Sept. 11, 1956 W. K. BECKWITH 2,762,337

WRITING INSTRUMENTS

Filed Dec. 4, 1952 3 Sheets-Sheet 1

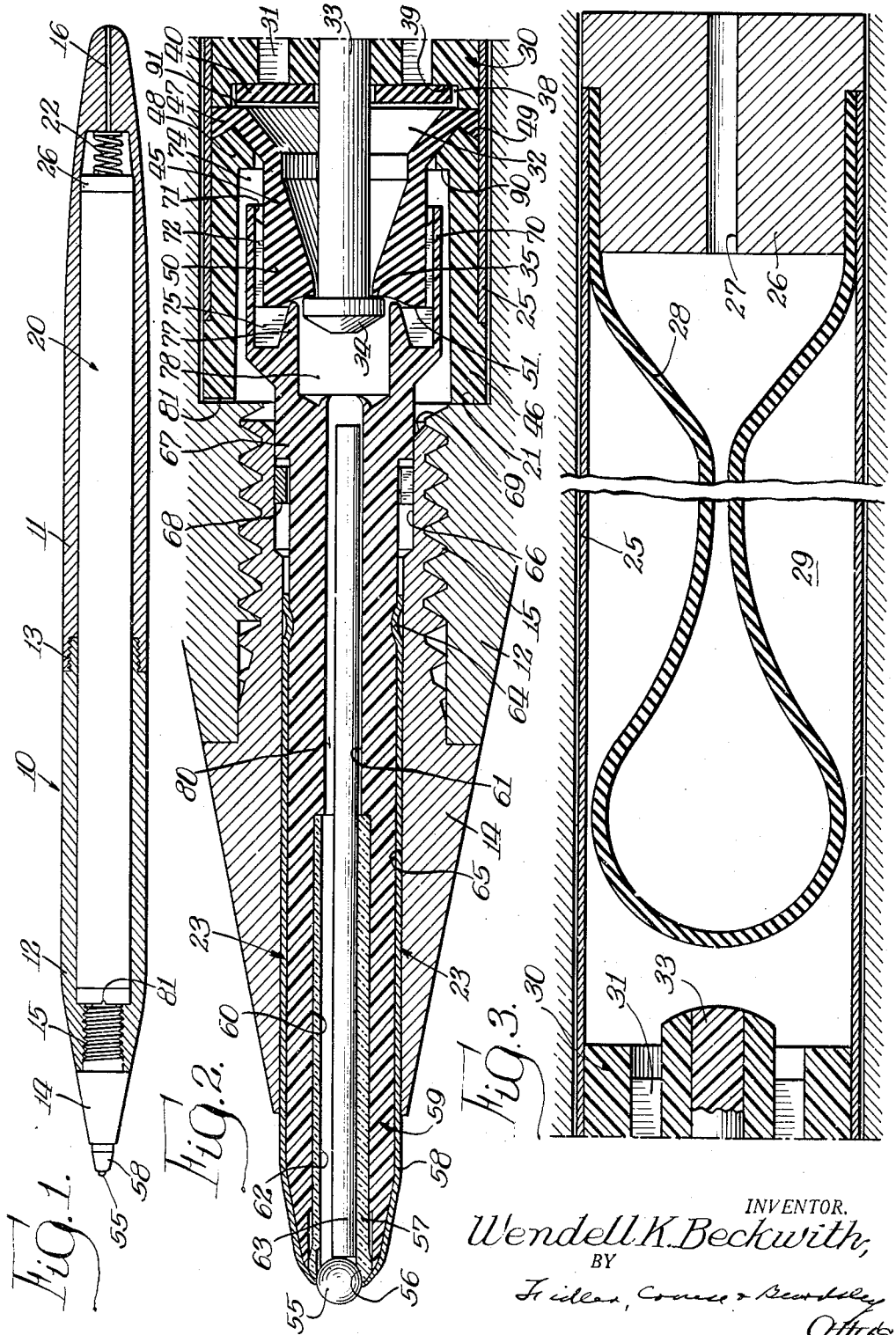


Fig. 1.

Fig. 2.

Fig. 3.

INVENTOR.
Wendell K. Beckwith,
BY
Fidler, Connor & Beardsley
Attys.

Sept. 11, 1956 W. K. BECKWITH 2,762,337

WRITING INSTRUMENTS

Filed Dec. 4, 1952 3 Sheets-Sheet 2

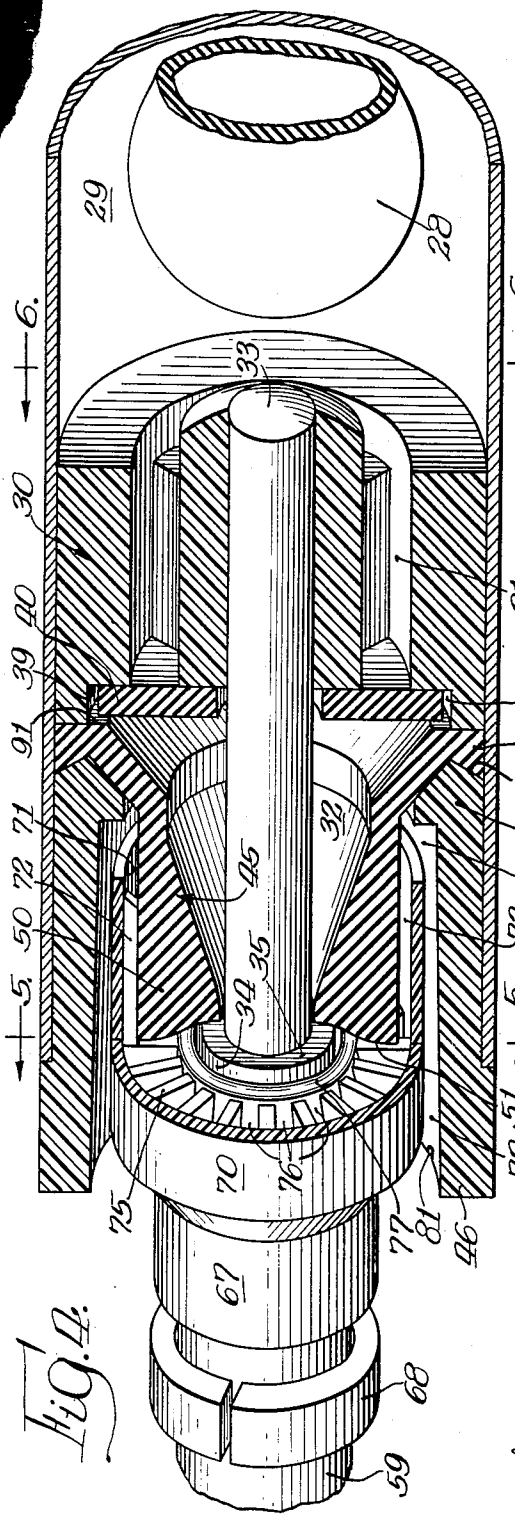


Fig. 4.

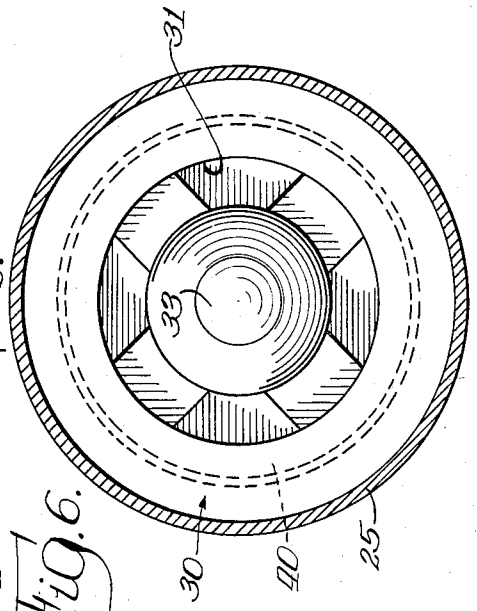


Fig. 6.

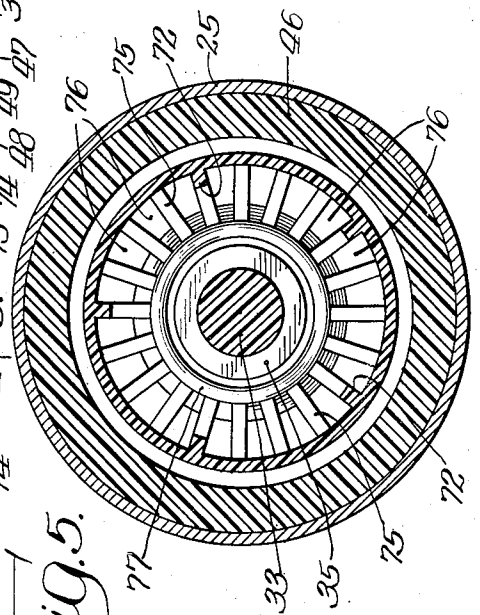


Fig. 5.

INVENTOR.

Wendell K. Beckwith,

BY

Fuller, Cowles & Beardsley

Attys.

Sept. 11, 1956 W. K. BECKWITH 2,762,337

WRITING INSTRUMENTS

Filed Dec. 4, 1952 3 Sheets-Sheet 3

Fig. 7.

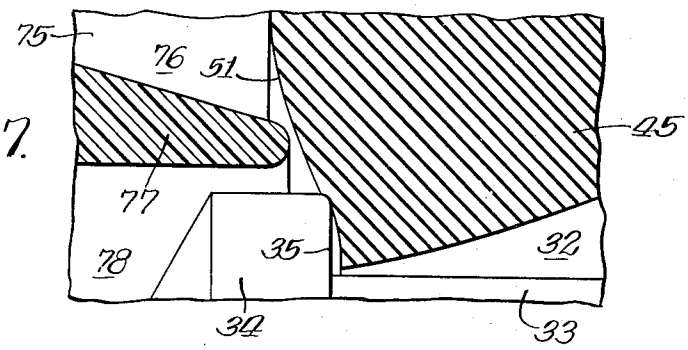


Fig. 8.

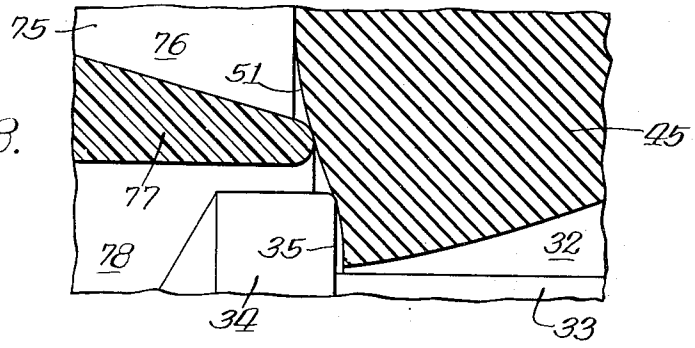


Fig. 9.

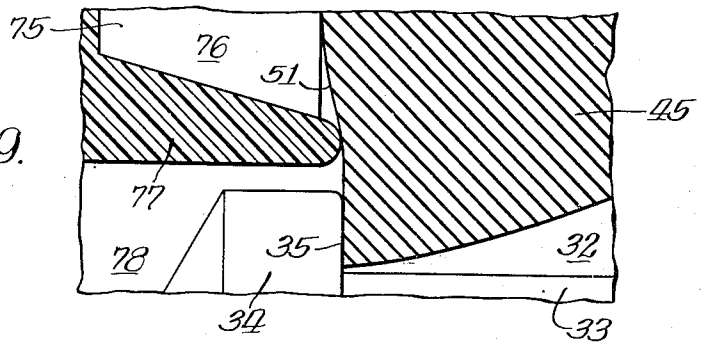
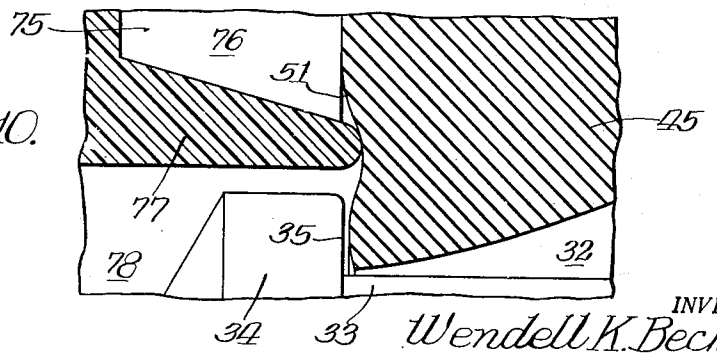


Fig. 10.



INVENTOR.
Wendell K. Beckwith,
BY
Miller, Cowan & Beardsley
Attys.

United States Patent Office

2,762,337

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WRITING INSTRUMENTS

Wendell K. Beckwith, Whitewater, Wis., assignor to The Parker Pen Company, Janesville, Wis., a corporation of Wisconsin

Application December 4, 1952, Serial No. 324,090

17 Claims. (Cl. 120—42.16)

This invention relates to writing instruments and has to do particularly with an ink reservoir and means for feeding ink from the reservoir to the writing point. The invention finds particular application in connection with ball point writing instruments.

An object of the present invention is to provide a writing instrument of the type having a ball writing point wherein the ink is retained against leakage resulting from the forces of gravity, regardless of the position of the pen, or resulting from thermal expansion of the ink or air within the instrument, or from internal pressures resulting from a lowering of surrounding atmospheric pressure, or resulting from kinetic shock applied in any direction.

Another object of the invention is to provide an ink container or reservoir which is removable from the writing instrument and which is sealed against leakage of the ink both when the container is in place in the writing instrument and when it is removed.

Another object of the invention is to provide an ink container for a writing instrument in which the ink is sealed against contact with the atmosphere and thereby prevented from deterioration such as would otherwise result from contact with the atmosphere.

Another object is to provide an ink container which is removable from the writing instrument and which may be simply and easily installed in the writing instrument and removed therefrom, and which may be readily connected to the ink feed means leading to the writing point to establish a flow of ink to the writing point such as to permit uninterrupted writing.

Another object is to provide a writing instrument wherein ink is fed from an ink container or reservoir to the writing point under positive pressure sufficient to maintain a continuous column of ink from the reservoir to the point during application of the point to the writing surface under writing pressure and thus provide continuous uninterrupted writing.

Another object is to provide a writing instrument wherein means are provided for releasing air trapped in the instrument between the ink reservoir and the writing point.

Still another object is to provide a writing instrument wherein application of the point to a writing surface establishes a pressure on the ink which is in the instrument between the reservoir and the writing point and wherein such pressure is released upon release of pressure upon the writing point, and the interior of the instrument is vented to atmosphere.

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

Figure 1 is a side view partially in cross section of a writing instrument embodying the invention;

Fig. 2 is an enlarged fragmentary longitudinal sectional view of the forward portion of the pen of Fig. 1;

Fig. 3 is an enlarged fragmentary longitudinal cross sectional view of the rearward portion of the pen of Fig. 1;

Fig. 4 is an enlarged fragmentary perspective view partially in cross section showing a portion of the interior construction;

Fig. 5 is an enlarged transverse sectional view taken along line 5—5 of Fig. 4;

Fig. 6 is an enlarged transverse sectional view taken along line 6—6 of Fig. 4; and

Figs. 7 to 10 inclusive are enlarged fragmentary cross sectional views showing a portion of the pump mechanism in various successive stages of operation respectively.

Referring now particularly to Fig. 1 of the drawings, there is shown one form of writing instrument embodying the present invention. The writing instrument includes a casing **10** which may take any suitable form but which, for convenience, is formed by a rear casing section **11**, a forward casing section **12** detachably connected to the rear casing section **11** as by threaded connection **13**, and a tapered ferrule or nose bushing **14** connected to the forward casing section **12** as by a threaded connection **15**. The casing members **11** and **12** may be made of any suitable material as, for example, metal or a plastic, and the nose bushing **14** preferably is formed of metal. The interior of the casing **10** is suitably vented to atmosphere as by a vent **16**.

Disposed in the casing is a reservoir-and-pump unit or cartridge **20** maintained against a shoulder **21** formed in the casing, as by a spring **22**. A writing unit or point assembly **23** is slidably mounted in the casing and detachably connected to the reservoir-and-pump unit **20** in a manner hereinafter described in detail.

The reservoir-and-pump unit **20** includes a casing **25** which may be formed of any suitable material such as a metal, as aluminum or steel, or a plastic as "nylon," "saran," or others. The rear end of the casing **25** is closed by a vent plug **26**, having a vent opening **27** which plug serves to position and retain a sac **28** of flexible material which is impervious to the ink used in the pen. I have found that excellent results may be obtained by forming a sac from butyl rubber, although other synthetic materials may be used. The sac **28** has a normal or free shape which is tubular and its outside diameter is approximately equal to the inside diameter of the casing or housing **25**. The sac **28** is substantially limp and is such that it can displace itself to its original tubular shape when submerged in ink, collapsed and submerged to a depth equal to its length. The sac **28**, together with casing **25**, forms an ink reservoir chamber **29** and the sac serves in the nature of a diaphragm which is under substantially atmospheric pressure, to maintain ink within the reservoir in a continuous body and to prevent contact between the air and the ink; it also serves to prevent leakage of ink from the reservoir through the vent opening **27**. It will be seen that as ink is withdrawn from the reservoir chamber the sac **28** expands to follow the surface of the ink in contact with the sac in a manner which is well known. The vent plug **26** is of such dimension that when the sac is in the position shown, there is an interference fit which serves to retain the sac and vent plug in the casing **25**.

A pump-and-valve mechanism is provided at the forward end of the reservoir which serves, under suitable actuation of the writing unit, to withdraw ink from the reservoir and pump it under pressure toward the forward or writing end of the writing unit **23**. The valve portion of the mechanism includes a valve holder **30**, preferably formed of "nylon" and having an interference fit in the casing **25**. The valve holder **30** is formed with a plurality of longitudinally extending ink passages **31**, communicating with the reservoir chamber **29** and with a pump chamber **32**. The valve holder **30** serves to rigidly support a valve stem **33** which preferably also is formed of "nylon" and is fused or otherwise secured

to the valve holder **30**. The valve stem **33** extends forwardly through the valve holder **30** and through the pump chamber **32** and is formed at its forward end with an enlarged head **34**, having a highly finished face **35**.

The valve holder **30** is formed with an annular recess **38**, the bottom face **39** of which has a smooth, flat finish, and disposed loosely within the recess **38** is a check valve **40** of annular form and made preferably of silicone rubber. The valve **40** has slightly greater clearance with respect to the valve stem **33**, than with respect to the valve holder **30**.

A pump member **45**, preferably formed of silicone rubber, is disposed in the casing **25** in abutment with the forward end of the valve holder **30** and is retained by a pump retainer **46** preferably formed of "nylon" and having an interference fit with the casing **25**. The pump member **45** has a generally tubular form with a radially extending flange or rim portion **47**, which member when assembled in the casing **25** is compressed between an enlarged head **48** on the pump retainer **46** and the adjacent end of the valve holder **30**. The head **48** has an angular face **49** which expands the flange **47** into a liquid-tight sealing relation with the reservoir casing **25**.

The interior of the pump member **45** provides the chamber **32**, previously referred to, which chamber tapers toward the forward end of the pump member **45**, the latter having a tapered thickened wall portion **50** at its forward end. The end face **51** of the pump member **45** is normally flat but is normally forced into a curved shape (as shown particularly in Fig. 2 of the drawings) by its engagement with the head **34** on the valve stem **33**.

The writing unit or point assembly **20** is slidably mounted in the forward casing section **10** and the nose bushing **14** and is adapted to perform several functions as will appear from the description which follows.

The writing unit **20** includes a writing ball **55** seated in a ball seat **56** formed in a seat member **57**. The ball **55** is retained in the seat member **57** by a front point housing **58**. A rear point housing **59** has a forward portion telescoped into the front point housing and formed with a bore **60** telescopically receiving the ball seat member **57**. The ball **55** and ball seat member **57** preferably are formed of sapphire and glass respectively, in a manner similar to that disclosed in my co-pending application Serial No. 274,741, filed March 4, 1952, and the seat **57** preferably takes the form illustrated in Figures 1 to 4 of said application. However, any form of ball writing point and seat may be employed which operates satisfactorily with ink of the character with which this writing instrument is adapted to be used.

The rear point housing **59** is formed with a bore **61** in rearward continuation of the bore **60**, and a bore **62** is formed in the seat member **57** which, together with the bore **61**, forms an ink feed passage designated generally at **80**, leading to the ball seat **56**. In certain cases it may be found desirable to insert in the feed passage a feed member, such as a rod **63** which serves to reduce the cross-section of the feed passage and thereby increase the capillarity thereof.

The rear point housing **59** preferably is formed of "nylon" and the front point housing preferably is formed of a ductile metal resistant to corrosion by the ink and of sufficient wall thickness to maintain it clinched against the rear point housing as indicated at **64**, for maintaining these members in unitary assemblage and also for providing a liquid tight seal at the point of clinching.

The nose bushing **14** provided with a bore having a forward portion **65** and an enlarged rearward portion **66**, which bore is adapted to receive the writing unit **23** with a sliding fit and to guide it in its movement therein. The rear point housing **59** is formed with a portion **67** of enlarged diameter slidable in the enlarged bore portion **66** and a point retainer **68** which takes the form of a split metal ring, is resiliently seated in the enlarged bore portion **66** and serves to limit forward movement

of the writing unit **20**. The inner diameter of the retainer **68** is such as to provide clearance around the adjacent portion of the rear point housing **59** but is smaller than the external diameter of the front point housing **58**. Thus, the point retainer **68** serves to prevent accidental removal of the writing unit **20** from the nose bushing **14**. The latter is chamfered as at **69** in order to facilitate assembly of the writing unit **23** in the nose bushing **14**.

The rear point housing **58** is formed with an enlarged head portion **70** defining at its outer end a socket **71** adapted to receive the forward cylindrical portion of the pump member **45**. Extending radially inwardly from the inner wall of the head portion **70** are a plurality of ribs or lands **72** extending longitudinally along the wall. Preferably five such lands are provided which are preferably equally spaced and are preferably each of approximately square cross section. The lands **72** engage the peripheral surface of the pump member **45** with light interference or friction fit and the lands thus grip the pump member **45** with a clutch-like grip. Between the lands are a plurality of longitudinally extending spaces or passages **73** which communicate at their rearward ends with a chamber **74** defined by the pump retainer **46**. The chamber **74** is suitably vented to the interior of the casing **10** and then to atmosphere. To this end one or more grooves **81** may be provided in the forward face of the pump retainer **46**.

Forwardly of the ribs **72** are a plurality of fins or partitions **75** which extend radially inwardly from the wall of the head portion **70** and are arranged in spaced relation in a circumferentially extending series to define a plurality of chambers **76** of capillary dimension. The fins or partitions **75** extend inwardly to an annular rim **77** extending rearwardly from the base or forward portion of the head **70**. The outer surface of the rim **77** converges rearwardly. The rearward edge of the rim **77** is rounded as illustrated, for a purpose which will hereinafter appear and projects rearwardly a slight distance beyond the plane of the rearward and free edges of the fins **75**.

The head portion **70** contains a chamber or cup **78** which communicates with the ink feed passage **80** and receives the head **34** of the valve stem **33** and permits relative sliding movement between the writing unit **23** and the valve stem **33**. The chamber **78** may be considered a part of the feed passage **80** since it serves to conduct ink from the pump member to the writing point.

Operation of the ink feed system of the writing instrument of the present invention embodies a cycle brought about by actually causing the pen to contact the writing surface under pressure and by transposing the pen from one scribed figure to the next. The alternation of pressure on the writing surface and lack of pressure when the point is removed from the surface effects a reciprocating movement of the writing unit which actuates the pump and valve mechanism to pump ink toward the point. It should be explained at this point that rearward movement of the writing unit is yieldably resisted by the resiliency offered by the cylindrical portion **50** of the pump **45**, which resiliency returns the writing unit to its forward position when pressure on the point is released. The spring **22** is of such strength that there is no rearward movement of the unit **20** in the casing **10**.

When the writing instrument is in normal condition of non-use (see especially Figs. 3, 4 and 7) and no pressure is applied to the point, the chamber **78** is at atmospheric pressure. Communication between the chamber **78** and the exterior of the instrument is provided through the space between the rear end of the rim **77** and the forward face **51** of the pump member **45**, the capillary spaces **76**, the passages **73**, the chamber **74**, the vent groove **81**, the clearance between the cartridge housing or casing **25** and the casing sections **10** and **11**, and the vent opening **16**.

Since, as above explained, the ink reservoir chamber

29 is substantially at atmospheric pressure, all of the ink in the writing instrument, except possibly ink in the pump chamber 32, is at atmospheric pressure. After the instrument has been filled and operated, ink stands in the ink feed channel 80 but such ink, of course, is at atmospheric pressure.

When pressure is applied to the point in a direction to urge the writing unit 23 rearwardly—as is the case when writing pressure is applied—the rearward movement of the writing unit causes the rounded edge of the rim 77 to contact the forward surface 51 of the pump member 45 (see Fig. 8). This effectively seals the chamber 78 from the capillary spaces 76 and consequently from the atmosphere. The relative movement between the rear point housing 59 and the head 34 of the valve stem results in a reduction in volume of the chamber 78 as in progression from Fig. 8 to Fig. 9 of the drawings and the ink feed passage and the ink contained therein is placed under pressure and caused to feed to the ball seat 56 from whence it is removed by rotation of the ball 55 and applied to the writing surface.

Upon an increase in pressure on the point and consequent further rearward movement of the writing unit 23, the rearward faces of the fins 75 and the rim 77 progressively take up the compressive load exerted by the pump member 45 and the face 51 of the latter tends to assume a substantially flat, planar condition (see Fig. 9). Further rearward movement of the writing unit 23 causes the forward face of the pump member 45 to be moved away from the rear face 35 of the head 34, thus establishing communication between the chambers 32 and 78 (see Fig. 10). Further pressure on the writing unit 23 and consequent further rearward movement thereof further compresses the wall of the pump member 45 and results in a further reduction in volume of the pump chamber 32.

The check valve 40 is freely confined within the recess 38 and, as the volume of the pump chamber 32 is reduced, ink within that chamber tends to flow rearwardly and past the check valve 40 and into the ink reservoir space 29. No resistance to such flow is offered since the sac 28 is in neutral state and freely collapsible by the escape of air through the vent hole 27. The check valve 40 follows a rearward flow of ink until it comes to rest on the face 39 of the valve holder 30, whereupon the remaining ink in the pump chamber 32 is placed under pressure. Rearward movement of the writing unit 23 ceases when the writing pressure equalizes the opposing liquid pressure of the ink, together with the resilient resistance to deformation in the pump member 45. The stress on the pump member 45 in supporting the writing unit is approximately 40 grams, while normal writing pressure ranges from 50 grams to 175 grams. Thus, it will be seen that the major supporting thrust is distributed hydrostatically through the continuous column of ink which is in the feed passage 80, the feed chamber 78 and the pump chamber 32.

The initial reduction in volume of the pump chamber 32 causes the check valve 40 to seat in advance of the opening of communication with the pump chamber 32 and the cup or chamber 78, so that ink is placed under pressure within the pump chamber 32 before the latter is placed in communication with the chamber 78. Thus, there is no momentary drop in pressure in the column of ink such as might otherwise occur due to the rearward flow of ink prior to closure of the check valve 40.

Pressure on the ink in the chambers and passages forwardly of the check valve is maintained with the maintenance of writing pressure and ink feed is maintained by reason of the reduction in volume of the pump chamber 32, corresponding to the amount of ink consumed in writing. The limit of such volume reduction is attained when the rear face or edge of the head 70 engages the face 90 of the head 48. It should be noted that normally, continuous and steady writing pressure of such duration as to consume sufficient ink in the pump chamber 32 to allow such faces to contact is never realized in actual writing.

When pressure on the point is released, as when the point is raised from the writing surface, the resiliency of the forward, thickened portion 50 of the pump 45, together with the collapsed, stressed skirt 90 of the pump 45, urges the writing unit 23 forwardly. The pump chamber 32 thus increases in volume causing the check valve 40 to move away from the face 39 and rest against the face 91 of the pump member 45. Since some ink was withdrawn from the pump chamber 32 and consumed in writing, a reduction in pressure is created in the pump chamber 32 which causes a flow of ink from the reservoir space 29 through the passages 31 and around the check valve 40 into the pump chamber 32 to reestablish atmospheric pressure therein.

Further forward movement of the writing unit 23 allows the forward face of the pump member 45 to engage the head 34 and seal the pump chamber 32. Still further forward movement of the writing unit causes the rim 77 to be moved out of engagement with the pump member 45 and thus open communication between the chamber 78 and the atmosphere, through the capillary cells 76.

It is well known that ink in a pen is subject to both temperature and barometric pressure changes and such changes may result in forcing ink from the writing instrument. For example, the ink contained in the ink conduit of the present pen expands linearly approximately 0.001 inch per degree Fahrenheit increase in temperature. In the pen of the present invention, the feed chamber 78 is in communication with the capillary cells 76 when the pen is in a condition of non-use. Thus, when a temperature or pressure change occurs which would tend to force the ink from the pen, the ink is forced from the feed chamber 78 and into the capillary cells 76, which retain the ink therein by capillary action.

It will be noted that owing to the radial arrangement of the fins or partitions 75, the capillary cells 76 increase in width in an outward direction. Accordingly, the capillarity of each cell increases in a direction inwardly toward the rim and thus ink is retained at the radially innermost portion of the cell. Furthermore, because of the rearwardly converging outer surface of the rim 77, the cells have greatest capillarity at the rearward end of their innermost portions. Accordingly, when ink is withdrawn from the cell through the space between the rim and the front face of the pump member 45, it feeds toward the inner portion of the cell.

In the operation of the instrument and in attaching the cartridge to the writing unit, air finds its way into the chambers and passages within the instrument. An increase in temperature of the ink or lowering of atmospheric pressure results in an expansion of the air bubble and such bubbles cause extrusion of ink into the capillary cells. Air in the form of small bubbles can escape by way of the capillary cells where they migrate to the ink-air interface and escape to the atmosphere through the vent passages hereinbefore explained.

Upon the contraction of the ink due to the lowering of the temperature or an increase in atmospheric pressure, ink which has been extruded into the capillary cells reenters the chamber 78. In addition, it is pumped into the chamber 78 upon actuation of the writing instrument in writing. Such pump action is effected by the advancement of the rim 77 which first contacts the face 51 of the pump member 45 to seal the chamber 78 and then develops momentary pressure increase in the ink in the feed channel and the feed chamber which exists until the seal between the valve stem head 34 and pump member 45 is broken. The compressive action on the ink results from motion as shown between the conditions shown in Figs. 8 and 9 respectively. Upon the forward, return movement of the writing unit the seal between the valve stem head 34 and the pump member 45 is reestablished and a reduced pressure is developed in the ink which is in the feed

passage and in the feed chamber, as in going from the condition shown in Fig. 9 to the condition shown in Fig. 8. When the rim 77 is moved away from the face 51, this reduced pressure is relieved by drawing ink from the capillary cells or air, if no ink is in the cells.

The writing instrument of the present invention is especially well adapted for use with a relatively thin ink such as one having a viscosity of approximately 40 centipoises at 80° F., which ink should of course be compatible with the materials with which it comes into contact in the writing instrument. Since the ink is retained in the reservoir by the pump and valve mechanism, except when withdrawn by the writing action, it is possible to employ a relatively thinner ink than has heretofore been considered practicable in ball point writing instruments.

The present invention is also adaptable to a fountain pen of the type employing a slitted writing nib of conventional construction. In such case a slitted nib and a suitable feed means for delivering ink to the writing nib are substituted for the ball writing point seat and feed disclosed in the present application and are reciprocable to the unit and casing in a generally similar manner to that disclosed herein. The construction of the reservoir, valve and pump mechanism is similar to that shown in the drawings and described hereinbefore.

I claim:

1. A writing instrument comprising a casing having an ink reservoir with an outlet, means in the casing operative for constantly subjecting ink in the reservoir to atmospheric pressure, a flexible, resilient, tubular pump member positioned with its interior communicating at one end with the outlet of said reservoir, a check valve preventing flow from said pump member into said reservoir, a valve member fixed relative to said reservoir normally closing the other end of said pump member, said pump member being disengageable from the fixed valve member in rearward direction, a writing element, and a member carrying said writing element having a passage leading from said other end of the pump member to said writing element and reciprocable relative to said fixed valve member and engageable with said pump member to move it away from said fixed valve member and establishing communication between the pump member and passage upon movement of said reciprocable member in rearward direction.

2. A writing instrument comprising a casing having an ink reservoir, means including a flexible, resilient pump member defining a chamber having an inlet and an outlet with the inlet communicating with said reservoir, a check valve adapted to close communication between said pump chamber and said reservoir when the ink pressure in the pump chamber exceeds the ink pressure in the reservoir, valve means fixed relative to said reservoir normally closing said pump chamber outlet, and a writing unit reciprocable relative to said reservoir, said writing unit including a writing element, means defining an ink feed channel leading to said writing element adapted to communicate with said chamber outlet, and a head engageable with said pump member upon rearward movement of said unit to disengage the pump member from said fixed valve means to thereby open said outlet and distort the pump member and reduce its internal volume to thereby apply pressure to ink in said chamber.

3. A fountain pen comprising a casing having a reservoir, a writing unit mounted in said casing for longitudinal reciprocation therein in forward and rearward directions and having a writing element and a feed passage leading to the writing element, a resilient tubular pump element interposed between said reservoir and writing element and communicating with the reservoir and said feed passage, check valve means preventing flow from the pump element to the reservoir, and a member fixed relative to the casing engaged by the front end of the pump element when the latter is extended forwardly, the member thereby limiting forward extension of the pump element and closing the forward end thereof the rear end of said writing unit upon rearward movement thereof engaging said pump element and removing the latter from said member and establishing communication between said pump element and feed passage, said pump element being reduced in internal volume and thereby operative for pumping ink therefrom to the feed passage in response to rearward movement of the writing unit, said pump element urging the writing unit forwardly, said pump element and writing unit being relatively dimensioned for establishing a release passage therebetween from the feed passage to the exterior when the writing element is in its forward position.

4. A fountain pen comprising a casing having a reservoir, a writing unit mounted in the casing for forward and rearward reciprocation and including a writing element and a feed passage leading to the writing element, a tubular resilient pump element interposed between the reservoir and writing unit, a check valve preventing flow from the pump element to the reservoir, a valve member fixed relative to the reservoir engageable by the forward end of the pump element and closing the latter when so engaged, said writing unit having a continuous rim surrounding and spaced outwardly from said fixed valve member and operative upon rearward movement of the writing unit for engaging the pump element and removing it from the fixed valve member and establishing a closed passage between the pump element and feed passage, said pump element being reduced in internal volume and thereby operative for pumping ink therefrom in response to rearward movement of the writing unit, said writing unit and pump element forming a release passage therebetween from the feed passage to the exterior when the writing unit is in its forward position, and an annular collector surrounding the feed passage and including a plurality of grooves of capillary dimension positioned for receiving ink from the vent passage, each groove diverging radially outwardly.

5. A fountain pen comprising a casing having a reservoir with an outlet opening at its forward end, a writing unit mounted in the casing for forward and rearward reciprocation and including a writing element and a feed passage leading to the writing element, a tubular resilient pump element interposed between the reservoir and writing element with its rearward end communicating with the outlet of the reservoir and its forward end communicating with the feed passage, check valve means between the reservoir and tubular pump element preventing flow of ink from the pump element into the reservoir, a valve stem mounted in the reservoir and extending forwardly through the pump element and having an enlarged head forwardly beyond the pump element for engagement by the forward end of the pump element and operative to close the latter when so engaged, the forward end surface of the pump element being inclined forwardly and outwardly, the rear end of said writing unit having an annular rearwardly facing rim surrounding the head of said valve stem and spaced outwardly therefrom and positioned for engaging the forward end face of the pump element, a tubular head portion surrounding at least a portion of the pump element, and a plurality of fins between said rim and head portion and defining therebetween grooves of capillary dimension and diverging radially outwardly and opening only in rearward direction, said head portion having longitudinal, circumferentially spaced ribs for spacing the head portion from the pump element and thereby forming an air passage therebetween, said rim being operative in response to rearward movement of the writing element for engaging the forward end surface of the pump element and removing the latter from said valve stem head and establishing a closed passage between the pump element and feed passage, the peripheral portion of the forward end surface of the pump element being in constant engagement with the said fins and acting therethrough operative for biasing the writing unit forwardly, the writing unit

and pump element being relatively contoured for establishing a passage therebetween from said feed passage into the grooves defined by said fins.

6. The combination of claim 5 wherein the radial outer surface of said rim converges rearwardly whereby said grooves have greatest capillarity at their radially innermost and rearward portions.

7. A writing instrument comprising a casing having an ink reservoir and means constantly subjecting ink in the reservoir to atmospheric pressure, a writing unit mounted in the casing reciprocable relative to said reservoir and including a writing element and defining an ink feed channel leading to said writing element, said writing unit being movable in rearward direction in response to pressure applied to said writing element as in writing, a resilient tubular pump member having a chamber interposed between said reservoir and writing unit, check valve means interposed between the reservoir and pump member, the writing unit in response to rearward movement thereof engaging and distorting the pump member and reducing the volume of said chamber and thereby pumping ink from the chamber into said ink feed channel, and the pump member being effective for moving the writing unit forwardly upon release of writing pressure from the writing element.

8. A writing instrument comprising a casing having an ink reservoir and means constantly subjecting ink in the reservoir to atmospheric pressure, a writing unit mounted in the casing reciprocable relative to said reservoir and including a writing element and defining an ink feed channel leading to said writing element, said writing unit being movable in rearward direction in response to pressure applied to said writing element as in writing, a resilient tubular pump member having a chamber interposed between said reservoir and writing unit, check valve means interposed between the reservoir and pump member, the writing unit in response to rearward movement thereof engaging and distorting the pump member and reducing the volume of said chamber and thereby pumping ink from the chamber into said ink feed channel, and the pump member being effective for moving the writing unit forwardly upon release of writing pressure from the writing element, and means fixed relative to the reservoir extending from the pump member into the ink feed channel and coacting with said pump member and said writing unit to vary the volume of said ink feed channel upon reciprocation of the writing unit.

9. A writing instrument comprising a casing having a reservoir, means constantly subjecting ink in the reservoir to atmospheric pressure, a writing unit mounted in the casing reciprocable in forward and rearward directions relative to the reservoir and including a writing element and having an ink feed passage leading thereto, a pump including a resilient member defining a chamber, uni-directional valve means preventing flow from the reservoir to the chamber, said writing unit in rearward movement thereof engaging said resilient member and thereby establishing a continuous passage from the chamber to the ink feed passage and distorting the resilient member and thereby reducing the volume of the chamber forcing the ink toward the writing element through the feed passage, said writing unit in its forward position producing a release passage between itself and said resilient member for escape of ink from the feed passage in response to excessive pressure therein, and capillary collector means exteriorly of said feed passage and serially arranged relative thereto and thereby positioned for receiving all ink flowing through said release passage and having greatest capillarity nearest the release passage for holding ink thereat and effecting return of the ink therefrom into the ink feed passage by air flowing in that direction.

10. A fountain pen comprising a casing having a reservoir and including a construction constantly subjecting the ink in the reservoir to atmosphere, a writing unit mounted in the casing for reciprocation and having a writing element and an ink feed passage leading thereto, pump means separate from said writing unit but engageable by a sealing portion thereof upon rearward movement of the unit and actuatable upon reciprocation thereof for pumping ink into said ink feed passage, the pump means tending to extend forwardly and biasing the unit forwardly and engaging the unit at a second portion to move the sealing portion away from the pump means to provide a release passage thereat and the unit having a formation with said second portion continuing the release passage past the pump means, and a valve closing the outlet of the pump means when the latter is in forwardly extended position and the release passage is formed.

11. A writing instrument comprising a casing having a reservoir and a construction constantly subjecting ink in the reservoir to atmospheric pressure, a writing unit mounted for reciprocation in the casing and having a writing element and an ink feed passage leading thereto, a resilient pump member between the reservoir and unit actuatable by the unit upon reciprocation of the unit and operating to yieldingly restrain rearward movement of the unit, the pump member being normally closed and the unit in an initial portion of its rearward movement engaging the pump member and after a predetermined extent of rearward movement thereafter opening the pump member to the ink feed passage and operating the pump member to force ink into the passage, and means forming a rear wall to the passage having at least a portion fixed relative to the reservoir operative for reducing the volume of the ink feed passage in response to rearward movement of the unit between its engagement with the pump member and the opening of the latter.

12. A writing instrument comprising a casing having an ink reservoir and including a construction constantly subjecting ink in the reservoir to atmospheric pressure, a writing unit mounted in the casing reciprocable forwardly and rearwardly relative to the reservoir and including a writing element and an ink feed passage leading thereto, a pump member having a pump chamber providing ink-feeding communication between the reservoir and the feed passage engageable and actuatable by the writing unit in response to reciprocation thereof for pumping ink from said reservior through the pump member and feed passage to the writing element, means limiting forward movement of the pump member and thereby sealing the forward end thereof when the pump member is in forwardmost position, said pump member and writing unit being relatively dimensioned and positioned for sealing the pump chamber and feed passage to the exterior when interengaged and establishing a passage therebetween from the ink feed passage to atmosphere when the writing unit is in its forward position.

13. A writing instrument comprising a casing having an ink reservoir and including a construction operative for constantly subjecting ink in the reservoir to atmospheric pressure, a writing unit mounted in the casing reciprocable forwardly and rearwardly to the reservoir and including a writing element and an ink feed passage leading thereto, a pump member engageable by the writing unit when the latter is in rearward position providing ink-feeding communication between the reservoir and the feed passage actuatable by the writing unit in response to reciprocation thereof for pumping ink from the reservoir through the pump member and feed passage to the writing element, means limiting forward movement of the pump member and thereby sealing the forward end thereof when the pump member is in forwardmost position, said pump member and writing unit being relatively dimensioned and positioned for sealing the pump chamber and feed passage to the exterior when interengaged and establishing a release passage therebetween from the ink feed passage to atmosphere when the writing unit is in its forward position, and capillary overflow collector means

serially arranged relative to said release passage for receiving ink flowing through the latter.

14. The invention as set forth in claim 13 wherein said collector means includes capillary cells having greatest capillarity at a position closely adjacent said release passage.

15. A writing instrument comprising a casing having an ink reservoir and means constantly subjecting ink in the reservoir to atmospheric pressure, a writing unit mounted in said casing reciprocable relative to said reservoir and including a writing element and means defining an ink feed channel leading to said writing element, a resilient tubular pump element having a chamber with an inlet communicating with the reservoir and having an outlet end, check valve means between the reservoir and chamber, a stem fixed relative to the reservoir having a head engaged by the forward end face of the pump element when the latter is extended forward and closing the outlet of the chamber, said head extending at least partially into the feed passage, said head and forward end face constituting a rear end wall to the feed passage, the unit in an initial portion of its rearward movement engaging said forward end face of the pump element and upon continued rearward movement lifting the pump element from said head and establishing communication between the pump element chamber and feed channel, said rear wall operating to reduce the volume of said feed channel in response to rearward movement of the unit before the pump element is lifted from the head, and the unit after lifting the pump element from the head serving to distort the pump element and thereby reduce its internal volume and pump ink therefrom through the feed channel to the writing element.

16. The invention set forth in claim 15 wherein a release passage is formed between the unit and pump element when the unit is in forward position.

17. A writing instrument comprising a casing having an ink reservoir and means constantly subjecting ink in the reservoir to atmospheric pressure, a writing unit mounted in said casing reciprocable relative to said reservoir and including a writing element and means defining an ink feed channel leading to said writing element, a resilient tubular pump element having a chamber with an inlet communicating with the reservoir and having an outlet end, check valve means between the reservoir and chamber, a stem fixed relative to the reservoir having a head engaged by the forward end face of the pump element when the latter is extended forward and closing the outlet of the chamber, said head extending at least partially into the feed passage, said head and forward end face constituting a rear end wall to the feed passage, the unit in an initial portion of its rearward movement engaging said forward end face of the pump element and upon continued rearward movement lifting the pump element from said head and establishing communication between the pump element chamber and feed channel, said rear wall operating to reduce the volume of said feed channel in response to rearward movement of the unit before the pump element is lifted from the head, and the unit after lifting the pump element from the head serving to distort the pump element and thereby reduce its internal volume and pump ink therefrom through the feed channel to the writing element, said front end face of the pump element being of substantial radial extent the inner portion thereof engaging and being limited in forward movement by said head and the outer portion thereof extending forwardly beyond the inner portion, the writing unit having a portion engaged by the outer portion of said end face whereby the unit is moved forwardly for establishing a release passage between the pump element and writing unit, and the unit having a radially outer serrated portion to provide a continuation of the release passage beyond the pump element.

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