Jan. 19, 1954 E. W. RICKMEYER 2,666,416

WRITING INSTRUMENT

Filed Sept. 11, 1948

Fig. 1.

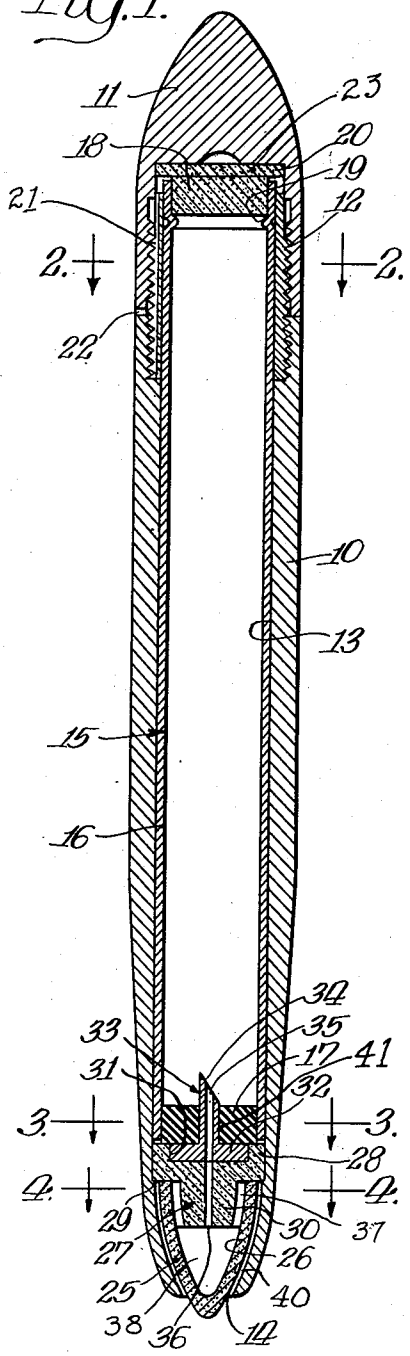


Fig. 2.

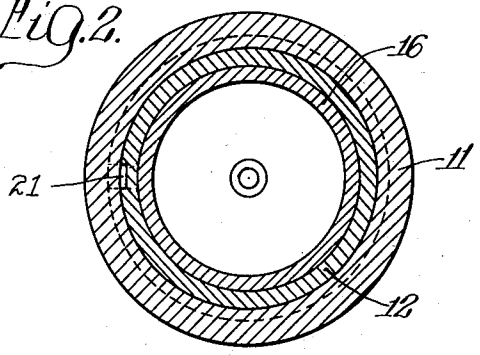


Fig. 3.

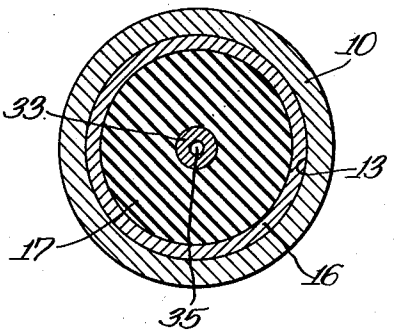
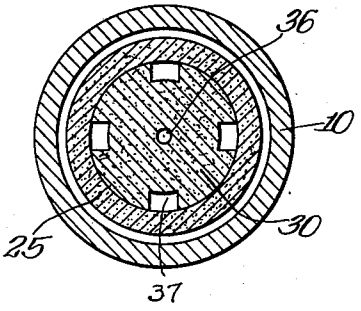


Fig. 4.



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WRITING INSTRUMENT

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Application September 11, 1948, Serial No. 48,837

3 Claims. (Cl. 120—51)

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This invention relates to ink-writing instruments and has to do particularly with a capillary writing point and ink feed means therefor.

An object of this invention is to provide an improved writing instrument.

Another object is to provide a writing instrument of the stylus point type having improved means for feeding ink to the writing point and for admitting air thereinto to insure a controlled and even feed of ink to the writing point.

Another object is to provide a writing instrument of the stylus point type capable of use with a relatively thick, pasty ink.

Another object is to provide a writing instrument of the stylus point type having an improved writing point formed from porous sintered metal.

Another object is to provide an improved writing element or point for a writing instrument of the stylus point type.

Another object is to provide an improved ink feed element for a writing instrument of the stylus point type.

A further object is to provide an improved ink cartridge for a writing instrument.

Another object is to provide a writing instrument having an improved venting arrangement.

Another object is to provide a writing instrument having a porous metal writing point which does not starve or flood when used in writing and which does not leak during periods of non-writing.

Other objects and advantages of the invention will appear from the following description taken in connection with the appended drawing, wherein:

Figure 1 is a longitudinal sectional view of a preferred embodiment of my invention;

Fig. 2 is an enlarged, transverse, sectional view taken along line 2—2 of Fig. 1;

Fig. 3 is an enlarged, transverse, sectional view taken along line 3—3 of Fig. 1; and

Fig. 4 is an enlarged, transverse, sectional view taken along line 4—4 of Fig. 1.

In accordance with my invention, a writing instrument is provided which is adapted for use with a relatively thick, somewhat viscous ink such as commonly employed in ball point writing instruments. The writing instrument of the present invention has a writing point or element formed from porous sintered material, the pores being of capillary size and serving to retain ink therein by capillary action except when the writing element is in contact with a writing surface. The writing element is formed as a hollow member having a closed forward end, thereby permitting air to enter into the interior of the member to prevent "locking" of the ink flow and to permit ink to be withdrawn readily from the member in writing.

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Referring now particularly to Fig. 1, the writing instrument includes a barrel or casing which preferably is formed by a forward barrel section 10 and a rear barrel section or end cap 11 detachably connected as by a threaded sleeve 12. While the barrel may be formed of barrel sections of nearly equal size, or with a long rear barrel section and short forward barrel section, I prefer to employ a construction such as that illustrated. The barrel defines a chamber 13 having an opening 14 at its forward end through which projects a writing element 25 hereinafter described more in detail.

The writing element 25 is disposed in the forward end of the casing 10 and takes the form of a hollow member formed of porous sintered metal. The writing element preferably is of generally tapered conical form, providing a principal body portion of substantial diameter and a forward tip portion of reduced size adapted to serve as a writing point and which is capable of depositing on a writing surface on ink line of the desired width. The porous sintered metal from which the writing element is formed preferably is made in the manner disclosed in my copending application entitled "Fountain Pens," executed August 17, 1948, Serial No. 45,823, filed August 24, 1948. The porous sintered metal is formed with interconnected pores which provide capillary spaces of sufficient size to permit the ink to be drawn therein by capillary action when the sintered metal member is placed in ink feeding communication with a supply of ink and at the same time sufficiently large to permit ink to be withdrawn therefrom by capillary action when the writing element is placed in writing contact with a writing surface. The pores are sufficiently fine to retain the ink by capillary action so that ink will not leak therefrom during periods of non-use of the instrument. I have found that satisfactory results may be obtained by forming the pores so that they have a wall-to-wall dimension of from around 0.006'' to around 0.008'' or somewhat larger. It will be understood that the hollow writing element is formed to the desired shape by molding in a suitable mold the material or materials from which the sintered metal is formed by the sintering operation, as more fully described in my aforesaid copending application.

Ink is delivered to the writing element 25 from the reservoir, hereinafter described more in detail, by an ink feed element 27 which preferably

is formed of porous sintered material in a manner generally similar to the writing element. The feed element 27 is formed with an enlarged head portion 28 adapted to seat snugly in the forward portion of the barrel, a small, rearwardly facing shoulder 29 preferably being provided to serve as an abutment to aid in positioning the feed element in the barrel. The head 28 preferably is formed with such diameter that it is held frictionally against rearward displacement when not otherwise securely held in the barrel. The feed element 27 has a body portion 30 extending forwardly from the head 28 and shaped to fit tightly within the open rear end of the writing element 25, with the periphery of the body portion 30 in firm abutment with the corresponding interior of the surface of the writing element 25 to securely retain the writing element 25 frictionally on the feed element 27. At the same time, the abutting surfaces of the feed element 27 and writing element 25 are in sufficiently intimate contact to place the pores of these two elements in ink feeding relation to provide for the transfer of ink from the feed element to the writing element. It will be noted that in the embodiment illustrated herein the forward face of the head 28 is in abutment with the rearward face of the writing element 25 and thus an additional connection is provided between the pores of the two elements.

The feed element 27 is formed in its rear face with a recess 31, preferably of circular shape and adapted to snugly receive the head portion 32 of a channel element 33 formed with a tubular stem 41 having a bore 35 extending therethrough and in alignment with a bore 36 extending axially through the body 30 of the feed element 27. The stem 41 is adapted to enter the ink reservoir to place the passage 35 in feeding communication therewith, thus providing a feed passage or channel leading from the interior of the reservoir to the body portion of the feed element 30.

While the ink reservoir may be defined in various ways, I prefer to provide an ink cartridge which is removable from the barrel and which is adapted to be filled with ink by the manufacturer and dispensed as a filled cartridge which may be inserted in the writing instrument by the user. To this end, the cartridge is so formed as to prevent ink from leaking therefrom when the cartridge is stored or shipped but is adapted to be placed in condition for use by merely inserting it in the barrel of the writing instrument. The cartridge 15 preferably includes a tubular casing 16 closed at its forward end by an imperforate, puncturable closure member 17 formed of rubber or equivalent material and suitably secured in the forward end of the casing 16 in such manner as to prevent leakage of ink therefrom so long as the closure member 17 remains imperforate. To this end the forward end closure preferably is adhesively secured in the casing 16.

The rear end of the casing 16 preferably is closed by a closure member 18 adapted to prevent ink from leaking from the casing but at the same time adapted to permit air to enter the casing to replace ink which is withdrawn from the casing 16 in writing. Preferably, the rear end closure 18 is formed of porous sintered metal having pores of such size as to permit air to pass therethrough but sufficiently fine to prevent ink from leaking from the rear end of the cartridge. The rear end closure 18 is suitably secured in the rear end of the casing 16, a shoulder 19 being provided for aiding in positioning the rear end closure.

The interior of the casing 16 is vented through the rear end closure 18 and, when the cartridge is in position in the barrel 10, the reservoir is vented to the exterior of the pen through a vent slot 21 formed in the metal sleeve 12 and a port 22 suitably located, as, for example, at the juncture of the barrel 10 and rear end cap 11. In order to insure the desired venting action, a seating element 23 is provided which takes the form of a disc of material similar to the rear end closure 18. The disc 23 is snugly seated in the rear end cap 11 in position to be abutted by the rear end closure 18 when the cartridge 15 is assembled in the barrel 10 and the rear end cap 11 is in position. Thus, the pores in the seating disc 23 provide vent passages connecting the pores in the end closure 18 with the interior space in the end cap 11.

The ink cartridge is adapted to be inserted in the barrel 10 from the rear end and forced home against the rear face of the feed element 27 and the rear face of the head 32. When it is thus forced home the sharpened or barbed end 34 punctures the forward closure member 17 and enters the reservoir to place the rear end of the feed passage 35 in communication with the interior of the reservoir. Ink therefore flows through the passages 35 and 36 and is drawn from the latter by capillary action into the feed element 27, particularly at the body portion thereof. Ink, in turn, is drawn from the feed element 27 by capillary action into the writing element 25 and stands at the outer surface thereof. Preferably the writing element 25 is formed of pores of slightly smaller size than the pores of the feed element 27 to insure that ink will be drawn into the former so as to maintain ink in the same, so that the instrument is in condition for instant writing.

In writing, when the forward end of the writing element is placed in contact with a writing surface, the capillary thus established draws ink from the writing element, and ink to replace the withdrawn ink is drawn into the writing element from the feed element. Air to replace ink which is withdrawn from the reservoir enters the writing instrument through the port 22, the vent slot 21, the pores in the disc 23 and the pores in the inner end closure 18.

During periods of non-use, when the pen is not employed in writing, ink is retained in the reservoir by adhesion to the walls of the casing 16 and by the internal cohesions of the ink, as well as by the restriction imposed by the outlet passage 35. However, the gravitational force on the ink in the reservoir, aided by the capillary effect of the outlet passage 35, is sufficient to cause the ink to flow into the outlet passages 35 and 36, and the capillary attraction exerted by the pores of the feed element 27 causes ink to be drawn from the reservoir and into the feed element, from whence it is drawn into the writing element to replace ink withdrawn in writing. It has been found that where a porous capillary member of substantial wall thickness is employed, locking of the ink columns may occur, due to the inability of air to enter the pores behind the ink, thus causing an uneven withdrawal of ink, or even complete stoppage of the passage of ink, especially when the writing instrument is employed in rapid writing. In order to permit ink to pass readily along the spaces or pores in the feed element 27 and the writing element 25 to replace ink withdrawn from the latter in writing, the writing element, and preferably also the feed

element, are so formed and arranged that there are no relatively thick cross-sectional areas, and atmospheric pressure is applied to the surfaces of these elements on opposite sides of relatively thin wall portions. Thus, as ink is withdrawn from the writing element, air enters the pores and prevents any restriction on the passage of ink, or "locking," which might otherwise occur if the feed element and writing element were formed with very thick wall portions.

The writing element therefore is formed as a hollow member and is provided with a space **38** therein forwardly of the feed element, which space under normal conditions contains air at atmospheric pressure. The writing element is spaced slightly from the adjacent wall of the barrel to provide a space **40** into which air may enter to maintain the outer surface of the writing element at atmospheric pressure substantially over its entire area. In addition, the body portion **30** of the feed element preferably is provided with grooves **37** into which air may enter from the space **38** to further aid in the venting action.

Since air at atmospheric pressure is in contact with the outer face of the writing element, and also normally in contact with the inner face thereof, the ink in the pores of the writing element normally is under atmospheric pressure and therefore flows evenly along the channel provided by the pores as ink is withdrawn from the tip of the writing element. However, since air will enter empty pores more readily than ink, some air may be drawn into the pores as the ink is withdrawn, some of this air being drawn in from the outside of the writing element and some from the space **38**. Air will normally find its way through the wall of the writing element at some point and thus maintain atmospheric pressure within the space **38**.

Should ink tend to flow from the reservoir to the feed element and thence to the writing element at a more rapid rate than it is withdrawn from the writing element in writing, it will tend to "sweat" from the external surface of the writing element and will enter the space **40**. This space, however, is of sufficiently small size to retain the ink therein and prevent it from leaking through the forward opening **14** in the barrel. When ink stands in the space **40**, at least a portion of the external surface of the feed element is sealed against the entrance of air, thus restricting the venting action and diminishing the tendency of the ink to flow from the reservoir through the feed element and to the writing element. Upon further writing, ink is drawn into the writing element **25** from the space **40** before any further ink will be drawn from the reservoir. When a sufficient quantity of the ink has been withdrawn from the space **40** the venting action again takes place and permits further ink to be withdrawn from the reservoir.

When the ink in the reservoir has been exhausted by writing the cartridge may be removed and replaced by merely unscrewing the rear end cap and withdrawing the cartridge, whereafter a fresh full cartridge may be inserted and the rear end cap replaced.

It will be seen from the foregoing that the present invention provides a writing instrument which is very simple in construction and which can be made very inexpensively, but which at the same time is effective in operation. The writing point is of such form and so mounted

that there are no highly critical dimensions or spacings which must be observed in order to provide satisfactory operation. It is important, of course, that the pores in the feed element and writing element be of such size as to provide the desired passage of ink therethrough and the proper venting action. However, the dimensions of the foregoing elements and the positioning thereof in the barrel are not very critical.

The writing element is of such form and so mounted that there is no likelihood of clogging of the ink flow passages by lint from the pocket of the user or fibers or sizing material from the paper with which the instrument is used in writing.

The venting action insures an even flow of ink from the reservoir to the writing point, determined by the rate of withdrawal of ink from the writing point, and also insures against flooding such as might otherwise occur, as, for example, from the heating of the contents of the reservoir owing to the heat of the hand when the instrument is held in the hand in writing.

I claim:

1. In a writing instrument of the type having a casing with a vent opening in its rear portion, and an ink reservoir in said casing vented through said opening, the combination of a hollow, shell-like writing element formed of porous sintered metal the pores of which provide interconnected capillary ink feed spaces, said element being stationarily mounted in the forward end of the casing, and defining a chamber communicating with the atmosphere solely through said pores and through said reservoir, and ink feed means stationarily mounted in the forward end of said casing in constant engagement with the writing element, said ink feed means defining a first passage of substantially greater cross-sectional area than said pores extending from the reservoir to the interior of said writing element and a plurality of other passages of capillary size and of smaller size than said first passage connecting the latter with the pores of said writing element, said other passages communicating with said first passage throughout a substantial portion of the latter and with the pores of said writing element throughout a substantial area, said casing having a portion surrounding said writing element, except the writing tip thereof, and spaced from said element a distance providing a substantially uniform capillary space communicating forwardly with atmosphere for receiving and storing ink flowing from the reservoir in excess of that required for writing.

2. A writing instrument comprising a casing having an open end, an ink reservoir in said casing vented to atmosphere, a hollow, shell-like writing element formed of porous material the pores of which provide interconnected capillary ink feed passages, said writing element being stationarily mounted in the casing and having a closed writing tip projecting through the open end of said casing and defining an air chamber communicating with the atmosphere solely through the pores of said writing element and through said reservoir, the external walls of said writing element rearwardly of the tip being close to but spaced from the internal walls of said casing to define a substantially uniform capillary space communicating forwardly with atmosphere adapted to receive and retain ink which flows from the reservoir in excess of that required for writing, and ink feed means stationarily mount-

ed in said casing and constantly connecting said reservoir in ink feeding relation with the pores in said writing element at the portion thereof remote from said tip.

3. A writing instrument comprising a casing having an open end, a reservoir in said casing vented to atmosphere, a hollow, shell-like writing element formed of porous sintered metal the pores of which provide interconnected capillary ink feed spaces, said writing element having a closed writing tip and being mounted in said casing with said writing tip projecting through the opening in the casing and its external walls rearwardly of said tip spaced from but close to the interior walls of said casing to provide a capillary space vented through the open end of said casing and adapted to receive and retain ink which flows from the reservoir in excess of that required for writing, and an ink feed element in said casing formed of porous sintered metal the pores of which provide interconnected capillary ink feed spaces and which are connected to said reservoir, said feed element having a portion in firm abutment with said writing element, with the pores of said elements in ink-feeding relation, the pores of said writing element being of greater capillarity than the pores of said feed element, said feed element defining with said writing element an air chamber communicating with the atmosphere solely through the pores of said writing element and through said reservoir.

ERNST W. RICKMEYER.

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