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722,058, Apr. 17, 1968, now abandoned.

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[54] **PROCESS AND COMPOSITION FOR PREVENTING
OFFSETTING OF DRYING PRINTING INK**
10 Claims, 3 Drawing Figs.

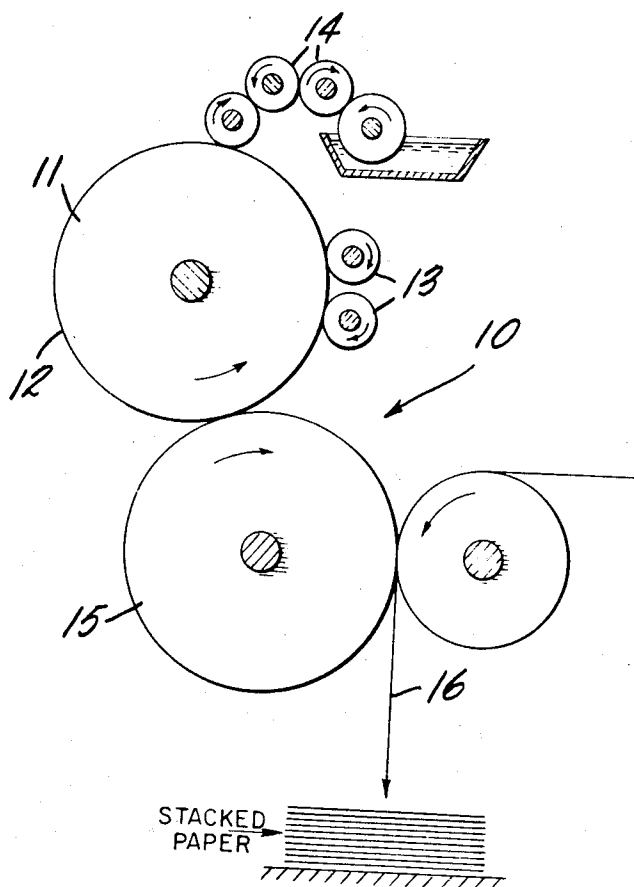
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ABSTRACT: A process and composition of matter for preventing undried ink on printed sheets of paper from off-setting or imprinting onto adjacent sheets, for example in a printing process employing a high-speed offset press, including the steps of forming a printing ink additive containing starch particles uniformly dispersed in a nonaqueous medium compatible with the printing ink, mixing the ink additive with the printing ink, contacting the starch-containing printing ink with water, and printing the ink on sheets of paper which are then stacked.



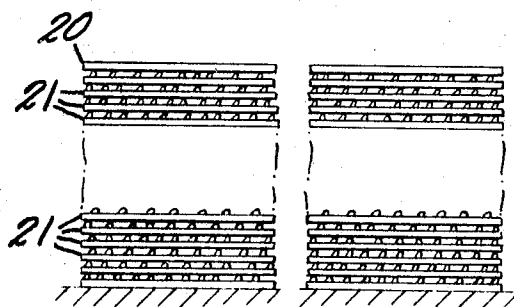
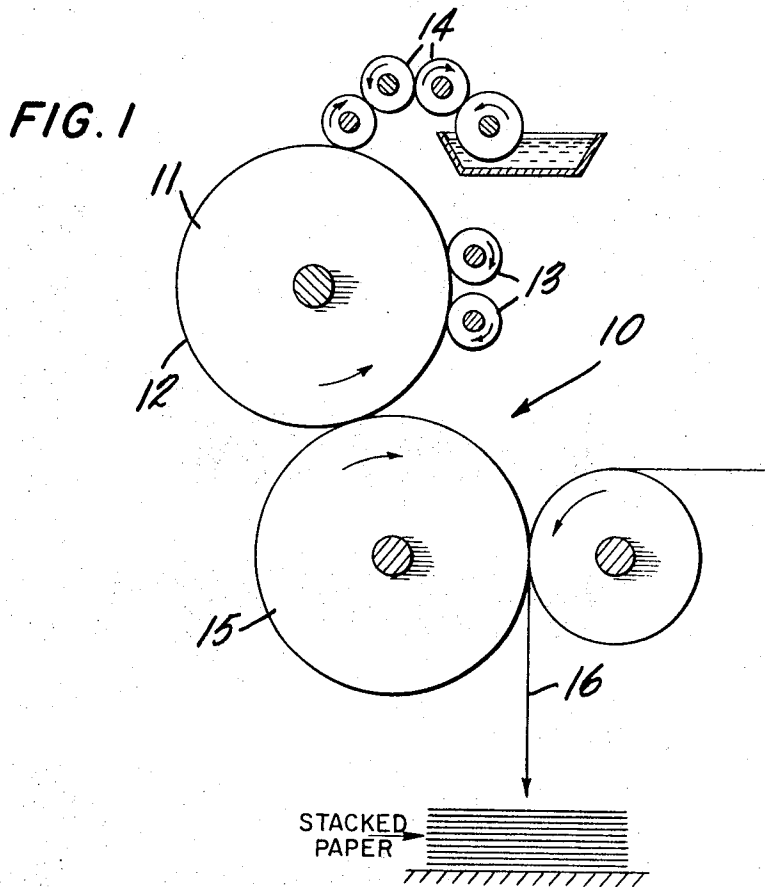


FIG. 2

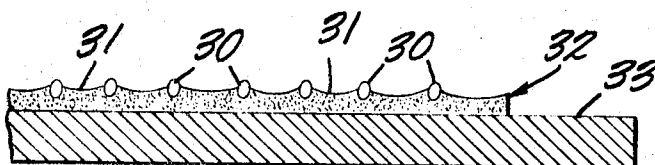


FIG. 3

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PROCESS AND COMPOSITION FOR PREVENTING OFFSETTING OF DRYING PRINTING INK

This application is a continuation-in-part of U.S. application Ser. No. 722,058, filed Apr. 17, 1968 now abandoned.

This invention relates to a process for preventing undried printing ink on printed sheets of paper from offsetting or imprinting upon adjacent sheets of paper. This invention also relates to a composition of matter for use as a printing ink additive containing uniformly dispersed starch particles in a nonaqueous oil medium for preventing the offsetting of dry printing ink on sheets of paper.

A serious problem recognized by all printers has developed with the advent of modern high-speed printing presses. The printed sheets are ejected rapidly from the outlet of the printing press into stacks before the newly printed ink has had sufficient time to dry. The printed ink offsets or imprints itself upon the adjacent sheets of paper in the stack.

There are two measures in current use designed to hinder the drying ink from offsetting onto the adjacent stacked sheets. The most popular method utilizes an atomizer which spreads a fine coat of transparent powder upon the sheet of printed paper immediately following the printing. The coat of powder forms a protecting shield between the undried ink and the adjacent sheet of paper in the stack.

An inherent disadvantage in the use of such a method is the attendant scattering of the powder into the sensitive mechanism of the press, necessitating frequent work stoppages to clean the press. In addition, the powder tends to settle on the printing cylinder preventing proper ink transfer to the paper. The presence of sprayed powder in the air also constitutes a health hazard to those persons working around the press.

The second procedure currently in use adds components to the printing ink which have rapidly drying properties. In practice, this measure has shown few positive results, and the results which are obtained are accompanied by a significant reduction in the quality of the printing. In addition, modern printing presses operate at such high speeds that the printed sheets are stacked before even the rapidly drying ink can dry.

It is therefore an object of this invention to provide a process and a composition for preventing the offsetting of drying printing ink from printed sheets of paper onto adjacent sheets of paper, rapidly and efficiently without reducing the quality of the printing, interfering with the proper transfer of ink to the paper, or creating a health hazard to press workers.

The preferred embodiment of the invention will be described initially, and includes a description of the composition, a preferred method for manufacturing the composition and a description of a preferred printing process utilizing the composition an offset lithographic press to achieve the objectives set forth above.

The composition is a printing ink additive comprising a substantially uniform dispersion of starch particles and an organic acid salt or acid, such as potassium tartrate or tartaric acid, in a nonaqueous oil-based fluid medium which is compatible with the printing ink with which the additive is to be mixed. The starch particles should be deagglomerized and substantially uniformly dispersed throughout the medium, and preferably constitute approximately 60 percent to 65 percent by weight of the total ink additive. The organic acid or acid salt is preferably potassium tartrate or tartaric acid and can be present preferably in the amount of approximately 0.5 percent by weight of the total additive. The oil-based medium constitutes the remaining 35 percent to 40 percent of the additive and preferably is a petroleum fraction distilling between the temperatures of 260° C. and 320° C. This petroleum fraction has been found to be compatible with most printing inks.

A process for preparing the ink additive has been developed which provides uniform dispersion and deagglomeration of the starch particles in the medium. The process utilizes a rotary disperser having interior blades or projections and which rotates at a predetermined velocity, such as the Cawles disperser. The oil-based medium and the acid or acid salt are placed in the disperser and mixed for approximately 5 minutes

at 600 revolutions per minute r.p.m. The starch particles are added to the mixture, and the mass is dispersed at 1,200 r.p.m. for approximately 30 minutes. The mechanical agitation of the starch particles serves to break up any agglomerations of starch particles found in the dry state and to form a dispersion of discrete particles with maximum surface exposure to the oil-based medium.

Although it is preferred to have the acid or acid salts present in the additive, the additive may be prepared without the acid or acid salts. The presence of the acid or acid salts in the additive conditions the starch particles to absorb more water and increase in size more rapidly than happens otherwise. If the additive is prepared without acid, the 5 minutes step of combining acid and medium in the disperser is not, of course, utilized.

It is preferred that the additive be mixed with the ink shortly before the ink is used in the printing press. The presence of acid in the printing ink for longer periods of time tends to cause the ink to deteriorate and modify its drying time. In addition, the starch particles absorb ink fluid and alter the balance of fluid and ink pigment. This results in blinding of the halftone screen in the printing process causing poor image transfer.

Approximately 3 percent by weight of the ink additive as described above is added to the printing ink, transferring approximately 1.8 percent starch particles by weight to the ink. The starch particles are dispersed throughout the ink by gentle mixing.

The description of a process for printing using an offset lithographic printing press and ink containing the ink additive follows.

Referring now to the accompanying drawings:

FIG. 1 illustrates a schematic offset printing press;

FIG. 2 represents a stack of printed paper sheets on which the printed ink is drying with the separation of the sheets exaggerated to illustrate the starch particles on each sheet separating the sheets; and,

FIG. 3 is a cross-sectional view of a sheet of paper having ink printed upon it showing exaggerated starch particles swelled to approximately three times their dry size and rising above the plane of the printed ink.

Referring now to FIG. 1, in the operation of the offset printing press 10, the plate cylinder 11 contains the image to be printed formed in greasy areas located upon the surface 12 of the cylinder 11. Dampening rolls 13 apply water to the surface 12 of the cylinder 11, and water adheres to the nonimage areas. As the plate cylinder 11 revolves, the inking rolls 14 apply the ink mixture containing the dispersed starch particles to the plate cylinder 11 and the ink adheres to the greasy image areas and is rejected by the nonimage areas which are moist.

Sufficient water is picked up by the inking rolls 14 from the moist nonimage areas to contact the starch particles in the ink permitting the starch particles to absorb the water and swell.

The ink containing the swelling starch particles is then transferred from the image areas of the plate 11 onto the blanket cylinder 15. From the blanket cylinder 15 the ink is printed onto the sheet of paper 16.

As shown in FIG. 2, as the printed paper is ejected from the printing press it is stacked in the form of cut sheets 20 or folded signatures. It is during this time that the ink is drying and the starch particles have swollen to a size sufficient for them to project above the plane of the surface of the drying ink and thereby prevent the ink from offsetting onto the adjacent sheets 21 of paper in the stack.

As is seen by reference to FIG. 3, the swollen starch particles 30 (seen here in exaggerated size) rise above the surface 31 of the printed ink 32 on the paper 33. The starch particles 30 shelter the drying ink 32 from contact with the adjacent sheet of paper.

Use of the printing ink additive containing the dispersed starch bodies of which the majority are discrete granules in a fluid medium, when mixed in the printing ink results in de-

cided advantages over printing processes in use today. The absorption of the water by starch particles enables the ink to dry approximately twice as fast as was heretofore possible. This savings in drying time enables the printed sheets to be passed through the printing press again for printing on the reverse side of the sheet in half the time as before.

It has been noted that the addition of dried starch alone directly to the ink results in approximately a 15 percent reduction in offsetting. However, at the same time the following disadvantages and inconveniences appear. (1) The ink density increases. (2) The starch particles prematurely aggregate and form clumps, making difficult the transfer of ink to the paper. Also, the clumps are noticeable on the printed sheet. (3) The halftone screen dots are blinded. (4) The ink is dried prematurely at the rollers. (5) The gloss of the ink is reduced significantly. (6) The starch adheres to the inking rollers necessitating frequent cleaning of the rollers. The many disadvantages accompanying this form of introducing the starch into the ink do not compensate for the advantage of reduction in the offsetting by 15 percent.

Insufficient agitation of the ink additive during preparation gives results in preventing ink offsetting which are below the 100 percent anti-offsetting efficiency may be acceptable for some types of printing. A simple test may be conducted to ascertain whether the threshold minimum of agitation and dispersion has taken place in the preparation of the additive. The test comprises adding an equal volume of water to a sample of the ink additive in a test tube. Following vigorous shaking for 30 seconds, three layers form in the tube, the top layer contains starch particles and water suspended in the oil-based medium, the second or middle layer contains water with starch particles suspended therein, the bottom layer contains the majority of starch particles at the bottom of the tube in water.

If upon combining the starch particles, the fluid medium and an equal amount of water in a test tube, only two layers are formed, the oil-based medium in the upper layer and the starch particles and water in the lower layer, such a formation of layers indicates inadequate dispersion of the particles in the medium, and does not constitute an acceptable ink additive.

Use of the printing ink additive containing an oil-based medium and starch particles in a uniform dispersion without the presence of an acid or acid salt may result in a reduction in offsetting of 60 percent. However, again the following disadvantages appear. (1) The halftone screen dots are blinded. (2) The gloss of the ink is reduced. (3) The inking rollers become clogged and necessitate frequent cleaning. In view of this, use of the ink additive without acid or acid salt may give satisfactory results depending on the quality of the paper employed and the type of printing ink required.

The addition of the acid or acid salt to the printing ink additive results in approximately 100 percent reduction of the offsetting with complete disappearance of the above-mentioned disadvantages and accompanied by the attendant one-half decrease in drying time. In addition, the gloss of the printed ink is improved when compared with printing processes using spray powders, and avoids at the same time the rough touch, which these powders present.

Starch particles may be used of any type which is known to swell upon contact with water. Starch has the general formula $(C_6H_{10}O)_n$ and includes such varieties as cornstarch and starch from what, potatoes, tapioca and rice. Starch particles derived from potatoes are generally considered to be the largest particles in diameter of the commonly used starches. Potato starch particles range in diameter from 15 microns to 100 microns with an average diameter of approximately 30 microns. Starch particles from other sources have an average diameter of less than 30 microns.

Cornstarch particles were measured in a dry undispersed state and found to have an average diameter of approximately 11 microns and a volume of approximately 697 cubic microns based upon 83 measurements taken evidencing a range in diameter from 3 microns to 18 microns. The starch particles

after having been dispersed in the printing ink additive were found to have increased their diameter based upon 119 measurements evidencing a range of from 3 microns to 22 microns, resulting in an average of 13 microns and a volume of approximately 1,150 cubic microns, due presumably to the absorption of the fluid medium in which they were dispersed.

The cornstarch particles in the printing ink additive were exposed to water and found to have increased their diameter based on 208 measurements evidencing a range of 5 microns to 28 microns, for an average of approximately 16 microns and a volume of approximately 2,145 cubic microns. This resulted in a volume increase of approximately three times over the volume of the dry starch particles.

Although the oil-based medium, described above, comprising the petroleum fraction distilling at 260° C. to 320° C. is preferred, virtually any other oil-based medium can be used, as long as it is nonaqueous and compatible with the printing ink. By compatible it is meant that the oil-based medium is of a viscosity which when made up into the ink additive is 100 percent miscible with the printing ink and does not significantly alter the viscosity or appearance of the ink. The medium also should not significantly attach the pigment or other components of the ink. Illustrations of suitable oils include animal and vegetable oils which are drying, half-drying or nondrying, such as: castor oil, linseed oil, tung oil, cottonseed oil, olive oil and coconut oil.

Mineral oils may also be employed, among which the following aliphatic hydrocarbons have been found particularly suitable: gasoline, heavy naphtha, white spirit and high petroleum fractions. Organic solvents can be employed such as tetrahydronaphthalene and decahydronaphthalene.

The major consideration in selecting the proper viscosity for the fluid medium is the amount of starch particles which can be dispersed in the medium. A highly viscous medium permits fewer starch particles to be dispersed therein. A fluid medium having therefore a high viscosity would contain fewer dispersed starch particles and would be difficult to mix with a high-viscosity printing ink.

Depending on the viscosity of the printing ink, which normally ranges from approximately 200 poise to 1,100 poise, it has been found that the viscosity of the oil-based medium can successfully range from approximately 0.01 poise to approximately 1,200 poise. Higher viscosity media may require the use of surfactants to disperse sufficient amounts of starch therein.

It is generally desirable to use fluid media of lower viscosity, because more starch particles can be dispersed therein resulting in the utilization of smaller amounts of additive mixed in the ink to provide sufficient amounts of starch particles in the ink, as explained below.

The amounts of starch which can be dispersed in the fluid medium are not limited to 60 percent-65 percent by weight of the total additive. A number of variables influence the amount of particles which can be utilized in the medium. The viscosity of the fluid medium is one factor, since at higher viscosities it becomes increasingly difficult to successfully disperse starch particles. Also, the presence of starch particles increases the viscosity of the additive which, in turn, bears on the ease with which the additive is mixed with the ink. Additional factors are the viscosity of the printing ink to be employed and the amount of starch particles to be dispersed in the ink. In general, it has been found possible to introduce up to about 78 percent starch particles by weight without the use of such aids as surfactants. Such a high percentage is generally achievable only in fluid media of very low viscosity.

The viscosity of the ink additive is significant in that, if the additive is too viscous it does not mix well and readily with the printing ink. Since printing inks can have their stability and quality upset by vigorous agitation, the viscosity of the additive should be such that it is relatively easily mixed with the printing ink.

It is difficult to measure the viscosity of the additive due to the presence of the starch particles in the additive. However, as an example, an additive containing a fluid medium of 0.17 poise and 60 percent by weight starch particles had an average viscosity of approximately 32 poise. The same concentration in a medium of 10 poise produced an additive having an average viscosity of approximately 73 poise.

As has been brought out above, the additive may be prepared without acid or acid salts, but the efficiency of the resulting printing process is somewhat lower. Any of the approximately 500 known organic acids can be used having the general formula $R-COOH$, wherein R is a hydrocarbon radical. Illustrations of those exhibiting particular suitability are citric acid, racemic tartaric acid, meso tartaric acid, and malic acid. The finely divided acid salts of the organic acid can be employed interchangeably with the acids. In general, it has been found easier to handle the acid salts than the acids.

An added advantage to the presence of acid in the additive is the adjusting of the pH of the water when it comes in contact with the ink and starch particles during the printing process. Water is employed in the process normally at pH 5. The acidification of the water during the printing process by contact with the acid in the ink-additive mixture reduces the pH to approximately 3 to 5, preferably 4, depending on the pH of the initial water. The lower pH serves to maintain the cleanliness of the halftone screen and dots, preventing misting of the screen and emulsification of the ink. Additionally, the acid causes the regrouping of the dispersed starch particles after they have contacted water and become swollen. The groups of starch particles on the printed sheets cause, in turn, a greater separation of sheets when stacked, thereby enhancing the prevention of offsetting.

Although the 0.5 percent by weight acid has proved sufficient to accomplish the goals set forth for the acid, the acid can range in amounts from about 0.25 percent to 2.0 percent by weight of the total additive, depending on the amount of additive mixed with the ink and the desired pH of the ink-water mixture during the printing process.

Any device may be used to combine the components of the additive, as long as the starch particles are sufficiently deagglomerized and dispersed throughout the fluid medium. The Cawles disperser has proved effective and is preferred. The following table sets forth the mixing time periods required to disperse adequately varying amounts of starch particles in media of varying viscosities. These data do not represent the limits of the invention, but merely illustrate the possibilities that are inherent in the invention. It should be noted that the entries in the squares designated by "0," are for variables of less than five, but more than zero.

The amount of additive to be mixed with the printing ink will depend on several factors. (1) The amount of starch particles in the additive; (2) The amount of starch particles to be placed in the ink; (3) The viscosity of the ink; (4) The viscosity of the additive; (5) The effect the additive has on the composition and quality of the ink; (6) The quality of the paper; and (7) The type of printing to be performed.

In general, the upper and lower limits on the amount of starch particles which can be introduced into the ink by way of the additive with good overall results are from about 0.3 percent to 3.3 percent by weight of the total ink-additive mixture. Fewer particles result in ineffective reduction in offsetting of the drying ink, while amounts larger than about 3.3 percent tend to clog the screens and accumulate on the rollers, reducing the quality of the printed ink.

Preferably, about 1.8 percent starch particles by weight are included in the ink-additive mixture. In the preferred additive combination described above using 60-65 percent starch, only about 3 percent additive need be added to the ink to achieve the desired percentage starch in the ink. In general, it has been found that up to approximately 20 percent additive by weight of the total ink-additive mixture can be mixed with the ink without causing harmful alteration of the viscosity of the printing ink and significant lowering of the ink quality.

Direct addition of starch particles to printing ink results in an unsatisfactory degree of offsetting prevention. The particles cannot be adequately dispersed, and attempts to vigorously mix the starch and ink cause deterioration of the ink. In addition, the screens become clogged and the quality of the printed ink decreases sharply.

The amount of water customarily employed in an offset lithographic printing press provides sufficient moisture in contact with the starch particles in the ink to enable the particles to swell and perform their function on the printed sheet. This amount of water is usually about 2.5 liters per kilogram of ink with a minimum of about 1.25 l./k.g. and a maximum of 3.75 l./k.g. An aqueous solution of water and alcohol can also be used if desired.

The preferred ratio of water actually contacting the starch as compared with the additive present in the ink is about 1:1 in an additive containing 60 percent starch particles. For a 30 percent starch dispersion the preferred ratio is 0.5:1 water to additive, and for a theoretical 90 percent starch dispersion the ratio is about 1.5:1 water to additive. In general, the minimum amount of water required is the ratio 0.3:1 water to additive. Any less water endangers the likelihood that the starch will expand to its maximum size and, thereby, lose some of its effectiveness in preventing offsetting.

TABLE I

Mixing time (in minutes) in cawles disperser to obtain properly dispersed additive

| Viscosity of the fluid, poises | Percentages of starch added | | | | | | | | | | | | | | | | |
|--------------------------------------|-----------------------------|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|--|
| | 0 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | |
| 1,200..... | 20 | | | | | | | | | | | | | | | | |
| 1,150..... | 20 | | | | | | | | | | | | | | | | |
| 1,100..... | | 30 | | | | | | | | | | | | | | | |
| 1,050..... | | 30 | | | | | | | | | | | | | | | |
| 1,000..... | | 30 | | | | | | | | | | | | | | | |
| 950..... | | 30 | | | | | | | | | | | | | | | |
| 900..... | | | 45 | | | | | | | | | | | | | | |
| 850..... | | | 45 | | | | | | | | | | | | | | |
| 800..... | | | 45 | | | | | | | | | | | | | | |
| 750..... | | | 45 | | | | | | | | | | | | | | |
| 700..... | | | 45 | | | | | | | | | | | | | | |
| 650..... | | | | 55 | | | | | | | | | | | | | |
| 600..... | | | | 55 | | | | | | | | | | | | | |
| 550..... | | | | 55 | 70 | | | | | | | | | | | | |
| 500..... | | | | 55 | 70 | | | | | | | | | | | | |
| 450..... | | | | 55 | 70 | 65 | | | | | | | | | | | |
| 400..... | | | | | 70 | 65 | | | | | | | | | | | |
| 350..... | | | | | 70 | 65 | | | | | | | | | | | |
| 300..... | | | | | 70 | 65 | | | | | | | | | | | |
| 250..... | | | | | 70 | 65 | | | | | | | | | | | |
| 200..... | | | | | 70 | 65 | 60 | | | | | | | | | | |
| 150..... | | | | | 70 | 65 | 60 | | | | | | | | | | |
| 100..... | | | | | | 65 | 60 | 80 | 75 | 70 | | | | | | | |
| 50..... | | | | | | | | | | 70 | 85 | | | | | | |
| 0..... | | | | | | | | | | | 90 | 100 | 120 | 190 | 260 | 350 | |

As with any offset lithographic printing process, it is contemplated that four colors may be printed in succession with each ink utilizing its own amount of starch particle additive.

In the following seven examples in table II, ink additives were prepared employing fluid media of varying viscosities and containing varying amounts of starch particles.

TABLE II

| Fluid description | Distillation fraction, ° C. | Viscosity, poise | Percent starch | Percent acid | Percent additive in ink | Printing Remarks |
|--|-----------------------------|------------------|----------------|--------------|-------------------------|--|
| 1..... | 260-320 | 0.17 | 60 | 0.5 | 3 | Good. |
| 2..... Mixture of aliphatic and aromatic hydrocarbons..... | 150-200 | .056 | 53 | 0.5 | 3.5 | More volatile than No. 1. |
| 3..... Tetrahedral naphthalene..... | 205-215 | .12 | 49 | 0.5 | 3.7 | Prolongs drying of printing. |
| 4..... Aliphatic hydrocarbon..... | 270-320 | .64 | 52.6 | 0.5 | 3.5 | Prolongs drying, but less than No. 3. |
| 5..... Aliphatic hydrocarbon..... | (1) | .52 | 60 | 0.5 | 3 | Prolongs drying and tends to separate from ink on cylinders. |
| 6..... Aliphatic hydrocarbon..... | 90-140 | .04 | 47.7 | 0.5 | 3.8 | Good, but more volatile than No. 1. |
| 7..... Heavy naphtha derivative..... | 180-300 | .088 | 52 | 0.5 | 3.5 | Prolongs drying of ink. |
| 8..... Heavy naphtha..... | 90-190 | .072 | 50 | 0.5 | 3.6 | Bad odor, tended to stain white paper. |

¹ Very high temp. fraction.

Table III contains data illustrating selected concentrations of components in the ink additive, but is not intended to be complete, nor limiting in any way.

TABLE III

| Number | Starch | Medium | Acid salt |
|--------|--------|--------|-----------|
| 1 | 50% | 49.5% | 0.5% |
| 2 | 52% | 47.5% | 0.5% |
| 3 | 54% | 45.5% | 0.5% |
| 4 | 56% | 43.5% | 0.5% |
| 5 | 58% | 41.5% | 0.5% |
| 6 | 60% | 39.5% | 0.5% |
| 7 | 62% | 37.5% | 0.5% |
| 8 | 64% | 35.5% | 0.5% |
| 9 | 66% | 33.5% | 0.5% |
| 10 | 68% | 31.5% | 0.5% |
| 11 | 70% | 29.0% | 1.0% |
| 12 | 72% | 27.0% | 1.0% |
| 13 | 74% | 25.0% | 1.0% |
| 14 | 76% | 23.0% | 1.0% |
| 15 | 78% | 21.0% | 1.0% |

Table IV contains illustrations of typical printing ink compositions with which additives of the invention can be employed.

TABLE IV

| Component | Ink Color | | | |
|-------------------------------------|-----------|------|------|-------|
| | Yellow | Red | Blue | Black |
| 3,3 Dichlorobenzene pigment | 20% | | | |
| Resin with 80% dryer oil | 13% | 13% | 13% | 12% |
| Phenolic varnish | 62% | 62% | 62% | 56% |
| Polyethylene wax | 4% | 4% | 4% | 4% |
| Cobaltic Naphthenate | 0.7% | 0.7% | 0.7% | 1.4% |
| Lead Naphthenate | 0.3% | 0.3% | 0.3% | 0.6% |
| Calcium salt of Naphthalic acid | | 20% | | |
| Phthalate of Copper in β form | | | 20% | 4% |
| Black Carbon | | | | 22% |

In table V data are provided illustrating typical viscosities of various inks used for four color printing on varying quality

paper. It is understood, of course, that the quality of paper and the type of printing dictate in large part the type of ink to be employed. Unfortunately, paper is not supplied in standardized grades or qualities, but is ordered on the basis of the quality and type of printing desired.

TABLE V

| Ink color | Viscosity ranges of inks, poises | Ink usage |
|-------------|----------------------------------|---|
| Blue..... | 600-630..... | Typical ink showing standard order of viscosity ranges. |
| Red..... | 450-475..... | |
| Black..... | 300-345..... | |
| Yellow..... | 225-245..... | |
| Blue..... | ca. 900..... | High viscosity ink for use with good quality paper. |
| Red..... | ca. 550..... | |
| Black..... | ca. 400..... | |
| Yellow..... | ca. 320..... | |
| Blue..... | ca. 1,100..... | Highest viscosity ink for use on best quality paper. |
| Red..... | ca. 650..... | |
| Black..... | ca. 450..... | |
| Yellow..... | ca. 380..... | |

The following examples illustrate further the preparation of the additive and the mixing of the additive with printing ink.

EXAMPLE 1

A 100 kilogram sample of the dispersed starch additive was prepared by adding 33.8 kilograms of a petroleum distilling within the temperature range of 260° C. and 0.5 kilogram potassium tartrate to a Cawles rotary disperser having interior blades. The disperser was rotated at 600 r.p.m. for 5 minutes. A portion of cornstarch weighing 65.67 kilograms was added to the disperser and the rotation continued for 15 minutes. The mixture was then rotated at 1200 r.p.m. for 30 minutes. At this point, 0.03 kilogram of violet essence, a scenting agent, was added to the disperser and the revolutions continued for 1 minute.

EXAMPLE 2

A 100 kilogram sample of the starch dispersion was prepared as follows: 38 kilograms of a petroleum fraction distilling within the temperature range of 260° C. to 290° C. and 60 kilograms of cornstarch in a Cawles rotary disperser having interior blades. The disperser was rotated at 600 r.p.m. 1.97 kilograms of cream of tartar and 0.03 kilograms of violet essence were immediately added. The disperser was kept at the said revolutions for 30 minutes. Then the speed was increased to 1,200 r.p.m. and the revolutions continued for 90 minutes.

EXAMPLE 3

Samples of the starch dispersion as prepared in example 1 were combined with an oil-based lithographic ink in the following weight proportions:

| | 1 | 2 | 3 | 4 | 5 |
|----------|-------|-----|-----|-----|-----|
| Ink | 99.5% | 98% | 97% | 90% | 80% |
| Additive | 0.5% | 2% | 3% | 10% | 20% |

• Addition of the starch dispersion to printing inks did not adversely affect the quality of the ink or behavior of the ink during the printing process in any way. The starch particles did not begin to swell until contacted with water, which commonly occurs during the printing process, but may occur at any time prior to the stacking of the printed sheets. The rapidity with which the starch particles absorbed water and began to swell determined the amount of time necessary for the starch particles to be contacted with water prior to the stacking of the printed sheets.

We claim:

1. In an offset printing process, wherein a controlled amount of water contacts a cylinder having greasy image areas and nongreasy areas, the water adhering to the nongreasy areas, followed by inking of the image areas with printing ink and finally impressing the inked image onto successive sheets of papers which are then stacked, the improvement comprising the steps of:

- a. forming an additive composition by substantially completely dispersing a plurality of starch particles in a nonaqueous oil-based fluid medium, said medium being compatible and completely miscible with the printing ink, and said particles being swellable in water and at least 10 percent by weight of the additive, and having a maximum average diameter of 30 microns when in dry form;
- b. mixing an amount of the additive composition effective to prevent offsetting of the drying ink and not exceeding 20 percent gently with the printing ink until said starch particles are substantially completely dispersed within the printing ink prior to utilizing the printing ink in said printing process; and
- c. contacting said starch particles in the ink with the water in the offset printing process and permitting the particles to absorb water and expanding in size as the inked image areas containing the expanding starch particles are transferred to sheets of paper, which sheets of paper are then stacked with the expanded starch particles rising above the plane of the upper surface of the printed image areas, thereby preventing offsetting of the drying ink onto adjacent sheets of paper.

2. In a process as set forth in claim 1 the additional step of mixing into the ink additive from 0.25 percent to 2 percent (by weight) of a compound selected from the group consisting of organic acids and their acid salts, said acids having the chemical formula $R-COOH$, wherein R represents a hydrocarbon.

3. A substantially nonaqueous additive composition adapted to be mixed with offset printing ink for preventing the offsetting of drying printed ink, comprising: a nonaqueous oil-based fluid medium, being compatible and completely miscible with the printing ink; and a plurality of starch particles swellable in water and having a maximum average diameter of 30 microns when in dry form, said particles also comprising at least 10 percent by weight of the additive and being substantially completely dispersed in the fluid medium at the time of preparation.

4. An additive composition as described in claim 3, wherein said additive contains additionally from 0.25 percent to 2 percent (by weight) of a compound selected from the group consisting of organic acids and their acid salts, said acids having the chemical formula $R-COOH$, wherein R represents a hydrocarbon.

5. A substantially nonaqueous offset printing ink adapted to be used in an offset printing process for preventing the offsetting of drying printed ink, comprising:

- a. printing ink, comprising ink solvent, pigment, resin and drier;
- b. from 0.3 percent to 3.3 percent (by weight) starch particles swellable in water substantially completely dispersed in the printing ink having a maximum average diameter of 30 microns when in dry form; and
- c. up to 20 percent (by weight) nonaqueous oil-based fluid medium compatible and completely miscible with the printing ink.

6. A printing ink as described in claim 5, wherein the printing ink contains additionally a compound selected from the group consisting of organic acids and their acid salts, said acids having the chemical formula $R-COOH$, wherein R represents a hydrocarbon.

7. A process for preparing an additive composition adapted to be mixed with printing ink for preventing the offsetting of drying printing ink, comprising the steps of:

- a. contacting (1) a nonaqueous oil-based fluid medium compatible and completely miscible with the printing ink, and (2) at least 10 percent (by weight) starch particles in a mixing device, said particles having a maximum average diameter of 30 microns when in dry form and being swellable in water; and
- b. mixing the fluid medium and the starch particles until the starch particles are substantially completely dispersed in the fluid medium.

8. In a process as set forth in claim 7 the additional steps of:

- a. contacting (1) a substantially nonaqueous printing ink comprising ink solvent, pigment, resin and drier, and (2) said additive composition; and
- b. gently mixing the printing ink and the composition to achieve substantially complete distribution of the starch particles in the composition throughout the printing ink.

9. A process as set forth in claim 7, wherein from 0.25 percent to 2 percent (by weight) of a compound selected from the group consisting of organic acids and acid salts said acids having the chemical formula $R-COOH$, wherein R represents a hydrocarbon, is mixed with the fluid medium and the starch particles in the mixing device.

10. In a process as set forth in claim 9 the additional steps of:

- a. contacting (1) a substantially nonaqueous printing ink comprising ink solvent, pigment, resin and drier, and (2) said additive composition; and
- b. gently mixing the printing ink and the composition to achieve substantially complete distribution of the starch particles in the composition throughout the printing ink.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,615,751 Dated October 26, 1971

Inventor(s) Manuel J. Lecha; Jose S. Mascaro

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 10, "dry" should read --drying--. Column 2, line 1, "r.p.m." should be --(r.p.m.)--; line 14, "minutes" should read --minute--; line 23, "screen" should read --screens--. Column 3, line 4, "he" should read --the--; line 59, "tome" should read --time--; line 63, " $(C_6H_{10}O)_n$ " should read -- $(C_6H_{10}O_5)_n$ --; line 64, "what" should read --wheat--. Column 4, line 23, "attach" should read --attack--; line 34, "The" should read --A--. Column 5, line 15, "organic acid" should read --organic acids--. Column 8, line 43, after "petroleum" insert --fraction--; line 44, after "260°C." insert --to 320°C.--. Column 9, line 35, "expanding" should read --expand--. Column 10, line 46, after "salts" insert a comma.

Signed and sealed this 13th day of June 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents