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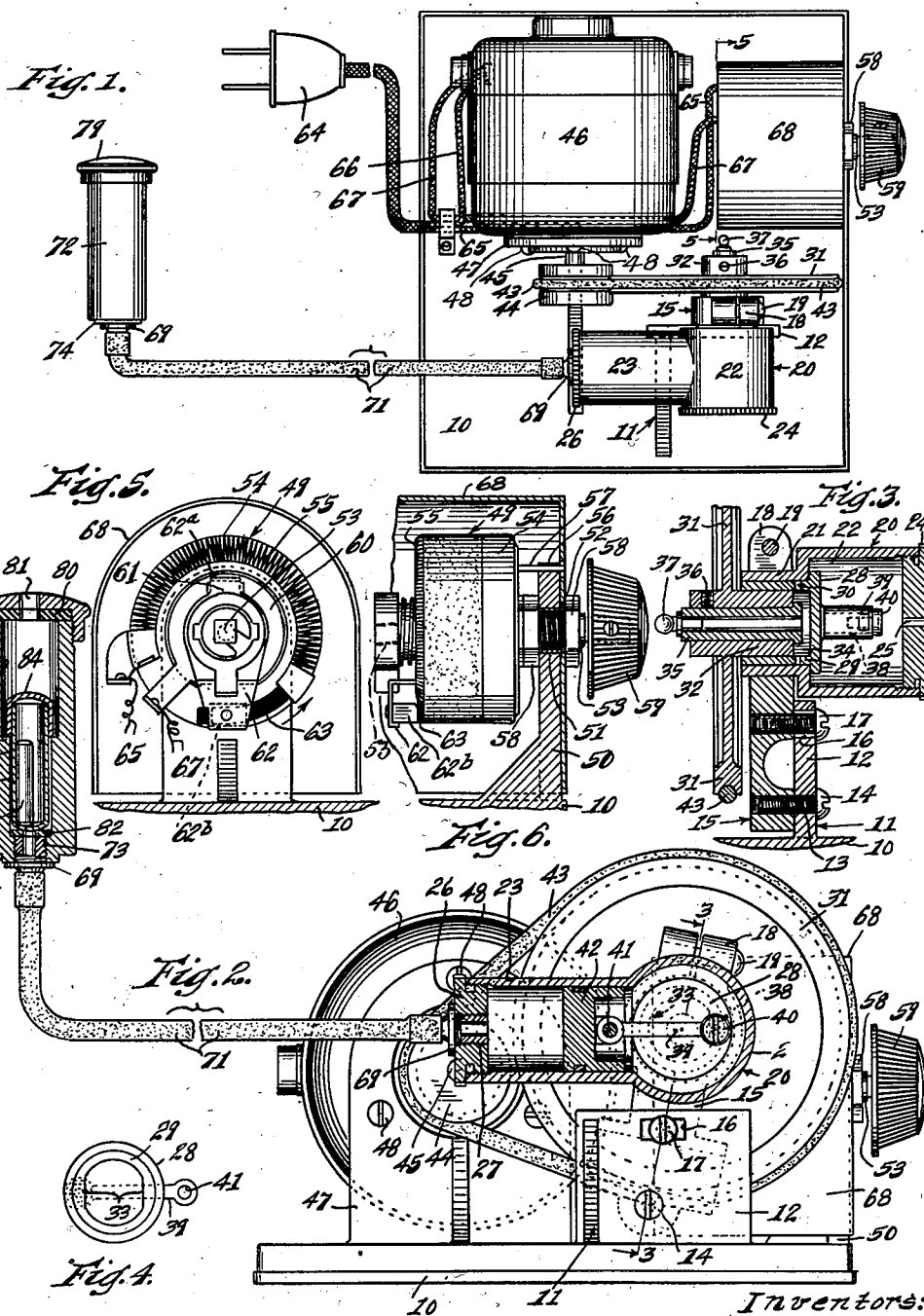
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2,306,296

AMALGAMATOR

Filed June 9, 1941

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

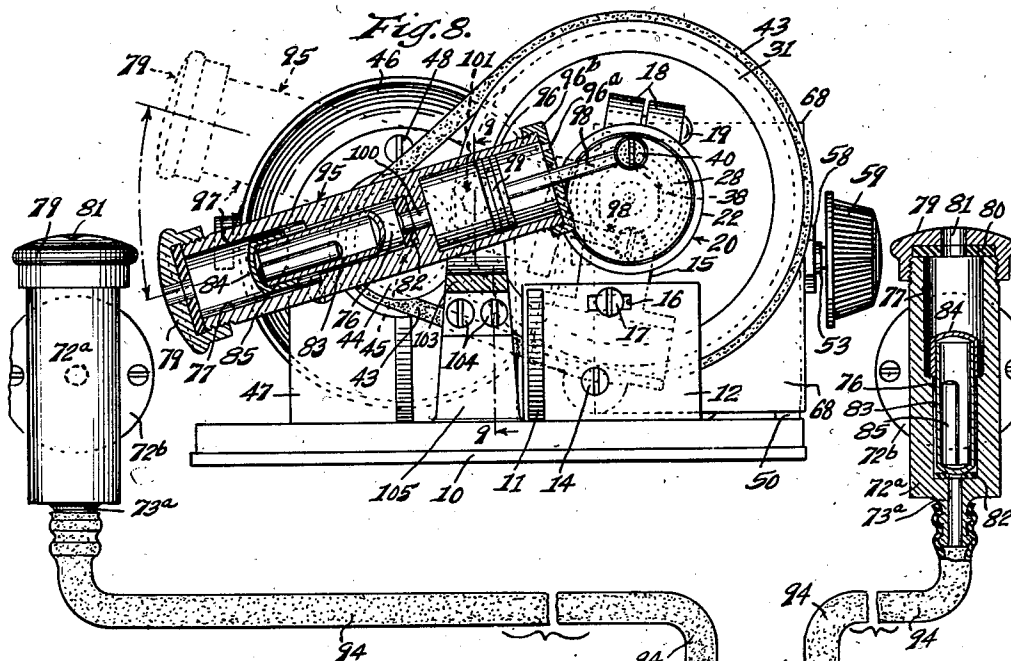


Fig. 7.

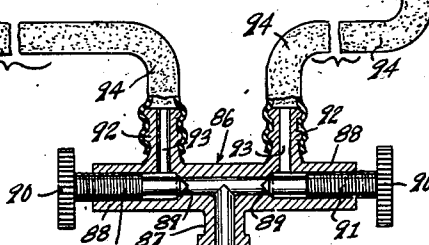
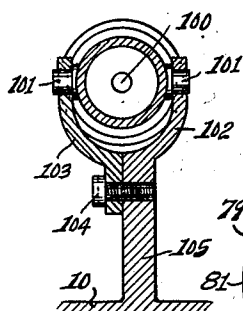


Fig. 10.



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UNITED STATES PATENT OFFICE

2,306,296

AMALGAMATOR

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Application June 9, 1941, Serial No. 397,288

3 Claims. (Cl. 259—91)

Our invention relates to amalgamators or mixers for triturating, blending and mixing different substances and more particularly dental alloys for fillings and the object thereof is to provide novel and simple means for quickly and economically as well as thoroughly mixing dental amalgams with a minimum expenditure of manual effort or energy.

It is one of the Government requirements or specifications that fillings, especially those made of amalgam consisting of alloys including quick silver or mercury, usually expand at least to a slight degree so that the same will maintain its position in a cavity when used in a filling and will not contract, shrivel or shrink to become loose or fall out of position.

It is therefore an important object of the present invention to provide means in the form of a fluid or pneumatic power device or pump for imparting a reciprocating or combined reciprocating and swinging or oscillating motion to a mortar chamber and pestle therein for quickly grinding, blending and mixing the ingredients of the amalgam or the like so that the same may be thoroughly brayed or comminuted in the form of a moist mixture or filling instead of being dry, and effective for filling the requirements above referred to and also regulating the force of the strokes and speed of actuation according to the nature and weight of the alloy and the degree of mixing required.

Another object of the invention is to provide an amalgamator for thoroughly blending and mixing the different elements or ingredients of the amalgam or other substances using fluid power and particularly pneumatic power in the form of a pump for imparting motion to the mortar chamber, and mortar and pestle therein so that the device may be positioned locally or immediately at the point of use or at one or more points distant from the machine itself and particularly closely adjacent the patient in a dentist's chair where the work is carried on, thus permitting the device to be either used at such latter point or the machine installed in a laboratory and the fluid or pneumatic power device mounted or installed for use by one or more laboratory experts or dentists at the immediate point of use.

Another object of the invention is to provide a small motor operated power device capable of minute and accurate control from a single control member or switch particularly a rheostat controlling the operation of an electric motor which operates the pump and in turn causes alternate compression and suction within the mortar

chamber for actuating a plunger in the form of a mortar of the capsule type containing a pestle or pellet for mixing the ingredients therein and for localizing or distributing the power for such use at a plurality or various convenient points distant from the machine for use or where treatments are being given.

Other objects and advantages will appear hereinafter and be brought out more fully in the following specification, reference being had to the accompanying drawings, wherein:

Fig. 1 is a plan view of an amalgamator or mixer constructed in accordance with the invention;

Fig. 2 is a side elevation thereof partly in section;

Fig. 3 is a fragmentary vertical section taken on the line 3—3 of Fig. 2;

Fig. 4 is an inside elevation of the eccentric or crank disk;

Fig. 5 is an inside face view of the rheostat;

Fig. 6 is a side view of the rheostat with the cover in section;

Fig. 7 is a sectional elevation of the amalgamator with additions and modifications;

Fig. 8 is a sectional elevation of another modification of the amalgamator;

Fig. 9 is a detailed vertical sectional view showing the mounting of the cylinder, taken on the line 9—9 of Fig. 8; and

Fig. 10 is an axial section of an interchangeable coupling nipple.

Referring to the drawings, the amalgamator or mixer in the form shown in Figs. 1 to 6, inclusive, includes a base 10 upon which is mounted a vertical bracket 11 illustrated as of right angular form and braced to the base both at the front and back or inner and outer sides. The bracket includes a vertical plate 12 having an aperture 13 for receiving a fastening shown in the form of a screw 14 for pivotally anchoring a vertical bearing arm 15 which is capable of being swung on its pivot 14 in a vertical plane parallel to the plane of the bracket plate 12 for purposes to be subsequently pointed out. The bracket plate 12 is also provided with an elongated or arcuate slot 16 above the pivot 14 to take a fastening shown in the form of a screw 17 which like the screw 14 engages a threaded hole in the bearing 15 thus permitting angular adjustment of the bearing against the bracket on the pivot 14 and the retention thereof in any desired position in which it is adjusted. The bearing 15 has a split bearing collar or clamp 18 with apertured ears for receiving a screw or other connection 19 to rigidly

mount a motor housing 20 which has a tubular extension 21 rigidly held in the collar. The tubular extension is reduced relative to the crank case 22 of the pump or motor housing and is formed with a radial cylinder 23 the free end of which is open. A head 24 in the form of a knurled plug is threaded in the crank case 22, the latter being adapted to contain lubrication or grease for working parts contained therein. This head is provided with an air escape hole 25 where pneumatic power is used and as illustrated this hole or duct is positioned at the axial center or some other point above the bottom of the crank case so as not to permit escape of the grease or other lubricant contained therein. A cylinder head 26 is provided for the cylinder 23 and is threaded therein the same as the plug or head 24 and is further provided with a threaded bore or hole 27 preferably in the center. A suitable crank is provided in the crank case and is shown in the form of a disk 28 flanged against the inner end wall of the crank case where the latter is reduced to form the extension 21 and has a reduced bearing sleeve 29 which is designed to rotate in the bearing sleeve formed by the tubular extension 21. The bearing sleeve 29 has oil or grease ducts 30 near the crank disk 28 extending radially there-through from its inner to its outer surfaces.

A pulley 31 which also forms a fly-wheel has a hub 32 fixed or keyed in the bearing sleeve 29, co-acting flattened portions 33 being shown for this purpose and the hub 32 terminating in spaced relation to the disk 28 to provide an oil or grease space therebetween communicating with the ducts 30. A tubular stud or stub shaft 35 is similarly fixed within the bearing sleeve 32 or may be keyed or fixed thereto by means of a set screw 36 disposed through a threaded bore in the sleeve 32 and engaging with the periphery of the shaft while a plug 37 closes the adjacent end of the tubular shaft and permits the supply of lubricant thereto. The crank motion is produced by an eccentric, crank or crank pin 38 on the disk 28 and is in the form of a gudgeon, tubular extension or boss on the disk for pivotal connection with a connecting rod or link 39 shown held by a stud screw 40. The opposite end of the connecting rod is pivoted at 41 to a piston 42 operating in the cylinder 23 and adapted to be reciprocated back and forth to produce alternate suction and compression. Suitable gearing or drive means may be employed for the shaft and crank and as illustrated, an endless drive member or belt 43 is disposed on the pulley 31 and is also trained around a pulley 44 on a shaft 45 of a motor 46 illustrated as a conventional electric motor either A. C., D. C. or both mounted upon the base 10. Adjustment of the bearing 15 on the pivot 14 by the slot 16 and screw 17 is used to tighten the belt 43. A vertical bracket 47 is shown supporting the motor 46 at which one side of the motor housing or casing is secured by means of screws or other fastenings 48. Means is provided to control the operation and speed of the motor and thus also the speed of operation of the pump and such means is shown in the form of a rheostat 49 also mounted on the base 10 adjacent the parts previously described in a compact machine or unit which is not only of light weight and simple but economical to produce and operate. The motor and pump are capable of minute control by connection with the rheostat which includes a vertical bracket 50 suitably braced to the base and having a horizontal threaded bore 51 adapted to take a threaded

sleeve 52 which supports a manually rotatable shaft 53, both ends of which are squared or of other polygonal shape as shown. A porcelain, refractory or other dielectric disk 54 is fixed to the stationary sleeve 52 so that the shaft which extends therethrough is designed to be turned and the disk carries a resistance coil 55 which may be covered with insulation except at its inner edge where the coils are exposed for the major portion of a circle. The bracket 50 has a notch 56 in the top to receive an arm or lug 57 carried by the disk 54 constituting means to restrain the latter and parts carried thereby against rotation in connection with clamping nuts 58 on the sleeve 52 which receives the shaft 53, against the opposite faces of the bracket 50. A knob 59 of knurled form is provided on the outer end of the shaft 53 and is fixed thereto by a set screw or other means for turning the shaft and a movable contact against the coils of the resistance coil 55. The stationary disk 54 also carries a circular contact 60 of current conducting material engaged by a movable contact 61 fixed to the inner end of the shaft 53 and forming part of a spring held commutator or movable contact 62 insulated from the inner end of the shaft, to engage the stationary contact 60 at all times by means of a brush 62a. In the hiatus provided between the ends of the resistance coil 55 and especially at the remote end thereof, an insulated covering 63 is provided for engagement by a movable brush 62b which also engages the resistance coil 55. In order to supply current to the motor through the rheostat or adjustable resistance the device may be tapped through into the house wiring by connection with the usual form of wall socket by means of a plug 64 from which a flexible cable extends having conductors 65 and 66 leading to one end of the resistance coil 55 and to the motor as shown in Figs. 1 and 5 of the drawings. A conductor 67 leads from the motor to the stationary contact 60 and thus the circuit is completed to the motor by electrical connection of the movable contact 61 engaging the contact 60 at the brush 62a and moving the brush 62b into engagement with the resistance coil 55 through which current may flow to the motor to effectively regulate the speed thereof to a nicety according to the position of the movable brush 62b relative to the resistance coil and thereby minutely regulate the speed at which the pump is driven. The rheostat may be covered by a housing 68 which has an outer wall fitting over the sleeve 52 and is held in position by the adjacent clamping nut 58 while the inner side of the housing may be left open.

As the pump is operated by the rotation imparted to the shaft 35 from the motor shaft and rotor through the pulleys and belt constituting one form of gear drive connection, rotation is also imparted to the crank disk 28 to reciprocate the piston 42 within the cylinder 23 thus producing alternate compression and suction in front of the piston within the chamber at the free end of the cylinder. To make use of this alternate compression and suction or exhaust for operating the mixing device proper, a nipple coupling 69 may be provided to thread in the hole 27 and is shown flanged against the head 26 of the cylinder with an interposed packing if desired. However, in lieu of the coupling 69, a simple threaded nipple 70 as shown in Figs. 7 and 10, may be employed for local mounting of the mortar or triturating chamber or an adaptor 75 86 for a plurality of mortars as will be subse-

quently described and as more particularly shown in Fig. 7 of the drawings. Where the nipple coupling 69 is used the outer reduced portion of the coupling is designed to take a rubber tube or hose 71 of any desired length and for use at any remote or distant point of conveyance of the power means. As shown, the mortar is in the form of a cylinder 72 which may be made relatively small so as to be held in the hand and vibrated or oscillated, or allowed to shift under the alternate compression and suction pulsations or mounted at any convenient point for such movement or fixed and this cylinder has a threaded bore 73 at one end to take a coupling similar to the couplings 69 or 70 and for attachment of the other end of the rubber tube or hose 71 so that the alternate pressure and suction may be conveyed to the interior of the cylinder 72. If desired the end of the cylinder 72 may have a shoulder 74 to engage the flange of the nipple or coupling 69 or head 26 through the medium of a nipple or coupling 70 with an interposed packing 75 as shown in Fig. 7. The cylindrical chamber 72 has a reduced bore portion 75 and a large bore portion 77 remote from the connection of the hose and at the free open end of the cylinder producing a forwardly facing shoulder 78 therebetween the purpose of which will be later described. A closure preferably in the form of a cap 79 is provided for the free end of the cylinder and may have an interposed cushion ring 80 and has an axial escape hole 81 for compressed fluid or air. In addition to the cushion ring or gasket 80, a cushion ring 82 may be provided at the small end against the inner end of the nipples 69 or 70 and the chamber is designed to take a capsule type of mortar 83 which is shown substantially conforming to the shape and size of the chamber, particularly in cross-section, but shorter than the chamber, said chamber having an enlarged cap 84 frictionally or otherwise held on the open end thereof so that the body of the capsule operates in the small bore portion 76 and the cap operates in the large bore portion 77 while the end of the cap is outward of the shoulder 78 and may be so proportioned as to engage the same or to be spaced therefrom on the suction stroke when the small portion of the capsule is at the inner end of the cylinder. Normally however the reciprocation of the capsule mortar is cushioned by the rings 80 and 82 upon the compression and suction strokes which cause the reciprocation of the mortar within the cylinder. In addition, a pestle of any desired form may be employed within the capsule mortar chamber and is shown in the form of a cylindrical pellet 85 preferably with convex ends substantially conforming to the concaved ends of the capsule at the inner faces of the closed end of the body and cap thereof as seen especially in Fig. 2 of the drawings.

In the operation of the device as described, the rheostat constitutes not only a control means for the current passing to the motor to regulate the speed thereof and the speed of operation of the pump but also is a switch for controlling the operation of the entire device and the circuit is closed to the motor which through the inter-gear connection of its shaft with the crank shaft will rotate the latter and reciprocate the piston 42. The alternate compression and suction or exhaust created in the cylinder 23 will be conveyed to the chamber of the cylinder 72 whether directly connected to the cylinder head 26 or connected thereto through the hose 71 or

otherwise as later described. This will reciprocate the mortar formed by the capsule 83 within the chamber of the cylinder 72 which may also be vibrated or oscillated and likewise the pestle 85 within the mortar produced by said capsule to quickly amalgamate or triturate the materials forming the alloy or dental amalgam contained within the capsule. The cylinder may also be oscillated by hand or allowed to shift under the suction and compression pulsations to increase the mixing efficiency. The speed of operation thereof may be controlled through the rheostat 49 by controlling the speed of the motor 46 and thus of the pump actuated thereby. On the compression stroke, the air within the chamber of the cylinder 72 in front of the capsule may pass out through the escape duct or opening 81 but on the suction stroke air will be drawn in through said opening by reason of the connection with the interior of the cylinder 23 and the exhaust may take place through the air escape hole 25 in the head of the crank case. However, sufficient pressure and suction is usually provided without extremely accurate fit between the parts comprising the motor proper forming the pump and also in the cylinder 72 through loss of power and speed is prevented by providing air tight connections. The suction stroke or operation may also be controlled, impeded or checked by placing a finger over the hole 81 and the device may be so regulated that if amalgamation is not complete at any time upon inspection of the material within the capsule 83 secured by removing the cap 79 and expelling the same by gravity or under the pressure of air from the pump and then removing the cap 84, such additional mixing may be effected as is necessary and this of course may be readily determined by a laboratory expert, dentist or other person trained in this field.

In Fig. 7 of the drawings, in addition to the direct connection of the cylinder 72 with the end of the pump cylinder 23 or through the hose 71 as previously described, an additional or plurality of cylinders 23 may be provided and as shown, one is extended upwardly from the crank case 20 and crank provided on the shaft 35. In this construction, adjustment of the bearing 15 angularly on its pivot 14 may be employed for tightening the belt 43 and to dispose the cylinders at the proper angle so that the best triturating action may be obtained as well as to insure clearance between the connecting rods 39 and the inner ends of the cylinders. In either instance the action is the same, in that alternating compression and suction or exhaust tending to create a vacuum in the cylinder in front of the piston, will effectively reciprocate the capsule mortar within its chamber. When a plurality of radial cylinders 23 are provided, additional connecting rods are provided between the pistons and the crank 33 with a sleeve for each connecting rod where it connects to the crank, eccentric or crank pin and held by the stud screw 40 or otherwise so that the parts may operate independently insofar as their oscillation on the crank is concerned. To adapt either device for use at a plurality of remote or distant points instead of immediately at the machine or at a local point such as where the cylinder 72 is mounted directly at the end of either cylinder 23 of the pump or motor 20, an adapter in the form of a distributor or T-shaped coupling 86 may be employed depending upon the number of outlets or distributing points and amalgam mixers to be provided such as from the laboratory to any one of a number of dental

offices. As shown, this coupling 86 is provided with a flanged threaded nipple 87 which engages the threaded bore 27 in the cylinder head 26 the same as nipples 69 or 70 so that they are interchangeable and is provided with two or more branches 88 with suitable valve means at any point in the hose or at cylinders 72 or 72a for controlling the passages therethrough and thus the movement of compressed air and the creation of suction therein by the pump. As illustrated two seats 89 are provided with which knurled headed needle valves 90 cooperate, the same having enlarged coacting threaded bores and stems 91 as well as tapered ends cooperating with the seats 89 and controlling outlet branches 92 in the form of coupling nipples having passages 93 which lead to hose 94. These hose are connected to the cylinders 72a which instead of being held in the hand like the cylinder 72 and vibrated or oscillated, may be rigidly, pivotally or universally supported for vibration or oscillation at any suitable point as by means of a wall bracket or plate 72b attached to or forming part of each cylinder 72a and provided with extension nipples 73a which may be integral therewith or coupled thereto as described in connection with the coupling nipples 69 or 70 previously referred to. Otherwise the construction of the cylinders 72a is the same as described in connection with the cylinder 72 including the parts of the capsule and mortar and operation is the same whether the device is arranged vertically, horizontally or adapted to be vibrated or oscillated or otherwise. Thus, the pump may be arranged in the laboratory and the hose extended to different distant points remote therefrom such as in the various dental offices where the cylinders 72a may be rigidly or pivotally mounted by means of the brackets 72b upon a wall or cabinet in convenient position for use adjacent the dentist's chair where the amalgam may be quickly mixed and promptly used before drying and to insure that the same is in proper condition as will be determined upon the inspection without carrying the same from a point distant and delaying use so that it will have a chance to dry out.

In the form of the invention shown in Figs. 8 and 9 of the drawings, the construction is the same except that the cylinders 72 and 72a are formed integral with or attached to a cylinder 23 and mounted to oscillate therewith instead of being vibrated or oscillated by hand or by the pulsations as are cylinders 72 in Figs. 1 and 2, or 72a in Fig. 7, or to be vibrated or oscillated on their universal or pivotal mountings as also described in connection with the cylinders 72a in Fig. 7, or being held stationary as is cylinder 72 in Fig. 7. The crank case 20 may be cut off or eliminated entirely or its opening into the cylinder enlarged to permit oscillation of the connecting rod so that the cylinder of the pump and the mixer may be oscillated therewith. As shown, the chamber for the capsule motor or cylinder 95 constituting the mixing chamber is formed integral with the pump cylinder 96 and may be in a single casting or rigidly attached thereto by a nipple such as nipple 70 as it is thought will be readily understood by a person acquainted with this art. The mortar cylinder or mixing chamber 83 in the cylinder chamber 97 forming part of the casing 95 which includes the pump cylinder extends in the same angle or in alinement with the latter. A connecting rod 98 forming a plunger is rigid with the piston 99 in the cylinder 96 and pivotally connected to the

crank 38 and instead of having an air escape hole 25 in the head of the crank case, a similar opening 96a may be provided in a cap type of head 96b provided at the inner end of the cylinder 96 to relieve compression and suction or tendency to produce a vacuum at the inner end of the cylinder or compression chamber thereof. A passage 100 is provided between the compression chamber or pump cylinder 96 and the cylinder chamber 97 through an interposed partition and this passage may be axially arranged as shown and extends through the cushion ring 82 the same as previously described. Trunnions 101 are provided to pivotally support the motor casting at any convenient point intermediately or offset from the transverse center thereof and are free to pivot in the arms of a forked bearing including an arm 102 and an arm 103 the latter of which may be detachably connected as at 104 to a bracket 105 supporting the bearings so that the desired oscillation of the cylinders may be obtained upon oscillation of the connecting rod 98 with the crank. The bracket 105 may be supported upon the base 10 as a part of the entire unit or the structure may be mounted at any remote point from the source of energy or power for driving the crank shaft which actuates the pump. In this construction the operation is the same as previously described except that in addition to the reciprocating motion imparted to the mixing chamber or mortar capsule 83, the latter is oscillated or canted upwardly and downwardly or in any other suitable direction with the cylinders 95 and 96 at each motion of the driving crank or reciprocation of the piston, thus imparting a universal, sliding, diagonal throw, canting, tumbling or oscillating motion to the mortar 83 and also to the pellet 85 therein with an oscillating action against the concaved ends of the mortar chamber so as to quickly and more efficiently grind and mix the ingredients of the alloy from which the amalgam filling or other similar product is produced. Also, the adjustment of the bearing arm 15 on the pivot 14 at the slot 16 by the screw clamp 17 is not only used to tighten the belt 43 and the positional angle of the pump and mortar chamber, but regulates the stroke or relative position of the piston 99 in the cylinder 96 as independently mounted in the bearing bracket 105 and also the degree of compression and suction produced in the cylinder and mixing or mortar chamber. Thus, practically all manual effort is avoided and a power device provided which will insure the production of a product not only in a much shorter time than produced by many other machines or by hand, but which will stand up under the requirements incident to such mixtures. The device is capable of control at all times from the slowest to the highest speed possible by merely turning the switch and controlling said speed by the rheostat or other device for regulating the speed of the motor in accordance with the form of the invention as shown and described. It is also convenient to provide for the expulsion of the mortar capsule from the mixing chambers of the cylinders 72 or 72a under compression of the fluid therein by merely removing the cap 79 and while the device is particularly described as a pneumatic device employing an air pump, it is to be understood that it may be of other fluid operation, hydraulic or the like though the pneumatic type is particularly preferred as it obviates many of the difficulties which might be encountered in

the use of a liquid and obviates air and fluid tight connections at many points.

It is also to be understood that in addition to pivotally mounting the pump and capsule mortar or mixing chamber receiving cylinder as shown in Figs. 8 and 9 for imparting an oscillating motion to the cylinder chamber and mortar together with the pestle therein, in the direction of their short or transverse axes or different from the direction of reciprocation thereof, any other desired transverse motion, tumbling or otherwise or even rotation, universal, sliding, diagonal, canting, whipping or other motion may be imparted thereto and this may be accomplished by hand where the chamber such as cylinder 12 or 12a is not fixedly supported, such as where it is held in hand, in which instance such additional motion or motions may be accomplished by moving the hand and the small chamber or cylinder 12 held therein, in any direction or with any desired motion or motions to more speedily and thoroughly as well as properly mix the ingredients, materials or substances of the alloys, amalgam or mixture as required to produce the desired or best results and meet all requirements or specifications. Otherwise, the operation of the amalgamator, with any suitable type of pump operated by an electric or other motor and suitably controlled as to starting and stopping intervals and speed, is the same as previously set forth.

While we have illustrated and described the preferred form of construction for carrying our invention into effect, this is capable of variation and modification without departing from the spirit of the invention. We, therefore, do not wish to be limited to the precise details of construction set forth, but desire to avail ourselves

of such variations and modifications as come within the scope of the appended claims.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A mixer of the class described including a chamber, means for alternately creating suction and compression in the chamber, said chamber having large and small portions forming a shoulder, and a mortar capsule in and substantially conforming in cross-section to the chamber containing a pestle and reciprocated in the chamber by said alternate suction and compression, said capsule having a body portion operating in the small portion and a cap on the body portion operating in the large portion toward and away from the shoulder.

2. A mixer of the class described including a chamber, means for alternately creating suction and compression in the chamber and a mortar capsule in and fitting the wall of the chamber adapted to be shifted back and forth therein, a pestle in the capsule adapted to be shifted back and forth therein during the shifting of the capsule, said chamber being also adapted to be oscillated simultaneously with the shifting of the capsule and pestle.

3. An amalgamator including a cylinder having a chamber, a pump having a passage at one end connected to the cylinder to create compression and suction therein, a closed mortar fitting in the chamber adapted to be reciprocated under the action of said suction and compression, and means for imparting a motion to the cylinder transverse to the direction of movement of the mortar.

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