



[54] DRY PAINT TRANSFER PROCESS FOR MAKING HIGH DOI AUTOMOTIVE BODY PANELS

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Related U.S. Application Data

[63] Continuation of Ser. No. 346,548, Nov. 29, 1994, which is a continuation of Ser. No. 179,765, Jan. 10, 1994, abandoned, which is a continuation of Ser. No. 25,827, Mar. 3, 1993, abandoned, which is a continuation of Ser. No. 873,708, Apr. 22, 1992, abandoned, which is a continuation of Ser. No. 424,302, Nov. 22, 1989, abandoned, which is a continuation-in-part of Ser. No. 162,917, Mar. 2, 1988, abandoned, which is a continuation-in-part of Ser. No. 31,984, Mar. 27, 1987, abandoned.

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[52] U.S. Cl. 156/230; 156/231; 156/239; 156/245; 156/246

[58] Field of Search 156/230, 231, 156/233, 235, 238, 240, 245, 239, 196, 246; 428/200, 201, 202, 203, 204

[56] References Cited

U.S. PATENT DOCUMENTS

| | | | |
|-----------|---------|----------------------|---------|
| 2,159,693 | 5/1939 | Gaylord, Jr. | 41/33 |
| 2,977,639 | 4/1961 | Barkhuff, Jr. et al. | 18/59 |
| 3,057,018 | 10/1962 | Lawrence et al. | 18/59 |
| 3,253,060 | 5/1966 | Koblitz et al. | 260/900 |
| 3,458,391 | 7/1969 | Miller, Jr. | 161/189 |
| 3,459,834 | 8/1969 | Schmitt | 260/898 |
| 3,493,257 | 2/1970 | Fitzgerald et al. | 293/71 |
| 3,524,906 | 8/1970 | Schmitt et al. | 260/900 |
| 3,654,062 | 4/1972 | Loew | 161/119 |
| 3,679,510 | 7/1972 | Conley et al. | 156/245 |

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

| | | |
|---------|--------|--------------------|
| 0109313 | 5/1984 | European Pat. Off. |
| 0133119 | 2/1985 | European Pat. Off. |
| 0177829 | 4/1986 | European Pat. Off. |
| 0178096 | 4/1986 | European Pat. Off. |
| 0230364 | 7/1987 | European Pat. Off. |
| 0251546 | 1/1988 | European Pat. Off. |

(List continued on next page.)

OTHER PUBLICATIONS

Fuchs, SME Technical Paper No., FC 77-647, "A State of the Art—Evaluation of Hot Stamping Decorative Plastic," dated 1977.

(List continued on next page.)

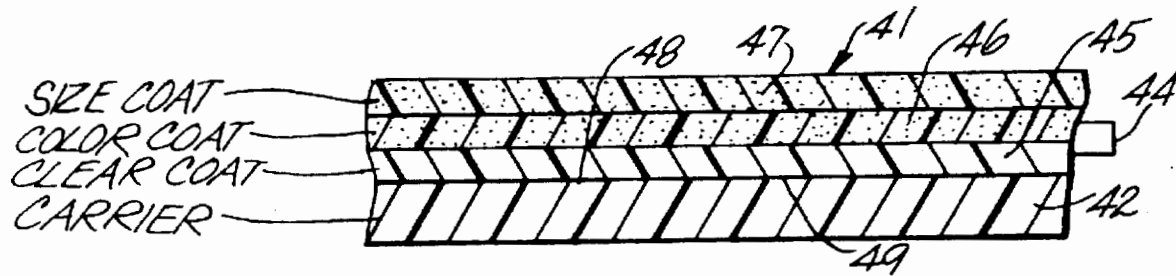
Primary Examiner—James Engel

Attorney, Agent, or Firm—Christie, Parker & Hale, LLP

[57] ABSTRACT

An automotive quality paint coat is laminated to the exterior surface of a molded plastic car body panel. In one embodiment, the paint coat includes an exterior clear coat above a color coat. The clear coat and color coat are each coated on a temporary flexible casting sheet and dried. A high gloss surface is transferred to the clear coat from the casting sheet. The paint coat is then transferred from the casting sheet to a thin, semi-flexible thermoformable plastic backing sheet by dry paint transfer-laminating techniques. The resulting laminate is thermoformed into a complex three-dimensional shape of the car body panel. The pre-formed laminate is then bonded to a plastic substrate material by injection-cladding techniques to form the finished article. The paint coat has sufficient elongation to retain exterior automotive appearance and durability properties during thermoforming without deglossing. The backing sheet absorbs defects in the substrate material so the paint coat retains its appearance and durability properties. The finished article comprises a high gloss, defect-free paint coat on the exterior of a molded plastic car body panel. Solution-form polyvinylidene fluoride/acrylic paint systems have remarkably high combined gloss and distinctiveness-of-image levels and durability properties.

66 Claims, 5 Drawing Sheets



U.S. PATENT DOCUMENTS

| | | | |
|-----------|---------|-------------------|------------|
| 3,880,690 | 4/1975 | Fuchs et al. | 156/242 |
| 3,949,139 | 4/1976 | Dunning et al. | 428/328 |
| 4,101,698 | 7/1978 | Dunning et al. | 428/31 |
| 4,208,465 | 6/1980 | Chang | 428/416 |
| 4,235,949 | 11/1980 | Van Manen et al. | 428/31 |
| 4,248,762 | 2/1981 | Hornibrook et al. | 260/42.22 |
| 4,263,077 | 4/1981 | Rampelberg | 156/238 |
| 4,275,099 | 6/1981 | Dani | 428/31 |
| 4,307,058 | 12/1981 | Morello et al. | 264/510 |
| 4,314,004 | 2/1982 | Stoneberg | 428/421 |
| 4,317,860 | 3/1982 | Strassel | 428/421 |
| 4,349,592 | 9/1982 | Nussbaum | 428/31 |
| 4,359,504 | 11/1982 | Troy | 428/403 |
| 4,364,886 | 12/1982 | Strassel | 264/171 |
| 4,369,157 | 1/1983 | Conner | 264/246 |
| 4,396,680 | 8/1983 | Chang | 428/421 |
| 4,415,519 | 11/1983 | Strassel | 264/171 |
| 4,451,522 | 5/1984 | deVroom | 428/201 |
| 4,451,597 | 5/1984 | Victorius | 524/39 |
| 4,474,845 | 10/1984 | Hagerman et al. | 428/283 |
| 4,499,151 | 2/1985 | Dowbenko et al. | 428/447 |
| 4,515,649 | 5/1985 | Nussbaum | 156/244.11 |
| 4,578,426 | 3/1986 | Lenz et al. | 525/131 |
| 4,595,551 | 6/1986 | Maurer | 264/321 |
| 4,605,596 | 8/1986 | Fry | 428/423.3 |
| 4,639,341 | 1/1987 | Hanamoto et al. | 264/40.1 |
| 4,643,789 | 2/1987 | Parker et al. | 156/219 |
| 4,769,100 | 9/1988 | Short et al. | 156/285 |
| 4,810,540 | 3/1989 | Ellison et al. | 428/31 |
| 4,818,589 | 4/1989 | Johnson et al. | 428/201 |
| 4,828,637 | 5/1989 | Mentzer et al. | 156/212 |
| 4,838,973 | 6/1989 | Mentzer et al. | 156/212 |
| 4,868,030 | 9/1989 | Mentzer et al. | 428/174 |
| 4,902,557 | 2/1990 | Rohrbacher | 428/215 |
| 5,114,789 | 5/1992 | Reafter | 428/328 |
| 5,342,666 | 8/1994 | Ellison et al. | 428/46 |

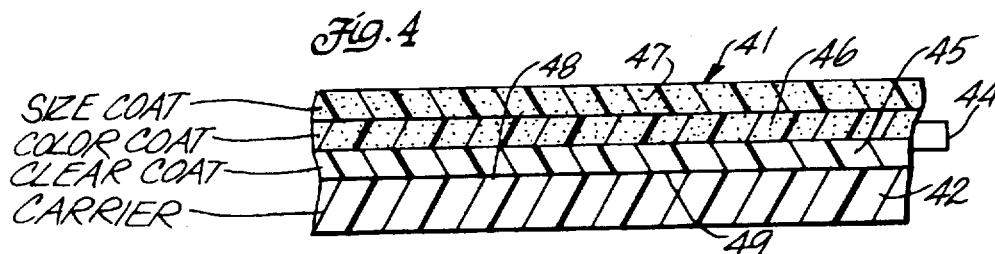
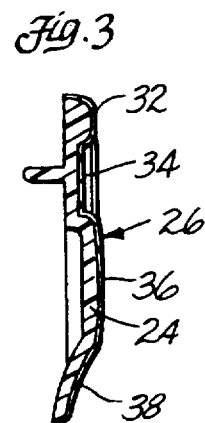
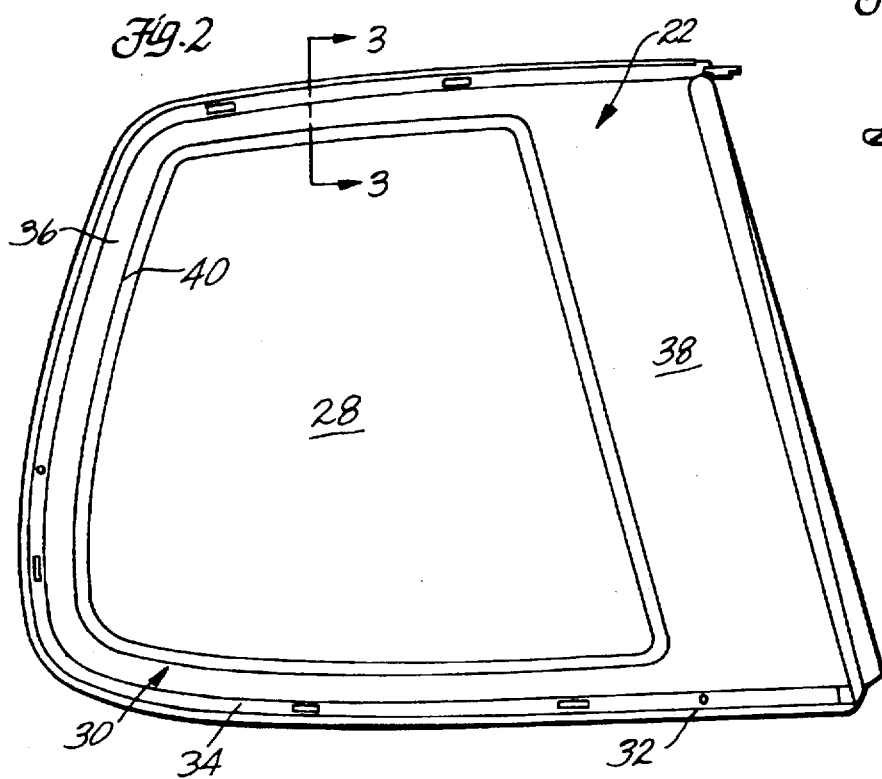
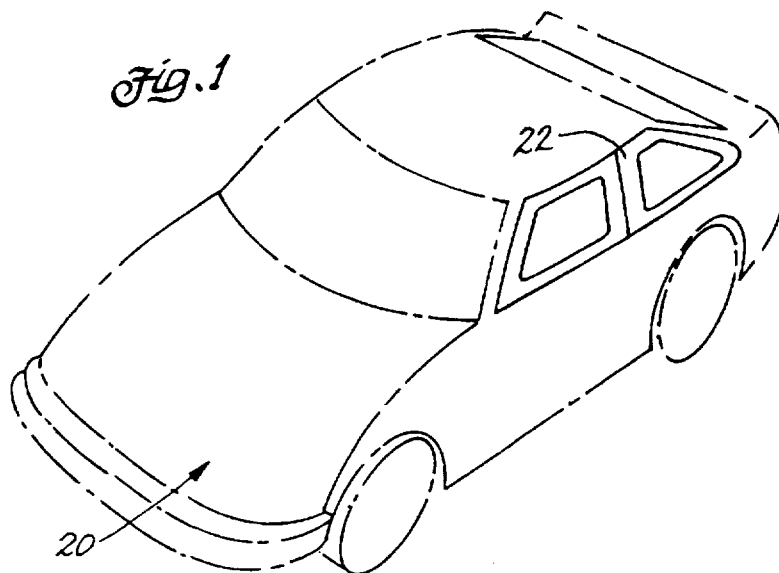
FOREIGN PATENT DOCUMENTS

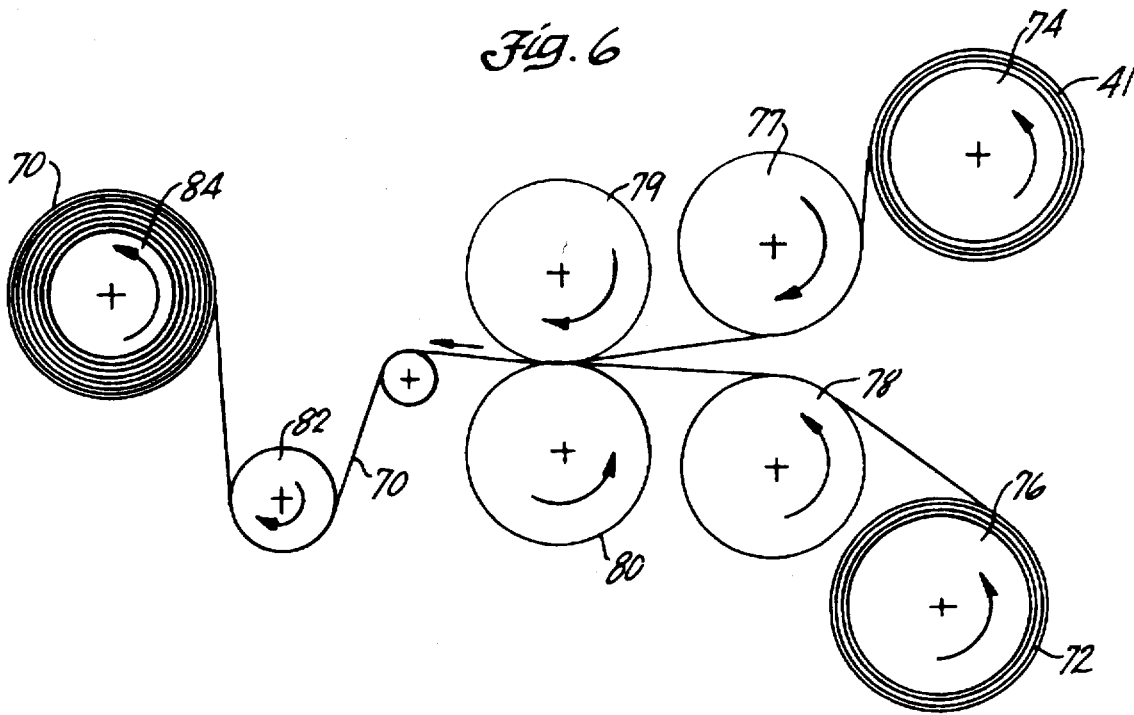
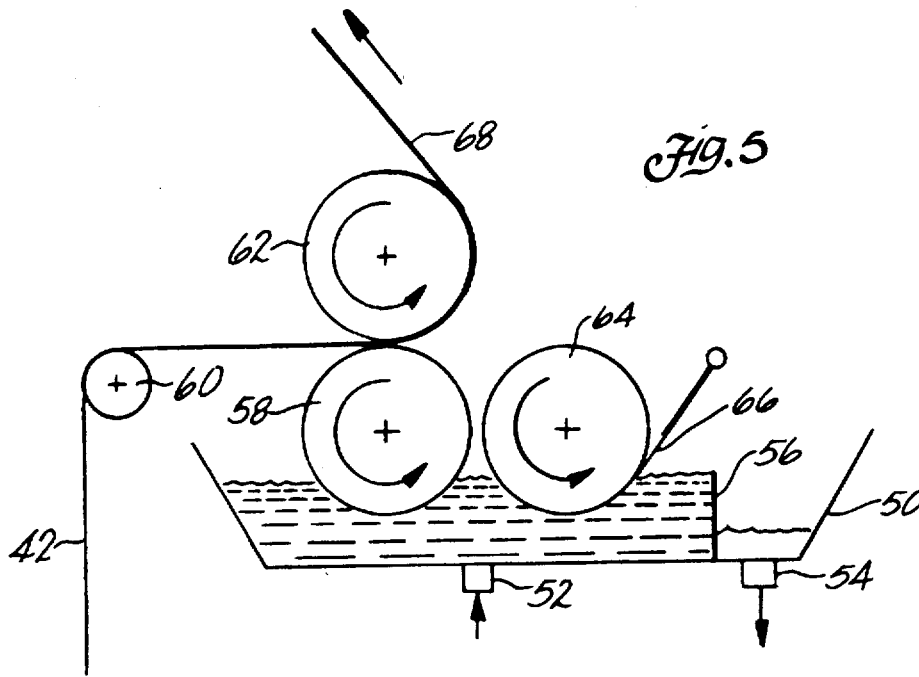
| | | |
|----------|--------|--------------------|
| 0266107 | 5/1988 | European Pat. Off. |
| 0266109 | 5/1988 | European Pat. Off. |
| 50-19132 | 7/1979 | Japan |

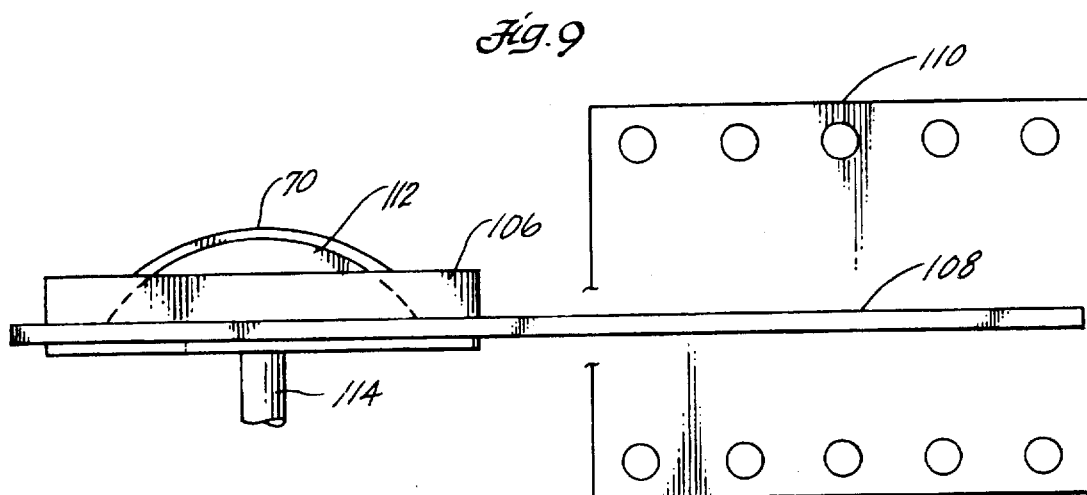
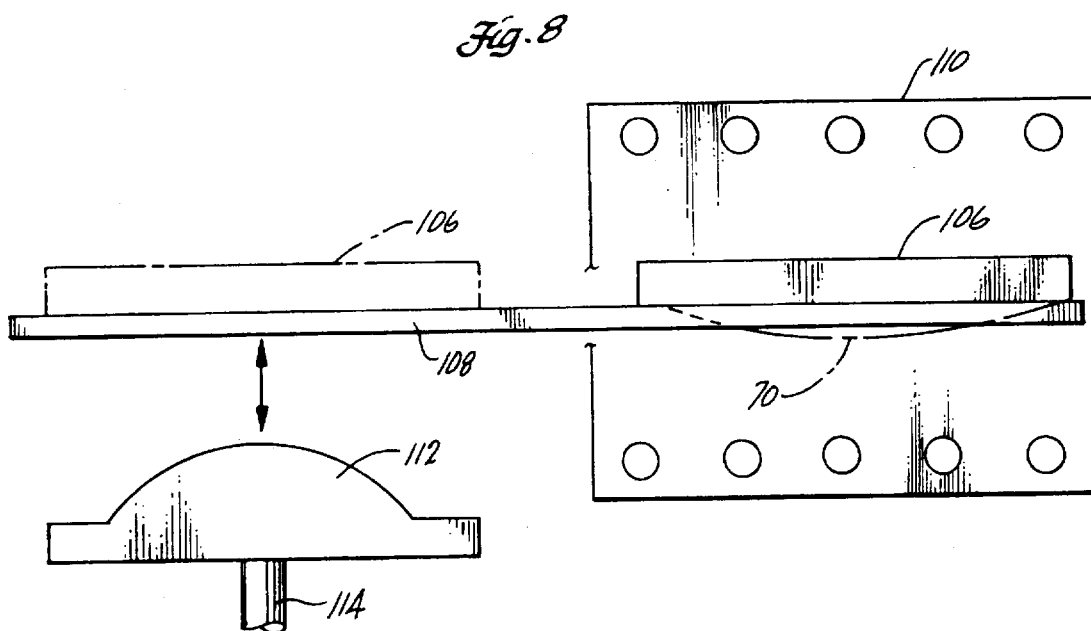
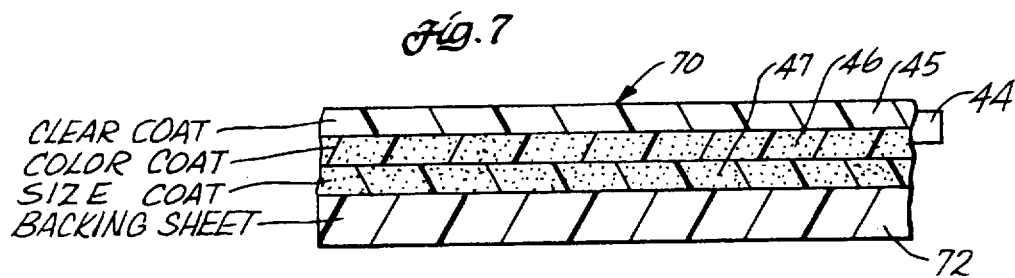
| | | |
|-----------|---------|----------------|
| 54-127464 | 10/1979 | Japan |
| 54-33561 | 11/1979 | Japan |
| 56-140064 | 3/1983 | Japan |
| 59-135231 | 8/1984 | Japan |
| 59-227447 | 11/1984 | Japan |
| 59-120432 | 12/1984 | Japan |
| 61-008349 | 1/1986 | Japan |
| 1232971 | 5/1971 | United Kingdom |
| 2084513 | 4/1982 | United Kingdom |
| 8100233 | 2/1981 | WIPO |

OTHER PUBLICATIONS

- Polymers Paint Colour Journal*, Oct. 29, 1980, p. 796. "The Orientation of Aluminum Pigments in Automotive Finishes," Toyo Aluminum K.K.
- Automobiltechnische Zeitschrift*, vol. 84, No. 5, May 1982.
- Chemical Week*, Jul. 4, 1984, p. 30 "Automotive Coatings: Helping Detroit Woo Customers".
- Anonymous, "Research Disclosure," Jul. 1984.
- Ullman, et al., "Composites, Science and Technology," 1985, pp. 97-112.
- BP&R, Nov. 1985, pp. 29-30.
- Avery International Thermark*, "The Driving Force in Laminates," 1985.
- Plastics World*, "Composite Structures: Next Wave in Detroit," Miller, Nov. 1986, pp. 30-34.
- "Brilliant Performance," Rexham Corporation, dated 1987.
- Plastics Engineering*, "Solvent Cast Films", May 1987, pp. 29-33.
- Affidavit of Dennis Northrop.
- Affidavit of Victor H. Rampelberg and supporting exhibits.
- Japanese Opposition by Minnesota Mining and Manufacturing Co. against Japanese Patent Application No. 63-504355 and attached exhibits.
- Japanese Opposition by Rexham Industries Corp. against Japanese Patent Application No. 63-504355 and attached exhibits.
- Japanese Opposition by Nissha Printing Co., Ltd. against Japanese Patent Application No. 63-504355 and attached exhibits.







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