

[54] **AGITATOR ASSEMBLY FOR MIXING PAINT**

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[57] **ABSTRACT**

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A paint agitator assembly comprising an impeller carried by a magnet in the cup for mixing the paint, with the pain discharge tube located between the impeller end and the cup wall for preventing a vortex. The magnet is rotated by a second magnet external to the cup, and the second magnet is in turn rotated by a high speed air turbine through a series of plastic gears arranged to provide speed reduction and high torque for rotating the first magnet. The air for driving the turbine is provided through a throttling valve and metering orifice to the air turbine and follows a tortuous path extending in sequence through circumferentially offset holes to reduce noise.

[21] Appl. No.: **432,556**

[52] U.S. Cl..... **259/108, 259/DIG. 46**

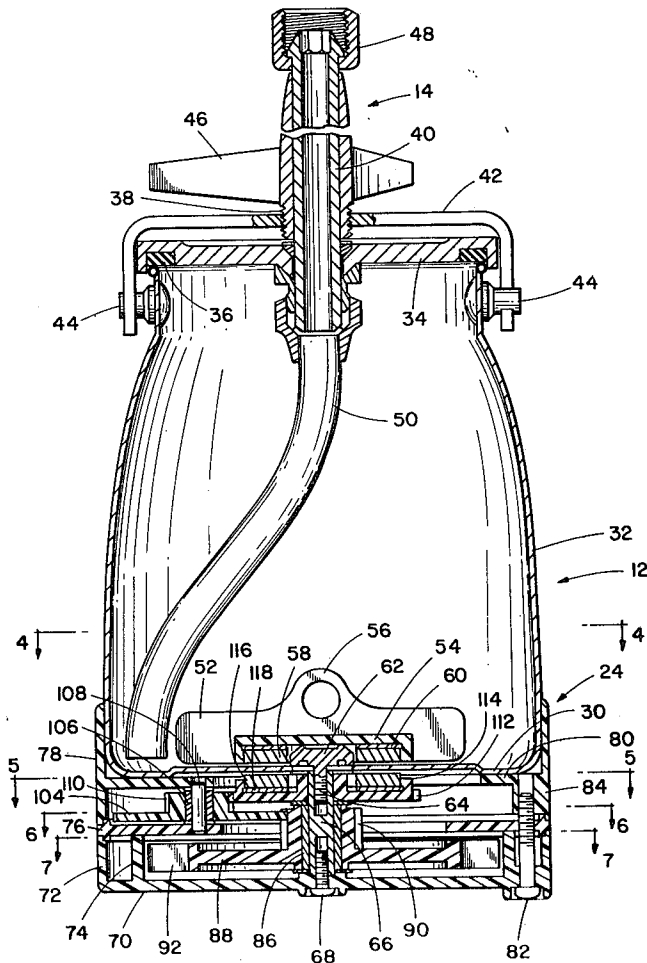
[51] Int. Cl..... **B01f 7/18**

[58] Field of Search..... 259/107, 108, DIG. 46, 259/106, 103, 121, 122, 6, 7, 8, 42, 43, 44, 22, 23, 24, 65, 66, 67

[56] **References Cited**
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1,784,416 12/1930 Brockmann..... 259/122
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14 Claims, 9 Drawing Figures



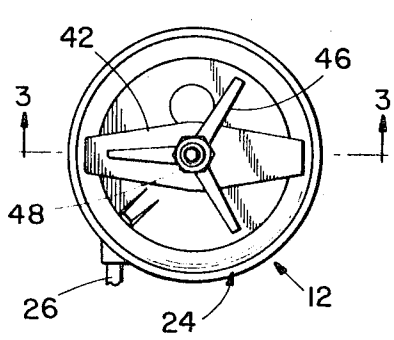


FIG. 2

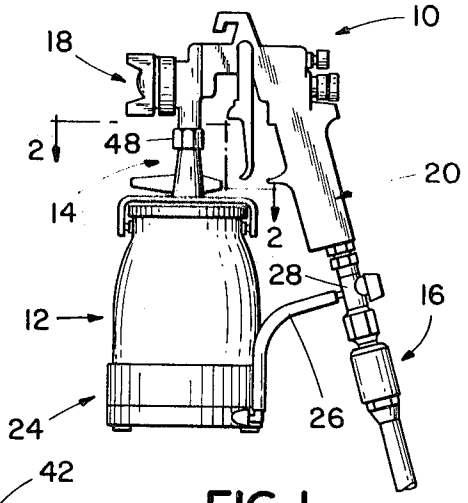


FIG. 1

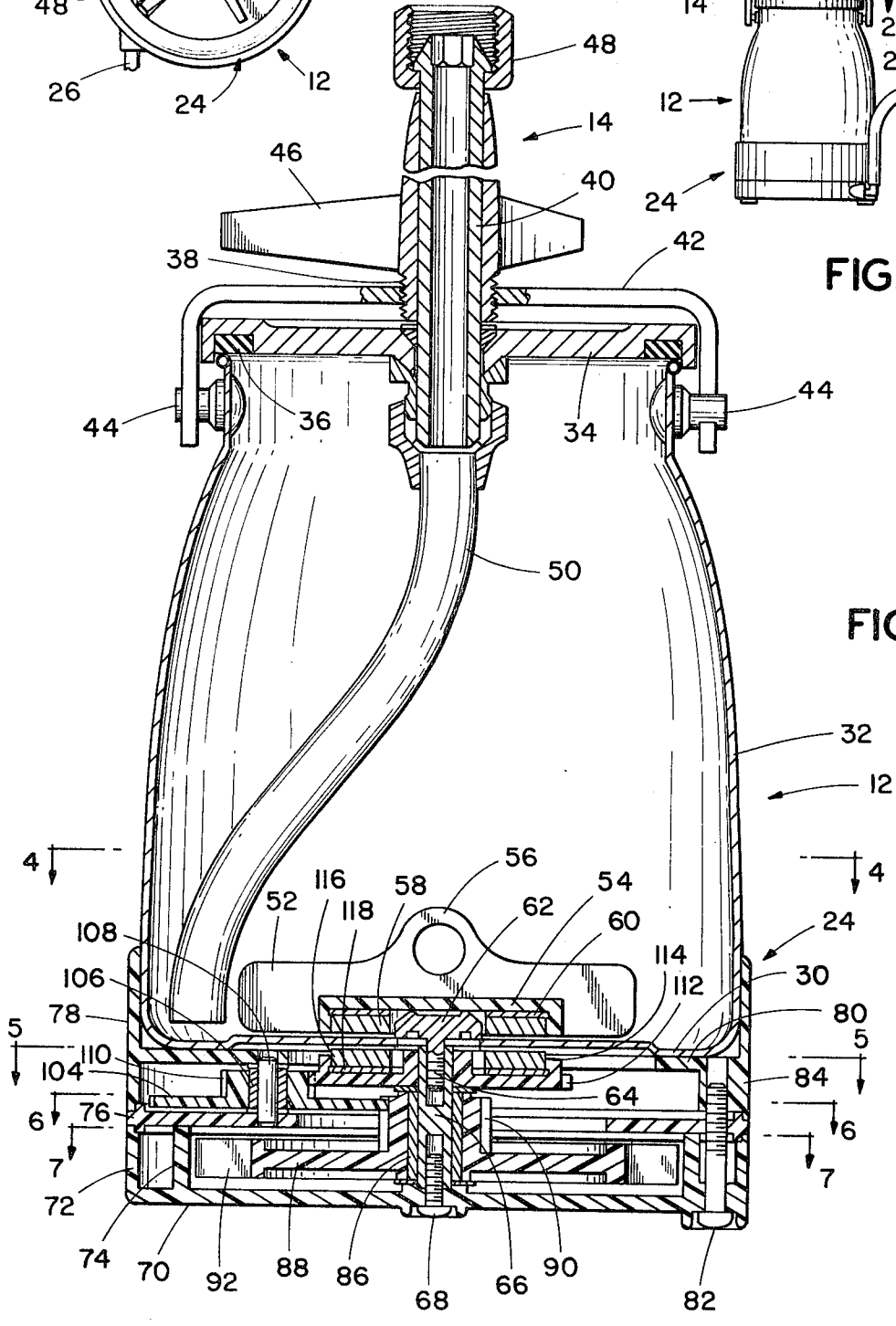


FIG. 3

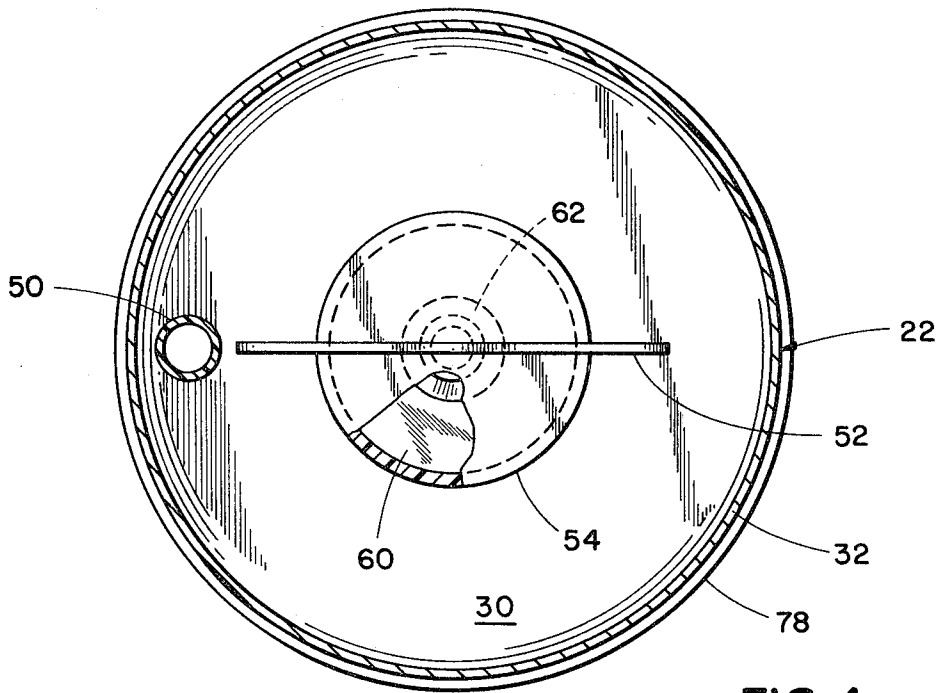


FIG. 4

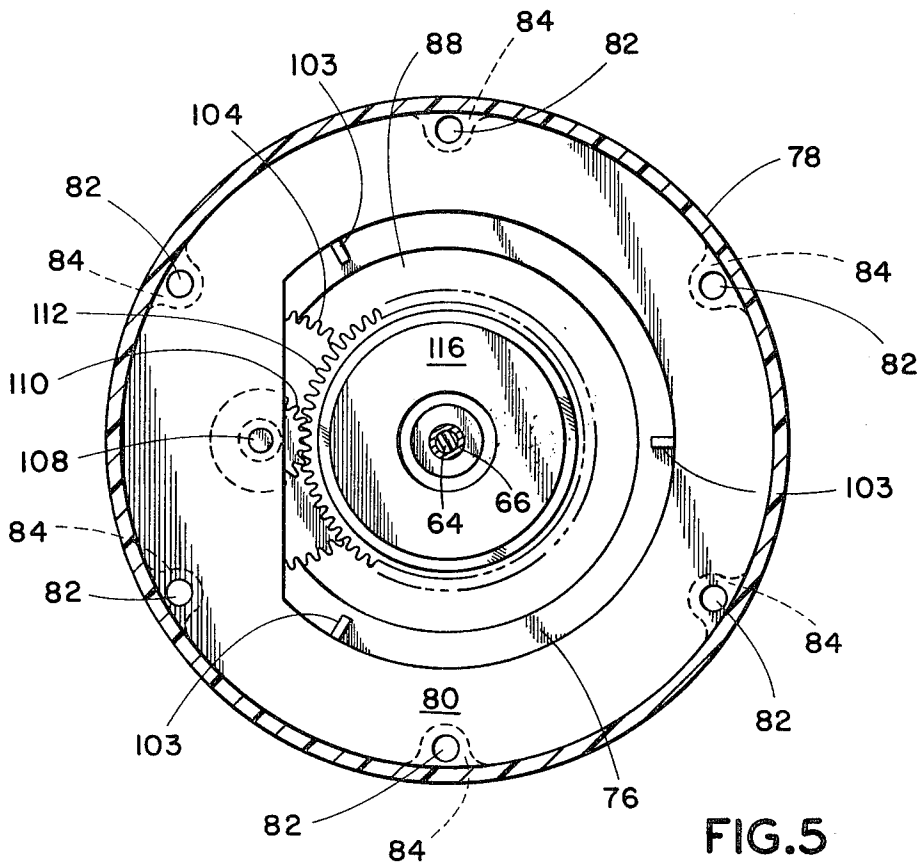


FIG. 5

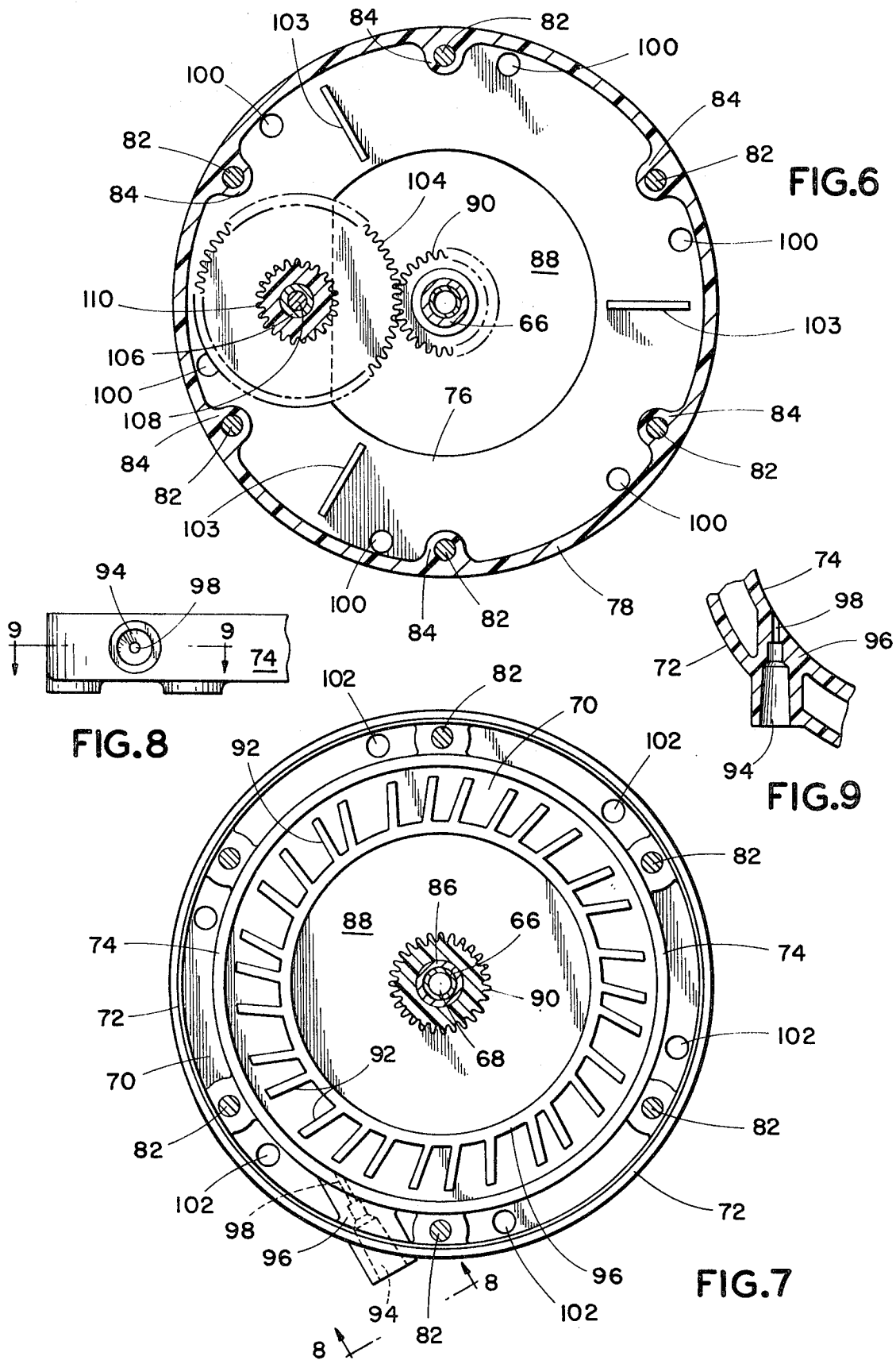


FIG.6

FIG.8

FIG.9

FIG.7

AGITATOR ASSEMBLY FOR MIXING PAINT

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to paint mixing and more particularly to an improved agitator assembly for mixing paint.

2. Description of the Prior Art

Agitator assemblies for material mixing often utilize a rotating magnet and impeller in a mixing vessel. The magnet is rotated by a magnetic field usually provided by an externally located magnet, which is coupled to a power source. Magnetic coupling has the advantage of avoiding a rotary seal in the vessel wall, which is required if the impeller is mechanically coupled to the power source. Such seals become clogged, especially when used with paint of the type employed in painting auto bodies. Alternatively, providing sufficient torque to rotate a magnet and impeller through magnetic coupling has not been practical if the material is paint.

Thus, auto body paint utilizes heavy pigments or metal flakes or, alternatively, extremely light solvents so that the flake or pigment settles quickly. This situation in turn requires a relatively high magnetic force or torque on the impeller to prevent pigment settling. If the pigment settles during painting of the body or between successive paint coats, the finished appearance is marred or uneven.

Various mixing approaches have been tried including a so-called trigger paddle, balls in the cups, top and side mounted quasi displacement pumps and air mixing. The trigger paddle is operated each time the operator operates the spray gun trigger and, therefore, does not stir often enough to mix the paint. Likewise, dumping balls in the cup, which move in response to occasional manual swirling of the cup, does not mix the paint often enough to secure a good mix. The top and side mounted quasi pumps directly drive propeller shafts in the paint and, therefore, require rotary seals which clog with paint and also result in variable speed. These quasi pumps are similar to turbines but have close fitting chambers which are expensive. Air mixing in which air is blown through the paint evaporates the solvent too rapidly and creates an undesirable froth.

Using a true air driven turbine for rotating an external magnet to provide a magnetic field for rotating a magnet and impeller in the paint cup would offer the most advantageous solution. However, the turbine operates at high speeds and low torque. With low torque, the impeller stalls due to heavy pigments or flakes and good mixing does not occur. On the other hand, a positive displacement air motor of the vane or gear type to provide sufficient torque for rotating the magnets is relatively expensive. An air motor arrangement is also heavy and tiring to the operator, since the cup and agitator assembly are usually manually held. Therefore, the use of a magnetically driven impeller to mix paints having heavy pigments or metal flakes has heretofore been subject to a number of drawbacks.

SUMMARY OF THE INVENTION

The present invention proposes to solve the above and other problems in paint mixing apparatus by utilizing an agitator assembly having a low cost air turbine in conjunction with a speed reduction gear train to rotate the magnets. With a low coat plastic turbine and plastic gears, this agitator assembly provides both the

proper speed and torque for mixing paint having heavy pigments or metal flakes, together with the requisite economy. The plastic turbine and gears are carried in a plastic housing to also minimize weight and avoid tiring of the painter's arm.

In order to provide maximum agitation of the paint while minimizing undesirable vortex action, the paint discharge tube, which extends from an axial outlet conduit at one end of the paint cup, is extended to a position between the periphery of the impeller and the wall of the cup.

The air for driving the turbine is passed from a throttling valve through a metering orifice for application to the turbine and then is passed sequentially through a series of circumferentially offset holes for muffling noise and vibration. In addition, the turbine blades are spaced circumferentially at unequal positions to thereby avoid resonant noises. The metering orifice provides a high speed air jet for the turbine, while limiting the applied air to thereby limit the drain on the air supply compressor, which is important in preserving the air supply, especially in the case of a low capacity compressor. The quasi pumps mentioned previously allow large quantities of air to escape past the ends and sides of the blades and gears resulting in relatively inefficient operation.

The paint impeller is also provided with a self-centering arrangement which is effective to seat the impeller on its drive capstan in response to jiggling the can in the event the impeller has been dislodged during assembly of the cup lid and discharge tube.

It is therefore a primary object of the present invention to provide an improved economical agitator assembly for mixing paint.

Other objects and features of the present invention will become apparent on examination of the following specification, claims and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a spray gun, together with an associated paint cup and agitator assembly to which the principles of the present invention are applied;

FIG. 2 is a sectional view taken generally along the line 2—2 in FIG. 1;

FIG. 3 is a sectional view of the paint cup and agitator assembly taken generally along the line 3—3 in FIG. 2;

FIG. 4 is a sectional view of the paint cup taken generally along the line 4—4 in FIG. 3;

FIG. 5 is a sectional view taken generally along the line 5—5 in FIG. 3;

FIG. 6 is a sectional view taken generally along the line 6—6 in FIG. 3;

FIG. 7 is a sectional view taken generally along the line 7—7 in FIG. 3;

FIG. 8 is a sectional view taken along the line 8—8 in FIG. 7; and

FIG. 9 is a sectional view taken along the line 9—9 in FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 a conventional spray gun 10 is shown carrying a paint cup 12 connected thereto by means of a conventional conduit and fitting assembly 14. Assembly 14 may, for example, be of the type such as shown

in U.S. Pat. No. 3,714,967 issued Feb. 6, 1973 to Zupan et al. The spray gun 10 is fed air by means of a conventional hose assembly 16 connected to a conventional pressurized air supply or compressor (not shown), which supplies air usually in a range between 40 p.s.i. to 75 p.s.i., for the purpose of siphoning paint from the paint cup assembly 12 through the conduit and fitting assembly 14 for dispersion through a nozzle assembly 18 of the spray gun. Alternatively, the pressurized air is applied to the paint through a conduit (not shown) to drive it under pressure through the assembly 14 and gun 10. The paint from the nozzle assembly 18 is directed toward an object to be painted by an operator, whose hand holds the gun 10 and cup 12 by means of handle 20 on the gun.

The paint cup 12 carries an agitator assembly 24 for mixing paint in the cup. A flexible conduit 26, connected to the air supply through a throttling valve 28 in the hose assembly, supplies air to the agitator assembly 24. The valve 28 permits air to be optionally supplied at a selected rate to assembly 24.

The paint cup 12 includes a back wall 30 and a peripheral wall 32 having an open end, which is closed by a lid 34, as seen in FIGS. 2 and 3.

The lid 34 has an annular gasket 36 seated in a recess adjacent the lid periphery for engaging the open end of cup 12 under pressure of a threaded sleeve 38. The sleeve 38 encircles a conduit 40 passing axially through the lid 34 into the cup 12 through an appropriate or conventional seal. The threaded portion of sleeve 38 engages a threaded opening in the back leg of a U-shaped locking bracket 42 having slots in the end legs thereof for engagement with a pair of lugs 44 projecting radially outwardly from adjacent the upper end of wall 32.

The sleeve 38 is manually threaded through the back wall of locking bracket 42 by means of handle 46 to lift the bracket against lugs 44 and bear against the lid 34 to secure the lid or cover tightly against the open end of wall 32. Conduit 40 has a fitting 48 at one end projecting from lid 34 for attachment to the spray gun 10. The outer end of the conduit 40 projecting into the cup 12 sealingly communicates with one end of an aluminum paint discharge tube 50.

The tube 50 projects downwardly and radially outwardly to a position adjacent the juncture of the cup back wall 30 and peripheral wall 32 and radially outwardly of the ends of an impeller or vane 52 of the agitator assembly 24, as seen in FIGS. 3 and 4.

The impeller 52 comprises a longitudinally or radially extending vane integrally formed on a plastic cup member 54. An apertured axial finger grip or projection 56 is formed intermediate the ends of impeller 52. The cup member 54 is moulded around a magnet 58 having an annular steel back plate 60 secured to the upper surface of magnet 58 and adjacent the cup back wall. The cup 54, magnet 58 and impeller 52 are rotatably supported by a capstan 62 in a position spaced from wall 30.

The capstan 62 has a beveled or conical periphery with the small diameter at one axial upper end for seating against the back wall of the cup member 54. An integrally formed threaded projection 64 is formed at the lower or other capstan end extending axially through the back wall 30 of the paint cup 12. A steel shaft 66 substantially one inch long and having threaded axial openings at opposite ends, threads onto projection 64

and tightly seals the bottom capstan surface against the back wall 30. The opposite lower threaded axial end of shaft 66 is engaged by a screw 58 for securing a cup-shaped housing 70 to the shaft 66 and cup 12.

The housing 70 comprises a pair of radially spaced circumferential walls 72 and 74 whose upper axial ends bear against the lower surface of a radial wall 76. The upper surface of wall 76 bears against a top annular wall or section 78 overlappingly engaging the surface of cup wall 32. A radially inwardly extending wall 80 is formed integrally on wall 78 for engagement with the cup back wall 30. Screws 82, passing through the back wall of housing 78 between walls 72 and 74 through wall 76, are threaded into locating lugs 84 formed on walls 78 and 80, and serve to secure walls 76 and 78 to housing 70 and in turn to shaft 66 and cup 12.

The shaft 66 also carries an axially extending bushing or bearing member 86 for rotatably supporting a plastic turbine 88, seen in plan view in FIG. 7. A hub extending axially from turbine 88 has a small diameter gear 90 integrally formed thereon. The turbine 88 has a plurality of circumferentially spaced radially extending teeth or vanes 92 to enable the turbine 88 and gear 90 to be rotated or driven by the passage of air against the vanes. It will be noted that the turbine blades 92 are spaced circumferentially at unequal positions, in this case six differently spaced positions, to minimize resonant noises with the number and location of the vanes being chosen to maintain the turbine balance.

The turbine 88 is located axially between wall 76, the back wall of housing 70 and within wall 74, which forms a turbine chamber to which air is supplied under pressure through a passageway 94 in a wall section 96 formed between walls 72 and 74 at one circumferential position. Air is communicated to passageway 94, seen in FIGS. 7, 8 and 9, from the conduit 26 and an appropriate fitting tangentially into the turbine chamber through a reduced metering portion 98 of passageway 94 for driving the turbine. Metering through orifice 98 provides a constant flow of high speed air. The air exits through a central opening formed in the radial wall 76 about gear 90, as seen best in FIG. 6, through openings 100 formed in wall 76 at positions spaced radially between walls 72 and 74, and exits to atmosphere through openings or passageways 102 formed in the back wall of housing 70. The openings 102 are offset circumferentially from passageways or openings 100 for the purpose of muffling or reducing the noise of air passing through the described path. Ribs 103 on wall 76 assist in stiffening wall 76 and reducing air noise.

The gear 90 engages a larger diameter plastic gear 104 rotatably carried on a bushing 106 and a coaxial pin 108 mounted at opposite ends in radial walls 76 and 80. A small diameter gear 110, axially displaced above gear 104, is integrally formed on the hub of gear 104 and it in turn engages a large diameter plastic gear 112, as may be seen in FIG. 5. The gear 112 is rotatably carried on the shaft 66 and has an annular projection 114 thereon moulded around a magnet 116 to mouldably secure the gear and magnet, and a steel back plate 118 secured to the lower surface of magnet 116. Magnet 116 is located adjacent, but spaced from, wall 30 and serves to rotate or drive the magnet 58 and impeller 52. Thrust washers or retaining rings are also provided for the gears and wheel, and the washers properly space the gears and wheels.

In assembling the agitator assembly 24 to the cup, the capstan stud or projection 64 is inserted through the axial opening in wall 30, and the shaft 66 carrying housing 70 and walls 76 and 78, together with wheel 88 and gears 90, 104, 110 and 112, are secured thereto. The impeller 152 is inserted into the cup 12 and the cup 54 engaged with the capstan 62. It will be noted that agitator assembly 24 may occupy any angular position relative wall 30.

Thereafter, paint is deposited in the cup 12 and the lid 34, together with the conduit and fitting assembly 14, are placed in position with the paint discharge tube 50 located between the radial end of vane or impeller 52 and wall 32. If the impeller 52 is cocked relative the capstan 62 when placing the tube 50 in position, the cup 12 is simply jiggled or swiveled about a vertical axis to align the magnets 58 and 116, which attract each other, to seat the cup 54 on capstan 62.

The fitting 48 is attached to the gun 10, and conduit 26 is connected between passageway 94 and the throttling valve 28. Application of air pressure to the gun through hose assembly 16 creates a vacuum in the siphon or paint discharge tube 50 so that paint is pressed through tube 50, conduit 40 and through the gun nozzle 18 for dispersion to the object to be painted. Atmospheric air is supplied to the cup 12 in a conventional manner through a small opening in lid 34. Alternatively, air under pressure is supplied to drive the paint through tube 50 under pressure.

Air is also supplied from conduit 26 through passages 94 and 98 for tangentially engaging the turbine vanes 92 to rotate the turbine 88 and gear 90 at high speed of substantially 6,000 R.P.M. The unequal vane spacing prevents the buildup of resonance and minimizes noise. Gear 90 and the remaining gears 104, 110 and 112 are arranged as speed reduction gears to provide a 15 to 1 speed reduction so that magnet 116 is rotated through the gear train relatively slowly at 400 R.P.M. and thereby provides adequate torque to rotate magnet 58 against the heavy paint load. Magnet 58 carries cup 54 and impeller 52 into rotation to agitate and mix the paint. Movement of the paint would normally create a vortex and prevent adequate mixing, but tube 50 disrupts the vortex and drives the paint back over the vane 52 to ensure good mixing. The air, after driving the turbine 88, exits through the central opening in wall 76, through the openings 100 and 102 in wall 76 and the back wall of housing 70, respectively.

It will be noted that the throttling valve 28 permits air to be selectively supplied to agitator assembly 24 in the proper amount, when needed for paint mixing, and to be terminated when unnecessary. Metering orifice 98 serves to limit the air drain on the supply compressor to substantially $\frac{3}{4}$ c.f.m., while providing a high speed jet for driving the turbine. This ensures that sufficient air pressure is available to drive the paint through the gun 10 even if the compressor capacity is as low as 5 c.f.m.

Various modifications of the described agitator assembly can be constructed without departing from the concepts of the invention, which are set forth in the accompanying claims.

What is claimed is:

1. An agitator assembly for a paint cup having a back wall and a peripheral wall, comprising a first magnet, an impeller, means securing said impeller to said first magnet, means on the back wall of said paint cup for

rotatably supporting said first magnet and impeller in said paint cup, a second magnet, means supporting said second magnet for coaxial rotation with said first magnet and external to said cup in a position adjacent to said cup back wall for rotating said first magnet in response to rotation of said second magnet, an air turbine, a plurality of speed reduction gears, and means rotatably supporting said gears and turbine with said gears interconnected between said turbine and said second magnet for rotating said second magnet at a speed substantially below the speed of said turbine in response to the rotation of said turbine.

2. The assembly claimed in claim 1 in which said gears are formed of plastic.

3. The assembly claimed in claim 2 in which said means for securing said impeller to said magnet comprises a cup member formed of plastic having a peripheral wall in encircling engagement with said magnet, and said impeller is integrally formed on said cup member.

4. The assembly claimed in claim 3 in which said means on said paint cup comprises a capstan formed of plastic having one end for rotatably supporting said plastic cup member and first magnet, an axially extending wall passing axially through said first magnet, and a projection at the other end of said capstan extending through said paint cup back wall.

5. The assembly claimed in claim 4 in which said means supporting said gears comprises a shaft secured at one end to said capstan projection, a pair of axially spaced radially extending walls encircling said shaft, a cup-shaped plastic housing, means securing the back wall of said cup-shaped plastic housing to the other end of said shaft with said turbine and a first small diameter gear rotatably supported on said shaft and located axially intermediate the back wall of said plastic housing and one of said radially extending walls, said second magnet and a large diameter gear rotatably supported on said shaft intermediate said radially extending walls, and an integrally formed large and small diameter gear rotatably supported between said radially extending walls for engaging said turbine small diameter gear and second magnet large diameter gear respectively.

6. In the assembly claimed in claim 1, a metering orifice for supplying air under pressure at a limited rate and tangentially to said turbine.

7. In the assembly claimed in claim 6, valve means for selectively supplying pressurized air at a controlled rate to said metering orifice to drive said turbine.

8. In the assembly claimed in claim 1, a paint discharge tube for said paint cup with said discharge tube having a terminating portion located between said impeller and the peripheral wall of said paint cup and adjacent the back wall of said paint cup.

9. The agitator assembly claimed in claim 1 in which said turbine includes vanes spaced at circumferentially unequally spaced positions.

10. An agitator assembly for a paint cup having a back wall and a peripheral wall, comprising a magnet, an impeller carried by said magnet, means extending through the back wall of said cup for rotatably supporting said magnet and impeller in said cup, a second magnet, a shaft secured to said extending means, means including a large diameter gear secured to said second magnet and supporting said second magnet for rotation about the axis of said shaft in a position axially aligned with said first magnet and adjacent to said back wall for

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rotating said first magnet in response to rotation of said second magnet, an air turbine including an integrally formed small diameter gear supported for rotation about the axis of said shaft at a position axially spaced from said paint cup back wall, and a pair of integrally formed gears rotatably supported for engaging said turbine gear and said second magnet gear respectively for rotating said second magnet at a speed substantially below the speed of said turbine in response to the rotation of said turbine.

11. In the assembly claimed in claim 10, a cup-shaped housing secured to said shaft with a metering orifice therein for passing air under pressure in a direction tangential to the vanes of said turbine.

12. In the assembly claimed in claim 11, a throttling

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valve interconnected between said orifice and a source of pressurized air for controlling the application of air to said metering orifice.

13. In the assembly claimed in claim 12, circumferentially offset air passageways for sequentially passing air to atmosphere after passage tangential to said vanes to thereby limit the noise and vibration created by said air.

14. In the assembly claimed in claim 10, a lid for said paint cup, and a paint discharge tube secured to said lid at a position coaxial with said shaft and extending to a position adjacent the path described by a radial end of said impeller.

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