March 27, 1951 W. C. HUEBNER 2,546,304

PRINTING ELEMENT OR CYLINDER

Filed March 14, 1946

Fig. 1.

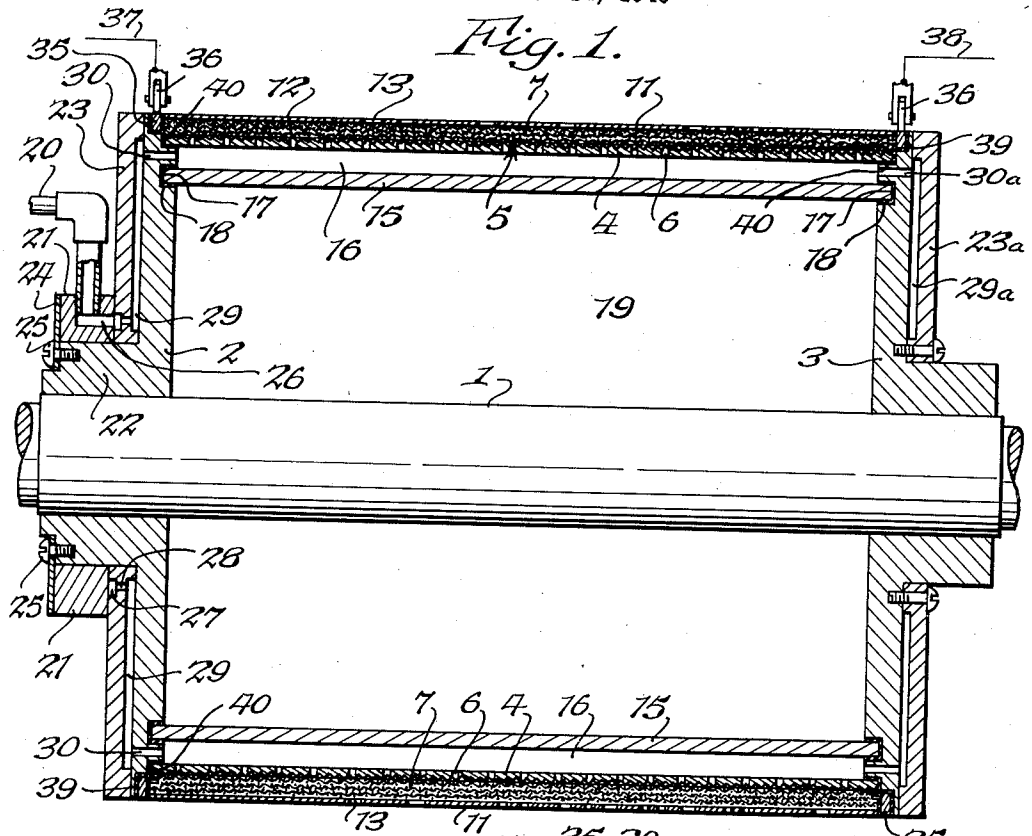


Fig. 2.

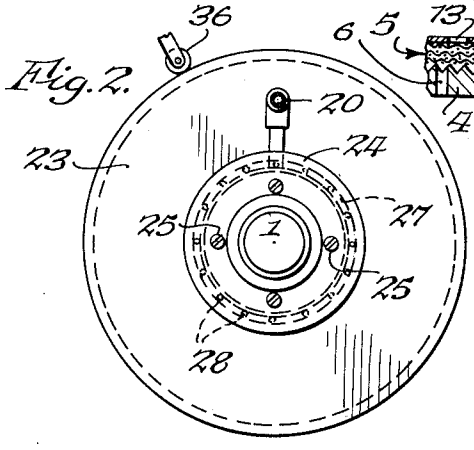


Fig. 6.

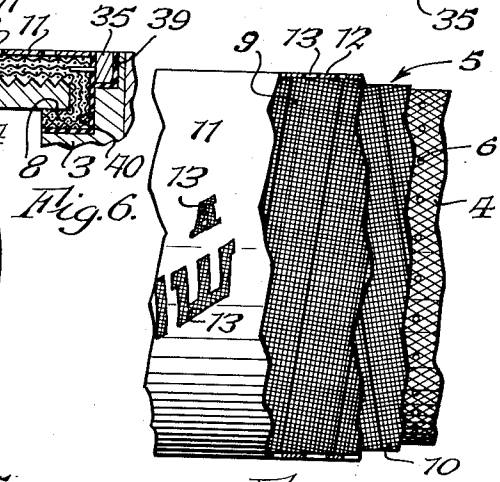


Fig. 3.

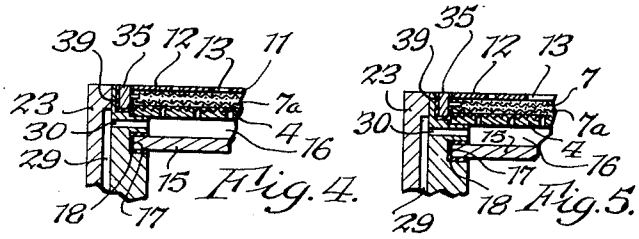


Fig. 4.

Fig. 5.

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PRINTING ELEMENT OR CYLINDER

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2 Claims. (Cl. 101—116)

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This invention relates to printing elements or cylinders suitable for use in various different methods of printing, but which are particularly adapted for use in printing apparatus where the printing is effected without the heavy pressures employed in orthodox printing presses, such for example as apparatus in which the ink is transferred from the printing element to the print receiving paper or material through the instrumentality of electronic, electrostatic or magnetic lines of force. More specifically, the invention relates to improvements in printing elements of the nature disclosed in certain of my copending applications for U. S. Letters Patent.

My U. S. application, Ser. No. 623,703, now abandoned, for example, discloses printing elements having tubular or hollow cylindrical bodies which are made of materials that are porous or permeable by liquids and are provided with exterior printing surfaces comprising areas that mask portions of the permeable body of the element and are impervious to liquids and other areas to which the liquids are delivered or applied by permeation or expulsion through the pores or interstices of the body of the element. Said application shows printing elements of two forms having a tubular body of porous material provided with an exterior printing surface. In one form this printing surface is composed of image-printing areas that mask portions of the porous body and are impervious by fluids or liquids, and nonprinting areas formed by pervious parts of the printing surface or exposed surface portions of the porous body which in the use of the element are moistened by a dampening fluid permeating or passing through the body pores of the element. In the printing element of the second form, the exterior printing surface is composed of non-printing areas that mask surface portions of the porous body and are impervious to liquids, and image-printing areas formed as by exposed surface portions of the porous body which, in the use of the element, are inked or covered with fluid ink, dye or liquid printing material expelled or passing through the body pores of the element. The first form of element provides a printing surface in the nature of a planographic surface in which the non-printing areas can be dampened, without the use of the orthodox dampening roller, by a dampening fluid passing through the body pores of the element for repelling the printing ink, which may be applied, as by the orthodox inking rollers, to the image printing areas of the printing surface. Said second form of element provides a

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printing surface in the nature of an intaglio or gravure surface in which the pervious image-printing areas are inked, without the use of the orthodox inking rollers, by fluid ink, dye or liquid printing material that passes or is expelled from the interior of the element through the body pores thereof to said image-printing areas.

Printing elements of such character avoid the cost and inconvenience of the inking rollers used in the present-day orthodox relief presses and offset presses and also avoid the use of doctor blades or other surface wiping instrumentalities used in orthodox gravure presses.

As disclosed in said applications, the permeable tubular body of the printing element is formed by a hollow cylinder or tube of porous ceramic or other suitable plastic material which, after being ground to true cylindrical exterior and interior shape, is provided exteriorly with a printing surface such as described, comprising pervious areas formed as by exposed or bare surface portions of the porous element body and other areas which mask surface portions of the porous body and are impervious to dampening fluids or fluid ink, dye or liquid printing material.

One object of this invention is to provide an improved printing cylinder or element that can be readily and economically produced of required accuracy for high grade printing and has a pervious body of novel construction that will insure free and uniform passage or expulsion of liquids through the pores or interstices thereof to the printing surface, either for dampening the non-printing areas when the printing surface is of the relief or planographic type, or for inking the image-printing areas when the printing surface is of the intaglio or gravure type.

Other objects of the invention are to provide a printing cylinder or element of the character mentioned having a pervious or liquid expulsion body of novel construction or formation which is of greater strength and durability and less fragile and liable to breakage or injury during the manufacture or use thereof than the bodies of previous printing cylinders or elements of analogous type; also to provide a printing cylinder or element of the character mentioned having a pervious or liquid expulsion body of novel construction which provides means for effectively charging the printing liquid in its passage to the printing surface with an electric charge of required polarity for cooperation with other electrical means in apparatus in which the printing is effected by electronic or other electric action.

Further objects and advantages of the inven-

tion will appear from the following specification of the preferred embodiments of the invention shown in the accompanying drawings, and the novel features of the invention are set forth in the appended claims.

In said drawings:

Fig. 1 is a longitudinal, sectional elevation of a printing cylinder or element of one form embodying my invention.

Fig. 2 is an elevation of one end of the printing cylinder, the left hand end, as shown in Fig. 1.

Fig. 3 is a fragmentary elevational view of the tubular shell of the element with portions of the external printing surface broken away to show how the underlying porous or permeable body may be formed by windings of mesh or reticulated material.

Figs. 4 and 5 are fragmentary, longitudinal, sectional elevations showing printing elements of slightly modified forms embodying the invention.

Fig. 6 is a similar sectional view on a larger scale showing one way of fastening the ends of the mesh fabric ribbons at the ends of the supporting tube.

The printing element as illustrated in the drawings is in the form of a hollow cylinder comprising a peripheral tubular shell supported at its ends by and connecting opposite circular heads or ends 2 and 3, which are suitably secured on an axial shaft or tube 1. The tubular shell of the cylinder comprises an inner perforated supporting tube 4 made of metal or other sufficiently strong, rigid material, around which are tightly wound or wrapped one or more, preferably several, superposed layers of open mesh, screen-like material or liquid-permeable cloth to form or build up on and around the inner tube 4 a body 5 of suitable thickness having closely spaced fine pores or interstices through which liquid can permeate or pass. Preferably the inner tube 4 has a knurled or roughened outer surface and is provided with perforations 6 extending therethrough for the passage of liquid from the interior of this tube to the surrounding pervious body 5 for passage therethrough. The mesh material forming the body 5 may be, as shown at 7 in Fig. 1, fine wire, open mesh screen fabric of about 200 meshes to the inch, or other analogous material such as glass fiber cloth, as shown at 7a in Fig. 4, and the pervious body 5 of the cylinder shell may be formed wholly by any required number of layers of either the wire mesh or glass fiber material, or by one or more layers of the wire mesh material alternating with one or more layers of the glass fiber cloth, as indicated at 7 and 7a, Fig. 5. This open mesh fabric or cloth of whatever kind is wrapped or wound on the tube 4 in such a way as to provide a uniform, annular, cylindrical body 5 without creases, ridges or seams which would give it an uneven, outer cylindrical surface.

Fig. 3 represents a desirable way of winding the mesh fabric or cloth on the tube 4 to form the pervious body 5 of the cylinder shell, in which a relatively narrow ribbon or band of the fabric is wound helically and tightly about the tube with the side edges of adjacent convolutions of the ribbon abutting flush with one another so as to form a continuous or unbroken layer of the fabric or cloth, with the starting and finishing ends of the ribbon suitably fastened at the ends of the cylinder shell. For instance, the ends of the ribbon may be turned over the end edges of

the tube 4 and cemented thereto, as indicated at 8, Fig. 6. Any desired number of superposed layers of fabric or cloth can be thus formed by helically winding the fabric ribbons about the tube in one layer upon another, but preferably the ribbons in alternate layers are wound helically in opposite directions so that the covolutions of the ribbon forming one layer will cross those of the next adjacent layer, as indicated in Fig. 3, in which 9 represents the ribbon forming one layer and 10 the oppositely wound ribbon forming the next layer. The opposite ends of each ribbon are suitably fastened or anchored in place, for instance, by cementing to the tube 4, as above indicated, so as to hold the ribbons intact about the tube, without shifting. This manner of constructing the pervious body of the open mesh material insures that the outer peripheral surface of the porous body will be a continuous or unbroken, true cylindrical surface, free from creases or ridges where the edges of the wound fabric meet.

After building up the pervious body 5 to the required thickness or diameter, it is enveloped by a continuous or unbroken outer peripheral coating or layer 11 of material of a character suitable for forming the exterior peripheral printing surface of the cylinder, depending upon the method of printing for which the cylinder or element is to be used. For instance, this layer or coating 11 may be a metallic layer of tin, copper or other suitable metal of a thickness, say in the neighborhood of 1½ thousandths of an inch, and may be formed by any suitable method, such as by spraying the metal in a molten condition uniformly over the outer surface of the porous body 5; or by applying a suitable flux exteriorly on the wire mesh body 5 and rotating the tube with its mesh body dipping into a molten bath of coating metal; or by electrolytically depositing the metal coating on the pervious body of the shell, as disclosed in said application Ser. No. 623,703. This metal layer or coating when formed is ground or finished to provide it with a polished or smooth outer surface of true cylindrical form.

The finished metal coating or layer 11 is suitably treated to convert it into a printing surface composed of areas 12 which are impervious by liquids and mask or cover underlying surface portions of the pervious body 5 of the shell, and other areas 13 which are pervious or leave bare the registering surface portions of the pervious body 5 for expulsion or permeation of liquid through the pores or interstices of said body to the exterior of the printing surface at these bare or pervious areas. Thus, liquid can pass or be expelled from the interior of the cylinder shell through its pores or interstices to these printing surface areas 13 either for the purpose of dampening them, when they constitute non-printing areas of the printing surface, as in the case of a printing surface of the planographic or relief type; or for the purpose of the passage or expulsion of fluid ink, dye or liquid printing material through the pores or interstices of the shell to these bare or pervious surface areas when they constitute the image-printing areas of a printing surface of the intaglio or gravure type. It is to be understood that the masking areas 12 of the printing surface are impervious by liquids so that the liquids can pass through the pores or interstices of the shell body to the exterior of the printing surface only at the bare or pervious areas 13 thereof.

This printing surface having the impervious areas 12 and the bare or pervious areas 13 can

be produced by different suitable methods, depending on the required character of the printing surface. For example, the printing surface can be prepared by a method such as disclosed in said application, in which the metal layer 11 is coated with a light-sensitive solution and the printing image or images is or are produced thereon photographically by exposing the light-sensitive coating to light through a negative or positive film, and then developing the sensitized coating so as to leave on the metal layer 11 only those portions of the light-sensitive coating which were hardened by light action, the other portions of the sensitized coating, which were protected from light action, being dissolved or washed off, leaving bare or exposed the corresponding portions of the metal coating or layer 11. Then, after baking or suitable treatment of said light-hardened portions to convert them into an acid-resistant enamel or its equivalent, the bare portions of the metal layer 11 are removed as for example, by the use of a suitable etching acid or by reversed electrolytic action as disclosed in said application, to expose or leave bare the corresponding surface portions of the underlying pervious body 5 of the cylinder shell for the passage therethrough of liquid from the interior of the cylinder shell to these bare or pervious areas 13 of the printing surface.

While a printing element having the printing surface formed by the outer metal layer or coating 11, as above described, is preferred for use in many printing methods, nevertheless, instead of providing such a metal printing surface on the pervious body 5 of the shell, the printing surface can be produced directly on the pervious body without or omitting the metal layer, as by forming a coating or layer of light-sensitive material directly on the pervious body of the printing element and developing this coating or layer by a well known photographic process to provide the light-hardened, impervious or masking areas 12 of the printing surface and the pervious areas 13 thereof formed as by removing the non-light-hardened portions of the light-sensitive coating by development to expose or bare corresponding surface portions of the pervious body 5 of the element as above described.

The liquid, whether a fluid for dampening the pervious areas 13 of the printing surface or a fluid ink, dye or other liquid printing material for inking these areas, may be applied or delivered to the interior surface of the perforated tube 4 of the cylinder shell in various ways. For this purpose, as illustrated in the drawings, the printing element is provided within the tube 4 with an annular wall or tube 15 which extends from one to the other of the heads 2 and 3 of the cylinder and is separated from the tube 4 by a shallow liquid space 16 to which the liquid is supplied or delivered for passage through the perforations of the tube 4 to the pervious body of the shell. The ends of the wall 15 may be, as shown, supported in annular grooves 17 in the cylinder heads 2 and 3 with its ends seated in suitable sealing gaskets or rings 18 interposed in the grooves 17 between the heads and the ends of the wall 15 to prevent the escape of the liquid from the liquid space 16 past the wall 15 into the interior chamber 19 of the printing element. The liquid may be delivered to the liquid space 16 of the element under suitable pressure from a supply pipe 20, which as shown, connects with a stationary ring 21 that surrounds the hub 22 of one head 2 of the rotatable cylinder, and is held in place against a face plate 23 of said cylinder head 2 by a retaining ring 24 which is secured, as by screws 25, to the hub 22 at the outer side of the ring 21. The ring 21 shown is provided with a transverse port 26 which connects the supply pipe 20 with an annular channel 27 in the outer side of the face plate 23, and this groove 27 connects by transverse ports 28 in the face plate 23 with an annular chamber 29 formed between the face plate 23 and the adjacent face of the cylinder head. Ports 30 passing through the cylinder head 2 connect said chamber 29 with the annular liquid space 16 of the printing element. Thus, liquid is supplied to this liquid space 16 for passage or expulsion therefrom through the pervious body 5 of the element to the pervious areas 13 of the printing surface. Any other suitable means or method of supplying or applying the liquid to the interior surface of the pervious tubular shell of the element for passage or expulsion through its pores or interstices could be employed. Other means for this purpose are disclosed in the above mentioned applications. The other cylinder head 3 may have a chamber 29*a* similar to the chamber 29 of the head 2, and connecting by ports 30*a* with the liquid space 16 to ensure uniform distribution of the liquid throughout the whole annular liquid space 16.

When the body of the printing element is formed with one or more layers of metal wire mesh material, as before described, one or more of these wire mesh layers may be supplied with electric current for charging the printing liquid with a given electric polarity during its passage through the meshes of the material to the peripheral printing surface of the element. As illustrated, for instance in Figs. 1 and 2 for this purpose, one or more layers of the wire mesh material are joined at their ends in electrical conducting relation with annular conductor rings 35 provided peripherally on the cylinder heads 2 and 3 and on which rings ride contact devices, such as rollers 36, for conducting electric current through the wire mesh material from and to supply and discharge wires or conductors 37 and 38. By such means, an electric current can be passed through the wire mesh layer or layers so as to effectively and uniformly impart an electric charge of required polarity to the printing liquid on its way to the peripheral printing surface of the element. The conductor rings 35 may be suitably insulated from the heads 2 and 3, as shown at 39, and the tubular peripheral shell of the element may be supported in annular grooves in the cylinder heads and suitably insulated therefrom, as indicated at 40 in Figs. 1 and 6.

Printing elements constructed as shown and described are of strong and durable construction, not liable to fracture or distortion during the manufacture, handling or use thereof, nevertheless, they can be produced economically. The pervious body of the element formed by the fine mesh fabric or cloth ensures free and uniform distribution of the liquid to the enveloping printing surface for passage or expulsion of the liquid through its open or pervious areas. The image-printing areas of the printing surface may be of half-tone lines or grain texture or of other character, depending upon the method of printing in which the element is to be employed or the character of printed material to be produced.

I claim as my invention:

1. A printing cylinder having a tubular cylindrical shell comprising a rigid perforated supporting tube of full cylindrical form, cylinder

heads attached to opposite ends of said shell, an approximately rigid pervious body completely surrounding said shell and formed of thin flat open-mesh metal fabric ribbon wound helically on said supporting tube with the convolutions of the ribbon disposed with their side edges in edge to edge relation to form a plain cylindrical surface free from ridges, said body being permeable by liquid passing through the perforations of said tube, and an outer coating completely surrounding said pervious body and forming a full cylindrical printing surface comprising areas which are impervious to said liquid and other pervious areas through which the liquid can pass to the exterior of said printing surface, an auxiliary tube of smaller diameter arranged within said shell and forming a space between the said tube and the shell, said auxiliary tube being supported in said heads in spaced relationship to said shell to permit inks or other liquid to be forced into said space for discharge through said pervious areas of said outer coating, and connections for conducting an electronic current to said metal mesh, which current can be projected from said mesh and through the ink to create an electric discharge of ink through said pervious areas of said outer coating.

2. A printing cylinder having a tubular cylindrical shell comprising a rigid perforated supporting tube of full cylindrical form, cylinder heads attached to opposite ends of said shell, an approximately rigid pervious body completely surrounding said shell and formed of thin flat open-mesh metal fabric ribbon wound helically on said supporting tube with the convolutions of the ribbon disposed with their side edges in edge to edge relation to form a plain cylindrical surface free from ridges, said body being permeable

by liquid passing through the perforations of said tube, and an outer coating completely surrounding said pervious body and forming a full cylindrical printing surface comprising areas which are impervious to said liquid and other pervious areas through which the liquid can pass to the exterior of said printing surface, an auxiliary tube of smaller diameter arranged within said shell and forming a space between the said tube and the shell, said auxiliary tube being supported in said heads in spaced relationship to said shell to permit inks or other liquid to be forced into said space for discharge through said pervious areas of said outer coating, a collector ring mounted on said cylinder adjacent to an edge thereof and in electrical contact with said metal fabric ribbon, and a current conducting contact engaging said collector ring for supplying electronic current to said ribbon through said collector ring, for projecting said current from said mesh through said ink to create an electric discharge of ink through said pervious areas of said outer coating.

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