May 30, 1967 F. FRASER 3,322,307

DEVICES FOR SUPPLYING MATERIALS

Filed Aug. 19, 1965 2 Sheets-Sheet 1

Fig. 7.

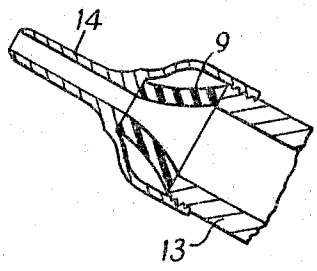
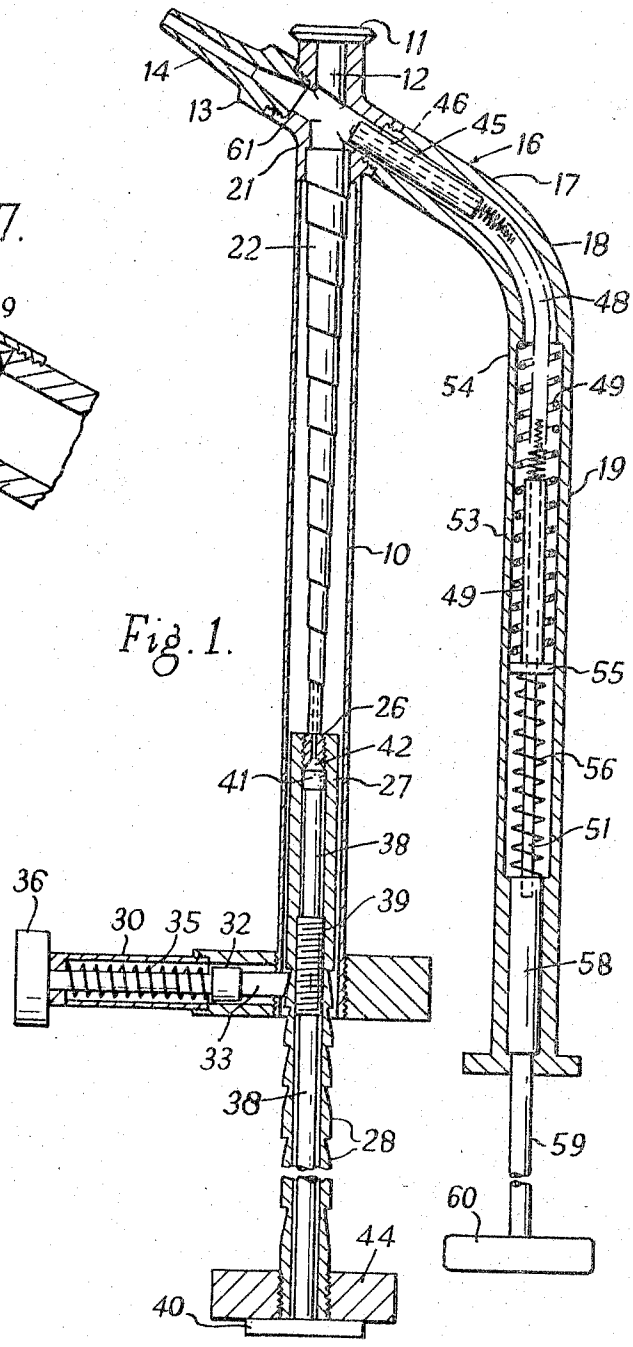


Fig. 1.



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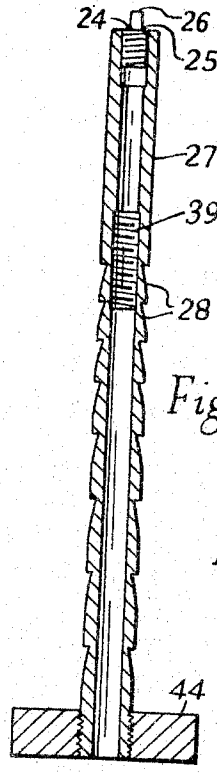

Fig. 3.

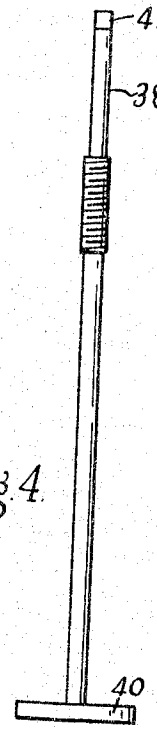

Fig. 4.

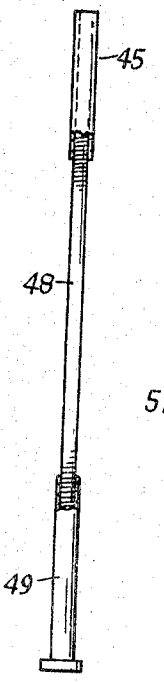

Fig. 5.

Fig. 6.

Fig. 2.

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DEVICES FOR SUPPLYING MATERIALS

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8 Claims. (Cl. 222—207)

This invention relates to supply devices for supplying required quantities of a plastic or other flowable material. The invention is in particular intended for supplying quantities of a dentist's amalgam for filling cavities in patients' teeth, but can be used for other purposes.

It has been common practice for many years for dentists to use tools comprising a tube containing a plunger. The plunger can leave a small space in the end of the tube which the dentist fills with a small quantity of amalgam. The dentist then carries the tool to the patient and presses the plunger to expel the amalgam from the tube into the cavity in the patient's tooth. For a larve cavity or when several cavities are to be filled at the same time, the dentist must make at least several visits to the table where the amalgam is available in order to take up a number of small quantities of the amalgam and transfer these to the patient. This is time absorbing and inconvenient to the patient and to the dentist. It is not practicable to fill a long tube with amalgam and try to press this out by a plunger because the amalgam becomes compacted and jams in the tube.

According to the present invention a collapsible tubular device is provided to contain the plastic material, said device having walls which slide into one another so as to eject the material. The tubular device may be located within a container having an opening at one end through which the material is ejected.

The material may be ejected into the path of a plunger which can be moved to eject successive small quantities of the material. Thus the device contains a large quantity of the material which is fed in successive portions as required. Means for collapsing the device may be connected with the plunger or other final ejecting means so that they are actuated by a single operating member.

The device may comprise a helical strip spring the convolutions of which are offset progressively in the axial direction. The spring collapses axially with the helices sliding one within the other.

In an alternative construction the device comprises a series of separate flat section rings of progressively diminishing diameters, so that each (except the largest) moves with a sliding fit within the next largest ring, spring means being provided to extend the device axially while stop means limit the extent of this movement.

A constructional form of the invention will now be described by way of example with reference to the accompanying drawings wherein:

FIGURE 1 is a sectional view of a device made in accordance with the invention;

FIGURE 2 is an enlarged view of part of FIGURE 1;

FIGURES 3 to 6 are views of separate parts of FIGURE 1; and

FIGURE 7 is an enlarged sectional view of the nozzle.

The device comprises a tube or barrel **10** closed at one end by a cap **11** that carries a spigot **12** that can be pushed into the end of the barrel. Near the cap the barrel has a tube **13** detachably fixed to it with its axis at an angle of about 45° to the axis of the barrel and extending above the cap. A nozzle **14** is screwed on to the tube **13**. The nozzle **14** has a bore of smaller diameter than the tube **13**. Between the outer end of tube **13** and the inner end of the bore of the nozzle is an elastic

tapering rubber guide **9** the large end of which is about the same size as the bore of the tube **13** and the small end of which is about the same size as the bore in the nozzle against which it is located. Screwed into the barrel on the side opposite the nozzle and in alignment therewith is a second tube or barrel **16** which has a straight part **17**, followed by a curved part **18** leading to a straight part **19** that is parallel to the first barrel **10**.

The barrel **10** has an internal annular shoulder **21** against which engages the large end of a collapsible tubular device which is in the form of a volute spring **22** composed of about ten to twelve turns of spring ribbon each turn of which closely and slidably overlaps the adjacent turn by about one sixteenth of an inch when the spring is unloaded so that no escape space from it exists. Both ends of the spring are squared off. The small end of the spring has a diametrical cut across it to receive knife-like projections **24**, **25** on a nozzle **26** that is screwed into the end of a hollow plunger **27**. The plunger **27** is a sliding fit in the barrel **10** and projects out of the other end of the barrel where it is provided with annular grooves **28** forming abutments in gradually increasing intervals axially along the plunger.

At the plunger end of the barrel **10** a head **29** is screwed on and this head has a radial bore extended by a tube **30** having inturned edges **31** at its outer end. A plunger **32** slides in the bore and carries a stop in **33** which enters a hole in the barrel **10** and engages in the grooves **28** in the plunger **27**. A spring **35** surrounds the stem of the plunger **32** and is compressed between the plunger **32** and the edges **31** so as to urge the stop pin **33** into engagement. The stem projects out of the tube and carries a knurled knob **36** whereby the stop pin can be withdrawn.

Within the hollow plunger **27** is a rod **38** screwed at **39** to the plunger **27** and having a knurled knob **40** at one end which projects out of the plunger and carries a rubber piston **41** at its inner end so that by screwing the rod into the plunger, a space **42** in the plunger between the piston **41** and the nozzle **26** can be progressively reduced in size. The outer end of the plunger **27** also carries a knurled knob **44**.

Within the straight part **17** of the second barrel **16** is an outer tubular plunger **45** which slidably contains an inner plunger **46**. The outer plunger is connected by a tightly wound helical spring **48** to a second tubular outer plunger **49** located in the straight part **19** of the second barrel. The inner plunger **46** is connected by a helical spring **50** to a second inner plunger **51** that is slidable in plunger **49**. A spring **53** surrounds the plunger **49** and engages between an internal annular shoulder **54** in the barrel **16** and a flange **55** on one end of the plunger **49**. A spring **56** surrounds part of the plunger **51** that projects out of the plunger **49** and engages between the plunger **49** and a piston **58** that is slidable in the barrel **16** and is operated by a piston rod **59** that projects out of the barrel and carries a knob **60**.

With the volute spring in its extended position as on the drawing, and the pull-off cap removed, the instrument is loaded with a mix of amalgam through a small funnel inserted in place of the cap, by holding the instrument vertically and shaking or vibrating it. The amalgam falls down and more or less fills the interior of the volute spring. The cap is then replaced.

Assuming sufficient amalgam has been loaded to fill the spring, pressure is applied to the plunger **27** with the thumb, to move the plunger and compress the spring **22**. As the spring is compressed amalgam will be expelled from within it into a space **61** just above the spring. As soon as a unit measure of amalgam has been expelled, the stop pin **33** will engage in a groove **28** on the plunger **27** with a click. If this quantity is sufficient for the opera-

tor he transfers his thumb to the operating knob **60** and presses this, but if not he can compress the spring **22** to a second or third groove **28**. Pressure on the handle knob **60** actuates the two concentric plungers in barrel **16**. They move forward together carrying the pellet of amalgam (or a part of it) towards the exit nozzle. When this point is reached further progress of the outer plunger is halted by contact with the tapered rubber guide **9**. The inner plunger **46** continues on through the exit nozzle **14** which it closely fits, carrying the pellet forward in advance of itself. At the end of its travel the inner plunger projects slightly beyond the nozzle and can be used as a plugger to consolidate the amalgam into the tooth cavity. The operating handle is then released and returns to its extended position, the two concentric plungers being retracted. The procedure can now be repeated by alternately pressing the two operating heads until the spring **22** is completely closed and its contents used.

Lifting the knurled head **36** releases the spring **22** which can then return to its open position ready for a fresh charge of amalgam. If desired plunger **27** can be completely withdrawn from the barrel together with the spring for quick cleaning.

Spring **56** is of heavier gauge than spring **49**. This ensures that the inner concentric plunger will not move out of the mouth of the outer plunger until the latter is brought to rest by the tapered rubber washer.

The inner plunger **51** is connected to the piston **53** and therefore moves directly forwards and backwards with the movement of knob **60**; the outer plunger however is moved through the force of the spring **56**.

When contact of the outer plunger **45** with the rubber washer occurs, there is a momentary expansion of the rubber followed by contraction to normal shape. This assists in contracting the diameter of the pellet to assist its expulsion through the exit nozzle. A small residue of amalgam may remain. However, as the volute spring **22** is progressively emptied, the pellet gradually reduces in diameter until, at the end, it is the same diameter as the exit, so that little or no residue will finally remain. The nozzle nevertheless is quickly removable for ease of cleaning.

The space **42** serves as a reservoir to contain mercury. By removing rod **38** the reservoir can be filled. After rod **38** is replaced with its rubber face making contact with the column of mercury within, any further motion of the rod will then expel mercury through the small orifice in the nozzle **26** into the spring space. This allows for possible delay in utilising the whole charge of amalgam within the instrument, during which time the amalgam may begin to set. The addition of a small extra quantity of mercury restores its plasticity. As only a very small quantity of mercury is required at a time the contents of the reservoir suffice for many mixes.

Additionally, by giving knob **44** a half-turn during the earlier stages of compression, the volute spring is rotated so as to present the residue of amalgam more directly to plunger **45**.

In a modification the instrument is designed in which, by suitable linkage the compression of the volute spring **22** and ejection of the amalgam at the exit nozzle are both effected by one control knob.

The cylinder may be shaped to receive a small funnel into which the amalgam may be placed. By placing the device against a vibrator such as is commonly used for mixing the amalgam the amalgam is caused to move down the funnel into the collapsible device.

I claim:

1. A device for supplying quantities of a flowable material comprising a substantially rigid tubular member, a collapsible tapering volute spring to contain the material, and means for injecting material into one end of the spring and for compressing the spring, said spring having walls which slide into one another so as to eject the material only from the other end of the spring.

2. A device as claimed in claim **1** wherein the rigid tubular member has an opening at one end through which the material is ejected and a tapered elastic guide and an outlet nozzle of smaller diameter than said opening, said guide being located between said opening and said nozzle.

3. A device as claimed in claim **1** wherein the said means for injecting the material and compressing the spring comprises a plunger, and wherein stop means are provided to locate the plunger in various positions of increasing axial disposition.

4. A device as claimed in claim **1** wherein said injecting means comprises a rod screwed into a bore in the plunger, said plunger having a nozzle leading to the interior of said tubular device.

7. A device as claimed in claim **2** wherein the axis of said opening is at an angle to the axis of said tubular member, and wherein an ejecting device is attached to said member in alignment with said opening.

6. A device as claimed in claim **5** wherein said ejecting device comprises inner and outer plungers, one within the other, and means for moving the plungers so that the inner plunger moves further than the outer plunger during ejection.

7. A device as claimed in claim **5** wherein said ejecting device comprises a barrel having a straight part in line with said opening, a second straight part parallel with said tubular member, and a curved part between them, first and second plungers in the straight parts, respectively, the plungers being connected together by flexible means, and a piston in the second straight part.

8. A device as claimed in claim **7** having an inner plunger in each of said plungers and slidable therein and connected together by flexible means, the inner plunger in the second straight part being fixed to the piston, a spring urging the second plunger to its rest position.

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