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PRODUCTION OF STEREOTYPES.

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This invention relates to an improved method of producing stereotypes and printing surfaces. The present methods employed in the duplication or multiplication of existing raised printing surfaces in a material capable of standing the wear of printing, has generally necessitated the use of heavy, brittle and unwieldly metal stereotypes. These are expensive and difficult to reproduce, often subject to distortion or shrinkage, costly to send through the post and easily liable to become damaged or broken.

Further, to obtain such duplication in material other than stereo metal has usually hitherto entailed the preliminary cost of an expensive die and the time necessary for its preparation.

The object of the present invention is to provide a method of obtaining stereotypes and other printing surfaces which will enable a cheap, extremely durable and accurate printing surface to be speedily obtained.

Broadly according to this invention stereotypes and like printing surfaces of a hard and durable nature and also the matrices for producing them are obtained by utilizing a suitable base, for instance paper, cellulose, paper pulp or other suitable substance which can be subjected to the treatment referred to in the following description, impregnated with and treated with a composition which has the result of rendering the said base hard or fairly hard, after the base and impregnant have been placed in a press carrying either an original or a matrix, the base then being subjected to heat under pressure.

According to the present invention I do not propose to employ exclusively a metal or metal alloy as the material to form the stereotype or printing surface, but I subject to a special process an absorbent substance for instance filter paper, paper pulp in sheet or mass form, cellulose or the like impregnated with an aldehyde, a coal tar intermediate and a small proportion of an alkali salt. The aldehyde is formaldehyde, and the coal tar intermediate is preferably carbolic acid (phenol). The salt can be a salt of potassium, sodium or ammonium. A material selected from the chromium oxides, chromates and dichromates, for instance ammonium chromate or dichromate, is added subsequent to the amalgamation of the formaldehyde, phenol and alkali salt.

The following is a proper proportion by weight of substances which are involved in the first step of the complete process: Carbolic acid (crystals) C_6H_5OH, 12 lbs.; formaldehyde (40%) CH_2O, 12 lbs.; potassium hydroxide KOH, 2½ to 6 ozs.

These substances are intimately mixed in a suitable container, preferably enamel lined, and with constant stirring brought to boiling point. At about this stage the seething and effervescence can be intensified if a piece of aluminum metal is placed in the mixture and left there throughout the process. Though practically unaffected the aluminium serves to emphasize the progress of the reaction. The same effect can be produced by a little boric acid, a suitable amount commensurate with the proportions of substances quoted being ⅛ to ¼ of an ounce.

The mixture is kept boiling, preferably with constant stirring, until this first seething has subsided and until, after an interval, a second seething begins to appear. It is chiefly to indicate this stage by making the second seething more evident, that the addition of aluminium or boric acid is useful as otherwise it is not so easy to follow the progress. At this point the strong smell of formaldehyde begins to disappear and is replaced by a not unpleasant aroma. Great care must be exercised that the boiling is not carried too far or the whole mixture may suddenly solidify into an insoluble mass. Moreover, if the mixture is boiled too much it will not have sufficient plasticity or solubility for the purpose in view and if it is not boiled enough it will be too thin and too fluid. The more the mixture is boiled the less chromate can be used, and the adjustment of the amount of chromate to the degree of boiling gives some latitude in the operation of the process. As a rough guide it may be indicated that if on the foregoing quantity the heat applied requires 30 minutes to produce the first seething, the mixture will be ready after about another 30 minutes of the same heat. Varying quantities require varying times according to the degree of heat applied and the amount of potassium salt used.

When this stage is reached and the well known pungent smell of formaldehyde has become hardly noticeable, a quantity of cold water is added which reduces the temperature and may produce a slight cloudiness in the mixture which will disappear when the continued heat again raises it to boiling point. A suitable quantity of water is about 2½ lbs.

The mixture is now cooled to about normal

atmospheric temperature by any suitable cooling means, and I then add a previously prepared solution of: Ammonium dichromate $(NH_4)_2Cr_2O_7$, 2½ to 5 ozs.; ammonium hydroxide .880, 4 to 8 ozs.; water, 4½ to 8 lbs. I also find it useful to include in the above solution about ¼ oz. of copper hydroxide. Instead of the ammonium dichromate the proportionate amount of ammonium chromate can be used. When the above solution has been added to the mixture it is well stirred and then if necessary a small quantity of methylated spirits (3 to 12 ozs.) or other form of alcohol is added, and a small further excess of ammonium hydroxide. This combination has the effect of keeping the mixture in its water-soluble state despite the addition of the dichromate, the importance of which will appear hereafter.

A further addition of glycerine, from 2 to 6 ounces, can be made to the mixture for reasons which will also appear hereafter.

Other chromates can be used but I prefer the ammonium salt on account of the volatility of the ammonium and the comparative ease with which it effects combination. When for any purpose it is desired that the product should dry rapidly it is preferable to use calcium chromate. Sodium or potassium chromate or dichromate are less useful on account of the potassium already incorporated in the mixture. Chromate acid (chromium trioxide) can also be used, but has a tendency to cause precipitation when used alone. Copper, aluminium, zinc and other metallic chromates can be used, preferably dissolved in a sufficient quantity of chromium trioxide and water. It is also possible first to neutralize the KOH with an acid, for instance nitric or hydrochloric acid, adding a smaller quantity of ammonium dichromate afterwards.

With the mixture, which has now a more or less syrupy consistency according to the degree of boiling and the amount of water used in the foregoing processes, I proceed to impregnate, for instance, sheets of filter paper, (some grades of commercial blotting paper can be also used but are not so reliable), cellulose or paper pulp, either by means of immersion, spraying, coagulation, or with a brush, and these sheets are hung to dry at ordinary atmospheric temperature upon lines. If the base is in mass or powder form it can be dried in shallow trays. The sheets or pulp can be made to dry more thoroughly for certain purposes by means of the previous addition to the mixture of a small quantity of some drying salt, for instance calcium borate, or on the other hand their drying can be retarded as previously indicated by the addition of a quantity of glycerine.

For ordinary purposes and to secure deep impressions the sheets should not be allowed to dry hard and stiff but should be used while containing sufficient retained moisture or glycerine to make them soft and flexible. After some hours upon the lines it is advisable to remove the sheets and to store them in some air-proof container in a cool place ready for use as required.

These impregnated sheets can be used for the production of both intaglio matrices and stereos in relief. The matrix, however, is usually easier to produce as it is simply necessary to press the plates or type into the surface. When duplicating from the matrix, however, it is necessary to mould the stereo sheets to project beyond their own normal surface. Therefore the sheets used for the intaglio matrices may be much dryer and less pliable than those used for making the stereos in relief. The effect of a sufficient quantity of a chromium salt is to prevent the matrix adhering to a stereo made of the same material. This effect can be enhanced if a greater quantity of chromate is introduced into the sheets intended for use as matrices. This can be done for instance, if a number of the ordinary sheets, after partial or complete drying, are immersed in a two-five per cent solution of ammonium or other chromate or dichromate preferably with an excess of ammonium hydroxide added to facilitate the absorption of the solution by the sheets. These sheets are then hung up again until dry and can then be distinguished from the ordinary sheets by a somewhat deep red colour and by their greater stiffness and lack of flexibility. The extra amount of dichromate thus introduced into the sheets used for matrices will effectively prevent the sheets used for stereos from adhering to them, and will also further strengthen the matrix. A hundred or more stereos can easily be taken from a single matrix.

When it is desired to obtain reproductions of blocks, cliches or plates with only very shallow etching (for example the half-tone blocks used for newspaper photographs) it is only necessary to clean the surface of the block with plumbago or talcum-powder or a paste of these made with olive oil, vaseline, or certain other similar vehicles.

The number of sheets of impregnated filter paper to be used depends upon the thickness of the matrix or stereo which it is desired to make. For deep line engravings about eight sheets of ordinary filter paper may be used for the matrix, and one less for the stereo, but for shallow etching three or even two sheets may serve.

It is characteristic of the mixture with which the sheets are impregnated that under the influence of sufficient heat it is rendered temporarily fluid, while the continuance of the heat makes it then become solid, and if the process has taken place under sufficient pressure the resultant product will have great strength and durability. This fact is taken advantage of in the manner now described.

The sheets are pressed upon the selected

plate or type at considerable pressure to obtain a negative reproduction of the printing matter, the parts which are in relief on the plate being in intaglio on the matrix. To achieve the best results the press should be capable of a pressure of at least 300 lbs. to the square inch. Both the upper and lower platens of the press are heated by any suitable means, a good temperature being approximately 300 degrees Fahrenheit. Still better results can be obtained if the platen which bears against the sheet of impregnated material (usually the top platen) is hotter than the other platen, for instance about 340–360 degrees Fahrenheit. As a general rule the plate or type should be heated in the press before the sheets are imposed thereon, as this will prevent the entire or too copious flow of the impregnant from the surface to the sunken parts. Thus under the influence of simultaneous heat and pressure an exact reproduction of the plate or type will be sunk into the imposed sheets.

The length of time of the pressing operation varies according to the degree of heat employed, the relief of the printing surface, the proportion of moisture in the sheets and the number of sheets forming the matrix. However the pressing operation need not in most cases exceed six minutes, and normally it need only take three minutes.

In order to prevent the back sheet sticking to the exposed platen of the press I usually cover this sheet with an extremely thin plate of steel the surface of which, next to the impregnated sheet, is wiped over with a mixture of vaseline and talcum-powder, so that only an almost imperceptible film remains. To this plate the sheets will not adhere except, perhaps, slightly at the edges from which however they can be easily and cleanly detached.

When the sheets are removed from the press they will be in a tough consistent and somewhat flexible board which will stand considerable rough usage, and cannot be easily broken. If there is any tendency of the sheets to stick to the printing plate, it is due to the exuded excess of impregnating substance hardening not under pressure around the edge of the matrix or printing plate. By inserting a sharp tool under the edge of the matrix or plate the separation becomes easy.

Before the matrix can be used for reproduction it must be thoroughly cooled. The surface of the matrix should be brushed over with a mixture of a vehicle such as vaseline or olive oil made into a paste with talcum-powder or plumbago or the like, which should then be well brushed out of the crevices of the matrix. This should be done each time a new stereo is to be taken from the matrix.

This matrix can now be employed for reproducing from it any desired number of copies of the original printing plate by merely substituting the matrix for the printing plate and repeating the operation, with the following modifications. The cold matrix bearing the superimposed impregnated sheets is placed upon a cold metal plate of 3/8 to 5/8 of an inch thick, the press being brought into operation as speedily as possible. By this means the heat of the platen applied directly to the impregnated sheets has its effect upon those sheets considerably in advance of the heat of the other platen which must traverse both the plate upon which the matrix is placed and the matrix itself, and consequently at first the impregnating substance will tend to move towards the surface and into the recesses of the matrix where the pressing action has preceded the action of the heat, thereby obtaining a reproduction having the finest detail (provided the etching is not so deep as to require the special treatment hereinafter described) and hardened on the arrival of the delayed heat which has traversed the iron plate and matrix. A metallic or partially metallic surface may be secured by dusting or brushing the surface of the outer impregnated sheet with the desired metal in powder form before it is placed in contact with the matrix.

When medals, zincos and other originals are to be reproduced, and the recesses in the matrix are very deep, these recesses can, before the pressing operation, be filled in with matter that will unite with the impregnating substance of the imposed sheets. The filling substance is preferably absorbent but an absorbent filler may be mixed in certain proportions with finely powdered metallic substance for instance zinc. A suitable compound can be obtained in the following manner. A quantity of fine wood flour, say 1 lb. is impregnated with a solution made in the following manner. From two to three times the weight of this wood flour is taken from the original mixture as described herein, after boiling and cooling (i. e. before the addition of the dichromate, hydroxide or glycerine) and to this is added a solution of about ½ oz. of chromic acid (chromium trioxide) in from 6 to 12 ozs. of water. This is well stirred into the mixture and allowed to stand for some minutes, and is then intimately mixed with the wood flour and afterwards dried, first at a gentle heat and then at a temperature up to 300° Fahrenheit. When thoroughly dry this impregnated wood flour can be ground to a very fine and hard powder. The exact amount of chromic acid to be used depends upon the amount of potash in the original mixture and the degree to which it has been boiled. If too little chromic acid is used the resultant powder may be too light and soft for the purpose, and if too much is used the stereos may be too brittle. Zinc, copper, aluminium or other metallic chromates can be used dissolved in the chromic acid, or calcium chromate may be used in

place of or in addition to chromic acid. A very large number of metallic salts and metals in powder form can be mixed with the wood flour during impregnation and an actual printing surface largely or almost entirely metallic can be secured. When inserted into the sunken parts of the matrix the powder will resist the applied pressure and will also absorb the exuding impregnant so as to form a perfect replica in relief of the intaglio parts of the matrix. By means of this powder and the impregnated sheets an exact copy can be taken of a line block the entire thickness of which has been sunk into the matrix. Not merely the surface, as in the case of shallow etchings, but the whole thickness of the plate will stand out from the backing of the impregnated sheets, which even the greatest pressure (without the aid of the powder) could only force into partial conformation with the deeply sunken parts of the matrix. The powder above described becomes an integral part of the stereo forming with the sheets a strong whole which can be cut or sawn as required. When taken from the press the stereos can, moreover, be bent into any shape and they retain a degree of flexibility even when they have become quite cold.

It is also possible to impregnate the wood flour with the same impregnating substance as used on the sheets before the addition of the glycerine, but the special treatment described above gives a much better powder for the purpose and a more flexible stereo.

In place of or in addition to wood flour, charcoal, lampblack or other constituents may be used but are not so flexible, and wood flour without such admixture has the best natural advantages for general use. Powdered cork and asbestos can also be used.

When taking a matrix from hand set type, monotype, linotype, or other printing surfaces where there is no airtight background but invariably a large number of crevices and interstices between the letters or lines, it is advisable to proceed in the following manner. A paste of talcum powder or plumbago or a mixture of both and water is spread over the surface of the type, several sheets of blotting paper placed over the whole, which is then dried under heat and pressure in the press. The surface of the type is then brushed clean while the talcum-powder is left in the crevices beneath the actual printing surface where it was forced by the blotting paper. This can be done, for instance, by means of an ordinary brush attached to the sides of which are two pieces of flat wood beyond which the hairs of the brush barely project. By drawing this over the surface it is cleaned to the required depth. The talcum-powder remaining in the crevices will absorb the excess of exuding impregnant which might otherwise pass between the lines and letters and make it very difficult for the type to be separated. Further, instead of using many sheets of impregnated paper as in the case of plates or other originals presenting a solid background, it is advisable to interleave dry sheets of filter paper between the impregnated sheets so that no more impregnant shall flow into the type and talcum-powder than is necessary to get sufficient depth in the matrix. Perfect results from type and from type and illustration mixed can be secured by means of three or four sheets of impregnated paper interleaved with three or four sheets of dry filter paper. The type should be heated before the impregnated sheets are imposed as this impedes the flow of the impregnant into the crevices where it is not wanted. Instead of interleaving plain sheets it is possible to dilute the impregnant (without glycerine) with 33 to 100% its weight in water, to which sufficient alcohol has been added to keep the impregnant in solution. These thinly impregnated sheets are treated with a 2 to 5% solution of a chromate as already described.

The "stereos" produced from the matrices described in this process can be made of uniform thickness with only the very slightest variation, but where for any purpose the thickness of each stereo must be absolutely exact this can be secured by sandpapering or planing the back in a suitable machine. Otherwise the sole plant required to operate the process is one heated press. The stereos can be strenghtened by utilizing for instance a sheet of textile at the back of or among the impregnated sheets.

The "stereos" made by this process are resistant to any further application of heat, and an important consequence of this is that these stereos can be incorporated with the ordinary metallic type in cases where a "flong" matrix has to be taken of a composite page for reproduction by the ordinary casting process. If the matrices are used for casting metallic stereos they will outlast several ordinary "flong" matrices and give more perfect and deeper replicas of the originals.

It will be appreciated that the present invention in one embodiment briefly consists in obtaining printing surfaces from originals by pressing a matrix obtained from a porous fibrous or cellulose substance impregnated with formaldehyde, a coal tar intermediate, an alkali salt and a salt of chromium, upon a printing plate or type at considerable pressure, and allowing the matrix to become cold.

By means of my invention printing surfaces are obtained which are more durable than most cast-metal printing surfaces and cheaper to produce, a useful feature of my invention residing in the flexible nature of the printing surface when first produced

where it may be either bent around a printing cylinder or used upon any ordinary flat-bend printing machine. It is also possible to produce from one printing surface a large number of corresponding printing surfaces, whilst the process involves only a few minutes as compared with the existing laborious and lengthy process involved in the preparation of a number of similar printing surfaces.

I claim:—

1. The method of making printing plates and matrices therefor which consists in impregnating a sheet of plastic material with a phenolic condensation product in moist and water-soluble state and containing material selected from the chromium oxides, chromates and dichromates, subjecting said sheet to a drying process, placing said sheet in a press carrying an original and subjecting the sheet whilst in contact with said original to heat and pressure sufficient to harden said phenolic condensation product and to convert it to the non-water-soluble state.

2. The method of making matrices for printing plates which consists in impregnating a sheet of plastic material with a phenolic condensation product in a moist and water soluble state and containing material selected from the chromium oxides, chromates and dichromates, in partially drying said sheet, in immersing said sheet in a solution of ammonium dichromate, in subjecting said sheet to a further drying operation, in placing said sheet in a press containing an original and in subjecting said sheet whilst in contact with said original to heat and pressure sufficient to harden said phenolic condensation product and convert it to the non-water-soluble state.

3. The method of making printing plates and matrices therefor which consists in impregnating a sheet of plastic material with a phenolic condensation product in moist and water-soluble state and containing a chromate, subjecting said sheet to a drying process, placing said sheet in a press carrying an original and subjecting the sheet whilst in contact with said original to heat and pressure sufficient to harden said phenolic condensation product and to convert it to the non-water-soluble state.

4. The method of making matrices for printing plates which consists in impregnating a sheet of plastic material with a phenolic condensation product in a moist and water soluble state and containing chromate, in partially drying said sheet, in immersing said sheet in a solution of ammonium dichromate, in subjecting said sheet to a further drying operation, in placing said sheet in a press containing an original and in subjecting said sheet whilst in contact with said original to heat and pressure sufficient to harden said phenolic condensation product and convert it to the non-water-soluble state.

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