Oct. 20, 1959 F. L. WELLCOME, JR 2,909,118

MAGNETICALLY IMAGEABLE PLANOGRAPHIC PLATE

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Fig. 1.

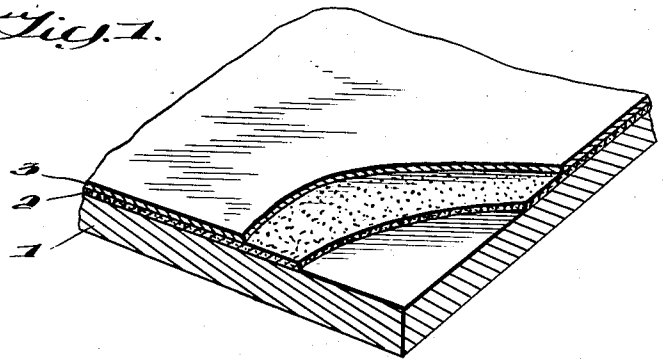


Fig. 2.

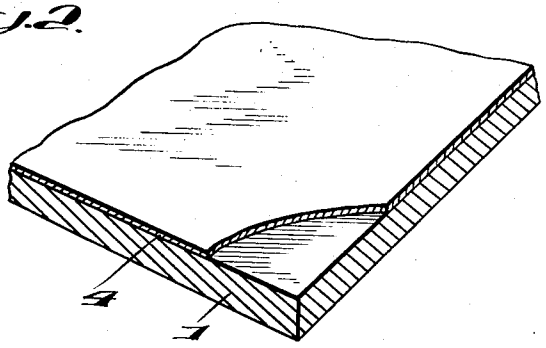
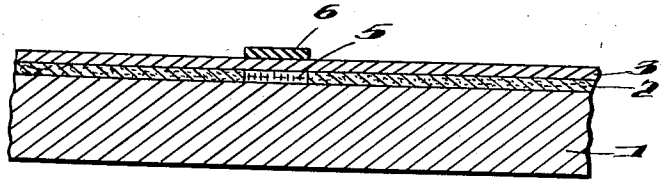


Fig. 3.



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MAGNETICALLY IMAGEABLE PLANOGRAPHIC PLATE

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6 Claims. (Cl. 101—149.2)

This invention relates to a magnetically imageable recording member having planographic printing properties. The invention relates further to a method of developing and printing copies of a magnetic image.

The invention may be embodied in a flexible sheet of paper or other non-magnetic material suitable for use as the base of a planographic printing plate, said sheet having a coating thereon of a magnetic powder bound together and to the sheet by a hydrophilic adhesive suitable for planographic printing. Or the invention may be embodied in a base sheet having a lower magnetizable coating which may or may not have planographic printing properties and an upper coating which does have planographic printing properties. Said upper coating may be magnetizable or not and preferably but not necessarily has a light color upon which a dark colored image is clearly visible.

The method of printing of my invention resides essentially in imparting an invisible magnetic image to a magnetically imageable planographic printing plate, developing said image by coating the same with planographic ink receptive material and printing.

The term "magnetic" as used herein is synonymous with "ferro-magnetic" and is used to distinguish ferro-magnetic matter from matter which is diamagnetic or paramagnetic to only a slight degree.

The art of planographic printing and the art of providing planographic printing plates having a paper or other suitable flexible base with a hydrophilic coating thereon and the art of magnetic recording on sheet material such as a paper base having a magnetizable coating thereon are all well known and will be described herein only to the extent necessary to provide basis for a disclosure of my invention.

It is well known that writings, printings, drawings, pictures, and in fact all types of graphic intelligence can be recorded on a magnetizable medium such as a sheet of paper having a coating of magnetic powder bound to its surface. The recorded magnetic pattern takes the form of variations in the remanent magnetization of the magnetic recording medium, and by itself it is not visible. The magnetic pattern can be developed to visibility by applying to the surface of the recording medium finely divided magnetic particles, which particles will adhere rather strongly to the magnetized areas but can be readily removed from the non-magnetized background. The powder image so formed can then be transferred to a sheet of paper or other surface to form a print. Powder images can be formed and transferred as many times as desired, so that the process described provides an operable but exceedingly slow method of making duplicate copies.

The present invention provides an improved process and means for carrying it out, whereby a magnetic image may be formed, developed, and duplicated hundreds of times, if desired, all in a very short period of time. In a preferred form of the invention a flexible sheet of paper is coated with a layer of liquid suspension of a ferro-

magnetic powder and adhesive and dried. A hydrophilic top coating is then applied, as a layer of aqueous composition containing hydrophilic film-forming adhesive material and preferably also a light colored filler or pigment such as clay to hide to some degree at least the normally dark-colored magnetizable layer beneath. The ferro-magnetic coating must, of course, be of such a character that the top coating will adhere to it and the top coating must have planographic printing properties. The so-coated sheet is dried and smoothed as by calendering. Thereafter a magnetic pattern is formed in the magnetizable layer in the well-known way such as by passing over the surface of the sheet a magnetic transducing head to which is fed electric impulses from a scanning device which views the graphic matter to be reproduced. Then the invisible magnetic image may be developed by flowing over the surface of the sheet a suspension in a volatile organic liquid of finely divided ferromagnetic powder, e.g. magnetic oxide of iron, the particles of which have thereon a coating of potentially adhesive resinous composition. The magnetic particles therein are attracted to and adhere to the areas on the surface which overlie the magnetic pattern, but are washed away from the unmagnetized areas by the liquid. The sheet is therefore left with its surface bearing a visible powder image corresponding to the underlying magnetic image. If the sheet is now heated to evaporate the volatile liquid and fuse the resin coating on the magnetic powder, the visible image becomes permanently attached to the surface of the sheet. This resin-containing image will be grease-receptive and water-repellent. If now the surface is successively moistened with aqueous lithographic solution and inked with lithographic printing ink on the cylinder of a rotary offset duplicator, prints can be made therefrom which are faithful reproductions of the invisible image on the magnetized sheet, said prints having good clean backgrounds free from scum or "tone."

A less preferable variation of the invention is to provide a sheet in which the magnetic and planographic printing qualities are combined in a single coating layer. In such a case magnetic iron oxide, either black or red, of sufficiently fine particle size, can be substituted for all or part of the clay customarily used in a conventional aqueous pigment-and-hydrocolloid adhesive coating composition suitable for forming the surface of a planographic printing matter or plate.

The invention is illustrated in the accompanying drawings in which:

Fig. 1 is a perspective view with parts in section illustrating that embodiment of my invention in which the sheet consists of a base, a lower magnetizable coating and an upper coating suitable for planographic printing.

Fig. 2 is a perspective view of that embodiment of my invention in which the sheet consists of a base and a single coating which is both magnetizable and has planographic printing properties; and

Fig. 3 is a cross sectional view of the embodiment shown in Fig. 1, illustrating the magnetic image and the visible image.

Referring to the drawings, in Fig. 1 numeral 1 is the paper base, 2 is the lower magnetizable coating which need not have planographic printing properties and 3 is the top coating having planographic printing properties. In Fig. 2, 1 is the base and 4 is the single coating having both magnetic and planographic printing properties. Referring to Fig. 3, 1 is the base, 2 is the lower magnetizable coating, 3 is the planographic coating, 5 is the magnetic image on the coating 2 and 6 is the visible and printing image.

Although any suitable base may be used to support the magnetizable coating, paper makes a very satisfactory support and is the most practicable one available as well

as the cheapest. A paper web made from a mixture of moderately beaten pulp fibers derived from coniferous and deciduous trees and having an air-dry weight of about 70 pounds per ream of 500 sheets 25 x 38 inches in size is adequately strong for any use normally expected of such a product. In most cases a lighter weight sheet of about 55 pounds per ream will be found adequately strong.

Since the product is intended for use as a plate or master on a lithographic printing press it is desirable that the base paper possess some degree of wet-strength, though this is not absolutely essential if not more than 100 copies are expected to be printed from the master. However it is usually advisable to include in the fibrous furnish from which the paper web is formed a wet-strength resin such as a melamine-formaldehyde condensate, or to apply to the surface of the formed web a surface-size such as an aqueous solution of casein and formaldehyde, or to use both expedients. If an unusually large number, say 2000 or more, of copies are expected to be printed from the master it is advisable to apply to the paper base a barrier coat of about 6 pounds dry weight per ream of about equal parts by weight of clay and styrene-butadiene copolymer of high styrene to butadiene ratio. These are all well-known expedients in the production of coated paper planographic printing plates.

The magnetizable layer applied to the paper web, which may or may not have a surface size or base coat thereon as desired, must obviously contain a magnetic powder and an organic adhesive. If the magnetizable layer is to serve also as the planographic printing surface the adhesive thereof must be hydrophilic in the sense that it provides a surface having planographic printing properties. If, however, a second or top coating having planographic properties is to be applied then the magnetizable layer need be hydrophilic only in the sense that it is wetted by and adheres to the top coating. The powder may be of iron or of magnetic alloy or of magnetic iron oxide. The adhesive may be casein, modified starch, polyvinyl alcohol, carboxymethyl cellulose or the like. Such compositions are well known for making magnetizable coatings. For the present use, however, it is necessary that the adhesive shall be water-insoluble after it has dried. Inclusion of an amino-aldehyde condensate in the coating composition will adequately insolubilize any of the common adhesives. Formaldehyde in the coating composition or applied to the formed layer of coating will insolubilize casein. Certain metal salts applied to the surface of the coating will insolubilize either casein or carboxymethyl cellulose.

As one satisfactory magnetic coating composition the following may be cited. In this example all parts are parts by weight. First, 500 parts of finely divided black magnetic iron oxide—red gamma ferric oxide can be used if desired—were placed in a pebble mill with 15 parts of gum arabic (a dispersing agent), 6 parts of Dow's "Anti-Foam A" (a commercial silicone foam depressant), and 450 parts of water. The mixture was ground for about 16 hours until free from lumps. Into this mixture were well stirred 31.5 parts of casein dispersed in 155 parts of water and 3.5 parts of strong ammonia water. Then there were added to the mixture 153 parts of a commercial styrene-butadiene copolymer latex (Dow's 512K latex) containing 73.5 parts of the copolymer. The coating composition so formed was screened through cheese-cloth to remove any lumps which might have been present.

The above-described composition may be applied to one side of a suitable paper base as by means of a reverse-roll coating device in amount equivalent to about 18 pounds dry weight, per ream. After the coating has been dried the coated sheet, especially if it is smoothed as by calendering, is suitable for reception of magnetic impulses, as for example, impulses from a facsimile transmitter. On this sheet, however, the magnetic image after development by dark-colored magnetic powder is not readily discernible against the dark background. Neither can copies be lithographically produced directly from this imaged sheet because, although it is sufficiently hydrophilic or wettable by water to be wetted by and adhere to a hydrophilic top coating it is not, due to its content of styrene-butadiene copolymer, sufficiently hydrophilic to serve as a planographic printing surface.

A layer of white or light-colored coating applied over the above-described magnetic layer is useful in that it makes magnetic images developed thereon readily visible. This is a considerable advantage whether or not duplicate copies of the image are desired. The light-colored coating also is one which is definitely hydrophilic so that lithographic prints can be made from its imaged surface.

There are many known coating compositions suitable for producing planographic printing surfaces. In general these comprise a pigment component and a suitably water-insolubilized hydrophilic adhesive component. The pigment component may well be paper-coating clay, fortified if desired by titanium dioxide for added hiding power or opacity. As adhesive insolubilized polyvinyl alcohol, carboxymethyl cellulose, and hydroxyethyl starch, are examples of satisfactory materials. It is especially beneficial to include in the printing surface a considerable quantity of soluble divalent metal salt or of buffered soluble multivalent metal salt as disclosed in U.S. Patents Nos. 2,534,650 and 2,635,537. With use of such salts, satisfactory printing surfaces can be prepared from coating compositions containing casein, soy protein, starch adhesives, or practically any hydrophilic adhesive.

One satisfactory coating composition for the provision of a planographic printing surface is the following in which all parts are by weight:

Paper-coating clay	100
Starch adhesive (Penford gum No. 280)	40
Melamine-formaldehyde condensate (Parez 611) (to render the dried coating insoluble)	14
Zinc acetate (anhydrous)	40
Monochloracetic acid (to control pH)	3.5
Propanol (foam dispersant)	25
Water	425

This composition may be applied in quantity equivalent to 12 pounds, dry weight, per ream (25 x 38—500 basis), to the previously described sheet bearing the magnetizable layer of coating. The so-coated sheet should then be dried and smoothed as by calendering on a supercalender.

The coated paper sheet made as described will be grayish in appearance, but sufficiently light colored so that typing is readily legible upon it. The sheet is susceptible to imaging by means of a magnetic transducer and the magnetic image can be developed by resin-coated magnetic powder as previously described to form a readily discernible image thereon. The developed sheet can then be put on a rotary offset duplicator and be wet with conventional lithographic solution and inked with lithographic ink so that 200 or more good prints can be made therefrom.

A less preferred product is one in which the layer of magnetizable powder coating likewise serves as a planographic printing surface. This product lacks the advantage of a light-colored surface and images thereon are difficult to decipher until a print is made therefrom. In some cases, however, such a product is adequate for use.

A coating composition suitable for providing a double-purpose single coating which is both magnetizable and suitable for planographic printing was made as described here below. In the following all parts are parts by weight. 500 parts of red iron oxide (gamma ferric oxide) of fine particle size was put in a pebble mill with 435 parts of water, 15 parts of gum arabic, and 25 parts of butanol. This mixture was ground for 16 hours until

substantially free from lumps. To the mixture was then added, with stirring, 200 parts of modified starch (Penford gum #280) which had been swollen and dispersed in 400 parts of water by means of heat, and 70 parts of melamine-formaldehyde condensate (Parez 611) and 12 parts of monochloracetic acid in 400 parts of water. Finally 150 parts of anhydrous zinc acetate were dissolved in the mixture. The resulting composition was then strained through cheese-cloth and was ready to use.

This coating composition was applied to one side of surface-sized base paper previously mentioned in quantity amounting to 20 pounds dry weight per ream. The coated web was dried and then supercalendered. Thereafter the supercalendered web was subjected to a brushing operation with rotating brushes to improve the planographic printing qualities thereof as disclosed in U.S. Patents Nos. 2,534,588 and 2,707,359.

A magnetic image corresponding to typed matter was impressed on the coated paper by a magnetic transducing head. This image was developed by means of magnetic iron oxide powder coated with resin, which was fixed on the sheet by heating. Then the sheet was attached to the plate cylinder of a rotary offset duplicator and 500 good prints were made therefrom by standard planographic printing procedure.

The resin coated magnetic powder used for developing the invisible magnetic image as described above may be prepared for instance by stirring a magnetic powder such as magnetic iron oxide into a melted resin having a relatively low melting point. The mixture is cooled and ground to a powder in a volatile liquid which is not a solvent for the resin. For example 100 parts by weight of finely divided black magnetic iron oxide were stirred with 50 parts of molten low melting polyamide resin which was fairly liquid at 150° C. The mixture was cooled and solidified and then ground in sufficient petroleum ether to give a fluid suspension of the resin coated magnetic particles.

Another way to prepare a resin-coated magnetic powder is to stir magnetic powder such as magnetic iron oxide or powdered iron into an alcoholic solution of dewaxed shellac, dry the mixture, and then grind it to powder. This powder can be suspended in petroleum ether or other non-solvent for shellac and used as described below.

In developing the invisible magnetic image the sheet bearing the image was dipped into the suspension of resin coated magnetic particles described above and then drained and dried. Or instead of dipping the sheet into the suspension, the suspension can be flowed across the sheet. In either case the magnetic image areas are covered with the resin coated powder while the background remains surprisingly clean. If any magnetic powder happens to adhere to the background it may be washed off by means of the clear liquid of the suspension e.g. petroleum ether.

After the sheet has been developed as described above the liquid is evaporated and the sheet is then heated sufficiently to cause the resin coating on the magnetic particles to fuse and adhere firmly to the surface of the sheet. The resulting image is clearly visible if applied to a light-colored coating and is also ink receptive and therefore suitable for planographic printing. As is evident the resin coating on the pigment particles must be ink receptive i.e. it must be wettable by planographic printing ink in the presence of the aqueous lithographic liquid or solution which serves to maintain the background or non-imaged areas ink repellent.

The invisible magnetic image can be developed also by sprinkling the sheet with a dry powder and then removing the powder from the background areas by simply shaking the sheet or applying a blast of air or by washing the surface with a liquid such as petroleum ether which does not dissolve the resin coating.

I claim:

1. A coated sheet suitable for both magnetic recording and planographic printing comprising a non-magnetic flexible base and a surface coating thereon, said coating being magnetizable and containing finely divided ferromagnetic particles bound by a water-insoluble hydrophilic adhesive, said coating also containing zinc acetate sufficient to ensure satisfactory planographic printing qualities in the surface of said coating.

2. A magnetic recording sheet having a planographic printing surface, said sheet comprising a non-magnetic flexible base, a lower coating thereon comprising a ferromagnetic powder and an adhesive and an upper coating thereon comprising a light colored pigment and a hydrophilic adhesive.

3. A magnetic recording sheet as defined in claim 2 in which the non-magnetic flexible base is paper.

4. A magnetic recording sheet as defined in claim 2 in which the ferromagnetic powder is magnetic iron oxide.

5. A magnetic recording sheet as defined in claim 2 in which the light colored pigment is clay.

6. A magnetic recording sheet as defined in claim 2 in which the non-magnetic flexible base is paper, the ferro-magnetic powder is magnetic iron oxide, the light colored pigment is clay and the hydrophilic adhesive is a water-insoluble hydrophilic adhesive.

References Cited in the file of this patent

UNITED STATES PATENTS

2,132,443	Simons	Oct. 11, 1938
2,297,691	Carlson	Oct. 6, 1942
2,699,408	Camras	Jan. 11, 1953
2,826,634	Atkinson et al.	Mar. 11, 1958

FOREIGN PATENTS

324,099	Great Britain	Jan. 17, 1930
466,023	Great Britain	May 18, 1937

OTHER REFERENCES

Atkinson et al.: Ferrography, pages 373 to 381 of Journal of the Franklin Institute, vol. 252, No. 5, November 1951. (Only pages 373 to 375 made of record.)