Patented Aug. 24, 1937

2,090,704

UNITED STATES PATENT OFFICE

2,090,704

EMULSOID INKS

George S. Rowell, Cleveland, Ohio, assignor, by mesne assignments, to Addressograph-Multigraph Corporation, Cleveland, Ohio, a corporation of Delaware

No Drawing. Application September 13, 1933, Serial No. 689,288

4 Claims. (Cl. 134—35)

This invention relates to emulsoid inks for planographic printing and to a method of making the same and it consists in milling into a pigmented varnish vehicle of a planographic ink an aqueous ink-repellent composition, effective to maintain the non-printing areas of a printing plate substantially free from ink, comprising a thickening agent which may be and preferably is an organic colloid and sometimes, but not always or necessarily, comprising glycerin, said composition having a viscosity higher than that of glycerin alone, whereby is obtained an emulsoid ink of the water-in-oil type of high colloidal stability, all as more fully hereinafter described and particularly defined in the claims.

The use of emulsoid inks for planographic printing, which process depends fundamentally upon the immiscibility of oil and water, has heretofore been suggested to the end that the dampening of the printing plate as a separate operation might be avoided; but so far as I am aware all emulsoid inks heretofore suggested or used have had in common the objectionable feature of "breaking" or demulsifying in the ink fountain. In order to be commercially feasible, the inclusion of an aqueous dispersed phase in a printing ink must not change in any substantial manner those physical characteristics of the ink which are requisite to the satisfactory fulfilment of its function as a printing-image inking means. When an emulsoid ink "breaks" in the ink fountain or suffers such partial demulsification therein that separation of the aqueous phase or some of it occurs on the ink-distributing rolls, the uniform distribution of ink is interferred with, the printed image is dull and sometimes of actually lowered color saturation, and sometimes a stipple is produced. It is to the elimination of these undesirable effects due to demulsification of emulsoid inks that this invention relates.

The dampening operation, which the emulsoid inks of this invention are designed to accomplish simultaneously with the inking of the printing image, must comprise three functions in order to be effective for commercial operation. These are (1) the maintenance of the non-printing areas in a moist condition, (2) the maintenance of the non-printing areas in a hydrophilic condition, and (3) the displacement from the non-printing areas of any ink which may have become mechanically attached thereto notwithstanding the hydrophilic and moistened condition. It is not enough therefore that the emulsoid ink should contain a mere dampening agent, such as glycerin for instance. Because of the abrasion to which the plate is subjected by the repeated passage thereover of the inking rolls during the printing operation, it is necessary that the dispersed phase dampening composition comprise some agent or agents capable of repairing any abrasive damage the surface may have suffered and of maintaining the non-printing areas in a hydrophilic and moist condition throughout. The adsorption of gum, as gum arabic for instance, from the dampening composition by the metal surface provides a hydrophilic filmiform layer on the non-printing areas; but in practice it is found that such a layer moistened with water alone is not capable of maintaining these surfaces free from ink for long. An acidic cleaning agent, as dilute phosphoric acid or ammonium acid phosphate, is needed to displace or cause the detachment of any ink which may have become mechanically attached to these surfaces. To be effective the cleaning agent must be in aqueous solution; but solutions of these agents even when combined with a large proportion of glycerin are of very low viscosity as compared to that of the body of the ink, and if emulsified in the latter in effective proportions produce emulsions of low stability.

It is an object of this invention to provide a method of making dual-function emulsoid inks of the water-in-oil type suitable for planographic printing and characterized by a high colloidal stability. Another object is to make an ink of the type described which is free from the above-recited objectionable features of prior inks, and which will in addition print a dense solid color without stipple or other objectionable evidence of the emulsoid character of the ink. A further object is to provide an emulsoid ink comprising a colloidally dispersed aqueous phase capable of maintaining the non-printing areas of a planographic printing plate hydrophilic and moist and free from extraneous ink throughout the printing of large editions therefrom, the composition of said aqueous phase being characterized by a viscosity higher than that of glycerin alone. Other objects and advantages will become apparent as the description proceeds.

I have discovered as part of this invention that a high degree of colloidal stability may be obtained in an emulsoid ink by imparting to the dispersed aqueous phase thereof a viscosity higher than that of commercial C. P. glycerin alone. For the purpose of this specification the viscosity of commercial C. P. glycerin at 20° C. is considered to be 6 C. G. S. units (centipoises).

I am aware that glycerin and salts of widely variant types have been heretofore proposed for the dispersed phase of the emulsified inks. I am also aware that gums, such as gum arabic for instance, have in general been used as important constituents of fountain solutions and etches because of their well known desensitizing properties, but I know of no prior suggestion to the effect that such gums might advantageously be used in such amounts as to impart to an ink repellent solution a viscosity higher than that of glycerin alone. The inclusion with glycerin of "liquid gum" which might be either gum arabic, gum tragacanth, or other gum in solution has been proposed. But such proposed aqueous compositions are inherently incapable of increasing the viscosity of glycerin.

The class of thickening agents suitable for the purposes of this invention includes, in the order of their descending preference, gum tragacanth and agar agar, gelatin, starch acetate, locust bean extract, and gum karaya.

For the etching component of the thickened repellent I prefer to use a solution of ammonium acid phosphate and nickel nitrate; but other and commonly used etches may be employed.

A typical formula illustrative of thickened repellents which I have found to be effective for my purpose is given below:

Glycerin C. P.	520 cc. (approximately 655 grams)
Water	120 cc. (120 grams)
Ammonium acid phosphate	5 grams
Nickel nitrate	1 gram
Gum tragacanth	30 grams

In general and particularly when using my preferred thickening agent, gum tragacanth and glycerin, I recommend that the thickening agent be stirred into the glycerin first and then add the salts dissolved in the requisite amount of water. In this manner I avoid the formation of lumps which are slow to dissolve.

When the ratio of water to glycerin is that given above, the thickening agent may, within the scope of the invention as defined in the claims, be varied over a fairly wide range to suit the consistency of the ink. If for example the amount of gum tragacanth in the formula be reduced to 15 grams, the viscosity of the composition at room temperature will still be somewhat higher than that of glycerin alone and high enough, when emulsified in an ink and in effective proportions, to impart such a high degree of stability to the resulting emulsoid ink as to substantially prevent demulsification in a usual ink fountain. I do not in general, and unless the ink is very stiff, recommend that the amount of gum tragacanth be increased over that in the given formula to more than about 45 grams, since then the stability of the resulting emulsoid ink becomes so high that the dispersed phase does not "break" satisfactorily to the plate and the use of the gum in excessive amount tends thus to defeat its purpose.

Gelatin, agar agar and other thickeners chosen from the above listing, may be substituted for gum tragacanth. Bactericides of suitable type and amount must be used with some of them when in aqueous solution, as is well known. Gum arabic is in general not satisfactory, and I do not recommend its inclusion for the reasons that not only must it be protected against bacterial action, but it is in general contaminated with impurities which are not compatible with the solution of my preferred etching salts, ammonium acid phosphate, ammonium nitrate and nickel nitrate; and also, when used in sufficient amounts in a stiff ink it renders the plate and particularly the blanket tacky and causes the latter to pick lint, which is objectionable.

Because of the hygroscopic nature of glycerin, I prefer to include it in my repellent especially when the relative humidity of the atmosphere is low, but its presence is not essential and the ratio of glycerin to water and thickener may be adjusted to suit any atmospheric conditions, or the glycerin may be omitted entirely if desired.

To demonstrate the high stability afforded by the emulsoid inks of this invention containing as the dispersed phase an aqueous ink-repellent composition of a viscosity higher than that of glycerin alone, I proceed as follows: An amount of the emulsoid ink to be tested sufficient for several thousand impressions is placed in a clean ink fountain of the usual type, run down on a properly etched plate and the press started. If the ink has too low a stability, the ink will break in the fountain within the first one or two thousand copies, whereas, if it has too high a stability, the plate will scum within the same printing range.

The stability of an emulsoid ink depends not only upon the viscosity of the dispersed aqueous phase, but also upon the ratio of the dispersed to continuous phase, and it varies inversely as this ratio of the dispersed phase to continuous phase is increased. In order to demonstrate the relative advantages of the high stability inks of this invention over prior art emulsoid inks, it is essential that the conditions be the same for both inks and that the inks to be compared contain the same proportion of dispersed phase. And inasmuch as the stability varies directly with the degree of dispersion the latter is also a factor and it therefore is essential that the mean size of the dispersed particle be substantially the same for both inks, as well as that the average departure from the mean be the same.

It is one of the advantages of the method of this invention that a mean particle size of about 5 microns with an average deviation of about 2 microns may be obtained readily, whereas, when an aqueous solution having a viscosity slightly less than that of glycerin is emulsified in the same ink vehicle, it is very difficult to produce a mean particle size as low as 5 microns, and even so the average deviation from the mean may be and frequently is of the same order as the mean. It follows in this case that many of the particles are too small to be freed readily to the plate and hence are mere surplusage in the ink, and that there are also many very large globules which tend to be squeezed out of the ink as it is forced between the ink-fountain roll and the ductor blade. Any attempt under these conditions to offset the production of uselessly small particles and of highly unstable large particles by increasing the amount of the dispersed phase is negative because of a corresponding and inevitable increase not only in the average departure from the mean, but in the mean particle size itself, according to the law of diminishing returns.

In marked contrast to prior art repellent solutions, the ratio of the viscous repellent of this invention to the ink vehicle may be varied over a fairly wide range to meet the requirements of the particular image to be printed and of the

prevailing relative humidity. In general, the greater the ratio of the non-printing area which must be moistened to the image areas which must be inked, the higher is the ratio of repellent to ink vehicle which is required to prevent the non-printing areas from drying between successive dampenings effected by the delivery thereto of repellent from the dual-function emulsoid ink. Under ordinary conditions, I find that the inclusion, in 130 grams of ink, of 62 grams of the thickened repellent, made up according to the illustrative formula given above, will maintain the non-image areas substantially free from scum for several thousand copies and will not disadvantageously "break" in the ink fountain. When, however, the prevailing relative humidity is below 35% or so, or the printing image consists of very few fine lines in a large expanse of non-printing area, I sometimes find it expedient to increase the repellent content of my ink by ten to thirty per cent of the amount given above, or alternatively, and particularly if the ink is of a very delicate color, I may maintain the given ratio of repellent to ink and make use in addition of conventional dampening means, as, for instance, when printing on very absorptive paper which necessitates an unusually abundant supply of moisture to the plate.

To determine the suitability of any thickener and the amount required to decrease the fluidity of any suitable etch to a viscosity greater than that of glycerin alone, it is merely necessary to dissolve the thickener in the etch, wait until equilibrium is reached and determine that the viscosity is, and remains, higher than that of glycerin alone at the same temperature. If the particular thickening agent is susceptible to bacterial action whereby the viscosity becomes lowered, known bactericides should be added before making the above-described test. When an agent has been found satisfactory from the standpoint of imparted viscosity, the suitability of the thickener in question as a component of an etch may be determined by testing whether under printing conditions the blanket does not pick lint from the particular paper to be printed upon and whether the scum-removing ability of an etch thickened therewith is not appreciably less than that of a like etch of the highest viscosity obtainable with glycerin in the absence of any other thickener. Since the determination of both of these factors is well understood, any one skilled in the art is deemed competent to make the tests without further directions.

I claim:

1. An emulsoid ink for planographic printing consisting of 130 grams of a pigmented varnish vehicle of a planographic ink and 62 grams of an aqueous ink-repellent composition containing approximately 1.9 to 5.4 percent of an organic colloid and having a viscosity higher than six centipoises.

2. An emulsoid ink for planographic printing consisting of 130 grams of a pigmented varnish vehicle of a planographic ink and approximately 62 to 80 grams of an aqueous ink-repellent composition containing approximately 1.9 to 5.4 percent of an organic colloid and having a viscosity higher than six centipoises.

3. An emulsoid ink for planographic printing consisting of a pigmented varnish vehicle of a planographic ink and an aqueous ink-repellent composition containing an organic colloid in an amount sufficient to impart to the composition a viscosity higher than that of glycerine.

4. An emulsoid ink for planographic printing consisting of a pigmented varnish vehicle of a planographic ink and an aqueous ink-repellent composition containing an organic colloid in an amount sufficient to impart to the composition a viscosity higher than that of glycerine, the mean size of the dispersed particles in said ink being about five microns with an average deviation of about two microns.

GEORGE S. ROWELL.