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(54) **Process and means for making metal inking rolls, particularly for flexographic printing, with highly hardened superficial engraved layer, and rolls obtained with such process and means.**

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(73) Proprietor: **Della Torre, Renato**
Via Di Vittorio 9
I-21057 Olgiate Olona Varese(IT)

(72) Inventor: **Della Torre, Renato**
Via Di Vittorio 9
I-21057 Olgiate Olona Varese(IT)

(74) Representative: **Sassi, Romano**
UFFICIO BREVETTI VARESINO Viale Belforte 89
I-21100 Varese(IT)

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Description

The present invention relates to a process and means for making metal inking rolls, particularly for flexographic printing, which are precisely screened, with highly hardened superficially engraved layer, adapted to simplify and better their making, as well as their function and duration characteristics. Moreover, the present invention relates to rolls obtained with such process and means.

In the present state of the art, inking rolls are made in three substantially different ways. In accordance with a first conventional process, resulting in a product of very high initial quality, though decaying in a relatively short time, the roll are made of metal and the outer layers are, at first, mechanically engraved and then plated, with a layer of chromium, by galvanization. The thickness of such plating layer cannot be thicker than a few microns (maximum 15μ), in order not to waste the unplated screen surface as engraved. This plating layer of chromium provides an hardness and an ink and/or solvent anticorrosion characteristic, drastically superior than that of the roll body. However, these rolls, have a life so short, as low is the thickness of the chromium plating thereon. In fact, in use, rolls are continuously, hardly engaged, by a metal doctor or blade. Such doctor or blade, of course, wears the sharp projections of the screen, which, being of reduced area, are subjected to very high specific pressures. This rubbing is strongly wearing and the very thin layer of chromium, totalizing a small area has a life relatively short. The destructive effect of the doctor or blade reached its top in case of an, even small, eccentricity. This dictated eccentricity tolerances lower than 20 microns, since even at this level bad inking occurs, resulting in correspondingly bad printing, even if the rolls are substantially new. This for two reasons: the first was that rolls are hardly doctored on the projecting side, which thus results poor of inking and secondly the corresponding rear surface, diametrally opposed, only scarcely adhers to the flexographic roller and to the doctor. Moreover, the phenomenon is progressive, since wearing of embankment of cell concavities, reduced, more and more, the ink capacity of cells.

Another known process, includes a complicate provision of a ceramic covering on a cylindric, metallic, substratum; such covering is grinded and the screen is laser engraved. Laser engraving provides cells which are similar to those obtained from metal, though less precise, even if with more capacity. The ceramic covering layer has a thickness of 0,1 - 0,2 mm and was very hard, thus it had a much longer life than that of rollers obtained with the first process by a time factor from 5 to 10. However, the complications involved are such that the same cost is many times multiple than that of rollers of the first kind described, even if the engraving quality thereof is higher. Moreover, they are excessively fragile. It might happen that even a slight contact with a small metal piece a very small shock or the like may irreparably damage a very expensive roller.

In accordance with a third known process: a substratum of steel is, galvanically plated with a layer of copper, having a thickness of about 0,5 mm; such plated roll is then engraved with a pointed tool, made of diamond and provided with a go and back movement, controlled by an electronic device. This process provides a screen of cells with quality and characteristics substantially corresponding to those resulting from the first described process. Whereas, herein, the lower hardness of copper imposed, even in this case, a galvanic plating with chromium, with the said defects pointed out hereabove.

The limitations involved by known processes and the need of process not involving such drawbacks it was suggested in recent years to increase at least the hardness at least of cell walls particularly by nitriding. For example, prior U.S. Patent 4,537,127 describes a steel ink metering roller for use in lithographic printing having an engraved surface that has been nitride hardened followed by an oxidizing process that results in a surface with a composition of mainly Fe_3O_4.

Another example, prior U.S. Patent 4,637,310, describes a mesh roller for a lithographic printing press wherein a nitride layer is formed into all of an external surface of the mesh roller including recesses (cells) for metering amount of ink, so that the volume of the recesses is not reduced before subsequent plating. Thereafter copper is plated on the nitride surface of the recesses, trying to minimize the reduction of the volume of the recess. Such copper plating is intended to provide a coating of hydrophobic material over the entire outer peripheral surface of the roller including the internal surfaces of the recesses formed therein; and removing the hydrophobic material from external surface areas surrounding the recesses and thus exposing the hardened layer of nitrided wear resistant material. However none of these two prior art patents suggests the process according to claim 1 of the present application.

The invention, as claimed, is intended to remedy these drawbacks. The inventor, with ingenious perception, has conceived a simple and not expensive process, founded on a preparation step, which substantially repeats that of the first described process, but resulting in a longer life, substantially corresponding to that of the second process. Thus, the screen precision is maintained as provided by the engraving tool, not being any longer altered and compromised by the chromium plating and/or by deformations, due to impact of engraving tool, against a soft material, such as copper. In fact, in accordance with the present invention, the superficial hardening does not involve an additional layer, since the engraved roll material is a chromium containing steel. Nitriding provides an hardness degree comparable with that of ceramic rolls, without having the fragility of same with a resulting precision degree of the screen strongly superior than those obtained with the three conventional processes described. In accordance with the present invention, ionic nitriding is employed. It includes several arrangements pointed to keep the roll distortion to the minimum. Such reduced distortion, occurring despite of arrangement provided, is eliminated with a centring control device adapted to provide the necessary corrections, generally reducing them within the tolerance limits. The inventor has devised as very important that the selection of nitride hardenable steel is made among the stainless steels capable of reaching, through nitriding, a surface hardness of at least 60 HRc. Particularly adapted, since capable of attaining, through nitriding, a surface hardness up to 77 HRc. is a 12% to 15% chromium containing stainless steel. Such chromium percentage being comprised in stainless steel, with 420 AISI denomination comprising 12 to 15% of chromium. Also particularly important is the possibility of assiduously intervening, with testing and corrective means, to affect shape and centring, including a selection a low temperature nitriding hardening process, whereby deformations are eliminated or contained in a range easily controllable by the means according to the present invention. Such means includes substantially a machine, resulting from the combination of devices to support and rotate the roll and a bridge hydraulic press. Such means and bridge being adapted to be mutually itineratable. A plant, mainly to control the descent, including a programmed and programmable electronic circuitry and operating in function of the eccentricity tested. In order to set the arrangement that the machine may operate the necessary corrections on the rolls to be provided, so that they result without induced and undesired distortions, it is necessary to make out it from a solid blank and/or project the wall thickness of the roll and operate the machine accordingly; above all in order that the axial straightness of the roll viz. the elimination of the undesirable eccentricity is not transformed into a local distortion of the section, in other words, in a deflection affecting the cross section and this for the very manufacturing purpose, since for use reasons they are not a problem. Whereas, such generous structure is not only undamageous to use but even advantageous to this respect.

Some ways of carrying out the invention are described, in detail, below through examples and with reference to drawings which illustrate specific embodiments thereof, in which:

EXAMPLE I

As reference example, three lengths 1), 2) and 3) of nitridingable steel bars, respectively corresponding to 1) UNI 30 Cr, Mo 10; 2) UNI 40 Cd 4 , 3) UNI Lf 2, all of them having a diameter of mm 110 and a length of 1470 mm, to provide the same number of screened inking, rolls, for flexographic printing, having a diameter of 100 mm x 1170 mm of length. Each of three lengths, was tempered, providing the following common procedure: heating to 1000° C., with air- cooling and tempering to 630° C., followed by cooling in an oven. Then, each of them was rough turned, to the diameter of 102 mm and the roll bosses were provided. At the end of rough-turning, a new stabilization was executed, providing the following heating procedure: heating to 600° C., with cooling in an oven. At the end of this cycle, each roll, was turned to size, with grinding finish, and its resistance was tested and resulted to be, for all of them, 75 Kg/cm^2. The pieces were submitted to grinding of the surfaces to be engraved. On such grinded surfaces The mechanical engraving was provided with a new die, characterized by a screen of 120 cells per linear centimetre, providing a pressure of about 10.000 Kg/cm^2, during about 10 hours; it was performed in a single running, at a speed of 20 r.p.m., with a die feeding pitch of about 80 microns. Upon engraving, the three engraved rolls were tested, for eccentricity: roll 1) had, in the middle of its length, an eccentricity of mm 0,35, the second one 2) an eccentricity of 0,07 mm and the third one 3) an eccentricity of 0,02. The first one (1) was momentarily discarded and the other ones were subjected to gaseous nitriding. Gaseous nitriding took place at a temperature of 500° C., during 15 hours, in a suitable oven, in an atmosphere of hydrogen nitrogen, with vertical hanging of the roll. Cooling took place in an oven. Once cooled, their hardness was tested and resulted to be 60 HRc for roll (2) and 63 HRc for roll (3), i.e. substantially corresponding to the hardness of chromium plated conventional rolls. Then, the eccentricity was tested and resulted in roll 2) to be 0,12, and in roll 3) 0,075. The nitrided and engraved surface was tested, in several points of the screen and it was appraised that both rolls, had changed their state, from shining and without pores, into opaque and porous. For the two reasons, resulted from testing, even these two rolls 2) and 3) had to be discarded; at any rate, at least for the important reason of the poor degree of finishing of the screen surface.

EXAMPLE II

Two lengths 4) and 5) of nitridingable steel bars, respectively corresponding to 4) UNI LF 2; 5) UNI 31 Cr, Mo V 9, having a diameter of mm 110 and a length of 1470 mm, for providing two screened inking rolls, for flexographic printing, having a diameter of 100 mm x 1170 mm were taken. Each of two lengths was tempered, providing the following common procedure: heating to 1000° C., in air and tempering to 630° C. and successive cooling in an oven. Then they both were rough turned, to a diameter of 102 mm and the bosses thereof were provided. At the end of rough-turning a new stabilization was executed, providing the following heating procedure: heating to 600° C. with cooling in an oven. At the end of this cycle, each roll was turned to size, with grinding finish, and the resistance was tested and resulted to be in either cases 75 Kg/cm^2. The pieces were submitted to grinding of the surface to be engraved. On the so grinded surfaces a mechanical engraving was executed, with a new die, characterized by a screen of 120 cells per linear centimetre, with a pressure of about 10.000 Kg/cm^2, during about 10 hours, whereby a single running was executed, at a speed of 20 rpm., with a feeding pitch of about 80 microns. Upon engraving, the two engraved rolls were tested, for eccentricity: roll 4) had, in the middle, an eccentricity of mm 0,03, and roll 5) an eccentricity of 0,02 mm. In accordance with the present invention, both rolls were subjected to ionic nitriding. Ionic nitriding took place at a temperature of 400° C., during 11 hours, in a suitable oven, in plasma ambient, provided by a high intensity nitrogen with other filling current, with vertical hanging of the roll. Cooling took place in an oven. Once cooled the hardness of pieces was tested and resulted to be, 65 HRc for roll 4) and 65 HRc for roll 5), i.e. even higher than that of chromium plated rolls. The the eccentricity was tested and resulted to be for roll 4) 0,06, and for roll 5) 0,07. The engraved and nitrided surfaces were tested, in several points of the screen, and it was appraised that both rolls, had not changed attitude, which remained the same i.e. shining and without pores. Since the sole obstacle to qualify the rolls in a high quality range was their lack of precision, both rolls were subjected to straightening, in accordance with the present invention. Such straightening of the two rolls reduced their eccentricity: for roll 4) to 0,015 mm and for roll 5) to 0,018 mm. Both rolls, were tested for printing and proved, firstly to be, even at the beginning of the use, better than plated conventional rolls, though subjected to a very slow degradation due to a slight oxidation and corrosion, though strongly contrasted by nitriding, as well as by an hardness not exceptionally high.

EXAMPLE III

According to a preferred embodiment of the present invention, two bar lengths 6) and 7) of stainless, nitride hardenable steel, both with AISI 420 denomination, having a diameter of mm 110 and a length of 1470 mm, to provide two screened inking rolls, for flexographic printing having a diameter of 100 mm x 1170 mm of length, were taken. Each of two lengths was tempered, providing the following common procedure: heating to 1000° C., with air-cooling and tempering to 630° C. and successive cooling in an oven. Then, both were rough turned, to the diameter of 102 mm and the bosses were provided. At the end of rough-turning, either pieces, a new stabilization was provided, including the following heating procedure: heating to 600° C., with cooling in an oven. At the end of this cycle, each roll was turned to size, with grinding finish, and the resistance was tested and resulted to be 80 Kg/cm^2 in either cases. The pieces were submitted to grinding of the surfaces to be engraved. On such grinded surfaces a mechanical engraving with a new die, characterized by a screen, with 120 cells per linear centimetre, by a pressure of about 12.000 Kg/cm^2, during about 10 hours, whereby a single running was executed, at a speed of 20 r.p.m., providing a feeding pitch of about 80 microns. Upon engraving, each of the worked rolls was checked, gauging its eccentricity: the roll 6) had, in the middle, an eccentricity of mm 0,015, and roll 7) an eccentricity of 0,02 mm. In accordance with the present invention, either rolls were ionic nitrided. Ionic nitriding took place at a temperature of 400° C., during 9 hours, in a suitable oven, in a plasma ambient provided by a high intensity nitrogen with other filling, current, with vertical hanging of the roll. Cooling took place in an oven. Once cooled the pieces, its hardness was tested and resulted to be 72 HRc, equal in either cases, i.e. substantially the same than that of ceramic rolls. Then, the eccentricity of each was tested and resulted to be as follow: 0,04 mm in roll 6) and 0,03 mm. in roll 7). The nitrided and engraved surface was tested, in several points of each screen and it was appraised that both rolls, had not changed the previous state, which was still very bright, absolutely poreless and having a shape characterized by sharp corners and having perfect definition. Since the sole obstacle to qualify the rolls, in the range of those of very high quality, was the slight lack of precision, straightening of rolls, in accordance with the present invention, was provided. This working run operation improved the two rolls, so that they attained an acceptable tolerance, reducing the eccentricity to 0,01 mm in both rolls. Both rolls, were tested for printing and gave very high results both from the point of view of duration and inking flexibility, even in comparison with printing obtained from chromium plated rolls, i.e. completely without imperfections and in perfect constancy of results.

A comparison was made, between the data regarding conventional available rolls and the rolls obtained in accordance with the present invention and a mark of merit was given to the different features, which render appreciable an inking roll for flexography. With such data a table, table I, was drafted and is herewith set forth:

TABLE I

No.	KIND OF INCISION	MATERIAL	TREATMENT				PRECISION	HARDNESS	ECCENTRICITY	LIFE	SCREEN FINISHING OR PRINTING	COST OR PRICE
			Heating	Galvanic	Mechanic							
					Incision	Strghtng						
1	Laser	Ceramic	NO	NO	NO	NO	8	10	9	10	7-8	10
2	Mechanic	Fe chrome plated	YES-NO	YES	YES	YES	8	6	8	2	8-9	2.5
3	Mechanic	Cu chrome plated	NO	YES	YES	NO	8	6	9	2	8-8	3.5
4	Mechanic	Ordinary steel	YES	NO	YES	YES	5	5	9	3	7	3
5	**Mechanic**	**Chrome alloyed steel**	**YES**	**NO**	**YES**	**YES**	**10**	**9**	**9**	**9**	**9-10**	**7**

5 = according to the invention

The marks of merit are substantially empirical but abundantly confirmed by practical testing. For example, the most significant mark, i.e. that of screen finishing and of printing quality gives a difference, between the conventional chromium plated roll and the preferred embodiment, in accordance with the present invention, of about 20%. in favour of the latter At this stage, in order to better explain the results and the operation of the straightening means, reference is made to the figures of the drawings, wherein: With reference to figures 1 and 2 attached showing:

Figure 1, a 250x micro-photography of a screen for a conventional inking roll for flexography, with 19600 cells/cm^2, of the kind obtained mechanically, on a steel substratum, with a chromium plating layer 15 microns thick.

Figure 2, a 250x micro-photography of a screen for an inking roll for flexography, with 19600 cells/cm^2, of the kind obtained mechanically, on a stainless steel substratum, nitrided with the modality set forth in example III hereabove, thus in accordance with the present invention. It corresponds also to the challenge of merit set forth in the last line of table I.

Figure 3 a schematic front view of a bridge press for providing the straightening operation in accordance with the present invention and as set forth in the examples.

Figure 4 a side view of the press of Figure 3.

Referring now to figures 1 and 2, the cell sizes were surveied and it was remarked that effectively their capacity, of containing the ink or the like, emerging from the ratio 0-hollow/1-solid, is superior, in Figure 2, by about 20%, in comparison with Figure 1, confirming the difference of the mark given. From the same survey, it is noted that the screen of figure 2, in accordance with the present invention, is sharper and neater, with more defined corners, less superficial cracks and thinner walls, in comparison with the conventional ones of figure 1, substantially corresponding to the second line of table I.

Before explaining the straightening operation, it must be pointed out that the same is possible, at a condition that is effected on a roll, whose screen was already treated by nitriding, which treatment, in turn, may be used at a condition that are known the ways and means to eliminate constitutional eccentricity, as well as those resulting from the heat treatment. But even the straightening operation must be effective and providing a permanent distortion, in a direction exactly opposed to that wherein the rise occurs, substantially eliminating it. The condition, wherein such useful distortion results is that the action is provided through a surface, sufficiently large, in order not to damage the screen, and deforming the cross section of the roll locally, instead of eliminating or at least correcting, reducing it, the rise. The condition of not distorting the section, which would increase the problem instead of solving it, when the rolls are provided from solid rolls, is to use tubular blanks, whose wall thickness complies structure criteria. The minimum wall thickness, in tubular rolls, being direct function of the diameter and inverse function of the length, must be such that, when it is supported at both ends and stressed in the middle on a surface relatively distributed, may be permanently distorted in the axial attitude earlier than at the transverse or cross-section.

Referring now to figures 3 and 4 the straightening means will be described. They comprise: a frame 9, in the form of lathe bed, with longitudinal guides 90 and 91 alongside and thereon The side guides 90 are engaged by the arms 80 of the bridge press 8, comprising the pressing unit 8', driven by pumping station 8". The unit may slide longitudinally, on wheels 89, which rolls on the guides 90. On the upper guides 91 each of the stock units 7, 7' may be slidden.therealong One of them, the unit 7, is a driver and includes a catchplate head 70, to rotate the roll (not shown) to be straightened, to test its eccentricity and localize it. The other unit 7' is substantially a tailstock, but both have cylinder-piston units 77, 77', connected to a pumping station (not shown). The roll, not shown, to be straightened, is shown mounted between the centres 6, and its eccentricity is tested in several points, drawing a suitable map. The control panel 5 of the machine, monitors such eccentricity and provides the control to correct it. The direct pressure on the roll is provided through a concave half bush, made of soft metal such as copper.

Claims

1. Process for making metal inking rolls, particularly for flexographic printing, of the kind comprising a structure completely made of steel, with screen mechanically engraved, by a die, subject to conventional preparation of at least superficial layers, including, both from mechanic, and heating treatment point of view, the screen, characterized in that it comprises: at least the selection of a nitride hardenable steel comprising chromium, to provide the roll engraved structure, the selection of a body solid structure or optionally of a tubular one, wherein the minimum thickness of the wall, when tubular, is a direct function of its diameter and inverse function of its length, such that, when supported at the ends of the engraved body section and stressed, in the middle, on a surface relatively distributed, may be permanently distorted in the axial attitude instead than at the transverse or cross- section; at least a post-engraving ionic nitriding step, to increase the surface hardness of the engraved screen to at least 60 HRc and finally at least a step of straightening, to correct the eccentricity

at least to 0,02 mm.

2. Process for making metal inking rolls, particularly flexographic printing, as claimed in claim 1, characterized in that the selection of nitride-hardenable steel is made among the stainless steels capable of reaching, through nitriding, a surface hardness of at least 60 HRc

3. Process for making metal inking rolls, particularly for flexographic printing, as claimed in claim 2, characterized in that the nitride-hardenable, stainless steel, capable of attaining, through nitriding, a surface hardness up to 77 HRc. is a 12% to 15% chromium containing stainless steel

4. Process for making metal inking rolls, particularly for flexographic printing, as claimed in claim 3, characterized in that an nitride-hardenable, stainless steel, with 420 AISI denomination comprising 12-15% of chromium, is used.

5. Process for making metal inking rolls, particularly for flexographic printing, as claimed in claims 3 and 4, characterized in that the austempering preliminary to rough-turning occurs providing the following procedure: heating to 1000° C., with air-cooling and tempering at 630° C. and successive cooling in an oven.

6. Process for making metal inking rolls, particularly for flexographic printing, as claimed in claims 3, 4 and 5, characterized in that stabilization post-rough turning occurs providing the following heating procedure: heating to 600° C., and quenching in an oven.

7. Process for making metal inking rolls, particularly for flexographic printing, as claimed in claims from 3 to 6, characterized in that the mechanical engraving with die, occurs with a pressure from 6.000 to 20.000 Kg/cm^2, respectively for screens included in a range between 220 and 3 cells per linear centimetre.

8. Process for making metal inking rolls, particularly for flexographic printing, as claimed in preceding claims, characterized in that a roll is made out from a solid bar and/or, if tubular, its wall thickness is projected as direct function of diameter and inverse function of length, so that when supported at both ends of screened surface and stressed in the middle thereof on a surface relatively distributed, may be permanently distorted viz. straightened in the axial attitude instead of at the transverse or cross-section.

9. Process for making metal inking rolls, particularly for flexographic printing, as claimed in claim 1, characterized in that a low temperature ionic nitriding process is employed.

10. Process for making metal inking rolls, particularly for flexographic printing, as claimed in claim 1, characterized in that ionic nitriding is executed at a temperature of 400° C., during 9 hours, in a suitable oven in a plasma ambient provided by a high intensity nitrogen with other filling current, with vertical hanging of the roll, the quenching being made in an oven.

11. Process for making metal inking rolls, particularly for flexographic printing, as claimed in claim 1, characterized in that straightening process occurs scanning the position and size of any eccentricity and providing a distorting pressure of at least 100 tons in the middle of the roll supported at the ends of screened surface, through a large halfbush made of soft metal such as copper or the like.

12. Process for making metal inking rolls, particularly for flexographic printing, as claimed in claim 1, characterized in that the straightening process occurs with a testing and correcting instrument operating on the shape and centring including substantially a machine, resulting from the combination of means (6, 6', 7, 7', 70, 77, 77') to support and rotate the roll and a bridge hydraulic press (8), wherein the bridge (80) is mutually itineratable and a plant, mainly to control the descent, including a programmed and programmable electronic circuitry (5) and operating in function of the eccentricity tested resulting in a permanent deformation of the roll axis, is provided.

13. Means for straightening metal inking rolls, particularly for flexographic printing, characterized by including a straightening bridge press (8) is employed, comprising at least a frame (9), in the form of lathe bed, with longitudinal guides (90 and 91) along its sides and on its top, wherein the side guides (90) are engaged by the arms (80) of the bridge press (8), comprising a proper press unit (8'), driven by a pumping station (8"), wherein the whole unit may be moved longitudinally on wheels (89), which rolls on bottom guides (90), while on the upper guides (91) may be slidden each of two units (7, 7') one of which (7) is a driver and includes a catchplate head (70) to rotate the roll to be straightened to test eccentricity and localize it and wherein the other unit (7') is substantially a tailstock, both units being provided with devices (77, 77') cylinder-piston, connected to a pumping station.

14. A metal inking roll, particularly for flexographic printing, characterized in that the metal is a nitride hardenable steel comprising chromium, said inking roll having been ionically nitrided after engraving to exhibit a surface hardness of at least 60 HRc, said inking roll having an eccentricity lower than 0,02 mm and a very bright and absolutely poreless engraved and nitrided surface, and a shape exactly corresponding to that engraved by the die, with sharp corners having a perfect definition and the same size.

Patentansprüche

1. Verfahren zur Herstellung von metallischen Farbwalzen, besonders für den Flexo-Druck der Art, die eine Struktur vollkommen aus Stahl, mit einem durch Molettierung mechanisch eingravierten Raster, unter der Bedingung, daß zumindest oberflächliche Schichten, einschließlich des Rasters, sowohl vom mechanischen als auch thermischen Aspekt, konventionell vorbehandelt sind; dadurch gekennzeichnet: daß es mindestens die Auswahl eines nitrierbaren, chromhaltigen Stahles, für die eingeprägten Vertiefungen der Walzenstruktur, die Auswahl eines Festkörpers oder einer röhrenförmigen Struktur, wobei die minimale Wanddicke, falls röhrenförmig, der direkten Funktion des Umfangs und der Umkehrfunktion der Länge entspricht, so daß, wenn sie an den Enden der eingravierten Körpersektion gestützt wird und an ihrer Mitte, auf einer relativ verteilten Oberfläche belastet wird, andauernd in der Axiallage, anstatt im Querschnitt oder im Querprofil verzerrt werden kann, voraussetzt; weiter setzt das Verfahren nach der Einprägung zumindest einen Ionennitrierungsschritt voraus, um die Oberflächenhärte des eingeprägten Rasters mindestens auf 60 HRC zu erheben und schließlich als letztzen Schritt eine Ausrichtung, um die Exentrizität mindestens auf 0,02 mm zu korrigieren.

2. Verfahren zur Herstellung von metallischen Farbwalzen, besonders für den Flexo-Druck, nach Anspruch 1, dadurch gekennzeichnet, daß die Wahl, des nitrierbaren Stahles, unter den rostfreien Stählen getroffen wird, die durch Nitrierung eine Oberflächenhärte von mindestens 60 HRc ermöglichen.

3. Verfahren zur Herstellung von metallischen Farbwalzen, besonders für den Flexo-Druck, nach Anspruch 2, dadurch gekennzeichnet, daß das nitrierbare Edelstahl, fähig eine Oberflächenhärte bis zu 77 HRc zu erreichen, ein 12% bis 15% Chrom enthaltendes Edelstahl ist.

4. Verfahren zur Herstellung von metallischen Farbwalzen, besonders für den Flexo-Druck, nach Anspruch 3, dadurch gekennzeichnet, daß ein nitrierbarer rostfreier Stahl, mit einer 420 AISI Bezeichnung und 12-15% Chrom Gehalt benutzt wird.

5. Verfahren zur Herstellung von metallischen Farbwalzen, besonders für den Flexo-Druck, nach den Ansprüchen 3 und 4, dadurch gekennzeichnet, daß die vorbereitende Vergütung zum Vordrehen nach dem folgenden Verfahren geht: erhitzen auf 1000° C., mit Luftkühlen und Anlassen bei 630° C. und nachfolgendem kühlen in einem Ofen.

6. Verfahren zur Herstellung von metallischen Farbwalzen, besonders für den Flexo-Druck, nach den Ansprüchen 3, 4 und 5, dadurch gekennzeichnet, daß die Stabilisierung nach dem Vordrehen dem folgenden Erhitzungsverfahren entspricht: erhitzen auf 600° C., und kühlen in einem Ofen.

7. Verfahren zur Herstellung von metallischen Farbwalzen, besonders für den Flexo-Druck, nach den Ansprüchen 3 bis 6, dadurch gekennzeichnet, daß das mechanische Einprägen der Vertiefungen mit der Molette, bei einem Druck von 6.000 bis 20.000 kg/cm^2 stattfindet, beziehungsweise für Raster, die in der Skala zwischen 220 und 3 Näpfchen pro Linearcentimeter in begriffen sind.

8. Verfahren zur Herstellung von metallischen Farbwalzen, besonders für den Flexo-Druck, nach den vorangehenden Ansprüchen, dadurch gekennzeichnet, daß die Walze aus einem Festkörper hergestellt wird und/oder, falls sie röhrenförmig ist, ihre Wanddicke der direkten Funktion des Durchmessers und der Umkehrfunktion der Länge entspricht, so daß, wenn sie an den Enden der gerasterten Oberfläche gestützt wird und in ihrem Zentrum, auf einer relativ verteilten Oberfläche, belastet wird, in der Axiallage, anstatt im Querschnitt oder Querprofil, andauernd verzerrt oder ausgerichtet wird.

9. Verfahren zur Herstellung von metallischen

Farbwalzen, besonders für den Flexo-Druck, nach Anspruch 1, dadurch gekennzeichnet, daß ein Niedrigtremperatur-Ionennitrierverfahren vorgesehen ist.

10. Verfahren zur Herstellung von metallischen Farbwalzen, besonders für den Flexo-Druck, nach Anspruch 1, dadurch gekennzeichnet, daß das Ionennitrieren in einem geigneten Ofen, bei einer Temperatur von 400 C°., während 9 Stunden, in einer, von einem hochintensiven Strom mit Stickstoff und anderen Füllstoffen erzeugten, Plasmaumgebung, erfolgt, bei senkrechter Aufhängung der Walze und mit Abkühlen in einem Ofen.

11. Verfahren zur Herstellung von metallischen Farbwalzen, besonders für den Flexo-Druck, nach Anspruch 1, dadurch gekennzeichnet, daß der Ausrichtungsprozeß stattfindet, indem die Lage und die Größenordnung der Exentrizität Registriert wird und ein Verzerungsdruck von mindestens 100 Tonnen,.durch eine große Backe aus Weichmetall, wie Kupfer oder ähnlichen, in der Rollenmitte, die an den Enden der gerasterten Oberfläche gestützt ist, ausgeübt wird.

12. Verfahren zur Herstellung von metallischen Farbwalzen, besonders für den Flexo-Druck, nach Anspruch 1, dadurch gekennzeichnet, daß der Ausrichtungsprozeß durch ein Prüf- und Korrekturinstrument stattfindet, welches auf die Form und die Zentrierung einwirkt; es besteht im wesentlichen aus einer Maschine, resultierend aus der Kombination von Elementen (6,6',7,7',70,77,77') zum Unterstützen und Drehen der Walze und aus einer hydraulischen Brückenpresse (8), wobei die Brücke (80) gegenseitig beweglich ist und eine Anlage, hauptsächlich zur Kontrolle der Abwärtsbewegung, einschließlich einer programmierten und programmierbaren elektronischen Schaltung (5), die relativ zur ermittelten Exentrizität einwirkt um eine permanente Deformation der Walzenaxis zu verursachen, vorgesehen ist.

13. Mittel zum Ausrichten von metallischen Farbwalzen, besonders für den Flexo-Druck dadurch gekennzeichnet, daß zur Ausrichtung eine Brückenpresse (8) eingesetzt wird, die aus den folgenden Elementen besteht: einem Gestell (9),der Form eines Drehbankbetts, mit Längsschienen (90 und 91) längs der Seiten und an der Oberseite, wobei die Seitenschienen (90) von den Armen (80) der Brückenpresse (8) beansprucht werden, einschließlich der eigentlichen Presse (8'), die von einer Pumpstation (8'') betätigt wird, wobei die gesamte Einheit auf Rädern (89), die auf den unteren Schienen (90) rollen, in Längsrichtung bewegt werden kann, während aufder oberen Schienen (91) jede der Einheiten (7,7') gleiten kann, wobei die eine ein Spindelstock (7) ist und ein Drehherz (70) hat um die auszurichtende Walze rotieren zu können und damit die Exentrizität feststellen und lokalisieren zu können, wobei die andere Einheit (7') im Wesentlichen eine Reitstock ist, beide Einheiten sind mit einer Zylinder-Kolben und an einer Pumpstation angeschlossenen Vorrichtung (70,70') versehen.

14. Eine metallische Farbwalze, besonders für den Flexodruck, dadurch gekennzeichnet, daß das Metall ein Nitrierbares und Chrom enthaltendes Stahl ist, wobei die erwähnte Farbwalze nach der Eingprägung ionennitriert worden ist um eine Oberflächenhärte von mindestens 60 HRc auszuweisen, wobei die erwähnte Farbwalze eine Exentrizität von höchstens 0,02 mm und eine sehr glänzende und porlose und nitrierte Oberfläche mit eingeprägten Vertiefungen hat, die dervon der Molette eingeprägten Form exakt entsprechen, mit scharfen Kanten, die eine perfekte Definition und die gleiche Größe ausweisen.

Revendications

1. Procédé pour la fabrication de rouleaux encreurs métalliques, notamment pour l'impression flexographique, du type comprenant une structure complètement d'acier, avec la trame gravée mécaniquement par une molette, ayant été prévue une préparation conventionnelle préalable des couches, au moins superficielles, comprenant la trame, aussi bien du point de vue mécanique, que de celui thermique, la trame, caractérisé par le fait qu'il comprend: au moins le choix d'un acier nitrurable, contenant du chrome, pour la construction de la structure à graver du rouleau, la sélection d'une structure pleine ou l'option d'une tubulaire, où l'épaisseur minimale de la paroi, si elle est tubulaire, est fonction directe de son diamètre et fonction inverse de sa longueur, telle que la structure, supportée aux extrémités de la section du corps gravé et soumise à sollicitation au centre, sur une surface relativement distribuée, est déformable permanentement dans le rangement axial au lieu que dans celui transversal ou de section; au moins une phase de nitruration ionique après-gravure, pour augmenter la dureté superficielle de la surface de la trame gravée à au moins 60 HRc et finalement au moins une phase de redressement, pour corriger l'excentricité à au moins 0.02 mm.

2. Procédé pour la fabrication de rouleaux encreurs métalliques, notamment pour l'impression flexographique, selon la revendication 1, caractérisé en ce que le choix de l'acier nitrurable est fait parmi ceux inoxydables et capables de rejoindre, par nitruration, une dureté superficielle d'au moins 60 HRc.

3. Procédé pour la fabrication de rouleaux encreurs métalliques, notamment pour l'impression flexographique, selon la revendication 2, caractérisé en ce que l'acier inoxydable nitrurable, capable de rejoindre avec la nitruration une dureté superficielle jusqu'aux 77 HRc est un acier inoxydable contenant de 12% à 15% de chrome.

4. Procédé pour la fabrication de rouleaux encreurs métalliques, notamment pour l'impression flexographique, selon la revendication 3, caractérisé en ce que un acier inoxydable nitrurable, avec la dénomination 420 AISI contenant 12-15% de chrome est utilisé.

5. Procédé pour la fabrication de rouleaux encreurs métalliques, notamment pour l'impression flexographique, selon les revendications 3 et 4, caractérisé en ce que le traitement d'amélioration préliminaire au tournage grossier a lieu selon la procédure suivante: chauffage jusqu'à 1000° C, avec refroidissement par air et revenu à 630° C. et refroidissement suivant dans un four.

6. Procédé pour la fabrication de rouleaux encreurs métalliques, notamment pour l'impression flexographique, selon les revendications 3, 4 et 5, caractérisé en ce que la stabilisation après le tournage grossier se produit selon le suivant cycle thermique: rechauffement à 600° C., et refroidissement dans un four.

7. Procédé pour la fabrication de rouleaux encreurs métalliques, notamment pour l'impression flexographique, selon les revendications de 3 à 6, caractérisé en ce que la gravure mécanique par une molette se produit par une pression entre 6000 à 20000 Kg/cm^2, respectivement pour des trames inclues dans une gamme comprise entre 220 et 3 alvéoles au centimètre linéaire.

8. Procédé pour la fabrication de rouleaux encreurs métalliques, notamment pour l'impression flexographique, selon les revendications précédentes, caractérisé en ce que le rouleau est fabriqué en partant d'une barre solide et/ou s'il est tubulaire l'épaisseur de la paroi est representée comme fonction directe du diamètre et comme fonction inverse de la longueur, de façon que quand supporté aux extrémités de la surface gravée avec la trame et soumis à sollicitation au centre sur une surface relativement distribuée il est permanentement déformé ou redressé dans le rangement axial au lieu de celui transversal ou de section.

9. Procédé pour la fabrication de rouleaux encreurs métalliques, notamment pour l'impression flexographique, selon la revendication 1, caractérisé en ce que un procédé de nitruration ionique à basse température est utilisé.

10. Procédé pour la fabrication de rouleaux encreurs métalliques, notamment pour l'impression flexographique, selon la revendication 1, caractérisé en ce que la nitruration ionique est réalisé à une température de 400° C., pendant 9 heures, dans un four approprié dans un milieu au plasma constitué par un courant à haute intensité d'azote et d'autres additifs, le rouleau étant suspendu verticalement, le refroidissement aura lieu dans un four.

11. Procédé pour la fabrication de rouleaux encreurs métalliques, notamment pour l'impression flexographique, selon la revendication 1, caractérisé en ce que le procès de redressement a lieu en relevant la position et la dimension de quelconque excentricité et en appliquant une pression déformante d'au moins 100 tonnes au centre du rouleau soutenu aux extrémités de la surface pourvue de trame, avec une joue en métal tendre comme le cuivre ou similaires.

12. Procédé pour la fabrication de rouleaux encreurs métalliques, notamment pour l'impression flexographique, selon la revendication 1, caractérisé en ce que le procédé de redressement a lieu avec un instrument de relèvement et de correction qui travaille sur la forme et le centrage, consistant essentiellement d'une machine, résultante de la combinaison de moyens (6, 6', 7, 7', 70, 77, 77') pour le soutien et la rotation du rouleau et d'une presse (8) hydraulique, à pont mobile, où le pont (80) mobile est mutuellement itinerable et une installation, principalement pour contrôler la descente avec un tableau (5) électronique programmé et programmable et intervient sur l'excentricité relevée, causant une déformation permanente de l'axe du rouleau est prévue.

13. Moyens pour le redressage de rouleaux pour l'impression flexographique, caractérisé en ce que pour le redressement on utilise une presse (8) à pont, constituée au moins d'une charpente (9) comme la plaque de fondation d'une tour, avec des guides (90et 91) longitudinaux le long de ses cotés et à son sommet, où les guides (9O) latéraux sont engagés par les bras (80) de la presse (8) à pont, comprenant l'unité de presse (8'), actionnée par une station de pompage (8"), où l'entier complexe peut être déplacé longitudinalement sur des roues (89), qui roulent sur les guides (90) inférieurs pendent que sur les guides supérieurs (91) se peuvent déplacer chacune des unités 7 et 7', où l'une desquelles est une broche (7) qui reçoive un plateau (70) qui ainsi tourne le rouleau à redresser, pour vérifier et localiser l'excentricité du rouleau et dont l'autre unité (7') est essentiellement une contre-pointe, les deux unités étant pourvues d'un mécanisme cylindre-piston connecté à une station de pompage.

14. Un rouleau d'encrage métallique, particulièrement pour l'impression flexographique, caractérisé en ce que le métal est un acier nitrurable, contenant du chrome, ce rouleau d'encrage ayant été soumis a une nitruration ionique après la gravure pour présenter une dureté superficielle d'au moins 60 HRc, ce rouleau d'encrage ayant une excentricité inférieure à 0.02 mm et une surface gravée et nitrurée très brillante, absolument depourvue de pores ainsi qu'une forme exactement équivalente à celle gravée par la molette, avec des coins aigus ayant une définition parfaite et la même dimension.

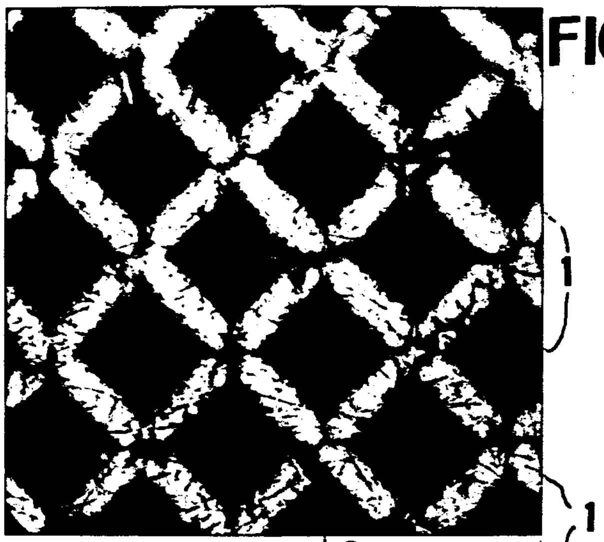

FIG.1

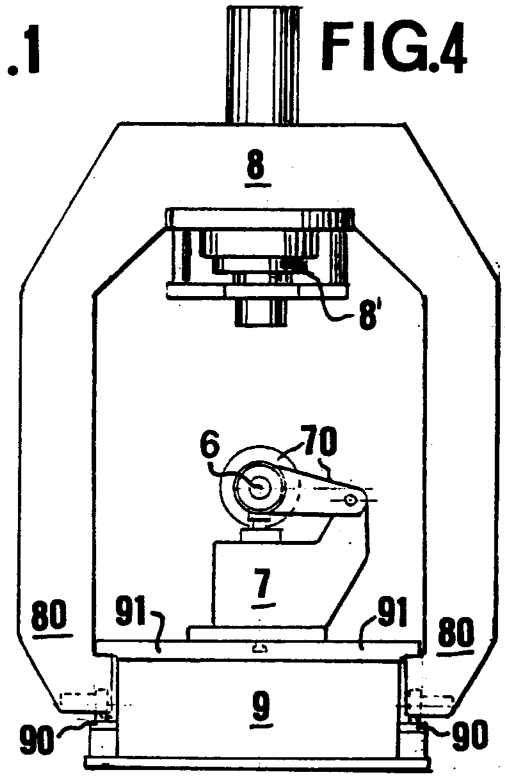

FIG.4

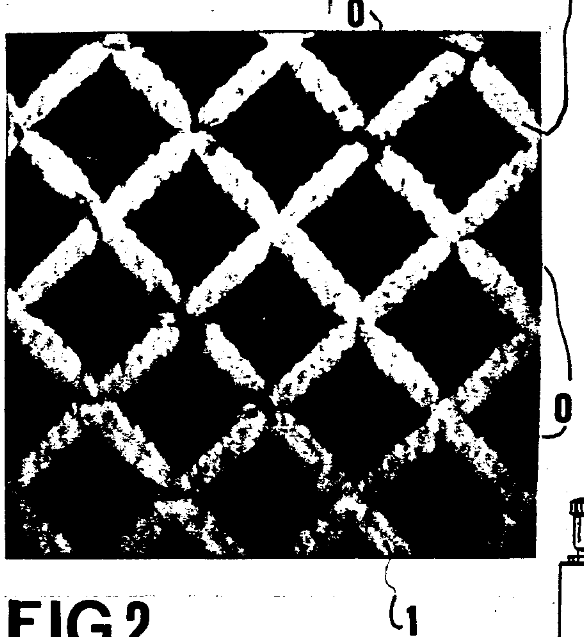

FIG.2

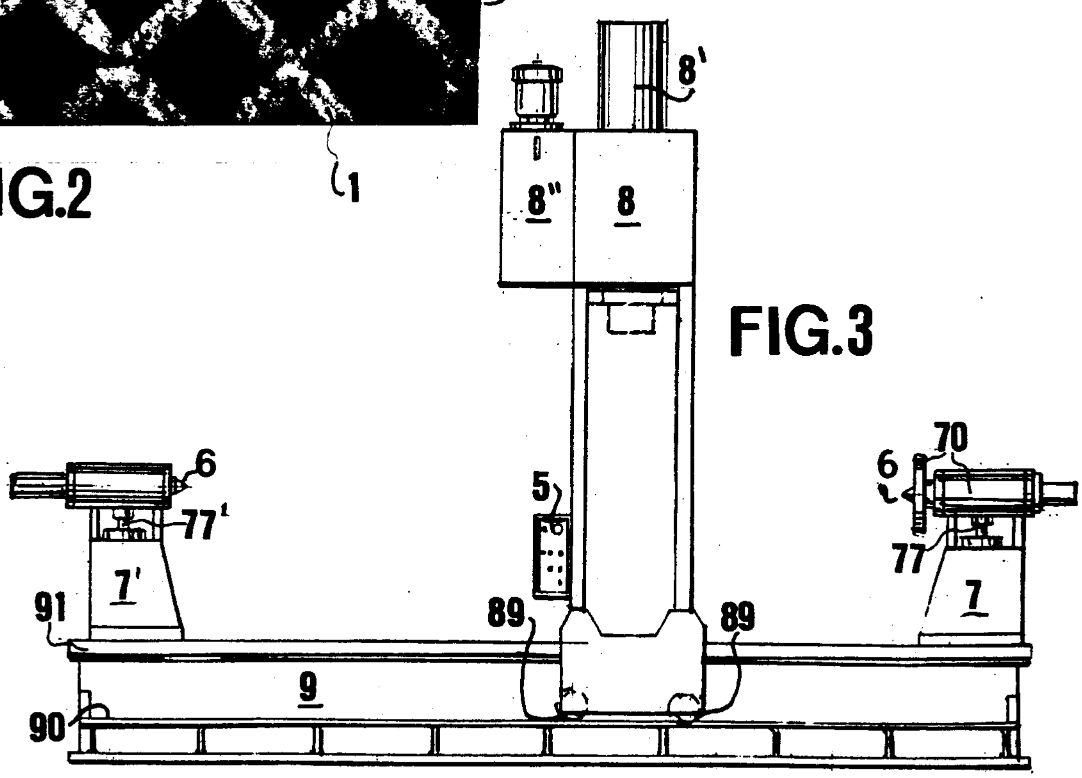

FIG.3