United States Patent [19]

Funahashi

[11] **3,812,782**

[45] **May 28, 1974**

[54] **SELF-INKING ROLLER**

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[21] Appl. No.: **315,188**

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Sept. 4, 1972	Japan	47-103117
Nov. 7, 1972	Japan	47-128162
Nov. 7, 1972	Japan	47-128163

[52] **U.S. Cl.** **101/367,** 29/125, 29/130, 401/197

[51] **Int. Cl.** **B41f 31/22**

[58] **Field of Search** 101/348, 367; 401/197; 29/132, 125, 130

[56] **References Cited**

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Primary Examiner—Clyde I. Coughenour

Attorney, Agent, or Firm—Waters, Roditi, Schwartz & Nissen

[57] **ABSTRACT**

A self-inking roller comprising an inner cylindrical member made of porous synthetic polyvinyl formal resin having innumerable fine continuous pores, and an outer cylindrical member concentrically mounted over the outer surface of the inner cylindrical member and made of sponge rubber having innumerable fine continuous pores.

12 Claims, 21 Drawing Figures

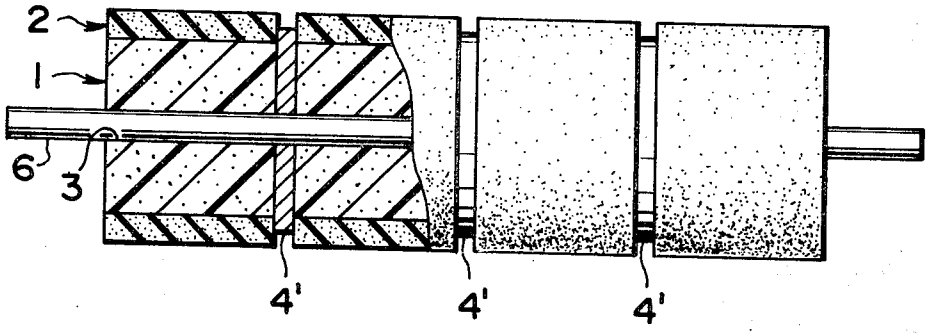


FIG. 1

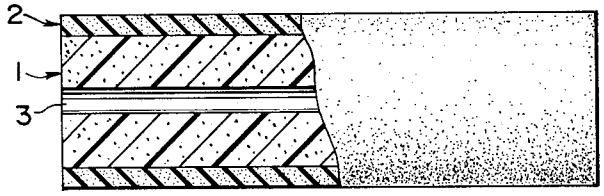


FIG. 2

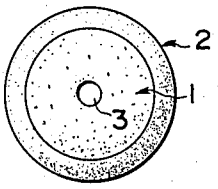


FIG. 3

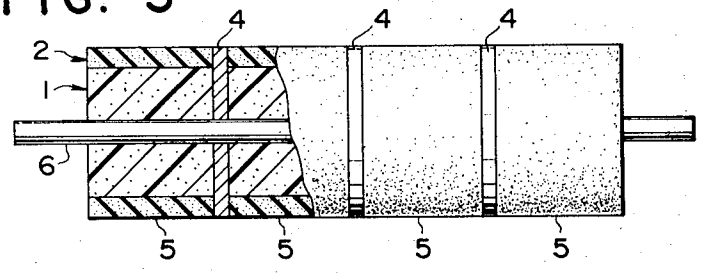


FIG. 4

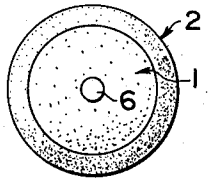


FIG. 5

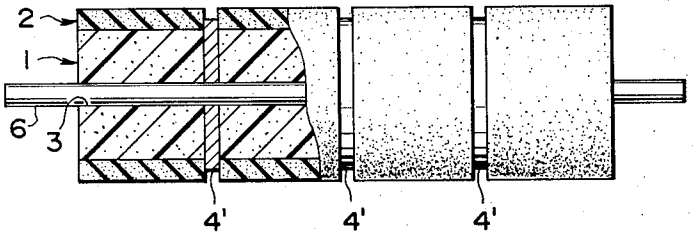


FIG. 6

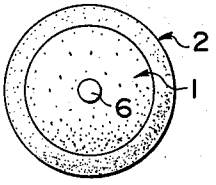


FIG. 7

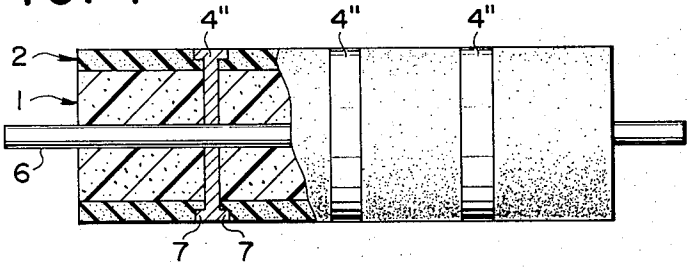


FIG. 8

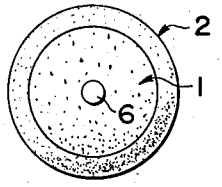


FIG. 9

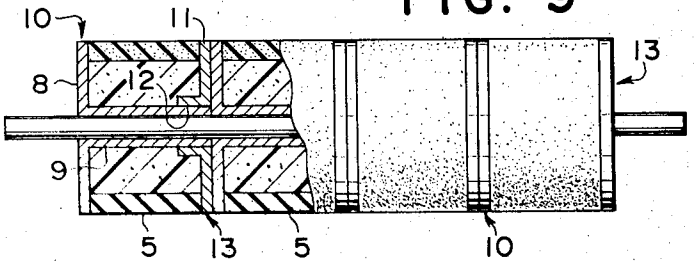


FIG. 10

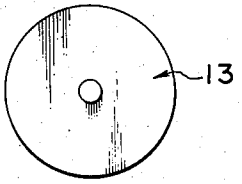


FIG. 11

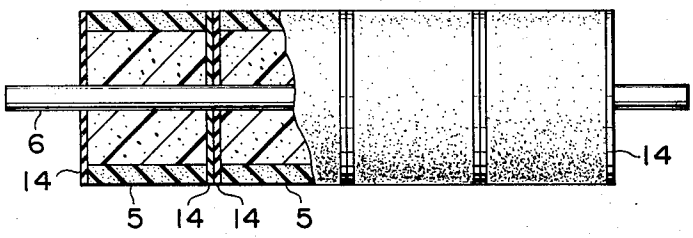


FIG. 12

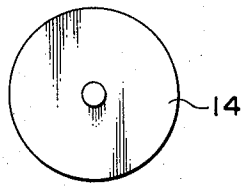


FIG. 13

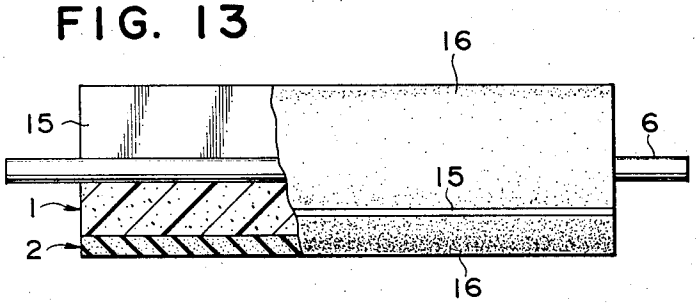


FIG. 14

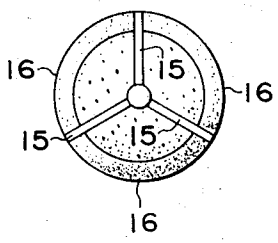


FIG. 15

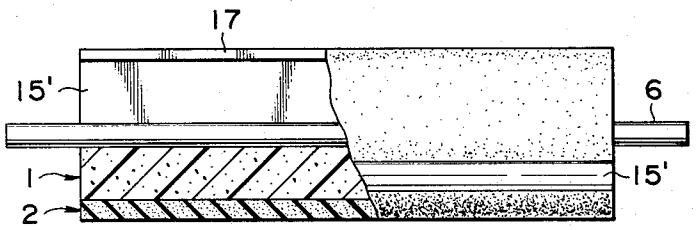


FIG. 16

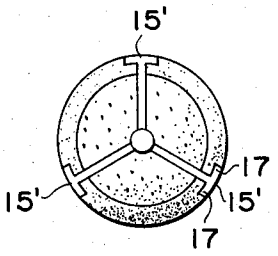


FIG. 17

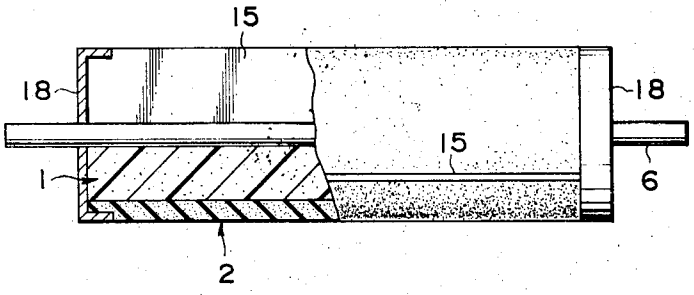
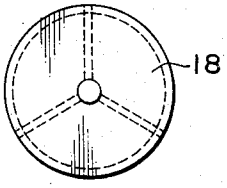


FIG. 18



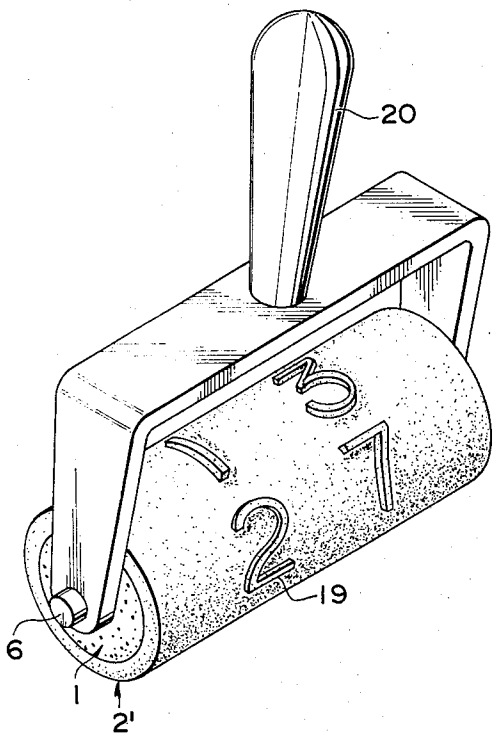


FIG. 19

FIG. 20

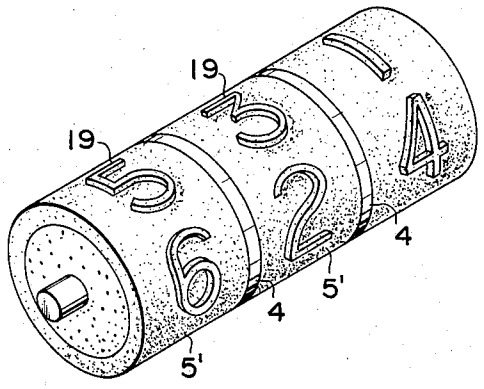
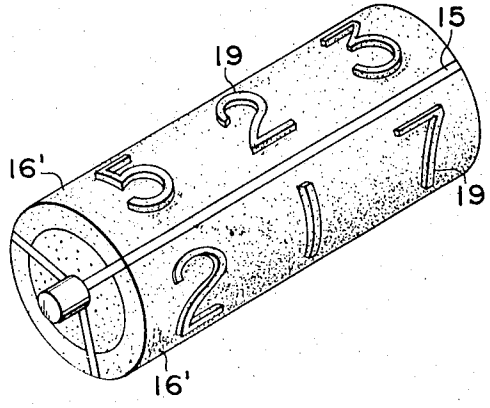


FIG. 21



SELF-INKING ROLLER

BACKGROUND OF THE INVENTION

This invention relates to inking rollers and stamping rollers.

Conventional inking rollers, such as, for instance, rollers to ink the printing surface in a printer used in printing machines, automatic ticket dispensing machines, electronic computers, registers, etc. are usually made of rubber. In using such inking rubber rollers, it is necessary to supply ink to the surface of the rubber roller for every revolution of it by means of another roller immersed in an ink reservoir. Therefore, in such printing machines, one inking roller must be accompanied by an ink reservoir roller, an ink transfer roller, an ink mixing roller and an ink distributiong roller, etc.

There are also known inking rollers made of only porous material having continuous foams such as felt, sponge rubber, etc. This kind of inking roller has the disadvantage that too much ink is apt to attach to the printing surface to be inked if the porous material of the roller has a higher ink absorptivity. On the other hand, this roller is also disadvantageous in that if it is to be designed so as to deposit an appropriate quantity of ink on the printing surface, the absorptivity of the porous material becomes so small that there can occur unevenness of shade or illegible printing in a high speed printing process. Furthermore, this kind of roller is disadvantageous in that, because of the too greater softness of its porous material, the stiffness of the roller cannot be maintained at the optimum value suitable for printing if it is not combined with a shaft, for example, of steel contained therein.

Referring next to conventional stamping rollers, that is, rollers having printing surfaces of letters or patterns, etc., carved in the outer surface, these have been usually made of metal or rubber. This kind of stamping roller also requires depositing ink on the printing surfaces via the outer surface of the roller by other means for instance, by means of separate inking rollers. Therefore, a machine incorporating this kind of stamping roller tends to be of complicated construction and is disadvantageous in that if the feeding of ink to the stamping roller is not conducted evenly, an unclear printing may result from the stamping roller.

SUMMARY OF THE INVENTION

An object of the invention is to provide a roller that can avoid the deficiencies of the foregoing conventional rollers.

Another object of the invention is to provide an inking roller and a stamping roller that are of simple construction and able to feed a suitable quantity of ink by itself over the circumferential surface of the roller without replenishing ink from the outside for every revolution of the roller during its operation.

Another object of the invention is to provide inking and stamping rollers of a simple construction that is able to self-feed evenly a suitable quantity of ink of different colors onto the outer surface of the roller.

A still further object of the invention is to provide an inking and stamping roller of a simple construction that can self-feed a suitable quantity of ink evenly over the surface of the roller without undergoing deterioration, swelling or contraction due to the ink.

According to the present invention, there is provided a self-inking roller comprising an inner cylindrical member made of porous synthetic resin containing innumerable fine continuous pores and an outer cylindrical member mounted concentrically over the outer surface of said inner cylindrical member and made of sponge rubber containing innumerable fine continuous pores.

In accordance with the invention there is provided a self-inking roller in which said inner and outer cylindrical members each comprises a plurality of cylindrical units divided by one or more partitions, which are located in planes perpendicular to the cylindrical members and are of a size not greater than the outer diameter of said outer cylindrical member.

In further accordance with the invention there is provided a self-inking roller in which said inner and outer cylindrical members each comprises a plurality of cylindrical units of sector-shaped cross section divided by a plurality of partitions located in longitudinal and radial planes and having outer edges not projecting from the outer circumferential surface of said outer cylindrical member.

In still further accordance with the present invention there is provided a self-inking roller in which said outer cylindrical member has printing faces of shapes of letters or patterns recessed in or projecting from the outer peripheral surface of the cylindrical member.

In yet further accordance with the present invention there is provided a self-inking roller in which said inner cylindrical member is made of polyvinyl formal.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be more fully described with reference to the accompanying drawings which show several embodiments of the invention, in which:

FIG. **1** is a side elevation view, partially in longitudinal cross section, of an inking roller embodying the invention;

FIG. **2** is the front view of the roller shown in FIG. **1**;

FIG. **3** is a side elevation view, partially in longitudinal cross section, of another inking roller embodying the invention;

FIG. **4** is a front view of the roller shown in FIG. **3**;

FIG. **5** is a side elevation view, partially in longitudinal cross section, of an inking roller embodying the invention;

FIG. **6** is a front view of the roller shown in FIG. **5**;

FIG. **7** is a side elevation view, partially in longitudinal cross section, of another inking roller embodying the invention;

FIG. **8** is a front view of the roller shown in FIG. **7**;

FIG. **9** is a side elevation view, partially in longitudinal cross section, of another inking roller embodying the invention;

FIG. **10** is a front view of the roller shown in FIG. **9**;

FIG. **11** is a side elevation view, partially in cross section, of a further inking roller embodying the invention;

FIG. **12** is a front view of the roller shown in FIG. **11**;

FIG. 13 is a side elevation view, partially in cross section, of still another inking roller embodying the invention;

FIG. 14 is a front view of the roller shown in FIG. 13;

FIG. 15 is a side elevation view, partially in cross section, of another inking roller embodying the invention;

FIG. 16 is a front view of the roller shown in FIG. 15;

FIG. 17 is side elevation view, partially in cross section, of another inking roller embodying the invention;

FIG. 18 is a front view of the roller shown in FIG. 17;

FIG. 19 is a perspective view of a stamping roller in accordance with another form of the invention;

FIG. 20 is a perspective view of another stamping roller in accordance with the invention; and

FIG. 21 is a perspective view of still another stamping roller in accordance with the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The embodiments shown in FIGS. 1 through 18 relate to inking rollers. The roller shown in FIGS. 1 and 2 comprises an inner cylindrical member 1 made of porous synthetic resin having innumerable fine continuous pores and an outer cylindrical member 2 mounted coaxially over the outer surface of the inner cylindrical member 1 and made of sponge rubber having innumerable fine continuous pores.

The inner and outer cylindrical members 1 and 2 are preferably assembled together using the elasticity of the outer cylindrical member 2.

The inner cylindrical member is formed with a bore 3 extending coaxially through it. The bore may be formed in opposite end portions only, instead of extending through the inner cylindrical member.

In FIGS. 3 and 4, which show another embodiment, the inner cylindrical member 1 and the outer cylindrical member 2 comprise four cylindrical units 5 separated by three partitions 4 located in planes perpendicular to the axis of the cylindrical members and having the same size as the outer diameter of the outer cylindrical member 2.

Each partition 4 has the same diameter as the outer cylindrical member and is made of a material that is not permeable to ink. One or more of such partitions may be provided. A shaft 6 may be inserted through the central bore 3 of said inner cylindrical member.

The embodiment shown in FIGS. 5 and 6 is the same as that shown in FIGS. 3 and 4 except that the diameter of each partition 4' is a little smaller than that of the outer cylindrical member 2.

Another embodiment shown in FIGS. 7 and 8 is the same as the embodiment shown in FIGS. 3 and 4, except that each partition 4'' has flanges 7 on both sides of its circumferential edge.

In the embodiment shown in FIGS. 9 and 10, each of the partitions comprises a part 10 consisting of a disk 8 of the same outer diameter as the outer diameter of the outer cylindrical member 2 and a small cylinder 9 of the same outer diameter as the inner diameter of the bore in the inner cylindrical member and attached at its one end to the central side of the disk 8, and a part 13 consisting of a disk 11 having the same outer diameter as that of the outer cylindrical member 2 and having at its center a hole 12 of the same inner diameter as the outer diameter of the small cylinder 9. The small cylinder 9 of each part 10 is inserted from one end of each cylindrical unit 5 and each part 13 is mounted in abutment with the other end of each cylindrical unit 5, whereas the free end of the small cylinder 9 is closely fitted in the hole 12 of the part 13.

In FIGS. 11 and 12, which show another embodiment, each of the partitions is made by providing a thin membrane 14 of rubber, plastic, etc., at the end faces of the cylindrical unit 5. The thin membrane 14 may be made by immersing the end faces into liquid rubber or plastic or spraying liquid rubber or plastic onto the end faces and then drying the end faces.

In FIGS. 13 and 14, which show another embodiment, the inner cylindrical member 1 and the outer cylindrical member 2 comprise cylindrical units 16 of sector-shaped cross section separated by partitions 15 which lie in longitudinal and radial planes and whose outer edges do not project from the outer surface of the outer cylindrical member 1.

The embodiment shown in FIGS. 15 and 16 is the same as the embodiment shown in FIGS. 13 and 14, except that each partition 15' has flanges 17 formed on both sides of its outer end.

The embodiment shown in FIGS. 17 and 18 is the same as the embodiment shown in FIGS. 13 and 14, except that the inner and outer cylindrical members 1 and 2 are provided with end plates 18 having the same large outer diameter as that of the outer cylindrical member 2.

The embodiments shown in FIGS. 19 to 21 relate to stamping rollers.

In the embodiment shown in FIG. 19, the outer cylindrical member 2', which is similar to that in the embodiment shown in FIGS. 1 and 2, has printing surfaces 19 in the shape of letters or patterns carved in recessed or projecting forms on its outer circumferential surface. Its shaft 6 is provided with a suitable support means 20.

In the embodiment shown in FIG. 20, each cylindrical unit 5' which is similar to that of the embodiment shown in FIGS. 3 and 4 has printing surface 19 formed as a recessed portion or a projecting portion on its outer surface. This embodiment may also be made of cylindrical units which are similar to those in the embodiments shown in FIG. 5 to 12.

The embodiment shown in FIG. 21 is provided with cylindrical units 16' similar to those in the embodiment shown in FIGS. 13 and 14 and having recessed or projecting printing surfaces 19 formed on the outer circumferential surface. Also this embodiment may be made of cylindrical units that are similar to those in the embodiments shown in FIGS. 15 to 18.

The inner cylindrical member may be made of any one of polyolefinic synthetic resin, polyvinyl formal, nylon and vinyl chloride.

Preferred methods of making said inner cylindrical member will now be described.

Fibers or fine powder of any of said synthetic resins is packed uniformly in a shaping metallic die of desired shape and then heating the die to the melting point of the synthetic resin or to a slightly lower temperature so that said fibrous or powdered resin will melt partially to combine each other and form a cylindrical body containing many fine continuous pores. In doing this, if ex-

cessive pressure is applied during the heating, the fibers or fine particles will melt to combine wholly with each other and fail to give continuous pores. Therefore said press should be chosen suitably. Also the heating temperature and time should be selected properly since a small pore ratio will result if the heating temperature is high and the heating time is long.

A satisfactory cylindrical body having innumerable fine continuous pores has resulted by using a powder of an average of 200 mesh of polyethylene, heating it for an hour at a temperature of 180°C and then cooling and removing it from the die.

Said inner cylindrical member made of polyolefinic synthetic resin does not swell, soften and contract even if the solvent for the ink is water, alcohol or alcoholic ether. In addition, the inner cylindrical body made of such material has almost no dyeing affinity and its ink impregnation is 50 – 70 percent by volume.

Inner cylindrical bodies made of polyvinyl formal sometimes swell and soften if the ink solvent is water, alcohol or alcoholic ether and sometimes contract if ink impregnation is small. Inner cylindrical bodies made of such material can be dyed by almost all kinds of dye and their ink impregnation is 80 – 90 percent by volume. When nylon is used, the shaping temperature is 250°– 265°C and the shaping time is 40 minutes.

An inner cylindrical body made of nylon sometimes swells if the ink solvent is water and sometimes dissolves partially if the ink solvent is methanol or phenol. An inner cylinder made of this material sometimes presents some changes in the color of the ink for acid dyes and its ink impregnation is 50 – 70 percent by volume.

An inner cylinder made of vinyl chloride sometimes swells or dissolves when the ink solvent is ketone or ketone alcohol. An inner cylinder made of this material has a 50 – 70 percent ink impregnation by volume.

Next, preferred methods for making the sponge or rubber for the outer cylindrical member will be described.

As described in the present inventor's Japanese Pat. Publications Nos. Sho 38-24714 (published Nov. 28, 1963), Sho 39-29183 (published Dec. 16, 1964) and the letter's corresponding U.S. Pat. No. 3342911, synthetic rubber (nitril butadiene rubber) 100 parts, sulfur **2**, zinc powder **5**, vulcanizing accelerator **3** and softener **33.5** consisting of liquid rubber (low polymer nitril butadiene rubber), vaseline, dibutyl phihalate, etc., carbon black **50**, reinforcing agent **2.5**, age resistor **2**, bubbling promotor **2**, p-p'-oxybisbenzene sulfonile hydrazide **2**, fine powdered sodium chloride or sodium sulfate **800** are added together and kneaded and mixed sufficiently to form a thin sheet. On the other hand, separately, synthetic rubber (nitrile butadiene rubber) 100 parts, sulfur **2**, zinc powder **5**, vulcanizing accelerator **3**, softener **32**, carbon black **55**, reinforcing agent **2.5**, age resistor **2**, bubbling promoter **10**, sodium bicarbonate **10**, p-toluene sulfonile hydrazide **5**, p-p'-oxybisbene sulfonile hydrazide **4**, sodium chloride or sodium sulfate **900** are added together, kneaded and mixed to form a somewhat thick sheet. Both sheets are then superposed and vulcanized by means of a metallic die, removed from the die, and then washed with water to eliminates sodium chloride or sodium sulfate and finally dried. By this method, sponge rubber having continuous pores can be produced. In doing this, by carving desired letters or patterns on the inner surface of the die, it is possible to obtain recessed or projecting desired printing surfaces over the outer surface of the outer cylindrical member.

In the inking roller shown in FIGS. **1** to **18**, the continuous pores of the inner cylindrical member is impregnated with ink going from its end faces and then the ink contained in the inner cylinder is gradually transferred to the outer cylinder to impregnate it. It is also possible to impregnate the outer cylinder with ink at the same time as impregnation of the inner cylinder with ink.

When the inking roller is used in a printing machine so that the inking roller rotates in contact with the printing types of the printing machine, the ink contained in the outer cylindrical member is deposited onto the types. At this time, the decrease of ink in the outer cylinder is replenished by the ink contained in the inner cylinder because of the absorption characteristics of the sponge material of the outer cylinder, so that the quantity of ink contained in the outer cylinder is always maintained nearly constant. Therefore, no shading nor unclearness of printing will result even if the roller is used with a high speed printing machine.

Because of the high impregnation of the inner cylinder with ink, one ink impregnation permits a very long period of operation.

Although the inner cylindrical member is of low softness, the outer cylindrical member, made of said sponge rubber is of relatively high softness and can be properly contacted with the types at its outer surface.

The stamping roller shown in FIGS. **19** and **20** may also be impregnated with ink in the same way as said inking roller.

The stamping roller may be used as a manual stamping roller with a handle **20** as shown in FIG. **19.**

The stamping roller may also be used with automatic ticket vending machines, electronic computers, registers and the like. In such a case, it is possible to carry out stamping of letters or patterns for a very long period of time without depositing ink for every use. It goes without saying that the inking roller also may be used as a manual inking roller with the handle **20** shown in FIG. **19.**

The inking roller shown in FIGS. **1** and **2** and the stamping roller shown in FIG. **19** is for use with an ink of one color.

With the inking rollers shown in FIGS. **3** to **18** and the stamping rollers shown in FIGS. **20** and **21**, it becomes possible to conduct inking or stamping in different colors by impregnating the partitioned units with inks of different colors. Such inks of different colors will not mix with each other because of the presence of the partitions between the units.

What is claimed is:

1. A self-inking roller comprising:

an inner cylindrical member of synthetic resin having sufficient rigidity to provide a predetermined stiffness to said self-inking roller and having a central bore for slidably receiving a shaft of rotation, said inner cylindrical member being formed with a multiplicity of fine continuous pores for a reserve of ink therein; and an outer cylindrical member of sponge rubber concentrically and coextensively covering said inner cylindrical member for providing a stamping surface at its outer surface and also for preventing the reserve of ink from oozing excessively and drying on said stamping surface,

said outer cylindrical member being formed of a multiplicity of fine continuous pores having constant inking communication with the pores of said inner cylindrical member so that a predetermined quantity of the reserved ink is automatically delivered through the pores thereof to said stamping surface due to capillarity, said inner cylindrical member being constituted of partially intermelted and combined fibers or fine powders of polyvinyl formal which provide a multiplicity of fine continuous pores and an ink impregnation of 80–90 percent by volume, said outer cylindrical member being a composite of relatively thick and thin sheets of sponge rubber which are superposed on one another and vulcanized together.

2. A self-inking roller comprising a plurality of distinct roller units each having a central bore slidably receiving a common rotatable shaft, a plurality of partitions of a material impermeable to ink separating said roller units, each partition extending radially from the inner surface of the associated adjacent roller units to a slightly recessed position relative to the outer surface of the roller units, said partitions being securely interposed between each adjacent pair of roller units for combining the units into an integral cylindrical assembly, each of said roller units comprising: an inner cylindrical member of synthetic resin having a sufficient rigidity to provide a predetermined stiffness to said integral cylindrical assembly and provided with a respective central bore, said inner member being formed with a multiplicity of fine continuous pores for a reserve of ink therein; and an outer cylindrical member of sponge rubber concentrally covering said inner member for providing a stamping surface at the outer surface thereof and also for preventing the reserve of ink from oozing excessively and drying on said stamping surface, said outer cylindrical member being formed with a multiplicity of fine continuous pores having constant inking communication with the pores of said inner cylindrical member so that a predetermined quantity of the reserve of ink is automatically delivered through the pores thereof to said stamping surface due to capillarity, said inner cylindrical member being constituted of partially intermelted and combined fibers or fine powders of polyvinyl formal which provide a multiplicity of fine continuous pores and an ink impregnation of 80–90 percent by volume, said outer cylindrical member being a composite of relatively thick and thin sheets of sponge rubber which are superposed on one another and vulcanized together.

3. A self-inking roller according to claim **2,** further comprising two end discs of a material impermeable to ink covering both ends of said cylindrical assembly to provide a predetermined stiffness thereto and also to prevent the reserve of ink from oozing therefrom.

4. A self-inking roller according to claim **2,** wherein both said inner and outer members are cylindrically shaped and axially coextensive, said partitions being generally disc-shaped and disposed in planes perpendicular to the axis of said cylindrical assembly.

5. A self-inking roller according to claim **4,** wherein each said outer member is provided with peripheral notches at both outer end peripheries thereof for defining an annular groove with the peripheral notches of adjacent outer members, each of said partitions including a flange portion of a size and shape to fit in said annular groove but slightly recessed from said stamping surface.

6. A self-inking roller according to claim **4,** further comprising innermost cylinders made of a rigid material impermeable to ink and each fitted in the central bore of a respective said roller unit for directly receiving said shaft.

7. A self-inking roller according to claim **4,** wherein said partitions are made of a thin membrane.

8. A self-inking roller according to claim **2,** wherein said inner and outer members have the shape of a sector in cross sections perpendicular to the axis of said cylindrical assembly so that adjoining cross sections thereof lie in a common sector, said partitions being rectangular and disposed in longitudinal planes of said cylindrical assembly.

9. A self-inking roller according to claim **8,** wherein said outer member is provided with longitudinal notches at both outer peripheral sides thereof for defining a longitudinal groove with the longitudinal notches of adjacent outer members, each of said partitions including a flange portion of a size and shape to fit in said longitudinal groove but be slightly recessed from said stamping surface.

10. A self-inking roller according to claim **2,** wherein said stamping surface of each unit has a stamping shape inclusive at least of letters or patterns, such that the stamping surfaces of said roller units can be deposited independently of each other with different colors.

11. A self-inking roller according to claim **10,** wherein the stamping shapes are recessed from said stamping surface.

12. A self-inking roller according to claim **10,** wherein said stamping shapes project from said stamping surface.

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