United States Patent [19]

Nicholls

[11] **3,738,535**

[45] **June 12, 1973**

[54] **MIXING AND PROPORTIONING SYRINGE**

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[22] Filed: **Oct. 26, 1970**

[21] Appl. No.: **84,058**

[52] **U.S. Cl.** **222/137**

[51] **Int. Cl.** **B67d 5/52**

[58] **Field of Search** 222/135–141, 222/145, 167, 233–235, 385, 488, 137, 117; 259/29, 117; 417/492, 500; 239/399

[56] **References Cited**

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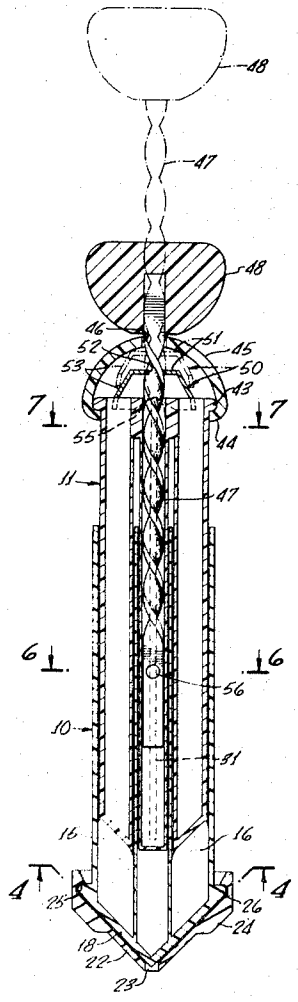
[57] **ABSTRACT**

A mixing syringe including a cylindrical barrel having a transverse web dividing it into two chambers to receive components to be mixed, the barrel having a conical end wall having outlet openings from each chamber, a conical end cap fitting over the end wall and rotatable relative to it for receiving and mixing materials discharged from the barrel and ejecting them from an aperture in the cap, a plunger having two sections, one received in each barrel chamber and movable axially to discharge the materials in the chambers, and a ratchet drive for engaging a transverse wall of the plunger and simultaneously imposing a longitudinal and rotational force on the plunger for causing the plunger to move for ejecting materials and at the same time rotating the barrel relative to the end cap.

15 Claims, 11 Drawing Figures



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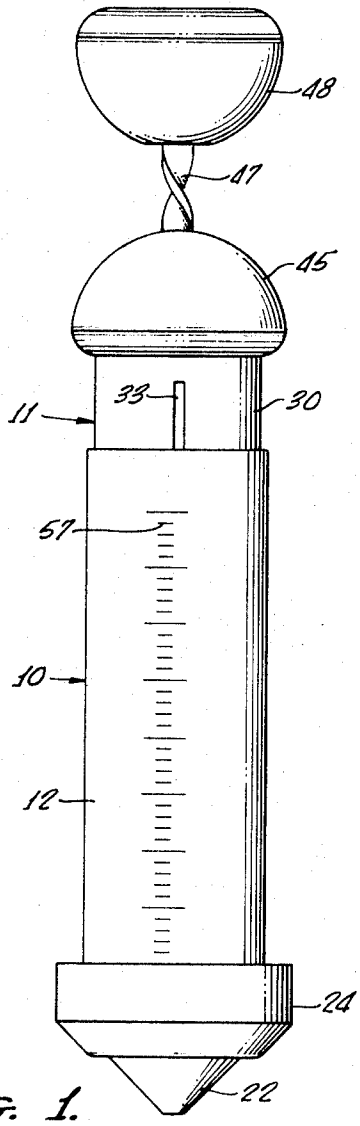

FIG. 1.

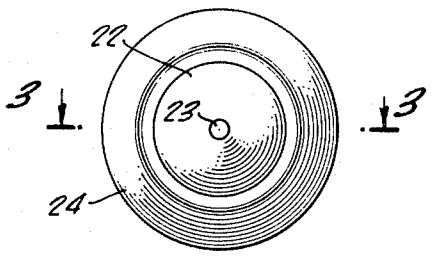

FIG. 2.

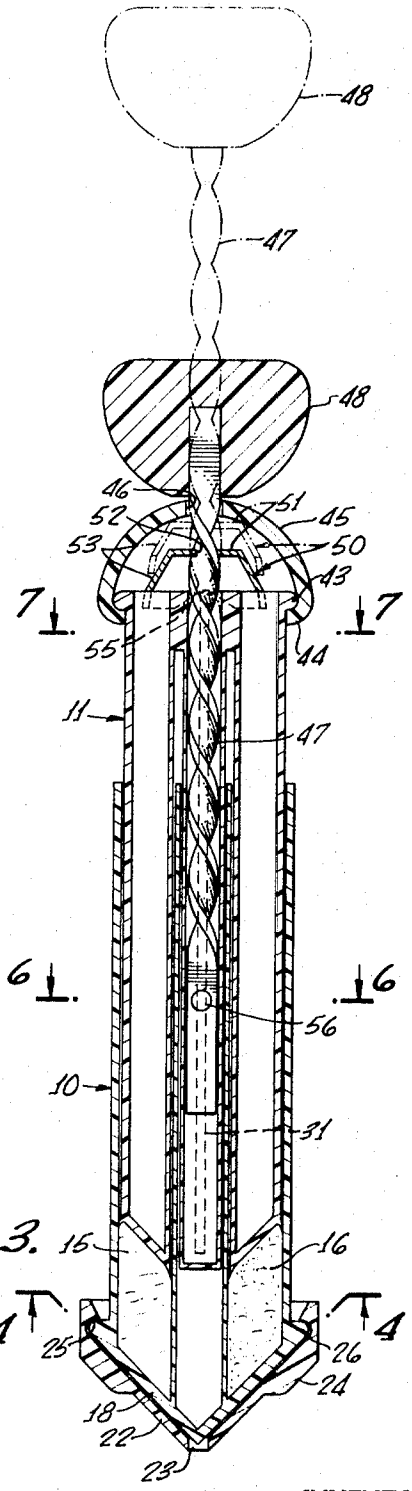

FIG. 3.

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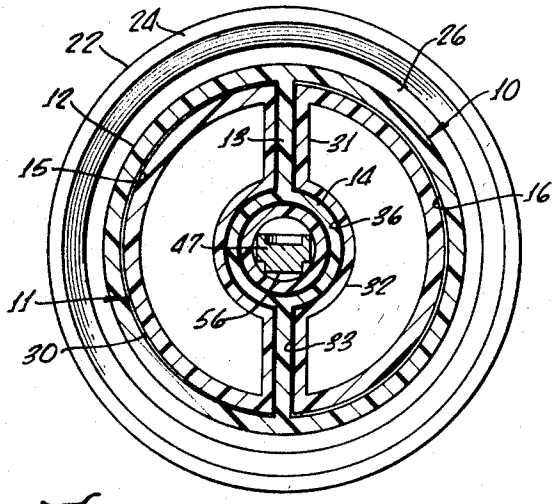

FIG. 6.

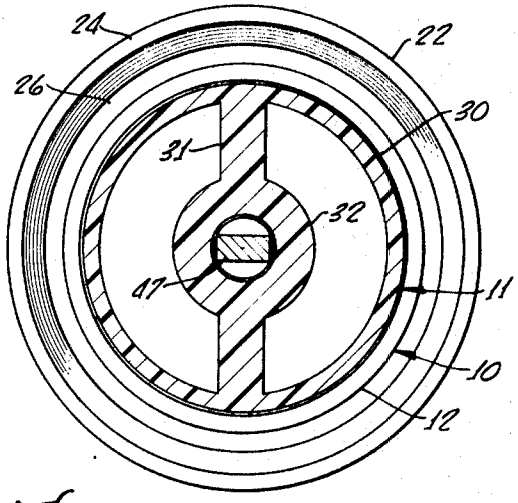

FIG. 7.

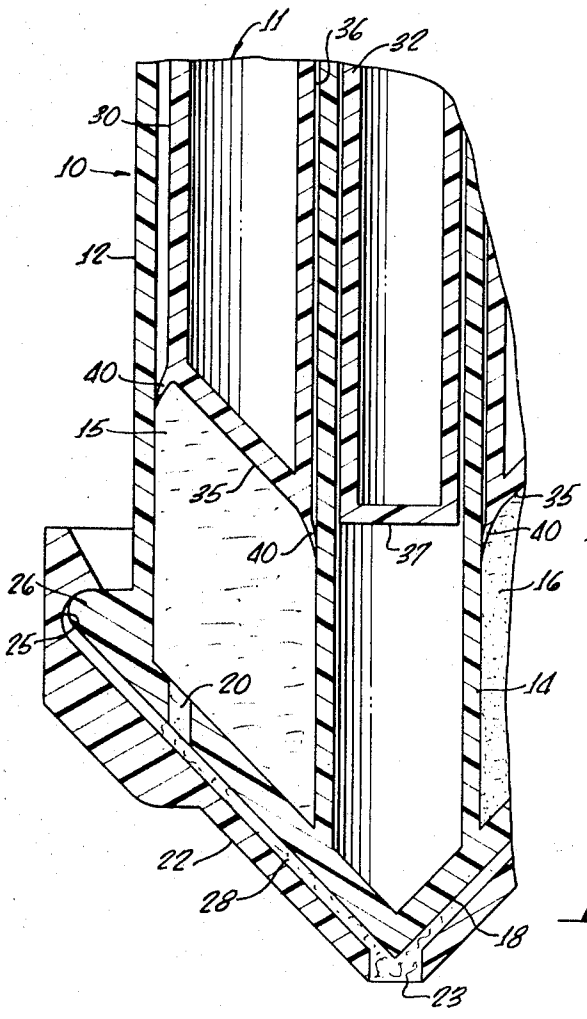

FIG. 5.

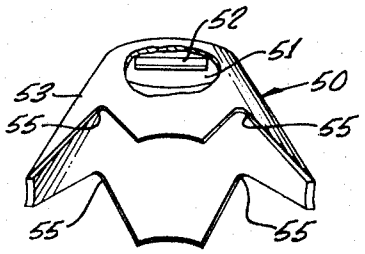

FIG. 10.

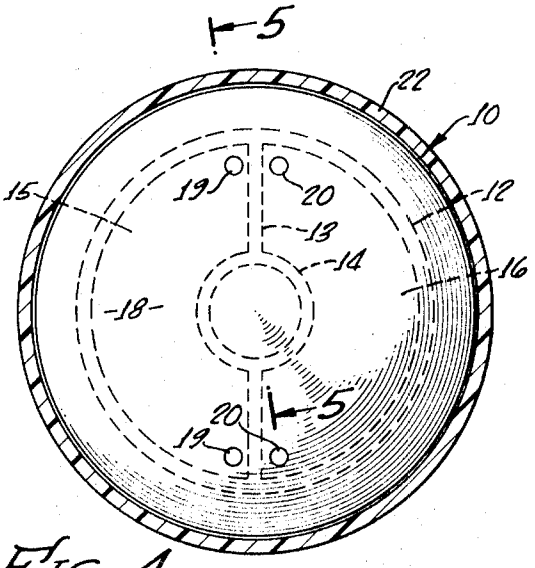

FIG. 4.

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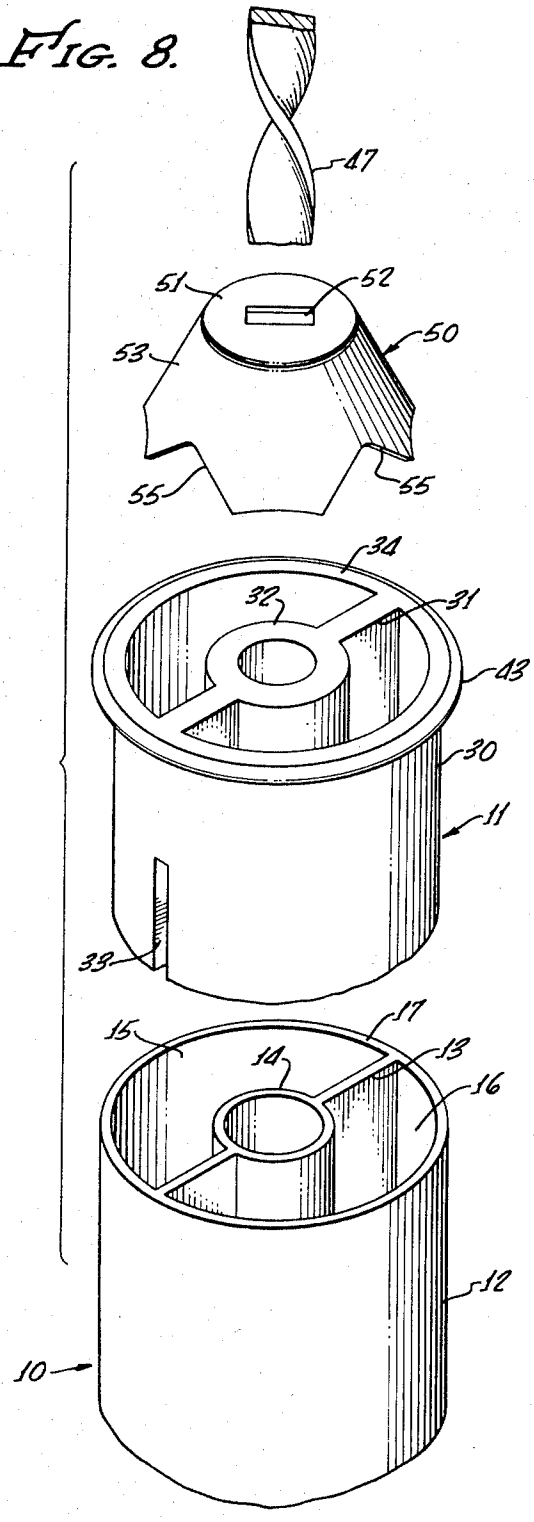
FIG. 8.



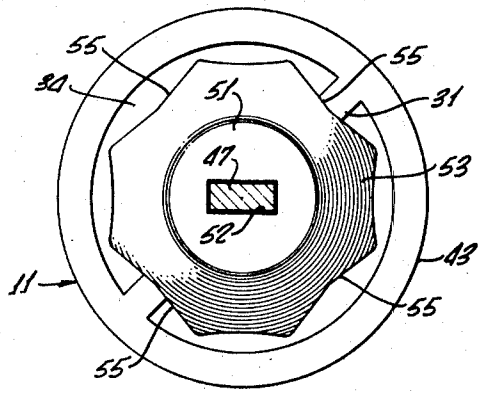


FIG. 11.

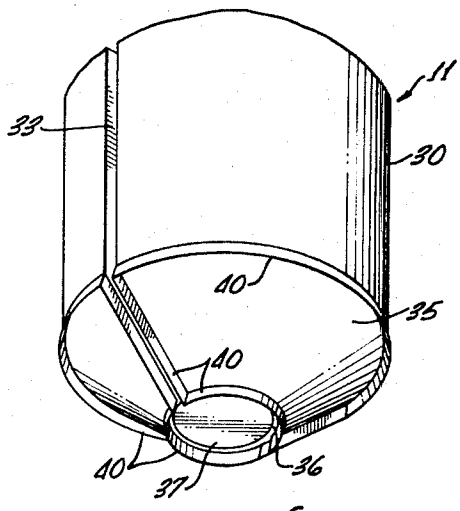


FIG. 9.

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MIXING AND PROPORTIONING SYRINGE

BACKGROUND OF THE INVENTION:

1. Field of the Invention

This invention pertains to a syringe for dispensing a plurality of materials.

2. Description of the Prior Art

Certain materials in both commercial and domestic use must be mixed at the time of use but require separate storage. Typically, this is a two-component adhesive system, such as an epoxy resin and its catalyst. The resin and catalyst must be mixed shortly before application to avoid premature setting up of the adhesive. Commonly, the adhesive and catalyst are marketed in separate metal foil tubes. Quantities of the adhesive and catalyst are dispensed by squeezing the two tubes, and the two components then are mixed together. For domestic use, this normally is accomplished by observing the amounts that are squeezed from the tubes and estimating when equal quantities have been obtained. Similarly, visual estimates are made of total quantities of the components that are needed. Inherently, true accuracy cannot be achieved.

For commercial use, it may be necessary to more accurately attain the correct quantities of the components by weighing. This, of course, is a time-consuming and, therefore, costly operation. Unless performed with care, the weighing operation may not produce precisely identical quantities of the resin and catalyst. In any event, the operation of obtaining the appropriate quantities of the two components becomes messy, relatively slow and requires cleanup.

When metal foil tubes are used, faulty crimping or puncturing frequently produces leaks in the tubes. By being in two separate containers, one or the other component may become misplaced before the components are to be mixed together. Furthermore, often there are air pockets in the containers for the components to be dispensed, which makes it impossible to estimate the amounts remaining in the containers for future use.

After the materials have been proportioned, they must be mixed thoroughly if satisfactory results are to be obtained. Adhesives will not provide prescribed bond strength unless adequately mixed with the catalyst. In some instances, it becomes almost impossible to effect complete mixing by hand operation where corners of the mixing containers may retain materials and prevent their circulation as the mixing operation takes place. Obviously, the mixing operation is time consuming and, therefore, a costly operation. Extra handling of the materials and the mixing devices is required. Messy cleanup is required when the mixing is completed. Materials may be wasted from mixing excess quantities together.

SUMMARY OF THE INVENTION

The device of this invention simultaneously dispenses, proportions and mixes materials, overcoming the problems outlined above. The materials are ejected from the dispenser in an exact ratio, with the components thoroughly intermixed. No separate mixing or weighing operations are needed. Time is saved, waste is eliminated and results are improved. The dispenser is an easily used leakproof unit with most of its components adapted for low-cost production as molded plastic parts.

The device of this invention includes a cylindrical barrel having a transverse web dividing it into two chambers. A conical wall at one end has openings providing outlets for the chambers. An end cap fits over the end wall of the barrel and has an annular recess receiving a flange on the barrel, allowing relative rotation between the end cap and the barrel for mixing materials discharged from the barrel chambers. A central opening in the end cap ejects the mixed materials. A plunger fits in the barrel, having sections generally complementary to the two chambers and being movable longitudinally in the barrel for discharging the materials in the barrel.

A ratchet drive for simultaneously rotating the barrel and longitudinally moving the plunger includes an exterior knob from which extends a spiral member that fits within a central opening in the web in the plunger. A drive member has a rectangular opening that nonrotatably receives the spiral member and is notched in its surface that is adjacent the web of the plunger. Consequently, when the spiral member is moved inwardly by the knob, it brings the notched surface of the drive member into engagement with the plunger web, whereupon further movement of the spiral member provides both torque on the plunger for rotating it and the barrel, and a longitudinal force component for moving the plunger inwardly to discharge the fluids. When the spiral member is pulled outwardly by the knob, the drive member lifts off the plunger web and rotates freely.

Repeated strokes of the spiral member, while the end cap is held in one hand, cause the plunger to discharge materials from the barrel chambers, while the relative rotation between the barrel end wall and the end cap results in a mixing of the materials prior to their ejection through the discharge opening of the end cap.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side elevational view of the dispenser of this invention;

FIG. **2** is an end view of the dispenser;

FIG. **3** is a longitudinal sectional view taken along line **3—3** of FIG. **2**;

FIG. **4** is an enlarged sectional view taken along line **4—4** of FIG. **3**;

FIG. **5** is an enlarged fragmentary longitudinal sectional view taken along line **5—5** of FIG. **4**;

FIG. **6** is an enlarged transverse sectional view taken along line **6—6** of FIG. **3**;

FIG. **7** is an enlarged transverse sectional view taken along line **7—7** of FIG. **3**;

FIG. **8** is a fragmentary exploded perspective view of the ratchet drive members and the outer ends of the plunger and barrel;

FIG. **9** is a fragmentary perspective view of the inner end of the plunger;

FIG. **10** is a perspective view, partially broken away, of the ratchet drive member; and

FIG. **11** is a top plan view illustrating the engagement of the ratchet drive member with the outer end of the plunger.

DESCRIPTION OF THE PREFERRED EMBODIMENT:

The syringe of this invention includes a barrel **10** which receives a plunger **11**. The exterior wall **12** of the barrel **10** is cylindrical. Inside, there is a transverse diametrical web **13** which connects to a smaller tubular

cylindrical section 14 coaxial with the barrel. This divides the interior of the barrel longitudinally into two principal chambers 15 and 16. As illustrated, the upper end 17 of the barrel is open, while at the lower end there is a conical wall 18. The web 13 and the central cylindrical section 14 extend from the open end 17 to the conical end wall 18, so that the chambers 15 and 16 are completely separated. A pair of outlet openings 19 for the chamber 15 is provided in the end wall 18 on one side of the web 13. The openings 19 are adjacent the web and at opposite portions of the chamber 15 adjacent the cylindrical barrel wall 12. Similar openings 20 in the wall 18 provide outlets for the chamber 16.

An end cap 22 fits over the end wall 18 of the barrel 10. The end cap 22 is generally conical in shape, having a central outlet opening 23. The base portion 24 of the cap 22 has an increased wall thickness and defines an annular recess 25. An outwardly projecting flange 26 on the barrel 10 adjacent the end wall 15 is received within the recess 25. The recess 25 is dimensioned to allow the end cap 22 to separate slightly from the barrel end wall 18 so as to provide a thin clearance space 28 between the inner surface of the cap 22 and the outer surface of the wall 18 of the barrel 10, as best seen in the enlarged view of FIG. 5. The only attachment between the barrel 10 and the end cap 22 is at the flange 26 and recess 25, so that the end cap and barrel are relatively rotatable.

The plunger 11 is contoured to generally complementarily fit within the barrel 10. Thus, the plunger 11 includes a cylindrical outer wall 30, diametrically across which extends a longitudinal web 31 which connects to a smaller tubular cylindrical segment 32 at the axis of the plunger 11. A longitudinal slot 33 in the web 31 extends from a location spaced inwardly of the open end 34 of the plunger to the opposite end of the plunger. At the latter location is a frustoconical end wall 35, which is bisected by the slot 33. There is, in addition, a cylindrical slot 36 in the cylindrical section 32 that begins adjacent but spaced from the end 34 at the same location as the diametrical slot 33, and extends to the frustoconical end wall 35. A flat radial end surface 37 provides a closure for the inner end of the tubular element 32 adjacent the frustoconical end wall 35.

When the plunger 11 is received in the barrel 10, the web 13 of the barrel fits within the slot 33 of the plunger web 31. Also, the axial tubular section 14 of the barrel 10 is received in the cylindrical slot 36 of the plunger. As a result, the plunger 11 provides a piston in each of the chambers 15 and 16, these pistons being movable simultaneously relative to the barrel by virtue of their connection at the web 31 and around the periphery at the end 34 of the plunger. A deflectable, forwardly projecting, wedge-shaped lip 40 is provided at the edges of the end wall 35 of the plunger to effect a seal between the plunger and the walls of the chambers 15 and 16.

At the open end 34 of the plunger 10 is a rounded outwardly projecting flange 43, beneath which fits the inturned flange 44 of a domelike end closure 45. An opening 46 is at the center of the closure 45 and through it extends an elongated spiral drive member 47. The latter member is made from a flat strip of metal which is twisted into a helical form, and extends into the tubular element 32 of the plunger 11. A knob 48 is fitted on the outer end of the spiral member 47.

Within the domed end cap 45 is a ratchet drive member 80 which has a flat central wall 51 through which is a rectangular opening 52 that substantially complementarily receives the helical member 47. The drive member 50 has a generally frustoconical wall 53 connected to the central wall 51, with four opposed, inwardly directed, substantially V-shaped notches 55 being provided in the wall 53.

When the dispenser is to be used, the two chambers 15 and 16 are charged with equal quantities of components to be dispensed and mixed, preferably being filled from the closed end and displacing the plunger 11 outwardly. Typically, the dispenser will contain an epoxy resin in one chamber and a catalyst in the other. The cap 22 is installed over the end wall 18 after the chambers have received the two materials.

When the materials are to be mixed and discharged, the cap 22 is gripped with one hand, preferably at the thickened portion 24. Then the knob 48 is reciprocated so as to pull the spiral member 47 out and push it in repeatedly. When the spiral member 47 is pushed inwardly, it carries with it the ratchet drive member 50, causing the drive member to engage the outer portion of the web 31 of the plunger 11. The edge of the web 31 will fall into a pair of the opposed notches in the wall 53 of the ratchet drive member 50. Then, as the knob 48 is pressed inwardly without turning it, the plunger 11 will receive both a rotational and a longitudinal force component. This is because the drive member 50 is coupled to the spiral member 47 at the opening 52 in the central wall 51 of the drive member. As the spiral member 47 moves axially relative to the drive member 50, the helical shape of the member 47 causes a torque to be produced so that the member 50 is turned. At the same time, the turns of the spiral member 47 exert an axial force on the drive member 50 as they pass through the opening 52. With the plunger web 31 being received in the notches 55 of the drive member 50, the forces on the drive member are transmitted directly to the plunger 11. The rotational force component on the plunger 11 causes the barrel 10 to turn with it because no relative rotation is possible between the plunger and barrel. However, the plunger is longitudinally movable relative to the barrel so that the longitudinal force component will push the plunger inwardly relative to the barrel. This will displace materials from the chambers 15 and 16 outwardly through the openings 19 and 20 in the barrel end wall 18. Because both sections of the plunger move equally in the chambers 15 and 16, the quantities of materials ejected will be the same.

The materials so ejected by the plunger enter the clearance space 28 between the end cap 22 and the end wall 18 of the barrel 10. With the barrel rotating relative to the cap 22, which is held by hand, the materials discharged through the openings 19 and 20 become intermixed. The movement of the conical cap and body surfaces relative to each other causes a shearing of the materials present in the clearance space, resulting in a thorough and uniform mixing. Ultimately, the materials reach the discharge opening 23 of the cap 22, where they are exhausted from the syringe. The materials must travel a substantial distance from the openings 19 and 20 to the central discharge aperture 23, which maximizes the mixing action. Therefore, when the materials have been discharged from the dispenser, they are both completely mixed together and in an exact ratio to each other.

When the knob **48** is pulled outwardly, the spiral member **47** lifts the drive member **50** off the end of the web **31**, causing it to engage the inner surface of the dome end member **45**. This position is shown in phantom in FIG. **3**. The member **50** then is free to rotate as the spiral member **47** is withdrawn from the plunger, without applying torque to the plunger. A small protuberance **56** is struck on the side of the lower portion of the spiral member **47** to prevent its complete withdrawal through the opening **52** in the drive member **50** and keeps the end of the member **47** in the cylindrical chamber **32**.

After the knob **48** has been pulled outwardly, the next stroke inwardly of the knob will bring the drive member **50** back into engagement with the web **31** to again apply torque to the plunger **11** and barrel **10**, as well as to push the plunger axially further into the barrel. In this manner, the continued reciprocation of the knob **48** causes the materials in the chambers **15** and **16** to be ejected and thoroughly mixed in a predetermined ratio.

In the embodiment illustrated, the chambers **15** and **16** are of equal cross-sectional areas, so that the dispensed materials have a **1**:1 ratio. Other ratios may be obtained by proportioning the chambers differently. In any event, the two pistons of the plunger move equally and simultaneously in the chambers so that the materials are ejected in an exact proportion.

When the barrel **10** is made of translucent or transparent plastic, the contents may be observed, so that it can be determined how much of the materials remain. A scale **57** may be included on the exterior of the barrel to enable the dispensing of precisely metered amounts. This eliminates weighing of the materials dispensed, as well as giving an accurate indication of remaining quantities.

Cleanup of the dispenser is very simple, accomplished by unsnapping the cap **22** and wiping its inner surface and the end wall **18** of the barrel **10** with tissue paper. Alternatively, the adhesive may be allowed to cure and later peeled off the plastic surface to which it has a low adhesion. Teflon coatings may be applied to facilitate the removal of the adhesive from the dispenser surfaces.

The foregoing detailed description is to be clearly understood as given by way of illustration and example only, the spirit and scope of this invention being limited solely by the appended claims.

I claim:

1. A device for dispensing and mixing materials comprising
- a body defining a plurality of separate chambers,
  - each of said chambers having an outlet opening,
- a unitary plunger having an element in each of said chambers,
  - said plunger being movable relative to said body for displacing materials from said chambers and discharging them through said outlet openings,
- a member adjacent said outlet openings for receiving said materials so discharged,
  - said member having an aperture for ejecting materials received by said member,
- and axially reciprocative means for applying a torque to said body for rotating said body relative to said member simultaneously with said movement of said plunger relative to said body for mixing said materials received by said member.

2. A device for dispensing and mixing materials comprising
- an elongated barrel defining a duality of separate chambers,
  - each of said chambers having an end wall,
    - each of said end walls having an opening therethrough, a discharge member adjacent said end walls for receiving materials discharged through said openings,
  - said discharge member having a surface adjacent said end walls,
  - said end walls being rotatable relative to said surface for mixing said materials so received,
  - said discharge member having an aperture for discharging said materials,
- plunger means in said barrel,
  - said plunger means having a portion in each of said chambers and being movable longitudinally thereof for forcing material from said chambers through said openings in said end walls and through said aperture in said discharge member,
- and means for so moving said plunger means and simultaneously applying torque to said barrel for rotating said barrel relative to said discharge member thereby to rotate said end walls relative to said surface of said discharge member.

3. A device as recited in claim **2** in which said barrel is substantially cylindrical, and includes transverse web means dividing said barrel into said duality of chambers.

4. A device as recited in claim **2** which
- said end walls are defined by sections of a cone,
- said surface of said discharge member is substantially conical and overlies said end walls,
- said aperture in said discharge member is at the apical portion of said surface,
- and said openings in said end wall are remote from said aperture.

5. A device as recited in claim **4** in which said barrel includes an annular outwardly projecting flange adjacent said end walls of said chambers, and in which said discharge member includes an annular recess receiving said flange for thereby holding said discharge member to said barrel while permitting relative rotation of said discharge member and said barrel.

6. A device as recited in claim **2** in which said means for so moving said plunger means and simultaneously applying torque to said barrel includes a reciprocative member operable exteriorly of said barrel and plunger means.

7. A device as recited in claim **2** in which
- said plunger means includes transverse wall means,
- and said means for moving said plunger means includes a drive member movable between a position remote from said transverse wall means and a position in engagement with said transverse wall means,
- and spiral means,
  - said drive member having an opening therethrough slidably and nonrotatably receiving said spiral means,
    - whereby when said spiral means is moved axially in one direction said drive member is brought into a position of engagement with said transverse wall means for applying a longitudinal force and a torque thereto,

and movement of said spiral means in the opposite direction moves said drive member to a position remote from said transverse wall means.

8. A device as recited in claim **7** in which said plunger means includes a surface limiting the movement of said drive member away from said transverse wall means.

9. A device as recited in claim **7** in which said plunger means includes an elongated relatively small cylindrical chamber at the axis thereof, said spiral means extending into said relatively small cylindrical chamber.

10. A device as recited in claim **9** in which said drive member has a surface adjacent said transverse wall means, said surface including a plurality of notches therein, said transverse wall means being receivable in said notches, whereby rotational force applied to said drive member by said spiral means is transmitted through said drive member to said plunger means and to said barrel.

11. A device as recited in claim **10** in which said spiral means includes a flat strip twisted to a helical shape, and hand-engageable means exteriorly of said barrel for permitting axial reciprocation of said spiral means.

12. A device as recited in claim **3** in which

said web means includes a cylindrical tubular portion at the axis of said barrel,

said plunger means having

a substantially cylindrical exterior,

a second transverse web means extending longitudinally thereof,

and a second cylindrical tubular portion at the axis of said plunger means,

said second transverse web means including a longitudinal slot therein receiving said transverse web means of said barrel,

said second cylindrical tubular portion having an annular slot receiving said cylindrical tubular portion of said barrel.

13. A device as recited in claim **12** in which said means for moving said plunger means and simultaneously applying torque to said barrel includes a spiral member received in said second cylindrical tubular portion.

14. A device as recited in claim **13** in which said means for moving said plunger and simultaneously applying torque to said barrel includes a drive member engaging said spiral member, said drive member being engageable with said second transverse web means for applying rotational and longitudinal force components thereto.

15. A device as recited in claim **6** in which said reciprocative member is movable through a first stroke toward said discharge member, and a second stroke away from said discharge member, and including means for so applying torque to said barrel during said first stroke and not during said second stroke, whereby said barrel is rotated in only one direction relative to said discharge member.

* * * * *

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,738,535 Dated June 12, 1973

Inventor(s) Augustus H. Nicholls

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 5, between lines 60 and 61 (lines 11 and 12 of claim 1) insert -- said member having a surface in spaced adjacency with said body so as to define with said body a relatively narrow space into which said materials are discharged, --.

Signed and sealed this 20th day of November 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents