Dec. 17, 1929. M. C. BEEBE ET AL 1,740,061

LITHOGRAPHIC PLATE AND PROCESS OF PREPARATION

Original Filed Jan. 22, 1925

Fig. 1.

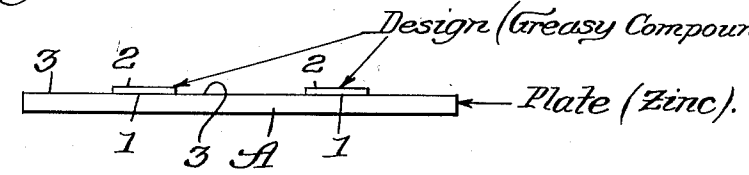


Fig. 2.

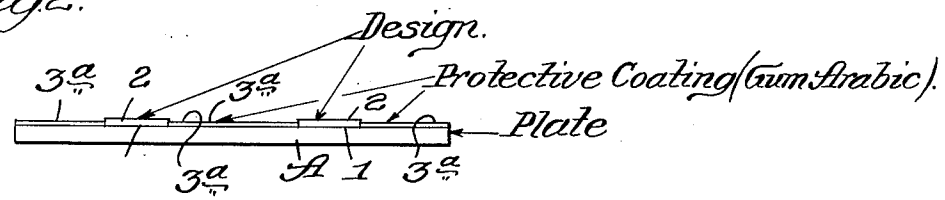


Fig. 3.

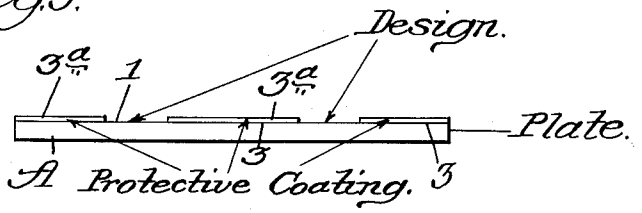


Fig. 4.

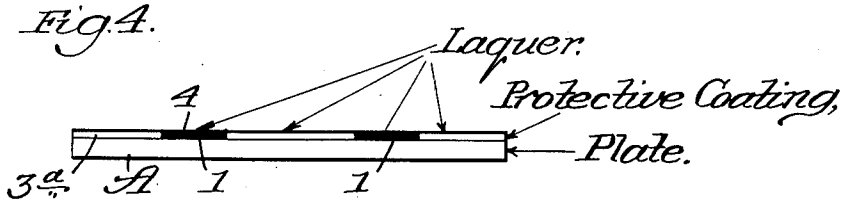
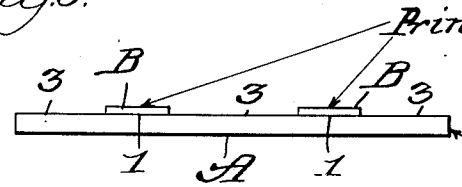


Fig. 5.



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Patented Dec. 17, 1929 1,740,061

UNITED STATES PATENT OFFICE

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LITHOGRAPHIC PLATE AND PROCESS OF PREPARATION

Original application filed January 22, 1925, Serial No. 4,103. Divided and this application filed October 20, 1928. Serial No. 313,938.

This invention relates particularly to plates for use in lithography and to a process of preparing such plates.

The primary object is to provide plates of the character mentioned with printing portions, such as images, designs, characters, or the like, which are highly resistant to the disintegrating action of lithographic ink, which will, nevertheless, "hold" the ink satisfactorily, and which are also strong and durable and capable of withstanding the mechanical stress to which the plates are subjected in press-printing operations.

Still another important object is to provide an improved process for applying to plates, suitable for lithographing purposes, highly resistant images, designs, or characters, which are capable of taking and holding the ink satisfactorily, and which will withstand the disintegrating action of ink and possess such other resistant qualities as to enable these printing surfaces to be used successfully for producing a very large number of reproductions.

According to the improved process, as preferably practiced, a lacquer comprising a well thinned solution of a highly insoluble and strongly resistant synthetic resinous compound is applied to those areas of a plate which are to serve as a medium for receiving and holding the lithographing ink and printing upon the surface to which the ink is to be transferred. It is preferred to employ a resinous compound which is insoluble in solvents of the order of acetone, benzol (benzene, i. e., the coal-tar product known as benzene), or the like; to dissolve such highly insoluble resinous compound in a special solvent, as for example, furfural, and to mix the solution with suitable thinners and preferably with certain other ingredients, thus producing a highly thinned lacquer. This lacquer then is applied in a thin coating to the "sensitive" areas of the plate at which areas the resinous compound and certain other ingredients in the coating are caused to become set and strongly adherent to the plate, while the solvent and thinning agents may be largely, or wholly, evaporated therefrom. Those portions of the plate which are not to permanently retain the image, design, or characters which function in the printing process may have applied thereto a suitable protective coating, such as a coating of gum arabic, so that the selected areas only will be permanently coated with the resistant coating.

It is preferred to employ in the lacquer a resin which is itself light-sensitive, or which has been rendered light-sensitive by the incorporation therein of suitable sensitizing agents. If desired, accelerators may be employed which comprise halogen-liberating agents. Also, it is preferred to employ a synthetic resin which is rendered highly insoluble in character before it is dissolved in the special solvent, and which can be rendered still more resistant and insoluble after the lacquer has been applied to the plate. Also, it is preferred to employ in the lacquer a highly insoluble resin which can be still further hardened and rendered more insoluble by subjecting the plate to a heating operation after the lacquer has been applied.

As an example, one may take a zinc plate and provide it with "sensitive" areas adapted to permanently receive the coating substance which forms the image, design, or printing characters, may protect the remaining portions of the plate by a suitable coating, such as a solution of gum arabic, may then coat the plate with the improved lacquer, may then harden the coating by heating the plate, and may then wash the coating from the protected areas by a suitable developing operation. For example, this may be done by washing with water; or, the plate may be put to use in the press, where the water from the damping roller, which ordinarily precedes the inking roller, will disintegrate the coating throughout the protected areas and leave the strongly attached portions of the coating, forming the image, or the like, in condition to receive and transfer the ink in the printing operation.

The zinc plate may be provided with "design" areas by applying transfer ink, in the form of an image, design, or characters, to the plate in a well-known manner; then coating the plate with gum arabic which adheres to those portions of the plate not covered by

the transfer ink, and then washing off the transfer ink, leaving the clean underlying portions of the zinc surface as "sensitive areas" i. e. clean, bare areas. The improved lacquer may then be applied to the plate, may be hardened so that the exposed areas of the plate receive a permanent coating, and the intervening protective coating may be removed by a developing operation (washing with water, for example), and the plate is then ready for use. It is to be understood that while the lacquer coating may cover the coating of gum arabic during the period when the plate is being subjected to heat to further harden the resinous coating, nevertheless, the gum arabic prevents the resinous coating from becoming (strongly) adherent to the plate, and the coating, comprising the resinous compound and the gum arabic, may be readily washed off the plate, leaving the resistant resinous coating at those areas which are to be used to receive and transfer the ink in the printing operation.

The preferred method of preparing a suitable lacquer in accordance with the invention is, as follows:

First, prepare a furfural-acetone resin by mixing five hundred seventy-five grams of furfural and five hundred seventy-five grams acetone; pouring the mixture slowly into a saturated aqueous solution of sodium hydrate, say one thousand grams of such a strong, caustic solution, thus producing a resinous material; draining off the caustic; crushing the remaining resin and washing it with a dilute solution of hydrochloric acid, say ten percent solution, to free it from the caustic; then heating the resin for a suitable period, say two hours, in an open kettle, at about 300° C. The resin melts and gradually thickens, while giving off fumes. The resin should be constantly stirred during the heating period, and, at the end of the heating period, fumes are no longer given off.

The heat treatment preferably is continued to a point where small samples of the resin are shown to be insoluble in benzol (benzene), and do not even discolor this solvent. The resin is then cooled and crushed.

The lacquer preferably is formed by using the highly insoluble resin prepared in the manner described by dissolving the resin in a special solvent, such as furfural, and compounding in accordance with the following formula:

Furfural-acetone resin, 400 grams; furfural 1500 cc.; benzene, 100 cc.; amyl acetate, or ethyl acetate, 1200 cc.; celluloid, 6 grams; oil of cassia 10 cc.; oil of lavender 10 cc.

The benzene and the acetate serve as thinners, or diluents. The essential oils disguise the odor of furfural and also resinify with heat; and the celluloid improves the ink-holding quality of the coating and tends to toughen the film.

The preferred manner of compounding the materials is to dissolve 400 grams of the highly insoluble furfural-aceton resin, prepared as described above, in about 1400 cc. of furfural, by heating to the boiling point for about twenty minutes; to add 500 cc. of an acetate (such as amyl or ethyl) while the solution is warm; to dissolve six grams of celluloid in 100 cc. cold furfural and add same to the solution; then mix 500 cc. of an acetate, such as ethyl acetate and 1000 cc. of benzene and add to said solution; and finally add the essential oils, i. e., oil of lavender and oil of cassia.

After the transfer ink has been washed off, the "sensitive" areas, or image, on the gummed plate, the lacquer, prepared as described, is wiped over the entire plate with a rag and rubbed down into a thin, smooth coating. For best results, the plate is then heated at about 100° C. for about one-half hour. This renders the resinous material even more insoluble. The plates may be sent directly to the press when cooled, in which case the water from the damping roller of the press, coupled with the operation of the press, will disintegrate and remove the coating between the areas which have received the permanent coating. If preferred, however, the coating applied over the gum arabic coating may be removed by washing with water before sending the plates to the press. In any case, the lithographing ink will adhere only to the image in the printing operation.

The improved lacquer, prepared as described, possesses high penetrating qualities. The improved coating is of such chemical insolubility in inks, and its resistance to mechanical abrasion on the press in such as to render the product far superior to a plate having simply an albumin coating, or a coating of other materials, such as have previously been used, including asphaltum. In fact, the improved lacquer provides an image far superior to that afforded by such coatings as albumin, asphaltum, or the like, even though the plate is not subjected to the heating operation after the lacquer has been applied thereto. On the other hand, when the plate is subjected to the heating operation, the resin in the lacquer, which previously remained potentially reactive in some degree, is transformed into its ultimate insoluble and resistant condition, in which condition it is no longer soluble in furfural.

While it is preferred to employ furfural as a solvent for the furfural-aceton resin, any special solvent which will dissolve the resin in the highly insoluble condition may be employed. Aniline, or nitro-benzene will act as solvents, for example. However, such solvents possess objectionable properties, having bad odors and being of poisonous character. In any event, the solvent should be such that the dissolved resin can be wiped

over the "sensitive" area of the plate, and afford a thin, smooth coating; also, the solvent should be such as to dry at a reasonably rapid rate after the film of lacquer has been applied.

What has been referred to as "transferring ink" is the colored, greasy compound which is applied to a photo transfer plate and which adheres to the resistant coating applied to "sensitive" areas protected originally by transfer ink, an ink image having been transferred to the plate and removed, after first covering the intervening spaces with gum. Such an ink contains an oil, or a grease. It may be readily washed off the picture by means of alcohol benzine, or turpentine.

Synthetic resins which are highly insoluble in oils, inks, or the solvents ordinarily used in lithographic processes are preferable.

The manner in which the process is practiced is illustrated in the accompanying drawing, in which—

Fig. 1 is an elevational view of a plan having ink characters, or designs, printed thereon, illustrating the first step of the process; Fig. 2 illustrates the condition of the plate after the application of the protective coating to the areas not covered by the ink; Fig. 3 shows the condition after the ink has been removed; Fig. 4 illustrates the condition after the lacquer has been applied; and Fig. 5 illustrates the condition after the lacquer has been finally hardened and the protective coating removed.

In the illustration in the drawings, A designates a plate, such as a zinc plate; and B, B designate the printing characters, or printing areas, formed on the plate in accordance with the improved process. The plate first has applied to its surface at the areas designated 1 the ink characters, or designs, 2. The areas of the plate not covered by the ink are designated 3. After the application of the ink, as by a transfer method, a protective coating, such as gum arabic, designated 3^a, is applied to the areas 3. The ink is then wasked from the plate, leaving the areas 1 bare and in proper condition to receive the lacquer. The lacquer, designated 4, is then applied in any suitable way, as, for example, by rubbing a thin coating of the lacquer over the entire surface of the plate. The lacquer fills the spaces between the areas covered by the protective coating, and a thin film of the lacquer may also cover the protective coating. The plate is then subjected to heat treatment which has the effect of converting the lacquer to the final hard, resistant state and causing the lacquer to become securely set on the plate.

The protective coating and the overlying film of lacquer may be removed, leaving the plate in the condition shown in Fig. 5. This may be accomplished by what is known as a developing operation. If preferred, however, the protective coating may be allowed to remain on the plate and it will disintegrate and disappear when the plate is used.

On the drawing, suitable legends are employed to facilitate an understanding of the invention. No undue limitations should be understood therefrom.

In place of the furfural-acetone resin employed in the lacquer, one may employ other suitable furfural resins, or other synthetic resins. For example, one may employ furfural resins prepared in accordance with the description given in the patent of Beebe, Murray and Herlinger, Number 1,587,269, granted June 1, 1926, or in the patent of Beebe, Murray and Herlinger, Number 1,587,273, granted June 1, 1926.

As another example, one may employ a phenolic condensation product, or phenol resin, prepared in any suitable manner and having incorporated therein suitable sensitizing agents, or suitable accelerating agents. Thus, one may prepare a phenolic condensation product by any of the well known processes in such manner as to produce a resin closely approaching the infusible stage, may incorporate in such resin suitable sensitizing agents, or accelerators, the resins still being soluble in a special solvent, and still potentially reactive in some degree, may prepare a lacquer from such a resin, and may apply it to the "sensitive" areas of the plate in accordance with the invention, and may then cause the reaction to proceed to render the resin still more resistant and insoluble and produce a permanent resistant coating at the areas which are to serve as the ink-transferring portions of the plate.

In any case, the resin employed in the lacquer preferably should be highly resistant to the solvent action of solvents of the order of benzene, acetone, etc., but should still be soluble in some special solvent; and such special solvent, in connection with suitable thinners, should be of highly penetrating character. Also, the lacquer should be of such character that it can be applied as a thin, smooth layer.

As has been indicated, it may be desired to incorporate in some of the resinous lacquers, such as a lacquer embodying a phenolic condensation product, a halogen-liberating agent, such as a metallic halide, iodoform, or some ingredient which will liberate halogen under the action of light, so that the halogen will be free to act as a catalyst to expedite further hardening of the resin. As an illustration a metallic halide, in colloidal form, may be introduced into a varnish, or a lacquer, by introducing small percentages of drying agents, such as lead resinate, lead oxide, or other metal salts, and introducing also a small percentage of a halogen, such as iodine. The halogen will combine with the metallic salt to form a metallic halide, which remains dispersed in colloidal form throughout the var-

nish. In the case of a phenolic resin an easier method, and perhaps more satisfactory, is to incorporate in the resinous lacquer about 3% of iodoform.

A light-sensitive varnish, or medium, embodying a phenolic condensation product, is disclosed, for example, in Beebe, Murray and Herlinger Patent Number 1,587,270, granted June 1, 1926.

Natural resins are not adapted to yield the highly resistant, insoluble printing surface desirable, and the artificial resin employed in the lacquer must be potentially reactive and capable of passing, in the final hardening operation, into the infusible and substantially insoluble condition.

This application constitutes a division of our application Serial No. 4103, filed January 22, 1925.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, but the appended claims should be construed as broadly as permissible, in view of the prior art.

What we regard as new, and desire to secure by Letters Patent, is:

1. The process of preparing a plate for the purpose set forth which comprises: applying to a metal plate an image, design, or character comprising a compound of greasy or oily character, applying to the plate a protective coating, removing from the plate the first-mentioned compound, thus leaving "bare" areas of the plate exposed, applying a lacquer comprising a potentially reactive synthetic resin, and transforming the synthetic resin to the final insoluble condition by heat.

2. The process of preparing a plate for the purpose set forth which comprises: applying to a metal plate an image, design, or character comprising a compound of greasy or oily character, applying to the plate a protective coating, removing from the plate the first-mentioned compound, thus leaving "bare" areas of the plate exposed, applying a lacquer comprising a synthetic resin, and subjecting the coating formed by the lacquer to hardening treatment to increase its insolubility and resistant character.

3. The process of preparing a plate for the purpose set forth which comprises: applying to a metal plate an image, design, or character, comprising a compound of greasy or oily character, applying to the plate a protective coating, removing from the plate the first-mentioned compound, thus leaving "bare" areas of the plate exposed, applying a lacquer comprising a synthetic resin, subjecting the coating formed by the lacquer to hardening treatment to increase its insolubility and resistant character, and removing the protective coating and overlying lacquer.

4. The process of forming a plate for the purpose set forth, which comprises: applying to a metal plate an ink transfer, and applying to the plate a protective coating, then washing off the ink transfer with a suitable solvent, then applying a lacquer coating comprising a synthetic resin which is highly insoluble but still reactive, then heating the plate to "transform" the lacquer coating to the final non-reactive state and cause it to become set on the exposed areas of the plate, and finally removing the coating at the other areas.

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