

REGULAR UTILITY

PCT/US83/01057

Form PTO 436
(Rev. 8/78)

SERIAL CLASSIFICATION 397986		PATENT DATE		PATENT NUMBER	
SERIAL NUMBER 04/597,586	FILING DATE 07/14/82	CLASS 430	SUBCLASS	GROUP ART UNIT 166	EXAMINER

APPLICANT: SIVANDAP IGPAI, SAN JOSE, CA.

REC'D 23 AUG 1983
WIPO PCT

CONTINUING DATA VERIFIED

FOREIGN/PCT APPLICATIONS VERIFIED

US83/1057

Foreign priority claimed 35 USC 119 conditions met	<input type="checkbox"/> yes <input type="checkbox"/> no	AS FILED	STATE OR COUNTRY	SHEETS OR DRWS.	TOTAL CLAIMS	INDEP. CLAIMS	FILING FILE RECEIVED	ATTORNEY'S DOCKET NO.
Verified and Acknowledged	Examiner's Initials	CA	0	12	1	8	89	BRX-POP200

ADDRESS: LIMBACH, LIMBACH & SUTTON
2001 FIFTH PLDG.
SAN FRANCISCO, CA 94111

TITLE: WATER-BASED MAGNETIC COATING COMPOSITION



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By authority of the COMMISSIONER OF PATENTS AND TRADEMARKS

M. Middleton
Certifying Officer

Date JUL 26 1983

397986

1 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
2 APPLICATION FOR UNITED STATES LETTERS PATENT

3
4 Title: ⁵⁰¹ WATER-BASED MAGNETIC COATING COMPOSITION

5 Inventor: Sikandar Iqbal
6

7 BACKGROUND OF THE INVENTION

8 This invention concerns itself with aqueous magnetic coating
9 formulations. It is desirable at times to use aqueous formula-
10 tions in place of organic formulations for the latter use
11 expensive and toxic flammable solvents, which must be captured
12 upon drying of the magnetic formulation to prevent air pollution.
13 Furthermore, there have been a number of recent developments in
14 improving magnetic aqueous formulations, which make them attrac-
15 tive as substitutes for organic-based coatings generally.

16 Notwithstanding the inherent advantages of employing
17 aqueous magnetic coating formulations, such coatings have not,
18 to date, replaced organic formulations commercially. One reason
19 for the lack of success is that prior art magnetic coating
20 layers employ emulsifiers or dispersants, which do not form an
21 adequate bond between the magnetic pigments incorporated in the
22 coatings and the water-based binders. As a result, the coatings
23 become brittle as the emulsifiers exude to the coating surface.
24 A further disadvantage of the emulsifiers of the prior art, such
25 as TAMOL 731 which is a sodium salt of a carboxylate sold by
26 Rohm & Haas and TRITON X-100 which is an alkyl aryl polyether
27 alcohol also offered from Rohm & Haas, is their tendency to not
28 only diffuse to the surface of the magnetic coating over time,
29 but also cause the aqueous formulation to foam during prepara-
30 tion. The antifoaming agents employed by the prior art do not
31 completely remedy the problem, particularly in the preparation
32 of high viscosity magnetic coating compositions.

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1 Yet another problem in prior art aqueous-based magnetic
2 coating compositions is the tendency of the magnetic particles
3 and other pigments, such as carbon, to flocculate. The use of
4 improved dispersion agents can not only avoid the flocculation
5 problem, but also stabilize the magnetic powder and other
6 pigments incorporated in the composition.

7 It is thus an object of the present invention to provide
8 an improved aqueous magnetic coating composition without the
9 drawbacks of prior art compositions.

10 It is yet another object of the present invention to employ
11 improved dispersing agents in aqueous magnetic coating composi-
12 tions to avoid those disadvantages outlined above.

13 These and other objects of this invention will be more
14 fully appreciated when considering the following disclosure.

15
16

SUMMARY OF THE INVENTION

17 The present invention deals with an aqueous coating compo-
18 sition for forming a magnetic recording layer, the improvement
19 comprising the use of a polyacrylic latex polymer as a dis-
20 persant. As a preferred embodiment, the polyacrylic latex
21 polymer can comprise a copolymer of styrene and a member selected
22 from the group consisting of butyl acrylate and ethyl acrylate.
23 In such a composition, the styrene is preferably present in an
24 amount between approximately 10-20% by weight, and the remaining
25 acrylate is present in an amount between approximately 80-90%
26 by weight. The styrene-acrylate copolymer preferably has a
27 molecular weight between approximately 20,000-40,000.

28 The aqueous coating composition, also as a preferred embodi-
29 ment, can further comprise a water-insoluble polymeric binder
30 having both a hard and soft component. The hard component
31 preferably comprises a member selected from the group consisting
32 of copolymers and terpolymers of acrylonitrile, ethylacrylate,

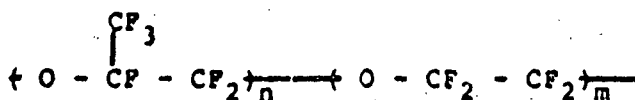
1 butylacrylate, methylmethacrylate and mixtures thereof. More
 2 specifically, the hard component can comprise a copolymer of
 3 approximately 10-20% by weight of acrylonitrile and approximately
 4 80-90% by weight of a member selected from the group consisting
 5 of ethylacrylate and butylacrylate. Similarly, the hard compo-
 6 nent can comprise a terpolymer of approximately 10-20% by weight
 7 of acrylonitrile, approximately 10-25% by weight ethylacrylate,
 8 approximately 60-80% by weight butylacrylate and approximately
 9 10-20% by weight methylmethacrylate.

10 The soft component making up the aqueous coating composi-
 11 tion, as a preferred embodiment, can comprise a polymer emulsion
 12 of a polyurethane having a glass transition temperature of
 13 between approximately -10°C to -40°C.

14 The aqueous coating composition can also employ flow
 15 agents, antifoaming agents, wetting agents and lubricants.

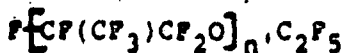
16 DETAILED DESCRIPTION OF THE INVENTION

17 The aqueous phase of the coating composition can be prepared
 18 in a manner taught in copending application Serial No. 345,082,
 19 filed on February 2, 1982. In fact, the present invention can
 20 include lubricants in the coating composition as are taught in
 21 the referenced copending application. More specifically, the
 22 aqueous coating composition can comprise lubricants selected
 23 from the group consisting of aliphatic and aromatic stearates,
 24 silicon oils, perfluoro alkyl polyethers and fluorinated fluids
 25 having one of the following structures:



27
 28 wherein n, m = 40-90

29 and



31 wherein n' = 12-45

32 and mixtures thereof.

1 The magnetic powders which can be employed in the aqueous
2 coating composition can be selected from the group consisting
3 of $\gamma\text{-Fe}_2\text{O}_3$, Fe_3O_4 , as well as other oxides which are doped or
4 surface treated with metal ions, such as cobalt, nickel or
5 chromium. Generally, these magnetic oxides can be characterized
6 as being needle-shaped and having coercivities from 300-800 Oe.

7 The polymer binders discussed above can be characterized as
8 being latexes of relatively high molecular weight. As previously
9 stated, they preferably comprise polyblends of hard and soft
10 components which provide the toughness which is necessary in
11 magnetic coating compositions. Further, the polyblends of
12 latexes form interpenetrating elastomeric networks in the
13 presence of magnetic pigments.

14 As a generality, the aqueous magnetic coating composition
15 should comprise the following classes of materials, in the
16 approximate parts by weight as indicated:

17	<u>Composition</u>	<u>Parts By Weight</u>
18	Magnetic Oxide (or Metal) Powder	70 - 80
19	Dispersing Agents	1 - 3
20	Antifoaming Agents	0.05 - 0.1
21	Flow Agents	0.5 - 2
22	Aqueous Emulsion (25-50% Solids)	30 - 20
23	Lubricants	1 - 2

24 The dispersants, flow agents, antifoaming agents and wetting
25 agents can be added to water followed by the addition of the
26 pigments, which are added slowly while subjecting the composition
27 to high shear mixing. The pH of the composition is maintained
28 from approximately 8 to 10 during the processing steps. The
29 magnetic powders are dispersed by milling and the polyblends of
30 latexes are added to the mix. Lubricants and rheology modifiers
31 are later added as a final mixing step.

32 ///

EXAMPLE 1

1
2 Approximately 0.31% (w:w) sodium polyphosphate, as well as
3 approximately 1.05% Acrysol WS-24, which is an acrylic emulsion
4 available from Rohm & Haas Co., were added, as dispersing
5 agents, to approximately 46.69% distilled water and dissolved
6 therein. The pH of the solution was controlled between approxi-
7 mately 8-10 by the addition of sodium hydroxide, although
8 ammonium hydroxide could have been used equally as well.

9 To this solution was then added approximately 0.47% of a
10 wetting agent, namely, Surfynol 104, an acetylenic glycol
11 available from Air Products Co., and the solution mixed vigor-
12 ously under high shear. Also under high shear was then added
13 the magnetic oxide, in this case, approximately 31.55% of the
14 mixed oxide Fe_2O_3/Fe_3O_4 . Flow agents can also be included to
15 improve the characteristics of the coating. A suitable flow
16 agent for practicing this invention is Acrysol RM4 which is
17 alkylene-soluble emulsion of ethyl acrylate and acrylic acid
18 sold by Rohm & Haas Co.

19 Mixing was continued under high shear employing, for
20 example, a "lead" mill utilizing glass, ceramic or steel milling
21 media. After a good dispersion was obtained, which was verified
22 by visual inspection, the latexes were added. In this example,
23 approximately 6.37% of Rhoplex 1024, an acrylic emulsion avail-
24 able from Rohm & Haas Co., was used as the "hard" segment and
25 approximately 12.25% of QW 4147, a polyurethane emulsion avail-
26 able from Quinn as the "soft" segment. High shear mixing was
27 continued and the lubricants were then added. Pre-emulsified
28 lubricants were employed, such as those disclosed in co-pending
29 application Serial No. 345,082. In this example, approximately
30 0.80% butoxyethyl stearate, available from Arnak, and approxi-
31 mately 0.18% of an emulsion of a silicon oil available from
32 Dow Corning, were used as lubricants.

1 It was observed that the butoxyethyl stearate acts as an
2 internal lubricant as it is compatible with the latexes used
3 herein. The second lubricant, namely, the silicon oil emulsion
4 was incompatible and thus rises to the surface of the water-
5 based coating in time forming a thin layer of lubricant thereon

6 EXAMPLE 2

7 The following ingredients were incorporated into a solution
8 in the manufacture of a water-based coating composition, the
9 mixing procedure being substantially the same as that taught in
10 Example 1.

11	<u>Ingredients</u>	<u>Weight %</u>
12	DI Water	46.09
13	Fe ₂ O ₃ /Fe ₃ O ₄ Oxide	31.14
14	Rhoplex WL91 (Acrylonitrile Acrylic)	7.58
15	QW4147 (Polyurethane Emulsion)	12.09
16	Acrysol WS-24 (Acrylic Emulsion)	1.04
17	Silicon Oil Emulsion	0.17
18	Butoxyethyl Stearate	0.79
19	Sodium Polyphosphate	0.31
20	Surfynol 106	0.47
21	NH ₄ OH (Ammonium Hydroxide)	<u>0.32</u>
22		100.00

23 The formulary of Example 2 differs in substance from that
24 shown in Example 1 through the inclusion of an acrylonitrile
25 acrylic. These materials improve the mechanical properties of
26 the magnetic coating layer by toughening the overall polymeric
27 composition.

28 It was found that formulations prepared according to the
29 present invention have improved mechanical properties and are
30 smooth and quite glossy after drying and after surface treat-
31 ment. The signal to noise ratio has been found to be excellent
32 and the output improved principally because of the ability to

1 control the rheological characteristics. By controlling the
2 viscosity of the formulation, one is able to improve the square-
3 ness and orientation ratio of magnetic tapes made therefrom
4 while exhibiting very low values in the coefficients of friction.

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WHAT IS CLAIMED IS:

1. In an aqueous coating composition for forming a magnetic recording layer, the improvement comprising the use of a polyacrylic latex polymer as a dispersant.

2. The aqueous coating composition of claim 1 wherein the polyacrylic latex polymer comprises a terpolymer of styrene and a member selected from the group consisting of butyl acrylate and methyl methacrylate.

3. The aqueous coating composition of claim 2 wherein styrene is present in the polyacrylic latex in an amount between approximately 10-20% by weight and the remaining acrylate is present in the polyacrylic latex in an amount between approximately 80-90% by weight.

4. The aqueous coating composition of claim 2 wherein said copolymer is of a molecular weight between approximately 20,000 to 40,000.

5. The aqueous coating composition of claim 1 further comprising a water insoluble polymeric binder having both a hard and a soft component.

6. The aqueous coating composition of claim 5 wherein the hard component comprises a member selected from the group consisting of copolymers and terpolymers of acrylonitrile, ethyl acrylate, butylacrylate, methylmethacrylate and mixtures thereof.

7. The aqueous coating composition of claim 6 wherein the hard component comprises a copolymer of approximately 10-20% by weight of acrylonitrile and approximately 80-90% by weight of a member selected from the group consisting of ethylacrylate and butylacrylate.

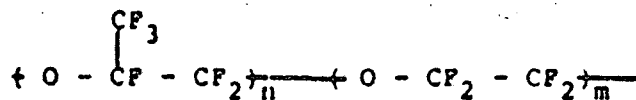
8. The aqueous coating composition of claim 6 wherein the hard component comprises a terpolymer of approximately 10-20% by weight of acrylonitrile, approximately 10-25% by weight ethylacrylate, approximately 60-80% by weight butylacrylate and approximately 10-20% by weight methylmethacrylate.

9. The aqueous coating composition of claim 5 wherein the soft component comprises a polymer emulsion of a polyurethane having a glass transition temperature of between approximately -10°C to -40°C .

10. The aqueous coating composition of claim 5 further comprising a flow agent, antifoaming agent, wetting agent and lubricant.

11. The aqueous coating composition of claim 10 wherein said flow agent is an alkylene-soluble emulsion of ethylacrylate and acrylic acid.

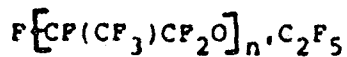
12. The aqueous coating composition of claim 10 wherein said lubricant comprises a member selected from the group consisting of aliphatic and aromatic stearates, silicone oils, perfluoro alkyl polyethers and fluorinated fluids having one of the following structures:



wherein n = 40-90

m = 40-90

and



wherein n' = 14-45

and mixtures thereof.

1002

ABSTRACT OF THE DISCLOSURE

1
2 Disclosure is made of an improved aqueous magnetic coating
3 composition employing a polyacrylic latex polymer as a
4 dispersant. As preferred embodiments, the composition further
5 comprises a polymeric binder having both hard and soft compo-
6 nents, as well as the inclusion of flow agents, antifoaming
7 agents, wetting agents and lubricants.

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DECLARATION COMBINED WITH PETITION SOLE INVENTOR

OFFICE NUMBER
 DOCRET
 MRX-P08800

I, the undersigned petitioner, declare that the information in Items 301, 302, and 303 below is true, that I believe that I am the original, first and sole inventor of the invention described and claimed in the attached specification, that I acknowledge my duty to disclose information of which I am aware which is material to the examination of this application, that, as to subject matter of this application which is common to my earlier United States of America application, if any, described in Item 105 below, I do not know and do not believe that the same was ever known or used in the United States of America before my invention thereof or patented or described in any printed publication in any country before my invention thereof or more than one year prior to said earlier application, or in public use or on sale in the United States of America more than one year prior to said earlier application, that the said common subject matter has not been patented or made the subject of an inventor's certificate issued before the date of said earlier application in any country foreign to the United States of America on an application, filed by me or my legal representatives or assigns more than twelve months prior to said earlier application and that no application for patent or inventor's certificate on said subject matter has been filed by me or my representatives or assigns in any country foreign to the United States of America except those identified in Item 400 below, if any, that, as to any subject matter of this application which is not common to said earlier application, I do not know and do not believe that the same was ever known or used in the United States of America before my invention thereof or patented or described in any printed publication in any country before my invention thereof or more than one year prior to the date of this application, or in public use, or on sale in the United States of America more than one year prior to the date of this application, and that said subject matter has not been patented or made the subject of an inventor's certificate issued in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to the date of this application; and that no application for patent or inventor's certificate on said non-common subject matter has been filed by me or my representatives or assigns in any country foreign to the United States of America, except those identified in Item 400 below.

2 FULL NAME OF APPLICANT (LAST, FIRST, MIDDLE, LAST)
 0
 1 **Sikandar Iqbal** CITIZENSHIP COUNTRY
Pakistan

2 RESIDENCE
 0 CITY STATE OR FOREIGN COUNTRY
 1 **San Jose California CA**

3 TITLE OF INVENTION
 0
 1 **WATER-BASED MAGNETIC COATING COMPOSITION**

4 CHRONOLOGICAL LISTING OF FOREIGN APPLICATIONS IF ANY FILED WITHIN 12 MONTHS FROM THE DATE OF THIS APPLICATION

COUNTRY	APPLICATION NUMBER	DATE OF FILING	PRIORITY CLAIMED UNDER 35 USC 119
----			<input type="checkbox"/> YES <input type="checkbox"/> NO
----			<input type="checkbox"/> YES <input type="checkbox"/> NO
----			<input type="checkbox"/> YES <input type="checkbox"/> NO

5 CHRONOLOGICAL LISTING OF FOREIGN APPLICATIONS IF ANY FILED MORE THAN 12 MONTHS PRIOR TO THIS APPLICATION

COUNTRY	APPLICATION NUMBER	DATE OF FILING

6 CHECK APPROPRIATE BOX IF APPLICABLE THIS APPLICATION IS A CONTINUATION DIVISION
 0 CONTINUATION-IN-PART AS DESCRIBED IN THE ATTACHED SPECIFICATION ON PAGE _____ OF MY PRIOR US APPLICATION
 1 SERIAL NUMBER FILED

7 SEND CORRESPONDENCE TO
 0 NAME PHONE NO. STREET CITY STATE ZIP CODE
 1 **601 LIMBACH, LIMBACH & SUTTON (415) 433-4150 2001 Ferry Bldg. San Francisco California 94111**

Wherefore I petition that letters patent be granted to me for the invention or discovery described and claimed in the attached specification and claims, and hereby subscribe my name to said specification and claims and to the foregoing declaration, power of attorney, and this petition.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

SIGNATURE OF APPLICANT **Sikandar Iqbal** DATE **June 27 1972**

POST OFFICE ADDRESS OF APPLICANT CITY STATE OR COUNTRY ZIP CODE
 STREET ADDRESS
5824 Southview Drive San Jose California 95138