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(54) Inking cylinder used in a printing apparatus and method for producing the inking cylinder.

(57) An inking cylinder adapted for a keyless inking system of a printing apparatus comprises a cylindrical base mumber, and an ink receiving layer covered over the surface of the cylindrical base member. The ink receiving layer is composed of a flexible substrate and many fine spherical members (and hard material powder) uniformly dispersed in the flexible substrate. External shell of each the fine spherical members is partially ruptured by grinding force and its hollow interior is opened. The ink on the cylinder surface is caught by this opened hollow interior of each the fine spherical members.

A method for producing the above inking cylinder comprises a a first step for uniformly dispersing fine spherical members (and hard material powder) in a substrate, a second step for covering the substrate dispersed with the fine spherical members on a surface of a cylindrical base member to form an ink receiving layer on the base member, and a third step for grinding the surface of the ink receiving layer so that the fine spherical members in the surface region are partially grinded and their shells are ruptured to open the hollow interior of the fine spherical members.

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INKING CYLINDER USED IN A PRINTING APPARATUS AND METHOD FOR PRODUCING THE INKING CYLINDER

BACKGROUND OF THE INVENTION

(1) Field of the Invention

The present invention relates to an inking cylinder used in a printing apparatus. More particularly, the present invention relates to an inking cylinder adapted for a keyless inking system which removes excess ink from the inking cylinder and supplies essentially constant amount of ink onto a printing surface of a plate cylinder. Further, the present invention relates to method for producing the inking cylinder.

(2) description of the Prior Art

In an offset printing system which has been broadly employed for printing newspaper, ink is precisely supplied to a plate cylinder by a cooperation between a metering roller and a doctor blade. The surface of the metering roller is formed with a plurality of cells configured in an essentially identical size and arranged in a regular formation. A constant amount of ink fluid is remained in each of the cells owing to the removing function of the doctor blade. This ink supplying system is called "keyless inking". Some prior arts have provided the especially designed metering roller adapted for such keyless inking. For example, Japanese Patent Laid-Open Publication No. 58-42463 entitled "metering Roller For Offset Printing system", Japanese Patent Laid-Open Publication No. 58-56856 entitled "Metering Roller For Offset Printing System" and Japanese Patent Laid-Open Publication No. 61-181645 entitled "Ink Measuring Roller Used For Planography" have taught that the surface layer, including the cells, of these metering rollers are partially or wholly made of lipophilic material such as copper or copper alloy to prevent dampening fluid from entering into the inking system.

Further, other designed metering rollers whose surfaces are made of mixture of inorganic (metal) powders and resin have been provided by Japanese Patent Publication No. 59-42119 entitled "Press Roller And Producing Method Thereof" (referred to 1st. prior art), Japanese Patent Laid-Open Publication No. 61-696 entitled "Press Roller" (referred to 3rd. prior art), Japanese Patent Laid-Open Publication No. 61-14997 entitled "Inking Cylinder For An Offset Printing" (referred to 3rd. prior art), Japanese Patent Laid-Open Publication No. 62-71649 entitled "Dampening Device Used In An Offset Printing Apparatus" (referred to 4th. prior art), and Japanese Patent (Utility Model) Laid-Open Publication No. 63-33970 entitled "Form Roller Used In An Offset Printing Apparatus" (referred to 5th. prior art).

The 1st. prior art discloses an press roller whose surface is made of non-porous hard polyurethane including stone powder to be possessed of Shore D hardness of 70 or more. The 2nd. prior art discloses another press roller whose surface is made of thermosetting resin including inorganic powders to be possessed of Shore D hardness of 70 or more. These press roller are provided with advantages that (a) their mechanical strength are extremely great, (b) they are easily separated from paper, and (c) their surfaces can be kept smooth because the contained powderly particles are hardly lost.

The 3rd. prior art discloses an inking cylinder used for an offset printing system whose surface is made of urethane resin including metal powder such as aluminium, brass or the like. The inking cylinder is possessed of advantages that (a) it is free from deterioration due to the ink solvent, (b) it can be easily received and release printing ink, and (c) ink particles are prevented from dispersing due to fine uneven surface caused by included powder.

The 4th. prior art discloses an dampening roller used in an offset printing apparatus. The surface of the dampening roller is covered with a layer made of liquid resin including hydrophilic powder. This dampening roller is possessed of advantages that (a) it can supply dampening fluid at a constant rate, (b) its life period is elongated, (c) its surface has superior water holding capacity owing to fine uneven configuration of the hydrophilic inorganic power included in the surface layer, and (d) its surface can be easily repaired.

The 5th. prior art discloses a form roller used in an offset printing apparatus. The surface of the roller is made of flexible urethane synthetic resin including at least one kind of oxidized ceramic powders. This roller is possessed of advantages that (a) lipophilic property of the roller surface is gradually changed to hydrophilic property in accordance with the kind and amount of the included powder, and (b) ink amount transferred to the form roller can be reduced owing to the hydrophilic property without addition of ink distributing roller.

The above described metering roller is provided on its surface with a plurality of cells each of which is formed in precise and essentially identical configuration. The cells are disposed in an regular

arrangement. After excess ink is removed by scraping motion of a doctor blade, ink amount remained in each the cells is substantially equivalent.

However, special works are required to form the cells on the metering roller surface. Further, the metering roller formed with the cells is subjected to abrasion by the doctor blade under its working condition. Thus the metering roller surface is gradually abraded as it works, so that the capacity of each the cells is too decreased to supply the ink with enough amount for accomplishing the printing work.

On the other hand, the rollers taught by the 1st. to 5th. prior arts are possessed of relatively high hardness because their surfaces are made of the combination of inorganic powder and synthetic resin. Although these hard surfaces have well abrasion resistance, they are not adapted to be used as a meterintg roller which should be brought in contact with a doctor blade to remove the excess ink from the metering roller for supplying essentially constant amount.

BRIEF SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide an inking cylinder used in a printing apparatus without any cells conventionally formed in an ink receiving layer.

Another object of the present invention is to provide an inking cylinder adapted for a keyless inking system which removes excess ink from the inking cylinder by a doctor blade brought in contact with the surface of the inking cylinder and supplies essentially constant amount of ink onto a printing surface of a plate cylinder.

A further object of the present invention is to provide an inking cylinder whose surface has an abrasion resistance against the doctor blade.

A still further object of the present invention is to provide a method for producing the inking cylinder.

To accomplish these objects the inking cylinder according to the present invention comprises a base member in a cylindrical shape, and an ink receiving layer formed on the base member, which ink receiving layer includes a plurality of fine spherical members.

According to another aspect of the present invention, a method for producing the inking cylinder comprises a first step for dispersing fine spherical members in an ink receiving layer, a second step for covering the ink receiving layer on a surface of a cylindrical base member, and a third step for grinding the surface of the ink receiving layer. So that the fine spherical members in the surface region are partially appeared and their shells are ruptured.

This method can easily provide the inking cylinder covered with the ink receiving layer including many dimple shape recesses which inking cylinder is possessed of superior metering and abrasion resistance properties.

Other objects and advantages of the present invenion will become apparent during the following discussion of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic illustration showing the overall view of the inking cylinder according to preferred embodiment of the present invention;

Fig. 2 is partially enlarged illustration of the ink receiving layer of the inking cylinder shown in Fig. 1; and

Fig. 3 is partially enlarged illustration of the ink receiving layer which is a modification of Fig. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

On preferred embodiment of an inking cylinder according to the present invention will be discussed in conjunction with the drawings. Through the drawings the same numerals denote the same parts or corresponding elements, so that the same explanation will not be repeated.

In Fig. 1, the reference numeral 1 denotes an inking cylinder whose base member 6 formed in a cylindrical shape is made of steel or the like. The base member 6 is covered with an ink receiving layer 2. As shown in Fig. 2, the ink receiving layer 2 comprises a substrate 4 and a plurality of fine spherical members 3 uniformly dispersed in the substrate 4. Alternatively, the ink receiving layer 2 further includes hard material powder 5 in addition to the substrate 4 and fine spherical members 3 as shown in Fig. 3.

The substrate 4 is made of a flexible material such as synthetic resin, natural resin, rubber or the like. In the embodiment, the substrate 4 is made of urethane resin.

The interior of each the fine spherical members 3 is hollow. The shell of the fine spherical member 3 is easily ruptured by grinding force so that the hollow interior is opened. The opened hollow space can catch the ink on the cylinder surface as same as conventional metering rollers formed with many cells. The spherical member 3 per se has been well knowm as various names of micro-balloon, micro-sphere, hollow balloon, and syntactic foam. For example, carbon balloon, glass balloon, silica balloon, shirasu balloon, phenol balloon, vinylidene

chloride balloon, alumina balloon, and zirconia balloon have broadly used as the fine spherical members. Typically, as commercial products "Carbo Spheres" (trade name) manufactured by VERSA Manufacturing Inc. in U.S.A. and "Fillite" (trade name) manufactured by Fillite Co., Ltd. in England have been commonly known. The former belongs to a carbon balloon and has bulk density of 0.15g/cm^3 and shell thickness of 1 to 2 μm. The company has supplied four types depending on particle size. A first type has particle diameter range of 50 to 150 μm (average particle diameter; 50 μm), a second type has particle diameter range of 5 to 100 μm (average particle diameter; 45 μm), a third type has particle diameter range of 5 to 50 μm (average particle diameter; 30 μm), and a fourth type has particle diameter range of 50 to 150 μm (average particle diameter; 60 μm). Further, these particles may be coated with various metals such as nickle, iron, copper, gold or the like. Such metal coated particles are also effectively used.

"Fillite" belongs to a silica balloon and has bulk density of 0.4 g/cm^3 and particle diameter range of 30 to 300 μm.

The fine spherical members 3 of this invention are preferably selected from the particle diameter range of 5 to 300 μm.

The hard material powder 5 is preferably selected from ceramics powder, metal powder, alloy powder, or combination thereof. The hard material powder 5 has preferably particle diameter range of 1 to 100 μm.

Next, a method for producing the above constituted inking cylinders according to the preferred embodiment and modification will be described.

The inking cylinder according to the preferred embodiment is produced by a first method comprising a first step for dispersing the fine spherical members 3 in the substrate 4, a second step for covering the substrate 4 on the surface of the cylindrical base member 6 to form the ink receiving layer 2, and a third step for grinding the surface of the ink receiving layer 2. The fine spherical members 3 dispersed in the vicinity of the surface are subjected to the grinding work and thus their shells are partially ruptured. the hollow interior of the fine spherical members 3 are partially opened in the surface of the ink receiving layer 2 as shown in Fig. 2.

The inking cylinder according to the modification is produced by a second method comprising a first step for dispersing the fine spherical members 3 and the hard material powder 5 in the substrate 4, a second step for covering the substrate 4 on the surface of the cylindrical base member 6 to form the ink receiving layer 2, and a third step for grinding the surface of the ink receiving layer 2. The fine spherical members 3 dispersed in the vicinity of the surface are subjected to the grinding work and thus their shells are partially ruptured. The hollow interior of the fine spherical members 3 and the hard material powder 5 are partially appeared in the surface of the ink receiving layer 2 as shown in Fig. 3.

In the first method (and second method), at the first step the fine sphrical members 3 (and the hard material powder 5) are uniformly dispersed in the substrate 4 by well known mixing or kneading means in response to the properties and shape of the substrate 4. At the second step, the substrate 4 dispersed with the fine spherical members 3 (and the hard material powder 5) is coated on the surface of the cylindrical base member 6 by well known casting, winding, or coating manner. At the third step, the surface of the ink receiving layer 2 is ground by a grinding machine or subjected to the grinding function by a doctor blade after the inking cylinder 1 has been assembled on a printing apparatus. By this grinding step, each the shell of the fine spherical members 3 dispersed in the vicinity of the surface of the ink receiving layer 2 is partially ruptured and removed so that the hollow interior of each the fine spherical member 3 is opened in the surface of the inking cylinder 1. Also the hard material powder 5 dispersed in the vicinity of the surface of the ink receiving layer 2 is appeared by this grinding step (in the second method).

Operation of the inking cylinder according to the present invention will be described. When the inking cylinder 1 shown in Fig. 2 manufactured by the first method is assembled on commonly used printing apparatus not shown and ink is supplied to the inking cylinder 1, the supplied ink is stuck on the ink receiving layer 2 of the inking cylinder 1 and caught by the hollow space of the fine spherical members 3. Then a doctor blade, not shown, is brought in contact with the surface of the ink receiving layer 2 to remove the excess ink from the surface. The ink partially enters into the hollow space of the fine spherical members 3. Each the hollow space functions as like as cells formed in the inking cylinder as disclosed in prior arts. So that the ink remained on the ink receiving layer 2 can be always controlled within substantially equivalent amount.

The modified inking cylinder 1 shown in Fig. 3 manufactured by the second method is operated in the same manner as the above and ensures the same function of the former. This modified inking cylinder 1 further provides abrasion resistance function against the doctor blade. The surface of the ink receiving layer 2 includes some hard material powder 5 which mainly suffers the abrasion force caused by the doctor blade. Accordingly the ink receiving layer 2 can be free from remarkable

abrading and thus its life can be elongated.

The ink receiving layer 2 includes many fine spherical members 3 (and hard material powder 5) uniformly mixed in the substrate 4. Even if the ink receiving layer 2 will be gradually abraded, new fine spherical members 3 (and the hard material powder 5) will be appeared on the surface of the ink receiving layer 2. Then such newly appeared fine spherical members 3 will be subjected to abrasion work, so that the hollow interior of the fine spherical member 3 will be also opened. Accordingly, the external surface of the inking cylinder 1 will be always kept in its primary state that a plurality of hollow space like as cell can catch ink therein to ensure the ink metering function with equivalent level. This ink metering function of the inking cylinder 1 will be maintained for a long period until immediately before the ink receiving layer 2 disappears.

The inking cylinder 1 provided by the present invention is especially optimum for use as a metering cylinder in a keyless inking system because the inking cylinder 1 can always supply ink at essentially equivalent rate without fluctuation of ink-metering which has been caused in conventional metering roller formed with mesh-shape recesses. Such mesh-shape recesses will become shallow by abrasion, and thus ink-metering amount will be fluctuated or decreased. Further, the methods for producing the inking cylinder 1 do not need complicated working steps such as cell forming work or special coating work required in conventional arts, thereby providing the inking cylinder with a low cost in comparison with of a flexible material so that the ink receiving layer 2 is softer than conventional cylinder surface. Thus the doctor blade brought in contact with the inking cylinder 1 is free from remarkable abrasion owing to scraping work against the inking cylinder 1 to remove the excess ink therefrom. Such constituted inking cylinder 1 can ensure long life span of the doctor blade.

As many apparently widely different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that the invention is not limited to the specific embodiments thereof except as defined in the appended claims.

Claims

1. An inking cylinder for a printing apparatus comprising a base member in a cylinderical shape, and an ink receiving layer covered on the base member, which ink receiving layer comprises a substrate and a plurality of fine spherical members.

2. The inking cylinder as set forth in Claim 1, wherein the fine spherical members are uniformly dispersed in the substrate and their shells are partially ruptured to open the hollow interior when the members in the surface region are subjected to grinding force.

3. The inking cylinder as set forth in Claim 1, wherein the ink receiving layer further comprises hard material powder.

4. The inking cylinder as set forth in Claim 3, wherein the hard material powder is uniformly dispersed in the substrate.

5. The inking cylinder as set forth in Claim 1, wherein the substarte is made of a flexible material such as synthetic resin, natural resin, rubber or the like.

6. The inking cylinder as set forth in Claim 5, wherein the synthetic resin is urethane resin.

7. The inking cylinder as set forth in Claim 2, wherein the fine spherical member has particle diameter within a range of 5 to 300 μm.

8. The inking cylinder as set forth in Claim 3, wherein the hard material powder is selected from ceramics powder, metal powder, alloy powder, and the like, whose particle diameter is in a range of 1 to 100 μm.

9. A method for producing the inking cylinder as set forth in claim 1, comprising a first step for uniformly dispersing fine spherical members in a substrate; a second step for covering the substrate dispersed with the fine spherical members on a surface of a cylinderical base member to form an ink receiving layer on the base member; and a third step for grinding the surface of the ink receiving layer so that the fine spherical members in the surface region are partially grinded and their shells are ruptured to open the hollow interior of each the fine spherical members.

10. A method for producing the inking cylinder as set forth in claim 3, comprising a first step for uniformly dispersing fine spherical members and hard material powder in a substrate; a second step for covering the substrate dispersed with the fine spherical members and hard material powder on a surface of a cylindrical base member to form an ink receiving layer on the base member; and a third step for grinding the surface of the ink receiving layer so that the fine spherical members in the surface region are partially grinded and their shells are ruptured to open the hollow interior of each the fine spherical members.

11. The method as set forth in Claim 9, wherein the first step is carried out by mixing or kneading means.

12. the method as set forth in Claim 10, wherein the first step is carried out by mixing or kneading means.

13. The method as set forth in Claim 9, wherein the second step is carried out by casting, winding or coating means.

14. The method as set forth in Claim 10, wherein the second step is carried out by casting, winding or coating means.

15. The method as set forth in Claim 9, wherein the third step is carried out by any grinding machine or abrading function caused by a doctor blade after the inking cylinder is assembled on a printing apparatus.

16. The method as set forth in Claim 10, wherein the third step is carried out by any grinding machine or abrading function caused by a doctor blade after the inking cylinder is assembled on a printing apparatus.

FIG. 1

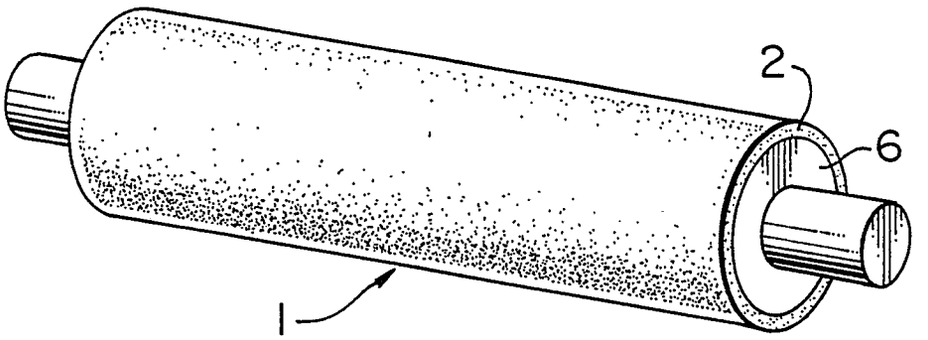

FIG. 2

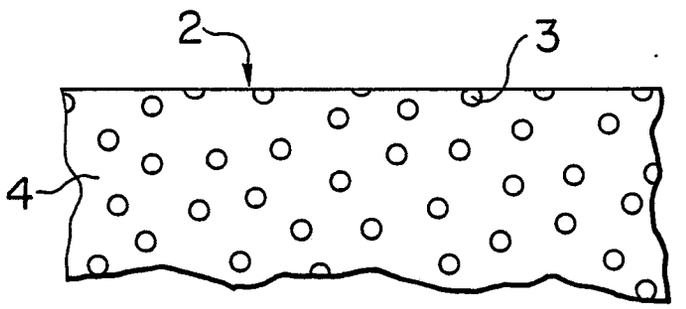

FIG. 3