too small for graining are excluded from the abrasive slurry, those abrasive particles which still have sufficiently large diameters for graining are prevented from being wasted, so the consumption of abrasive materials is reduced. As the waste of abrasive particles is reduced, the cost of waste disposal is reduced.

[0040] Using silica sand or silica abrasives as the abrasive materials, it is possible to reuse silica sand or silica abrasives as a material of light-weight cellular concrete, heat insulating medium or cement, after the particle diameters of the silica sand or silica abrasives decrease so much that they do not have sufficient abrasive power. Thereby, the waste abrasive materials and thus the cost of waste disposal are still more reduced.

[0041] Although the present invention has been described with respect to the preferred embodiment shown in the drawings, the present invention is not to be limited to the above embodiment but, on the contrary, various modifications may be possible to those skilled in the art without departing from the scope of appended claims. For example, it is possible to connect the feed back tube to a classification device like the classifier 24, and feed back the used abrasive slurry after having the smaller abrasive particles excluded.

Claims

1. A surface treatment method for graining a surface of an aluminum plate (15) as a base of a printing plate, wherein abrasive slurry (20) composed of abrasive materials mixed with water is rubbed on the aluminum plate surface with a graining brush (17) that is pressed onto the aluminum plate and is turned to brush the aluminum plate, characterized in that the amount of electric power required for driving the graining brush to turn at a constant speed as being in contact with the aluminum plate is monitored and maintained constant by changing pressing amount (X) of the graining brush onto the aluminum plate.

2. A surface treatment method as claimed in claim 1, wherein the aluminum plate is conveyed at a constant speed while being brushed by the graining brush.

3. A surface treatment method as claimed in claim 1, wherein the abrasive slurry after being used for graining is fed back to a slurry supply tank (12), and the abrasive materials contained in the abrasive slurry are classified according to their particle diameter before the abrasive slurry is reused for graining, such that those abrasive materials with smaller particle diameters than a predetermined value are excluded from the abrasive slurry, and only those abrasive materials with larger particle diameters than the predetermined value are included in the abrasive slurry.

4. A surface treatment method as claimed in claim 3, wherein the particle diameters of the abrasive materials contained in the abrasive slurry in the slurry supply tank are maintained within a range from 5 μm to 60 μm.

5. A surface treatment method as claimed in claim 3, wherein silica sand or silica abrasives are used as the abrasive materials.

6. A surface treatment method as claimed in claim 5, wherein those abrasive particles which are excluded from the abrasive slurry are reused as a by-product.

7. A surface treatment method as claimed in claim 5, wherein the abrasive materials having an average particle diameter of 20 μm is mixed with water at a density of 200 g/*l*, and the predetermined value for the classifying the abrasive materials according to the particle diameter is set to 8 μm.

8. A surface treatment method as claimed in claim 3, wherein a part of the abrasive slurry in the slurry supply tank is continually circulated for classifying the abrasive materials according to their particle diameter.

9. A surface treatment method as claimed in claim 1, wherein specific gravity of the abrasive slurry in the slurry supply tank is measured, and abrasive materials or water is supplemented to the slurry supply tank to maintain the specific gravity of the abrasive slurry constant.

10. A surface treatment apparatus for graining a surface of an aluminum plate (15) as a base of a printing plate, wherein abrasive slurry composed of abrasive materials mixed with water is rubbed on the aluminum plate surface with a graining brush that is pressed onto the aluminum plate and is turned to brush the aluminum plate, characterized by comprising:

a graining brush (17) mounted movable in a vertical direction to the surface of the aluminum plate;
an electric power monitoring device (32) for outputting a signal whose level corresponds to the amount of electric power required for driving the graining brush to turn at a constant speed while the graining brush is in contact with the aluminum plate;
a brush shifting device (31) for shifting the graining brush in the vertical direction to change the pressing amount of the graining brush onto the aluminum plate; and
a control device (33) for controlling the amount of electric driving power to be maintained constant by decreasing the pressing amount of the graining brush onto the aluminum plate through the brush shifting device when the output signal from the electric power monitoring device is above a predetermined level, or increasing the pressing amount of the graining brush onto the aluminum plate through the brush shifting device when the output signal from the electric power monitoring device is below the predetermined level.

11. A surface treatment apparatus as claimed in claim 10, further comprising a conveying device (16) for conveying the aluminum plate at a constant speed while the aluminum plate is brushed by the graining brush.

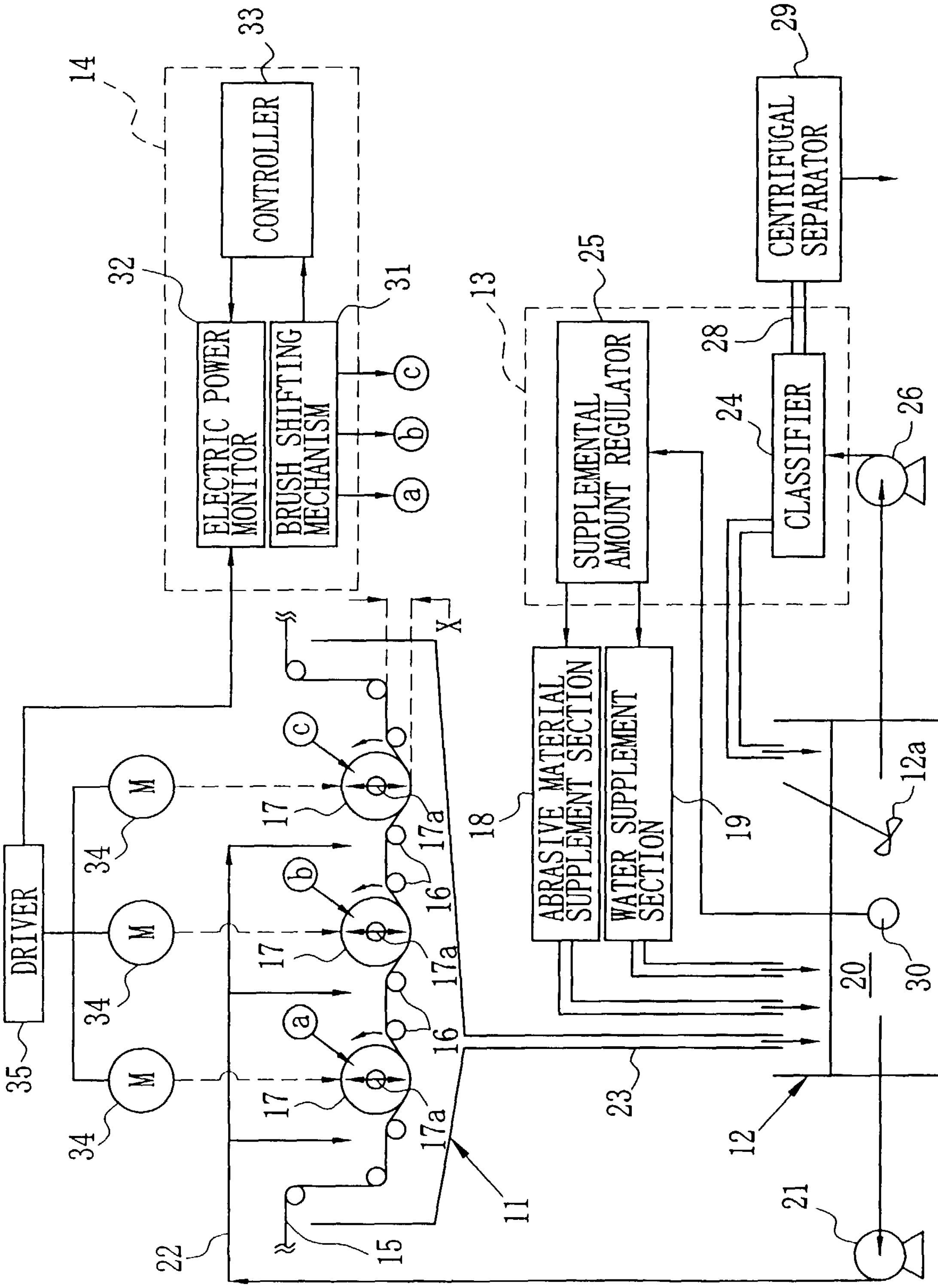
12. A surface treatment apparatus as claimed in claim 10, further comprising:

a feed back device (23) for feeding the abrasive slurry after being used for graining back into a slurry supply tank (12) so as to reuse the abrasive slurry for graining; and
a classification device (24) that classifies the abrasive materials contained in the abrasive slurry of the slurry supply tank according to their particle diameter, and excludes those abrasive materials with smaller particle diameters than a predetermined value from the abrasive slurry before being reused for graining.

13. A surface treatment method as claimed in claim 12, wherein the classification device continually takes in a part of the abrasive slurry from the slurry supply tank, and feeds back those abrasive materials with larger particle diameters than the predetermined value to the slurry supply tank so as to maintain the particle diameters of the abrasive materials contained in the abrasive slurry within a predetermined range, preferably from 5 µm to 60 mµ.

14. A surface treatment apparatus as claimed in claim 12, further comprising a hydrometer (30) for measuring specific gravity of the abrasive slurry of the slurry supply tank, and a supplemental amount regulating device for determining amount of abrasive materials or water to be supplemented to the abrasive slurry so as to maintain the specific gravity of the abrasive slurry constant.

FIG. 1


CONTROLLER
ELECTRIC POWER MONITOR
BRUSH SHIFTING MECHANISM
SUPPLEMENTAL AMOUNT REGULATOR
CLASSIFIER
CENTRIFUGAL SEPARATOR
ABRASIVE MATERIAL SUPPLEMENT SECTION
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EUROPEAN SEARCH REPORT

Application Number
EP 99 30 6265

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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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	3 November 1999	Martins Lopes, L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 99 30 6265

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03-11-1999

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