July 25, 1967 C. A. SONNTAG 3,332,400

INK CARTRIDGE

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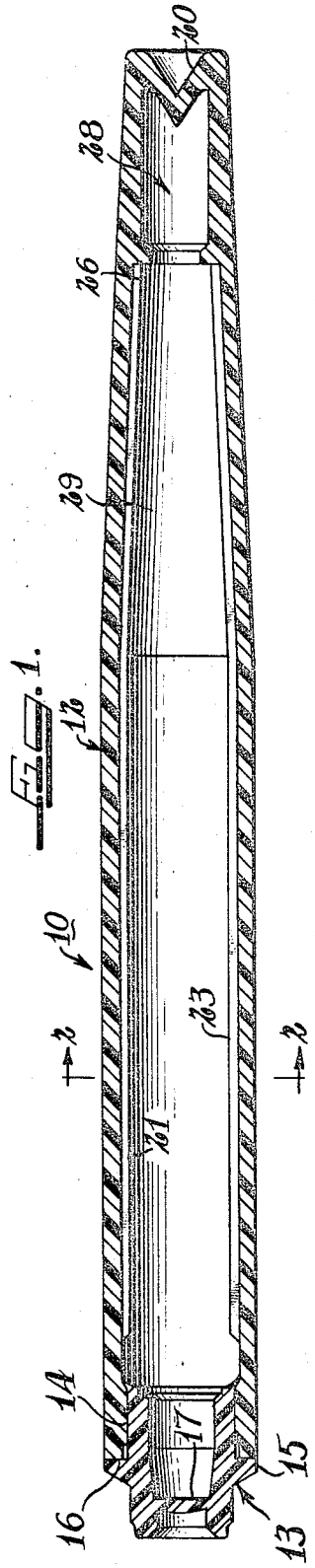


Fig. 1.

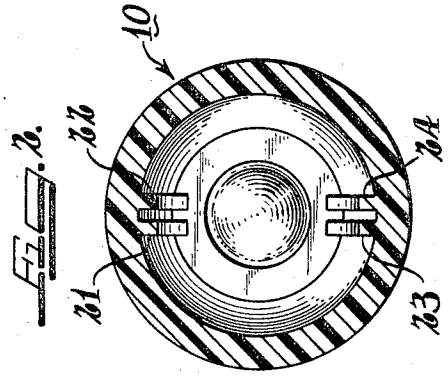


Fig. 2.

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INK CARTRIDGE

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The present invention generally relates to ink reservoir cartridges of the type used in fountain pens and it more particularly relates to a throw-away type of cartridge having a reserve chamber therein and means for indicating to the user when only a small predetermined amount of ink remains in the cartridge.

Because of the ease and convenience of use, fountain pens employing throw-away ink cartridges have become popular in the last few years. When the ink supply becomes exhausted in this type of fountain pen, the spent cartridge is removed and replaced with a new ink filled cartridge. Such cartridges cannot conveniently be refilled with ink from ink bottles and the like and, therefore, when the ink in a cartridge has been used up it is necessary for the user to have available another cartridge in order to continue writing with the instrument. Moreover, since the ink cartridges for different types of pens are not normally interchangeable, a new cartridge may not readily be available at the particular time that the ink supply runs out. This has proven to be one disadvantage or drawback to the use of cartridge-type fountain pens.

Accordingly, it would be desirable to incorporate into the fountain pen or cartridge, means for indicating to the user when the ink supply is nearly exhausted so that he may make the necessary provisions to have a new cartridge available when the cartridge being used becomes empty. As is more fully described hereinafter, the present invention provides a simple, inexpensive and yet reliable means for indicating when only a small, predetermined amount of ink remains in the cartridge.

A principal object of the present invention is, therefore, to provide a new and improved ink reservoir for use in fountain pens and similar writing instruments.

Another object of the present invention is to provide a new and improved throw-away type of ink cartridge reservoir.

Still another object of the invention is to provide a new and improved ink cartridge having means for indicating when only a predetermined amount of ink remains therein.

A further object of the present invention is to provide a new and improved ink cartridge incorporating therein a reserve chamber for holding a predetermined quantity of ink until the main chamber has become exhausted and the user transfers the ink from the reserve chamber to the main chamber.

Briefly, the above and further objects are realized in accordance with the present invention by providing near the rear end of a vacuum type ink cartridge a restriction having a cross-sectional shape and size such that the surface tension of the ink across such restricted area is sufficient to hold a predetermined quantity of ink rearwardly of such restriction against the force of gravity and also against the forces of momentum normally encountered during use and transportation of the fountain pen. The surface tension of the ink across the restriction is, however, sufficiently small such that the meniscus may be broken to feed the ink in the reserve chamber to the main reservoir chamber by sharply tapping the front end of the nib of the pen against a hard surface or by a lateral tapping of the rear end of the cartridge. When the meniscus is thus broken, the ink runs out of the reserve chamber down into the main chamber thereby providing

an additional quantity of ink which is of a small predetermined amount to enable the writer to use the pen for a substantial length of time. He will, however, be aware that the ink in the pen is about to become exhausted and, therefore, a new cartridge should be available to replace the spent one.

Further objects and advantages and a better understanding of the present invention may be had by reference to the following detailed description taken in connection with the accompanying drawing, in which:

FIGURE 1 is a longitudinally sectioned view of a throw-away type of ink reservoir cartridge embodying the present invention, and

FIGURE 2 is a cross-sectional view taken along the line 2—2 of FIG. 1, assuming the entire reservoir to be shown in FIG. 1.

Referring now to the drawing, there is shown a throw-away type of ink cartridge **10** comprising a generally tubular shell **12** which may be molded of a suitable plastic such, for example, as polyethylene, and a plug **13** which has a tubular portion **14** fitted into one end of the shell **12** and sealed thereto by any suitable means as, for example, in a spinning operation. The plug **13** further includes a generally annular flange **15** which abuts against the marginal, annular end **16** of the shell **12** to facilitate assembly of the cartridge **10** and to insure a hermetically tight seal between the plug **13** and the shell **12**. An integral wall **17** is provided within the plug **13** to hold ink in the cartridge **10** prior to its insertion in an associated fountain pen. When the cartridge is placed in an associated fountain pen, the wall **17** is pierced or otherwise partially severed from the plug and shifted to one side thereby to permit the passage of ink through the plug **13** and into the feed mechanism of the pen. A fountain pen which is suitable for use with the cartridge **10** is described in Patent No. 3,134,362 to Homer T. Green. The shell **12** has an outer envelope formed to closely follow the contour of the barrel of the pen in which it is adapted to be used, and therefore the shell **12** tapers toward its upper or right-hand end as viewed in FIG. 1.

The right-hand or upper end of the cartridge shell **12** is sealed off by means of an integral end portion **20** thereby to completely seal the rearward or upper end of the cartridge from the atmosphere.

The cartridge **10** is designed for use with liquid inks which ordinarily have a surface tension of the order of 45 to 60 dynes per centimeter. Moreover, the shell **12** is preferably formed of a relatively rigid and inexpensive material such, for example, as polyethylene. Linear polyethylene has been found to be particularly suitable for such a cartridge and is sufficiently nonwettable by conventional writing type fluid inks to support varying quantities of ink in the closed end of the chamber. In order to prevent such an occurrence, two pairs of longitudinally extending ribs **21**, **22** and **23**, **24** extend from a location a short distance rearwardly of the plug **13** to an annular flange **26** provided near but spaced from the rear end **20** of the cartridge. The ribs **21–24** and the flange **26** are integral with the shell **12** and are preferably molded when the shell **12** is formed. The ribs **21** and **22** are sufficiently close together that the cross-sectional area of the channel formed between the ribs is of capillary dimension thereby to provide a capillary passage from the location of the flange **26** to a location near the forward end of the cartridge **10**. A similar capillary passage is provided between the ribs **23** and **24**. The ribs **21–24** thus prevent the formation of a meniscus forwardly of the flange **26** by draining the ink from the locations adjacent the rearward end of the ribs **21–24**.

Rearwardly of the flange **26** there is thus defined a chamber **28** which is generally cylindrical in shape and

which is separated from the remainder of the cartridge chamber by the flange **26**. The chamber **28** provides a reserve chamber in which a reserve quantity of ink is retained by the meniscus which forms across the restricted area defined by the inner edge of the flange **26**. In the illustrated embodiment of the invention, the flange **26** is annular and defines a circular area of restricted cross-section between the auxiliary chamber **28** and the remainder or main portion of the cartridge chamber which is identified by the numeral **29**. The chamber **29** is thus the main ink supply chamber and the ink contained therein will be exhausted even though the reserve chamber **28** may remain filled with ink.

In order to prevent the ink in the reserve chamber **28** from freely flowing into the main chamber during use, the restricted area defined by the flange **26** is chosen such that the surface tension of the meniscus formed by the ink across such area is sufficiently strong to hold the reserve chamber **28** filled with ink even though the cartridge is held upright and is subjected to the occasional jarring and bumping which a writing instrument normally encounters. On the other hand, the restricted area formed by the flange **26** is sufficiently large so that the meniscus can be broken by sharply tapping the front end of the writing instrument against a hard surface such, for example, as a normal writing surface. For aqueous types of ink, it has been determined that a circular restricted area having a diameter of approximately 0.132 inch has the desired characteristics when used with linear polyethylene.

Another factor which must be considered in determining the size of the restriction is the adaptability of the cartridge to efficient molding techniques. By employing a flexible plastic for the cartridge, the flange is sufficiently flexible to permit facile withdrawal of a one piece core pin after the cartridge is molded.

By providing the flange **26** and the associated restricted area at a predetermined location in the cartridge, there is provided a reserve chamber **28** of predetermined size which will remain filled with ink during normal use of the pen. Therefore, when a person using a pen finds that it runs dry for the first time, he may merely tap the nib of the pen against the surface on which he is writing and will thereby break the meniscus formed across the restricted area at the location of the flange **26** whereby the ink from the reserve chamber **28** flows into the main chamber **29** and thence to the feed system of the pen. A small supply of ink such, for example, as 0.1 cc. has been found to provide an adequate reserve supply so that by the time such reserve is used up the writer can have another cartridge available.

Throughout this specification and claims the term capillary dimension is used to define a dimension which is sufficiently small when used with a particular ink and cartridge material to result in a sufficient capillary force being exerted on the ink to transfer it along said dimension.

While the present invention has been described in connection with a particular embodiment thereof, it will

be understood by those skilled in the art that many changes and modifications may be made without departing from the true spirit and scope of the invention. Therefore, it is intended by the appended claims to cover all such changes and modifications as come within the true spirit and scope of this invention.

What is claimed is:

1. In an ink cartridge,

a rigid unitary, generally tubular plastic member closed at one end and defining a chamber therein, and

an integral annular flange extending inwardly from the inner wall of said member to define a restricted passageway of greater than capillary cross section connecting the adjacent portions of said chamber,

said flange being positioned nearer to said one end than to the other end of said member,

said passageway being of such cross-sectional area that, in normal usage of said pen, surface tension retains ink in one portion of said chamber, and that said surface tension is broken by intentionally jarring said pen.

2. The invention set forth in claim **1** comprising

means defining a capillary groove extending from said flange into proximity with said other end of said member.

3. An ink reservoir for insertion into a fountain pen embodying main and reserve ink supply chambers, wherein ink is transferrable from said reserve chamber to said main chamber without removing said reservoir from said pen or opening said pen, the ink reservoir comprising:

a unitary, generally tubular and relatively rigid plastic member closed at one end,

an integral annular flange extending inwardly from the inner wall of said member and defining main and reserve ink supply chambers therein, said flange defining a restricted passageway between said chambers,

said passageway being of such cross-sectional area that, in normal usage of said pen, surface tension retains ink in said reserve supply chamber, and that said surface tension is broken by intentionally jarring said pen, and

means defining a capillary groove extending from said flange substantially the length of said main supply chamber, said annular flange extending farther inwardly from the inner wall of said member than do said means defining said groove.

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