April 21, 1931. R. C. WELLS ET AL 1,801,989

APPARATUS FOR BALANCING ANNULAR PARTS

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Fig. 1.

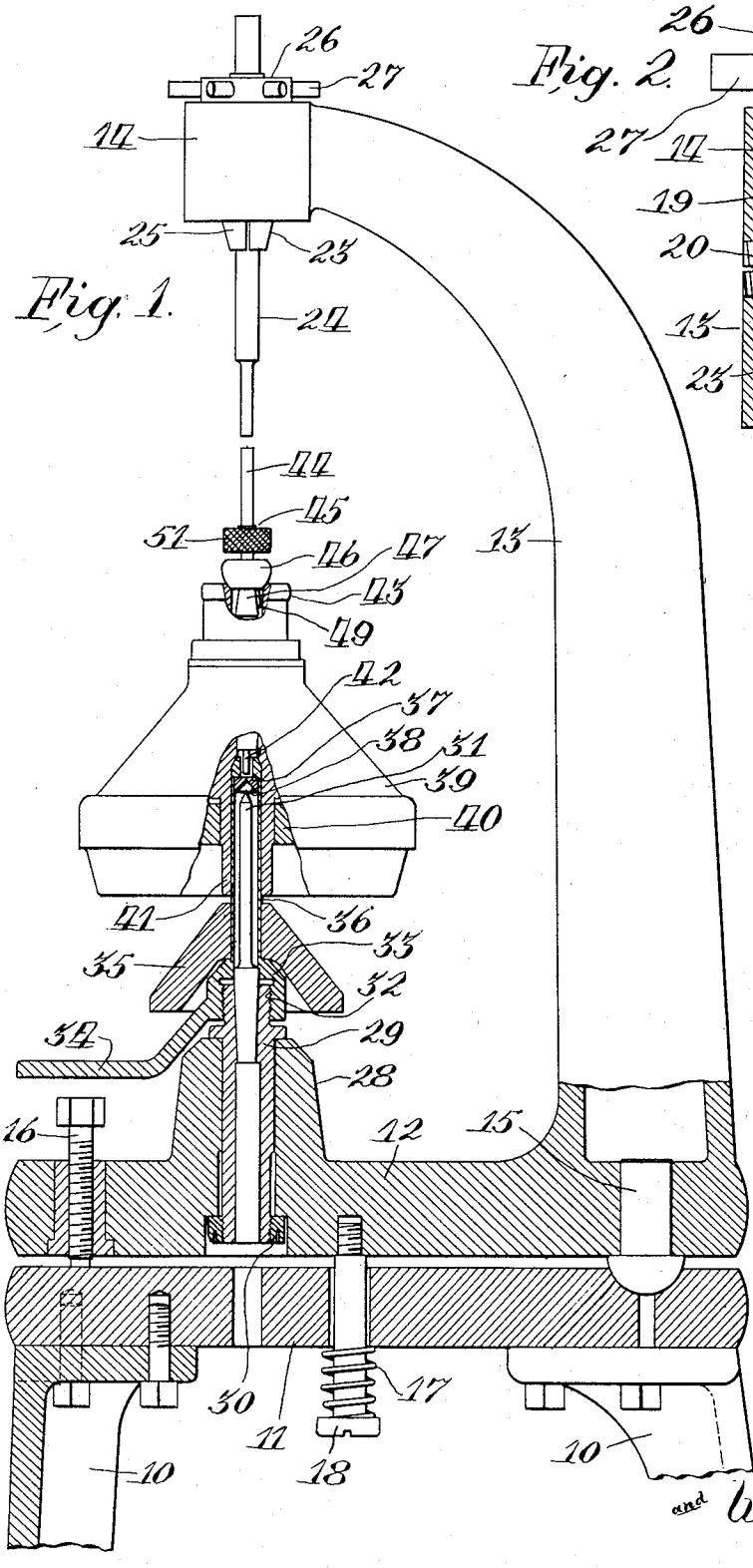


Fig. 2.

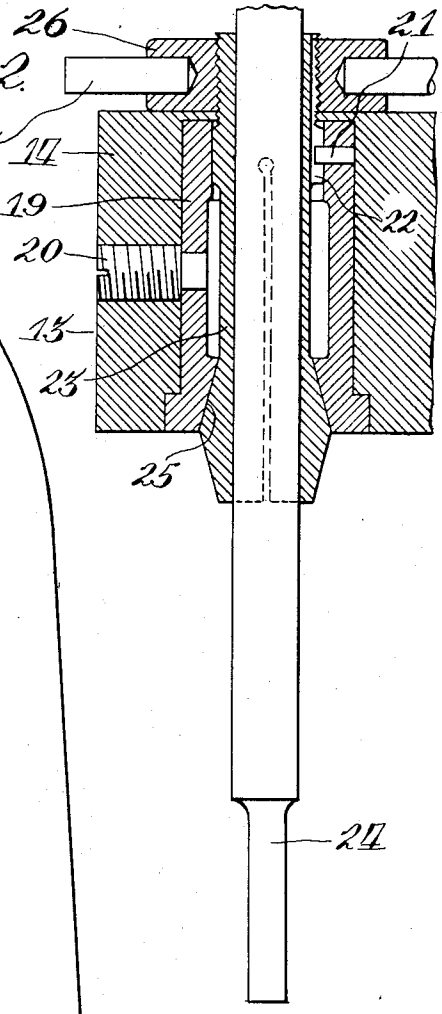
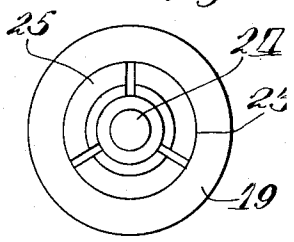


Fig. 3.



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Fig. 6.

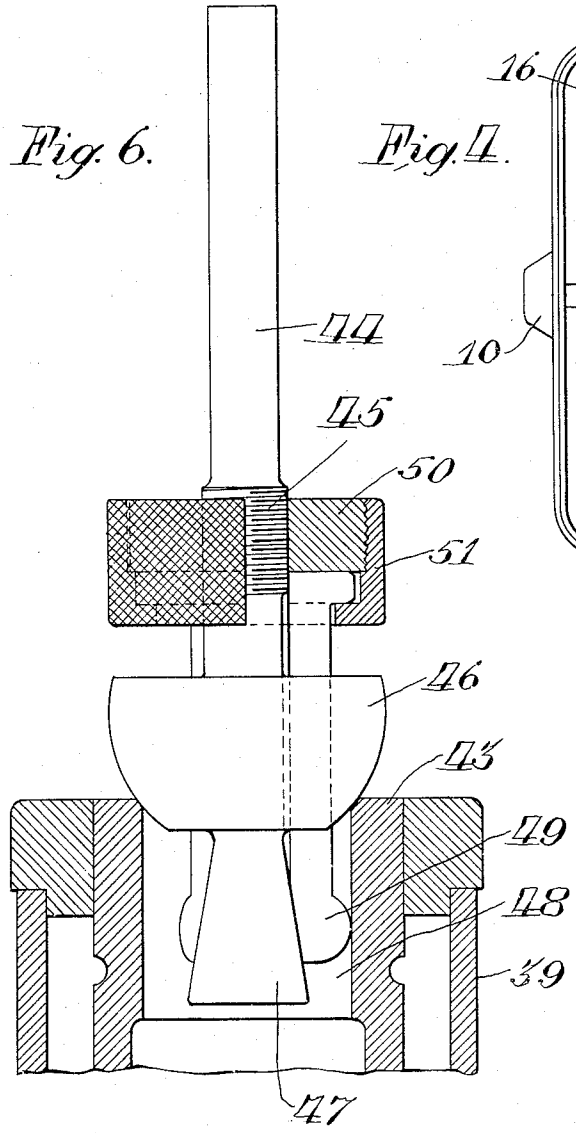


Fig. 4.

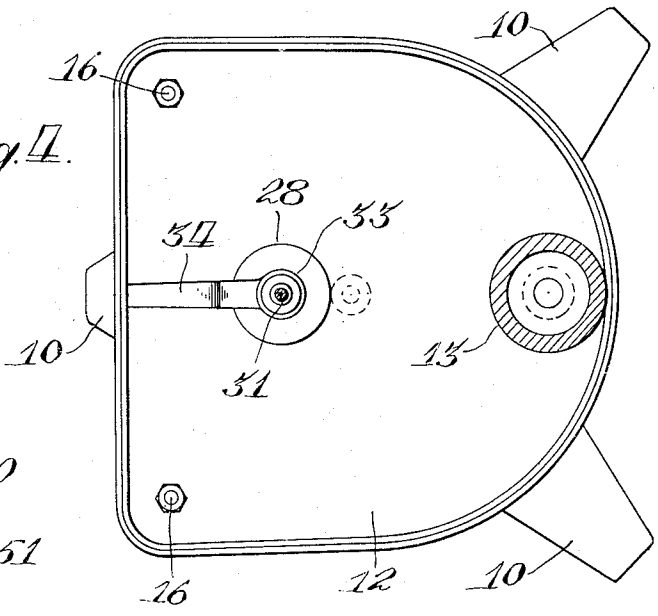


Fig. 5.

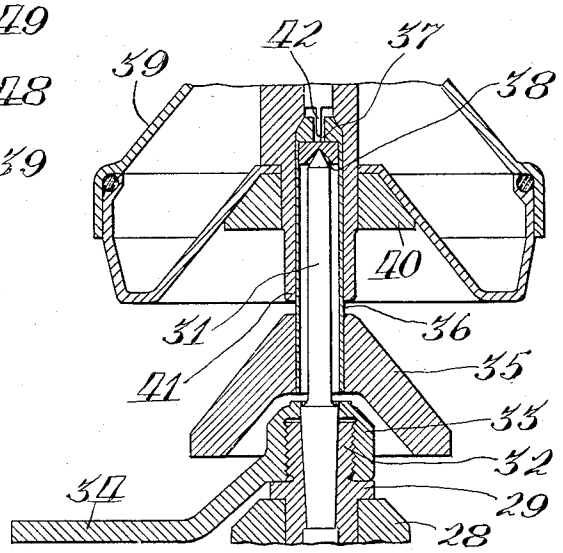
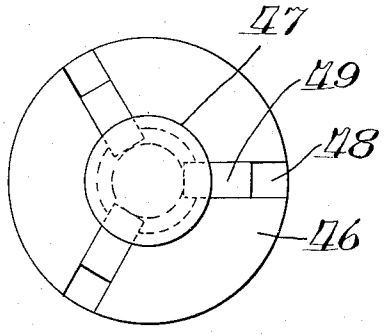


Fig. 7.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR BALANCING ANNULAR PARTS

Application filed October 16, 1929. Serial No. 399,993.

The invention is in an apparatus for statically balancing annular parts to ascertain points of weight inaccurateness.

Take, for example, the instance of cream separator bowls. It is essential that these annular parts have their mass uniformly and evenly distributed, lest such bowls fail to function properly when employed in a cream separator, because of uneven balance. Thus, in the manufacture of cream separators the bowls before being assembled in the separators must be balanced and corrected in respect to inaccuracies in weight.

More particularly, therefore, this invention relates to an apparatus for statically balancing cream separator bowls.

The object of the invention is to provide a simple, inexpensive apparatus for checking the balance of annular parts, such, for example, as cream separator bowls.

Other objects will become apparent to those skilled in this art as the disclosure is made.

Briefly, these desirable objects are achieved in a practicable form of the invention illustrated in the drawings, in which:

Figure 1 is a general side elevational view of the apparatus, a goodly portion thereof appearing in cross section better to illustrate the structure thereof;

Figure 2 is a vertical, cross sectional view, on an enlarged scale, of the upper-centering spindle;

Figure 3 is a bottom view of part of the structure shown in Figure 2;

Figure 4 is a plan view of the base which supports the apparatus;

Figure 5 is a vertical cross sectional view of the pivot spindle structure;

Figure 6 is a vertical cross sectional view of the lower centering spindle, on an enlarged scale; and,

Figure 7 is a bottom plan view of a part of the structure as shown in Figure 6.

The apparatus involves a supporting structure comprising legs 10, carrying a fixed horizontal bed 11. This bed carries a horizontal base 12 which includes an upright goose neck 13 terminating at its upper end in a vertical collar 14. The base 12 is rockably supported at one point on the bed 11 by means of an inverted bolt 15, having a hemispherical head, as shown in Figure 1, which rests in a complementary socket formed in the bed. At two other points the base carries two bolts 16 which are threadedly mounted therein and have their lower ends resting on the bed to support the base adjustably relative to the bed in an obvious manner. See also Figure 4. By this means, then, the base may be easily adjusted to a true horizontal position. Such adjustment is made yieldingly against the tension of a spring 17 encircling a bolt 18 passed loosely through the bed and threadedly fitted into the underside of the base at another point, as clearly appears in Figure 1.

Looking now especially to Figure 2, it will be seen that the collar 14 carries a bearing 19 locked to the collar by means of a set screw 20. This bearing is provided with an internally located, radial pin 21 that fits a vertical slot 22 in an expansible mandrel part 23 which is designed to clutch a vertically disposed upper centering spindle 24 which depends, as shown. The lower part of the mandrel includes a wedge head 25 cooperable with complementary wedge surfaces in the bearing 19 to permit tightening or loosening of the mandrel with respect to the spindle. The upper end of this mandrel is threaded to receive a nut 26 provided with hand grip pins 27 to turn the same. Turning of the nut raises or lowers the mandrel in an obvious manner because the nut contacts the upper surface of the collar 14. The pin 21 and slot 22 insure that the mandrel moves only up or down and does not turn. When the mandrel moves up, it grips the spindle 24, and, when it moves down, it frees the spindle, because of the action of the wedge described. It must be understood that the parts just described are so precisely made that at all times the centering spindle 24 is truly vertical, provided, of course, that the base 12 has first been properly leveled to a true horizontal position.

A work holder and spindle pivot structure is also provided, which will now be described. To this end, the base is formed with an upstanding hollow boss 28 (see Figure 1) which

receives a mandrel 29, disposed vertically therein, and locked securely in place by a nut 30 at its bottom. This mandrel carries the vertically disposed pivot spindle 31, which, by means of a plumb, will be disposed in exact vertical alinement with the upper centering spindle 24 already described. See also Figure 5. The outer surface of the upper end of the mandrel 29 is threaded, as appears at 32, to receive a turnable cap 33, turnable by means of a handle 34. Said cap 33 has its top perforated so that the spindle 31 may be passed upwardly therethrough, as shown.

As shown in Figure 1, a conical weight 35 rests on top of the cap, said weight having drive-fitted thereinto an upstanding tubular member 36 loosely embracing the spindle 31 to provide play for a purpose later to appear. The top of the tube 36 is closed and formed with a groove 37, there also being located in the top of said tube a block having an inverted conical depression 38 therein adapted to rest on the pivot point of the spindle 31, as appears best in Figure 5. A standard cream separator bowl is shown at 39 and includes, as unitary parts, the block 40 and tube 41. Inside the tube 41 is a projection 42. The bowl is adapted to be placed with its tube 41 telescoped over the tube 36 in a manner to cause the projection 42 to fit into the groove 37.

When the screw cap 33 has been turned up by the handle 34, the weight of the bowl 39 is carried by the cap 33 through the weight, or counter-balance, 35 and the tube 36, with the bowl free of the pivot point of the spindle 31, as shown in Figure 1; and, conversely, when said cap 33 has been turned down, freeing the weight 35, as shown in Figure 5, the weight of the bowl is directly on said pivot point of the spindle 31. Rocking movement of the bowl on the pivot point is permitted, if the mass thereof is unevenly distributed, because of the clearance space provided between the spindle 31 and the tube 36.

In balancing the bowl, a lower centering spindle is provided to line up with the upper centering spindle already described. The lower centering spindle is best shown in Figures 1 and 6, to which reference should next be made. The upper part of the bowl, as is usual, is formed with a tubular neck 43 which is utilized in holding the lower centering spindle, as will presently appear. This spindle appears at 44, a length thereof being threaded as at 45. Below these threads the spindle is formed with an integral half-ball-shaped stop 46 from the lower part of which extends an integrally formed cone-shaped wedge 47. The part 46 is formed with three slots 48 through which are passed wedge fingers 49 that contact the wedge 47, as shown. A nut 50 is threaded to the spindle part 45, and the top ends of the wedge fingers 49 engage the lower end of the nut. A cap 51 is secured to the nut and locks the fingers 49 against displacement, as clearly shown in Figure 6. See also Figure 7, showing a bottom view of the wedge structure. The operation and use of the bowl balancing apparatus will now be described.

First, the base 12 is leveled, by means of the screws 16, to a horizontal position. This assures an exact vertical disposition of the upper centering spindle 24. A bowl, as it comes from production, is then fitted with the lower centering spindle 44, which is locked inside the neck of the bowl by means of the wedge fingers 49, when the cap 51 and nut 50, as a unit, are turned down, causing the fingers 49 to wedge out and grip the bowl neck in an obvious manner. The bowl is now ready for test to determine its balance.

Accordingly, the handle 34 is given a turn to raise the tube 36 free of the pivot pin 31, as shown in Figure 1. Then the bowl is placed on top of said tube 36, as shown in Figure 1. A reverse turn of the handle 34 now slowly places the weight of the bowl on the point of the pivot pin 31 and frees the bowl for tilting, or pivoting movement. If the bowl's balance is correct, the lower centering spindle and upper centering spindle line up in a vertical line. If the bowl is unbalanced, it tilts to one side or the other and finally comes to rest with its axis out of alinement with the axis of the upper centering spindle. By trial and experiment, the operator then applies putty, or the like, to the deficient point on the bowl until enough putty, in weight, has been applied to cause the bowl to tilt toward its vertical axis. When the lower centering spindle, in this fashion, lines up with the upper, stationary centering spindle, the bowl has been properly balanced. Thereupon, the operator removes the mass of putty and marks the spot on the bowl in any appropriate manner. The next step is to weigh the removed mass of putty against a like mass of solder on a torsion balance, for example. This equal weight of solder is then soldered onto the bowl at the marked spot. The solder is then wiped smooth so that the bowl presents a neat appearance. Thus, the bowl has been corrected for improper balance and it is ready for use in a cream separator.

From this detailed disclosure, it is now apparent that an improved apparatus has been provided which achieves all of the desirable objects heretofore recited in connection with the static balancing of annular parts such as cream separator bowls.

It is the intention to cover all such immaterial changes of the illustrative form herein shown as do not depart from the spirit and scope of the invention, as indicated by the definitions thereof constituting the appended claims.

What is claimed is:

1. In an apparatus of the kind described, a

bed, a base adjustably carried thereby, a support on the base, an upper centering spindle carried by the support, a pivot spindle carried by the base and arranged in vertical alinement with the upper spindle, and means to support an annular piece of work on the pivot spindle to be balanced, said work adapted to carry a lower centering spindle to line up with the upper spindle when the work is properly balanced.

2. In an apparatus of the kind described, a bed, a base adjustably carried thereby, a support on the base, an upper centering spindle carried by the support, a pivot spindle carried by the base and arranged in vertical alinement with the upper spindle, means normally removed from the pivot spindle to support an annular part to be balanced, means to place said means with the annular part on the pivot spindle for free pivotal movement, said part adapted to carry a lower centering spindle to line up with the upper spindle when the part is properly balanced.

3. In an apparatus of the kind described, a bed, a base adjustably carried thereby, a support on the base, an upper centering spindle carried by the support, a pivot spindle carried by the base and arranged in vertical alinement with the upper spindle, means including a counter-balance said means normally removed from the pivot spindle to support an annular part to be balanced, means for causing said means and counterbalance with the annular part to be freely carried on the pivot spindle for pivoting movement, said part adapted to carry a lower centering spindle to line up with the upper spindle when the part is properly balanced.

4. In an apparatus of the kind described, a level base, a support thereon carrying an upper vertically disposed centering spindle, a vertical pivot spindle carried on the base in alinement with the upper spindle, a tubular member loosely surrounding the pivot spindle, operating means to lodge the tubular member for free pivoting movement on the pivot spindle or to hold it removed therefrom, said tubular member adapted to carry an annular part to be balanced, and said part adapted to carry a lower centering spindle which lines up with the upper spindle when the part is properly balanced.

5. In an apparatus of the kind described, a level base, a support thereon carrying an upper vertically disposed centering spindle, a vertical pivot spindle carried on the base in alinement with the upper spindle, a tubular member loosely surrounding the pivot spindle, operating means to lodge the tubular member for free pivoting movement on the pivot spindle or to hold it removed therefrom, and a counter-balance connected to the tubular member, said tubular member adapted to carry an annular part to be balanced, said part adapted removably to carry a lower centering spindle which lines up with the upper spindle when the part is properly balanced.

6. In an apparatus of the kind described, a level base, a goose-neck upright thereon, a mandrel carried by the upper end of said upright, an upper centering spindle carried in a vertical position by said mandrel, a boss on the base, a pivot spindle carried by the boss in vertical alinement with the upper centering spindle, a work holding device, and means to lodge said device for free pivoting motion on the pivot spindle or to hold it removed therefrom, the work adapted to carry a telltale spindle to line up with the upper centering spindle.

7. In an apparatus of the kind described, a level base, a support thereon, a vertical centering spindle carried by the support, a pivot spindle on the base, a holder adjacent the pivot spindle, operating means to lodge the holder on the pivot spindle for free pivoting movement or to hold it removed therefrom, means on the holder to carry a cream separator bowl, and a centering spindle adapted for detachable connection to the neck of the bowl, said spindle designed to line up with the vertical centering spindle on the support when the bowl is properly balanced.

8. In an apparatus of the kind described, a bed, a base adjustably carried on the bed for leveling, means on the base carrying a vertical pivot spindle, means on the base carrying a centering spindle above and in alinement with the pivot spindle but spaced therefrom, a work holder adapted to be carried on the pivot spindle and adapted to hold a piece of work to be balanced, and a centering spindle to be carried by the work and to cooperate with the first centering spindle to indicate the balance of the work.

In testimony whereof we affix our signatures.

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WILLIAM F. KOELPIN.