



US008424704B2

(12) **United States Patent**  
**Santrach**

(10) **Patent No.:** **US 8,424,704 B2**  
(45) **Date of Patent:** **Apr. 23, 2013**

(54) **SELF-CLEANING LID FOR A PAINT CONTAINER FLUID POUR SPOUT**

(75) Inventor: **Peter Santrach**, North Oaks, MN (US)

(73) Assignee: **X-Pert Paint Mixing Systems, Inc.**,  
Roseville, MN (US)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 973 days.

(21) Appl. No.: **11/142,815**

(22) Filed: **Jun. 1, 2005**

(65) **Prior Publication Data**

US 2006/0000838 A1 Jan. 5, 2006

**Related U.S. Application Data**

(60) Provisional application No. 60/576,318, filed on Jun. 2, 2004.

(51) **Int. Cl.**  
**B65D 51/18** (2006.01)

(52) **U.S. Cl.**  
USPC ..... **220/254.9; 220/700; 220/789; 220/798**

(58) **Field of Classification Search** ..... **220/700, 220/254.9, 798, 801, 789; 222/559**  
See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

2,027,297 A	1/1936	Tramosch	259/107
2,035,646 A	3/1936	Farrington	259/108
2,050,809 A	8/1936	Ruetz	221/60
2,068,646 A	1/1937	Hexter	226/100

2,111,482 A	3/1938	Ruetz	221/60
2,154,581 A *	4/1939	Pershall	222/473
2,272,867 A	5/1939	Cobel	
2,370,997 A	3/1945	Rudolph	222/559
2,423,969 A	7/1947	Foltz	259/58
2,428,492 A	10/1947	Haller	259/67
2,521,384 A	9/1950	Marienthal	259/66
2,585,334 A	2/1952	McCauley	220/55
2,603,461 A	7/1952	Marienthal	259/64
2,636,643 A	4/1953	McCauley	222/80
2,757,910 A	8/1956	O'Neill	259/108
2,802,649 A	8/1957	Stockton	259/67
2,898,094 A	8/1959	O'Neill, Jr.	259/116
3,052,386 A	9/1959	Martorelli	
2,965,363 A	12/1960	Worden	259/67
3,021,118 A	2/1962	Dedoes	259/43
3,041,052 A	6/1962	Dedoes	259/122
3,118,653 A	1/1964	Dedoes	259/66
3,147,891 A	9/1964	Fielitz	222/166

(Continued)

**FOREIGN PATENT DOCUMENTS**

CA	2298761	8/2001
DE	858607	12/1952

(Continued)

**OTHER PUBLICATIONS**

International Search Report having International Application No. PCT/US2005/019889 mailed on Jan. 11, 2006.

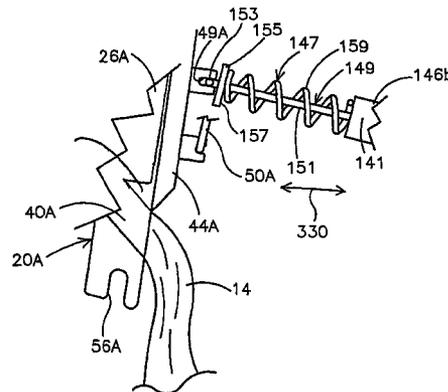
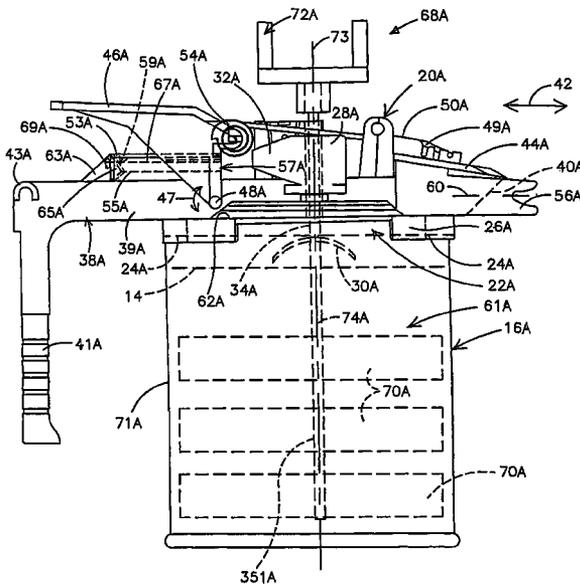
(Continued)

*Primary Examiner* — Anthony Stashick  
*Assistant Examiner* — Christopher McKinley  
(74) *Attorney, Agent, or Firm* — Dicke, Billig & Czaja, PLLC

(57) **ABSTRACT**

A self-cleaning lid for use with a paint container is disclosed.

**15 Claims, 14 Drawing Sheets**



U.S. PATENT DOCUMENTS

3,162,338	A	12/1964	Grubelic	222/484
3,175,808	A	3/1965	Dedoes	259/107
3,212,686	A *	10/1965	Di Piero et al.	222/472
3,284,057	A	11/1966	Duquette	259/88
3,350,083	A	10/1967	Buhrer et al.	266/38
3,412,937	A	11/1968	Chamberlain	239/142
3,670,785	A	6/1972	Heiss et al.	141/9
3,797,744	A	3/1974	Smith	239/172
3,930,598	A	1/1976	Slagle	222/129.4
4,090,475	A	5/1978	Kwan	222/70
4,127,212	A *	11/1978	Waterbury	220/255.1
4,163,523	A	8/1979	Vincent	239/305
4,225,248	A	9/1980	Para	366/251
4,299,500	A	11/1981	Bassetti	366/198
4,372,666	A	2/1983	Kaufmann	354/298
4,380,399	A	4/1983	Godat et al.	366/289
4,407,584	A	10/1983	Boudin et al.	366/279
4,538,222	A	8/1985	Crain et al.	364/172
4,585,148	A	4/1986	Ito	222/77
4,630,654	A	12/1986	Kennedy, Jr.	141/83
4,671,892	A	6/1987	Bereiter	252/370
4,691,850	A	9/1987	Kirschmann et al.	222/642
4,750,648	A *	6/1988	Krydiak	222/484
4,781,312	A	11/1988	Strazdins	222/309
4,792,236	A	12/1988	Heinis et al.	366/245
4,845,965	A	7/1989	Copeland et al.	68/17 R
4,898,308	A	2/1990	Rudick	222/325
4,926,390	A	5/1990	Murza	366/249
4,941,596	A	7/1990	Marty et al.	222/144.5
4,946,100	A	8/1990	Flemming et al.	239/1
4,967,938	A	11/1990	Hellenberg	222/144
4,976,137	A	12/1990	Decker et al.	73/53
5,020,700	A	6/1991	Krzywdziak et al.	222/487
5,020,917	A	6/1991	Homan	366/161
5,027,284	A	6/1991	Senghaas et al.	364/479
5,056,686	A	10/1991	Jarrett	222/129.2
5,062,542	A *	11/1991	Morton	220/269
5,078,302	A	1/1992	Hellenberg	222/144
5,094,543	A	3/1992	Mursa	366/247
5,096,071	A	3/1992	Neri	211/71
5,115,842	A	5/1992	Crafts et al.	141/286
5,119,973	A	6/1992	Miller et al.	222/144
5,153,825	A	10/1992	Yauk et al.	364/401
5,156,194	A	10/1992	Von Nehring et al.	141/1
5,160,198	A	11/1992	Fillon	366/198
5,169,232	A	12/1992	Fillon et al.	366/249
5,199,788	A	4/1993	Stallings	366/247
5,203,366	A	4/1993	Czeck et al.	137/3
5,251,979	A	10/1993	Larsen	366/248
5,267,675	A *	12/1993	Cane	222/556
5,310,258	A	5/1994	Godat et al.	366/251
5,335,806	A	8/1994	Dedoes	220/358
5,358,153	A *	10/1994	Caldwell et al.	222/505
5,368,388	A	11/1994	Fillon	366/245
5,368,389	A	11/1994	Dedoes	366/247
5,413,257	A	5/1995	Amberger et al.	222/472

5,437,385	A	8/1995	Fillon	220/238
5,454,639	A	10/1995	Krzywdziak	366/279
5,456,534	A	10/1995	Krzywdziak	366/249
5,472,277	A	12/1995	Dedoes	366/247
5,474,211	A	12/1995	Hellenberg	222/1
5,482,370	A	1/1996	Dedoes	366/247
5,493,840	A	2/1996	Cane	53/50
5,496,109	A	3/1996	Dedoes	366/198
5,498,076	A	3/1996	Krzywdziak	366/245
5,498,077	A	3/1996	Krzywdziak et al.	366/247
5,503,474	A	4/1996	Krzywdziak	366/347
5,511,878	A	4/1996	Dedoes et al.	366/198
5,533,802	A	7/1996	Garganese	366/256
5,542,761	A	8/1996	Dedoes	366/198
5,586,822	A	12/1996	Krzywdziak	366/247
5,603,426	A	2/1997	Krzywdziak et al.	220/324
5,622,289	A	4/1997	Dedoes	222/472
5,676,463	A	10/1997	Larsen	366/251
5,697,703	A	12/1997	Lucchetti	366/198
5,800,057	A	9/1998	Lesimple	366/198
5,813,760	A	9/1998	Strong	366/258
5,839,825	A *	11/1998	Krzywdziak	366/247
5,904,420	A	5/1999	Dedoes	366/198
5,947,598	A	9/1999	Dedoes	366/198
5,988,868	A	11/1999	Dedoes	366/198
6,053,218	A	4/2000	Boers	141/83
6,082,576	A *	7/2000	Counts-Bradley et al.	220/787
6,257,452	B1	7/2001	Allen	
6,290,110	B1 *	9/2001	Boers	222/559
6,398,050	B1 *	6/2002	Allora	215/228
6,755,326	B2 *	6/2004	Boers	222/135
RE39,732	E *	7/2007	Lesimple	366/198
7,455,191	B2 *	11/2008	Bhavani	220/592.17
2001/0035437	A1	11/2001	Boers	

FOREIGN PATENT DOCUMENTS

DE	29 51 731	7/1980
EP	0 035 422 A1	9/1981
EP	0 127 589 A2	12/1984
EP	0 298 806 A1	1/1989
EP	1 424 291 A1	2/2004
EP	1 424 291	6/2004
FR	2102417	4/1972
FR	2562874	10/1985
FR	2742072	1/1998
GB	2 203 059 A	10/1988

OTHER PUBLICATIONS

Written Opinion of the International Searching Authority of International Application No. PCT/US2005/019889 mailed on Jan. 11, 2006.

PCT Search Report, Oct. 20, 2010, 4 pages.

Office Action from European Patent Office, Nov. 17, 2011, 5 pages.

\* cited by examiner



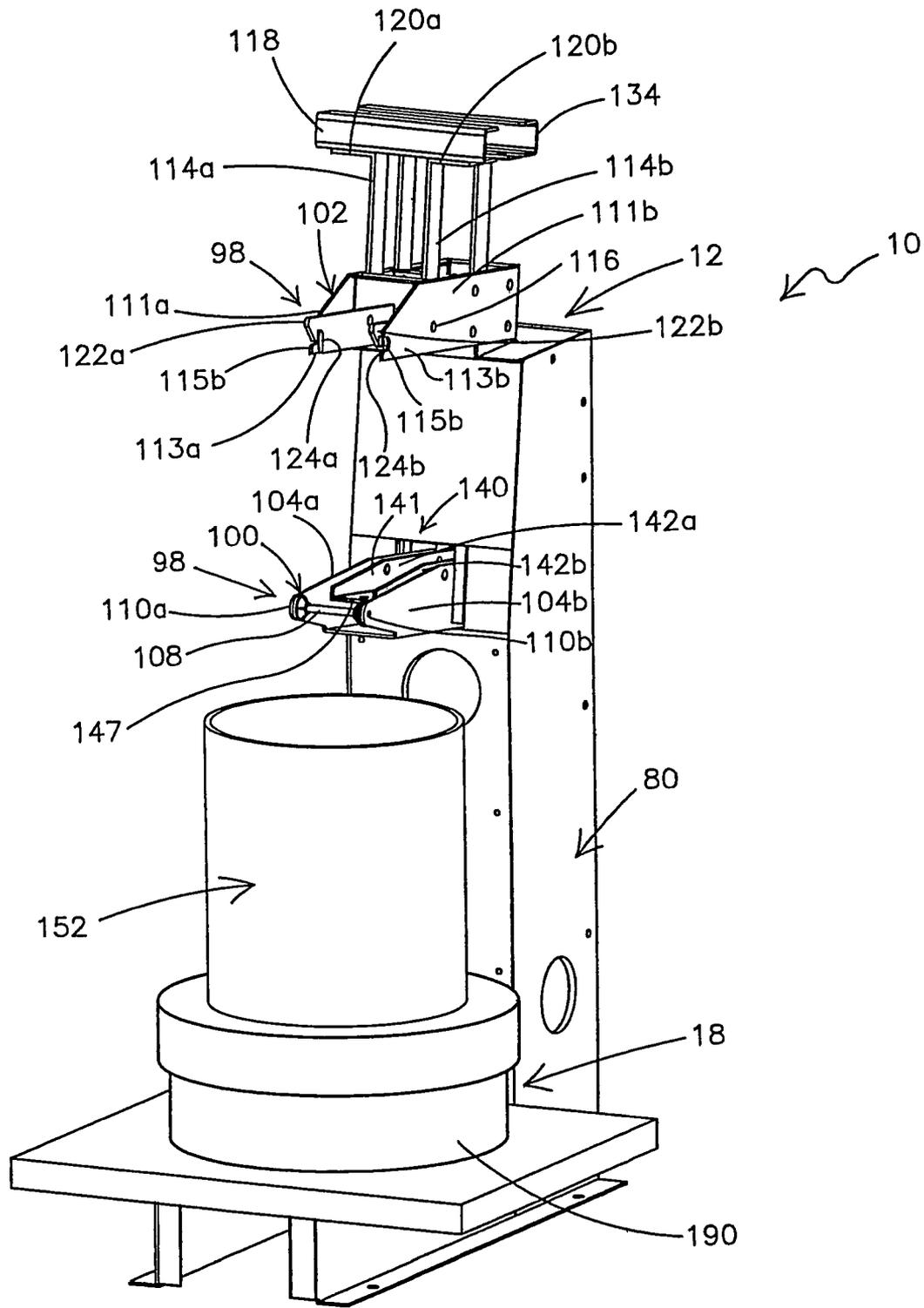


Fig. 2



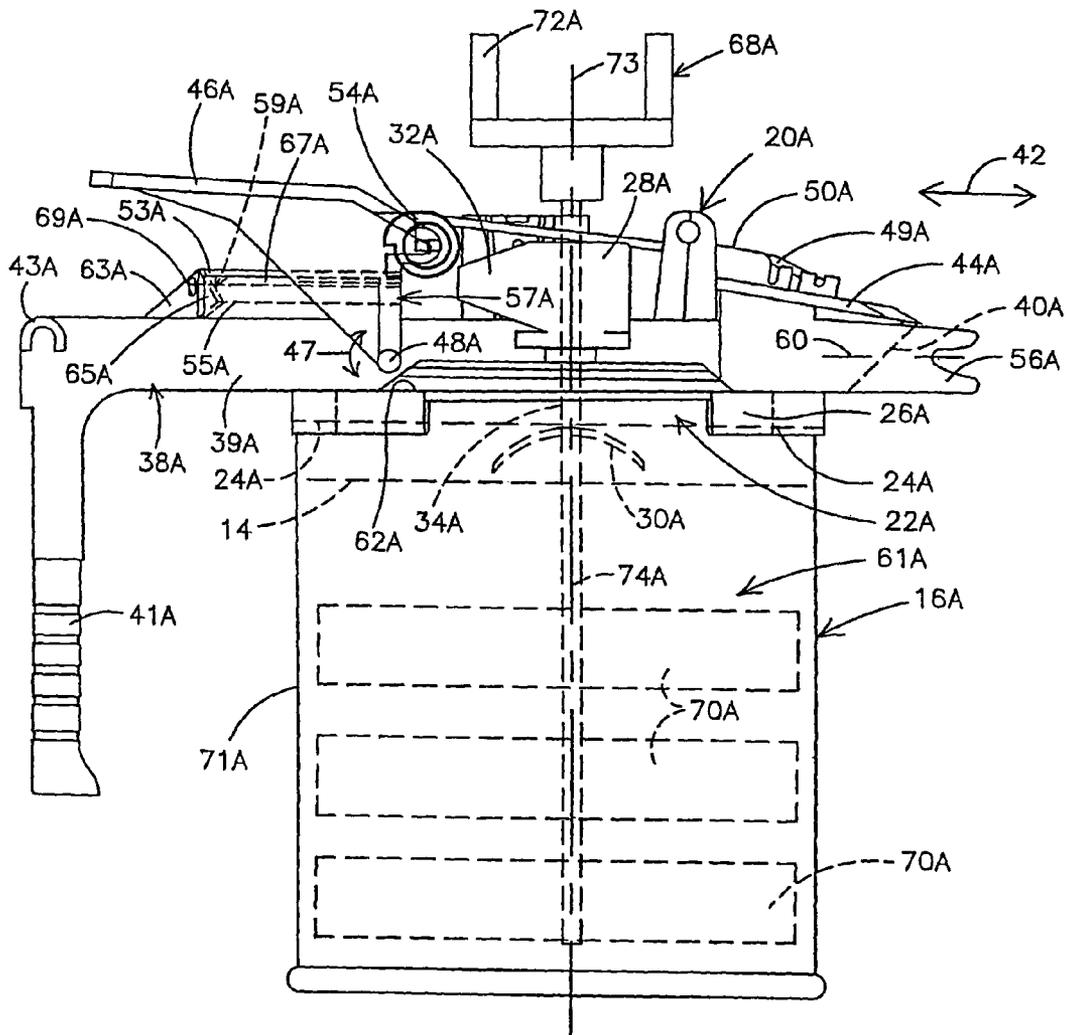


Fig. 3B



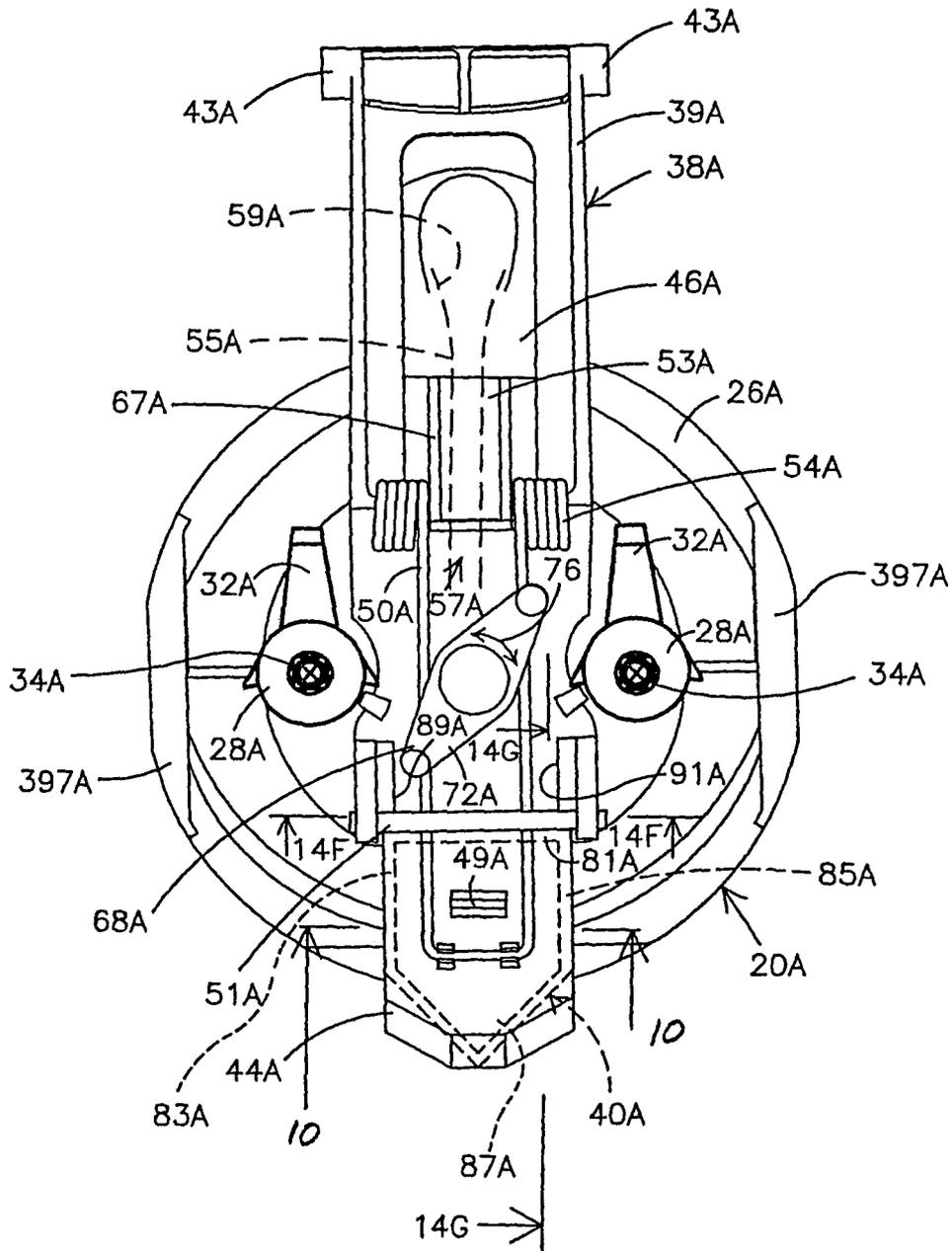


Fig. 5

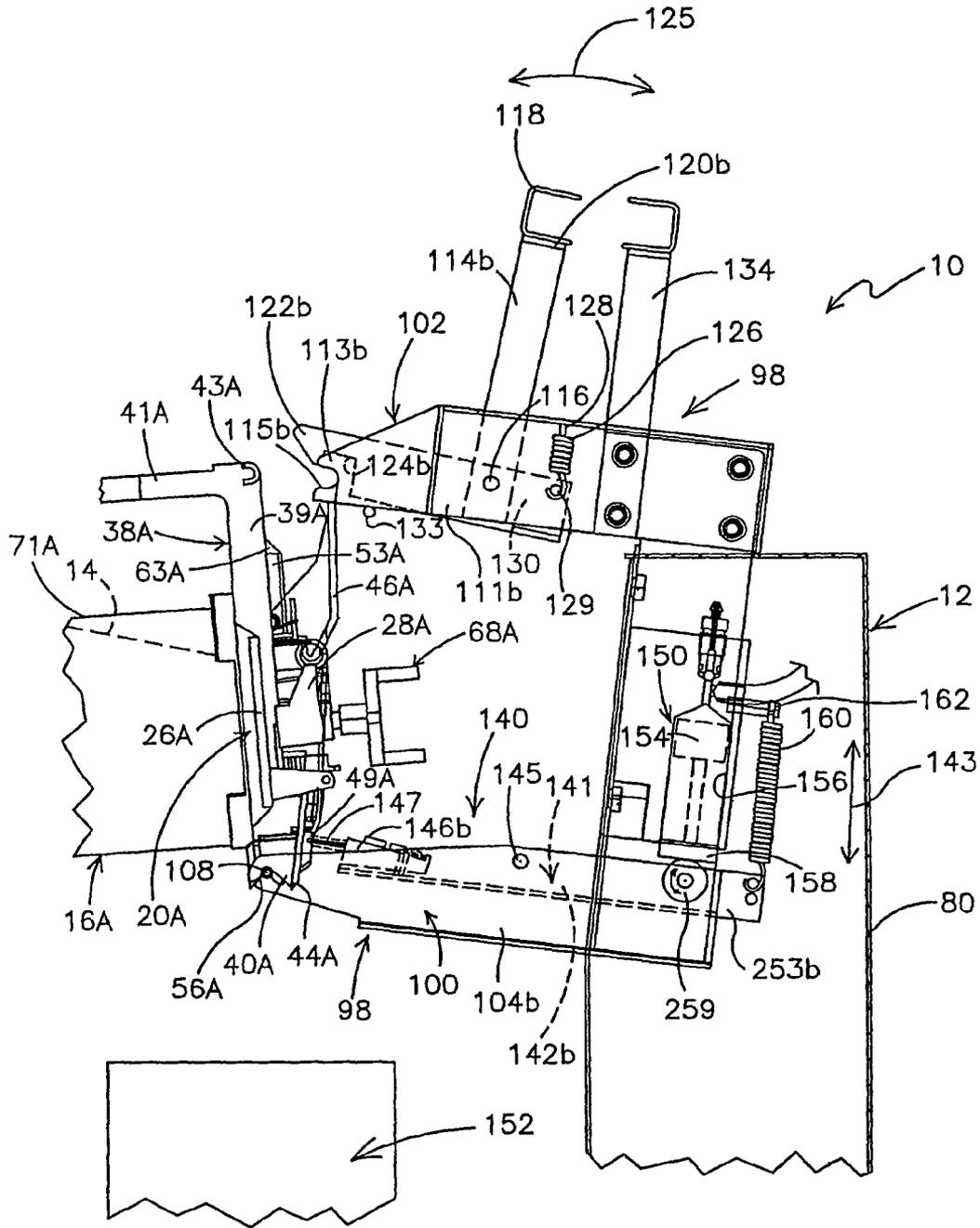


Fig. 6

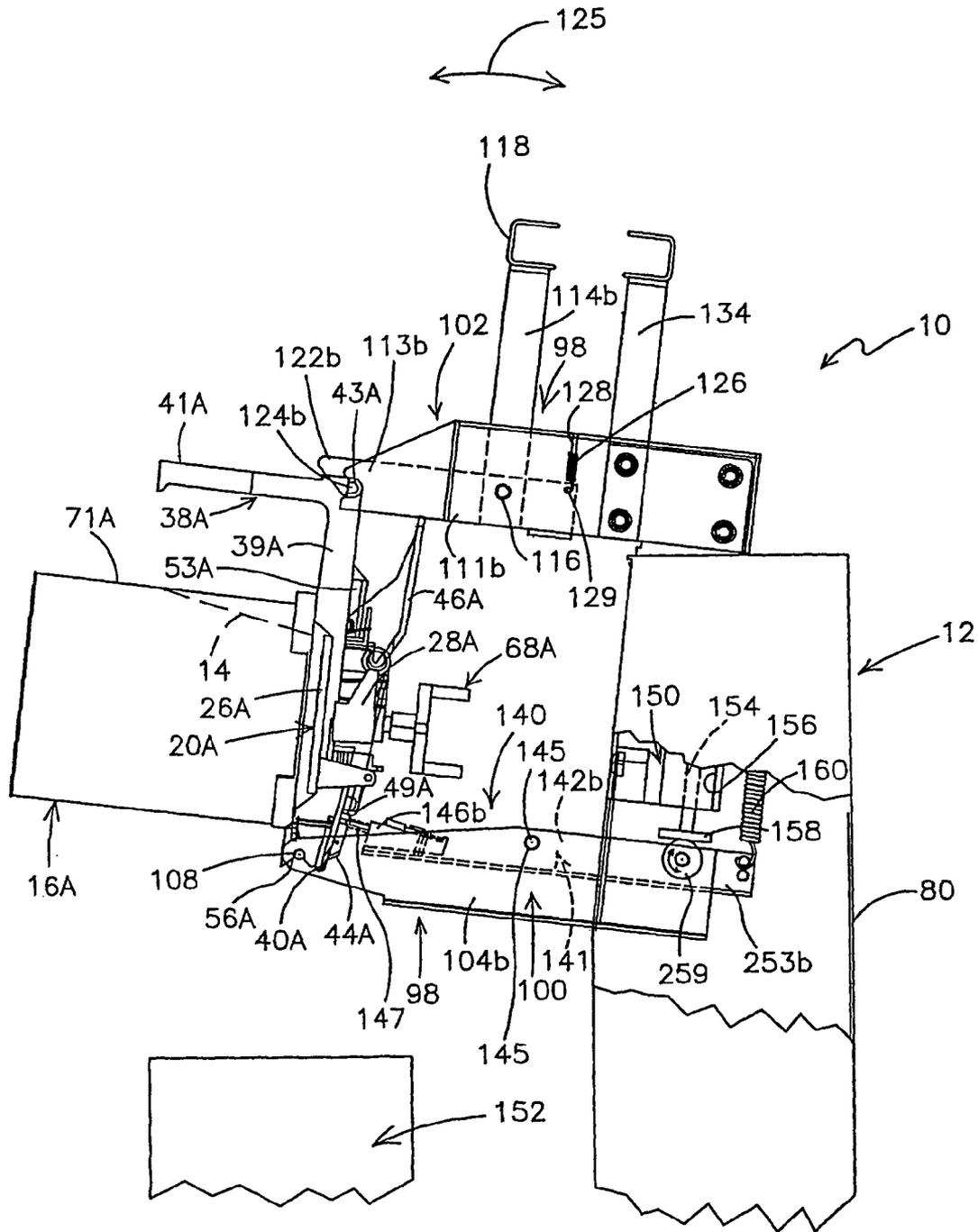
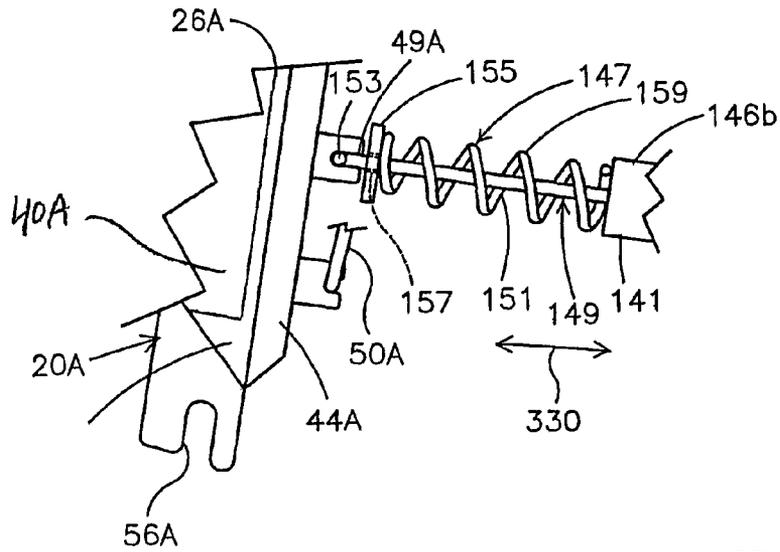
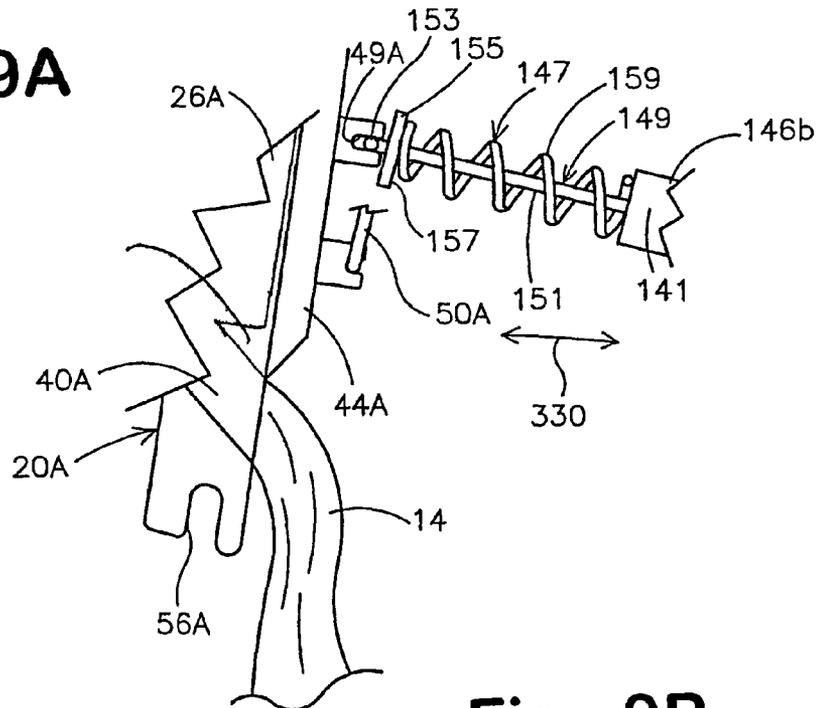


Fig. 7





**Fig. 9A**



**Fig. 9B**

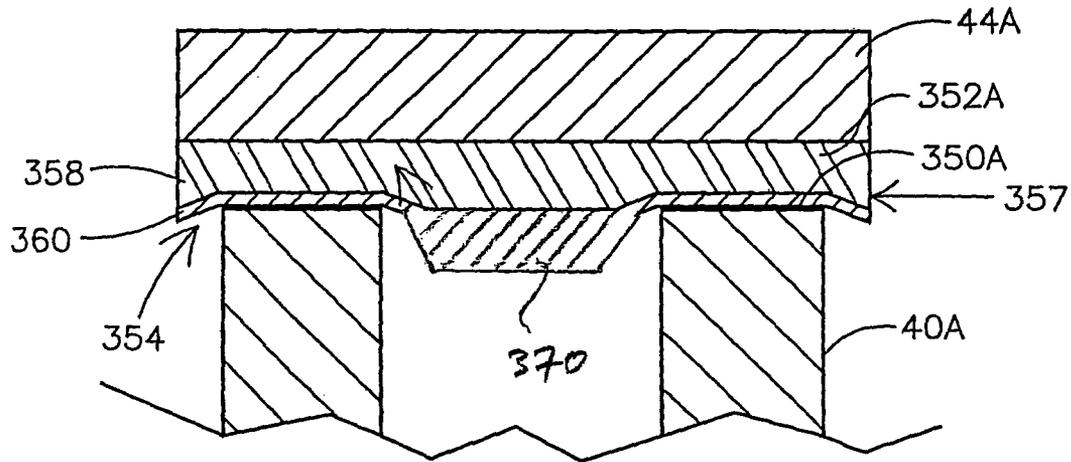
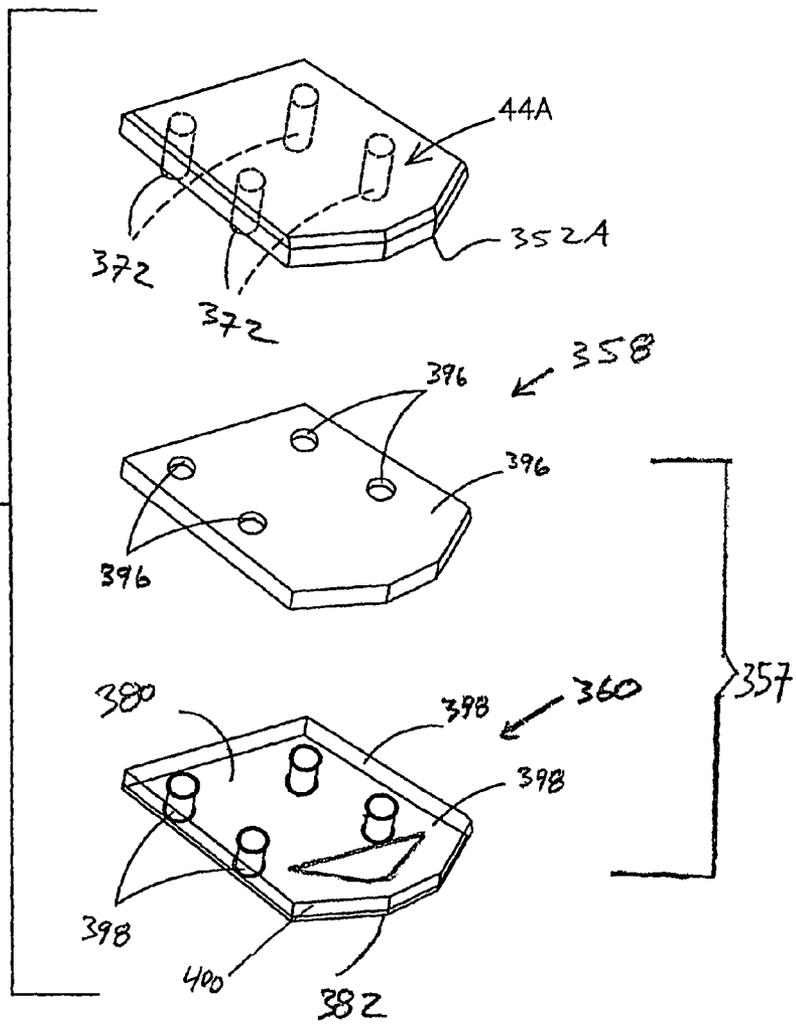


Fig. 10

Fig. 11



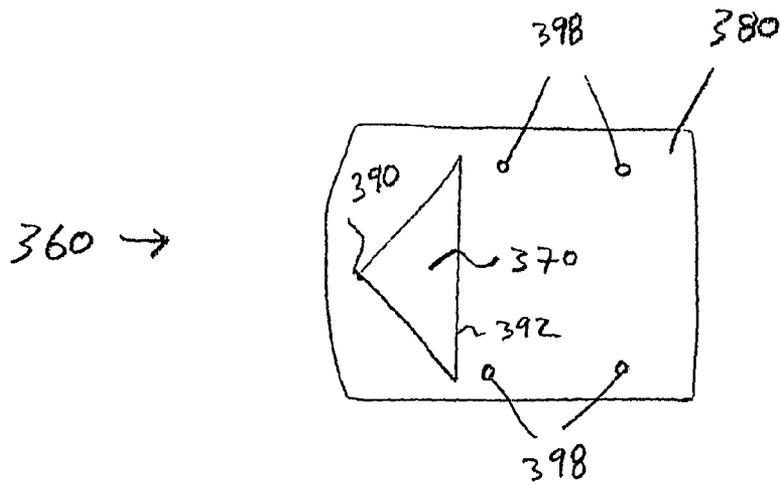


Fig. 12A

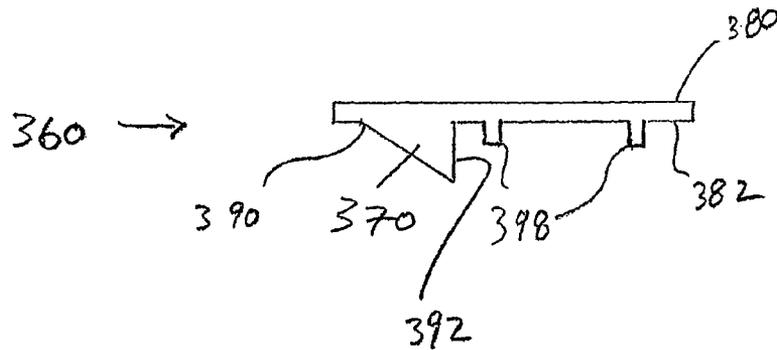


Fig. 13A

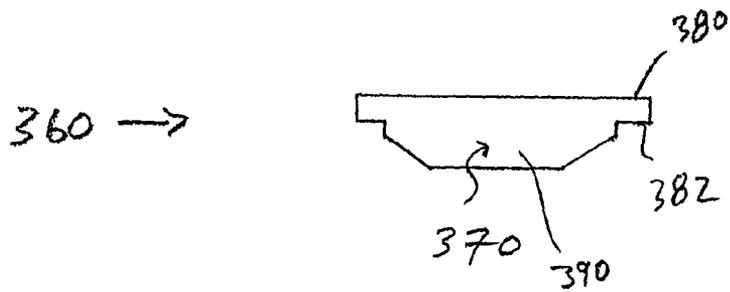


Fig. 14

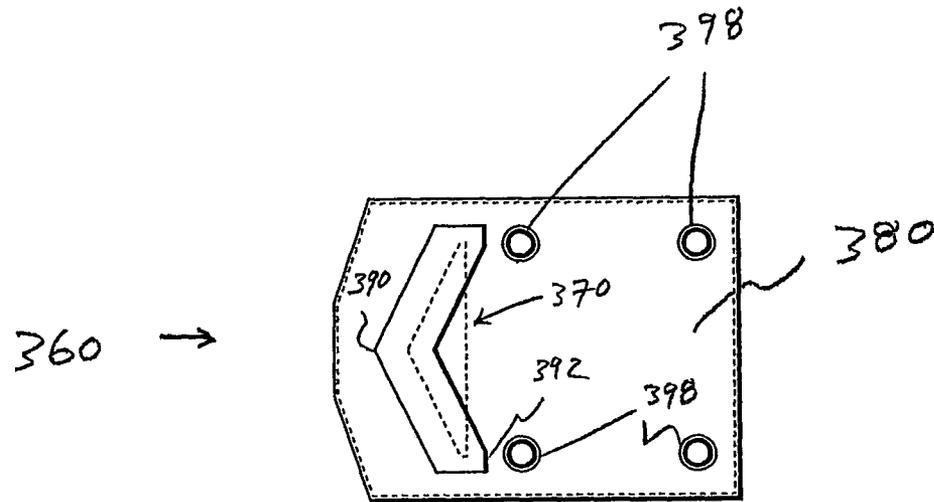


Fig. 12 B

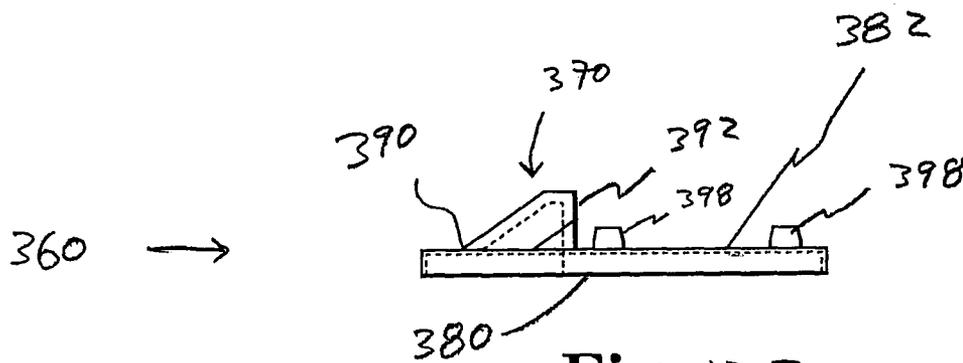


Fig. 13 B

## SELF-CLEANING LID FOR A PAINT CONTAINER FLUID POUR SPOUT

### CROSS-REFERENCE TO RELATED APPLICATIONS

This non-provisional application claims the benefit of the filing date of Provisional U.S. Patent Application Ser. No. 60/576,318, entitled "SELF-CLEANING LID FOR A PAINT CONTAINER FLUID POUR SPOUT," having a filing date of Jun. 2, 2004, and which is herein incorporated by reference.

### BACKGROUND OF THE INVENTION

This invention relates to mixing paint components, such as colorants, tints and pearls, to create automotive paint formulas. In particular, the present invention is a fluid seal structure configured to prevent contaminants from entering a paint container through the pour spout and configured to prevent leakage of the paint past the container.

In the automotive body repair industry, paint vendors provide auto body repair businesses, such as body shops and jobbers, with their paint formulas. Generally, these paint formulas are a composition (i.e., mixture) of paint components, such as colorants, tints, pearls, metallics, binders and/or balancers, that, once mixed, produce the desired color of paint to be applied to a repaired vehicle. The paint formulas of the paint vendors are formulated to match the colors that have been applied to vehicles by new car manufacturers over the years. In addition, these paint formulas include variants, to match the color fading of paint that can occur to a vehicle over years of service. Moreover, the palettes of paint formulas of the paint vendors also have custom colors (i.e., unconventional colors not typically used by vehicle manufacturers) that may be used to produce special finishes for custom or show cars. Hence, paint vendors provide body shops and jobbers with literally thousands of paint formulas for producing the vast spectrum of colors needed in the automotive body repair industry.

In the past, paint vendors would provide the body shops and jobbers with microfiche containing their paint formulas. Today the paint formulas are stored in computer memory. To determine the particular paint formula for a particular vehicle repair/paint job, a system operator, such as an employee of the body shop or jobber, first obtains the color code from the vehicle. This color code is typically part of the vehicle's identification number. In the case of an unconventional color, to be used to produce a custom paint finish, the code for a particular color is obtained from a catalog. This color code is then entered into the microprocessor of the computer, which accesses the computer memory, and displays, via a monitor, the paint vendor's paint formula which matches the identified vehicle color code.

The paint formulas are displayed according to the weight of the different paint components for mixing specific quantities of the paint formula, and the order in which the displayed paint components are to be mixed. Typically, paint formula mixing quantities are listed in quart, half gallon and gallon sizes, while the weight of the particular paint components needed to mix the desired quantity of paint, are listed in grams to a precision of a tenth of a gram. Generally, the paint components comprising tints, colorants, pearls and/or metallics are mixed first, while the paint components comprising binders and/or balancers are added last. Depending on the desired color, the paint formula can require just a few paint

components, or over a dozen paint components, that must be mixed with a great degree of precision, to achieve a perfect color match.

Once the system operator determines that the correct desired paint formula is displayed on the computer monitor, the operator places a paint receptacle on a weigh cell that is linked to the microprocessor of the computer. Generally, a receptacle larger than the quantity of paint formula to be mixed is used to accommodate any excess paint inadvertently mixed by the operator. With the receptacle on the weigh cell, the operator, to make ready for the process of adding paint components to the receptacle to mix the desired color paint formula, zeros the weigh cell. Generally, the various paint components (of which there are dozens) are stored in containers kept within a rack. The rack has a mechanism that periodically stirs the paint components within the containers, so that the various paint components are ready to be dispensed as part of the paint formula mixing process. Typically, these containers are the original quart and gallon sized metal containers within which the paint components are shipped to the body shop or jobber. In metric system countries, these containers are the original one-liter and four-liter sized metal containers within which the paint components are shipped to the body shop or jobber.

Specialized paint container lids that include stirring paddles that work with the stirring mechanism of the rack replace the original covers of these containers. These specialized paint container lids also have pour spouts that allow the paint components of the containers to be dispensed (i.e., poured out) into the receptacle atop the weigh cell. The pour spout of the specialized paint container lid is covered by a cover element. The cover element for the pour spout is movable between an opened state in which the paint component can be poured from its container through the pour spout by tipping (i.e., tilting) the container, and a closed state. The specialized paint container lid typically includes a vent to allow air to enter the container to displace the liquid paint component dispensed from the pour spout.

To reproduce the desired paint formula, the system operator begins by identifying the first listed paint component of the paint formula to be mixed. The operator then pours, by hand, the paint component into the weigh cell supported paint receptacle, until the weight of the paint component dispensed (i.e., poured) into the receptacle matches what is displayed on the computer monitor. The operator continues along on this course (i.e., hand pouring the paint components from their containers), until the correct weight of all paint components, needed to mix the desired color paint formula, have been added to the paint receptacle atop the weigh cell.

Although the above described system for mixing paint components (according to a paint formula), using the original containers of the liquid paint components and the above described specialized container lids, allows a skilled system operator to dispense the needed paint components to adequately recreate paint colors needed for repair/paint jobs, there are some disadvantages to this system. For example, during the process of dispensing the liquid paint component from the specialized container lid, the liquid paint component often undesirably flows out of the pour spout past the cover element when the cover element is in the closed position. In addition contaminants can enter the original container through the cover element/pour spout interface thereby adversely affecting the quality of the paint component contained within the original container. Moreover, to mix a desired paint formula requires that the paint components be added to the paint receptacle, atop the weigh cell, with a great degree of accuracy. This accuracy, as stated earlier, is typi-

cally to a precision of 0.1 grams. For even a highly skilled operator this great degree of precision is difficult to obtain when hand pouring the paint components needed to mix the desired paint formula. It is especially difficult when many paint components must be poured into the paint receptacle in order to duplicate the paint formula.

The most common error on the part of the system operator of the body shop or jobber is over pouring which is due primarily to the manual labor-intensive nature of the paint component dispensing process. Over pouring occurs when the weight of the paint component added to the receptacle atop the weigh cell, exceeds the weight of the component shown on the computer display for the desired paint formula. When this happens, the microprocessor of the computer recalculates the weights of the other paint components that need to be added to the receptacle to compensate for the over poured component. This recalculation is done automatically by the microprocessor since the weigh cell is linked to the computer. Based upon this recalculation, the system operator then needs to re-pour the other paint components to offset the over-poured component of the paint formula.

While this re-pouring task may not be difficult when the paint formula only has a few paint components, the re-pouring task is particularly time consuming when there is a great number of components in the paint formula. Specifically, if an over pouring error is made in the last paint component of a series of ten components of a paint formula, then all of the previous nine components may have to be re-poured to compensate. This re-pouring task may be further complicated if another error is made during the re-pouring of the paint components, as this further error may require that some components be re-poured two or three times until the paint formula is finally accurately reproduced. Hence, over pouring errors can be costly to a body shop or jobber because of the additional time needed to mix the paint formula.

There is a need for an improved system for mixing paint components according to a paint formula. In particular, there is a need for paint container lid members that can be used with the original containers of the paint components, and are compatible with a system for dispensing paint components according to a paint formula that substantially eliminates system operator errors, specifically over-pouring errors, that can be costly to a body shop or jobber. Further, there is a need for a paint container lid member having an automated pour spout cleaner.

### SUMMARY

In one embodiment, the present invention provides a self-cleaning lid for use with a paint container.

### BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the present invention are better understood with reference to the following drawings. The elements of the drawings are not necessarily to scale relative to each other. Like reference numerals designate corresponding similar parts.

FIG. 1 is a perspective view illustrating a dispensing and control apparatus of a semi-automated system for dispensing liquid paint components from their original containers in accordance with the present invention.

FIG. 2 is an enlarged perspective view better illustrating the dispensing apparatus of the dispensing system of FIG. 1.

FIG. 3A is a side elevational view of a quart size original paint container and lid member for holding a liquid paint component with a cover element and vent mechanism shown in a closed position.

FIG. 3B is a side elevational view similar to FIG. 3A of the quart size original paint container and lid member for holding a liquid paint component with the cover element and vent mechanism shown in an open position.

FIG. 4 is a perspective view of the quart size lid member shown in FIG. 3A.

FIG. 5 is top elevational view of the paint container and lid member shown in FIG. 3A.

FIG. 6 is partial side elevational view with some parts omitted for clarity of the dispensing apparatus of FIGS. 1 and 2, illustrating a quart size original container of a paint component being loaded into/unloaded from the dispensing apparatus.

FIG. 7 is a partial side elevational view with some parts omitted for clarity similar to FIG. 6, illustrating the quart size original container ready for dispensing of the liquid paint component.

FIG. 8 is a partial side elevational view with some parts omitted for clarity similar to FIG. 7, illustrating the liquid paint component being dispensed from its quart size original container.

FIG. 9A is an enlarged, partial side elevational view of a force applying mechanism for a cover element of the lid member with the cover element shown in a closed position corresponding to FIG. 7.

FIG. 9B is an enlarged, partial side elevational view similar to FIG. 9A with the cover element shown in an open position corresponding to FIG. 8.

FIG. 10 is a sectional view taken along line 10-10 in FIG. 5 illustrating one embodiment of a resilient seal mechanism for the cover element/pour spout interface of the lid member in accordance with the present invention.

FIG. 11 is a perspective, exploded view of a resilient seal mechanism including a cover member and a resilient seal member according to one embodiment of the present invention.

FIG. 12A is a top view of a second substrate according to one embodiment of the present invention.

FIG. 12B is a top view of another second substrate according to one embodiment of the present invention.

FIG. 13A is a side view of a second substrate of a resilient seal member oriented with a substrate side up according to one embodiment of the present invention.

FIG. 13B is a side view of a second substrate of a resilient seal member oriented with a spout side up according to one embodiment of the present invention.

FIG. 14 is a front view of a second substrate of a resilient seal member according to one embodiment of the present invention.

### DETAILED DESCRIPTION

A semi-automated dispensing system 10 for dispensing liquid paint components according to a paint formula to form a liquid paint mixture in accordance with the present invention is illustrated generally in FIGS. 1 and 2. The dispensing system 10 generally comprises a dispensing apparatus 12 for dispensing a liquid paint component 14 from its original container 16A and 16B, and a control apparatus 18 for controlling the dispensing apparatus 12. FIGS. 1, 3-8 show the quart size original container 16A having a lid member 20A, while FIG. 11 illustrates the gallon size original container 16B having a lid member 20B. In metric system countries, the lid member 20A fits a one liter size original container and the lid member 20B fits a four liter size original container. The containers 16A and 16B (without the lid members 20A and 20B) are typical cylindrical shaped, metal vessels within

5

which liquid paint components **14**, such as tints, colorants, pearls, metallics, binders and balancers (used to mix automotive paint according to a paint formula) are shipped from a liquid paint component manufacturer to customers, such as body shops and jobbers. Beyond their size differences, the quart size and gallon size containers **16A** and **16B** are substantially identical. Therefore, only the quart size original container will be described with particularity. The lid members **20A** and **20B** are substantially similar, therefore the quart size lid member **20A** will be described with particularity, and only the differences in the gallon size lid member **20B** relative to the quart size lid member **20A** will be described with particularity.

As seen best in FIGS. **3A** and **3B**, the original container **16A** is cylindrical shaped having an open top **22A** defined by a circumferential lip **24A**. As seen best in FIGS. **3-5**, the lid member **20A** includes a base portion **26A** adapted to engage and seal the open top **22A** of the container **16A** to protect the liquid paint component **14** within the container **16A**. The base portion **26A** of the lid member **20A** includes a pair of spaced, pivotable cam lock mechanisms **28A** that are used to releasably secure the lid member **20A** to the original container **16A**. Each of the cam lock mechanisms **28A** is defined by a cam element **30A** connected to a cam actuator **32A** by way of a post member **34A**. Pivotaly moving the cam actuators **32A** by hand, as represented by double-headed arrow **36** (see FIG. **4**), moves the cam elements **30A** into and out of engagement with the lip **24A** to secure and release the lid member **20A** from the original container **16A**.

The lid member **20A** further includes a handle **38A**, for easy handling of the original container **16A** when the lid member **20A** is secured thereto. The handle **38A** includes a first portion **39A** generally parallel to the lip **24A** of the original container **16A**, a second portion **41A** (grasped by a user) that extends substantially perpendicular to the first portion **39**, and a pair of oppositely directed dispensing system latch lugs **43A** positioned at the intersection of the first and second portions **39A**, **41A**. The purpose of the pair of dispensing system latch lugs **43A** will become clear below. In the gallon size lid member **20B**, the pair of oppositely directed dispensing system latch lugs **43B** are positioned along the length of the first portion **39B** of the handle **38B** instead of at the intersection of the first and second portions **39A** and **41A** as in the quart size lid member **20A**. Other than the size differences between the quart size lid member **20A** and the gallon size lid member **20B**, this different positioning of the dispensing system latch lugs **43A**, **43B** constitutes the main and only real difference between the lid members **20A** and **20B**.

As seen best in FIG. **5**, the lid member **20A** also includes a liquid paint component pour spout **40A** having a rear wall **81A**, first and second opposed side walls **83A** and **85A**, respectively, and a front pour wall **87A**. Also as seen in FIG. **5**, immediately adjacent to (i.e., to the rear of) the rear wall **81** of the pour spout **40A**, the lid member **20A** includes first and second spaced guide surfaces **89A** and **91A**, respectively, the purpose of which will be made clear below. The pour spout **40A** is covered by a linearly movable, as represented by double headed directional arrow **42** (see FIGS. **3A** and **3B**), cover element **44A**. The cover element **44A** is linearly movable between a closed state (shown in FIG. **3A**) and an opened state (shown in FIG. **3B**). In the closed state of the cover element **44A**, the liquid paint component **14** is prevented from being poured (i.e., dispensed) from the original container **16A** through the pour spout **40A**. In the opened state of the cover element **44A**, the liquid paint component **14** can be poured

6

from the original container **16A** through the pour spout **40A** by tilting the container **16A** using the handle **38A**.

As seen when comparing FIGS. **3A** and **3B**, the cover element **44A** is movable between its closed and opened states via a thumb actuator **46A** that is pivotally secured to the base portion **26A** by way of a pivot pin **48A**. The thumb actuator **46A** is pivotally movable as shown by double-headed directional arrow **47**. As seen best in FIG. **4**, the thumb actuator **46A** is connected to the cover element **44A** via a wire loop **50A**. When the thumb actuator **46A** is positioned as shown in FIG. **3A**, the cover element **44A** is in its closed state. The thumb actuator **46A** is biased to this normal position in a known manner by a coil spring element **54A** (see FIGS. **3A** and **3B**). The coil spring element **54A** acts between the base portion **26A** and the thumb actuator **46A**. When the thumb actuator **46A** is positioned as shown in FIG. **3B**, the cover element **44A** is in its opened state. The cover element **44A** is moved, from its closed state to its opened state, through the connecting wire loop **50A** by pivoting the thumb actuator **46A** about the pivot pin **48A** against the bias of the spring element **54A**. The cover element **44A** is allowed to return to its closed state from the opened state by simply releasing the thumb actuator **46A**. The lid member **20A** also includes a rotatable roller element **51A** (see FIGS. **4** and **5**) that bears against the wire loop **50A** to help maintain a seal between the cover element **44A** and the pour spout **40A**. As seen in FIGS. **3-5**, the cover element **44A** also includes a slot **49A** the purpose of which will be made clear below.

As seen best in FIGS. **5** and **10**, the walls **81A**, **83A**, **85A**, **87A** of the pour spout **40A** define a circumferential, planar edge surface **350A**, and the cover element **44A** includes a planar lower surface **352A**. A resilient seal mechanism **354** is positioned at an engagement interface **356** between the circumferential, planar edge surface **350A** of the pour spout **40A** and the planar lower surface **352A** of the cover element **44A**. The resilient seal mechanism **354** prevents leakage, upon tilting of the original container **16A**, of the liquid paint component **14** out of the pour spout **40A** past the cover element **44A** in the closed state of the cover element **44A**.

As illustrated in FIG. **10**, in one embodiment the resilient seal mechanism **354** defines a resilient seal member **357** that covers the entire planar lower surface **352A** of the cover element **44A**. The resilient seal member **357** comprises a first substrate **358** of a resilient material, such as foam, and a second substrate **360** of a smooth material. The second substrate **360** defines a downward projecting chevron **370** in three-dimensions such that the chevron **370** is configured to seal against a front portion (not shown) of the pour spout **40A** when the pour spout **40A** is in the closed state.

The second substrate **360** is also known as a self-cleaning lid and can be any smooth material configured to resist bonding with the contents of the container **16A** (FIG. **3A**). In one embodiment, the second substrate **360** is a thermoplastic polymer such as polyethylene. In a preferred embodiment, the second substrate **360** is a non-thermoplastic polymer such as polytetrafluoroethylene. In one example, the second substrate **360** is formed of a non-thermoplastic polymer known by the trademark TEFLON. In one preferred embodiment, the first substrate **358** has a thickness of approximately 0.0003 inches and the second substrate **360** has a thickness of 0.0001 inches.

FIG. **11** is an exploded view of the cover element **44A** in relation to the resilient seal member **357**. As shown, the first substrate **358** is coupled to the planar lower surface **352A** of the cover element **44A**. In one embodiment, the planar lower surface **352A** of the cover element **44A** defines downwardly projecting pins **372** that communicate through the first sub-

strate 358 and into, but not through, the second substrate 360. Alternately, the first substrate 358 can be adhesively attached to the second substrate 360, the combination of which can be mounted to the planar lower surface 352A of the cover element 44A. In any regard, the second substrate 360 extends from the cover element 44A and engages the circumferential, planar edge surface 350A of the pour spout 40A.

In one embodiment best illustrated in FIG. 11, the second substrate 360 defines a substrate side 380 and a spout side 382, where the substrate side 380 is adapted for attachment to the first substrate 358 and the spout side 382 is configured to slidably move relative to the pour spout 40A (FIG. 10) in dispensing paint. In a preferred embodiment, the spout side 382 defines the downward projecting chevron 370 in three-dimensions such that the chevron 370 is configured to seal against the pour spout 40A when the pour spout 40A is in the closed state.

FIGS. 12A and 12B illustrate top views of the chevron 370 of the self-cleaning lid 360. The downward projecting chevron 370 defines an apex 390 and a base 392, where the apex 390 of the chevron 370 is adapted to mate with the lip of the pour spout 40A (FIG. 10) when the pour spout 40A is in the closed state. During pouring, the apex 390 of the chevron 370 is retracted away from the lip of the pour spout 40A such that paint is permitted to flow by the downwardly projecting chevron 370.

The smoothness of the second substrate 360 (i.e., the self-cleaning lid) allows the cover element 44A to readily move relative to the pour spout 40A (FIG. 10) between the open and closed states. Preferably, the second substrate 360 is both smooth and configured to hermetically seal the pour spout 40A when in the closed state. As seen in FIG. 10, the resiliency of the first substrate 358 allows the resilient seal member 357 to conform to the shape of the circumferential, planar edge surface 350A of the pour spout 40A. By conforming to the shape of the pour spout 40A, the resilient seal member 357 provides an excellent fluid seal that prevents contaminants from entering the original container 16A through the pour spout 40A, and prevents leakage, upon tilting of the original container 16A, of the liquid paint component 14 out of the pour spout 40A past the cover element 44A in the closed state of the cover element 44A. In addition, by conforming to the shape of the pour spout 40A, the resilient seal member 357 prevents paint near the exit of the pour spout from hardening into a clump. Hardened paint clumps impede the flow of paint from the pour spout 40A, and are associated with over-pouring when the clump gives way and the paint gushes out of the spout. To this end, the self-cleaning lid 360 prevents the liquid paint component 14 from blocking the pour spout 40A.

By conforming to the shape of the cover element 44A, the resilient seal member 357 and the second substrate 360 provide an excellent fluid seal that prevents contaminants from entering the original container 16A through the pour spout 40A, and prevents leakage, upon tilting of the original container 16A, of the liquid paint component 14 out of the pour spout 40A past the cover element 44A in the closed state of the cover element 44A.

With additional reference to FIG. 11, the resilient seal member 357 is secured to the planar lower surface 352A of the cover element 44A. In one embodiment, for example, a plurality of downwardly projecting pins 372 are integrally formed in the cover element 44A and extend from the planar lower surface 352A thereof. In one preferred embodiment, there are four spaced pins 372. The spaced pins 372 engage the first substrate 358 and the second substrate 360 defining the resilient seal member 357. To accomplish this securing function, the first substrate 358 includes a plurality of spaced

openings 396. In one preferred embodiment, there are four spaced openings 396 that are formed via die cutting. Each of the openings 396 is sized to closely receive one of the pins 372 to secure the first substrate 358 against the planar lower surface 352A of the cover element 44A. The pins 372 cooperate with the closely fitting openings 396 to hold the first substrate 358 to the cover element 44A via only frictional engagement.

To further assist the securing function of the securing mechanism, the second substrate 360 includes a plurality of cup shaped protruding portions 398. In one preferred embodiment, there are four cup shaped protruding portions 398 that are formed in the second substrate 360 during an injection molding process. Each of the protruding portions 398 is sized to closely receive one of the pins 372 to secure the second substrate 360 against the first substrate 358 and to the planar lower surface 352A of the cover element 44A. The pins 372 cooperate with the closely fitting cup shaped protruding portions 398 to hold the second substrate 360 to the cover element 44A via only frictional engagement. The second substrate 360 includes an upstanding peripheral wall 400 that acts to enclose the first substrate 358.

As noted above, FIGS. 12A and 12B illustrate top views of the second substrate 360 showing the chevron 370. The downward projecting chevron 370 defines an apex 390 and a base 392, where the apex 390 of the chevron 370 is adapted to mate with the lip of the pour spout 40A (FIG. 10) when the pour spout 40A is in the closed state.

FIG. 13A is a side view of the second substrate 360 (the self-cleaning lid) oriented with the substrate side 380 up and showing the chevron 370. FIG. 13B is a side view of the second substrate 360 oriented with the spout side 382 up and showing the chevron 370. The base 392 of the chevron 370 extends downward (as oriented in FIG. 13A) from the spout side 382 beyond the protruding portions 398. The apex 390 blends into the spout side 382. With this configuration, the chevron 370 is adapted to be positioned in the closed pour spout 40A (FIG. 10) to impede the entrance of contaminants and to impede the drying and hardening of paint that has not left the container 16A (FIG. 3A).

FIG. 14 is a front view of the second substrate 360 (the self-cleaning lid) showing the chevron 370. As shown, the chevron 370 extends downward (as oriented in FIG. 14) from the spout side 382. In the view of FIG. 14, the protruding portions 398 are obstructed from view by the chevron 370.

With additional reference to FIGS. 10 and 11, the first substrate 358 engages the planar lower surface 352A of the cover element 44A, and the second substrate 360 (the self-cleaning lid) engages the circumferential, planar edge surface 350A of the pour spout 40A. The smoothness of the second substrate 360 allows the cover element 44A to readily move relative to the pour spout 40A between the open and closed states. The resiliency of the first substrate 358, combined with the flexibility of the second substrate 360, allows the resilient seal member 357 to conform to the shape of the circumferential, planar edge surface 350A of the pour spout 40A. In addition, the cup shaped protruding portions 398 slidably receive the pins 372 so as to allow some movement of the second substrate 360 relative to the cover element 44A upon compression and extension of the first substrate 358. This movement of the second substrate 360 relative to the cover element 44A is substantially perpendicular to the planar lower surface 352A of the cover element 44A and allows the resilient seal member 357 to engage and conform to the shape of the circumferential, planar edge surface 350A of the pour spout 40A.

As seen in FIGS. 3-4, the base portion 26A of the lid member 20A includes a vent member 53A defining a vent passage 55A that has a first open end 57A and an opposite second open end 59A. The vent passage 55A passes through the base portion 26A such that the first open end 57A communicates with an interior region 61A of the original container 16A and the second open end 59A communicates with atmosphere. The second open end 59A is sealable by way of a linearly movable plug element 63A. As seen best when comparing FIGS. 3A and 3B, the plug element 63A is linearly movable between a sealed position (see FIG. 3A) wherein a cone shaped end 65A of the plug element 63A is engaged with the second open end 59A of the vent passage 55A, and an unsealed position (see FIG. 3B) wherein the cone shaped end 65A of the plug element 63A is disengaged from the second open end 59A of the vent passage 55A.

The plug element 63A is linearly movable between the sealed and unsealed positions by actuation of the thumb actuator 46A. The thumb actuator 46A is coupled to the plug element 63A by way of a wire loop element 67A that engages a groove 69A in the plug element 63A. Movement of the thumb actuator 46A between the positions shown in FIGS. 3A and 3B moves the plug element 63A (by way of the wire loop element 67A) between the sealed and unsealed positions. In the sealed position of the plug element 63A, contaminants are prevented from entering the vent passage 55A. In the unsealed position of the plug element 63A (which occurs when the liquid paint component 14 is being dispensed from the original container 16A through the pour spout 40A upon actuation of the thumb actuator 46A), air is allowed to enter the vent passage 55A through the second open end 59A so that the air passes into the interior region 61A of the original container 16A through the second open end 57A to fill the void of the dispensed liquid paint component 14.

As seen best in FIGS. 3-8, the second open end 59A of the vent passage 55A is located radially exterior to the cylindrical side wall 71A of the original container 16A. This location of the second open end 59A of the vent passage 55A prevents the liquid paint component 14 from flowing out of the original container 16A through the vent passage 55A and the subsequent fouling of the exterior portions of the lid member 20A. This undesirable condition is prevented because the second open end 59A of the vent passage 55A is located above the fluid level of the liquid paint component 14 in the dispensing state of the liquid paint component illustrated in FIGS. 8 and 11. The vent passage 55A extends substantially perpendicular to and radially from a central axis 73 of the original container 16A (see FIG. 3A).

As seen best in FIGS. 3 and 4, the lid member 20A further includes an alignment slot 56A positioned at a first portion of the lid member 20A at the pour spout 40A adjacent to the cover element 44A. As seen in FIGS. 3A and 3B, the alignment slot 56A is positioned so as to define a plane 60 that is parallel to an upper surface 62A of the circumferential lip 24A of the original container 16A. The purpose of the alignment slot 56A will become clear below. The alignment slot 56A is formed integrally with the base portion 26A of the lid member 20A.

As seen best in FIGS. 3A and 3B, the lid member 20A further includes a stirring device 68A for stirring the liquid paint component 14 within the original container 16A. The stirring device 68A includes a plurality of paddles 70A connected to a paddle actuator 72A by way of a shaft member 74A. Rotating the paddle actuator 72A, as represented by double headed directional arrow 76, causes rotation of the paddles 70A and stirring of the liquid paint component 14. The paddle actuator 72A is driven (i.e., rotated) by a stirring

mechanism (not shown) that is part of a storage rack (not shown) for holding various original containers 16A of liquid paint components 14.

As seen best in FIGS. 1 and 2, the dispensing apparatus 12 of the dispensing system 10 includes a support frame 80. As seen best in FIGS. 2 and 6, the dispensing apparatus 12 further includes a receiving mechanism 98 for releasably engaging the original container 16A, 16B of the liquid paint component 14. The receiving mechanism 98 is defined by first and second engaging mechanisms 100 and 102, respectively.

As seen best in FIG. 2, the first engaging mechanism 100 includes first and second spaced arms 104a and 104b rigidly mounted to the support frame so as to be fixed against movement relative thereto. A registration rod 108 rigidly connects together the first and second arms 104a and 104b at their free ends 110a and 110b. The registration rod 108 is adapted to releasably receive (i.e., engage) the alignment slot 56A of the lid member 20A. As seen in FIG. 6, interengagement of the alignment slot 56A with the registration rod 108 mounts (i.e., secures) and aligns a first portion of the container 16A and lid member 20A combination to the receiving mechanism 98 of the dispensing apparatus 12.

The second engaging mechanism 102 includes first and second spaced plates 111a and 111b fixed to an upper end of the support frame 80. Free ends 113a and 113b of the plates 111a, 111b include latch slots 115a and 115b, respectively. The second engaging mechanism 102 further includes first and second spaced L-shaped arms 114a and 114b pivotally mounted to the support frame 80 via a pivot pin 116. A handle member 118 rigidly connects together the first and second L-shaped arms 114a and 114b at first ends 120a and 120b. Second ends 122a and 122b of the first and second L-shaped arms 114a and 114b include latching notches 124a and 124b. The latching notches 124a and 124b are adapted to releasably receive (i.e., engage) the latch lugs 43A on the handle 38A of the lid member 20A for the original container 16A to secure the latch lugs 43A in the latch slots 115a and 115b of the plates 111a, 111b. The L-shaped arms 114a and 114b of the second engaging mechanism 102 are pivotally movable as a unit, as represented by double headed arrow 125, between an unlatched state, wherein the original container 16A of the liquid paint component 14 can be engaged with and disengaged from the first and second engaging mechanisms 100 and 102 (shown in FIG. 6); and a latched state, wherein the original container 16A is securely held between the first and second engaging mechanisms 100 and 102 (shown in FIG. 7). As such the L-shaped arms 114a and 114b (i.e., the second engaging mechanism 102) exhibits only a single-degree-of-freedom of movement (i.e., pivotal movement only) relative to the support frame 80 and the first engaging mechanism 100 (i.e., the first and second spaced arms 104a and 104b). A tension spring element 126 is coupled between a mounting peg 128 of the support frame 80 and a mounting peg 129 of an extension arm 130 on the L-shaped arm 114a. The tension spring element 126 biases the L-shaped arms 114a and 114b defining a portion of the second engaging mechanism 102 to the latched state against the stop 133. A handle/stop member 134 limits movement of the L-shaped arms 114a and 114b in a clockwise direction as viewed in FIG. 6.

As seen best in FIGS. 2 and 6, the dispensing apparatus 12 of the dispensing system 10 further includes dispensing mechanism 140 mounted to the support frame 80 for moving the cover element 44A of the lid member 20A between its closed and open states. The dispensing mechanism 140 includes outwardly extending, first and second arms 142a and 142b that define an operating device 141 pivotally movable, as a unit, as represented by double headed directional arrow

143 (FIG. 8), relative to the support frame 80 about an axle 145. The free ends 146a and 146b, of the first and second arms 142a and 142b, include a force applying mechanism 147 (seen best in FIGS. 9-10) adapted to releasably engage the slot 49A in the cover element 44A on the lid member 20A (see FIGS. 6-10). The force applying mechanism 147 includes U-shaped wire member 149 having legs 151 and a connecting portion 153. The legs 151 are rigidly mounted to the operating device 141. As seen best in FIGS. 9 and 10, the connecting portion 153 is releasably received within the slot 49A of the cover element 44A. The force applying mechanism 147 further includes a force applying plate member 155 that is linearly movable relative to the U-shaped wire member 149 as represented by double-headed arrow 330. The force applying plate member 155 includes apertures 157 that freely receive the legs 151 of the U-shaped wire member 149 to permit movement of the plate member 155 along the legs 151. A compression spring 159 surrounds each of the legs 151 and acts between the operating device 141 and the plate member 155 to provide a biasing force urges the plate member 155 against the cover element 44A to prevent inadvertent leakage of the liquid paint component 14 from the pour spout 40A of the lid member 20 atop the original container 16A when the original container 16A is mounted in the dispensing system 10 (see FIG. 7) and the cover element 44A is in a closed position.

As seen in FIG. 8, with the connecting portion 153 of the force applying mechanism 147 of the operating device 141 engaged with the slot 49A of the cover element 44A, a transit mechanism 150 of the dispensing mechanism 140 can pivotally move the operating device 141 between a first position and a second position. In the first position of the operating device 141 (FIG. 7), the cover element 44A of the lid member 20A is in its closed state which prevents the liquid paint component 14 from being dispensed from the original container 16A with the help of the force applying mechanism 147. In the second position of the operating device 141 (FIG. 8), the cover element 44A is in its opened state, which allows the liquid paint component 14 to be dispensed (i.e., poured) from the original container 16A into a paint receptacle 152 (FIG. 1).

As set forth previously, the handles 38A and 38B of each of the lid members 20A and 20B include the latch lugs 43A, 43B. The difference in positioning of these latch lugs 43A and 43B between the quart size lid member 20A and the gallon size lid member 20B results in the latch lugs 43A, 43B being the same position relative to the alignment slot 56A, 56B. This allows the receiving mechanism 98 (defined by the first and second engaging mechanisms 100 and 102) and the dispensing mechanism 140 to accommodate quart size original containers 16A (FIGS. 6-8) and gallon size original containers 16B (FIG. 11).

As seen best in FIG. 6, the transit mechanism 150 of the dispensing mechanism 140 includes a piston member 154 linearly movable, along directional arrow 143 (FIG. 6), relative to a cylinder member 156. Opposite ends 253a and 253b of the first and second arms 142a and 142b (defining the operating device 141) are coupled to the piston member 154. A pad member 158 of the piston member rides on a roller member 259 rotatably mounted to the arms 142a, 142b. Therefore movement of the piston member 154 within the cylinder member 156 causes the operating device 141 to move between its first and second positions. Tension spring elements 160 are coupled between the opposite ends 253a, 253b of the arms 142a, 142b and a mounting member 162 on the support frame 80. The tension springs 160 bias the oper-

ating device 141 to its first position (also known as the primary position of the piston member 154).

As seen in FIG. 1, a drive mechanism 170 of the transit mechanism 150 moves the piston member 154 relative to the cylinder member 156. The drive mechanism 170 includes a piston member 172 linearly movable, along double-headed directional arrow 173, relative to a cylinder member 174 mounted to a frame 176 via bracket structure 177. A drive motor, such as a stepper motor 178, is also mounted to the frame 176. The drive motor 178 includes a drive screw 179 that is telescopically received within a drive tube 180 that is secured at one end to the piston member 172. The drive tube 180 is slidably received within a bearing 181 of the frame 176 to allow movement of the drive tube 180, and the piston member 172 therewith, relative to the frame 176, drive motor 178 and cylinder member 174. An opposite end of the drive tube 180 includes a drive nut 183 that threadably receives the drive screw 179 of the stepper motor 178. Operation of the stepper motor 178 turns the drive screw 179 within the drive nut 183. This in turn moves the drive tube 180 and therewith the piston member 172 within the cylinder member 174 along directional arrow 173. A fluid reservoir 182 containing a hydraulic fluid 184 is in fluid communication with the cylinder member 174. A fluid line 188 couples the fluid reservoir 182 to the cylinder member 156. In operation, movement of the piston member 172, via the stepper motor 178, forces hydraulic fluid 184 to move to and from the cylinder member 174 and the fluid reservoir 182 through the line 188 then into and out of the cylinder member 156 to move the piston member 154. Movement of the piston member 154, via the above described hydraulic fluid pressure, in turn moves the operating device 141 which in turn moves the cover element 44A of the lid member 20A between its opened and closed states.

The dispensing system 10 includes an automatic bleeder valve 300 to aid in initially filling the dispensing system 10 with hydraulic fluid 184. The hydraulic bleeder valve 300 includes a body member 302 defining an orifice 304 that extends through the body member 302 from a first end 306 to a second end 308. The orifice 304 is in fluid communication with the fluid line 188 and the cylinder member 156. A linearly movable ball valve 310 is positioned at the first end 306 of the body member 302. The ball valve 310 is movable between a first position, wherein the ball valve 310 forms a fluid seal and air/hydraulic fluid 184 is prevented from passing into the orifice 304, and a second position wherein the ball valve 310 acts as a check valve and air and/or hydraulic fluid 184 may pass through the orifice 304 from the first end 306 to the second end 308. The body member 302 threadably engages the support frame 80 via threads 307 so as to be movable linearly relative thereto. The body member 302 includes a nut 314 at the second end 308 used to twist the body member 302 to move the body member 302 relative to the support frame 80. Near the first end 306, the body member 302 includes an O-ring seal member 312 to prevent air/hydraulic fluid 184 from flowing past the body member 302 through the threads 307. An inner end 316 of the body member 302 bears against a compression spring 318 that in turn bears against the ball valve 310.

In operation, to fill the cylinder member 156 with hydraulic fluid 184, the body member 302 is loosened using the nut 314 that decompresses the spring 318 and allows the ball valve 310 to move to the position shown in FIG. 13. Hydraulic fluid 184 is then pumped through the fluid line 188 from the reservoir 182 via the piston member 172 of the drive mechanism 170. The hydraulic fluid 184 passes from the fluid line 188 into the cylinder member 156 primarily due to gravity and because this is the fluid path of least resistance. Air within the

fluid line 188 and the cylinder member 156 is automatically bled out (by the introduction of the hydraulic fluid 184) through the automatic bleeder valve 300. The air passes around the ball valve 310, through the spring 318 and through the orifice 304 as represented by the arrows 325. The fluid line 188 and cylinder member 156 are full of hydraulic fluid 184 when the hydraulic fluid 184 passes out of the orifice 304. The body member 302 is then tightened using the nut 314 which causes the inner end 316 of the body member 302 to bear against the spring 318 which compresses the spring against the ball valve 310 sealing off the orifice 304 of the bleeder valve 300, thereby completing the filling process.

As seen in FIG. 1, the control apparatus 18 of the dispensing system 10 includes a weigh cell 190 for supporting the paint receptacle 152 and a control module 192. The weigh cell 190 determines the weight of the liquid paint component dispensed (i.e., poured) from the original container 16A into the paint receptacle 152. The control module 192 includes a display monitor device 194 having a display 195, a microprocessor device 196, a data storage device 198 and a user interface device, such as a keyboard 200. The keyboard 200 is coupled to the microprocessor device 196 via a communication line 202. The microprocessor device 196 and the data storage device 198 are linked through a communication line 204. The microprocessor device 196 is linked to the stepper motor 178 and to a sensor 205 for monitoring the position of the drive screw 179 through the communication line 206. The microprocessor device 196 is linked to the display monitor device 194 through communication line 208 and is further linked to the weigh cell 190 via communication line 210. Since the control module 192 (i.e., microprocessor device 196) is linked to the stepper motor 178 and the sensor 205, the control module 192 can control operation of the stepper motor 178, and thereby movement of the piston members 172 and 154, and hence movement of the cover element 44A to dispense the liquid paint component 14 from the original container 16A. In addition, since the control module 192 is further linked to the weigh cell 190, the control module 192 can control the amount (i.e., the weight) of the liquid paint component 14 dispensed from its original container 16A to the paint receptacle 152 (atop the weigh cell 190) based upon data (i.e., information) obtained from the weigh cell 190. Moreover, since the control module 192 (i.e., the data storage device 198) stores the paint formulas, the control module 192 can determine which liquid paint components 14 and the weights of these components needed to duplicate a particular paint formula and can control the dispensing mechanism 140 in accordance therewith.

As seen in FIG. 1, the control module 192 and the drive mechanism 170 are positioned in another room such that the communication line 210 and the fluid line 188 pass through a wall 212 so as to provide explosion protection for the dispensing system 10. Alternatively, one or more of the display monitor device 194, the microprocessor device 196, and the keyboard 200 could be located next to the dispensing system 10 provided that these components are explosion protected.

In operation, to mix a particular paint formula, the operator of the semi-automated dispensing system 10 first accesses the control module 192 through the keyboard 200 to call up the desired paint formula using the microprocessor device 196 the data storage device 198. The paint formula (i.e., the liquid paint components 14) is then displayed on the display 195 of the display monitor device 194. The operator then loads the first container 16A, 16B of the needed liquid paint components into the dispensing apparatus 12.

As seen in FIG. 6, to mount (i.e., load) an original container 16A of a liquid paint component 14 to the receiving mecha-

nism 98 of the dispensing apparatus 12, the operator of the dispensing system 10 first needs to pivot the second engaging mechanism 102 (defined by the L-shaped arms 114a, 114b) clockwise (as viewed in FIG. 6) from its normal latched state to its unlatched state, against the handle/stop member 134 mounted to the support frame 80. The operator, while gripping both the handle member 118 and the handle/stop member 134 to hold the second engaging mechanism 102 in its unlatched state (against the bias of the spring element 126), then engages the alignment slot 56A of the lid member 20A with the registration rod 108 of the first engaging mechanism 100 (FIG. 6). Next, while still holding the second engaging mechanism 102 in its unlatched state, the operator pivots the container 16A and lid member 20A combination clockwise (as viewed in FIG. 6) until the connecting portion 153 of the force applying mechanism 147 of the operating device 141 is fully seated in the slot 49A of the cover element 44A, and the latch lugs 43A are fully seated in the latch slots 115a, 115b of the plates 111a, 111b. With the alignment slot 56 now fully seated on the registration rod 108, the connecting portion 153 of the operating device 141 fully seated in the slot 49A of the cover element, and the latch lugs 43A fully seated in the latch slots 115a, 115b, the operator pivots the second engaging mechanism 102 counter-clockwise to its latched state, so that the latching notches 124a and 124b engage the latch lugs 43A of the lid member 20A securing the original container 16A lid member 20A combination to the receiving mechanism 98 of the dispensing apparatus 12. To remove the container 16A for the dispensing apparatus 12, this above described process is simply reversed.

The operator then starts the dispensing process using the keyboard 200 of the control module 192. Since the control module 192 (i.e., microprocessor device 196) is linked to the stepper motor 178 and the sensor 205, the control module 192 controls operation of the stepper motor 178, and thereby movement of the piston members 154 and 172, and hence movement of the cover element 44A to dispense (i.e., pour) the liquid paint component 14 from the original container 16A into the paint receptacle 152. The arrangement of the second engaging mechanism 102 and the latch lugs 43A prevents movement of the cover element 44A from inadvertently disengaging the alignment slot 56A from the first registration rod 108. The weight of the liquid paint component 14 dispensed into the paint receptacle 152 is monitored by the control module 192 through the weigh cell 190, thereby ensuring an accurate liquid paint component pour. Once the first liquid paint component 14 is poured, its container 16A, 16B is removed and is replaced with the next paint component container 16A, 16B and so on, until all paint components 14 of the paint formula have been added to the paint receptacle 152, thereby completing the paint formula mixing process.

This lid member 20A, 20B can be used with the original container 16A, 16B of a liquid paint component 14 and the resilient seal mechanism 354 prevents contaminants from entering the original paint component container 16A, 16B through the pour spout/cover element interface 356. In addition, the resilient seal mechanism 354 of the lid member 20A, 20B prevents undesired leakage of the paint component 14 out of the pour spout 40A and past the cover element 44A in the closed state of the cover element 44A. Unwanted leakage of just four drops of the liquid paint component 14 from pour spout 40A, when the container 16A, 16B is mounted the dispensing system 10, can result in the addition of 0.1 grams of unwanted paint component 14 to the paint receptacle 152 which could require the operator of the dispensing system 10 to re-pour other paint components to compensate for this error. The guide mechanism 470 also helps to prevent undes-

15

ired leakage of the paint component 14 out of the pour spout 40A, by ensuring that the cover element 44A is accurately aligned with the pour spout 40A and guided during movement of the cover element 44A between the closed and opened states. The securing mechanism 460 ensures that the seal 5  
mechanism 354 is properly and securely mounted to the cover element 44A so as to be unaffected by the attributes of the paint component 14.

In addition, this lid member 20A, 20B is compatible with the semi-automated dispensing system 10, for dispensing 10  
liquid paint components 14 from their original containers 16A, 16B that virtually eliminates system operator errors, in particular over pouring errors, that can be costly to a body shop or jobber. The lid member 20A, 20B together with the semi-automated dispensing system 10 is easy to use, and does not require a highly skilled operator, since operator interface 15  
with the lid members 20A, 20B and the dispensing system 10 is substantially limited to identifying the desired paint formula, and loading and unloading the proper containers 16A, 16B of the liquid paint components 14 to and from the dispensing apparatus 12. The operator need no longer manually pour the paint components 14 from their containers 16A, 16B. The lid member/dispensing system interface automatically dispenses (i.e., pours) the liquid paint components 14 from their containers 16A, 16B, thereby ensuring a highly accurate liquid paint component pour. Moreover, the vent passage 55A, 55B arrangement prevents liquid paint component from flowing out of the second open end 59A, 59B of the vent passage during dispensing of the paint component from the container 16A, 16B. In addition, the lid members 20A, 20B, of the present invention, together with the paint dispensing system 10, makes efficient use of the operator's time, since the operator is free to perform other duties instead of holding the containers 16A, 16B and performing the task of manually pouring the proper amounts of the liquid paint components 14. This efficiency gain allows the operator to mix a greater number of paint formulas during the day. Lastly, the paint component lid members 20A, 20B, of the present invention, and the semi-automated dispensing system 10 comply with all regulations and laws, such as being explosion protected, governing the handling and mixing of liquid paint components 14 for the duplication of automotive paint formulas.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention. For example, although the self-cleaning lid member and the semi-automated dispensing system have been described as useable to dispense liquid automotive paint components from their original containers, self-cleaning lid members and the dispensing system can be used to dispense other pourable components, such as primers, thinners and liquid or powdered chemicals. In particular the lid members and the dispensing system could be used in laboratory or pharmaceutical organizations to accurately dispense liquid and powdered chemicals according to a desired formula.

What is claimed is:

1. A self-cleaning lid for use with a paint container comprising:

a pour spout;

a cover element linearly movable between a closed state over the pour spout and an opened state over the pour spout;

a first substrate coupled to the cover element; and

a second substrate coupled to the first substrate, the second substrate comprising a planar portion and a chevron

16

projecting downward from the planar portion, the chevron configured to seal against the pour spout when the cover element is in the closed state,

wherein the chevron defines an apex and a base opposite the apex, the apex at a point where the chevron joins the planar portion of the second substrate, the apex configured to mate with a lip of the pour spout when the cover element is in the closed state, and the base comprising a surface perpendicular to the planar portion of the second substrate,

wherein the cover element comprises projecting pins that communicate through the first substrate,

wherein the second substrate comprises cup shaped protruding portions configured to slidably receive the projecting pins,

wherein the base of the chevron extends downward beyond the protruding portions, and

wherein a thickness of the second substrate in a direction perpendicular to the planar portion of the second substrate varies continuously between the apex and the base to define the chevron.

2. The self-cleaning lid of claim 1, wherein the first substrate comprises a resilient material, and

wherein the second substrate comprises a smooth material.

3. The self-cleaning lid of claim 2, wherein the first substrate comprises a foam material, and

wherein the second substrate comprises a polymer material.

4. The self-cleaning lid of claim 1, wherein the first substrate has a thickness of approximately 0.0003 inches, and wherein the second substrate has a thickness of approximately 0.0001 inches.

5. The self-cleaning lid of claim 1, wherein the second substrate is adhesively attached to the first substrate.

6. The self-cleaning lid of claim 1, wherein the second substrate comprises an upstanding peripheral wall configured to laterally enclose the first substrate.

7. The self-cleaning lid of claim 1, wherein the second substrate is configured to hermitically seal the pour spout when the cover element is in the closed state.

8. The self-cleaning lid of claim 1, wherein the first substrate and the second substrate are configured to conform to a shape of a circumferential, planar edge surface of the pour spout.

9. A self-cleaning lid for use with a paint container comprising:

a pour spout;

a cover element linearly movable between a closed state and an opened state, the cover element preventing a liquid paint component from being poured from the paint container through the pour spout when in the closed state and the cover element allowing the liquid paint component to be poured from the paint container through the pour spout when in the opened state; and

a first substrate coupled to the cover element, the first substrate comprising a planar portion and a chevron projecting downward from the planar portion, the chevron configured to seal against the pour spout when the cover element is in the closed state and configured to allow the paint component to flow by when the cover element is in the opened state,

wherein the chevron defines an apex and a base opposite the apex, the apex at a point where the chevron joins the planar portion of the first substrate, the apex configured to mate with a lip of the pour spout when the cover

17

element is in the closed state, and the base comprising a surface perpendicular to the planar portion of the first substrate,

wherein the first substrate comprises protruding portions projecting downward from the planar portion,  
 wherein the base of the chevron extends downward beyond the protruding portions, and

wherein a thickness of the first substrate in a direction perpendicular to the planar portion of the first substrate varies continuously between the apex and the base to define the chevron.

10. The self-cleaning lid of claim 9, wherein the first substrate is configured to conform to a shape of a circumferential, planar edge surface of the pour spout, and

wherein the chevron extends between first and second opposed side walls of the pour spout, the first and second opposed side walls defining a portion of the circumferential, planar edge surface of the pour spout.

11. The self-cleaning lid of claim 9, wherein the first substrate is movable with respect to the cover element.

12. The self-cleaning lid of claim 9, wherein the chevron is configured to impede the entrance of contaminants into the paint container and to impede the drying and hardening of the liquid paint component within the paint container when the cover element is in the closed state.

13. The self-cleaning lid of claim 9, further comprising: a second substrate coupling the first substrate to the cover element.

18

14. A self-cleaning lid comprising:

a pour spout;

a cover element linearly movable between a closed state over the pour spout and an opened state over the pour spout;

a first substrate coupled to the cover element; and

a second substrate coupled to the first substrate, the second substrate comprising a planar portion and a V-shaped chevron projecting downward from the planar portion, the chevron configured to seal against the pour spout when the cover element is in the closed state,

wherein the chevron defines an apex and a base opposite the apex, the apex at a point where the chevron joins the planar portion of the second substrate, the apex configured to mate with a lip of the pour spout when the cover element is in the closed state, and the base comprising a surface perpendicular to the planar portion of the second substrate,

wherein the second substrate comprises protruding portions,

wherein the base of the chevron extends downward beyond the protruding portions, and

wherein a thickness of the second substrate in a direction perpendicular to the planar portion of the second substrate varies continuously between the apex and the base to define the chevron.

15. The self-cleaning lid of claim 14, wherein the chevron is triangular-shaped.

\* \* \* \* \*