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ANTIOFFSET COMPOSITION

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This invention relates to the prevention of offset from inked surfaces.

An inked surface, particularly when freshly inked, often tends to transfer ink to other surfaces with which it comes in contact. This action is known as offset. It is particularly a problem in the printing industry where the ink from one printed sheet in a pile tends to mark the sheet next to it. A number of methods have been devised to eliminate or minimize offset. One procedure has been to protect the ink film by spraying the sheets after printing with an anti-offsetting medium which deposits "lands" or projections higher than the ink film on the printed sheet to protect it from adjacent surfaces. Such a method is that described in U. S. Patent No. 2,078,790, issued April 27, 1937, to Edmond H. Bucy. This patent teaches employing an anti-offset medium which comprises a land-forming ingredient contained in an evaporable solvent. The anti-offset, composition is sprayed onto the sheets in such manner that the solvent volatilizes as the droplets travel to the sheet, producing small, dried, or partially dried, particles which adhere to the sheet in the form of the desired lands.

Another anti-offset method is described in Bucy Patent No. 2,142,666, issued January 3, 1939. According to this method, the inked surface is contacted with a roller, the surface of which contains numerous, small depressions or pits holding anti-offset composition. Composition deposits from the roller onto the inked surface to form the lands. The pits in the roller are then refilled with anti-offset composition for further application. This method is particularly adapted for preventing offset on work from web-fed presses.

A number of compositions have been devised which are useful in the Bucy processes. Two, which are the subject matter of Bucy Patents Nos. 2,142,667 and 2,142,668, issued January 3, 1939, employ land-forming materials such as cellulose esters or ethers and two solvents, one more readily volatile than the other.

It is an object of the present invention to provide for the prevention of offset by the application of new anti-offset processes and compositions.

It is further among the objects of the invention to provide anti-offset compositions which are economical to use and readily applied.

Often, and especially in multicolor work, each sheet is separately printed a number of times. Some prior art anti-offset compositions, while adequately effective for preventing offset, have shown a tendency to be picked up from the treated surface when a second impression is made. The picked-up composition deposits in cavities in the impression plates and takes ink

with the rest of the raised surfaces. An undesirable blurred print results. Some offset compositions on drying have also caused abrasion to printing equipment, limiting the life of rolls in presses through which printed matter may subsequently pass. Another object of the present invention is the production of anti-offset compositions which will have improved characteristics of pick-up and abrasion on presses.

Other objects will be apparent from the following description.

It has been found that solutions of combinations of a soluble organic compound containing at least 3 hydroxyl groups, a boric-acid producing material, and alkali are excellent anti-offset compositions.

The soluble organic compounds containing at least 3 hydroxyl groups usable for this invention preferably are ones containing a chain of no more than 6 carbon atoms. Examples of such are the polyhydric compounds, glycerol, erythritol, pentitols, pentoses, hexitols and hexoses.

As alkalies can be used any of the alkalies containing an alkali metal, ammonia, or water-soluble amines, such as triethanolamine. By "alkalies" as used in this specification are meant those containing alkali metal, ammonium or water-soluble amine radicals.

As a boric-acid producing material can be used any boron compound which forms orthoboric acid, H_3BO_3 in solution, such as metaboric acid, HBO_2 , tetraboric acid, $H_2B_4O_7$, or boron trioxide, B_2O_3 . Both alkali and boric-acid producing material may be, at least in part, simultaneously provided by borate salts of the alkalies, as, for example, borax.

An anti-offset composition of the present invention may be readily prepared by dissolving the separate ingredients in water. Whether or not a reaction occurs amongst the ingredients so-dissolved is at present not known. If hydroxy-containing organic compounds of the type herein employed and boric acid are heated together so as to drive off water, organic borate resins are formed which contain a boric acid molecule condensed with the hydroxyl-containing organic compound molecule. For example, sorbitol monoborate dicondensation product may be formed from the reaction of 1 mol of boric acid and 1 mol of sorbitol. Each boron atom in the resin contains a residual acid hydroxyl group which may be reacted with alkali with the resultant formation of alkali sorbitol borate. The reactions of boric acid with the other hydroxyl-containing organic compounds of the type used herein are quite similar.

A combination of a hydroxyl-containing compound, a boric acid producing material and an alkali according to this invention results regardless of whether the hydroxyl-containing organic

compound, the boric acid producing material, and the alkali are dissolved separately in water or whether combined forms of these ingredients are dissolved in water. For example, employing sorbitol as exemplary of the hydroxyl-containing organic compound, the combination of this invention may be prepared by dissolving sorbitol, alkali and boric acid in water separately; it may also be prepared by dissolving alkali sorbitol borate in water; it may be further prepared by dissolving sorbitol borate and alkali in water; or again it may be prepared by dissolving sorbitol and an alkali borate, such as borax, in water.

It is usually preferred to employ the organic compound containing at least 3 hydroxyl groups and the boric acid material in proportions such that they will be approximately one atom of boron for each molecule of organic compound. These proportions are not highly critical, but sometimes, if too little boric acid material is employed, the excess organic compound will plasticize the lands, making them too soft. On the other hand, too much boric acid material may result in a crystallizing out of boric acid from the solution before it is applied.

The properties of these new anti-offset compositions differ somewhat depending upon the particular organic compounds employed. Hardness of the lands and their efficiency as an anti-offset medium appears to increase, in general, with the number of hydroxy groups and chained carbon atoms in the organic material used. Glycol compositions are too soft for much commercial use. Glycerine compositions are harder and can be used if sufficiently concentrated. Hexitols, particularly sorbitol compositions, apparently produce the most workable solutions. Hexose compositions, for example, glucose, have the advantage of very low cost, but solutions prepared with hexoses are not as stable to standing as are the hexitols. Because of their cheapness, however, they have many anti-offset applications.

Control of the amount of alkali present in the composition effects to a considerable degree regulation of the properties of the lands. After hydroxyl-containing organic compounds have been reacted with boric acid to produce borate resins, each atom of boron has still attached to it an acid hydrogen atom which may be reacted with one equivalent of alkali. The resin exhibits properties of increased viscosity and hardness as the alkali content increases toward complete satisfaction of all molecules containing an acid group. Similar properties of increased hardness may be noticed in the lands produced from anti-offset solutions of this invention when they are prepared with increased concentrations of alkali. This effect is apparently related to the property of the alkali of making the drops crust over on evaporation. This is desirable because the droplets appear to be dry on their surfaces and rigid even as solvent is evaporating from their interiors. Consequently, deposited lands are most resistant and stand up higher on reaching the inked surface. Also, the lands produced adhere less permanently to the paper so that a permanently rough surface need not be produced. The ability to change the character and particularly the hardness of the lands by variation in the alkali content or pH of the anti-offset solution is an important advantage of this invention, for it provides an easy method of suiting the lands to the particular job in hand. Preferably, the solutions of this invention contain from approxi-

mately 0.5 to 1 gram equivalent of alkali per gram atom of boron present. A solution containing 0.5 equivalent of sodium per atomic weight of boron is conveniently made by adding borax ($\text{Na}_2\text{B}_4\text{O}_7$ in which the ratio of sodium to boron is 0.5) to a solution of hydroxyl-containing organic compound of the type employed in this invention. For example, if 1 mol of sorbitol and 0.25 mol of borax are added to water, a solution is obtained equivalent to that where a 0.5 alkali reacted sorbitol borate is dissolved in water. It is usually preferable not to employ more than one equivalent of alkali per gram atom of boron because the lands become over-brittle and excess alkali may harm some papers. Below a 0.5 equivalent of alkali per atomic weight of boron, the skin-forming effect is largely lost. For some work a solution corresponding to a sorbitol borate reacted with 0.95 equivalents of alkali per mol of borate has been found ideal. As indicated above, however, the alkali content should be adjusted for the particular job to be performed.

The proportion of solids in the solution is not at all critical but will depend largely on the type of printing for which the solution is prepared. Also it depends greatly on the particular organic compound employed. Glycerine requires more concentrated solutions than do the hexitols. Thus work using heavy inks on coarse papers generally requires larger lands than does finer work. Usually, more concentrated solutions are more viscous and will give larger lands than those of less concentration. For spraying purposes it has been found that less concentrated solutions are generally required than for the roll process.

A low boiling solvent more volatile than water such as, for example, dioxane, acetone, or water-miscible alcohols such as methyl, ethyl, or isopropyl alcohol, is conveniently added to anti-offset compositions of this invention as a drying aid.

It has been found that the spraying properties of these anti-offset solutions may be improved very appreciably by the addition of small proportions of an agent which is compatible with the solution and which exhibits gelatinizing tendencies therewith. Some gums have been found suitable for this purpose. Gum karaya, gum arabic, and locust gum are preferred examples of these. Other materials which may be employed are polyvinyl alcohol and starch acetate in their water-dispersible modifications. The improvement effected by these gelatinizing agents is a lessening of the proportion of total solids necessary to provide a usable composition. When one of them is present, a less concentrated solution is substantially equivalent to a more concentrated, and, hence, more expensive solution prepared without a gelatinizing agent. The reasons for this are not fully understood, but, without any intention to limit the invention to the correctness of the explanation, it is suggested that the action of the gelatinizing substance is two fold. The viscosity of the solution is increased moderately, and the solution becomes stringy, exhibiting an increased property of cohesiveness. Both of these effects, and particularly the latter, make for coarser atomization from the spray gun, so that the average particle size of the spray is larger and less of the solution is wasted in forming fines which do not produce the desired lands.

The anti-offset composition of the invention may also contain inert ingredients contained in other anti-offset compositions providing they are operative therewith. A few examples of

such ingredients are: organic soaps, such as aluminum stearate, aluminum palmitate, or zinc stearate, or materials such as asbestine, diatomaceous earth, fuller's earth, magnesium carbonate, talc, powdered mica, powdered magnesium, powdered aluminum hydrate, a starch such as corn starch, etc. Furthermore, the compositions of this invention may be added to other anti-offset compositions containing such or other ingredients to improve them.

The solutions of this invention may be applied in any convenient manner. Spray and roller techniques are known in the art. It is advantageous, however, to apply anti-offset composition so that the heat of the ink driers which are customarily employed in printing may be used to aid in its drying. Advantageously, application may be made just after the ink-drying step so that the anti-offset compositions deposit on heated paper. When spraying, the spray distance, size and quantity should be adjusted to produce lands of the desired characteristics.

The following examples are given as a few of the preferred embodiments of the invention. It is not, however, intended that it shall be limited by them.

Example 1

An anti-offset solution was prepared with the following ingredients:

	Percent by weight
Sodium sorbitol borate.....	33.3
95% ethyl alcohol.....	11.1
Water	55.6

The borate was prepared by heating equimolar parts of a non-crystallizing sorbitol of the type disclosed in U. S. Patent No. 2,172,357, issued September 12, 1939, to K. R. Brown, though crystallizing sorbitol could just as well be used, with boric acid to a temperature of 110° C., cooling to 90° C., and adding a 45% caustic soda solution in amount supplying 0.95 mol of NaOH per mol of boric acid used. The resulting resin had a pH of approximately 8.5 when diluted to 50% solids. To prepare the anti-offset solution, the resin was first diluted with one-third its weight of water while still warm. Then it was cooled and mixed with a solution containing proper weights of alcohol and water to yield the finished composition. This solution when applied in the usual manner was found to be excellent in producing lands which eliminated offset without perceptible roughening of the surface, and also did not show the pick-up and abrasive properties characteristics of some prior art solutions. The solution also showed no tendency to clog up spraying equipment.

Example 2

This example shows how the addition of a small quantity of a gum such as gum karaya will permit the use of lesser solids concentration. A solution of the following composition exhibited much the same spraying properties as did the solution of Example 1.

	Percent by weight
Sodium sorbitol borate.....	20
95% ethyl alcohol.....	10
Gum karaya	0.1
Water	72.9

The sodium sorbitol borate for this example was prepared in the same manner as that described in Example 1. It was diluted with one-third its weight of water and finally stirred into a pre-

viously prepared solution of gum karaya in the alcohol and the remainder of the water.

Example 3

This example shows the preparation of a specific anti-offset solution by mixing boric acid, alkali, sorbitol, gum karaya and alcohol. An open mixing tank was provided with heating and cooling coils for assisting the dissolving of the ingredients, a thermometer and agitating means. In this tank 530 lbs. of water containing 30 grams of sodium hydroxide were heated to 50° C. With vigorous agitation a slurry of 510 grams of gum karaya in one liter of alcohol was added slowly. Agitation was continued for two hours, the temperature being maintained between about 45 and 50° C. The following ingredients were then added in succession and without artificial heating:

	Pounds
Caustic soda solution (49.6% NaOH).....	30
Boric acid.....	40
Caustic soda solution (49.6% NaOH).....	20
Sorbitol syrup (84.6% solids).....	137

During the addition of the sorbitol the temperature was maintained below 50° C. by the use of cooling water in the coils. Finally, the solution was cooled to 30° C. and a mixture of 60 lbs. of 95% alcohol in 75 lbs. of water was added slowly with good agitation. The solution was stirred for 9 hours and then made an excellent anti-offset composition.

It should again be pointed out that the concentrations at which these solutions are employed are not critical. The solution shown in Example 1 has been used for spray purposes with solids contents of from 25 to 50%. At the upper ranges of concentration the spray becomes syrupy and uneconomical to use. At lower ranges when spraying the spray guns must be opened too wide and the amount of spray floating in the air becomes objectionable in the press room. Hence the middle concentrations are somewhat more satisfactory, though spray gun openings and other operational technique will compensate for wide ranges of concentration.

What is claimed is:

1. An anti-offset composition which comprises an aqueous solution of a combination of a soluble organic compound selected from the group consisting of glycerol, erythritol, pentitols, pentoses, hexitols, and hexoses; a boric acid-producing material; and an alkali, said composition forming resinous material on drying.
2. An anti-offset composition according to claim 1 in which the organic compound is a hexitol.
3. An anti-offset composition according to claim 1 in which the organic compound is glycerol.
4. An anti-offset composition according to claim 1 in which the organic compound is a hexose.
5. An anti-offset composition according to claim 1 in which the organic compound is a hexitol and the alkali is present in proportions of about $\frac{1}{2}$ to 1 equivalent of alkali to each atomic weight of boron.
6. An anti-offset composition according to claim 1 which also contains a further solvent which increases the volatility of the solution.
7. An anti-offset composition according to claim 1 which also contains a gelatinizing agent.
8. A composition according to claim 1 in which the organic compound is a hexitol, and the so-

lution also contains a further solvent which increases its volatility and a gelatinizing agent.

9. A composition according to claim 1 in which the organic compound is glycerol, and the solution also contains a further solvent which increases its volatility and a gelatinizing agent.

10. A composition according to claim 1 in which the organic compound is a hexose, and the solution also contains a further solvent which increases its volatility and a gelatinizing agent.

11. An anti-offset composition which comprises an aqueous solution of a combination of a hexitol, a boric acid producing material, an alkali, a small proportion of gum karaya, and a water-miscible alcohol, said composition forming a resinous material on drying.

12. An anti-offset composition which comprises an aqueous solution of a combination of

a hexitol, a boric acid producing material, a small proportion of locust bean gum, and a water-miscible alcohol, said composition forming resinous material on drying.

5 13. A process of preventing offset from inked surfaces which comprises spraying onto the inked surface a composition which comprises an aqueous solution of a combination of a hexitol, a boric acid producing material, and an alkali, the spray distance, size, and quantity being so adjusted that anti-offsetting lands are produced upon the inked surface.

14. A process according to claim 13 in which the inked surface is heated prior to spraying.

10 15. A process according to claim 13 in which the combination also contains a water-miscible alcohol and gum karaya.

ERNEST G. ALMY

CERTIFICATE OF CORRECTION.

Patent No. 2,354,979.

August 1, 1944.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 60, for "ad" read --and--; page 2, first column, line 64, for "most" read --more--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of September, A. D. 1944.

Leslie Frazer

(Seal)

Acting Commissioner of Patents.