Sept. 18, 1962 L. MARSH 3,054,600

FLUID MIXING APPARATUS

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FIG. 1

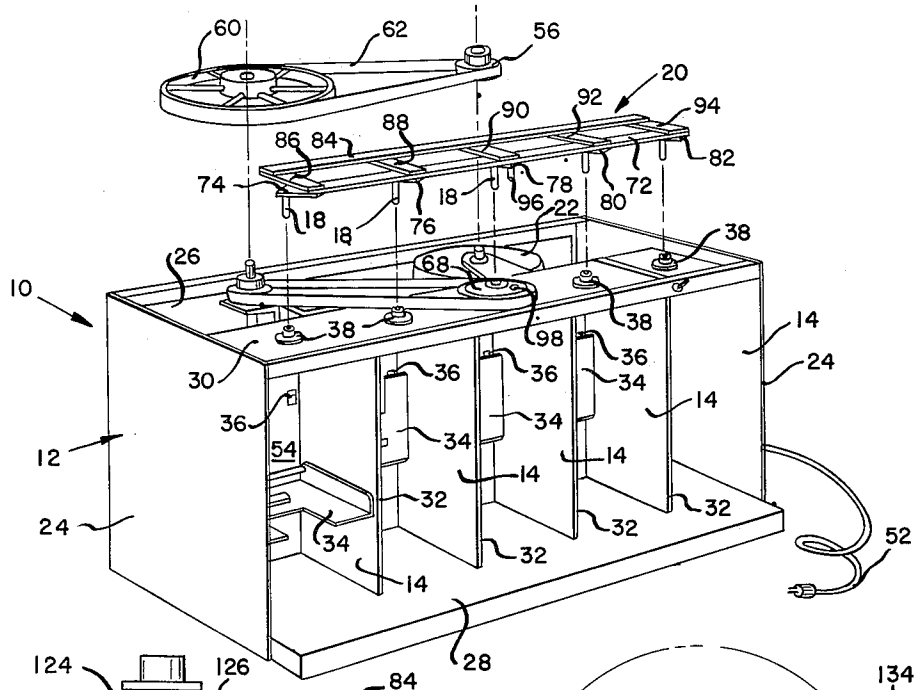


FIG. 4

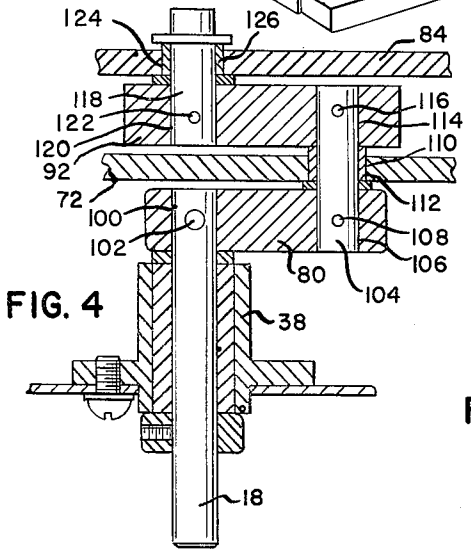
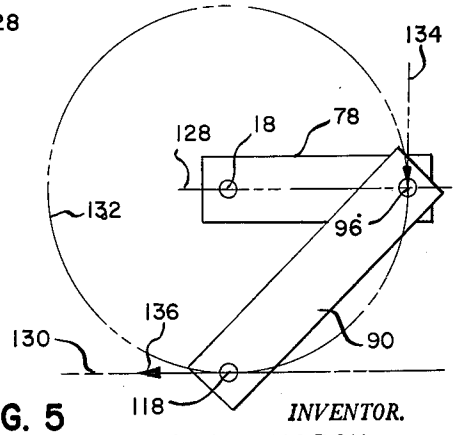


FIG. 5



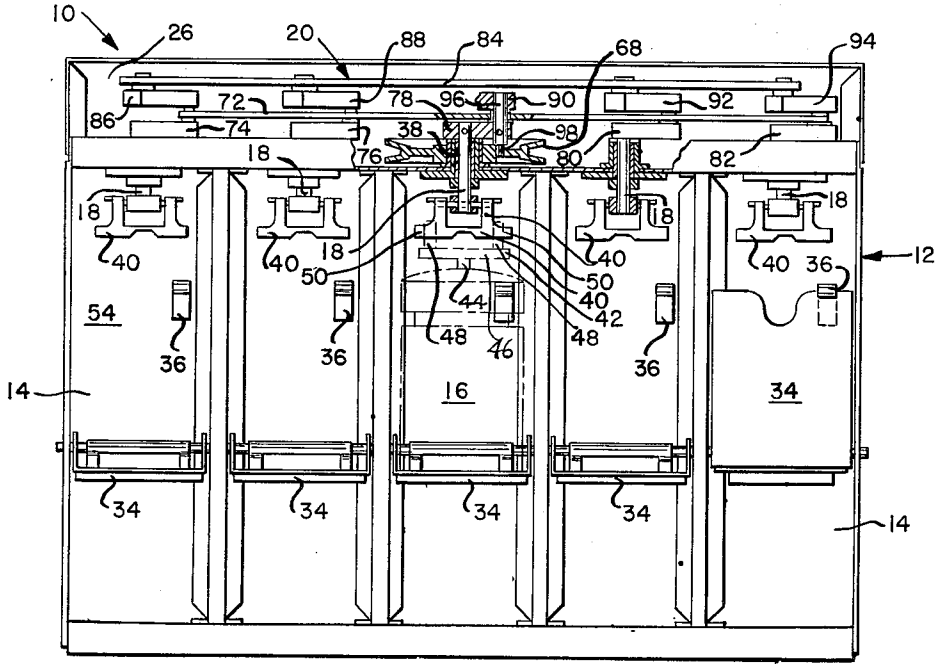
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FIG. 2



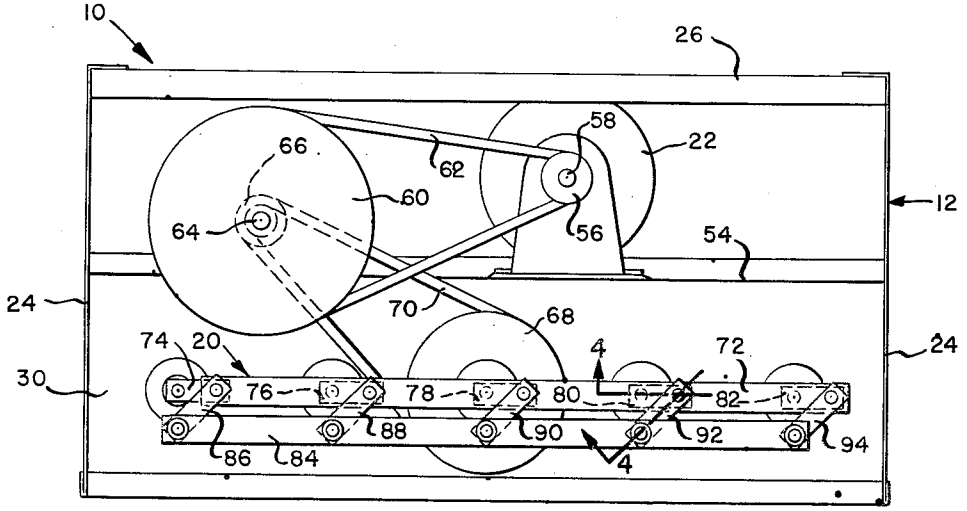


FIG. 3

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FLUID MIXING APPARATUS

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5 Claims. (Cl. 259—67)

This invention relates to mixing apparatus and more particularly to a power mixer having a plurality of agitator shafts driven by a single prime mover through a novel crank mechanism.

The fluid mixing device of the present invention is particularly adapted and will be described for use in connection with the agitation of paint. As will be readily apparent, however, the mixing device can be utilized in any situation where it is desired to mix the fluid in several containers at the same time. Multi-place power mixers are frequently used in retail paint stores to facilitate the rapid mixing of paint before it is sold to customers. A very important use for such mixers is in the formulation of a special color from several different base colors. Mixing of special paint colors is often required when preparing an automotive paint for bump shops and the like which must be matched to one of the numerous colors in current use for automobiles.

As is well known, the constituents of paint tend to separate upon standing. The lighter fluids, such as the solvents, tend to rise to the top while the heavier constituents, such as pigment, tend to settle to the bottom. Before such paints can be intermixed to form a desired color, they must be thoroughly mixed to insure the proper consistency. Frequently, three or four colors must be mixed together to formulate the desired color. In such cases, it is time consuming if each color has to be mixed by use of a single agitator. Multi-place power mixers are frequently employed to enable the simultaneous mixing of several colors.

It is an object of the present invention to provide a multi-place fluid mixing device.

Another object of the invention is to provide a single power means connected through a novel crank mechanism to drive the agitators of a multi-place fluid mixing apparatus.

A further object of the invention is to provide such a crank mechanism which will operate smoothly to avoid the jerky motion usually associated with cranks.

A further object is to provide a crank mechanism for a fluid mixing apparatus which is of simple and rugged construction.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIG. 1 is an exploded view in perspective of one embodiment of the fluid mixing apparatus of the present invention;

FIG. 2 is a front elevational view of the fluid mixing apparatus with parts broken away for the purpose of clarity;

FIG. 3 is a top plan view of the fluid mixing apparatus;

FIG. 4 is an enlarged sectional view of a portion of the crank mechanism taken substantially along the zig-zag line 4—4 of FIG. 3 looking in the direction of the arrows; and

FIG. 5 is an enlarged top plan view of one crank mechanism.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

The fluid mixing apparatus 10 of the present invention comprises a cabinet 12 having a plurality of compartments 14 for the reception of containers filled with fluid to be mixed. Extending into each compartment 14 is a rotary agitator shaft 18. As may be noted, the shafts 18 are positioned along a line through the axial centers thereof. The shafts 18 are driven by a crank mechanism 20 which in turn is driven by a prime mover 22 which is operably connected thereto by means of a pulley system.

Referring to FIGS. 1 and 2, it may be seen that the cabinet 12 comprises side walls 24, back wall 26, and bottom wall 28. A top member 30 is provided adjacent the front edges of the side walls 24 to leave a rectangular opening in the top rear portion of the cabinet 12. The interior of the cabinet is divided into a plurality of compartments 14 by spaced partitions 32 and a longitudinal wall 54. The front of the cabinet is left uncovered as shown. A retractable hinged shelf 34 is provided in each compartment 14 for use when small containers, such as one quart containers, are placed in the mixer. A spring clip 36 is provided on the back wall 54 of each compartment to hold the shelves in a vertical position when the mixer is to be used for larger containers, such as gallon containers.

As may be seen in FIGS. 2 and 4, the agitator shafts 18 are rotatably mounted in bearings 38. A portion of the shafts 18 extend beneath the bearing 38 and may be provided with a hinged coupling member 40 for engagement with a coupling member 42 provided on the upper end of a stirrer 44. The stirrer 44 extends into a container 16 to agitate the contents thereof. The coupling 42 comprises a horizontally extending member 46 having an upstanding pin 48 provided at each end thereof. In operation, the container 16 is placed in the compartment 14 while the shafts 18 and coupling 40 are rotating. The coupling 40 will strike the pins 48 to be pivoted into a horizontal position where it will slide over the tops of the pins. After the coupling 40 has passed over both pins 48, its weight will pivot it to a vertical position between the pins 48 as shown in FIG. 2. The fingers 50 of the coupling member 40 will then engage the pins 48 whereby the shaft 18 and stirrer 44 are coupled together. When the container 16 is to be removed, it is merely pulled out of the compartment 14 whereby the coupling member 40 will again pivot to a non-engaging position.

Power to drive the shaft 18 is provided by the prime mover 22 which may be an electric motor having a power cord 52. The motor 22 is mounted on the compartment back wall 54 in the space between this wall and the cabinet back wall 26. The motor 22 drives the crank mechanism 20 through a set of speed reducing pulleys. A small diameter sheave 56 mounted on the output shaft 58 of the motor is connected to a large diameter sheave 60 by means of the belt 62. The large sheave 60 is mounted on shaft 64 which also carries a small diameter sheave 66. The small sheave 66 is drivingly connected to a medium sized sheave 68 by means of belt 70. The sheave 68 is rotatably mounted on the outer periphery of the agitator bearing 38.

The sheave 68 drives the crank mechanism 20. The crank mechanism 20 includes a pair of angularly related cranks. One of the cranks may be considered to be the elongated tie bar 72 and associated parallel crank arms 74 through 82, while the second crank may be considered to comprise the tie bar 84, associated parallel links 86–94, and the crank arms 74 through 82. It will be

noted that the crank arms 74–82 are common to both cranks. A pin 96 provides the driving connection from the sheave 68 to both of the cranks. As may be seen in FIGS. 1 and 2, the lower portion of the pin 96 engages an opening 98 in one face of the sheave 68. The opening 98 is offset a distance from the center of the sheave 68 equal to the length of the crank arm 78.

The structure of the tie bar, crank arm, and link mechanism connections is illustrated in FIG. 4. The structure is the same for each agitator shaft 18 excepting for the provision of a special pin 96 in one structure to connect the crank mechanism to the sheave 68.

As may be seen, the upper end of the shaft 18 extends into an opening 100 of crank arm 80 and is fixed against rotation by transverse pin 102. A pin 104 extends into opening 106 in the opposite end of crank arm 80 and is fixed by transverse pin 108. The pin 104 extends rotatably through opening 110 in tie bar 72 which is provided with a bearing 112. The upper end of pin 104 extends into opening 114 of link 92 and is fixed by transverse pin 116. It will be appreciated that fixing the pin 104 against rotation relative to both the crank arm 80 and link 92 establishes a fixed angular relationship between the crank arm and link.

A pin 118 extends into an opening 120 in the opposite end of link 92 and is fixed by transverse pin 122. The pin 118 then extends rotatably through an opening 124 in tie bar 84 which is provided with a bearing 126. The upper end of the pin 118 is enlarged to hold the tie bar 84 in place.

As may be noted in FIG. 3, the tie bars 72, 84 are in substantial parallel alignment and are of equal length as are the crank arms 74 through 82 and the links 86 through 94. Parallel alignment of the crank arms and links is considered necessary to permit the desired rotation thereof by the tie bars and parallel alignment of the tie bars is necessary inasmuch as each tie bar is adapted to oscillate about the same line, i.e., a line drawn through the centers of the shafts 18.

In operation, crank arm 78 is driven in a circular path by the rotating sheave 68. The tie bar 72 is also driven by the pin 96 in a path determined by the crank arms 74–82. Inasmuch as each crank arm rotates about a shaft 18, the path of the tie bar 72 is about a line drawn through the centers of the shafts 18. The tie bar 72 will, of course, rotate the crank arms to drive the agitator shafts 18. The second tie bar 84 is also driven by the pin 96. The path of the bar 84 is determined by the crank arms 74 through 82 in association with the angularly related links 86–94. Since each link is fixed to its associated crank arm, each link will also rotate about a shaft 18. Consequently, the tie bar 84 also rotates about a line drawn through the centers of the agitator shafts 18.

The path of the tie bars 72, 84 may be visualized by reference to FIG. 5. As there shown, the shaft 18 represents the center of the circle about which the link 90 and crank arm 78 rotate. The pin 96 represents a point on the tie bar 72 and the pin 118 represents a point on the tiebar 84. In the position shown, the longitudinal axis of the tie bar 72, represented by the line 128, is in alignment with a line through the centers of the shafts 18 and the longitudinal axis of the tie bar 84, represented by the line 130, is displaced therefrom. As may be readily seen, since the shaft 18 is fixed, the point 96 will rotate in a path represented by the circle 132. Since the crank arm 78 and link 90 are fixedly secured together by pin 96, the point 118 must also rotate about the shaft 18. In practice, the length of link 90 and its angular relationship to the crank arm 78 are selected to result in the point 118 following the same circle 132 as the point 96, being however 90° displaced therefrom so that the tie bar 84 is at the maximum distance from the line through the centers of the shafts 18 when the tie bar 72 is in alignment with this line as illustrated in FIGS. 3 and 5, and, conversely, to have tie bar 72 at a maximum distance from the line through the centers of the shafts 18 when tie bar 84 is in alignment therewith.

The desirability of providing two separate cranks to drive the shaft 18 will be appreciated when the motion and force factors involved in the oscillation of the tie bars 72, 84 are considered. When the tie bar 72 is aligned with the line through the centers of the shafts 18, the force exerted by the pin 96 is at a right angle to the longitudinal axis of the tie bar 72 as shown by arrow 134 of FIG. 5. In addition to driving the bar 72 in the desired path, the right angle force will tend to pivot the bar about some point along its longitudinal axis. This follows from the unequal distribution of forces applied to the bar by the various crank arms 74 through 82 and also because of the unequal weight distribution of the bar 72 on either side of the applied force 134. Even though the pin 96 is located at the approximate mass center of bar 72, the exact balance point of the bar cannot as a matter of actual practice be as accurately located as would be necessary to prevent pivotal motion. Such pivoting causes a jerky motion and results in rapid deterioration of the crank. However, if the applied forces are along the axis of the bar, there is little or no tendency to pivot inasmuch as the forces opposing motion are substantially in line therewith. In the position shown, one component of the force exerted on link 90, represented by arrow 136, is along the axis of the bar 84. When the tie bar 84 is in line with the centers of the shafts 18, the tie bar 72 will be displaced and the forces exerted on it will be in directions along its axis. Consequently, with the arrangement shown, one of the tie bars 72, 84 always has some component of the driving force along the longitudinal axis of the bar. Each bar will carry the other smoothly through the section where pivoting occurs to prevent twisting or jerking of the bars which would occur if just one bar were used. When the longitudinal force in one bar is zero, it is a maximum in the other bar and vice versa. The result is a smooth drive for the shafts 18 and considerably reduced wear on the crank mechanism 20.

The exact angular relationship of the links and crank arms and the relative lengths thereof are preferably as described. However, it will be readily appreciated that these relationships could be altered while still maintaining the essential effect of the two-crank drive. Also, additional cranks could be added to the mechanism if desired.

Having thus described my invention, I claim:

1. Fluid mixing apparatus comprising a prime mover; a rotatable member driven by the prime mover; a plurality of rotary agitator shafts; a crank arm operably connected to each agitator shaft; a first tie bar interconnecting said crank arms for rotation; force transmitting means drivingly connecting said rotatable member to said first tie bar; a link extending outwardly from each crank arm and having a fixed angular relationship thereto; a second tie bar interconnecting said links for rotation of the links and crank arms; said force transmitting means drivingly connecting said rotatable member to one of said links whereby the direction of the driving force exerted by the force transmitting means on the first tie bar is angularly displaced from the direction of the driving force exerted by the force transmitting means, via the connecting link, on the second tie bar.

2. Fluid mixing apparatus comprising a prime mover; a rotatable member driven by the prime mover; a first crank arm rotatably driven by the rotatable member; a first agitator shaft driven by the crank arm; a second agitator shaft; a second crank arm connected to the second shaft and in substantial parallel alignment with the first crank arm; a first tie bar interconnecting said rotatable member and second crank arm to rotate the second crank arm and second shaft; a first link rotatably driven by the rotatable member; said first link having a fixed angular relationship with respect to said first crank

arm; a second link substantially parallel to said first link; said second link being drivingly connected to said second crank arm; and a second tie bar interconnecting said first and second links to rotate the second link and second crank arm whereby said second shaft is rotatably driven by the rotatable member through two separate crank mechanisms to provide an even drive.

3. Fluid mixing apparatus comprising a prime mover; a rotatable member driven by the prime mover; a plurality of rotary agitator shafts spaced along a line through the axial centers thereof; a crank arm operatively connected to each agitator shaft; said crank arms being of substantially the same length and in substantial parallel alignment; a first tie bar interconnecting said crank arms for rotation; force transmitting means drivingly connecting said rotatable member to said first tie bar; a link extending outwardly from each crank arm and having a fixed angular relationship thereto; each of said links being of substantially the same length and in substantial parallel alignment; a second tie bar interconnecting said links for rotation with the crank arms; said force transmitting means drivingly connecting said rotatable member to one of said links whereby the direction of the driving force exerted by the force transmitting means on the first tie bar is angularly displaced from the direction of the

driving force exerted by the force transmitting means, via the connecting link, on the second tie bar.

4. An apparatus as claimed in claim 3 and further characterized in that the distance from the connection point of each link and second tie bar to the center of the associated agitator shaft is substantially equal to the length of each crank arm.

5. A device as claimed in claim 3 and further characterized in that the force transmitting means is connected to the first tie bar at substantially the center of the mass thereof and is connected to the second tie bar, via the connecting link, at substantially the mass center of the second tie bar.

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