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METHOD AND PLATE FOR LITHOGRAPHIC PRINTING

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Fig. 1.

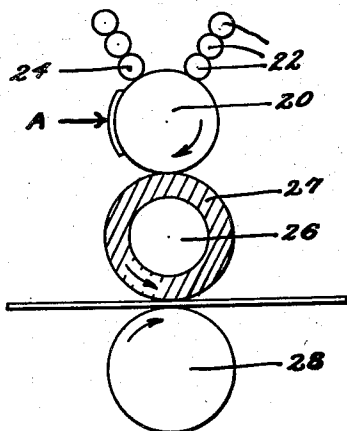


Fig. 2.

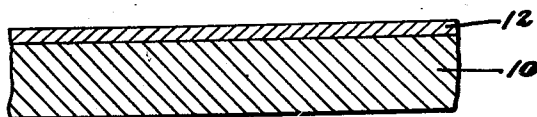
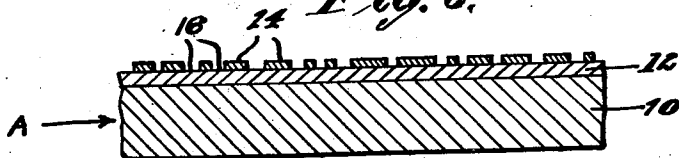


Fig. 3.



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METHOD AND PLATE FOR LITHOGRAPHIC
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This invention relates to improvements in printing plates and methods of printing, and especially to lithographic offset printing plates of the colloid type in which a water-swellable coating of a colloid or colloid-like substance is applied on a flexible support of some suitable material, such as metal, paper, plastics and the like. Such coatings are of an inherent water-swellable nature, a property which may be employed to repel greasy lithographic printing ink, thus enabling the coatings to constitute the non-printing portions of lithographic plates. Upon these coatings it is customary to apply relatively hard grease-receptive images which, in the manner well known to the art, are inked to form printing portions of the plates.

In all lithographic printing, including those methods where the use of lithographic stone and grained metal is resorted to, there is present a relatively narrow operating range resulting from the fact that two immiscible substances are constantly being brought together at the surface of the lithographic plate. This operating range is limited on the one hand by need for maintaining at the image portions a relatively heavy unemulsified ink body, and on the other hand by need for continually replenishing water in the non-printing portions of the plate to replace that carried away as the plate makes an impression. Maintaining even this narrow operating range in effect is completely dependent upon the use of an acid in the water furnished to the non-printing portions. The effect of the acid is to prevent emulsification of greasy ink and to aid in keeping tiny particles of greasy ink from becoming attached to the non-printing portions. At best it is difficult to keep the ink and water supply in balance and continual adjustment of the printing mechanism must be expected where a large number of impressions are being made.

The operating range becomes even narrower in the case of employing colloidal or water-swellable coating materials, the use of which is highly desirable from a fine quality printing standpoint. Such coatings introduce additional problems which center around the fact that a colloid-type coating has to be chemically hardened and thus strengthened in order to properly hold a greasy image, and in order also to withstand the wear and tear of press operation. It turns out to be very easy to toughen the colloid by chemical hardening agents but extremely difficult to do so without appreciably reducing its water-swellable property with a consequent loss of ink-rejecting power. As a result, colloid-type printing is in-

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variably subject to a progressive accumulation of tiny bits of ink in the non-printing portions of the plate, owing to failure of the water-swellable area to retain sufficient acid water and thus completely reject greasy ink. Over a period of years, this condition has come to be commonly referred to as "colloid scum" and has greatly limited commercial use of colloid-type plates despite their acknowledged superiority from other standpoints.

The improved method and printing plate of the invention avoids the difficulties indicated to a far greater extent than has heretofore been realized in lithographic printing, and almost entirely eliminates colloid scum. In making possible this advance in the art, an outstanding feature consists in broadening the operating range of lithographic printing, based on the novel concept of furnishing acid directly from within a colloidal printing plate body as well as externally from a fountain solution roller, with the two sources of acidity supplementing one another to sharply control the ink handling function.

We have discovered that we may thus broaden the operating range of lithographic printing by having in a colloid-type coating appreciable amounts of a water-soluble dibasic acid anion occurring either as free dibasic acid dispersed through the coating in a controlled manner as a finely divided solid, or as a potential product of hydrolysis of an acid ester or neutral ester, or other reaction product of the coating material and dibasic acid. An important aspect of the invention therefore is a colloid-type printing plate containing in its non-printing portions appreciable amounts of a water-soluble dibasic acid anion of the character noted.

We also find that by thus incorporating appreciable quantities of a water-soluble dibasic acid in a colloid and by subjecting the mixture to heat in suitable degree, we obtain a coating of relatively dense uniform texture. A characteristic of this texture is a precisely limited degree of strength and hardness from which a desirable balance between image-holding capacity and water-swellability may be realized. The water-soluble dibasic acid when heated with the colloid has the property of partially reacting with the colloid, esterifying or otherwise selectively modifying the hydroxyl group formation of the colloid and producing a product of smaller molecular size and greater uniformity. In the case of some colloids, this step of modifying the hydroxyl formation may be taken advantage of to

more efficiently utilize chemical hardening agents.

We have also discovered in this connection that by utilizing a water-soluble dibasic acid which is only very slightly soluble in water at room temperatures, but which is exceedingly soluble at higher temperatures, such as those temperatures which are desired to be employed in dispersing and coating our colloid-type materials, we can charge or fill a lithographic coating with relatively large amounts of the dibasic acid anion. The relatively large amounts of solid thus held in the coating in the presence of fountain solution will at room temperatures leach away from the colloid very slowly, lasting for an extended period of time, and thereby fulfilling demand for acid throughout the normal period of operation of a plate on a printing press.

We have further discovered that by holding a dibasic acid of the solubility character noted completely in solution while the colloid coating is being applied to the metal base, and especially by maintaining this condition in effect until the colloid has started to set, the acid-producing material may be caused to precipitate out while dispersed in a relatively solid colloid medium. This greatly retards crystal structure formation of the acid, a phenomenon which, if left free to proceed in the usual manner, would seriously impair the strength characteristics of the coating. These and other novel features and objects of the invention will appear from the following detailed description of the invention.

In the accompanying drawings:

Fig. 1 is a vertical cross sectional view of an offset printing mechanism in which is mounted the printing plate of the invention;

Fig. 2 is a cross-sectional view indicating diagrammatically a lithographic plate element of the invention; and

Fig. 3 is a cross-sectional view illustrating diagrammatically our improved lithographic printing plate.

The printing method of the invention preferably comprises an improved offset type of printing operation in which an ink impression is picked up from a lithographic printing plate by means of a transfer roll or blanket and then transferred to a paper surface to be printed. These press movements which distinguish a conventional offset printing operation, and especially the sequence in which they occur, aid somewhat in carrying into effect the novel steps which enable us to broaden the operating range of the offset process.

To more clearly understand our improved method of printing, there should be visualized the main component parts of an offset printing press, and these are illustrated diagrammatically in Fig. 1. The parts include the platen roll 20 on which the plate denoted by arrow A is clamped, the inking rolls 22, and fountain solution roller 24 in rolling contact with the platen roll and plate; a resilient transfer roll 26 arranged to come into rolling contact with the platen roll and take up the printing image from the plate; and finally an impression cylinder 28 carrying paper onto which the ink impression is transferred from the transfer roll. With these press elements we utilize a special lithographic plate A such as shown in Fig. 3, including a support 10 and a coating 12 on the surface of which are formed printing portions 14 and non-printing portions 16. The characteristic feature of the plate, as noted above, is use of a water-swellable colloid or colloid-like

material for the coating 12 in which is held appreciable quantities of water-soluble dibasic acid occurring in a finely divided solid state.

After mounting the plate A in the platen roll and starting the press, the fountain solution roller 24 first is allowed to come into contact with the plate. This supplies an acidic mixture of water and some weak acid such as phosphoric acid to the non-printing portions 16 of the plate. Greasy ink and water are thereafter applied to the plate in rapidly alternating succession. The water thus externally applied is drawn into the non-printing portions of the plate by reason of the water-attractive force of the water-swellable colloid portions. The water absorbed in the plate almost instantly starts to dissolve the finely divided oxalic acid held within the non-printing portions, thereby rendering the solvent water within the colloid more strongly acidic and creating a reservoir of this acidic solvent within a very short time after starting the press in operation.

With each rotation of the platen roll, the plate, after being charged with a fresh amount of water from the fountain solution roller, is almost immediately subjected to a light squeezing action by the resilient blanket 27 of transfer roll 26. This tends to force acidic water in the swollen areas outwardly on to the surface of the plate slightly ahead of the nip point of rolls 20 and 26. It will be apparent that the effect of this squeezing action is to constantly lay a thin film of acidic moisture before the inked surface areas of the transfer roll which are of course always carrying portions of ink left from the previous impression. It is these remaining portions of ink on the transfer roll which sometimes give trouble as the transfer roll moves across the non-printing areas in taking up a new impression. It will be seen that protection is constantly afforded by a film of acidic water continually squeezed out of the plate at the precise time when greatest protection is needed.

We find that the presence of the dibasic acid anion in the coating definitely provides for building up a more positive supply of water. This may be due to the fact that the capacity of the plate for holding water is increased, or due to the fact that there is present a stronger attractive force for absorbing water. The attractive force of water-swellable materials for water is not a matter of supposition and is definitely a material factor. However there is reason to suppose that the acid anion, occurring in the coating in the form of a finely divided solid, as it dissolves may create a relatively greater demand for water in response to forces seeking to reach a chemical equilibrium within the coating body. It is also suggested that during the leaking action, hydrogen ions from the dissolved acid may be caused to diffuse outwardly through the coating. It should be understood that the above-noted explanation is offered as a matter of opinion and we do not limit the invention to such a theory of operation. Whether due to the theories outlined, or to some other theory, it is definitely found that the presence of the dibasic acid anion provides in contact with water a constant acidic environment throughout the plate which materially aids the fountain solution acid in preventing ink emulsification as well as avoiding scumming. There is thus achieved the novel operation of dissociating a dibasic acid internally of a colloid plate body and moving the resulting acidic mixture outwardly on to the surface of the plate

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in response to movement of a roll, or other pressure exciting agency with the result that the operating range of lithographic plates is materially broadened.

In preparing the printing plate A illustrated in Fig. 3, we employ a so-called "lithographic base element" (Fig. 2) whose composition and method of manufacture will be described in greater detail. The support 10 may comprise any of the materials already noted and preferably consists of a thin sheet of steel. This support is furnished in any desired lithographic plate size, such as for example the common plate size of 18" x 22½". The steel is selected of a type to provide weight and flexibility characteristics which compare favorably with those of zinc and aluminum lithographic plates. Superimposed on the support 10 is the water-swellable coating 12 which for purposes of simplifying the present disclosure, has been shown directly bonded to the surface of the steel support, but which may, if desired, be applied to an intermediate bonding coating or coatings of well known substances such as urea formaldehyde, sodium silicate, casein and the like. The coating 12 may be formed in a single operation or may be built up from two or more coatings applied one upon another in order to arrive at some desired thickness.

The support element 10 and water-swellable coating 12 together make up the lithographic base element just above referred to which is in the nature of an intermediate product constituting a definite article of manufacture. In actual production, the coated base elements or sheets may be made up in relatively large lots to be stored and later shipped to the consumer, where the final plate making operations are carried out with printing portions and non-printing portions being formed for the particular subject-matter to be reproduced.

In preparing a colloidal mixture suitable for forming the coating 12, we find that a preferred example of a water-soluble dibasic acid is oxalic acid ($\text{HO}_2\text{CCO}_2\text{H}$). Appreciable amount of this dibasic acid, when mixed with a colloid or colloid-like materials, is found to provide a lithographic coating having distinctive characteristics as noted above. The acid may be employed in amounts ranging from 5% up to 50% by weight of the colloid present. In place of the oxalic acid we may employ other water-soluble dibasic acids such as succinic acid, fumaric acid and tartaric acid, with excellent results. Some water-soluble dibasic acids such as malonic acid and glutaric acid give less desirable but nevertheless workable results.

One preferred example of colloid-like material which may be used in coating 12 is polyvinyl alcohol. Excellent results may also be obtained with gelatin while various other colloids such as glue, gum arabic, Irish moss, water-soluble cellulose and the like, give results which are only slightly less desirable than those obtained with gelatin and polyvinyl alcohol. Mixtures of these colloids, especially mixtures of polyvinyl alcohol and gelatin, also may be employed to obtain variation in printing effects. As illustrative of suitable fillers there may be cited titanium oxide, barium sulphate, clays and the like. Hardening agents such as formaldehyde, dimethylol urea, hexamethylenetetramine and various others have been found to be satisfactory.

The following examples are given as illustrative of specific materials and amounts of such

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materials which may be utilized in making colloidal mixtures for forming the coating 12.

Example I

100# polyvinyl alcohol
300# titanium oxide
5# dimethylol urea
5# oxalic acid
120 gals. water

Example II

100# polyvinyl alcohol
300# titanium oxide
5# dimethylol urea
15# oxalic acid
120 gals. water

Example III

100# polyvinyl alcohol
200# titanium oxide
100# clay
¾ gals. 37% formaldehyde sol. in H_2O
10# oxalic acid
120 gals. water

Example IV

100# polyvinyl alcohol
300# titanium oxide
40# hexamethylenetetramine
25# tartaric acid
120 gals. water

Example V

100# polyvinyl alcohol
100# titanium oxide
100# barium sulphate (of Blanc Fixe)
100# clay
5# succinic acid
120 gals. water

Example VI

100# polyvinyl alcohol
200# titanium oxide
100# barium sulphate
50# clay
25# fumaric acid
5# dimethylol urea

Example VII

50# gelatin
37½ gals. water
10# oxalic acid
480 cc. 37% solution of formaldehyde in H_2O

Example VIII

50# gelatin
37½ gals. water
¾# oxalic acid
1½# hexamethylenetetramine
360 cc. 37% formaldehyde

Example IX

100# gum arabic
300# titanium oxide
5# dimethylol urea
15# oxalic acid
120 gals. water

Example X

100# polyvinyl alcohol
550# titanium oxide
3 gals. 37% formaldehyde
15# oxalic acid
120 gals. water

In preparing and applying colloidal mixtures such as those represented by the above noted

examples, advantage is taken of the varying solubility characteristics of the dibasic acids noted to charge the colloid with a relatively large amount of acid.

It is pointed out that most acid materials introduced into the coating would become rather quickly leached away when subjected to the rapid leaching action of the fountain solution roller and would thus fail to serve the purpose during the effectual operating life of the plate. We have found that due to the solubility characteristics of the water-soluble dibasic acids noted, we can not only incorporate relatively large amounts of acid but we can provide for holding the acid so that during press operation it is leached out of the plate very slowly. Oxalic acid, for instance, is only slightly soluble in cold water but is highly soluble at temperatures well above room temperatures. Thus 120 parts of oxalic acid are soluble in 100 parts of water at 194° F. while at 59° F., for instance, only about 9 parts of oxalic acid are soluble in 100 parts of water. Similar solubility characteristics are present with succinic acid, fumaric acid, tartaric acid and others.

One desirable procedure for combining an acid with a colloid based on these varying solubility characteristics is indicated with reference to the materials in Example I. An aqueous suspension of polyvinyl alcohol and water is first prepared. This may be done by placing the polyvinyl alcohol of Example I in the water specified while the latter is at room temperature and allowing the alcohol to swell. The mixture is gradually heated and brought to a temperature of from 160 to 180° F. at which temperature the alcohol becomes thoroughly dispersed in the water and the filler may be added. The resulting mixture is cooled to temperatures from 120 to 140° F. and the oxalic acid and hardener then added. This material is thoroughly agitated until the oxalic acid is completely dissolved and a homogeneous mixture is produced. The resulting product is then coated onto the base element with the stock being maintained within a temperature range of 120 to 140° F. while the polyvinyl alcohol sets. The coated base is then heated in a drying oven at temperatures ranging from 180 to 275° F., for example, for a period of 10 or 15 minutes.

It will be observed that at the temperature indicated for placing the polyvinyl alcohol in solution, a relatively large amount of oxalic acid, such as that represented in the above noted formula, may also readily pass into solution, and as long as the temperature indicated is maintained in effect, there is a great excess of water present in which the acid may remain in solution even after the mixture is applied as a coating and actually starts to gel. This situation is taken advantage of and carefully fostered with the procedure above specified for holding the mixture in a temperature range of at least 100-120° F. at all times while the coating is being coated and allowed to set into a firm layer. With the solid acid thus incorporated in the colloid in suitable amounts, drying at elevated temperatures causes the acid to partially react with the colloid breaking down some of its hydroxyl groups and reducing the size of its molecules to produce a more uniform product.

As moisture leaves the coating during the drying operation, the colloid passes from a substance dispersed in water to a viscous body, then to a hydrated film, and finally to a dense, hard mass. It is pointed out that free-moving colloid par-

ticles are thus gradually brought together as water is removed from around them until they are no longer free to move. When substantially all of the free water is removed, they become completely immobilized and fixed in position in the solid state.

At the point where the coating starts to dry under the temperature conditions noted, there is present a definite quantity of water heated to a wet bulb temperature corresponding to temperature of drying. In this heated water in the coating, oxalic acid as noted is completely soluble. As drying continues, with further removal of water from the gelled colloid, the oxalic acid is gradually thrown out of solution. At this point, the oxalic acid seeks to form tiny crystals and assume a solid state. It is believed that crystals tend to form and probably nuclei are formed but are prevented from moving together into any appreciable formation by the immobility of the polyvinyl alcohol film surrounding them. Thus the dried coating may be visualized as a continuous film of hardened polyvinyl alcohol and filler in which tiny particles of oxalic acid are relatively uniformly distributed and entrapped.

Several different types of finished lithographic plates may be made with coatings of the colloid mixtures illustrated in the above noted examples, including halftone plates, continuous tone plates, and direct image plates. The colloidal mixtures indicated in Examples I, II, III, IV, V, VI and IX are suitable for use in halftone printing plates; Example VII and VIII are especially suited to continuous tone plates; and Example X is designed for use in making a direct image plate.

A halftone plate made by the albumin process, using our improved colloid coatings, will be described since this is the most widely used type of plate and our colloid coating is especially adapted to the process. The procedure is as follows:

A light-sensitive coating of albumin and ammonium dichromate is first coated over the lithographic base illustrated in Fig. 2, and allowed to dry. The coating is next exposed to actinic light passed through a photographic negative and an intervening screen element. This forms in the albumin a multiplicity of hardened dots varying in size and hardness. Thereafter the entire surface of the albumin coating is rubbed over with a greasy developing ink. The inked plate is held under running water, and the unexposed portions of the albumin and developing ink are dissolved away, leaving hardened albumin dots covered with a film of greasy ink to form the printing image 14 as shown in Fig. 2. Those areas 16 of the coating 12 intermediate the dots 14 are thus laid bare and constitute non-printing portions from which the oxalic acid will gradually dissolve away when contacted by fountain solution rollers.

Highly unusual characteristics are observed in making our plate by the albumin process above described. After exposure and application of developing ink to conventional plates, the standard requirement is to develop the plate by holding it under running water for a period of 3 to 5 minutes, during which period the surface of the plate is lightly rubbed over with a pad of soft cloth. Upon subjecting our improved plate to running water, the developing ink drops away within a few seconds after contact with the water, in no case requiring more than a minute and the need for rubbing is substantially eliminated. This

makes possible a material saving of time and avoids the possibility of rubbing away portions of the greasy albumin dots, such as sometime occurs in conventional developing.

Of almost equal importance is a second phenomenon observed during this development operation. Ammonium dichromate, the sensitizer of the albumin process noted above, customarily stains conventional colloid materials a yellowish color and strikes in deeply at the unexposed areas. The stain is objectionable and must be washed out very slowly. If not entirely removed the bichromate may give trouble later by remaining in small invisible amounts and gradually hardening the non-printing portions to a point where they tend to scum.

In comparison, the plate of the invention is found to materially resist staining at the unexposed areas, and to hold the bichromate at the surface only of these areas, from which it can be washed away almost instantly. This provides for rapid development and the possibility of delayed hardening effects is avoided. Complete removal of ink and bichromate in this way leaves a clear white background of highly distinctive character which greatly aids the plate maker in determining if corrections are required. As a result of its ease of development and freedom from residual bichromate, the plate meets with the approval of printers and is very marketable.

Another excellent characteristic of the plate when running on the press is outstanding uniformity and stability in its swelling properties. This manifests itself especially during press operation. For example, stable swelling almost entirely prevents occurrence of "flooding," a term used to denote the presence of excess amounts of water such as may very easily occur at the surface of an ordinary colloid plate. Uniformity in swelling property of the plate also eliminates to a great extent the frequent adjustments in supply of fountain solution and ink which have heretofore been necessary during operation of a colloid-type plate on an offset press.

A considerable variation in quality of printing can be realized from the broadened range of operation made possible by the use of water-soluble acid in the coating. The best example of this is illustrated by a gelatin plate of continuous tone character made from coatings of Examples VII and VIII. This gelatin type of plate is made without the use of a screen and yields the very highest quality of printing. Gelatin has always been known as the finest lithographic printing material and was originally used in the art with a relatively smooth unreticulated surface in which the printing image was formed in the usual manner by exposure of a light-sensitive agent impregnated therein. This original type of gelatin surface would only work properly for four or five impressions, thus rendering it impractical for most commercial work. Subsequently it was found that by heating gelatin and reticulating its surface, it could be made to print a larger number of impressions with some loss of quality and at greatly increased expense. The expense factor and difficulty in handling has, up to the present time, limited commercial use of gelatin. We now find that by using acid in the gelatin in the manner described, the cost and difficulty in handling of this type of plate are greatly reduced and the continuous tone operation simplified to a point where even quality continuous tone work becomes practical in large scale commercial printing.

In the case of the gelatin plate, the use of the water-soluble acid is exceedingly beneficial, especially when heated in the manner described. This is due in part to the fact that toughness of gelatin, as ordinarily used in a film state, is substantially less than the toughness of polyvinyl alcohol and some other colloids. As a result, gelatin must be strengthened by chemical hardening to a greater degree than polyvinyl alcohol. This automatically reduces the water-soluble character of the gelatin and narrows its operating range a proportionately greater amount.

In this connection we find that heat reacting the gelatin with a water-soluble dibasic acid changes its character in such a manner that we may successfully use hardeners which would ordinarily harden the gelatin excessively. By using the water-soluble acid as a source of acidity with the gelatin coating and as an agent for aiding hardening, we not only extend the operating range of this difficult colloid but we convert it into a firm, uniformly stable product which holds the ink image properly and which has sufficient strength to undergo relatively extended press operation.

Similarly by using a colloid mixture such as that of Example IX, we can broaden the operating range of direct image plates, especially plates made by typing upon the lithographic base of Fig. 2 and in this way we may impart quality closely approximating that of a good halftone printing job in the direct image plate.

This application is a continuation in part of our earlier applications Serial No. 559,832, filed October 21, 1944 and Serial No. 666,504 filed May 1, 1946 (now abandoned).

We claim:

1. An improved printing plate of the lithographic printing class for use in a printing machine wherein the surface of the plate is alternately moved into contact with a water roller and a greasy inking roller, said plate comprising a flexible base member, a thin hydrophilic coating of colloidal material bonded to the base member, said coating including at its exposed surface area relatively hard grease receptive printing portions and relatively yieldable water receptive non-printing portions, scum retardant means in the non-printing portions operative in the presence of moisture applied thereto from the water roller to repel adhesion of small amounts of greasy ink to the said non-printing portions when the latter are contacted by the inking roller, said scum retardant means comprising a water-soluble dibasic acid occurring in the form of a finely divided solid which is distributed throughout the non-printing portions.
2. A printing plate as described in claim 1 in which the dibasic acid comprises oxalic acid.
3. A printing plate as described in claim 1 in which the dibasic acid comprises tartaric acid.
4. A printing plate as described in claim 1 in which the dibasic acid comprises succinic acid.
5. A printing plate as described in claim 1 in which the dibasic acid comprises fumaric acid.
6. A printing plate as described in claim 1 in which the dibasic acid comprises malonic acid.
7. A printing plate according to claim 1 in which the hydrophilic coating comprises a colloid selected from the group consisting of polyvinyl alcohol, gelatin, gum arabic, Irish moss, and water soluble cellulose.
8. An improved printing plate of the lithographic printing class for use in a printing ma-

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chine wherein the surface of the plate is alternately moved into contact with a water roller and a greasy inking roller, said plate comprising a flexible base member, a thin hydrophilic coating of polyvinyl alcohol bonded to the base member, said coating including at its exposed surface area relatively hard grease receptive printing portions and relatively yieldable water receptive non-printing portions, scum retardant means in the non-printing portions operative in the presence of moisture applied thereto from the water roller to repel adhesion of small amounts of greasy ink to the said non-printing portions when the latter are contacted by the inking roller, said scum retardant means comprising an oxalic acid occurring in the form of a finely divided solid which is distributed throughout the non-printing portions.

9. An improved printing plate of the lithographic printing class for use in a printing machine wherein the surface of the plate is alternately moved into contact with a water roller and a greasy inking roller, said plate comprising a flexible base member, a thin hydrophilic coating of colloidal material bonded to the base member, said coating including at its exposed surface area relatively hard grease receptive printing portions and relatively yieldable water receptive non-printing portions, scum retardant means in the non-printing portions operative in the presence of moisture applied thereto from the water roller to repel adhesion of small amounts of greasy ink to the said non-printing portions when the latter are contacted by the inking roller, said scum retardant means

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comprising a hydrolyzable reaction product of a dibasic acid and the said colloidal material.

10. An improved printing plate of the lithographic printing class for use in a printing machine wherein the surface of the plate is alternately moved into contact with a water roller and a greasy inking roller, said plate comprising a flexible base member, a thin hydrophilic coating of colloidal material bonded to the base member, said coating including at its exposed surface area relatively hard grease receptive printing portions and relatively yieldable water receptive non-printing portions, scum retardant means in the non-printing portions operative in the presence of moisture applied thereto from the water roller to repel adhesion of small amounts of greasy ink to the said non-printing portions when the latter are contacted by the inking roller, said scum retardant means comprising free oxalic acid and a hydrolyzable reaction product of oxalic acid and the said colloidal material.

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