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PLANOGRAPHIC PRINTING

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This invention relates to the art of planographic printing, in which a suitable plate or foundation, on which there is an image formed of ink receptive material, usually greasy ink, is wet with an ink repelling fluid, then inked over to deposit ink only on the image, which is then transferred to a sheet of paper usually by way of a blanket in offset printing, the image being reinked and foundation being maintained wet or ink repellent as repeated copies are printed.

For successful operation, the plate must be ink receptive to a degree where it receives and holds the image forming material and printing ink, and hydrophilic to a degree where it will receive and hold sufficient ink repellent fluid to limit the reinking of the plate to the image.

Many proposals have been made to meet these apparently conflicting requirements by making the plates of such material or impregnating or coating the plates with various films or surface strata so that they could be inscribed or printed with ink when dry and then be wetted to render the background of the image ink repellent.

Some such proposals have been only partially successful either because the plates age and deteriorate rapidly; or expand and distort excessively in use under continued wettings; or lose the required balance between the ink receptive and water receptive characteristics of the printed and unprinted portions respectively, resulting in forming unwanted and undesirable background on the printed copies; or lose image due to washing off or invasion of the ink receptive areas by the wetting fluid. The results obtained with prior proposals, for reasons above stated and others, are not uniformly satisfactory or reliable, for plates, apparently made or constituted in the same way, give vastly different results so far as fidelity of the prints to the original is concerned and the number of prints which can be made before the quality falls below an acceptable standard.

Most of the difficulties heretofore experienced, I discovered, have resulted from attempting to prepare the plate for printing or inscription so that the optimum balance between its water receptive and ink receptive properties is produced.

I have found that plates with an organic coating, impregnation or foundation designed for planographic purposes change their properties with age before use, and the prints obtained from fresh plates are different from those which have aged. Further, the properties of such plates vary in the manufacturing process so that plates formed at the beginning of a run may be satisfactory but those made later in run are relatively poor due to the material changing its physical and chemical properties during the run.

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The present invention obviates these difficulties by avoiding the necessity of maintaining this balance in the plate as it is prepared for printing or inscription, by preparing or selecting a plate, the surface of which is inherently, or made so by design, ink receptive so that ink applied initially and in printing copies will be received and held by the plate producing the desired image on the plate, then rendering the surface of the plate forming the background around the image predominantly hydrophilic and ink repellent before the plate is used for printing. This is done preferably by applying to the image-bearing plate a solution, repelled by the image-forming material, which forms a hydrophilic film on the plate masking the background around the image, and which film is insoluble in the fountain fluid of the press.

Thus, according to the present invention, the body of the plate may be made of any suitable or desirable material such as metal, cast plastic material, printing papers, wet-strength paper, parchmentized paper, or any of these with or without treated surface strata or coatings or films so long as it is strong enough when processed to withstand wetting and mechanical abrasion when used as a plate on a planographic printing machine; provided it is sufficiently ink receptive to receive and hold image-forming material and printing ink, and may be coated or impregnated with a solution forming a hydrophilic protecting masking film after receiving the image. Preferably, the plate should have a low or negligible wet expansion factor or should be treated to have same if a large number of prints are to be made from the same plate.

According to this invention, the hydrophilic masking film is formed on the plate after the image is produced thereon and preferably immediately or shortly before prints are to be made from the plate. If the plate is to be used while the film is fresh, the coating may be of a kind which would deteriorate with age. However, since it is usually desired to preserve or repeatedly use a planographic plate, it is preferable that the film be stable at least as to its hydrophilic properties.

In the duplicating of filled-in business forms, it may be desirable to print a supply of master plates with form matter such as headings, designated spaces, lines and rulings and then apply the film-forming solution to mask the unprinted

areas. When the plate is ready for use at an indefinitely later time, it may be filled-in on the typewriter, the typewriter ink falling on the film which, when dry, is sufficiently receptive to the ink.

I have found that excellent results may be obtained by applying to the image-bearing plate an aqueous solution including a carboxymethyl ether of cellulose, said solution being repelled by the image and forming a film on the background and around the image on the plate. Up to the present time, only sodium and aluminum salts of carboxymethyl ethers of cellulose have been available commercially and I have used these with phenomenal success, but any water-soluble salt of these ethers will perform at least as well as those mentioned. By the addition to the solution of an insolubilizing reagent such as mineral acids, for example hydrochloric, sulphuric or phosphoric acid and certain organic acids such as citric, tartaric, and tannic acid, the film which forms on the plate becomes permanently water insoluble upon drying.

It is therefore possible, and in many cases desirable since it meets many conditions of use, to apply as a coating an acidified aqueous solution including a water-soluble salt of a carboxymethyl ether of cellulose to the image-bearing surface of the plate and allow the same to solidify by drying into an insoluble tough film. This film is predominantly hydrophilic and protects the foundation of the plate against excessive water absorption and gives it additional wet strength, leaving the image predominantly ink receptive, sharp and well defined and protected from invasion and undermining by the wetting solutions used in printing from the plate, as so often happens with plates heretofore proposed. Likewise, the masking film, being predominantly and substantially uniformly hydrophilic when wet, prevents the formation of undesired background frequently present on prints made by plates heretofore proposed, especially on long runs.

I have found that a masking film of solidified carboxymethylcellulose is capable of being formed without including the insolubilizing agent in the coating solution, and that an aqueous solution of a salt of a carboxymethyl ether of cellulose may be applied to the image-bearing plate, dried, and then subjected to insolubilizing after-treatment. Thus, the film may be rendered insoluble by including in the wetting or fountain solution used in printing copies or by application in any way, of a precipitant salt such as aluminum sulphate and/or an insolubilizing mineral acid such as phosphoric, or certain organic acids such as tannic acid. I have discovered that the contact of the acid and/or salt with the film, even after the film is dried, insolubilizes the film and does not require that the film be redried to make it insoluble. Therefore, the reagent may be added to the solution in the fountain of the printing press, or it may be brushed or rubbed on the plate before the press is run, as desired.

Further, I have discovered that after the image-bearing plate has been coated with the film-forming solution, it is not necessary, where time is a factor, to allow it to become entirely dry or to solidify before using it in a printing press, especially when a short run is to be made. In using the plate with a partially solidified film, the film may be cast and insolubilized by including the reagent in the coating solution, or in the

fountain solution, or by rubbing or brushing it on the undried plate before it is applied to the press.

When the film is allowed to dry before use, it is given an opportunity to toughen and the plate is capable of producing a larger number of copies. Hence, this method of preparing the plate is usually preferable.

The masking film may be made pliant if desired by the addition to the coating solution of suitable plasticizers such as glycerine, and the drying of the film may be hastened by the inclusion of alcohol in the coating solution. Inert fillers such as China clay may be added to the filming solution especially if the coated plate is to receive inscriptions or additional printing before use.

The present invention may be practiced with the use of a metal plate, in which case it is not necessary or even desirable to remove the oxide formed on the plate, as this is more ink receptive than the polished and clean plate, and the film-producing coating adheres to the metal plate whether the latter is oxidized or not. However, if the plate is to receive its image by typewriter type, it is better to use a non-metallic plate, for the metal plate is unavoidably embossed by the type blows and its continued use will blunt the type badly. These difficulties are not encountered with the use of a cellulosic plate.

As stated above, any suitable coating may be applied to the plate after the image is produced thereon and before it is printed. I have found that a satisfactory coating solution may be made according to the following formula wherein parts are by weight:

	Parts
Low viscosity sodium carboxymethylcellulose	6.7
C. p. glycerine	5
85% ortho-phosphoric acid	1
Water	328.3

It should be understood that, although the image on the master sheet is usually formed in greasy ink, it is not necessary that oleous ink material be employed. It is merely necessary that the image on the master sheet repel the coating when it is applied thereto so as to leave the image uncoated, and that the image be receptive to the ink by which the duplicate copies are to be printed. For instance, instead of greasy ink, other inks such as those having a lacquer or casein base may be used.

Nor is it necessary, according to the present invention, to purposely make or print the printing plate, for I have found that any printed sheet or page, such as a page or clipping from a book or magazine, after being suitably mounted so that it may be placed on the printing cylinder if necessary and waterproofed and strengthened if the sheet is too water absorbent or weak for use in the printing machine, may be coated with the hydrophilic masking solution of the present invention, and then run on the press to make duplicate copies by the planographic method. This is of great commercial and practical advantage, especially when the number of copies wanted is not great enough to justify making planographic plate by photographic methods. For instance, in printing law briefs or records, of which relatively few copies are required, when it is necessary or desirable to include patent copies or printed paper exhibits for instance, the cost of reproducing these by photographic or photo-litho-

graphic methods is very high. By practicing the present invention, it is merely necessary to coat it with the masking solution and then run off on a planographic printing or duplicating machine the desired number of copies. Should the subject sheet be coated with waxy material as is sometimes the case, this wax should, of course, be removed by a suitable solvent before it is coated.

Even when but a few copies are required, the practicing of the present invention will effect saving of time and money. For instance, an order received by a merchant or manufacturer frequently must be routed through several departments to be filled, and if only one copy is received, time must be taken to typewrite duplicates. This would not be required according to the present invention, for it would merely be necessary to apply the masking coating to the order sheet and print the required number of copies on the planographic printing machine.

Taking advantage of my discovery that any sheet having an image thereon which repels the coating solution may be used, I have evolved a method whereby practically an unlimited number of copies may be made by the planographic method starting with one original master. In practicing this method, the master is made or prepared as above specified or otherwise, and a few copies printed from the master, preferably the first few, are set aside. The master on the machine is then used until just before the printed image falls below acceptable quality, and then it is discarded. One of the prints set aside is then coated and becomes itself a master which is placed on the planographic press cylinder and as many copies as possible are made from this. The other print-masters are used successively as they are needed. With this method, should it be desired to print 150,000 copies for example, it would merely be necessary to set aside nine of the prints made from the original master and then use these one after another using the original and each of the substitute masters to make approximately 1500 copies, again for example.

While I have described various methods of insolubilizing the carboxymethylcellulose coating which I apply to the master before printing, at the present time I refer to employ the method wherein the coating is insolubilized either immediately before use or by the fluid carried by the wetting fountain of the planographic press, but it should be understood, of course, that the coating may be self-insolubilizing depending upon the particular character of the coating composition employed.

While I have discovered that any paper having sufficient wet strength, or which may be given wet strength by treatment, may be used to make a commercially satisfactory and salable master sheet, for most purposes it will be found desirable and preferable to use a prepared master sheet, and this sheet may, according to my invention which is described and claimed in my other application, Serial No. 586,825, filed April 5, 1945, be impregnated with carboxymethylcellulose with or without suitable inert fillers and with or without suitable softening agents such as glycerine. Even though the foundation of the sheet is so prepared in the fabricating of the sheet or subsequent thereto, it will be found advantageous to treat the surface after it has been printed upon with the masking coating of the present invention so as to form as a background around the image the protecting masking coating of the present invention. By following this practice, even if the image is weak and only slightly ink receptive but yet will repel the masking solution, the image will be strengthened and given a sufficient body of ink as soon as the plate is dampened and inking material used in printing duplicate copies is applied to it.

Reference is made to my copending applications Serial No. 586,825, filed April 5, 1945, and Serial No. 637,087, filed December 22, 1945, in which are claimed as an article of manufacture and sale a planographic plate having a coating of an insolubilizable carboxymethyl cellulose compound.

Variations and modifications may be made within the scope of this invention and portions of the improvements may be used without others.

I claim:

1. The method of making a planographic printing plate which includes the steps of applying a solution including a salt of a carboxymethyl ether of cellulose to the face of the plate bearing an ink receptive water repellant image, the solution being aqueous and therefore being repellant to the image; drying the plate to produce a solidified predominantly hydrophilic film of said carboxymethyl ether of cellulose salt on the surface of the plate except over the image which remains ink receptive; and applying to the plate a reagent to insolubilize said film.

2. The method of making a planographic printing plate which includes the steps of applying a solution including a salt of a carboxymethyl ether of cellulose to the face of the plate bearing an ink receptive water repellant image, the solution being aqueous and therefore repellant to the image and forming a predominantly hydrophilic film of said carboxymethyl ether of cellulose salt on the surface of the plate except over the image which remains ink receptive; and while the film is still wet, applying to the plate a reagent to render the film water insoluble and ink repellant.

3. The method of making a planographic printing plate which includes the steps of applying a solution of sodium carboxymethyl ether of cellulose to the face of the plate bearing an ink receptive water repellant image, the solution being aqueous and therefore being repellant to the image and forming a predominantly hydrophilic film of sodium carboxymethyl ether of cellulose on the surface of the plate except over the image which remains ink receptive; and applying to the film a dilute aqueous solution of aluminum sulphate to render the film water insoluble and to wet the film and render it repellant to ink.

4. The method of making a planographic printing plate which includes the steps of applying a solution including a salt of a carboxymethyl ether of cellulose to the face of the plate bearing an oleous image, the solution being aqueous and therefore being repelled by the oleous image and forming a predominantly hydrophilic film of said carboxymethyl ether of cellulose salt on the surface of the plate except over the oleous image which remains predominantly oleophilic; and applying to the film a dilute solution of insolubilizing acid to render the film water insoluble.

5. The method of making a planographic printing plate which includes the steps of applying a solution including a salt of a carboxymethyl ether of cellulose to the face of the plate bearing an oleous image, the solution being aqueous and therefore being repelled by the oleous image and forming a predominantly hydrophilic film of said

carboxymethyl ether of cellulose salt on the surface of the plate except over the oleous image which remains predominantly oleophilic; and applying to the film a solution including a precipitant salt to render the film water insoluble.

6. The method of making a planographic printing plate which includes the steps of forming an image on a cellulosic plate with water repellant material; applying a self-insolubilizing solution including essentially a salt of a carboxymethyl ether of cellulose to the image-bearing face of the plate, the solution being aqueous and therefore being repelled by the image; and drying the plate to produce a substantially solid water insoluble predominantly hydrophilic film comprising essentially a water insoluble carboxymethyl cellulose compound on the surface of the plate except over the image matter which remains water repellant.

7. The method of making a planographic printing plate which includes the steps of printing form matter on an oleophilic cellulosic plate with oleous material; typewriting with water repellant material matter to fill-in the form printed on the plate; applying a solution including a salt of a carboxymethyl ether of cellulose to the printed and typed image-bearing face of the plate, the solution being aqueous and therefore being repelled by the oleous printed and filled-in image; drying the plate to produce a solidified predominantly hydrophilic film of said carboxymethyl ether of cellulose salt on the surface of the plate except over said image; and applying to the film a wetting solution containing an insolubilizing reagent for said carboxymethyl ether of cellulose salt from the fountain of the press before the plate is inked in the press.

8. The method of printing duplicates by the planographic method which includes the steps of preparing a planographic printing master by producing on a plate an ink receptive water repellant image; applying a solution including a salt of a carboxymethyl ether of cellulose to the image-bearing face of the plate, the solution being aqueous and therefore being repellant to the image; drying the plate to produce a solidified predominantly hydrophilic film of said carboxymethyl ether of cellulose salt on the surface of the plate except for the surface covered by the image; wetting the image-bearing film-carrying surface of the plate with a reagent containing wetting solution to render the film water insoluble and repellant to oleous material; applying oleous printing ink to the image-bearing surface of the plate to ink the image; transferring the ink from the image to a copy-receiving medium; and maintaining the film wet with said reagent-wetting solution and reinking the image as additional duplicates are made by transferring the image to copy-receiving media.

9. The method of printing duplicates by the planographic method which includes the steps of preparing a planographic printing master by producing on a plate an ink receptive water repellant image; applying a solution of sodium carboxymethyl ether of cellulose to the image-bearing face of the plate, the solution being aqueous and therefore being repelled by the image and forming a predominantly hydrophilic film of said sodium carboxymethyl ether of cellulose on the surface of the plate except for the surface covered by the image; applying the plate to a planographic printing machine while the film is still wet; wetting the image-bearing film-carrying surface of the plate with a reagent-containing solution to render the film water insoluble and repellant to oleous material; applying oleous printing ink to the image-bearing surface of the plate to ink the image; transferring the ink from the image to a copy-receiving medium; and maintaining the film wet with said reagent-containing solution and reinking the image as additional duplicates are made by transferring the image to copy-receiving media.

10. The method of printing duplicates by the planographic method which includes the steps of preparing a planographic printing master by producing on a plate an ink receptive water repellant image; applying a solution of aluminum carboxymethyl ether of cellulose to the image-bearing face of the plate, the solution being aqueous and therefore being repelled by the image and forming a predominantly hydrophilic film of said aluminum carboxymethyl ether of cellulose on the surface of the plate except for the surface covered by the image; applying the plate to a planographic printing machine; wetting the image-bearing film-carrying surface of the plate with a wetting solution including aluminum sulphate to render the film water insoluble and repellant to oleous material; applying oleous printing ink to the image-bearing surface of the plate to ink the image; transferring the ink from the image to a copy-receiving medium; and maintaining the film wet with said salt-containing solution and reinking the image as additional duplicates are made by transferring the image to copy-receiving media.

11. The method of printing duplicates by the planographic method which includes the steps of preparing a planographic printing master by applying to a sheet having an ink receptive water repellant image to be printed a solution including a salt of a carboxymethyl ether of cellulose to the image-bearing face of the sheet, the solution being aqueous and therefore being repellant to the image; drying the coating to produce a predominantly hydrophilic film of said carboxymethyl ether of cellulose salt on the surface of the sheet except for the surface covered by the image; wetting the image-bearing surface of the sheet with fountain solution containing an insolubilizing reagent to render the film insoluble and ink repellant; applying printing ink to the image-bearing surface of the sheet to ink the image; transferring the ink from the image to a copy-receiving medium; and maintaining the film wet and reinking the image as additional duplicates are made by transferring the image to copy-receiving media.

12. The method of printing duplicates by the planographic method which includes the steps of preparing a planographic printing master by forming a substantially solid image masking film comprising essentially a water insoluble carboxymethyl cellulose compound on the image-bearing face of a sheet inscribed with an ink receptive water repellant image; wetting the image-bearing film-carrying surface of the sheet to render the film repellant to printing ink material; applying printing ink to the image-bearing surface of the sheet to ink the image; transferring the ink from the image to copy-receiving sheets to make duplicate copies; and selecting one or more of said duplicate copies and forming on the printed surface of each a substantially solid protective image-masking film comprising essentially a water insoluble carboxymethyl cellulose compound whereby the selected and treated dupli-

cate copies may in turn be used as master plates for the making of additional duplicate copies.

13. The method of printing duplicates by the planographic method which includes the steps of selecting any printed sheet having the desired printed image thereon; forming a substantially solid protective image-masking film comprising essentially a water insoluble carboxymethyl cellulose compound on the image-bearing surface of the sheet; wetting the image-bearing film-carrying surface of the sheet to render the film repellant to printing ink; applying printing ink to the image-bearing surface of the sheet to ink the image; transferring the ink from the image to a copy-receiving medium; and maintaining the film wet and reinking the image as additional duplicates are made by transferring the image to copy-receiving media.

14. A planographic plate having an ink receptive water repellant image thereon and having a water insoluble hydrophilic film of a carboxymethyl ether of cellulose forming a substantially solid, plate-attached mask around the image over the background of the plate.

15. A planographic master comprising a cellulosic plate having on a face thereof an ink receptive water repellant image and on the same face a hydrophilic water insoluble film of an insolubilized carboxymethyl ether of cellulose providing a substantially solid, flexible, plate-attached mask around the image and over the background of the plate.

16. A planographic master comprising a cellulosic plate having on a face thereof an ink receptive water repellant image and on the same face a hydrophilic film of aluminum carboxymethyl ether of cellulose providing a substantially solid, flexible, plate-attached mask around the image and over the background of the plate.

17. A planographic master comprising a cellulosic plate having on a face thereof an ink receptive water repellant image and on the same face a substantially solid hydrophilic film comprising essentially a water insoluble compound of carboxymethylcellulose providing a mask around the image and over the background of the plate.

18. As a new article of manufacture, a planographic master form to receive matter to be filled-in on a typewriter, comprising a flexible cellulosic plate having printed thereon with oleous ink a blank form subsequently to be filled-in, said plate having thereon a film of a water insoluble carboxymethyl ether of cellulose forming a substantially solid, flexible, plate-attached mask around the oleous ink constituting the form and over the background thereof, which when dry is receptive to the fill-in ink material.

19. As a new article of manufacture, a planographic master form to receive matter to be filled in on a typewriter, comprising a flexible cellulosic plate having printed thereon with ink receptive water repellant ink a blank form subsequently to be filled-in, said plate having thereon a substantially solid film comprising essentially a water insoluble compound of carboxymethylcellulose forming a hydrophilic mask around the oleous ink constituting the form and over the background thereof which when dry is receptive to the fill-in ink material.

20. In the method of making a planographic plate comprising a foundation, that improvement which consists of first forming an ink-receptive image on the foundation and thereafter forming a masking film of an insoluble compound of carboxymethyl cellulose on the foundation around the image.

21. In the method of making a planographic plate comprising a foundation, that improvement which consists of first forming an ink-receptive image on the foundation and thereafter forming a substantially solid masking film comprising essentially an insoluble compound of carboxymethyl cellulose on the foundation around the image.

22. The method of making a planographic printing plate which includes the steps of producing on a plate an ink-receptive water-repellant image; applying a self-insolubilizing solution including essentially a compound of carboxymethyl cellulose to the image-bearing surface of the plate, the solution being aqueous and therefore repelled by the image; and then drying the plate to form a substantially solid masking film comprising essentially a water insoluble carboxymethyl cellulose compound around the image.

23. The method of making a planographic printing plate which includes the steps of producing on a plate an ink-receptive water-repellant image; applying an acidified solution including essentially a compound of carboxymethyl cellulose to the image-bearing surface of the plate, the solution being aqueous and therefore repelled by the image; and then drying the plate to form a substantially solid masking film comprising essentially a water insoluble carboxymethyl cellulose compound around the image.

24. A planographic plate having an ink-receptive water-repellant image thereon and having a substantially solid hydrophilic film comprising essentially a water insoluble carboxymethyl cellulose compound forming a mask around the image over the background of the plate.

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