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OFFSET PREVENTING MATERIAL

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This invention relates to the prevention of offset or smutting in printing caused by piling sheets one upon another after they have been printed. The invention relates more particularly to new and improved offset preventing materials.

The prevention of offset in printing is a well recognized problem which has caused many difficulties. It is a customary procedure to stack the printed sheets on top of each other as they leave the printing machine or press. The back of each sheet is then printed in a subsequent operation. Inasmuch as the stacking of the printed sheets places the printed side of the sheet in contact with the back of a succeeding or preceding sheet, any smutting of the printing ink onto the back of said sheets will necessarily interfere with or destroy the value of a succeeding print. It is accordingly highly desirable that this smutting or offset, as it is usually called, be eliminated.

Many methods and various types of materials have heretofore been proposed for offset prevention. One method involves the temporary insertion of so called "slip sheets" between the consecutive printed sheets. It has also been customary on cylinder printing presses to apply a liquid ink repellent or ink drying material to freshly printed sheets by spraying such materials upon the sheet so as to coat the entire imprint with the ink repellent. Probably the materials which are most widely used as spray materials for offset prevention are solutions of gum arabic and other similar water soluble materials. Such materials are normally employed in the form of alcoholic solutions and the fumes or mists which are formed where they are used are very undesirable.

It has also been proposed heretofore to prevent the offsetting of ink from a freshly printed surface by applying thereto in mist form a mixture consisting substantially entirely of a liquid and a powdered material, at least the greater portion of which is insoluble in the liquid, corn starch being mentioned by way of a specific example. The present invention is concerned with the prevention of offset by the use of a starch.

Among the problems encountered in the use of a liquid material consisting substantially entirely of a starch and a liquid is the non-uniformity of application of the offset preventing material. Raw or ungelatinized starch tends to settle from a suspension thereof in water and unless some means can be provided to prevent this settling, the natural result is the application to the printed sheets of a non-uniform coating of starch and possibly the eventual clogging of the spraying mechanism. This disadvantage may be overcome to some extent by continuously agitating the offset preventing material in order to keep the starch in suspension. Such an expedient is undesirable from the practical point of view, however, because it necessitates the use of additional agitation equipment which would not be necessary otherwise and which, therefore, adds to the cost of the process.

With the foregoing considerations in mind, one of the objects of the present invention is to provide a new and improved type of offset preventing material containing starch which does not have to be agitated during or immediately before its application. A feature of the present invention which contributes to the accomplishment of this object is the provision of an offset preventing material containing a water insoluble starch, for example, raw or ungelatinized starch intimately mixed in a liquid medium with a suspending or carrier medium. The latter should be of such character that it does not interfere with spraying or other customary methods of applying liquid offset preventing material and at the same time it should have sufficient suspending power to maintain the starch in uniform suspension.

In order to accomplish the objects of the invention it is essential that the suspending medium or carrier for the starch have the property of drying relatively rapidly so that the offset preventing material may be applied by a suitable sprayer or spray gun without substantially wetting or spotting the printed sheet. Furthermore, the carrier medium must be such that it does not react with or otherwise affect the ink on the printed sheet. As another requisite for the accomplishment of the objects of this invention, the carrier medium should be such that when applied to the printed sheet as a part of the offset preventing material it is substantially non-tacky or non-adhesive and should not cause the printed sheets to stick together. Additionally, the carrier medium employed in accomplishing the objects of this invention should be such that it can be used in concentrations which will not cause masking of the printed matter.

In carrying out the invention it has been found that a substantially non-adhesive hydrogel may be used as the carrier or suspending medium. The term "hydrogel" is used herein to define substances which form colloidal gels with water. Among such substances are bentonite, alumina "cream" (such as obtained by dissolving alum in water and slowly adding an alkali) and coagulated

silicic acid. Bentonite is the preferred hydrogel medium. When used in suitable concentrations it has the necessary suspending power to suspend starch in a liquid offset preventing material and likewise has the other characteristics previously mentioned.

Generally stated, therefore, the invention comprises the preparation of an offset preventing material formed from a liquid medium and a substantially water insoluble amylaceous substance such as raw or ungelatinized starch in an intimate dispersion with a substantially non-adhesive hydrogel suspending medium, preferably a mineral hydrogel. The concentrations of the various materials preferably correspond to certain preferred proportions, as hereinafter more fully described.

In practicing the invention, it has been found that offset preventing materials made from starch and a hydrogel, as herein described, sometimes have a tendency to form a precipitate or deposit on metal containers or in spray equipment, particularly where several different types of metals are employed in such equipment. This is due to the well known fact that colloidal particles carry electric charges and will therefore migrate to one or the other metal of an electro-couple depending upon the positions of the metals in the electromotive series.

Another object of this invention is to provide offset preventing materials of the type described in which the formation of such deposits either does not occur or is substantially retarded. To the accomplishment of this object a feature of this invention involves the addition of an alkali or acid reacting substance to an offset preventing composition formed from starch and a hydrogel of the type described. The acid or alkali reacting substance is added in amount to adjust the pH of the carrier medium, preferably to the isoelectric point of the hydrogel used. At this point the hydrogel carries no electric charge and therefore does not migrate. Although there is a tendency for a hydrogel to precipitate at its isoelectric point, this does not impair its usefulness as a suspending agent when used in the proportions and manner hereinafter described.

As an illustration of the above phenomena, I give the following experiments. Two electrodes of iron and tin, respectively, were partly immersed in the following solutions, and the exposed portions of the electrodes were connected by means of a copper wire:

I

	Parts
Bentonite	100
Starch	300
Soda ash	3
Water	2000

The resulting pH was 9.7.

II

	Parts
Bentonite	100
Starch	300
Soda ash	7
Water	2000

The resulting pH was 10.1.

III

	Parts
Bentonite	100
Starch	300
Soda ash	10
Water	2000

The resulting pH was 10.25.

Upon standing for awhile, and more particularly after standing over night, there is noted a deposit on the iron electrode in experiment I and on the tin electrode in experiment III, but there is no deposit on either electrode in experiment II.

Any alkali or acid reacting substance is effective for this purpose to a greater or lesser extent, depending upon the particular type of substance used. Among such substances are, for instance, soda ash, magnesium oxide and other alkaline materials, including as a general class of materials, the salts of weak acids with strong bases, and salts of strong acids with weak bases. This aspect of the invention is not limited, however, to the use of salts because the readily available oxides and hydroxides can also be used if they have an alkaline reaction in an aqueous medium. The alkaline reacting substance chosen would normally be one which under the conditions of use does not react with the starch and has no harmful effect upon the printed material to which the offset preventing composition is to be applied. Thus, as will readily be understood by those skilled in the art, it would be undesirable for the purpose of this invention, to employ an alkaline reacting substance such as sodium hydroxide or potassium hydroxide in any concentrations that would tend to gelatinize the starch. Hence, if such materials are employed at all, they are preferably used in amounts such that their concentration in the offset preventing material is less than about 1% by weight of the liquid.

It is sometimes desirable in the practice of the present invention to incorporate with the offset preventing composition other materials that have a known specific action or effect. Thus, it may be desirable to add to compositions of the character previously described fermentation or souring preventives such as formaldehyde, paraformaldehyde, other formaldehyde derivatives or other substances which are known to have a similar effect. Among the substances which may be added for a similar reason is magnesium oxide, preferably in the form known as "light" magnesium oxide." The use of this type of substance has the advantage that it not only prevents any fermentation or any tendency toward fermentation over a substantial period of time, but also it is an alkaline reacting substance, and therefore, tends to inhibit or retard the deposition of solids from the offset preventing material onto spray equipment, containers or other metal equipment employed in applying the material. Thus, two functions are accomplished by the use of only one additional material.

In preparing compositions of the character described it is also sometimes desirable to incorporate therewith a volatile solvent or diluent in sufficient amount to accelerate the drying of the sprayed material. For this purpose it is preferable to use a water-miscible volatile liquid such as ethyl alcohol or any other volatile liquid having similar properties. The particular type of volatile liquid chosen for this purpose is not limited except to the extent that it should be a substance that is substantially unreactive with starch and with the other ingredients of the offset preventing composition and also a substance which has no harmful effect upon the particular type of printing ink which is being used. Ordinarily, of course, this substance will be substantially completely volatilized and will not tend to condense upon the printed material.

The following examples are given in order to illustrate the types of compositions which may be

prepared in accordance with this invention but it will be understood that these examples merely represent preferred embodiments of the invention and are not intended to limit it. In the examples the quantities are stated in parts by weight unless otherwise indicated.

Example I

An offset preventing material was made up by mixing together the following ingredients:

	Parts
Bentonite (grit-free)	6
Corn starch	20
Water	200

The mixing was effected at normal temperatures. It was found that the starch stayed in suspension and this material gave good results as an offset preventing material when applied by spraying to printed sheets.

Example II

An offset preventing material was prepared by mixing together the following ingredients:

Bentonite (grit-free)	lb.	1
Corn starch	lbs.	3
Water	lbs.	20
Formaldehyde	cc.	14

This material also gave excellent results in the prevention of offset when sprayed onto printed sheets.

Example III

Another offset preventing material made in accordance with the present invention consisted of the following ingredients mixed together at substantially normal temperatures:

	Parts
Bentonite (grit-free)	100
Corn starch	300
Soda ash	7
Water	2000
Formaldehyde	3

This particular type of composition illustrates the use of an alkaline reacting substance, namely, soda ash, to prevent or retard deposition of solids on the spray apparatus.

Example IV

An offset preventing material may be mixed in dry form and sold as such to the printer who may then prepare a liquid dispersion of the material at his convenience merely by mixing the dry form of the material with water. A suitable dry composition of this type may have the following formula:

Starch	parts	200
Bentonite (grit-free)	do	100
Paraformaldehyde	percent	½

This dry form of the composition may be mixed with water in the proportions of 2 lbs. of dry mixture to a gallon of water or in some cases, in the proportions of 2 lbs. of solids to 10 lbs. of water. The resultant liquid material when sprayed on printed sheets is an excellent preventive for offset.

Example V

Another type of composition which may be prepared in accordance with this invention is made by mixing together at substantially normal temperatures the following ingredients:

	Parts
Bentonite (grit-free)	25
Light magnesium oxide	10
Corn starch	65
Water	450

This composition is an excellent offset preventing material and tests with magnesium oxide over a substantial period of time have shown that no souring of the composition takes place.

Example VI

In the preparation of an offset preventing material the following ingredients were mixed together as a dry blend:

Bentonite (grit-free)	ounces	11
Corn starch	do	21
Borax	grams	30
Paraformaldehyde	do	5

This dry blend may be mixed with water at ordinary temperatures and in proportions of 2 lbs. to a gallon of water to give an offset prevention spray material well suited for the prevention of offset in high speed printing operations.

It will be understood that the invention is subject to certain variations in the manner of its practical application. For instance, it is not limited to the use of any particular type of starch. Grain starches and, more specifically, corn starch, however, are preferred. Other suitable starches which may be mentioned are those derived from wheat, oats, rye, sago and tapioca.

The proportions of the various materials and the concentrations thereof may vary within certain limits and may be adjusted or modified in order to meet the needs of the type of spray equipment or other means which is to be used in applying the offset preventing material. The amount of hydrogel (e. g. bentonite) should be at least sufficient to maintain or hold the starch in suspension but should not be so great that the viscosity of the offset preventing material is increased to the point where it cannot be conveniently applied. Ordinarily a concentration of hydrogel (e. g. bentonite) will be within the range of about 1% to about 5% based upon the amount of water. The weight ratio of solids to water should preferably be within the range of about 1:1 to about 1:15 and the weight ratio of starch to hydrogel (e. g. bentonite) should preferably be from about 35:1 to about 1:1. Thus, it is possible to make a suitable offset preventing material in accordance with the invention containing say 100 parts of starch to 3 parts of bentonite. Under most circumstances about 3% bentonite based upon the amount of water is sufficient to maintain in suspension for the purpose of this invention a weight ratio of starch to bentonite up to 35:1. Such a composition would, therefore, contain 100 parts of water. An additional quantity of water is desirable in order to wet the starch, this additional quantity usually being about 75% by weight of the starch. The final offset preventing composition would, therefore, contain the following ingredients:

	Parts
Bentonite (grit-free)	3
Starch	100
Water	170

The following table is given to illustrate offset

spray solutions made in accordance with this invention having varying solids contents:

Offset spray solutions with varying solids content

Bentonite	Water	Starch	Additional water =A	Percent solids	Solids to water =1:x	Bentonite to starch
3	100	0	0	2.9	1:33	1:0
3	100	5	3.8	7.2	1:13	1:1⅔
3	100	10	7.5	10.8	1:8.3	1:1⅓
3	100	15	11.5	13.9	1:6.2	1:5
3	100	20	15.0	16.7	1:5	1:6⅔
3	100	25	18.8	19.1	1:4.2	1:8⅓
3	100	30	22.5	21.2	1:3.7	1:10
3	100	35	26.5	23.1	1:3.3	1:11⅔
3	100	40	30.0	24.9	1:3.0	1:13⅓
3	100	45	34.0	26.4	1:2.8	1:15
3	100	50	37.5	27.8	1:2.6	1:16⅔
3	100	60	45.0	30.3	1:2.3	1:20
3	100	70	52.5	32.4	1:2.1	1:23⅓
3	100	80	60.0	34.2	1:1.9	1:26⅔
3	100	90	67.5	35.7	1:1.8	1:30
3	100	100	75.0	37.1	1:1.7	1:33⅓

A=water necessary to wet starch.

In the above table it will be observed that the amount of water necessary to wet the starch is given as approximately 75%, although it will be understood that this amount of water may vary somewhat depending upon the type of starch. The quantities given in the first four columns of the table are in parts by weight. The percentage figures in column 5 are also based on total weight of the composition and the ratios given in columns 6 and 7 are weight ratios.

In any of the aforesaid compositions a volatile substance, for example, ethyl alcohol, may be added in order to accelerate the evaporation of moisture when the composition is applied. Normally up to 25% of ethyl alcohol may be used in the offset preventing composition based upon the weight of the composition.

It is contemplated that the compositions prepared in accordance with this invention are to be applied by spraying, although it will be understood that other methods of application may be employed. A feature of the invention, however, resides in the fact that these compositions are eminently suitable for spray application to printed materials. Among the spraying methods which may be employed are those described in Bucy, U. S. Patent No. 2,078,790, Paasche, U. S. 2,110,052, Green et al., U. S. 2,110,218 and 2,110,219, and Paasche, U. S. 2,114,723. The invention may be used in connection with all types of printed matters either in black and white or in color.

The method of application to successive printed sheets should preferably be such that the offset preventing material is applied to the atmosphere in the vicinity of the printed portion of the printed material and is substantially dry by the time it reaches the printed sheet. This is possible when using the offset preventing materials of the present invention even though the printing operation is being conducted at a very fast rate, say, 3200 sheets of size 3' x 5' per hour. The ingredients of the composition, moreover, do not tend to react with or otherwise affect all ordinary types of printing inks or colors including those inks containing cellulose derivatives and cellulose derivative solvents.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. An offset preventive comprising a substantially water insoluble amylaceous substance and a substantially non-adhesive hydrogel suspending medium for said substance, the weight ratio of said water insoluble amylaceous substance to said hydrogel suspending medium being within the range from about 35:1 to about 1:1.

2. An offset preventive comprising a substantially water insoluble amylaceous substance, a substantially non-adhesive mineral hydrogel suspending medium for said amylaceous substance, and an inhibitor of such character and in such amount as to substantially reduce the electric charge of the hydrogel and thereby retard the deposition of the solids content of said composition on metallic surfaces but of insufficient concentration to gelatinize the amylaceous substance, the amount of said inhibitor being sufficient to adjust the pH of the hydrogel to approximately its iso-electric point.

3. An offset preventive comprising a substantially water insoluble amylaceous substance and bentonite intimately dispersed in water in proportions of about 1% to about 5% bentonite based on the amount of water, a solids to water ratio within the range of about 1:1 to about 1:15 and a ratio of said insoluble amylaceous substance to bentonite from about 35:1 to about 1:1.

4. A dry base material adapted to form an offset preventive material when mixed with water and comprising a substantially water insoluble amylaceous substance and a substantially non-adhesive hydrogel medium in dry form adapted to disperse in water at ordinary temperatures and present in sufficient proportions to maintain substantially all of said amylaceous substance in suspension when said base material is dispersed in water, the weight ratio of said water insoluble amylaceous substance to said hydrogel suspending medium being within the range from about 35:1 to about 1:1.

5. The method of preventing offset from a freshly printed surface which comprises applying in finely divided condition in the vicinity of such surface an offset preventive comprising a water insoluble amylaceous substance and a substantially non-adhesive hydrogel suspending medium for said substance, the weight ratio of said water insoluble amylaceous substance to said hydrogel suspending medium being within the range from about 35:1 to about 1:1.

6. The method of preventing offset from a freshly printed surface which comprises applying in spray form to the vicinity of such surface an aqueous liquid containing a water insoluble amylaceous substance suspended in said liquid with a substantially non-adhesive mineral hydrogel suspending means, the weight ratio of said water insoluble amylaceous substance to said hydrogel suspending medium being within the range from about 35:1 to about 1:1.

7. The method of preventing offset from a freshly printed surface which consists in applying to said surface an offset preventive comprising a water insoluble amylaceous substance and bentonite intimately dispersed in water in proportions of about 1% to about 5% bentonite based on the amount of water, a solids to water ratio within the range of about 1:1 to about 1:15, and a ratio of starch to bentonite from about 35:1 to about 1:1.

8. The method of preventing offset from a freshly printed surface which consists in applying to said surface an offset preventive comprising a water insoluble amylaceous substance and bentonite intimately dispersed in water in proportions of about 1% to about 5% bentonite based on the amount of water, a solids to water

ratio within the range of about 1:1 to about 1:15, and a ratio of starch to bentonite from about 35:1 to about 1:1, said offset preventive also containing an alkaline reacting substance in sufficient amount to adjust the pH of the bentonite to approximately its iso-electric point.

9. An offset preventive comprising a substantially water insoluble amylaceous substance and a substantially non-adhesive hydrogel suspending medium for said substance intimately dispersed in water in proportions of about 1% to about 5% of hydrogel based on the amount of water, a solids to water ratio within the range of about 1:1 to about 1:15 and a weight ratio of said insoluble amylaceous substance to said hydrogel from about 35:1 to about 1:1.

10. An offset preventive comprising a water insoluble amylaceous substance and bentonite intimately dispersed in water in proportions of about 1% to about 5% bentonite based on the amount of water, a solids to water weight ratio within the range of about 1:1 to about 1:15 and a ratio of amylaceous substance to bentonite from about 35:1 to about 1:1, said offset preventive also containing an alkaline reacting substance in sufficient amount to adjust the pH of the bentonite to approximately its iso-electric point.

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