April 25, 1967 E. J. HENRIKSEN 3,315,437

METHOD OF CHARGING BALLPOINT PENS

Filed July 9, 1964

Fig. 3.

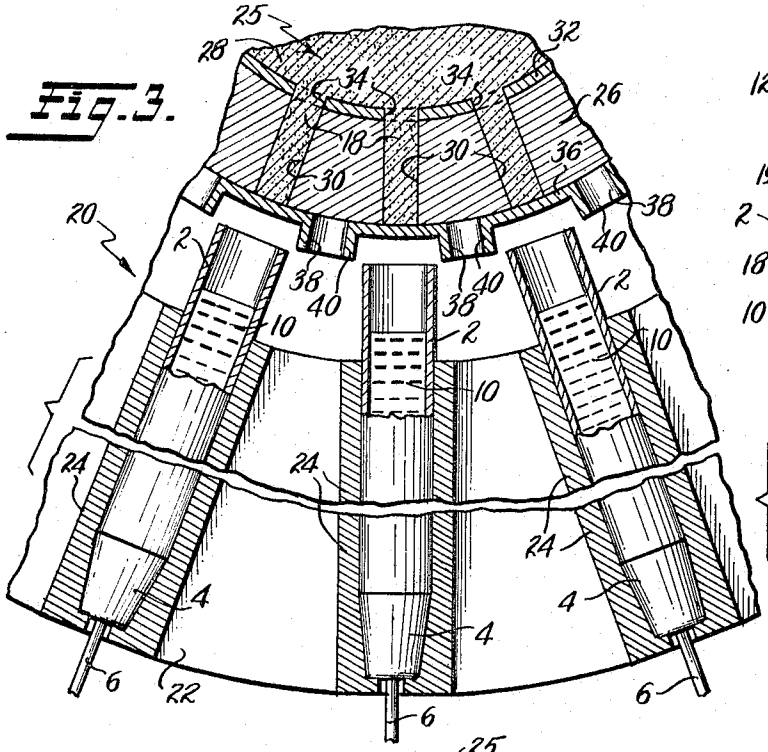
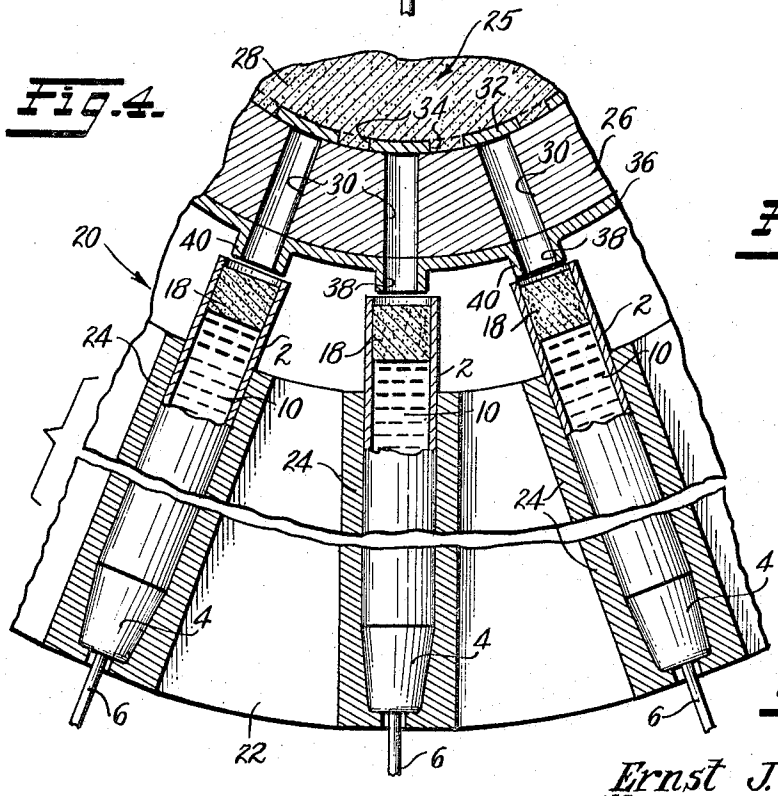


Fig. 4.



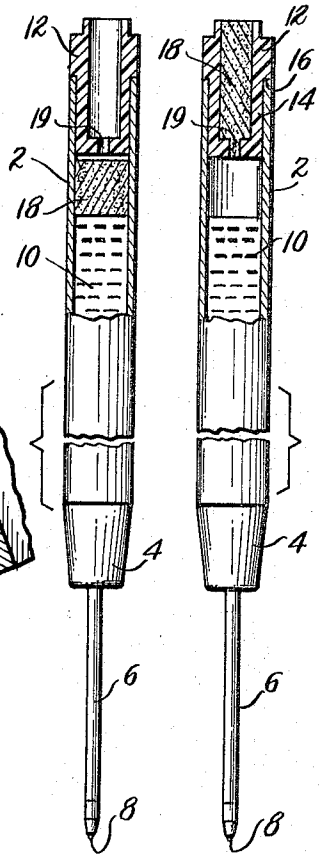


Fig. 2. Fig. 1.

Fig. 5.

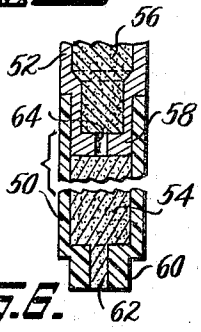


Fig. 6.

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METHOD OF CHARGING BALLPOINT PENS

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6 Claims. (Cl. 53—37)

This invention relates to a method of charging ballpoint pen reservoirs with a charge of ink and a plug follower means at the free surface of the ink.

While the description will proceed with reference to a ballpoint pen, it is to be understood that the invention is applicable, with equal facility, to reservoirs of other pens and/or applicators.

The present-day ballpoint pens employ a rather heavy ink and often an ink that dries or hardens on exposure to air. Applicant has devised a method for preventing such ink deterioration which comprises the provision of a non-solid follower comprising a plug of suitable material placed in the ink reservoir at the free surface of the ink and which plug follows the ink as it is consumed and keeps the ink surface isolated from air in the reservoir. Usually such follower material is a greasy or pulpy mass. Such a follower plug is more fully described in this applicant's prior Patent No. 2,678,634. The follower plug may be placed in an ink reservoir of capillary dimensions or even in a reservoir of greater than capillary diameter and in the latter case serves the further purpose of preventing flow of the ink out through the open end of the reservoir when a pen or refill is placed on its side.

Many, if not most, commercial ballpoint pens today employ such a follower as described above and the present invention relates to a manner of efficiently and inexpensively placing that material in the reservoir. In the manufacture of such pens, and of refills, therefor, an open-end tube, open at both ends, is charged with a supply of ink by forcing the same into one end thereof in an amount less than that required to completely fill the reservoir. Thereafter, a writing tip is affixed and secured to the end of the tube through which the ink was inserted. The writing tip is customarily empty of ink and contains only air which would prevent even the commencement of writing and it becomes necessary to force the ink into the writing tip and to expel any entrapped air therefrom before the pen is ready for use. Customarily, after assembling the writing tip to the charged reservoir, the device is placed in a centrifuge with the writing tip outermost and the centrifuging operation causes the ink to flow into and completely fill the writing tip and any air therein or air trapped in the ink is forced through the body of ink, out through the other end of the reservoir. It is the present practice to thereafter insert the plug follower mentioned above into the open end of the reservoir and the processes presently employed add expense and time to the completion of the pen.

According to the present invention a body of the follower material, of the proper predetermined volume, is positioned adjacent the open end of the ink reservoir when the latter is placed in the centrifuge and upon subsequent centrifuge action, the previously described expulsion of air is accomplished and at the same time the centrifugal force acting on the follower material causes the same to move into the open end of the reservoir, to contact the free surface of the ink and to conform to the inner surface of the reservoir in sealing relation thereto. The means by which the follower material is placed in the described position will be described in more detail.

It is also within the scope of the present invention to change a pen reservoir with ink alone, or with a follower, by the centrifugal method disclosed and claimed.

It is, therefore, a principal object of this invention to

provide a novel method of inserting a fluent material in a pen reservoir.

Another object is to provide a novel method, as set forth above, wherein the insertion of a plug material is accomplished by centrifugal action simultaneously with the performance of a conventional step in making and charging pen ink reservoirs.

Additional and further objects and advantages will become apparent to those skilled in the art as the description proceeds with reference to the accompanying drawings wherein:

FIG. 1 is a side view of one form of ballpoint pen reservoir showing the follower material in position to be forced into the reservoir;

FIG. 2 is a view similar to FIG. 1 but showing the parts after a centrifuging operation;

FIG. 3 is a fragmentary schematic view of an apparatus for measuring predetermined quantities of the follower material in a centrifuging apparatus;

FIG. 4 is a view similar to FIG. 3 but showing the parts in different relative positions;

FIG. 5 is a detailed sectional view of a modified form of holder for the material; and

FIG. 6 is an enlarged detailed sectional view of a further modified form of holder for plural materials.

FIG. 1 shows what may be considered a conventional ballpoint ink reservoir or refill comprising a tubular reservoir portion **2** and a writing tip having a connector portion **4** secured to one end of the tube **2** and a tubular writing tip portion **6** carried by the connector **4**, and including a ballpoint **8**. The refill shown in FIG. 1 is merely by way of illustration since other forms of reservoir may be employed to practice the present invention. As previously pointed out the tube **2** is conventionally filled with a body of ink **10** by forcing the same thereinto, under pressure, from the lower end of the tube before the writing tip is installed. Thereafter, the connector **4** is secured to the lower end of the tube and, according to the present practice, the assembly is then placed in a centrifuge and rotated at high speed so as to force ink **10** into the writing tip **6** and to force air upwardly therefrom through the body of ink **10** and to the exterior of the reservoir.

In the example, shown in FIGS. 1 and 2, a holder device **12** is shown which comprises a generally tubular member having a reduced diameter portion **14** terminating in a shoulder **16**. The holder device **12** is hollow, open at both ends, and the portion **14** is of a size to be snugly received in the open end of the tube **2** with the shoulder **16** abutting the end of the tube. Prior to placing the device **12** on the tube **2**, the interior thereof is filled with a suitable non-solid follower plug material **18**, which may be of the type heretofore referred to. Obviously, the material **18** may be placed in the holder **12** by automatic machinery or otherwise, in a rapid manner suitable for mass production. After the parts are assembled as shown in FIG. 1, the assembly is placed in a centrifuge with the writing tip pointing radially outwardly and upon rotation, the previously described removal of air is accomplished and at the same time centrifugal force acts on the material **18** to cause the same to flow inwardly into the tube **2** into contact with the surface of the ink **10** and to expand in shape to completely engage the inner surface of the tube **2** and thus seal the ink against contact by air. Many commercial ballpoint pens and refills include a cap member at the open end of the tube **2**, which cap member is provided with an opening for the admission of air into the reservoir to replace the ink as the latter is used. Obviously, the holder **12** may be left in the position shown to serve as such a cap, in which case it may be secured permanently to the tube **2** by indentations (not shown) or in any other

suitable manner. In many cases, the inner end of the passageway through holder 12 may be of reduced diameter (as shown at 19) to temporarily restrict or control the rate of flow of material 18 into the tube 2. The size of the restriction 19 must be chosen according to the consistency of the material 18. When the material 18 is a liquid such as the main ink supply restriction 19 must be quite small and may be a plurality of very small openings as shown at 21 in FIG. 5.

Likewise the outer end of that passageway may be restricted or partially closed, especially if the holder 12 is to be left on the tube 2 as a permanent cap.

FIGS. 3 and 4 illustrate a slightly different manner of providing a measured quantity of the follower plug material and holding it in the proper position to be centrifuged into a reservoir. In FIGS. 3 and 4, the tubular reservoir 2 and other associated parts of the pen structure may be identical to those shown in FIGS. 1 and 2 and are so identified. It is to be understood, however, that other forms of reservoir may also be used. In these figures, numeral 20 indicates generally a centrifuge having a rotor 22 provided with holding means 24 designed to receive and hold a reservoir thereon with its writing tip 6 extending radially outwardly and its open inner end pointing inwardly. The centrifuge rotor 22 is provided with a central chamber 25 defined by a thick wall 26 and containing a supply 28 of the follower material 18. The chamber 25 is defined by a relatively thick cylindrical wall 26 having openings 30 therethrough each of which is radially aligned with a reservoir 2 in the holders 24. Each of the openings 30 is of a volume to contain exactly the desired quantity of follower material 18. An inner movable wall member 32 is movably mounted within the chamber 25 and is provided with a plurality of openings 34 therein, which openings may be placed in alignment with the openings 30, as shown in FIG. 3. An outer wall 36 is movably mounted on the exterior surface of the chamber wall 26 and is likewise provided with a plurality of passageways 38 therein adapted to be moved into or out of alignment with the openings 30 and reservoirs 2, as shown in FIG. 4. Each of the passageways 38 is preferably defined by a short nozzle structure 40 integral with the wall 36. The nozzles 40 are of such radial extent as to extend to a position closely adjacent the ends of the reservoirs 2 when the latter are mounted in the holders 24.

With the parts in the position shown in FIG. 3, the material 28 may be forced by pressure into the openings 30 to fill the same while the outer wall 36 closes the outer ends of those openings. The filling of the openings 30 may be accomplished by applying static presure to the mass of semi-fluid material 28 or the latter may be caused to flow into the openings 30 after the centrifuge has started to rotate, by centrifugal force. In any event, after the openings 30 are filled with the material 18, the inner wall member 32 is moved to the position shown in FIG. 4 to interrupt communication between the openings 30 and the supply chamber 25 and thereafter the outer wall 36 is moved to the position of FIG. 4 to open the outer ends of openings 30 and provide a flow path therefrom into the upper ends of the reservoirs 2. This all may be accomplished prior to commencement of rotation of the rotor 22 or it may be done after the rotor has started to rotate. In the latter case, more time is available for expelling all air from the ink reservoir before insertion of the follower plug. However, even if the parts are brought to the position of FIG. 4 before rotation commences, the material 18 will remain in the openings 30 until sufficient centrifugal force has been developed to cause the same to flow outwardly and assume the shapes and positions shown in FIG. 4. Obviously, those skilled in the art may adopt any desired sequence of operation of the parts of the mechanisms shown in FIG. 3, without departing from the spirit of the invention.

It is to be noted that after the centrifuging step, the amount of follower material 18 in each reservoir is preferably less than the amount that would be necessary to completely fill the latter to its upper end. It is desirable that the follower plug be initially located at least a short distance inwardly of the open end of the reservoir.

In some instances, it is desirable to provide a ballpoint pen with a follower plug consisting of more than one layer of material, the different layers being of different materials. The present invention lends itself readily to the insertion of such multi-layer followers by permitting the easy and economical insertion of the various layers of the follower plug by successive centrifuging steps irrespective of the viscosity or nature of the material of each layer. In some instances, an intermediate layer may be a very thin flowable material and difficult to insert in the reservoir by conventional or prior methods.

FIG. 6 shows an alternative method of introducing plural layers of material into the pen reservoir. As shown, a holder for the material, corresponding generally to the holder 12 of FIG. 1, consists of two separate sections 50 and 52. The section 52 has a reduced end portion 58 telescopically received in the outer end of the portion 50. The portion 50 has a reduced end portion 60 adapted to be telescopically positioned and held within the open end of the pen reservoir 2 (not shown in FIG. 6). As shown, the section 50 has an opening 62 therein whereas the section 52 has a restricted opening 64 in the lower end thereof. Thus, a material 56 may be loaded into the section 52 and a second material 54 loaded into section 50. The sections are thereupon assembled in the manner shown and placed in the open end of the pen reservoir and the entire assembly then placed in a centrifuge machine to cause both materials 54 and 56 to enter the reservoir. Obviously, the capacities of the sections 50 and 52 will depend upon the purpose and material of the materials therein. The material 54 could be the main ink supply and material 56 a suitable follower plug. On the other hand both materials 54 and 56 could be different components of a multilayer follower. Preferably, the opening 64 is more restricted than the opening 62 so that the material 54 will enter the pen reservoir before the material 56 begins to flow. The size of the openings 62 and 64 will, of course, depend upon the viscosity or consistency of the particular materials in the corresponding sections of the holder. By making opening 64 more restricted, the discharge of the material 56 is thus delayed until material 54 is discharged. On the other hand the size of the restrictions may be so calculated and related to their respective materials so that material 54 will discharge at one particular speed of the centrifuge and the material 56 will then be discharged only at a higher speed. Obviously, many other modifications will be apparent to those skilled in the art.

Obviously, the capacity of holder 12 or openings 30 would be greater than shown, in those instances where the present invention is used to charge a pen reservoir with its main ink column.

The holder 12 of FIGS. 1 and 5 and the holders 50 and 52 of FIG. 6 are of a material having low affinity for the materials 18, 54, or 56 so that it will clean itself during the centrifuging step. Polyethylene and polypropylene plastics are very good materials for many inks and greases.

While a limited number of specific embodiments have been described, it is to be understood that the same are merely illustrative of the principles involved and that the invention may be practiced by other apparatus or means, all within the scope of the appended claims.

I claim:

1. The method of charging an open ended pen reservoir with fluent material, comprising the steps of: measuring a quantity of said fluent material, less than the quantity necessary to fill said reservoir; centrifuging said reservoir with said open end extending radially inwardly; and simultaneously positioning said measured

quantity of said fluent material adjacent said open end and aligned therewith whereby said centrifuging step causes said measured quantity of fluent material to enter said open end and conform to the inner periphery of said reservoir leaving empty a portion of said reservoir, at said open end.

2. The method of charging an open ended pen reservoir with ink and a non-solid follower, comprising the steps of: placing a body of fluid material, including a column of ink in said reservoir to a level adjacent but spaced inwardly from said open end; centrifuging said reservoir and fluid material with said open end extending radially inwardly; and simultaneously positioning a body of non-solid follower material adjacent said open end and aligned therewith whereby said centrifuging step simultaneously expresses air from said reservoir and column of ink and causes said body of follower material to enter said open end, engage the adjacent end of said body of fluid material and conform to the inner periphery of said reservoir.

3. The method of claim 2 including the step of limiting the size of said body of follower material to a size insufficient to fill said reservoir to the open end thereof.

4. The method of claim 2 wherein said step of positioning said body of follower material adjacent said open end is performed by placing the same in an open-ended generally tubular holder and inserting a portion of said holder in the open end of said reservoir, to be supported thereby.

5. The method of claim 4 including the further step of securing said holder to said reservoir to serve as a cap therefor.

6. The method of claim 2 wherein said step of positioning said body of follower material adjacent said open end is performed by establishing a supply of said follower material, establishing a measuring zone of predetermined volume adjacent said open end, forcing follower material from said supply into said zone to fill the same, isolating said zone from said supply, and then establishing communication between said zone and said open end.

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TRAVIS S. McGEHEE, *Primary Examiner.*