Dec. 13, 1955 F. R. WITTNEBERT 2,726,639

FOUNTAIN PEN

Filed Feb. 25, 1953 2 Sheets-Sheet 1

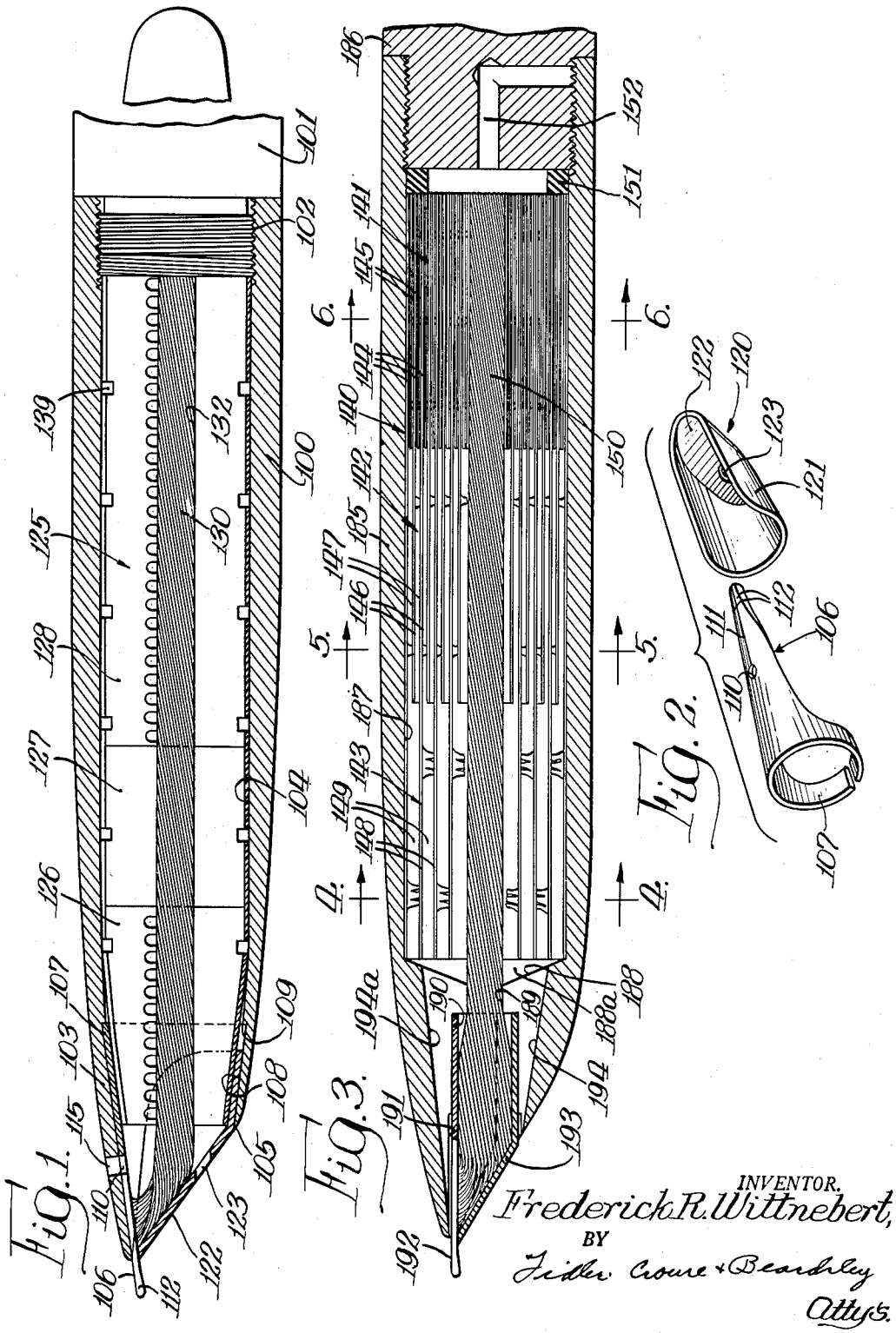

Fig. 1.

Fig. 3.

Fig. 2.

INVENTOR.
Frederick R. Wittnebert,
BY
Fidler Crowe & Beardsley
Attys.

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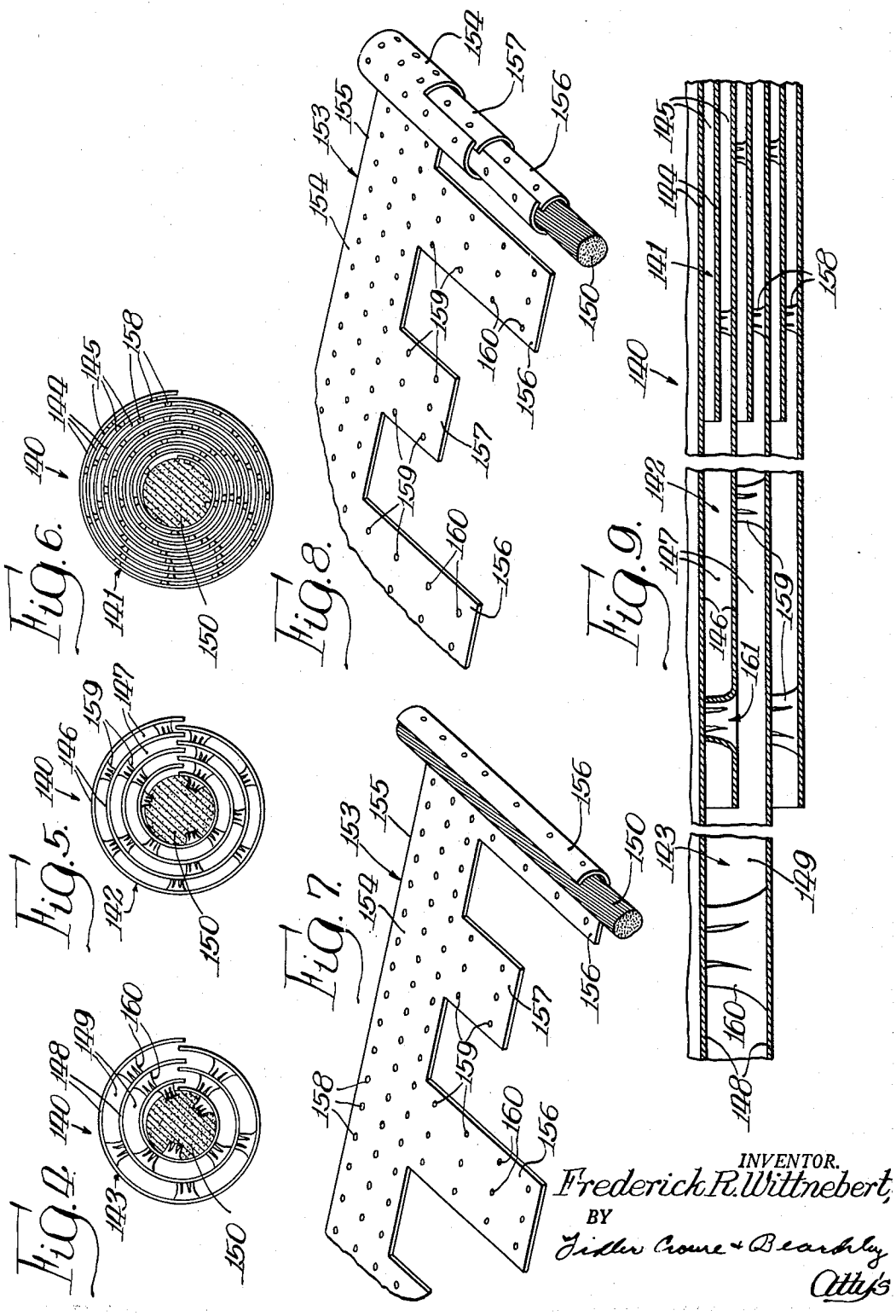


INVENTOR.
Frederick R. Wittnebert,
BY
Fidler Crowe & Beardsley
Atty's

United States Patent Office

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2,726,639

# FOUNTAIN PEN

Frederick R. Wittnebert, Chicago, Ill., assignor to The Parker Pen Company, Janesville, Wis., a corporation of Wisconsin

Application February 25, 1953, Serial No. 338,823

7 Claims. (Cl. 120—50)

The present invention relates to fountain pens and has to do particularly with fountain pens of the type wherein the ink reservoir is adapted to be filled by capillary action, the ink is held in the reservoir by capillary action and the ink is fed therefrom by capillary action to a writing surface when the pen is used in writing.

An object of the invention is to provide an improved fountain pen of the foregoing character.

Another object is to provide a fountain pen of the capillary type, of novel construction having a plurality of capillary ink storage spaces or cells extending longitudinally of the pen and formed with greater capillarity at the portion thereof more distant from the writing end of the pen than at the portions nearer to the writing end of the pen.

A further object is to provide a capillary filler element for a fountain pen, having a plurality of capillary spaces or cells extending longitudinally thereof and so formed that the capillarity of the spaces at the various portions of the filler element corresponds generally with the distance of such portions from the writing end of the pen, and which is made of a single sheet of material.

A still further object is to provide a capillary filler element of the foregoing character which is made of a single sheet of material rolled into spiral form.

Another object is to provide a capillary filler element for a fountain pen, which is made of a single sheet of material and hence is relatively simple of construction and capable of being formed by simple manufacturing methods.

Still another object is to provide a fountain pen having a capillary filler element having graded capillarity longitudinally of the pen, in which the filler element is made of a single piece of material and hence the capillarity thereof can be accurately predetermined and easily maintained.

Other objects and advantages of the invention will be apparent from the following detail description taken in conjunction with the accompanying drawings in which—

Figure 1 is a fragmentary view, in longitudinal cross section, of the forward portion of a pen constructed in accordance with the principles of the present invention;

Fig. 2 is an exploded perspective view of a nib and enclosure member forming a portion of the pen shown in Figure 1;

Fig. 3 is a fragmentary view, in longitudinal cross section of another form of pen constructed in accordance with the principles of the invention;

Fig. 4 is a sectional view taken on line 4—4 of Figure 3, with the convolutions of the filler element in the background omitted;

Fig. 5 is a cross-sectional view taken on line 5—5 of Figure 3, with the convolutions of the filler element in the background omitted;

Fig. 6 is a cross-sectional view taken on line 6—6 of Figure 3, with the convolutions of the filler element in the background omitted;



Fig. 7 is a fragmentary and somewhat diagrammatic view showing the sheet from which the capillary filler element is formed in an initial step in forming the filler element;

Fig. 8 is a view similar to Figure 7 showing the sheet in a later step of the formation of the filler element; and

Fig. 9 is an enlarged longitudinal cross-sectional view of a portion of the capillary filler element showing the relative spacing between the convolutions thereof in the various parts of the element.

The present application is a continuation-in-part of my copending application, Serial No. 773,815, filed September 13, 1947, now Patent No. 2,670,711.

The fountain pen of the present invention may be made as a pocket pen having the usual cap or it may be made as a desk pen having the usual elongated tailpiece, or if desired it may be made as a convertible pen which can be used either as a pocket pen or a desk pen.

Referring now particularly to Figure 1 of the drawings, the pen includes a pen body or barrel including a front section **100** and a rear section **101**, detachably connected to the front section as by a threaded joint **102**. The body may be formed of any suitable material such as metal or a plastic and preferably is formed from a plastic such as "Lucite" (methyl methacrylate resin). The forward body section **100**, which preferably terminates at its forward end in a tapered portion **103**, is formed with a bore **104** extending longitudinally therethrough and opens to the exterior of the pen in a forward opening **105**.

Carried at the forward end of the pen body is a writing element which preferably takes the form of a pen nib **106**. The pen nib **106** (Figure 2) has the general form of a portion of a cone and at its rear end is provided with a split ring portion **107** adapted to resiliently and frictionally engage against a tapered portion **108** of the bore and to bear against a shoulder **109** for the purpose of positioning the nib within the forward end of the body with only the forward writing tip projecting therefrom. The nib **106** is formed with a slit **111** providing two flexible nib sections **112**, and with a pierce **110** which registers with an air opening **115** formed in the upper wall of the forward section **100** of the pen body for a purpose which will hereinafter appear.

For the purpose of substantially closing the open forward end of the pen body and for retaining the feed element, hereinafter described, in ink feeding relation with the nib, an end piece or shoe **120** is provided which has a generally trough shaped body **121** adapted to fit into the tapered portion **108** of the bore forwardly of the nib **106**. The edges of the body portion **121** are generally complemental in shape to the edges of the nib so that the end piece fits against the nib when these two members are in position in the pen body. The end piece is provided with a forward end wall **122** preferably inclined, as illustrated, and having its periphery conforming generally to the periphery of the opening **105** in the end of the pen body and providing, in effect, a continuation of the external contour of the pen body. The end wall **122** is formed with an ink inlet opening **123** below the center thereof for the purpose of admitting ink into the interior of the pen as hereinafter more fully described.

The interior of the forward body section **100** provides an ink reservoir chamber or space in which is located a capillary filler-and-reservoir element **125** (hereinafter called a "filler element") which is adapted to be filled with ink by capillary action when the writing end of the

pen is inserted in a supply of ink. The capillary filler element **125** has a plurality of passages or ink storage spaces therein suitably connected and adapted to be placed in communication with the supply of ink and to draw ink therein by capillary action. The capillary ink spaces are of such capillarity that they retain ink therein by capillary action when the pen is not in use and permit ink to be withdrawn therefrom when the pen is used in writing. The capillary storage spaces, together with the ink feed means connected between these spaces and the nib slit maintain the ink in the pen entirely under capillary control at all times and there is no free body of ink within the pen subject to influences which tend to cause leakage in fountain pens of the type having a reservoir containing a free body of ink.

The capillary filler element **125** includes a plurality of elongated partitions or fins **126** extending longitudinally of the pen body and disposed in generally radial arrangement to define therebetween a plurality of longitudinal spaces or passages of generally wedge-shaped cross-section and of capillary width. The fins **126** terminate inwardly short of the center of the capillary filler element **125** to define a longitudinally extending central space **132** which provides inter-communication between all of the capillary spaces **129**.

The capillary spaces between the fins are each connected in ink feeding relation with the nib slit **111** by a feed element **130** which is so formed as to provide a plurality of capillary passages extending from the inner open longitudinal edges of the spaces between the fins to the nib slit **111**. The feed element **130** may be formed in various ways but preferably is formed as a wick consisting of a large number of fibers or threads of suitable material. In one specific embodiment of my invention excellent results were obtained by forming the wick as a bundle of essentially parallel spun glass filaments. Other materials which have been found suitable for forming the wick are animal or vegetable fibers, or nylon and in one embodiment the wick was formed of 20 denier nylon threads each consisting of 20 filaments. Preferably the material should be one which is not absorbent and which is not detrimentally affected by inks of the types used with the pen. The feed element extends preferably throughout the entire length of the capillary filler element and at the forward end thereof projects beyond the end of the capillary filler element and into direct contact with the underside of the pen nib adjacent the slit therein. Preferably the feed element is of sufficient length so that it is held against the underside of the pen nib and capillary passages are maintained in ink feeding relation with the nib slit.

Means are provided in the pen of my invention for venting the interior to atmosphere to maintain the air substantially at atmospheric pressure thereby permitting the pen to fill rapidly by capillary action and permitting ink to be withdrawn under capillary control when the pen is used in writing. In addition, the equalization of pressure between the exterior and interior of the pen renders the pen substantially insensitive to changes in atmospheric pressure whereby in the event that atmospheric pressure should be reduced, as for example, when the pen is carried to a high elevation there is no tendency for ink to be forced from the pen as often occurs in the case of fountain pens wherein ink is retained within the pen by the maintaining of subatmospheric pressure within the ink reservoir. Similarly, the equalization of pressure prevents any tendency of the ink flow to be blocked during writing such as might occur upon an increase in atmospheric pressure.

Equalization of pressure between the interior and exterior of the pen is effected by providing an air pressure equalizer or vent passage which extends longitudinally of the capillary filler element preferably throughout the length thereof and communicates with all of the capillary ink spaces in the capillary filler element. As



shown and described in detail in the above mentioned copending application, the vent passage is provided by so forming the capillary filler element that a generally wedge-shaped passage is provided between a pair of adjacent radial fins, which extends inwardly into communication with the central space **132**. The vent passage communicates with ink of the cells in the manner described in the above mentioned application, and extends to the space forwardly of the filler element which is in communication with atmosphere through the nib piece **110** and the air inlet port **115**. In certain cases it may be found desirable to provide a space within the interior of the pen body at the rear of the capillary filler element, as in Fig. 3, which serves to connect the rear ends of each of the capillary spaces between the fins with the rear end of the air vent passage.

In order to provide the maximum ink capacity in a pen of any predetermined size, the ratio of total void space to the total volume of space within the ink reservoir is made as great as possible, consistent with the requirement that the capillary spaces be of suitably small width to provide the necessary capillarity to draw ink into these spaces and retain it therein by capillary action. Accordingly, the fins forming the capillary filler element are made as thin as practicable consistent with mechanical strength and rigidity thereby providing as great a number as possible of capillary spaces or cells of predetermined wall-to-wall width or thickness.

It will be understood that the narrower the cells the greater will be the capillarity exerted thereby on ink contained in the cells. The cells are made of such width that they exert sufficient capillarity to draw ink therein during filling to fill the cells substantially throughout their entire lengths and to retain ink therein when the pen is not in use. The capillarity of the cells, however, is not so great as to prevent ink from being withdrawn from the cells by capillary action established between the writing tip of the nib and a writing surface when the nib is placed in contact with the writing surface during writing. In order to insure that ink will be drawn into the capillary cells during filling, when the end of the pen is inserted in a supply of ink, it is necessary that the cells have such capillarity as will lift the ink substantially to the top-most portion of the cells, at least at the narrowest portion adjacent the feed element, when the pen is held in filling position.

The width of each portion of each cell at any point throughout the length of the cell theoretically should be such as to provide the necessary capillarity to lift a column of ink to that particular point of the cell during filling. However, for convenience in manufacturing, the cells are not dimensioned so that they increase in capillarity continuously from the writing end of the pen toward the rear end of the pen; but the capillary filler element is formed in a plurality of longitudinally adjacent sections in each of which the cells are of greater capillarity than the section next nearer the writing end of the pen.

This progressive increase in capillarity may be accomplished conveniently in a capillary filler element by providing a greater number of cells in the sections in which it is desired the cells shall have the greater capillarity. For example, the capillary filler element **125** is formed by three sets of fins **126**, **127**, and **128**, the fins in the three sets being of different lengths. Thus, the cells provided in the forward section of the capillary filler element are defined only by the long fins **126**; the cells provided in the second or intermediate section of the capillary filler element are defined by the long fins **126** and the fins **127** of intermediate length and the cells formed in the third or rear section of the filler element are defined by the fins **126**, **127** and the short fins **128**.

As is brought out fully in the above copending application, the fins extend inwardly from a surrounding web which includes a backing sheet having annular passages **139** spaced longitudinally of the filler element, for pro-

viding relatively free air communication between the capillary spaces and the longitudinal air vent passage referred to above.

While the foregoing embodiment of the invention includes a plurality of individual sheets or pieces arranged radially to form a filler element, the invention also encompasses a filler element formed in a spiral or convolute shape, and in which the spiral or convolute filler element is formed from a single sheet of material. The filler element, as will hereinafter appear, is formed from a sheet having such shape that when it is rolled into spiral or convolute form, the filler element thus formed includes sections in which the capillary spaces formed are of graded capillarity so that those in the section most remote from the writing element are of greater capillarity than the spaces in the sections nearer the writing element. Such a filler element is disclosed in Figs. 3 to 9.

The pen of Fig. 3 includes a body of any suitable form and having, for example, a forward body section **185** and rearward body section **186** detachably secured thereto. The pen body may be made of any suitable material of the character referred to in connection with the pen body of Fig. 1. The forward body section is formed with a bore or chamber **187** defining an ink reservoir space and having a dished forward end wall **188**. A bore **189** leads forwardly from the chamber **187** and communicates with a counterbore **190** extending through the forward end of the pen body and which preferably is provided with an enlarged or counterbored portion **191** at the forward end thereof.

A writing element, which preferably takes the form of a slitted nib **192**, is seated in the counterbore **190** and a shoe **193** cooperates with the nib **192** in a manner generally similar to that described in connection with the form of pen shown in Figure 1; in the present embodiment, however, the nib and shoe are held in position solely by friction.

Leading from the chamber **187** and through the forward end of the pen are a plurality, and preferably two, filling slots **194** and **194***a* of generally V-shaped cross section which provide passages for the entry of ink into the pen during filling as hereinafter more particularly described. The capillary filler element **140** of Figures 3 to 9 is made up of a single thin-walled member of sheet form (Figs. 7 and 8) rolled into convolute form, defining capillary ink storage spaces between adjacent wall portions formed by the convolutions of the rolled element. The sheet member from which the filler element is formed is provided with a plurality of portions of respectively different dimensions which in the rolled condition of the sheet member form wall portions of respectively different lengths, and sections of the filler element in which the adjacent and opposed wall portions are more numerous and more closely spaced in certain sections than in others. In the sections in which the wall portions are more closely spaced, the spaces between the adjacent wall portions are of lesser width and of greater capillarity. When the sheet is rolled and the filler element formed, the capillary spaces in the different sections are respectively graded in dimension and capillarity longitudinally of the filler element, that is, the spaces of greatest capillarity are disposed at one end of the filler element, whereby the filler element is adapted for insertion in the pen body in such a way that those capillary spaces of greatest capillarity are disposed most remote from the writing element in accordance with the desired relationship of the filler element **125** of Fig. 1 described above.

The filler element **140** of Figures 3 to 10 includes a plurality of sections or stages, **141**, **142** and **143**, respectively, progressing from the rear end to the forward end of the pen, with the capillary spaces in the section **141** of least wall-to-wall dimension and greatest capillarity, the spaces increasing in dimension and decreasing in capillarity toward the forward end, successively in sections **142** and **143**. In the section **141**, the convolutions or wall portions **144** are relatively closely spaced and define cells or spaces **145** therebetween of small wall-to-wall dimension and great capillarity. In the section **142** the convolutions or wall portions **146** are more widely spaced, forming capillary spaces **147** therebetween of greater dimension and lesser capillarity than the spaces **145**. Similarly in the section **143** the convolutions or wall portions **148** are most widely spaced, forming capillary spaces **149** therebetween of greatest dimension and least capillarity of all the spaces.

The material from which the sheet forming the filler element **140** is made is preferably of minimum thickness but of sufficient mechanical strength and rigidity to maintain its own shape in normal use thereof. The material also must not be deteriorated by the ink or adversely affected thereby. The filler element may be formed either from a suitable metal foil as, for example, silver or from a plastic material such as "Vinylite"; for convenience in forming the filler element I prefer to use a metal. The sheet from which the filler element is formed is shown at **153** in Figures 7 and 8, and is generally elongated in one direction with a plurality of leg portions extending laterally from one edge thereof. The sheet member **153** includes a continuous strip portion **154** which forms the wall portions **144** in the section **141** of the filler element. The sheet member **153** is so shaped that the strip portion **154** has a substantially straight edge extending in the longitudinal direction of the sheet member, and extending laterally from its other edge are a plurality of legs or portions **156** and **157**, respectively, alternately relatively short and long, and mutually spaced apart longitudinally along the sheet member. The short legs **157** together with the inner portions of the long legs **156** form the wall portions **146** of the central section **142** of the filler element. The outermost end portions of the long legs **156** form the wall portions **148** in the section **143** of the filler element.

The sheet member **153** is rolled into convolute or spiral form on the feed element **150**, on an axis transverse to the longitudinal direction of the sheet member. The feed element **150** is preferably in the form of a wick similar to the wick **130** described hereinabove. The feed element **150** is preferably longer than the greatest transverse dimension of the sheet member, that is, it is longer than the long legs **156** so that the feed element may extend longitudinally beyond the rolled filler element for providing means for engaging the pen nib **192** for establishing communication between the filler element and the nib.

Preferably the sheet member **153** is formed with one of the long legs **156** adjacent one end for aiding in properly positioning the feed element relatively to the sheet member in the rolling operation. In rolling the sheet member into convolute form on the feed element, the latter is placed on the end of the sheet member in overlying relation to the long leg **156** at that end (Fig. 7), with the longitudinal axis of the feed element transverse to the sheet member. One end of the feed element is disposed in register with the straight edge **155** and the sheet member is then rolled on the feed element so that the straight edge **155** forms one end of the rolled filler element with the adjacent end of the feed element substantially flush with the thus formed end of the filler element.

The segments of the sheet member **153** constituted by the legs **156** and **157** and portions of the strip portion **154** in alignment therewith, and the portions of the strip portion between adjacent legs are relatively dimensioned longitudinally of the sheet member so that each segment forms one and only one substantially complete convolution in the rolled filler element. As the sheet member is rolled, it continuously increases in diameter, and the segments are therefore formed so that they are successively of greater dimension longitudinally of the sheet member from the end from which it is rolled to the opposite end, that is, each segment is of appropriate longitudinal dimension to form substantially one complete convolution

in the rolled element at the diameter determined by the length of the portion of the sheet member previously rolled. As will be noted from Figures 7 and 8, the legs **156** and **157** as well as the spaces therebetween are of progressively greater dimension longitudinally of the sheet member in the direction in which the sheet member is rolled, namely from right to left, as viewed in Figures 7 and 8. More specifically, it will be noted that the first long leg **156** at the right end is narrower than the space between that leg and the adjacent short leg **157**; similarly, the space just mentioned is narrower than the adjacent short leg; in a like manner the short leg is narrower than the space immediately to its left; and the progressive increase in dimension of the segments from right to left is carried out throughout the length of the sheet member.

In the rolling operation, as carried out in the manner mentioned above, the long leg **156** at the end of the sheet member and on which the feed element is placed and the corresponding part of the strip portion **154**, form one convolution around the feed element (Fig. 8) of a length equal to the transverse dimension of the sheet element from the straight edge **155** to the extended edge of the leg.

Upon continued rolling of the sheet member, the segment of the strip portion **154** between the first two legs forms the second convolution of the rolled filler element (Fig. 8). Upon further rolling of the sheet member the first short leg **157** forms the third convolution. Similarly the segment of the strip portion **154** between the first short leg and the second long leg forms the fourth convolution.

In the rolled filler element, all segments of the strip portion **154**, since the strip portion is continuous, cooperate in forming a succession of convolutions or wall portions **144** in the section **141** in the filler element. The short legs **157** and those portions of the long legs **156** in longitudinal alignment therewith form successive convolutions or wall portions **146** in the section **142** which are spaced apart a distance greater than the wall portions **144**, by reason of the intervening sections of the strip portion **154** (as well as the spacing projections to be referred to hereinafter). Similarly the outermost portions of the long legs **156** form a succession of convolutions or wall elements **148** in the section **143** but spaced apart a distance greater than the wall portions in the other two sections of the filler element.

In order that the capillary spaces between the adjacent wall elements formed by the convolutions in all of the sections of the filler element be properly and accurately spaced apart to define capillary spaces of the desired dimensions, spacing means in the form of projections on the sheet member are provided so that the projections on the convolutions engage respectively adjacent convolutions for spacing them apart the desired distances. It is also desired that the convolutions of the filler element be provided with apertures or perforations for establishing direct communication between radially spaced cells or spaces, although the filler element forms a continuous space of spiral cross section. The provision of the apertures or perforations enables more rapid passage of ink between adjacent spaces in radial directions, and hence more rapid filling of the pen by capillary action than would be the case if ink passage between the spaces occurred only in circumferential direction.

For the purpose of facilitating the manufacture of the filler element it is preferred that the projections and apertures be contained in a single element. In the preferred construction, the sheet member forming the filler element is subjected to a punching or piercing operation which forms apertures surrounded by transversely turned portions which form spacing projections. Such projections are shown in detail in Figure 9 where the projections **158**, **159** and **160** are disposed in the sections **141**, **142** and **143**, respectively, of the filler element.

The projections **158** are formed on the strip portion **154** and are of the least height so as to provide the desired spacing between the convolutions or wall portions **144** formed by the strip portion **154** to provide spaces therebetween of smallest dimension and greatest capillarity. The projections **159** formed on the short legs **157** and the inner portions of the long legs **156** in longitudinal alignment therewith are of intermediate height for providing greater spacing between the wall portions **146** in the section **142**. The projections **160** formed on the outer portions of the long legs **156** which form the wall portions **148** are of the greatest height for providing the desired spacing of those wall portions. The projections, instead of being formed as hereinabove described, may be formed merely as imperforate relief elements insofar as their function in spacing is concerned, but I prefer to form them by puncturing the sheet and thereby providing perforations or apertures **161** extending through the sheet and through the projections which serve to place the spaces on opposite sides of the wall portions in the rolled filler element in communication. Thus the projections not only function as spacing means but provide openings through the sheets for the passage of ink therethrough. It is within the concept of the present invention to provide, instead of the projections and apertures in the manner above described, imperforate projections and separate perforations (not shown) for providing respectively the desired spacing of the wall portions and ink passages.

Although the projections **158** on the wall portions **144** theoretically would serve to space the wall portions **146** and **148** apart the desired distance because of the normal rigidity of the filler element, it is nevertheless desirable to provide the projections **159** and **160** because the sheet member from which the filler element is formed is so thin that it might be accidentally bent or otherwise distorted out of its intended shape in which the various wall portions are properly spaced apart in the respective sections of the filler element.

The feed element functions as means for conducting ink by capillary action from the capillary cells in the filler element **140** to the nib. The feed element **150**, since the sheet member forming the filler element is rolled on it, extends centrally of the capillary filler element. It also extends throughout the length thereof, as pointed out above, and the extended forward end thereof extends through the bore **189** and into the space defined by the nib and shoe. The forward end of the wick is maintained in abutment with the slit of the nib **192** and the capillary passages in the wick thus are connected in ink feeding relation with the nib slit.

The capillary passages in the feed element **150** are in ink feeding relation with the innermost capillary spaces of the filler element by reason of the openings in the convolutions of the portion of the sheet immediately surrounding the feed element. The outer convolutions of the capillary spaces are in communication with the inner convolutions of the spaces through the openings in the intervening convolutions of the sheet. Moreover, by reason of the spiral form of the capillary spaces the several convolutions form a single space continuous in a circumferential or spiral direction.

The capillary filler element **140** may be maintained in the chamber **187** in any suitable manner and by way of example there is illustrated a ring or washer **151** of relatively soft resilient material, such as rubber, abutting the rear end of the capillary filler element and itself maintained in position by abutment with the forward end wall of the rear body section **186**.

For the purpose of venting the interior of the pen body, in order to maintain the air pressure therein substantially at atmospheric pressure I provide preferably a port **152** in the rear body section **186** which at one end is in communication with the chamber **187** and at its other end terminates adjacent the joint between the body sections whereby when the latter are slightly unscrewed the port is opened to the atmosphere. The pen

also may be vented through the ink filling openings **194** and **194***a* at its forward end and in certain cases it may not be necessary to provide any vent passage at the rear end of the chamber **187** although this is preferable in order to insure rapid filling.

In filling the pen, the end of the pen is inserted in a supply of ink preferably a sufficient distance to place the forward end of the capillary filler element **150** below the level of the ink. Ink enters the pen through the filling passages **194** and **194***a* and enters the capillary spaces **149** at their forward end. Ink rises in the capillary spaces by capillary action and completely fills the spaces to the top or rear end of the capillary filler element. Since the forward ends of all of the capillary spaces are in communication with the space **188***a* between the forward end of the capillary filler element and the forward end wall **188**, ink enters all of the capillary spaces simultaneously and rapid filling takes place. Air which is in the capillary spaces at the beginning of the filling operation is forced out by the incoming ink and, when a rear end vent is provided, passes out through such vent; where no rear end vent is provided the air is forced out through the forward end of the pen and bubbles up through the body of ink in which the pen is inserted. Inasmuch as all of the capillary spaces are in communication with adjacent spaces and since each space has an extensive cross-sectional dimension in a circumferential direction there is little, if any, possibility of an air bubble being trapped in any portion of the capillary space in a manner which would tend to block or retard the filling to any material extent.

In writing, the capillarity established between the writing tip of the nib and the writing surface draws ink from the nib which is immediately replaced by ink from the feed element **150**. The latter in turn is maintained in substantially saturated condition by reason of its being in ink feeding communication with the innermost capillary surfaces of the several sections of the capillary filler element. It will be understood that the capillarity of the feed element **150** is greater than that of the smallest spaces **145** of the capillary filler element and the capillarity of the nib slit is still greater, thereby insuring that ink will be drawn to the nib slit by capillarity so long as any ink remains in the pen. The space between the inner convolution of the filler element and the feed element is at least as small and of at least as great capillarity as any of the spaces in the filler element including the spaces **145**, so that there is no break in the passage of ink from any of the outermost spaces in the filler element to the feed element.

The capillary filler element is so constructed that the capillarity of the spaces **149** is sufficient to lift ink to the height of these spaces above the supply of ink and to maintain ink in these spaces at all times but insufficient to prevent ink from being withdrawn therefrom when the pen is used in writing. In a similar manner the capillary spaces **147** have sufficient capillarity to lift ink to the height of these spaces above the supply of ink, and in a similar manner the spaces **145** have the greatest capillarity which is sufficient to raise ink to the upper end of the capillary filler element during filling.

I claim:

1. A capillary filler-and-reservoir element for a fountain pen comprising a single member in sheet form including a generally elongated strip portion and a plurality of leg portions extending laterally from one side edge thereof and spaced apart longitudinally along the strip portion, said sheet member being rolled in convolute form on an axis transverse to the strip portion, with adjacent convolutions forming capillary spaces therebetween.

2. A capillary filler-and-reservoir element for a fountain pen comprising a single thin-wall sheet member including a generally elongated strip portion and a plurality of leg portions extending laterally from one edge thereof and spaced longitudinally along the strip portion, said leg portions successively increasing in width, in directions longitudinally of the strip portion, from a first end of the strip portion to the other end, said sheet member being rolled in convolute form from said first end on an axis transverse to the strip portion, with the convolutions thereof defining capillary spaces therebetween.

3. A capillary filler-and-reservoir element for a fountain pen comprising a single thin-wall sheet member including a generally elongated strip portion and a plurality of leg portions extending laterally from one side edge thereof, said leg portions being alternately relatively long and short and being mutually spaced apart longitudinally along the strip portion, said sheet member being rolled in convolute form on an axis transverse to the strip portion.

4. A capillary filler-and-reservoir element for a fountain pen comprising a single sheet member having a longitudinal dimension, rolled into convolute form from a first end on a transverse axis, said sheet member including a longitudinal strip portion and a plurality of leg portions extending laterally from one edge thereof, said leg portions being alternately relatively long and short and being mutually spaced apart longitudinally along the strip portion, the segments of said sheet member corresponding to said leg portions and the spaces therebetween successively increasing in dimension, in directions longitudinally of the sheet member, from said first end to the other end, and each segment being of a dimension to form a single complete convolution in the rolled element, the convolutions of the rolled element forming capillary spaces therebetween.

5. A capillary filler-and-reservoir element for a fountain pen comprising a single member in sheet form including a generally elongated strip portion and a plurality of leg portions extending laterally from one edge thereof and spaced longitudinally along the strip portion, said sheet member being rolled in convolute form on an axis transverse to the strip portion, said strip portion having a plurality of spacing projections extending from at least one surface thereof and said leg portions having spacing projections of greater height than the spacing projections on said strip portion extending from at least one surface thereof, whereby in the rolled element the projections on the respective convolutions engage the adjacent convolutions and space the several convolutions apart, said projections being dimensioned to form spaces of capillary size between adjacent convolutions.

6. A capillary filler-and-reservoir element for a fountain pen comprising a single member in sheet form including a generally elongated strip portion and a plurality of leg portions extending laterally from one edge thereof, said leg portions being alternately relatively long and short and being mutually spaced apart longitudinally along the strip portion, and being successively of increasing width, in directions longitudinally of the strip portion, from a first end of the strip portion to the other, said sheet member being formed in a roll about an axis transverse to the strip portion, and having spacing projections on at least one surface thereof of graded sizes, those projections on the strip portion being of least height, on said short leg portions and the parts of the long leg portions in longitudinal alignment therewith of intermediate height, and on the parts of the long leg portions laterally beyond the short leg portions of greatest height, all of said projections being dimensioned to form spaces of capillary size between respectively adjacent convolutions.

7. A capillary unit for a fountain pen comprising a single, thin-walled sheet member having a longitudinal strip portion with one relatively straight edge and a plurality of alternately relatively long and short leg portions extending laterally from the other edge and mutually spaced apart longitudinally of the strip portion, and having

a long leg portion adjacent a first end of the sheet member, and an elongated feed element having relatively small transverse dimensions and having capillary passages extending throughout its length, said feed element being longer than the greatest transverse dimension of the sheet member, said sheet member being rolled on said feed element on a transverse axis from said first end and with said one leg portion substantially in engagement with said feed element, said straight edge forming one end of the rolled member, said feed element having one end substantially flush with said one end of the rolled member and its other end projecting beyond the opposite end of the rolled member, said strip portion having projections



for spacing adjacent convolutions thereof apart and forming capillary spaces between adjacent convolutions, the spaces between adjacent convolutions formed by said leg portions having lesser capillarity than the first spaces, and the passages in said feed element having a capillarity at least as great as said first spaces.

**References Cited** in the file of this patent

UNITED STATES PATENTS

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|---|---|---|
| 2,587,949 | Zodtner | Mar. 4, 1952 |
| 2,670,711 | Wittnebert | Mar. 2, 1954 |