

### APPLICATOR FOR CORRECTION FLUID

The invention relates to applicators for correction fluids.

Correction fluids are used for correcting handwritten, typewritten or photocopied markings on paper. Generally, correction fluids are applied to a paper surface in liquid form. After application, the fluids harden to a film which can effectively cover erroneous markings on the surface and can receive a corrected marking. Correction fluids typically contain a resin that provides the flexible film, and an opacifying pigment, usually titanium dioxide, dispersed in a liquid. The liquid may be water or an organic solvent.

Correction fluids are often supplied in a small container with an applicator brush attached to the cap through a stem. A user unscrews the cap from the container and withdraws the brush loaded with correction fluid. The user then contacts the erroneous marking with the brush, and correction fluid is transferred to the substrate to cover the marking.

The invention relates to an applicator that can be used to apply correction fluid. The applicator preferably includes a stem, an applicator tip including foam, and preferably a flexible material, i.e., a flexor, within the tip. The applicator is easy to use and preferably can be inserted into a correction fluid container in the same general manner as brush applicators. The applicator provides an even laydown of correction fluid on a substrate, resulting in good correction quality. The applicator has good durability and facilitates precise correction.

In one aspect, the invention relates to an applicator, including a stem and an applicator tip including foam, having a flexibility of at least 0.0005 inch of deflection per gram of force, preferably at least 0.002 inch of deflection per gram of force.

In another aspect, the invention features an applicator, including a stem and an applicator tip including foam, having an angled chisel-shaped application surface for applying correction fluid to a substrate.

In another aspect, the invention relates to an applicator including a stem and an applicator tip including a quenched foam. By quenched foam, it is meant a foam that is reticulated (substantially all membranes have been removed to make it open-celled) by chemical methods.

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In another aspect, the invention relates to an applicator including a stem and an applicator tip including foam having an average pore size of between 20 ppi (pores per linear inch) and 130 ppi.

The invention further relates to correction fluid products including a body defining a reservoir and having an opening. The reservoir includes a correction fluid, and the applicator is inserted through the opening so that the portion is in contact with the correction fluid. Preferably, the product also includes an insert through the opening, through which the applicator passes during use. Preferred inserts include a narrowed neck portion that removes excess correction fluid when the applicator tip is withdrawn from the reservoir.

The invention further relates to an applicator having an applicator tip including foam, a correction fluid reservoir, including correction fluid, from which the correction fluid is fed to the applicator tip. The applicator has a flexibility of at least 0.0005 inch of deflection per gram of force. The applicator may also include a removable enclosure (e.g., a cap) for the tip.

Other features and advantages of the invention will be apparent from the description of the preferred embodiment thereof, and from the claims.

Fig. 1 is an exploded view of a correction fluid container including a correction fluid;

Fig. 2 is a side view of the end portion (including the applicator tip) of the foam applicator in Fig. 1;

Fig. 3 is a side view of the applicator tip removed from the applicator in Fig. 2, with the portion of the flexor within the tip shown in broken lines;

Fig. 4 is a front view of the end portion of the foam applicator tip in Fig. 3;

Fig. 5 is a side view of a second applicator, with the flexor shown in broken lines;

Fig. 6 is a side view of a third applicator, with the flexor shown in broken lines; and

Fig. 7 is a rear view of the applicator in Fig. 6.

Referring to Figs. 1-4, a correction fluid container 10 includes a cap 12, an applicator 14, a body 16 including a correction fluid reservoir, and an insert

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18.

Applicator 14 includes a stem 20, and an applicator tip 22. The applicator tip includes a foam portion 24 enclosing a flexor 26. The applicator has a flexibility of at least 0.0005 inch of deflection per gram of force, preferably at least 0.002 inch of deflection per gram of force, measured as described below. The flexibility of the applicator depends on a number of factors, including the stiffness of the stem; the composition, length, width, and thickness of the flexor; and the chemical composition and thickness of the foam portion.

The stiffness of the stem depends on the composition, length, and diameter of the stem. Generally, the less stiff the stem, the more flexible the applicator. Stems composed of softer materials are less stiff than stems composed of harder materials, and longer stems are less stiff than shorter stems. Stems may be made of, for example, polymeric materials such as a low density and/or high density polyethylene or polypropylene. The stem may have a length, for example, of between 2 cm and 15 cm, and preferably between 2 cm and 10 cm. It also may have a diameter of between, for example, 0.1 cm and 2 cm, and preferably between 0.2 cm and 0.8 cm. Stem 20 has a length of 4.1 cm and a diameter of 0.31 cm.

Flexor 26 includes an extension 28 that fits into the hollow end of stem 20.

Generally, the softer the foam and the thinner the applicator tip the greater the flexibility of the foam applicator. The foam may be, for example, an open cell foam having a pore size, for example, of between 20 ppi and 130 ppi, preferably between 80 ppi and 120 ppi, and may be, for example, a polyether/polyurethane, polyester/polyurethane, polyether, or polyester foam. The foam can have a density, for example, in the range of 1.6 lb/ft<sup>3</sup> to 15.0 lb/ft<sup>3</sup>, a compression deflection (CLD) of 25% R (radius) at (0.05-5.0) psi and a CLD of 65% at (0.2-10) psi. A preferred foam is a quenched polyester polyurethane foam having a density of 1.85 lb/ft<sup>3</sup>, a pore size of 80 ppi to 120 ppi, a CLD of 25% R at 0.25 psi, and a CLD of 65% R at 0.45 psi.

The foam portion (including the enclosed flexor) may have a thickness ( $t_1$ ), for example, of between 0.16 cm and 1.27 cm, a length (l) of between 0.3 cm and 2.0 cm, and a width (w) between 0.2 cm and 1.0 cm. Foam

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portion 24 has a thickness ( $t_1$ ) (at midpoint) of about 0.44 cm, and a length (l) of about 0.9 cm. Foam portion 24 is tapered and has a thickness at its base of about 0.44 cm and a thickness towards its tip of about 0.34 cm.

Generally, the softer the composition of the flexor the greater the flexibility of the foam applicator. The flexor may be composed, for example, of a composite of linear low density polyethylene and a thermoplastic olefin having a very high softness and low modulus (e.g., Adflex KS-359P, available from Mobil), low density polyethylene, high density polyethylene, polypropylene, or nylon. In addition, as a general rule, thinner flexors provide more flexible foam applicators.

5 The flexor may have, for example, a width (w) of between 0.02 cm and 0.15 cm, and a thickness (t) of between 0.1 cm and 1.0 cm. Flexor 26 has a width (w) of 0.06 cm. Flexor 26 is tapered but has a thickness of about 0.25 cm at its mid-point.

Foam applicator 14 has an angled chisel-shaped applicator surface 30 that includes a point 32. The angle ( $\alpha$  in the Figure) preferably is between 15° and 60° (e.g., 30°). The long applicator side surface can be used to apply correction fluid over words; the point or straight edge of 32 allows a user to easily apply correction fluid to individual letters.

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Insert 18 may be composed, for example, of a high density polyethylene. The insert has a narrowed neck region 30 that may have an inside diameter of between 3.0 mm and 5.0 mm (e.g., 3.8 mm), and may have a length of between 5 mm and 40 mm (e.g., 25 mm). When portion 24 is removed (wiped off) from the correction fluid reservoir for use, excess correction fluid is removed by narrowed neck 34. When portion 24 is reinserted into the fluid reservoir after use, any excess correction fluid that comes off portion 24 during reinsertion generally is accommodated by the portion of insert 18 above the narrowed neck, thus avoiding spillage of correction fluid.

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Applicator 10 may be used with organic solvent-based or water-based correction fluids. In addition to the liquid vehicle, correction fluids may include an opacifying agent such as titanium dioxide, a film-forming polymer, and various other standard ingredients. Correction fluids may have a viscosity, for example, of between 10 cps and 2000 cps, preferably between 30 cps and 1000 cps, at 20 rpm using a Brookfield Viscometer. Preferred correction fluids are described in, for

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example, U.S. Patent Nos. 5,199,976 and 5,306,755, which are incorporated by reference herein.

Referring to Fig. 5, an applicator 34 has a design similar to applicator 14. Applicator 34, unlike applicator 14, does not have a tapered foam portion or tapered flexor.

Referring to Figs. 6 and 7, an alternative applicator 36 has a spear-shaped tip and includes a stem 38, a flexor 40, and a foam portion 42.

The flexibility of an applicator can be measured using an Instron Model 1122 Compression Tester. The capped end of the applicator is attached to a fixed stand, having a rotating fixture to vary the angle of attachment. The angle is set at 40° so that the foam-tip is just underneath the vertical cylinder (probe) of the tester, having a diameter of 15 cm. This probe is then moved downwards slowly at a controlled rate of 0.13 cm/min while pressing the foam-tip during its downward movement. The force generated by the probe to deflect the foam-tip and the actual deflection of the foam-tip were continually monitored and transmitted to a recorder for recording on a X-Y graph. The flexibility (calculated from the graph) corresponds to the ratio of deflection distance to the applied force, i.e., the slope of deflection vs. applied force graph. The measurements are conducted at various deflection distances, e.g., 0.05", 0.1", 0.15", 0.20" and 0.25".

The flexibility of 12 applicators was measured according to this procedure. The results are shown below in Tables 1 and 2. "Spear" in the applicator in Figs. 6 and 7; "Chisel #1" is the applicator in Figs. 1-4; and "Chisel #2" is the applicator in Fig. 5.

TABLE 1 -- Applicator Tested

|    | <u>Design</u> | <u>Code</u> | <u>Flexor</u>               | <u>Foam</u> <sup>2</sup>      | <u>Stem</u> |
|----|---------------|-------------|-----------------------------|-------------------------------|-------------|
|    | Spear         | G           | Polypropylene               | 3/16" Zapped <sup>3</sup>     | HDPE        |
|    | Spear         | Z           | Polypropylene               | 3/16" Ultra Fine <sup>4</sup> | HDPE        |
| 5  | Chisel #1     | A           | 100% LDPE                   | 3/16" Quenched <sup>5</sup>   | LDPE        |
|    | Chisel #1     | V           | 100% Adflex <sup>1</sup>    | 3/16" Quenched                | LDPE        |
|    | Chisel #1     | W           | 75% Adflex/25% LLDPE        | 3/16" Quenched                | LDPE        |
|    | Chisel #1     | X           | 50% Adflex/50% LLDPE        | 3/16" Quenched                | LDPE        |
|    | Chisel #2     | B           | 100% Polypropylene          | 3/16" Quenched                | HDPE        |
| 10 | Chisel #2     | C           | 100% Adflex                 | 1/8" Quenched                 | HDPE        |
|    | Chisel #2     | D           | Natural Linear LDPE (LLDPE) | 1/8" Quenched                 | LDPE        |
|    | Chisel #2     | E           | 50% Adflex/50% LLDPE        | 1/8" Quenched                 | HDPE        |
|    | Chisel #2     | F           | 50% Adflex/50% LLDPE        | 1/8" Quenched                 | LDPE        |
|    | Chisel #2     | Y           | 50% Adflex/50% LLDPE        | 3/16" Quenched                | LDPE        |

15 <sup>1</sup>Purchased from Montell Polyolefins.

<sup>2</sup>The number is the thickness and the type of foam.

20 <sup>3</sup>SIF® Zapped (reticulated by thermal method), purchased from Foamex International of Eddystone, PA.

<sup>4</sup>SIF® Ultra-Fine, a high density (6.0 lb/ft<sup>3</sup>), fine pore (100-110 ppi) fully open cell polyesterpolyurethane foam purchased from Foamex.

<sup>5</sup>SIF® Quenched (reticulated by chemical method), available from Foamex.

TABLE 2 -- Flexibility  
(inch of deflection per gram of force applied)

|    | Deflection,<br>Inches | A        | B        | C        | D        | E        | F        |
|----|-----------------------|----------|----------|----------|----------|----------|----------|
| 5  | 0.05                  | 0.002776 | 0.002778 | 0.02     | 0.007143 | 0.005263 | 0.018182 |
|    | 0.1                   | 0.003571 | 0.001563 | 0.016667 | 0.005882 | 0.003333 | 0.014815 |
|    | 0.15                  | 0.003846 | 0.001785 | 0.0125   | 0.006122 | 0.003614 | 0.012766 |
|    | 0.2                   | 0.004167 | 0.001852 | 0.011765 | 0.006557 | 0.00354  | 0.011429 |
|    | 0.25                  | 0.004587 | 0.001923 | 0.008065 | 0.00625  | 0.004237 | 0.008403 |
| 10 | G                     | V        | W        | X        | Y        | Z        |          |
|    | 0.001667              | 0.005    | 0.011111 | 0.005882 | 0.007143 | 0.001316 |          |
|    | 0.001802              | 0.007273 | 0.012903 | 0.005128 | 0.005128 | 0.001695 |          |
|    | 0.002                 | 0.006522 | 0.013333 | 0.006    | 0.00625  | 0.001829 |          |
|    | 0.001869              | 0.005479 | 0.0125   | 0.006452 | 0.007018 | 0.001942 |          |
| 15 | 0.001437              | 0.004    | 0.006757 | 0.005051 | 0.007143 | 0.001429 |          |

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Although the flexibility of the examples were measured at various deflection distances, "flexibility"(as that term is used in the claims) should be measured at a deflection distance of 0.05".

CLAIMS

1. A correction fluid product, comprising  
a body including a reservoir and an opening,  
a correction fluid within the reservoir, and  
5 an applicator, inserted through the opening, including a stem and an  
applicator tip comprising foam, the applicator having a flexibility of at least 0.0005  
inch of deflection per gram of force.
2. The product of claim 1, wherein the stem has a length between 2 cm  
and 15 cm.
- 10 3. The product of claim 1, wherein the foam comprises a quenched  
foam.
4. The product of claim 3, wherein the foam comprises  
polyurethane/polyester.
5. The product of claim 1, wherein the foam comprises a material  
15 selected from the group consisting of polyurethane/polyester and  
polyurethane/polyether.
6. The product of claim 1, wherein the foam is stable to organic  
solvents.
7. The product of claim 1, wherein the applicator tip has an angled  
20 chisel-shaped edge.
8. The product of claim 1, wherein the applicator tip has an average  
thickness of between 0.16 cm and 1.27 cm.
9. The product of claim 1, wherein the applicator tip further comprises a  
flexor within the foam.
- 25 10. The product of claim 1, wherein the correction fluid includes organic  
solvent.
11. The product of claim 1, wherein the correction fluid has a viscosity  
of between 10 cps and 2000 cps.
12. The product of claim 1, wherein the foam portion has an average  
30 pore size of between 20 ppi and 130 ppi.
13. A method of applying a correction fluid to a surface to cover a  
marking using an applicator having a flexibility of at least 0.0005 inch of deflection



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per gram of force and including a stem and an applicator tip including a foam, comprising loading correction fluid onto the applicator tip, and contacting the surface with the applicator tip to transfer correction fluid over the marking.

14. The method of claim 13, wherein the applicator further includes a flexor within the foam.

15. A correction fluid product, comprising  
a body including a reservoir and an opening,  
a correction fluid within the reservoir, and  
an applicator, inserted through the opening, including a stem and an applicator tip comprising a foam, the applicator tip having an angled chisel-shaped applicator surface.

16. The product of claim 15, wherein the chisel-shaped applicator surface is angled at an angle of between 15° and 60°.

17. The product of claim 15, wherein the foam comprises a quenched foam.

18. The product of claim 15, wherein the foam has an average pore size of between 20 ppi and 130 ppi.

19. The product of claim 15, wherein the applicator tip has an average thickness of between 0.16 cm and 1.27 cm.

20. The product of claim 15, wherein the applicator tip further comprises a flexor within the foam.

21. The product of claim 15, wherein the stem has a length of between 2 cm and 15 cm.

22. The product of claims 1 or 15, wherein said product further comprises an insert in the opening through which the applicator passes during use, the insert having a narrowed neck portion that removes excess correction fluid from the applicator tip when the applicator tip is withdrawn through the insert.

23. A method of applying a correction fluid to cover a marking in a surface using an applicator including a stem and an applicator tip including a foam having an angled chisel-shaped applicator surface, comprising loading correction fluid onto the applicator tip, and contacting the surface with the applicator tip to transfer correction fluid over the marking.



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24. The method of claim 23, wherein the applicator further includes a flexor within the foam.
25. A correction fluid product, comprising  
a body including a reservoir and an opening,  
5 a correction fluid within the reservoir, and  
an applicator, inserted through the opening, including a stem and an applicator tip including a foam, the foam comprising a quenched foam.
26. The product of claim 25, wherein the applicator further comprises a flexor within the foam.
- 10 27. The product of claim 25, wherein said foam has an average pore size of between 20 ppi and 130 ppi.
28. The product of claim 25, wherein said foam comprises a polyurethane/polyester.
29. The product of claim 25, wherein the correction fluid includes an  
15 organic solvent.
30. A method of applying a correction fluid to cover a marking on a substrate using an applicator including a stem and an applicator tip including a foam comprising a quenched foam, comprising loading correction fluid onto the applicator tip, and contacting the surface with the applicator tip to transfer  
20 correction fluid over the marking.
31. The method of claim 30, wherein the applicator further includes a flexor within the foam.
32. A correction fluid product, comprising  
a body including a reservoir and an opening,  
25 a correction fluid within the reservoir, and  
an applicator, inserted through the opening, including a stem and an applicator tip including foam in contact with the correction fluid, the foam having an average pore size of between 20 ppi and 130 ppi.
33. The product of claim 32, wherein the applicator further comprises a  
30 flexor within the foam.
34. The product of claim 32, wherein the foam comprises a polyurethane/polyester.



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35. A method of applying a correction fluid to cover a marking on a substrate using an applicator including a stem and an applicator tip including a foam having an average pore size of between 20 ppi and 130 ppi, comprising

loading correction fluid onto the applicator tip, and

5 contacting the surface with the applicator tip to transfer correction fluid over the marking.

36. The method of claim 35, wherein the applicator further comprises a flexor within the foam.

37. A applicator comprising a stem, a foam portion having an average pore size of between 20 ppi and 130 ppi, and a flexor within the foam portion, the foam portion having an angled chisel-shaped applicator surface, and the applicator having a flexibility of at least 0.0005 inch of deflection per gram of force.

38. An applicator for applying a correction fluid to a substrate, comprising

15 an applicator tip including a foam, and

a correction fluid reservoir, including correction fluid, from which correction fluid is fed to the applicator tip,

wherein the applicator has a flexibility of at least 0.0005 inch per gram of force.

20 39. The applicator of claim 38, further comprising a removable enclosure for the applicator tip.

40. The product of claim 1, wherein the applicator has a flexibility of at least 0.002 inch of deflection per gram of force.

