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LITHOGRAPHIC PRINTING PLATE

James Finno, Brooklyn, N. Y.

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

This invention relates to an improvement in parchment planographic printing plates and the method of producing the same, and the present application is a continuation of my copending application Serial No. 596,718, filed May 30, 1945, now abandoned.

The standard commercially available equipment for carrying out the process of planographic offset printing consists, briefly, of a duplicating machine provided with an impression cylinder, a moistening roll, an inking roll and a rubber transfer cylinder. A planographic printing plate having an ink receptive image formed on the surface thereof in any suitable manner is mounted on the impression cylinder. During rotation of the impression cylinder the printing plate first comes into contact with the moistening roll which is saturated with an ink-repellent solution. The property of the non-image portion of the surface of the printing plate is such that it is uniformly wetted by the ink-repellent solution, while the ink forming the image portion of the printing plate is unwetted by the solution. As the impression cylinder continues to rotate, the printing plate comes into contact with the inking roll which applies a lithographic or grease base type of ink to the image on the printing plate. The non-image portion of the printing plate previously wetted with an ink-repellent solution will not pick up the ink. Further rotation of the impression cylinder brings the printing plate into contact with a rubber transfer roll which accepts the ink from the entire image. The transfer roll is then rotated over a sheet of paper and the ink portions which correspond to the original image are deposited upon the paper to provide a final copy.

The printing plates employed in the process outlined above were, in the earlier stages of development of the process, photographically prepared metal or cellulose plates. While such plates were, and still are, satisfactory, the cost thereof and the expense of preparing them are obvious disadvantages. In recent years, the trend has been to replace such plates by employing paper printing plates or masters and to

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develop simple, direct and inexpensive methods of forming an image on the surfaces thereof. This trend is illustrated by the patents granted to William B. Wescott, Patent No. 2,134,165, dated October 25, 1938; Patent No. 2,205,998, dated June 25, 1940; and Patent No. 2,348,771, dated May 16,1944. These patents are directed generally to a composite paper printing plate consisting of layers of cellulosic material adhesively or otherwise bonded. One of the layers which serves as a printing surface is formed from a dense amyloid parchment paper. The remaining layer is formed from a heavy, water-repellent paper and serves as a backing or support for the water-absorptive parchment layer. More recently a patent granted to Arthur Garrett, Patent No. 2,363,311, dated November 21, 1944, disclosed an unbacked printing plate formed from supercalendered amyloid parchment paper. Images may be formed on these printing plates by the simple expedient of depositing an image-forming ink thereon with a pen or pencil but preferably with a typewriter provided with a ribbon saturated with an image-forming ink. The paper printing plates thus prepared for printing on an offset duplicating machine are usually treated with ink or scum-displacing solutions since plates of this type are easily smudged either in handling or during the printing operation. These scum-removing compositions usually comprise aqueous solutions of glycerine and contain small quantities of phosphates and gum arabic. The chemistry of the action of such solutions has been thoroughly studied and it is known that, heretofore solutions of this type did not improve the quality of the image, per se. In addition to scum-removing solutions it has been necessary to employ dampening or fountain solutions with these plates to render the non-image portion of the printing plate ink-repellent. Such solutions consist essentially of aqueous solutions of glycerine and are applied to the plate with moistening rolls as previously described.

The foregoing paper printing plates have met with commercial success but are, albeit, subject to numerous objections. The multi-ply type of paper printing plates are expensive and uneconomical for preparing a small number of copies. The composite or multi-ply printing plates lack

flexibility and may not be erased satisfactorily. It has been found that multi-ply printing plates which have been erased will, upon being moistened with standard ink-repellent solutions, demonstrate swelling in the areas which have been erased with the result that images subsequently applied to the erased areas are broken by distension or buckling of the swollen surface. In the case of single-ply supercalendered amyloid parchment plates erasures produce a similar type of failure. This latter action is not understood but it is believed that supercalendering forms a tough skin on the surface of parchment paper so-treated which is broken by the erasing action and that when the latter occurs the fibers, which are uncoated or the coatings of which have been broken, absorb water and swell. Aside from the above objections, the principal disadvantage which both multi-ply composite sheets and supercalendered sheets have been found to possess lies in the lack of permanency of the images formed thereon. This has been found to be due to the surface characteristics of the paper employed and not merely to any property of the image-forming ink used. For example, various commercially available image-forming inks have been applied to both multi-ply sheets and supercalendered parchment sheets and it has been determined that such plates will last in storage no longer than approximately three days at which time the images were found to have disintegrated completely and become useless. The images formed on such plates, furthermore, failed to last as long as the paper printing plate upon which they were deposited when employed immediately following preparation in an offset printing process.

This invention is an improvement over the inventions disclosed in the above patents and is based essentially on the use of a single-ply, unsized and substantially uncalendered parchment paper in forming the planographic printing plate. The plates are thus formed of an inexpensive parchment paper stock which is not coated with any sizing material, does not contain any fillers, pigments or the like which increases the transparency and, furthermore, requires no backing or support. The parchment paper stock employed must be substantially uncalendered for the purposes of this invention since the absence of calendering imparts flexibility to the plate formed therefrom and provides a slightly rough surface which possesses an affinity for image-forming ink not heretofore demonstrated by any paper planographic printing plate. The lack of calendering of the parchment paper stock, furthermore, provides a printing plate which may be erased with a minimum loss of the original surface characteristics of the plate. The use of these parchment plates in standard duplicating or printing machine is limited, however, in that the dampening solution disclosed in my above-referred to copending application Serial No. 516,718 (now abandoned) must be employed therewith to produce the desired result and, if the use of a scum-removing etching solution is desired, only the etching solution disclosed in the above-mentioned copending application may be used in conjunction with the parchment plates and dampening solutions disclosed therein.

The etching or scum displacing solutions are applied to the plates in the usual manner prior to their use in the printing process. The etching solution consists of an aqueous solution of glycerine and preferably a minor amount of sodium sulfate. The most essential components of the solution, however, are sodium thiosulfate and citric acid. A minor portion of these latter ingredients are dissolved in equal amounts by weight in the solution and serve to impart permanency to the printing plate image. The dampening solution consists of glycerine, a small amount of gum acacia and as essential ingredients small amounts of sodium sulfate and boric acid dissolved in water. This solution is applied to the printing plate by the moistening roll of the duplicating machine and renders the non-image portion of the uncalendered parchment plate ink-repellent without causing swelling or buckling.

As an additional feature, the parchment plates of this invention may be provided with a preprinted image on the printing surface thereof consisting of a quick drying synthetic resin base ink. This image may be applied simply with a metal offset planographic printing plate and the image formed dries without offset practically instantaneously. Imprints of marginal scales or other guides may be applied to the reverse side of the printing plate as a reversed image employing a water soluble or other printing or non-printing ink. The transparency of the parchment paper plate permits the reversed image on the non-printing face of the plate to be viewed through the body of the plate from the printing surface thereof and thus provides a visual copy layout guide in the form of an unreversed or normal image.

It is, therefore, the principal object of this invention to provide an inexpensive flexible cellulosic planographic printing plate formed of a single ply, unsized, unbacked, and substantially uncalendered amyloid parchment characterized by low gloss and low smoothness.

Another object of the invention is to provide a substantially uncalendered parchment printing plate having its non-image area coated with an ink-repellent dampening or fountain solution to produce a non-penetrating and non-saturating film on the non-image area of the plate, whereby stretching, wrinkling or tearing of the plate is prevented.

Another object of this invention is to provide an unbacked, substantially uncalendered parchment planographic printing plate having an image-forming ink deposited thereon which may be stored for extended periods of time without image deterioration or loss of the printing quality thereof.

Another object of the invention is to provide a single-ply, substantially uncalendered parchment printing plate having a preprinted image formed from a quick drying synthetic resin image-forming ink.

Another object of this invention is to provide a single-ply, substantially uncalendered parchment printing plate which may be erased without altering the original surface characteristics of the plate.

The parchment planographic printing plate comprising this invention is prepared from parchment paper produced from high alpha cellulose pulp in the following manner. A waterleaf prepared from the pulp as a web on a paper making machine in the usual manner is subjected to the action of sulfuric acid under controlled conditions. The cellulose fibers or the surfaces thereof are gelatinized by the sulfuric acid to produce a substance known in the art as amyloid. The fibers of the paper are thus attacked by the acid

which forms a coating or film of gelatinous cellulose, covering the fibers and filling the interstices of the sheet, cementing or bonding the fibers into a coherent mass. Subsequently the excess acid is removed from the paper by both physical and chemical action and the web thereafter passed through drying rolls. The web is preferably not calendered within the industrial meaning of the term or, if so, only slightly. While the art has heretofore recognized that the impression factor of paper printing plates increases with an increase in the gloss and degree of calendering of the paper stock from which the plates are formed, contrary to this teaching the invention herein is predicated upon the use of a parchment paper stock, the surface of which is characterized by a minute grain finish similar to fine grain ground glass. The parchment paper stock must also possess low gloss and low smoothness values. The paper produced in the manner above described should have a smoothness measure of less than approximately 25 seconds when tested on a Bekk smoothness tester and preferably a smoothness measure of from 10 to 15 seconds. The gloss of this paper should be approximately 25.0 per cent when measured in an Ingersoll Glarimeter. The weight of the parchment paper may vary from 45 to 110 pounds per ream (500 sheets, 24 x 36) but it is preferred to employ a paper having a weight of approximately 60 pounds per ream (500 sheets, 24 x 36). The thickness of the paper varies according to the weight but in the case of paper having a weight of 60 pounds per ream the thickness should be approximately .0035". Regardless of the weight per ream this parchment paper possesses very nearly uniform texture throughout its cross-section. Owing to the lack of calendering it is highly flexible and it does not possess a high machine finish but rather a fine grain finish which does not differ materially from the texture of the paper beneath the surface. This characteristic is furthermore insured by excluding the use of paper sizes. The desired translucency of the paper is enhanced by omitting fillers and pigments.

The parchment paper made as above described and possessing the foregoing properties is cut into sheets of the desired size and shape. The printing plates thus formed are ready to receive an image forming ink of any standard type such as the grease-base, fatty acid type of image forming inks which are commercially available. The reverse of the printing plate is preferably provided with marginal scales and other lay-out guides formed by printing such material in the form of a reversed image on the non-printing face of the plate. Owing to the translucency of the plate, such images are visually perceptible as normal images through the plate from the printing surface thereof.

It has been found especially desirable to prepare preprinted planographic printing plates of parchment paper. Thus, offices employing standard forms such as contracts, leases, lists or the like have a need for a printing plate having standard clauses, tables and columns preprinted thereon and to which a typist may add additional special information with a standard image forming ink. Parchment printing plates so prepared may be used in duplicating machines to provide a large number of copies of both the preprinted portion and the subsequently applied indicia. An image forming ink suitable for preparing preprinted parchment printing plates has been developed which comprises an oil modified phenol-formaldehyde resin, partially polymerized linseed oil, polymerized linseed oil gel, driers and pigments. One ink composition which has been found to give satisfactory results appears in the following example:

Example I

	Parts by weight
Alkali blue—oil modified phenol-formaldehyde resin dispersion	40
Iron blue—No. 1 lithographic varnish dispersion	10
Lead tetroxide—No. 3 lithographic varnish dispersion	20
Metallic soap drier—polymerizable oil dispersion	20
Polymerized linseed oil gel having a viscosity substantially equal to that of a #5 varnish	10

The foregoing may be prepared by mixing the alkali blue and oil modified phenol-formaldehyde resin in the proportion of 3 parts to 5 parts by weight respectively. The Iron blue pigment is mixed in equal parts by weight with No. 1 lithographic varnish which is a commercially available oil consisting of partially polymerized linseed oil. The numerical designation of the oil indicates the degree of polymerization thereof and as the numerical designation increases the oil identified thereby is more completely polymerized. The lead tetroxide and No. 3 lithographic varnish are mixed in the proportion of 5 parts to 1 part by weight respectively. The metallic soap drier may be any of the common driers of this type available on the market such as cobalt linoleate or a mixture of lead and manganese soaps and are employed in small amounts dispersed in polymerizable oils. The polymerized linseed oil gel is a thickener and consists of a partially polymerized linseed oil mixed with a soap, which serves as a gelatinizing agent.

The proportions of the various ingredients may be varied according to the distribution and transfer required by a specific printing operation. Thus, the oil vehicles are increased if greater distribution and transfer are required. The synthetic resin binder employed may be any oil modified phenolic or alkyd type of resin which is quick drying. The ink sets as a result of both polymerization and oxidation and the rate thereof may be controlled by the amount and type of driers employed. The ink prepared in the manner described above may be applied to planographic parchment printing plates by offset printing methods, preferably by means of planographic metal printing plates. The images formed on the parchment plates dry practically immediately without offset. If necessary, the drying time may be reduced by warming the preprinted parchment plates slightly. The images thus formed are lasting and the preprinted parchment plates may be stored for from 6 months to one year without loss of the printing quality of the image. The same lasting quality of images formed from standard grease-base image forming inks is obtained with the uncalendered parchment printing plates described above. It is believed that this property is due to the surface characteristics of the plate and that the presence of a minutely fibrous surface on the uncalendered printing plate protects the images deposited thereon from failure due to abrasion as well as to oxidation.

The etching solution is especially adapted for

use with the uncalendered parchment printing plates previously described. These solutions perform not only the function of removing or displacing ink scum blemishes from the non-image areas of the printing plates but also act as hardening agents for grease-base type of image forming inks. The etching solution comprises an aqueous solution of glycerine, sodium sulfate and equal amounts by weight of sodium thiosulfate and citric acid. On the basis of a gallon of solution it is preferred to use one ounce each of sodium thiosulfate and citric acid. These quantities may be increased up to four ounces each of the citric acid and sodium thiosulfate, equal amounts by weight thereof always being employed. More than four ounces each of these ingredients tend to destroy the image on the printing plate rather than to harden and preserve it. The glycerine content of a gallon of the solution may be varied from 1 to 64 ounces by volume. It is preferred to employ approximately 20 ounces of glycerine. If the glycerine content is increased above 64 ounces it has been determined that the sensitivity of the printing image to the lithographic ink is retarded. The quantity of sodium sulfate may be varied from 1 to 8 ounces per gallon of solution with 2 ounces being the preferred quantity. If more than 8 ounces of sodium sulfate are employed, the action resulting from the combination of sodium thiosulfate and citric acid is neutralized. In the foregoing composition glycerine functions as a wetting agent while the sodium sulfate serves to impart a soapy texture to the surface of the printing plate and distributes the etching solution over the printing plate surface. The sodium thiosulfate and citric acid react to produce free SO_2 which imparts hardness to the grease-base type of image forming ink. This hardening effect lengthens the life of image and improves the printing quality thereof.

The etching solution is applied to the parchment printing plate by pouring the solution over the surface of the plate after the image has been applied thereto and is then gently spread over the surface of the plate with a cotton swab. Any blemishes such as finger smudges or ink stains deposited during the preparation of the plate for printing are either removed or loosened. Simultaneously the sodium thiosulfate and citric acid harden the grease base image forming ink. The plate may be placed on the impression cylinder immediately and the printing process commenced. Any blemishes which have been displaced by the etching solution during its application are removed by the fountain solution. The coating formed on the surface of the printing plate by the etching solution is such that ink scum blemishes which are deposited on the surface of the plate during the printing operation are likewise removed by the fountain solution.

The etching solutions described above may also be applied to metal planographic printing plates having image forming inks on the surface thereof. In addition to functioning as an ink scum blemish removing agent the sodium thiosulfate and citric acid actually etch the areas of the printing plate adjacent the ink image. This causes the image to stand out above the non-printing surface of the plate and materially improves the printing quality of such plates. The etching solutions, furthermore, do not coat the image which is a distinct advantage in metal plates having a half-tone or shaded image.

The dampening or fountain solutions are especially developed for rendering the non-image area of the uncalendered parchment printing plates described above ink-repellent. The solutions comprise glycerine, sodium sulfate, boric acid and gum acacia dissolved in water. In lieu of sodium sulfate, calcium chloride may be used in the solutions. However, it demonstrates a tendency to remain on the image portion of the plate and will, ultimately, produce light colored copies. On the basis of one gallon of solution the glycerine content may vary from 10 percent or 12.8 ounces to 50 percent or 64 ounces by volume. It is preferred to employ 64 ounces of glycerine in solutions for dampening plates formed from parchment paper having a weight of 60 pounds per ream (500 sheets, 24 x 36). The glycerine content of the solutions may be decreased to the lower limit of 12.8 ounces in dampening printing plates formed from heavier stock; as, for example, weights ranging from 60–110 pounds per ream (500 sheets, 24 x 36). The sodium sulfate (calcium chloride) content of the solutions may vary from 1 to 16 ounces per gallon of fountain solution with from 1 to 8 ounces per gallon being the preferred range. The range of from 1 to 8 ounces of sodium sulfate produces uniform heavy black copies throughout the entire run while amounts in excess of this range produce progressively lighter copies. In a solution for dampening plates formed from parchment paper having a weight of 60 pounds per ream (500 sheets, 24 x 36) a sodium sulfate content of 6 ounces per gallon has been found satisfactory. The boric acid content may range from 1 to 6 ounces per gallon of solution and produce the desired result. A boric acid content of approximately 2 ounces per gallon of solution is preferred. The gum acacia is employed in small amounts, usually ¼ to 3 ounces per gallon of solution. The glycerine functions as in fountain solutions previously employed in this field. The sodium sulfate serves as in the case of the etching solutions described above to distribute the solution over the surface of the plate. The most important relationship between the several ingredients of the fountain solution exists between the sodium sulfate and the boric acid. The former tends to distribute moisture over the surface of the parchment printing plate. The relationship is such that during each rotation of the impression cylinder the concentration and distribution of water on the surface of the printing plate is sufficient to render the non-image portions thereof thoroughly ink-repellent without the plate being saturated whereas the rate of evaporation is sufficiently great that, during the interval between the transfer of the ink from the printing plate to the rubber transfer cylinder and the remoistening of the plate, the great bulk of the water content of the solution is removed from the surface of the printing plate. This, in effect, prevents water puddling on the surface of the printing plate and overcomes any tendency of the plate to swell or buckle. The foregoing phenomenon is so marked that commercially available fountain solutions and the fountain solution described above may be deposited in thin films on an uncalendered parchment plate and, while the former solutions will saturate the printing plate substantially instantaneously, the latter will remain on the surface for several minutes without saturating the plate.

The fountain solutions described above are essential in offset printing processes in which the uncalendered parchment printing plates dis-

closed above are employed. The use of any other fountain solution results in distension of such plates as well as the destruction of the image thereon. Furthermore, these fountain solutions can be employed only with the etching solution described above. If commercially available etching or scum-removing solutions are used in conjunction with these fountain solutions the images on the printing plates are broken. However, the etching solutions and fountain solutions may be employed in printing processes involving the use of printing plates of any other type.

The advantage of the single-ply, unsized and uncalendered parchment planographic printing plate disclosed herein may be employed in a duplicating machine along with the fountain solutions described to produce over 3000 clear, deep black copies. Furthermore, the etching solutions and fountain solutions described herein have been employed in duplicating machines using commercially available multi-ply planographic printing plates with the result that the output thereof has been increased from approximately 3000 copies to over 10,000 copies.

Having thus described by invention, what I claim as new and wish to secure by Letters Patent is:

1. A planographic printing plate comprising an unbacked, single-ply, unsized sheet of uncalendered amyloid parchment paper having a minutely fibrous fine grain surface characterized by low gloss and low smoothness values and having its non-image area coated with an ink-repellent dampening solution composed of an aqueous solution of glycerine, sodium sulfate, boric acid and gum acacia in the proportions of from approximately 12.8 ounces to approximately 64 ounces by volume of glycerine, from approximately 1 to approximately 16 ounces of sodium sulfate, from approximately 1 to approximately 6 ounces of boric acid, and from approximately ¼ ounce to approximately 3 ounces of gum acacia, the foregoing proportions being for one gallon of solution, said dampening solution producing a non-penetrating and non-saturating film on the non-image area of the plate, whereby stretching, wrinkling or tearing of the plate is prevented.

2. A planographic printing plate comprising an unbacked, single-ply, unsized sheet of uncalendered amyloid parchment paper having a minutely fibrous fine grain surface whose smoothness measures less than approximately 25 seconds when tested by a Bekk smoothness tester and whose gloss as measured by an Ingersoll Glarimeter is approximately 25 per cent, said plate having its non-image area coated with an ink-repellent dampening solution composed of an aqueous solution of glycerine, sodium sulfate, boric acid, and gum acacia, and containing, for each gallon of solution, from approximately 12.8 ounces to approximately 64 ounces by volume of glycerine, from approximately 1 to approximately 16 ounces of sodium sulfate, from approximately 1 to approximately 6 ounces of boric acid, and from approximately ¼ ounce to approximately 3 ounces of gum acacia, said dampening solution producing a non-penetrating and non-saturating film on the non-image area of the plate, whereby stretching, wringling or tearing of the plate is prevented.

3. A planographic printing plate comprising an unbacked, single-ply, unsized sheet of uncalendered amyloid parchment paper having a minutely fibrous fine grain surface whose smoothness measures from 10 to 15 seconds when tested by a Bekk smoothness tester, and whose gloss as measured by an Ingersoll Glarimeter is approximately 25 per cent, said plate having its non-image area coated with an ink-repellent dampening solution composed of an aqueous solution of glycerine, sodium sulfate, boris acid, and gum acacia in the proportions of from approximately 12.8 ounces to approximately 64 ounces by volume of glycerine, from approximately 1 to approximately 16 ounces of sodium sulfate, from approximately 1 to approximately 6 ounces of boric acid, and approximately ¼ ounce to approximately 3 ounces of gum acacia, the foregoing proportions being for one gallon of solution, said dampening solution producing a non-penetrating and non-saturating film on the non-image area of the plate, whereby stretching, wrinkling or tearing of the plate is prevented.

4. A planographic printing plate as set forth in claim 2 having a preprinted image thereon formed from a quick-drying oil-modified synthetic resin base image forming ink.

5. A planographic printing plate as set forth in claim 3 having a preprinted image thereon formed from a quick-drying oil-modified phenol formaldehyde resin base image forming ink.

6. A planographic printing plate as set forth in claim 2 having an inverted ink image imprinted on the lower, non-printing surface thereof, said image being visually perceptible through said plate from the printing surface thereof to provide a marginal scale and other layout guides.

7. A planographic printing plate comprising an unbacked, single-ply, unsized sheet of uncalendered amyloid parchment paper having a minutely fibrous, fine grain surface characterized by low gloss, and low smoothness values and having its non-image area coated with an ink-repellant solution composed of an aqueous solution of glycerine, a salt selected from the group consisting of sodium sulfate and calcium chloride, boric acid, and gum acacia, and containing for each gallon of solution from approximately 12.8 ounces to approximately 64 ounces by volume of glycerine, from approximately 1 to approximately 8 ounces of the salt, approximately 2 ounces of boric acid, and from approximately ¼ ounce to approximately 3 ounces of gum acacia, the said dampening solution producing a non-saturating film on the non-image area of the plate, whereby stretching, wrinkling or tearing of the plate is prevented.

JAMES FINNO.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,976,039	Rowell	Oct. 9, 1934
2,060,190	Foster	Nov. 10, 1936
2,134,165	Wescott	Oct. 25, 1938
2,205,998	Wescott	June 25, 1940
2,348,943	Wescott	May 16, 1944
2,363,311	Garrett	Nov. 21, 1944