May 10, 1932. W. A. PERVIER 1,857,863

MIXING APPARATUS

Filed Jan. 3, 1931 2 Sheets-Sheet 1

Fig. 3

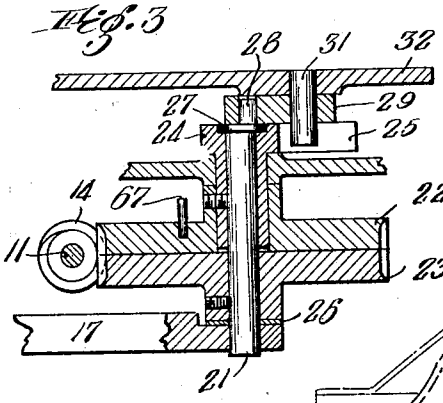
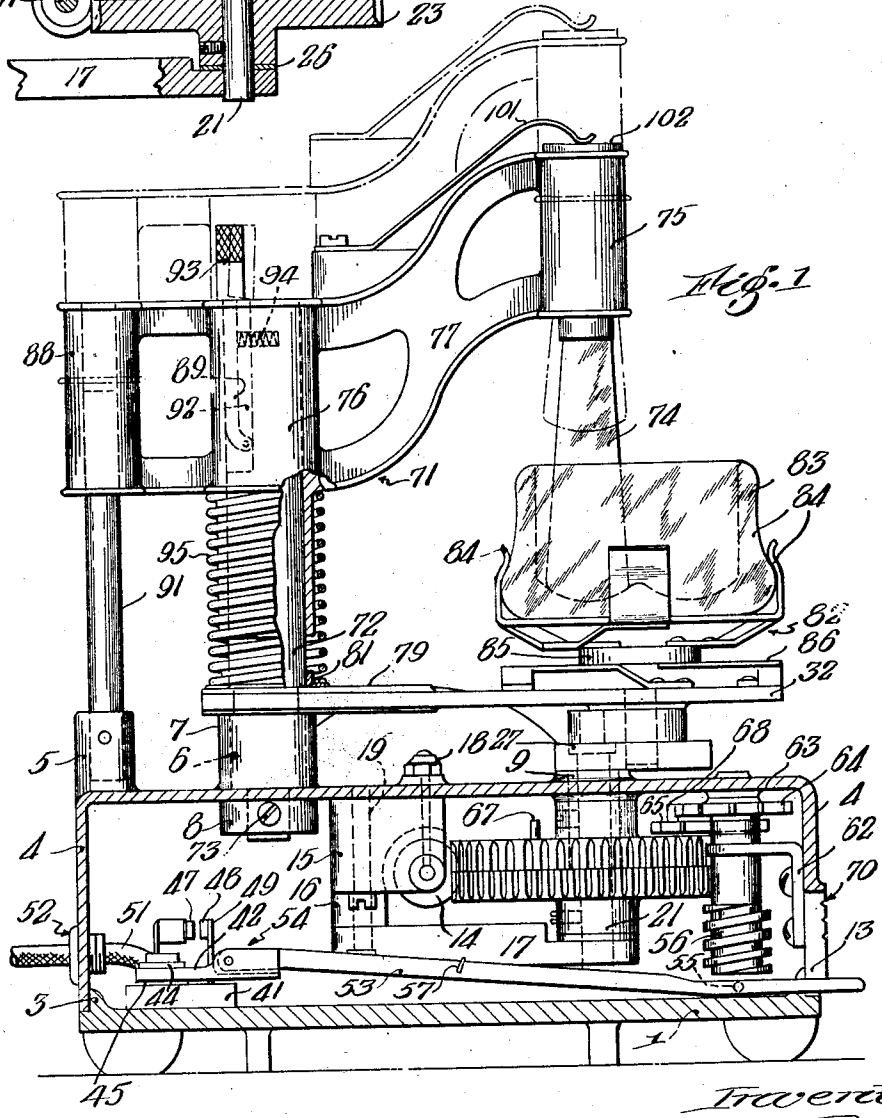


Fig. 1



Inventor
William A. Pervier
By Roberts Cushman & Woodberry
his Attorneys

May 10, 1932. W. A. PERVIER 1,857,863

MIXING APPARATUS

Filed Jan. 3, 1931 2 Sheets-Sheet 2

Fig. 2

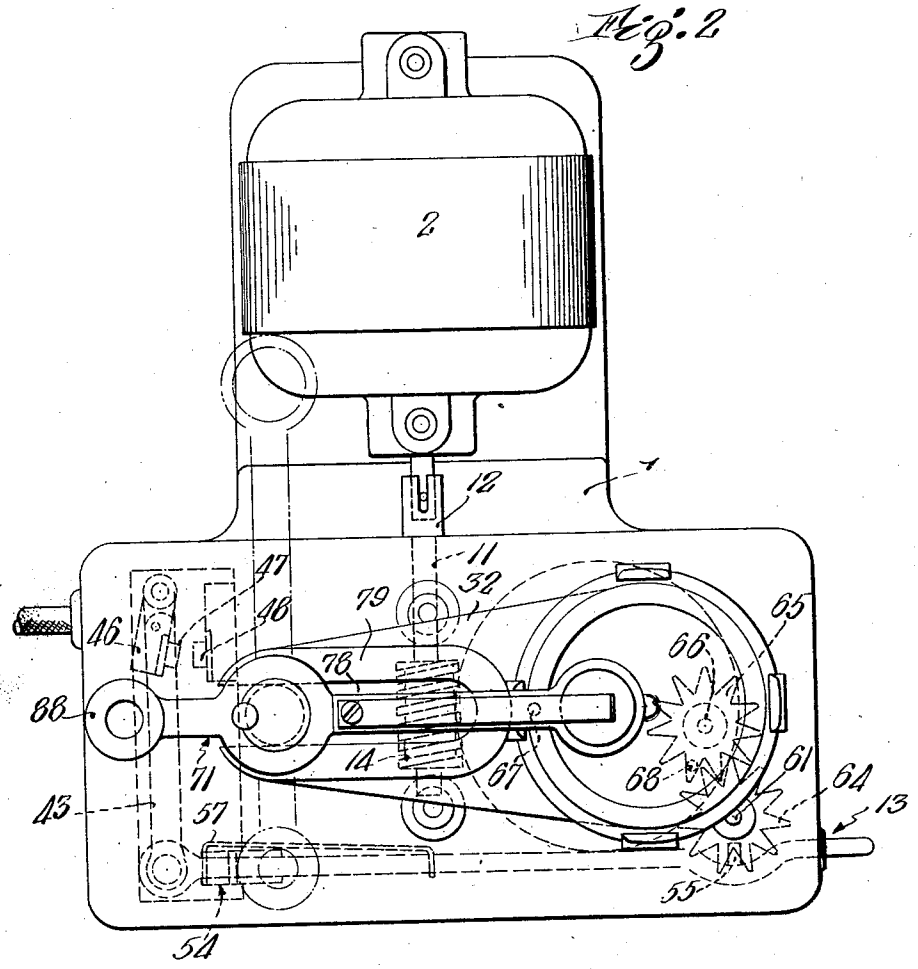
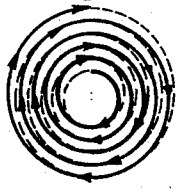


Fig. 4



Inventor
William A. Pervier
By Roberts, Cushman & Woodberry
His Attorneys

Patented May 10, 1932

1,857,863

UNITED STATES PATENT OFFICE

WILLIAM A. PERVIER, OF WATERTOWN, MASSACHUSETTS, ASSIGNOR TO CHARLES E. PARKHURST, OF SOMERVILLE, MASSACHUSETTS

MIXING APPARATUS

Application filed January 3, 1931. Serial No. 506,391.

This invention relates to apparatus for mixing or compounding materials of either a solid or liquid character, or ingredients comprising both liquids and solids, for example, medicinal preparations, dental amalgams, etc.

It is the object of this invention to provide a serviceable and efficient power-driven mixer having an agitator maintained in cooperative relation with a receptacle, and means for producing, between the two, relative motion whereby materials disposed in the receptacle will be quickly and homogeneously compounded or mixed. It is a further object of this invention to provide an apparatus of this character with means for automatically controlling the duration of the operation, whereby the same may be carried on for a predetermined period of time or number of cycles.

Further objects and advantages will be apparent as attributes of the construction and operation of the apparatus herein described and shown in the accompanying drawings which exemplify a recommended embodiment of the invention.

In the drawings:

Fig. 1 is a side elevation, partly in section, of a power-driven mixer;

Fig. 2 is a plan view of the same;

Fig. 3 is a sectional elevation of the transmission mechanism; and

Fig. 4 shows the paracentric paths or convolutions defined by the relative movement between the mortar and pestle.

The particular embodiment of the invention chosen for the purpose of illustration comprises a base 1 provided with a rear portion upon which a motor 2 is mounted and a front portion having a marginal flange 3 which the housing or casing 4 engages. The housing comprises a box-like casting within which is disposed a transmission gearing and a mechanism associated with a switch device and actuated by the transmission gearing for automatically controlling the operation of the apparatus.

The top of the housing is provided with a socket 5, an opening 6 having vertically projecting and depending flanges 7 and 8, and a second flanged opening 9. The rear wall of the housing is provided with an opening through which the driving shaft 11 projects, said shaft being connected to the shaft of the motor by coupling 12. The end wall is provided with a suitable opening 13 for the reception of an actuating lever associated with the switch. The transmission gearing comprises a differential worm and gear mechanism, the worm 14 being mounted on the shaft 11 which is supported by the hanger 15. The hanger comprises a block of metal having a recess intermediate its ends (shown by the dotted line, Fig. 1) and a centrally disposed depending boss 16 to which is secured a horizontally extending arm 17. The hanger is secured to the top of the housing by bolts or machine screws 18 and 19.

The arm 17 is provided with a bearing in which one end of shaft 21 is journaled. The gears 22 and 23 are mounted on the shaft 21 and each engages the worm 14. These gears have the same diameter but a differential number of teeth whereby one has a positive rotation relative to the other. The lower gear 23 is pinned to shaft 21 and is rotatable therewith. The upper gear 22 is pinned to the collar 24 which is provided with a horizontally projecting slotted arm or yoke 25, the gear, collar and arm being rotatable about the shaft 21. The collar 24 passes through the flanged opening 9 at the top of the housing and is provided with a flanged end or hub which engages the flange circumjacent the opening 9, thus providing a bearing surface. The gears 22 and 23 are provided with hubs engaging respectively the depending flange circumjacent the opening 9 and the bearing surface of arm 17. A washer 26 may be interposed between the hub of gear 23 and the bearing surface of arm 17.

The end of shaft 21 adjacent to the top of the housing is provided with a flange 27 on which is mounted an offset or eccentrically disposed crank pin 28 which engages the link 29. The pin 31 is secured to the movable plate 32 and projects downwardly through an opening in the link 29 into the slot of yoke 25. Thus the gear 22 imparts a translating motion to the pin 31 and causes the

plate 32 to move in a circular path about shaft 21 as an axis, and the gear 23 by virtue of its differential relation to gear 22 imparts a cam-like motion to the link 29. The resultant of these two movements, thus imparted to the plate 32, causes the same to travel in a paracentric or spiral path. As shown in Fig. 4 this path is endless; alternately its spirals outwardly through five revolutions, as shown by the solid lines, and then inwardly through five revolutions, as shown by the broken lines.

The operation of the apparatus is controlled by a switching device associated with a mechanism actuated by the gear 22. The device shown in Figs. 1 and 2 comprises a bell crank pivotally secured to a block of insulating material 41 mounted on the base 1. The arm 42 of the bell crank is insulated from the arm 43 by a fiber washer 44 and is spaced from the block 41 by a washer 45. The free end of arm 43 engages a lever 46 by means of a lug carried by the latter, the lever 46 being pivotally secured to the block 41. A contact 47 mounted on the lever 46 is adapted to engage the fixed contact 48 which lies in the path of movement of contact 47, the fixed contact being secured to the block by bracket 49 or other suitable means.

Electrical conductors 51 enter the housing through opening 52 and are connected with the contacts and motor in any suitable manner (not shown). A spring or other suitable means (not shown) preferably is associated with the lever 46 normally retaining the same in the position shown in Fig. 2, thus holding the contacts apart to provide an open circuit which may be closed by means hereinafter more fully described.

The arm 42 is provided with an extension or lever 53 pivotally secured to its free end as indicated by numeral 54. The lever 53 carries a stud 55 adapted to engage or mesh with the worm gear 56. The switch device is so disposed within the housing that in order to cause the stud 55 to engage the worm gear 56 it will necessitate an outward movement of the arm 53, causing the bell crank to actuate the lever 46 to close the circuit. The relationship thus established is maintained so long as the stud 55 is held in engagement with the worm gear 56. The spring 57 is secured to the arm 42 and one end or portion thereof engages the lever 53 and urges the same downwardly and inwardly so that when the stud 55 becomes disengaged from the worm gear 56 the lever will drop to the base, thus permitting the circuit (which is closed when the stud 55 is in engagement with the worm 56) to be opened, thus shutting off the motor.

The worm gear 56 is mounted on the end of shaft 61 which is journaled in the bracket 62, the other end of the shaft being journaled in bearing 63 which is secured to the top of the housing. The worm gear 56 is actuated by the star wheels 64 and 65, the former being mounted on shaft 61 and the latter on a stud shaft 66 which is secured to the top of the housing and offset in relation to shafts 21 and 61, as shown in Fig. 2. The wheel 65 lies in a horizontal plane intermediate that of the wheel 64 and the gear 22 (as shown in Fig. 1) and is so disposed that its addendum circle intersects a portion of the circular path defined by the revolution of the vertically projecting pin 67 carried by gear 22 and underlies a portion of the addendum circle of wheel 64. Thus the pin 67 engages one of the teeth on the wheel 65 during each revolution of the gear 22 and causes the same to be intermittently rotated, and the pin 68 mounted on one of the teeth of wheel 65 during each revolution likewise engages one of the teeth of wheel 64 and thus causes the worm gear 56 to be intermittently rotated. Consequently it requires a definite number of revolutions of the gear 22 to cause a single revolution of the worm 56 and, for a given speed of the motor, it requires a fixed time for the worm gear 56 to be intermittently rotated.

By using a worm gear having a pitch corresponding to a unit of time or multiple thereof required for a given operation, it is possible (for a given ratio of teeth in the star wheels) to set the lever 53 so that the stud 55 will engage or mesh with the worm gear at a point thereon corresponding to a desired period of time whereby the operation will be automatically terminated at the expiration of the desired period. Obviously such a mechanism could be designed to carry on the operation for a longer or shorter time by varying either the ratio of the teeth of the star wheel, the pitch of the worm gear, or both.

A scale 70 is secured to the wall of the housing adjacent to the opening 13 and is graduated in time units, e. g., minutes, corresponding to the teeth of the worm gear 56. By raising the lever 53 to a height corresponding to a given period of time, as shown by the scale, the stud 55 engages a tooth on the worm gear and (by maintaining a closed circuit as previously explained) causes the operation to be carried on for the desired period.

For holding the mortar and pestle in cooperative relation with each other, a preferred construction is shown in Figs. 1 and 2 comprising a bracket 71 slidably mounted on the cylindrical support 72. The support is mounted on the housing with its stepped end projecting into the opening 6 and firmly secured therein by the set screw 73 carried by the depending flange 8. The pestle 74 is secured in the socket-like holder 75 which is connected with the sleeve 76 by the web 77. The sleeve 76 has a free sliding fit about the upright support 72 permitting the bracket to be raised and lowered whereby the pestle

may be brought into or out of cooperative relation with the mortar.

The pestle is held in fixed operative relation with the mortar by the cupped member 88 secured to the bracket and also the locking member or latch 89. The cupped member 88 is provided with a cylindrical passage in which is received the free end of the upright spindle 91 which is mounted in the socket 5. The locking member or latch 89 comprises a lever received in a suitable slot 92 in the upright 72, the lower end of the lever being pivotally secured to the upright as shown in Fig. 1. The upper end of the lever has a knob 93 or other means providing a shoulder which is adapted to engage the top of the sleeve 76 of the bracket thereby to limit its upward movement. The spring 94, disposed in a horizontally extending recess, urges the lever 89 outwardly into locking engagement with the bracket when the latter is disposed in the position shown by the solid lines in Fig. 1. The coiled spring 95, circumposed about the sleeve 76 intermediate the web 71 and collar 81, is under compression when the mortar and pestle are in operative engagement and thus serves to limit the downward movement of the bracket. During the mixing operation the cupped member 88 prevents the bracket from rotating about the upright 72 and any vertical movement of the bracket is limited by the locking member 89 and spring 95.

One end of the movable plate 32 slidably engages the link 29 and is supported thereby, the pin 31 holding the plate in fixed relation thereto. The opposite end of the plate is provided with an elongate slot 78 through which the upright support 72 passes. The beaded marginal portions 79 adjacent to the slot slidably engage the top of flange 7 which supports this end of the plate. Vertical movement of the plate is prevented by the collar 81 which has a pressed fit about the upright 72.

A holder 82 for the mortar 83 is mounted on the plate 32 and preferably comprises a plurality of similar symmetrically disposed circumferentially spaced resilient fingers 84 projecting from the plate 85 which is secured to the plate 32 by the horizontally disposed fingers 86. This construction not only provides a simple and effective means for firmly holding the mortar which will permit the same to be easily removed and replaced, but also permits a universal tipping movement of the mortar and a yielding engagement between the mortar and pestle. The resilient arm 101 secured at one end to the web 77 engages the cap 102 of the holder 75. As the pestle preferably has a slight vertical movement in the holder, the arm 101 yieldingly resists any upward movement (the downward movement being limited by the engagement with the mortar) and thus provides an additional means for maintaining the mortar and pestle in yielding engagement. This feature is particularly advantageous when the apparatus is used for grinding or pulverizing in that it prevents large particles from jamming or wedging between the engaging surfaces and thus insures a smooth and even operation.

In using this apparatus the bracket is first raised to the position shown by the broken lines in Fig. 1 and the pestle is swung out of position, as shown by the dot and dash lines of Fig. 2. The materials to be mixed, ground, or otherwise treated are then placed in the mortar. The pestle is then brought into operative engagement with the mortar by swinging the bracket so that the opening in the cupped member aligns with the spindle and then lowering the bracket until the spindle passes into the opening of the cupped member and the latch 89 snaps into locking engagement with the sleeve of the bracket. The lever 53 is pressed outwardly and raised so that the stud 55 engages a tooth on the worm gear 56 corresponding to the desired period of time that the operation is to be carried on as shown by the scale 70. The operation is thus started and will continue for the desired period when it will be automatically terminated as hereinbefore described.

It is apparent that this apparatus could be easily modified without impairing or in any way altering its characteristic features by mounting the mortar on a stationary support and mounting the bracket on the movable plate. Obviously such a modification would merely involve a few changes in the structure of the bracket and the use of such expedients as are well known to those skilled in the art. In either case the path traced by the pestle on the mortar alternately spirals inwardly and outwardly as shown in Fig. 4 so that material which tends to accumulate at the center of the mortar is wiped off as the pestle spirals inwardly and when the pestle alternately spirals outwardly the side wall of the mortar is wiped off. Thus all of the material in the mortar is thoroughly mixed without unmixed accumulations at the center and periphery of the mortar such as have occurred in prior power-driven mixers.

From the foregoing it is apparent that the apparatus herein disclosed provides an efficient and serviceable means for quickly and homogeneously mixing or compounding materials of either a solid or liquid character, or ingredients comprising liquids and solids. Such an apparatus may also be used for grinding and pulverizing as well as other uses for which a mortar and pestle is ordinarily employed. This type of apparatus (built in a small size) is particularly adapted for mixing dental amalgams in that it quickly and thoroughly kneads and mixes mercury and

the metal without heating the compound, thus producing a perfect alloy.

While I have shown and described one desirable embodiment of this invention, I wish it to be understood that various changes in shape, proportion, and arrangement of parts, as well as the substitution of equivalent elements for those herein shown and described may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. An apparatus of the character described comprising mortar and pestle members, means to retain said members in cooperative relation with each other, resilient means supporting one of said members for universal tipping movement relative to the other whereby the same are held in yielding engagement with each other, and mechanism for producing, between the mortar and pestle, a relative movement defining a paracentric path.

2. An apparatus of the character described comprising a mortar and pestle, means adapted to retain said mortar and pestle in operative relation, resilient means supporting the mortar for universal tipping movement whereby the same is held in yielding engagement with said pestle, and mechanism associated with said supporting means for imparting a movement thereto to cause the mortar to travel in a paracentric path relative to said pestle.

3. Apparatus of the character described comprising mortar and pestle members, means supporting said mortar for universal tipping movement, means for retaining said members in yielding cooperative relation with each other, and means for producing, between said mortar and pestle, a relative movement defining paracentric paths.

4. Apparatus of the character described comprising mortar and pestle members, means for retaining said members in cooperative relation, resilient means supporting said mortar for universal tipping movement whereby said members are held in yielding engagement with each other, and mechanism for producing, between said mortar and pestle, a relative movement defining paracentric paths.

5. Apparatus of the character described comprising a mortar and pestle, means for retaining said pestle in fixed cooperative relation to said mortar, resilient means supporting the mortar for universal tipping movement whereby the same is held in yielding engagement with said pestle, and means for imparting to said supporting means translating motion to cause said mortar to travel in paracentric paths relative to said pestle.

6. Apparatus of the character described comprising a mortar, a movable plate having resilient fingers engaging said mortar and supporting the same for universal tipping movement, a pestle disposed in fixed cooperative relation to said mortar, and means for imparting translating motion to said plate to cause said mortar to travel in paracentric paths relative to said pestle.

7. Apparatus of the character described comprising a mortar, a movable plate having resilient fingers supporting the mortar for universal tipping movement, a pestle disposed in fixed cooperative relation to said mortar, and means for moving said plate in paracentric paths relative to said pestle, said means comprising differential driving members associated with said plate, one of said members tending to move said plate in a circular path, and the other tending to move said plate in a rectilinear path.

8. Apparatus of the character described comprising a base, a mortar, a movable plate supporting the mortar for universal tipping movement, a bracket pivotally mounted on said base, a pestle mounted in said bracket and adapted to be swung into fixed cooperative relation to said mortar, and mechanism associated with said plate for moving said mortar in curvilinear paths relative to said pestle.

9. The combination of mortar and pestle members, means for holding the members in operative relationship yieldingly to permit one member to move in any direction laterally of the axis of the mortar in response to lateral pressure from the other member, and means for producing relative movement between the members such that the pestle traces over the mortar a path which alternately spirals inwardly throughout a plurality of turns and then outwardly throughout a plurality of turns.

Signed by me at Belmont, Massachusetts this 30 day of December, 1930.

WILLIAM A. PERVIER.