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METHOD OF MAKING PLANOGRAPHIC PRINTING SHEETS

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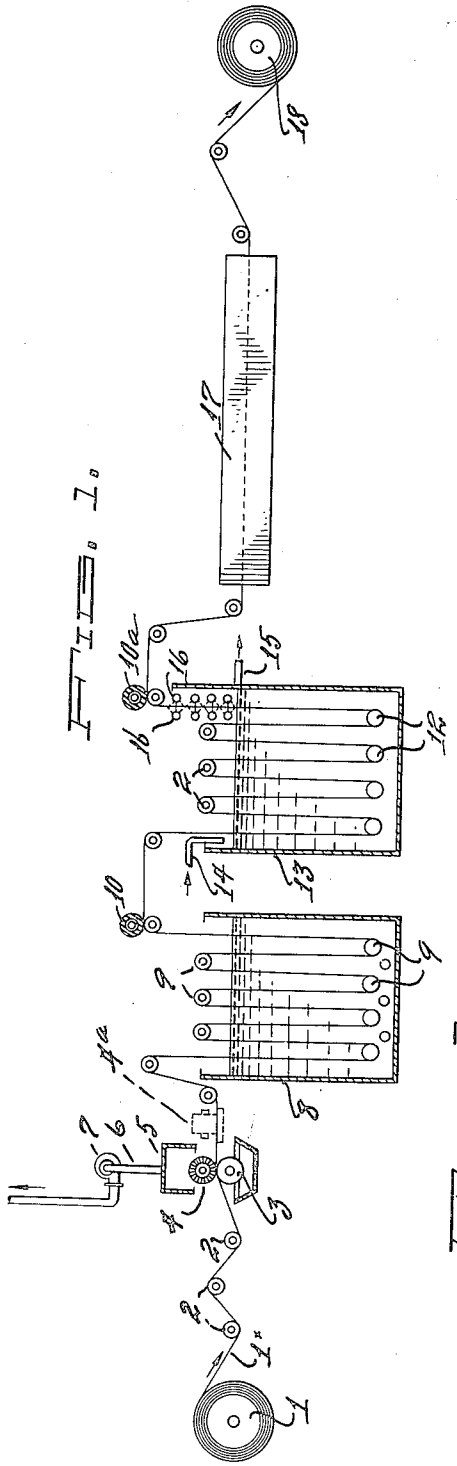


FIG. 1.

FIG. 2.

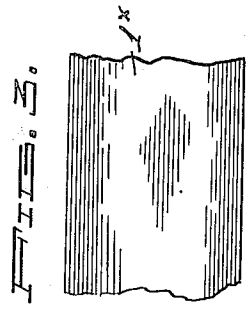


FIG. 3.

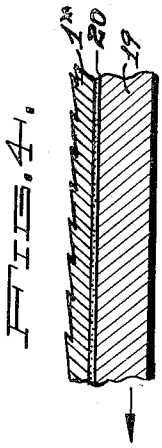


FIG. 4.

INVENTORS
O. Brooks Pollock,
Calvin L. Wilson and
Milton H. Pintsch
BY
H. Lee Helms
ATTORNEY.

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METHOD OF MAKING PLANOGRAPHIC PRINTING SHEETS

Orthello Brooks Pollock, Calvin L. Wilson, and Milton H. Pintell, Richmond, Va., assignors to Reynolds Metals Company, Richmond, Va., a corporation of Delaware

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This invention relates to planographic printing sheets such as those employed in the lithographic and lithographic graphic arts industry. An object of the invention is to provide an improved planographic, lithographic or offset printing plate.

Preparation of the improved planographic printing plate is accomplished by surfacing a selected light gauge metal foil such as zinc, aluminum, copper, tin, lead, or alloys formed by combinations of two or more of these metals by means of a rapidly rotating member preferably having filaments of special form which have a primary hammer-displacing action with a very minor metal removing action. By such process minute oriented depressions, regularly spaced across the surface of the metal, are formed, the depressions being greater in dimension in one direction, and further subjecting the surface of the printing sheet or plate, so produced, to the action of an aqueous solution of an alkali metal phosphate for a given period of time to effect the formation of a thin layer of metal phosphate on the surface of the plate.

The invention will be described with reference to the accompanying drawings in which Fig. 1 is a schematic view in plan and partly in section showing an assembly of units for carrying the method into effect;

Fig. 2 is a fragmentary view in elevation and partly in section showing schematically the zig-zag filament formation of the brush and its approach to a metal foil. In practice the filaments will be closely massed;

Fig. 3 is a schematic view in fragmentary plan showing the general line of action of the brush wire filaments;

Fig. 4 is a very greatly enlarged longitudinal section through a printing sheet constructed as a laminate structure and schematically indicating the wall overhang of the depressions according to the invention.

Referring to the drawings as shown at 1 a roll of metallic foil as, for example, tempered or full hard aluminum foil, a web therefrom being drawn over guide and tension rollers 2 and thence to a supporting roll 3. At the top of roll 3 and bearing upon the foil web is wire brush 4, the latter being shown schematically in Fig. 2. Above the brush is an exhaust box 5 having a conduit 6 leading to an exhaust blower 7. It will thus be seen that the zig-zag wire filaments of the brush act upon the foil web 1x longitudinally thereof. The grained metal surface thus produced is subjected to the action of an aqueous

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alkali phosphate solution to saponify any fatty components which may have remained on the foil. To this end the web is driven in looped formation through tank 8 the web being guided by sets of rollers 9. From tank 8 the foil web passes between squeeze rollers at 10 and then is led in looped manner over sets of rollers indicated at 12 in wash tank 13 wherein wash water may be led by pipe 14 and then through outflow pipe 15. At the egress end of tank 13 the moving grained foil may be subjected to cleansing sprays projected by a series of pipes or tubes 16 which may be apertured or have nozzles for that purpose. The foil web passes from wash tank 13 between the squeeze rolls 10a and thence through a drier 17 to a wind-in roll 18.

The longitudinal extending lines on the fragment of foil web 1x shown in Fig. 3 indicate the direction of action of the crimped wire filaments of the brush. The brush 4 may be supplemented, as shown in dotted lines 4a of Fig. 1 through the use of wire filaments carried by a transversely extending endless belt.

In Fig. 4 the grained foil 1x is shown mounted on a base sheet of paper or other fibrous material, or a light plastic and even woven fabric can be substituted. A base sheet is shown at 19 and an adhesive layer at 20.

For most satisfactory applications, tempered or full hard aluminum foil is preferred to provide for greater ease in handling to avoid wrinkling or distortion of the printing plate surface. Annealed aluminum of the previously indicated analysis or aluminum sheet of a temper or hardness intermediate between dead soft and full hard metal can also be advantageously employed. The grain or depression thus produced by displacement of the metal, as contrasted with a gouging or grinding action, is elongated with an overhang wall area.

According to the present invention, graining foil in web form, is accomplished by causing a continuous web of foil to move in contact with a rapidly rotating wire brush in which the filaments have longitudinal retraction and rebound, the brush rotating at sufficient speed to insure self-cleaning by centrifugal force. In practice, the moving web of metal contacts with such wire brush operating at surface speed of a minimum of 2200 feet per minute. Although surface speeds of the brush can exceed 2200 surface feet per minute, it has been our experience that this minimum speed must be maintained to insure satisfactory self-cleansing of the brush. Minimum surface speeds of 2200 feet per minute are

required when closely related brush bristles of from .001 to .005 inch diameter are employed. As the brush bristle diameter increased, the larger particle of metal displaced by the brushing action permits of reduction in brush surface speed. In consequence, when employing a brush having bristles of .007 to .009 inch in diameter, surface speed as low as 1500 to 1600 feet per minute can be satisfactorily employed.

Our experience has indicated that conventional metal wire larger in diameter than .010 inch performs no useful function and does not produce satisfactory planographic printing plate surfaces. Our experience has also indicated that the most effective wire brush bristle diameter is .003 inch with a maximum of .005 inch.

To provide for a more uniform grained or surface plate our investigation has indicated that the wire brush bristle is best crimped in a zig-zag form to insure a special resiliency or spring-like action. The preferred zig-zag pattern is one whereby the wire bristle is bent in the annealed state to a uniform shape whereby the included angle of the zig-zag runs from 90 to 175 degrees, is thereupon hardened to a state materially harder than the metal plate to be surfaced.

Prior to surfacing of the metal plate by means of the improved surfacing system described, we cleanse the aluminum foil or sheet by subjecting the tempered metal sheet to the action of aromatic or aliphatic hydrocarbons or selected organic solvents to materially remove all of the oils and grease normally present on the surface of tempered aluminum foil or sheet placed thereon during the rolling processes. Unless materially all of the rolling oils and other fatty substances are removed from the aluminum surface, these substances perform as lubricants and do not permit of the consistent production of a satisfactory or uniform surface.

Although the grained metal surface produced by our improved surfacing system is entirely satisfactory for photographic process, planographic printing plates or plates which are counter-etched or otherwise cleansed prior to application of a light sensitive medium, the surface so produced can be materially improved by further subjecting the surface plate to the action of an aqueous alkali phosphate solution to insure complete saponification of those fatty components capable of saponification and further insure complete removal of any oil, grease or fatty substance that might deleteriously affect the final performance of the plate.

Our investigation has indicated that a one-half to 5% solution of tri-sodium phosphate maintained at a temperature of 160 to 210 degrees Fahrenheit will satisfactorily cleanse the metal surface of fatty substances and will, in addition, insure the formation of a hydrated aluminum phosphate or oxyphosphate layer on the plate surface, the thickness of which can be controlled to insure any desired degree of plate sensitivity. In practice, we prefer to cause the surfaced aluminum foil or sheet to be subjected to the action of an 0.8% aqueous solution of tri-sodium phosphate maintained at a temperature of 210 degrees Fahrenheit for periods of from 15 seconds to 3 minutes dependent upon the original cleanliness of the surfaced aluminum plate and the desired degree of plate sensitivity. Aluminum foil or sheet ranging from .0008 inch to .025 inch can be successfully surfaced by our improved surfacing procedure, but the surfacing method is unique in its ability to surface metal

gauges as light as .0008 inch thicknesses, because the metal can be supported by a backing roll during the surfacing process. Commercially metal gauges in the range of .001 inch to .018 inch have been discovered to be most useful. Lighter metal gauges are in turn mounted to a more inexpensive supporting base stock such as paper to provide for more ready handling of the plate.

The normal graining depth will range from .00005 inch to .0002 inch and it will be seen that a useful plate surface can be secured with a thin gauge metal foil, slightly heavier in gauge than the depth of the grain. In practice, however, although light gauge metals below .001 inch can be successfully grained or surfaced by our improved procedure, we prefer to limit the lower thickness to .001 inch because of the greater prevalence of pin-holes normally present in aluminum foil gauges below this gauge. .001 inch thickness full hard aluminum foil is normally too thin for ready handling by most typists and in addition requires special adapters when employed in standard commercially available planographic process printing presses and in consequence practical experience has indicated that metal gauges below .003 inch thickness are more useful when mounted or bonded to specially selected bases or other fibrous or paper base stocks.

It has been our experience that the plate produced by mounting the previously surfaced and cleansed metal foil sheet tends to emboss during the typing procedure, when the paper or fibrous base metal mounted plates are typed. This is caused because of the softer character of the paper or fibrous base which may be employed, and the very thin cross-section of the metal foil which does not provide sufficient rigidity to insure obviation of this embossing characteristic. Although this difficulty can of course be overcome by the use of a heavier gauge metal foil or sheet, economic reasons in some instances are such that the use of a light gauge metal foil is indicated to insure the production and offering of a planographic printing plate competitive in cost with commercially existing plates.

We have discovered that the use of a hard, dense or treated paper or fibrous base stock will greatly minimize this embossing characteristic when the plates are typed, but we have discovered that the use of a specially selected alkali metal silicate will materially or completely obviate this embossing characteristic when a selected alkali metal silicate is employed as an adhesive to join the previously surfaced and cleansed aluminum foil to the paper base stock.

The result of our investigation has indicated that although most potassium and sodium silicates perform as more or less satisfactory adhesives, excellent adhesion and material improvement in resistance to embossing can be secured when a sodium silicate adhesive is employed comprising a Na_2O to SiO_2 ratio of 1 to 2.90 is employed. Although this Na_2 to SiO_2 ratio is most preferred, satisfactory fibrous base aluminum foil mounted plates have been successfully produced with sodium silicates having ratios of 1 to 2.10 to 1 to 3.30.

Mounting of the light gauge surfaced and cleansed aluminum or metal foil is accomplished on specially designed and constructed machines that apply a thin layer of sodium silicate to either the fibrous base or aluminum foil, causing both to be joined together, and then causing the joined foil-fibrous base stock to be passed through an oven or drying tunnel to materially

remove excess moisture normally present in the sodium silicate. A satisfactory nominal moisture percentage of both the paper and sodium silicate adhesive would run from 1 to 12% with a preferred range of 5 to 7% contained moisture. It has been our experience that this sodium silicate adhesive materially resists the pressure of the typing operation insuring the preparation of a plate consistently free of the embossing effect caused by the typing process when other adhesives are employed.

Having thus described our invention, what we desire to secure by Letters Patent is as follows:

1. A method of making planographic printing sheets by dislocating or displacing relatively soft metal without removal of substantial material therefrom in a moving foil to produce a grained surface having a grained depth of .00005'' to .0002'' comprising moving continuously a clean foil web and treating said web with at least one rotating brush having relatively hardened metal bristles each bristle with a plurality of zig-zag configurations therein having an angle of from 90° to 175° between the elements forming each zig-zag configuration and rotating said brush at a surface speed of at least about 2200 feet per minute for bristles having a diameter of 0.001'' to 0.005'' to a surface speed of about 1500 feet per minute for bristles having .009'' diameter, whereby foil metal is displaced to produce a grained surface sheet of minute depressions having overhanging ledges.

2. The method of claim 1 wherein the surface speed is at least about 2200 feet per minute and the bristle diameter is 0.003'' to 0.005''.

3. The method of claim 1 modified by treating the grained surface sheet with 0.5 to 5.0% solution of trisodium phosphate at from about 160° F. to about 210° F. to produce an oxyphosphate surface on said grained sheet.

4. The method of claim 1 wherein the foil thickness varies from 0.001 to 0.025''.

5. The method of claim 4 wherein the foil thickness is less than 0.003'' and said foil is bonded to a flexible fibrous backing base.

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