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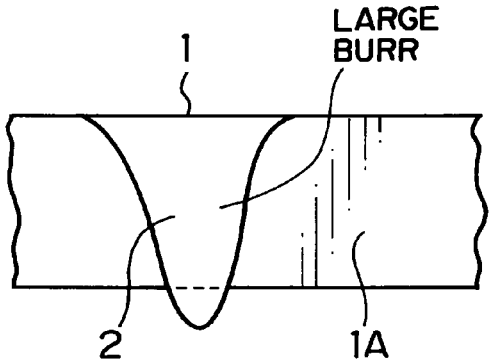
(54) Lithographic plate

(57) An Erichsen value of a lithographic plate (1) whose surface has been grained and anodically oxidized is set between 2 and 10, and more preferably between 5 and 6. This prevents the excessive plastic deformation during the machining of the lithographic plate (1), and prevents the formation of cracks in the anodic oxide film resulting from the difference in the rigidity between the aluminum alloy substrate and the anodic oxide film. In addition, the lithographic plate (1) is easy to handle since the cracks, etc. are not formed even if the end of the lithographic plate (1) is bent.

FIG. 1 (A)



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates generally to a lithographic plate, and more particularly to a lithographic plate, whose supporting base is an aluminum alloy plate and which is easy to cut, slit and punch.

Description of Related Art

[0002] A photosensitive printing plate or lithographic plate, whose supporting base is an aluminum alloy plate, is widely used for offset printing. To manufacture the lithographic plate, the surface of a sheet or coil-shaped aluminum alloy plate is gained and is anodically oxidized. A photosensitive composite is applied and dried on the surface of the aluminum alloy plate, which is then cut into a desired size by slitting with a slitter, by bundle-slitting with a guillotine cutter, or by cutting with a cutter. After the anodic oxidation, the surface treatment and the undercoating may be performed in order to improve the adherence between the photosensitive layer and the aluminum alloy plate. In addition, the aluminum alloy plate may be punched with a punching machine so that it can easily be positioned for use as a printing plate.

[0003] In order to improve the machining technique, a variety of proposals have already been made (Japanese Patent Provisional Publication Nos. 64-78793, 9-141599, 7-266291 and 10-100556). These proposals relate to controlling the effects of the plastic deformation during the machining; the deformation of the aluminum alloy plate such as a burr and an edge rounding. Improvements only in the machining technique, however, cannot prevent the deformation of the aluminum alloy plate, if there is unevenness in the mechanical characteristics of the aluminum alloy plate. If there is significant unevenness in the mechanical characteristics of the aluminum alloy plate, the defects called large burrs are formed irregularly to cause the decrease in the yield. In this case, the defects mean the burrs and the edge rounding formed during the machining, and the large burrs formed irregularly during the machining.

SUMMARY OF THE INVENTION

[0004] In view of the foregoing, it is an object of the present invention to provide a lithographic plate, which eliminates the unevenness in the mechanical characteristics of materials in the cutting with a slitter, the bundle-slitting with a guillotine cutter, the punching with a die set and the cutting with a cutter, and which prevents the defects during the slitting, the bundle-slitting, the cutting and the punching.

[0005] To achieve the above-mentioned object, the present invention is directed to a lithographic plate whose surface is grained and anodically oxidized, the lithographic plate characterized in that an Erichsen value is between 2 and 10, and more preferably between 5 and 6.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] The nature of this invention, as well as other objects and advantages thereof, will be explained in the following with reference to the accompanying drawings, in which like reference characters designate the same or similar parts throughout the figures and wherein:

Figs. 1(A) and 1(B) are conceptual front and side views showing large burrs of a cut surface; and
Figs. 2(A) and 2(B) are conceptual front and side views showing burrs and edge rounding of a cut surface.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0007] This invention will be described in further detail by way of example with reference to the accompanying drawings.

[0008] First, a description will be given of a method for manufacturing an aluminum alloy plate.

[0009] Molten aluminum alloy with a preset alloy content is cleaned in an ordinary way. In order to eliminate the unnecessary gas such as hydrogen in the molten aluminum alloy, a degasification is performed by a fluxing or using argon or chlorine gas. A filtering is also performed by using a so-called rigid medium filter such as a ceramic tube filter and a ceramic form filter, a filter made of alumina flakes, alumina balls, etc. and a glass cloth filter. A combination of the degasification and the filtering may be performed. Then, an aluminum alloy ingot is molded from the cleaned molten aluminum alloy in a die casting method using a fixed mold or a continuous molding method using a drive mold.

[0010] In the die casting method, for example, an ingot with the thickness of 300-800mm can be molded. The ingot is faced in an ordinary way, and the surface thereof is cut by 1-30mm, and more preferably 1-10mm. Then, the soaking is performed as the need arises.

[0011] In the soaking, the thermal treatment is performed at a temperature of 450-620°C for more than one hour and less than forty-eight hours in order to prevent the increase in the size of the grains of the intermetallic compound. If the thermal treatment is performed for less than one hour, the soaking cannot achieve the satisfactory effect. Then, the hot rolling and the cool rolling are performed to manufacture an aluminum alloy roll plate. The hot rolling is started at a temperature of 300-500°C. The intermediate annealing may be performed before or after the cool rolling, or in the middle of the cool rolling. The intermediate annealing is performed by a batch type annealing furnace at a temperature of 280-600°C for 2-20 hours, and more preferably, at a temperature of 350-500°C for 2-10 hours, or by a continuous annealing furnace at a temperature of 400-600°C for less than 360 seconds, and more preferably, at a temperature of 450-550°C for less than 120 seconds. If the continuous annealing furnace heats the aluminum alloy plate at a temperature rising rate of 10°C/sec or more, the fine crystal structure can be obtained.

[0012] Normally, the flatness of the aluminum alloy plate with a predetermined thickness of 0.1-0.5mm may be improved by a sizing apparatus such as a roller leveler and a tension leveler. In addition, the aluminum alloy plate is normally processed to have a predetermined width by a slitter line.

[0013] Thereafter, the surface graining and the anodic oxidation are performed for the surface of the aluminum alloy plate, and the aluminum alloy plate is coated with a photosensitive layer to be manufactured into a lithographic plate. After the anodic oxidation, the interface controlling process or the coating of an undercoating layer may be performed before the coating of the photosensitive layer. A mechanical gaining, a chemical graining and an electrochemical graining are performed singly or in a combination for the surface graining.

[0014] In the mechanical graining, the mechanical surface fining is performed to achieve the average surface roughness of 0.35-1.0μm as disclosed in Japanese Patent Provisional Publication No. 6-135175 and Japanese Patent Publication No. 50-40047 for example.

[0015] The electrochemical gaining is suitable for manufacturing a lithographic plate that is suitable for printing, because the fine unevenness can easily be formed on the surface of the aluminum alloy plate.

[0016] In the electrochemical graining, a direct current or an alternating current is used in a solution, which is comprised mainly of nitric acid or hydrochloric acid. The electrochemical graining can form craters or honeycomb pits with the average diameter of 0.5-20μm on 30-100% of the whole surface of the aluminum alloy plate.

[0017] The pits prevent the non-image part on the surface of the lithographic plate from becoming soiled and improve the run length of the non-image part. The quantity of electricity required for forming sufficient pits on the surface, in other words, the product of the electric current and the time in which the electric current is passed through is the important condition in the electrochemical graining. It is preferable to form the substantial pits with a small quantity of electricity in view of the energy saving.

[0018] Moreover, the anodic oxidation is ordinarily performed in order to improve the abrasion resistance of the surface of the aluminum alloy plate. Any type of electrolytes that can form a porous oxide film may be used for the anodic oxidation of the aluminum alloy plate. Sulfuric acid, phosphoric acid, oxalic acid or chromic acid or a mixture thereof is usually used. The density of the electrolyte is adjusted according to the type of the electrolyte. The conditions of the anodic oxidation are variable according to the types of the electrolytes, but the anodic oxidation is usually performed under the following conditions: the density of the electrolyte is 1-80wt%, the temperature of the electrolyte is 5-70°C, the density of the electric current is 1-60A/dm^2, the voltage is 1-100V, and the electrolytic period is 10-300 seconds.

[0019] The well-known sensitive layer is applied on the aluminum alloy plate as the supporting base to thereby acquire a photosensitive lithographic plate, which is processed into a lithographic plate with an excellent capability. Any types of photosensitive materials that are ordinarily used in this field may be used for the sensitive layer.

[0020] The obtained lithographic plate is cut into plates with a predetermined size via a cutting step, slitting step, bundle-slitting step, or the like. The lithographic plate is punched as the need arises. The cutting, the slitting, the bundle-slitting, the punching, and the like are the plastic working. The fine unevenness is formed on the surface of the aluminum alloy plate as the substrate, the anodic oxide film is formed on the unevenness, and the photosensitive resin layer is applied on the anodic oxide film. An intermediate layer for controlling the interface may be formed between the anodic oxide film and the photosensitive layer. Thus, the lithographic plate has three layers or more. The aluminum alloy plate has a relatively large ductility causing the bun and the edge rounding in the cutting, the slitting, the bundle-slitting and the punching. On the other hand, the anodic oxide film is rigid and brittle. The photosensitive layer has a smaller strength than the aluminum alloy and the anodic oxide film. The intermediate layer, which is formed between the anodic oxide film and the photosensitive layer, has different mechanical characteristics from the aluminum alloy and the anodic oxide film. Hence, if the cutting, the slitting, the bundle-slitting, the punching, etc. are performed for three or more layers with different mechanical characteristics, it is very difficult to control the cut surface. In particular, a large bun is easily formed around the cut surface of the lithographic plate.

[0021] Figs. 1(A) and 1(B) are conceptual front views and side views showing a cut section 1A of the lithographic

plate 1 in the case where the large burr 2 is formed. Figs. 2(A) and 2(B) are conceptual front views and side views showing the cut section 1A of the lithographic plate 1 in the case where the normal bun 3 and the edge rounding 4 are formed. The large bun 2 causes the cut surface 1A to be uneven, and damages another lithographic plate when the lithographic plates are stacked, thus resulting in the significant decrease in the yield.

[0022] In order to control the cut surface 1A, it is preferable to control the plastic working aptitude of the grained aluminum alloy plate including the anodic oxide film. The object of the present invention can be achieved by setting an Erichsen value of the lithographic plate except for the photosensitive layer within a predetermined range. More specifically, the Erichsen value of the lithographic plate except for the photosensitive layer is 10-2, preferably 7-4, and more preferably 6-5.

[0023] The alloy content in the aluminum alloy may be controlled to control the Erichsen value. More specifically, the additional elements in the aluminum alloy are decreased in order to increase the Erichsen value, and are increased in order to decrease the Erichsen value.

[0024] Alternatively, the reduction rate of the hot rolling and/or the cool rolling may be controlled to control the Erichsen value. More specifically, the reduction rate is lowered in order to increase the Erichsen value, and is raised in order to decrease the Erichsen value.

[0025] Alternatively, the ways of the intermediate annealing may be changed to control the Erichsen value. More specifically, in order to increase the Erichsen value, the intermediate annealing is performed when the final thickness of the aluminum alloy plate is nearly achieved, or the temperature of the intermediate annealing is raised. The ways of the intermediate annealing are reversed in order to decrease the Erichsen value.

[0026] If the Erichsen value is too large, the large burr is easily formed, and the anodic oxide film formed on the surface of the aluminum alloy plate is easily cracked. Consequently, the aluminum alloy plate easily causing soil during the printing. If the Erichsen value is too small, the aluminum alloy plate is easily broken along the fold when the end of the lithographic plate is folded during the attachment of the lithographic plate to a printer. This makes it difficult to handle the lithographic plate.

[0027] The Erichsen test is an ordinary method, which is specified by Japanese Industrial Standards (JIS) Z2247-1977 corresponding to International Standardization Organization (ISO) 8490-1986. According to the present invention, however, it is important to control the Erichsen value of the lithographic plate, whose surface has been grained and anodically oxidized.

EXAMPLE

[0028] In the embodiments of the present invention and comparative examples, the surface of the aluminum alloy plates with components specified by JIS A1050, which corresponds to ISO Al 99.5, are grained, anodically oxidized and made hydrophilic. Then, the photosensitive layer of the dried lithographic plates is eliminated in the development, and the Erichsen values are confirmed in the Erichsen test B using test pieces of the type 2 (90mm $\times$ 90mm).

[0029] Each sample is slit, and the formation of the large buns is evaluated. The slit part of the sample is observed through a scanning electronic microscope (SEM) to determine whether the anodic oxide film is cracked or not. The end of the sample is folded at a right angle, and whether there is a fine crack, etc. along the fold is determined to thereby evaluate the operability of the lithographic plate.

[0030] TABLE 1 shows the results in the embodiments 1-6 and the comparative examples 1-2.

TABLE 1

	Erichsen value	Large burr	Cracks of anodic oxide film	Operability
Embodiment 1	9.5	C	C	B
Embodiment 2	7.0	B	B	A
Embodiment 3	5.9	A	A	A
Embodiment 4	5.0	A	A	A
Embodiment 5	4.1	A	B	B
Embodiment 6	2.0	A	C	C
Comparative ex. 1	1.8	A	F	F
Comparative ex. 2	11.0	F	F	B

A: particularly excellent
B: excellent
C: acceptable
F: inferior

[0031] As is clear from TABLE 1, in the embodiments of the present invention, only a small number of large buns are formed, a small number of cracks are formed in the anodic oxide film, and the aluminum alloy plate is easy to handle. The particularly good results can be obtained if Erichsen value is between 5 and 6.

[0032] Since the large burr is not formed in the embodiments of the present invention, it is possible to broaden the allowable range of the unevenness in the accuracy of a slitter edge, a cutter edge, a guillotine cutter edge, and a punching die set.

[0033] As stated above, the Erichsen value of the lithographic plate, whose surface has been grained and anodically oxidized, is set between 2 and 10, and more preferably between 5 and 6. This prevents the excessive plastic deformation during the machining, and prevents the formation of cracks in the anodic oxide film resulting from the difference in the rigidity between the aluminum alloy plate and the anodic oxide film. In addition, the lithographic plate is easy to handle since the cracks, etc. are not formed even if the end of the lithographic plate is bent.

[0034] It should be understood, however, that there is no intention to limit the invention to the specific forms disclosed, but on the contrary, the invention is to cover all modifications, alternate constructions and equivalents falling within the spirit and scope of the invention as expressed in the appended claims.

Claims

1. A lithographic plate (1) whose surface is grained and anodically oxidized, said lithographic plate (1) characterized in that:

   an Erichsen value is between 2 and 10.

2. A lithographic plate (1) whose surface is grained and anodically oxidized, said lithographic plate (1) characterized in that:

   an Erichsen value is between 5 and 6.

FIG. 1 (B)

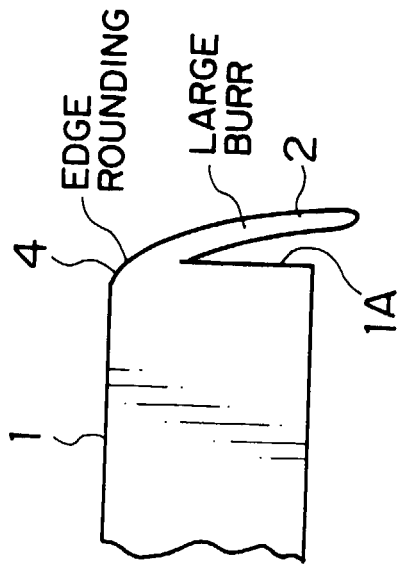


FIG. 1 (A)

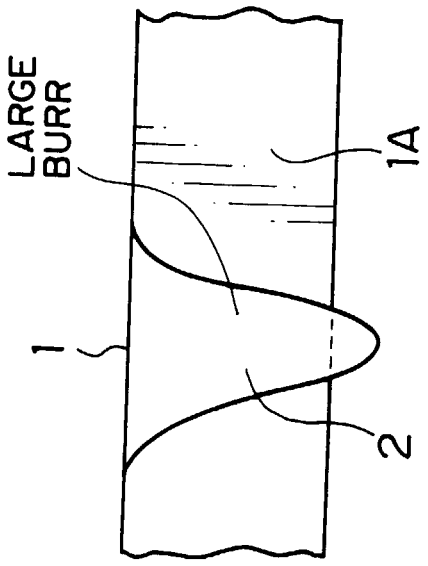


FIG. 2(B)

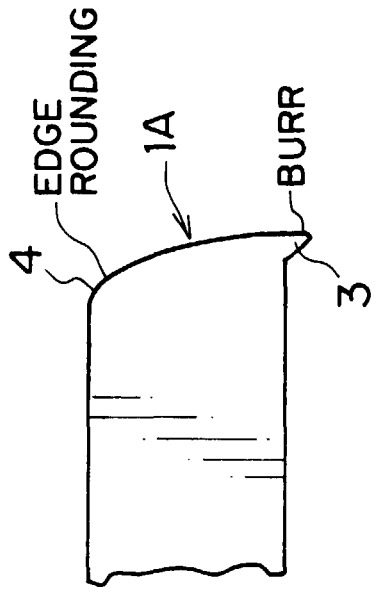
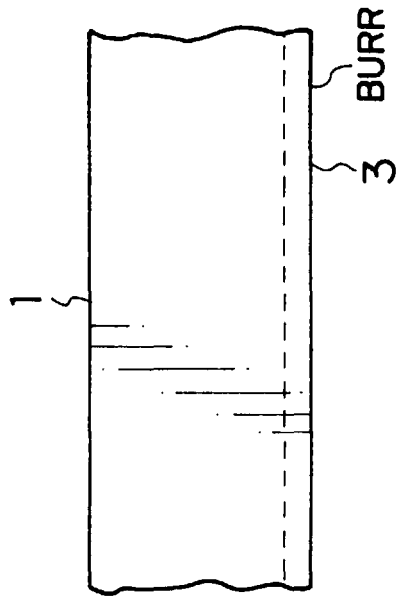


FIG. 2(A)



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EUROPEAN SEARCH REPORT

Application Number
EP 99 12 1883

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)
A	US 4 605 448 A (BABA YOSHIO ET AL) 12 August 1986 (1986-08-12) * column 7, line 20 - line 39; table 3 *	1,2	B41N1/08
A	US 4 808 247 A (KOMATSUBARA TOSHIO ET AL) 28 February 1989 (1989-02-28) * tables 3,5,6,8 * * column 14, line 64 - line 68 *	1,2	
A	US 5 266 130 A (UCHIDA HIDETOSHI ET AL) 30 November 1993 (1993-11-30) * table 3 * * column 12, line 39 - line 65 *	1,2	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B41N
C22F
C22C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	21 December 1999	Martins Lopes, L

CATEGORY OF CITED DOCUMENTS

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