

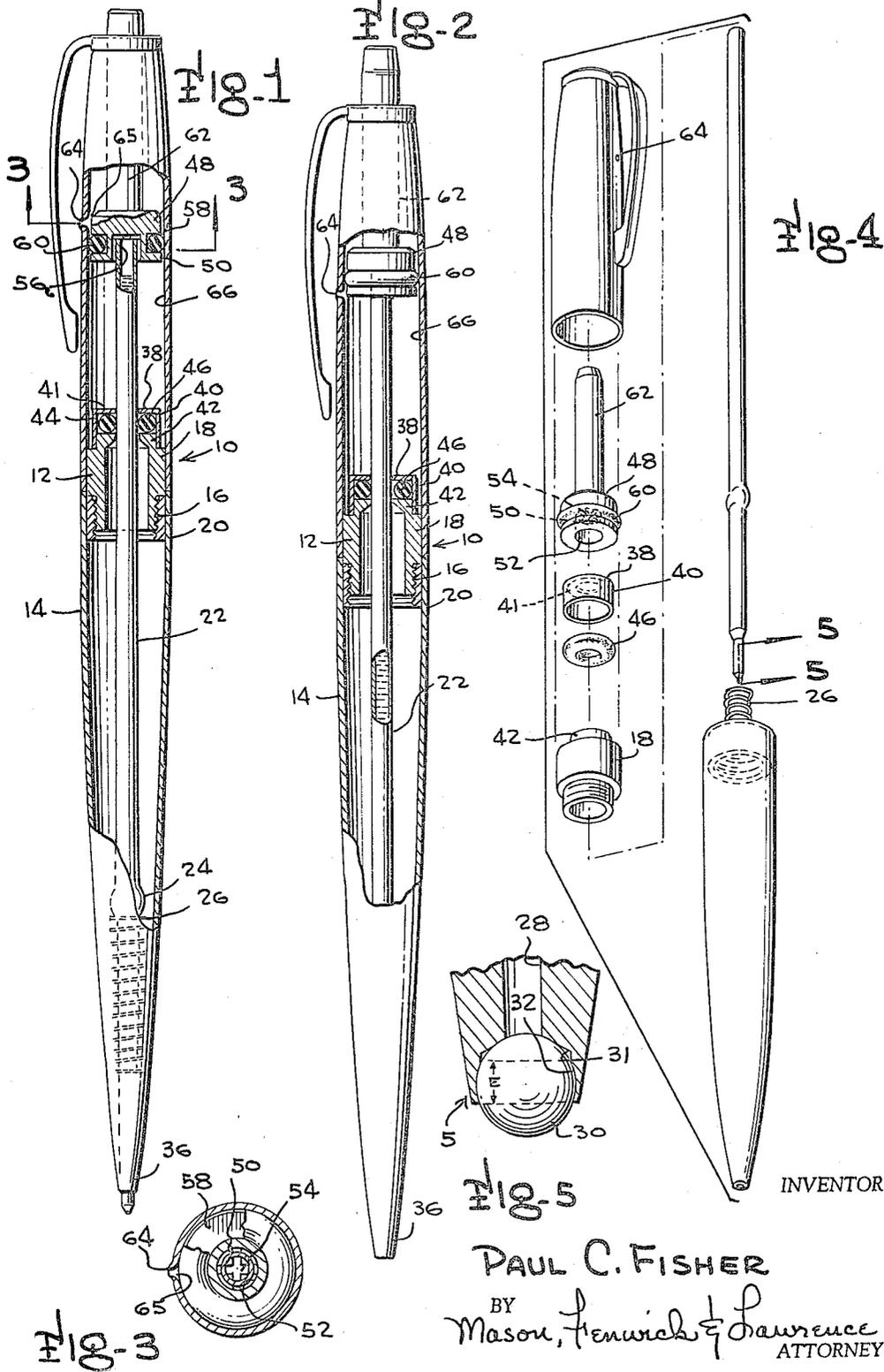
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ANTI-GRAVITY PEN

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FIG-5

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ANTI-GRAVITY PEN

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This invention relates generally to pressurized ball point pens; more particularly, the present invention relates to ball point pens which may be used with the ball point in an elevated position relative to the ink supply.

Ball point pens which have a pressurized feed are numerous. However, there is no commercially successful pressurized ball point pen on the market to date. The previous attempts to provide a pressurized ball point pen failed for a number of reasons and for the most part it was a combination of the elements of the pen construction which did not permit the successful operation of the pressurized ink supply over a substantial period of time.

It is the principal object of the present invention to provide a ball point pen having a pressurized ink supply which enables the pen to write when the force of gravity acts against the flow of ink in the ink cartridge.

Another object of the present invention is the provision for pressurizing the ink cartridge at the same time that the ball point is advanced into writing position.

Further, the object of the present invention is the provision of a chamber having extensive volume to minimize any variation in pressure due to variation in the ink volume.

This invention also has for an object the provision of a ball point pen which is pressurized manually when the ball point is advanced and which pressure is released upon retraction of the ball point.

It is a further object of the present invention to provide vent means in the barrel which is shaped in the manner such that it does not adversely effect the pressurizing of the ink supply by damaging the sealing ring.

Another particular object of the present invention is the provision of sealing means which achieves the pressurization without failure or extrusion of the seal.

These and other objects of the present invention become apparent on careful study of the specification, claims and the accompanying drawing wherein:

FIGURE 1 is a side elevational view partly cut away and partly in section showing the ball point in its advanced position and the ink supply pressurized.

FIGURE 2 is the side elevational view partly cut away and partly in section showing the ball point retracted and the ink supply at atmospheric pressure.

FIGURE 3 is a cross-sectional view partly broken away and taken along lines 3-3 of FIGURE 1.

FIGURE 4 is an exploded perspective view of the ball point pen according to the present invention.

FIGURE 5 is a side elevational view taken along lines 5-5 of FIGURE 4.

The ball point pen in accordance with the present invention is depicted generally by the numeral 10 and is composed of a conventional two-part barrel housing 12 and 14 which are joined together as by screw threads 16 on respective force fit sleeves 18 and 20. The barrel receives a conventionally shaped cartridge 22 which contains a suitable ink. The viscosity of the ink should be sufficiently high and the clearance between the ball and the side walls of the socket sufficiently tight to substantially eliminate the oozing of the ink from the tip when the ink is under the maximum pressure which exists when the ink chamber is full. This new design of pressure pump can be used successfully with most of the ball point inks currently on the market. The cartridge 22 has the conventional enlarged portion 24 upon which

spring 26 acts upwardly as is well known in the art. The cartridge at its lower end is provided with a passageway 28 that provides fluid communication between the main supply of ink in the cartridge and the ball 30. The ball is seated preferably positioned in a hard surfaced metal socket S having a seat 31 and in contact with side wall 32. One of the unique aspects of the present invention is that it has been found to be important to the successful operation of the pen that the equatorial band around the ball formed by the side wall 32 of the ball sockets should have a minimum width E not less than 25% of the ball diameter. The maximum clearance between the ball and the side wall must be somewhat less than .0003 inch. Preferably the side walls of the sockets including the seat 31 are made from stainless steel such as #303 or #416. With a .0394 inch diameter ball, a clearance of .00015 inch may be used.

The exterior 34 of the passageway 28 is slidingly received within the necked down portion 36 of the barrel to provide support for the cartridge at the lower end. The ink cartridge at the upper end is received within a sealing ring housing 38 formed by an annular collar 40 having top lip 41. The collar is fitted tightly against ring shaped boss 42 positioned on the upper end of the sleeve 18. It can be seen from FIGURES 1 and 2 that the collar 40, lip 41, and the boss 42 form a stationary enclosure or annular groove 44 which receives conventional sealing ring 46. The type of sealing ring that is found particularly useful is the quad ring. However, the O-ring may also be utilized. As shown, the sealing ring 46 bears tightly around the outside diameter of the cartridge 22 and thus forms an airtight fit preventing air from by-passing the seal.

The upper end of the cartridge is in contact with piston 48 which on its underside is provided with an abutting means 50 best shown in FIGURE 3. Preferably, the abutting means on the piston is formed with a recess 52 that loosely surrounds the upper portion of the ink cartridge. The abutting means 50 within the recess 52 is provided with at least one groove 54 or as shown a plurality of intersecting grooves which form an air passage means in conjunction with the spacing between the upper end of the cartridge and the side walls of the recess 52. This air passage means permits gaseous communication with the interior of the cartridge 22 through its open top 56.

The piston 48 is provided with an annular groove 58 which is closed on top, bottom and the side facing the ink cartridge but is open on the side facing the wall of the upper barrel 12 and accordingly provides an airtight sealing fit with the barrel when sealing means 60 is positioned within the annular groove 58. The sealing means 60 is essentially the same as sealing means 46 except for the difference in diameter. The piston is operable by a conventional plunger 62 which is maintained in retracted or advanced position by conventional catches not shown.

The barrel is provided with an air vent 64 having a beveled or rounded inner edge 65 which performs a unique function in the ball point pen according to present seal 60. The rounded edge of the vent prevents damage to the sliding sealing member.

The position of the air vent and its size readily determines the pressure created within the chamber 66 formed between the sealing means and the inside of the barrel. As the piston moves downwardly increased pressure occurring between the sealing means forces air out through the vent 64 until such time as the sealing means 60 contacts and closes vent 64. Further downward movement of the piston 48 increases the pressure within chamber 66 and with no means of relieving such pressure, the chamber 66 remains pressurized, the pressure being trans-

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mitted up through recess 52 through air passage means 54 and through opening 56 into the cartridge 22 to force the ink supply to the ball. During retraction of the point, pressure is relieved when the piston moves above the vent.

By varying the size of the air vent, the amount of air that is permitted to escape during depression of the piston is controlled and also by raising the air vent toward the top of the pen, greater pressure can be built up within chamber 66 since the piston is in its compression stroke for a longer period without venting. On the other hand, the larger the opening and the closer the air vent is to the upper side of sealing means 58 in its farthest down position, the lower is the pressure in chamber 66. It has been found that the size of the air vent, in accordance with the present invention should be between .005 to .050 inch, preferably the opening should be approximately .013 inch. The pressure within the chamber 66 during writing should be .1 p.s.i. and 2. p.s.i. for currently conventional ball pen inks.

It has been found that for satisfactory operation of the piston that the sealing rings should be lubricated. Among the best lubricants found the those formed from silicones such as produced by Dow Corning under the number 11. While this and other lubricants may be used, they all should have a viscosity of greater than 50,000 cpc. in order to prevent the seepage of air around the sealing rings. The air vent must be sufficiently large so that it will not be clogged by the high viscosity lubricant.

What is claimed is:

1. A ball pointed pen comprising:

a barrel housing,
a plunger operating within said barrel,
an ink cartridge containing an ink supply, said cartridge being slidably positioned within said barrel, and having an open end,
a rotating ball and a socket retaining said ball point being positioned at the other end of said cartridge,
a passageway communicating the seat and ball with the interior of said cartridge,
a piston operable by said plunger for sliding movement within said barrel,
said piston having an annular groove open in cross section on the side facing the barrel and substantially closed on the other sides,
a first annular sealing ring positioned within said groove,
said piston having abutting means for contacting the upper end of said cartridge for effecting downward movement of said cartridge and said ball point into writing position,
air passage means positioned between said piston and said cartridge for conducting air into and out of said cartridge,
a second annular sealing ring in sliding contact with said cartridge,
a stationary enclosure for said second sealing ring forming the bottom of said chamber, said enclosure being open in cross section on a side facing said cartridge,
an enclosed airtight chamber formed between said sealing rings, said compartment being in communication with the interior of said cartridge through said air passage means,
an air vent in said barrel, said air vent providing communication between the atmosphere and said chamber when said piston is positioned above said air vent,
whereby when said piston is moved downwardly said air vent is closed to pressurize said chamber and said ink cartridge and at the same time said ball point is moved into writing position.

2. The pen recited in claim 1 wherein said air vent is adjacent and above said first sealing ring when the latter is in a downward position.

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3. The pen recited in claim 1 wherein the sealing rings are lubricated with a lubricant with a viscosity in excess of 50,000 centipoise.

4. The pen recited in claim 1 including said air vent having an interior rounded edge in sliding contact with the first sealing ring.

5. The pen recited in claim 1 wherein the sidewall for the ball point socket is stainless steel.

6. The pen recited in claim 1 wherein the first sealing ring is slidable upon the interior side of said barrel and said sides form in part the boundary of said chamber.

7. A ball pointed pen comprising:

a barrel housing,
a plunger operating within said barrel,
an ink cartridge containing an ink supply, said cartridge being slidably positioned within said barrel, and having an open end,
a rotating ball and a socket retaining said ball point being positioned at the other end of said cartridge,
a passageway communicating the seat and ball with the interior of said cartridge,
a position operable by said plunger for sliding movement within said barrel,
said piston having an annular groove open in cross section on the side facing the barrel and substantially closed on the other sides,
a first annular sealing ring positioned with said groove, said piston having abutting means for contacting the upper end of said cartridge for effecting downward movement of said cartridge and said ball point into writing position,

air passage means positioned between said piston and said cartridge for conducting air into and out of said cartridge,

a second annular sealing ring in sliding contact with said cartridge,

a stationary enclosure for said second sealing ring forming the bottom of said chamber, said enclosure being open in cross section on a side facing said cartridge,

an enclosed airtight chamber formed between said sealing rings, said compartment being in communication with the interior of said cartridge through said air passage means,

an air vent in said barrel adjacent and above said first sealing ring when the latter is in a downward position, said air vent having an interior rounded edge in sliding contact with the first sealing ring, and said air vent providing communication between the atmosphere and said chamber when said piston is positioned above said air vent,

whereby when said piston is moved downwardly said air vent is closed to pressurize said chamber and said ink cartridge and at the same time said ball point is moved into writing position.

8. A ball pointed pen comprising:

a barrel housing,
a plunger operating within said barrel,
an ink cartridge containing an ink supply, said cartridge being slidably positioned within said barrel, and having an open end,

a rotating ball and a socket retaining said ball point being positioned at the other end of said cartridge.

a passageway communicating the seat and ball with the interior of said cartridge,

a piston operable by said plunger for sliding movement within said barrel,

said piston having an annular groove open in cross section on the side facing the barrel and substantially closed on the other sides,

a first annular sealing ring positioned within said groove, said piston having abutting means for contacting the upper end of the said cartridge for effecting downward movement of said cartridge and said ball point

into writing position, said abutting means being pro-

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vided with a recess to receive the upper end of said cartridge, said recess being constructed with grooves forming in part said air passage means,
 air passage means positioned between said piston and said cartridge for conducting air into and out of said cartridge,
 a second annular sealing ring in sliding contact with said cartridge,
 a stationary enclosure for said second sealing ring forming the bottom of said chamber, said enclosure being open in cross section on a side facing said cartridge,
 an enclosed airtight chamber formed between said sealing rings, said compartment being in communication with the interior of said cartridge through said air passage means,
 an air vent in said barrel adjacent and above said first sealing ring when the latter is in a downward position, said air vent having an interior rounded edge in sliding contact with the first sealing ring, and said air vent providing communication between the atmosphere and said chamber when said piston is positioned above said air vent,
 whereby when said piston is moved downwardly said air vent is closed to pressurize said chamber and said ink cartridge and at the same time said ball point is moved into writing position.

9. A ball pointed pen comprising;

a barrel housing,
 a plunger operating within said barrel,
 an ink cartridge containing an ink supply, said cartridge being slidably positioned within said barrel, and having an open end,
 a rotating ball and a socket retaining said ball point being positioned at the other end of said cartridge,
 a passageway communicating the seat and ball with the interior of said cartridge,
 a piston operable by said plunger for sliding movement within said barrel,
 said piston having an annular groove open in cross section on the side facing the barrel and substantially closed on the other sides,
 a first annular sealing ring positioned within said groove, being in sliding contact with said barrel, said piston having abutting means for contacting the upper end of said cartridge for effecting downward movement of said cartridge and said ball point into writing position, and abutting means being provided with a recess to receive the upper end of said cartridge, including said recess being constructed with grooves forming in part said air passage means,
 air passage means positioned between said piston and said cartridge for conducting air into and out of said cartridge,
 a second annular sealing ring is sliding contact with said cartridge,
 a stationary enclosure for said second sealing ring forming the bottom of said chamber, said enclosure being open in cross section on a side facing said cartridge,
 an enclosed airtight chamber formed between said sealing rings, said compartment being in communication with the interior of said cartridge through said air passage means,
 an air vent in said barrel adjacent and above said first sealing ring when the latter is in a downward position, said air vent having an interior rounded edge in sliding contact with the first sealing ring, and said air vent providing communication between the atmosphere and said chamber when said piston is positioned above said air vent,

whereby when said piston is moved downwardly said air vent is closed to pressurize said chamber and said ink cartridge and at the same time said ball point is moved into writing position.

10. A ball pointed pen comprising:
 a barrel housing,
 a plunger operating within said barrel,
 an ink cartridge containing an ink supply, said cartridge being slidably positioned within said barrel, and having an open end,
 a rotating ball and a socket retaining said ball point being positioned at the other end of said cartridge, said socket having side walls and a seat formed by a hard surfaced material, said side wall contacting said ball point along an equatorial band having a width not less than 25% of the ball point diameter, the clearance between said side wall and said ball point being not greater than .0003 inch.
 a passageway communicating the seat and ball with the interior of said cartridge,
 a piston operable by said plunger for sliding movement, within said barrel,
 said piston having an annular groove open in cross section on the side facing the barrel and substantially closed on the other sides,
 a first annular sealing ring positioned within said groove, said piston having abutting means for contacting the upper end of said cartridge for effecting downward movement of said cartridge and said ball point into writing position,
 air passage means positioned between said piston and said cartridge for conducting air into and out of said cartridge,
 a second annular sealing ring in sliding contact with said cartridge,
 a stationary enclosure for said second sealing ring forming the bottom of said chamber, said enclosure being open in cross section on a side facing said cartridge,
 an enclosed airtight chamber formed between said sealing rings, said compartment being in communication with the interior of said cartridge through said air passage means,
 an air vent in said barrel, said air vent providing communication between the atmosphere and said chamber when said piston is positioned above said air vent,
 whereby when said piston is moved downwardly said air vent is closed to pressurize said chamber and said ink cartridge and at the same time said ball point is moved into writing position.

11. A ball pointed pen comprising:

a barrel housing,
 a plunger operating within said barrel,
 an ink cartridge containing an ink supply, said cartridge being slidably positioned within said barrel, and having an open end,
 a rotating ball and a socket retaining said ball point being positioned at the other end of said cartridge, said socket having side walls and a seat formed of a hard surfaced material, said side wall contacting said ball point along an equatorial band having a width not less than 25% of the ball point diameter, the clearance between said side wall and said ball point being not greater than .0003 inch.
 a passageway communicating the seat and ball with the interior of said cartridge,
 a piston operable by said plunger for sliding movement within said barrel,
 said piston having an annular groove open in cross section on the side facing the barrel and substantially closed on the other sides,
 a first annular sealing ring positioned within said groove, said piston having abutting means for contacting the upper end of said cartridge for effecting downward movement of said cartridge and said ball point into writing position,
 air passage means positioned between said piston and

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said cartridge for conducting air into and out of said cartridge,
 a second annular sealing ring in sliding contact with said cartridge,
 a stationary enclosure for said second sealing ring forming the bottom of said chamber, said enclosure being open in cross section on a side facing said cartridge,
 an enclosed airtight chamber formed between said sealing rings, said compartment being in communication with the interior of said cartridge through said air passage means,
 an air vent in said barrel, said air vent providing communication between the atmosphere and said chamber when said piston is positioned above said air vent, whereby when said piston is moved downwardly said air vent is closed to pressurize said chamber and said ink cartridge and at the same time said ball point is moved into writing position.
 12. A ball pointed pen comprising:
 a barrel housing,
 a plunger operating within said barrel,
 an ink cartridge containing an ink supply, said cartridge being slidably positioned within said barrel, and having an open end,
 a rotating ball and a socket retaining said ball point being positioned at the other end of said cartridge, said socket having side walls and a seat formed of a hard surfaced material, said side wall contacting said ball point along an equatorial band having a switch width not less than 25% of the ball point diameter, the clearance between said side wall and said ball point being not greater than .0003 inch.
 a passageway communicating the seat and ball with the interior of said cartridge,
 a piston operable by said plunger for sliding movement within said barrel,
 said piston having an annular groove open in cross section on the side facing the barrel and substantially closed on the other sides,
 a first annular sealing ring positioned within said groove, and being in sliding contact with said barrel,

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said piston having abutting means for contacting the upper end of said cartridge for effecting downward movement of said cartridge and said ball point into writing position,
 5 air passage means positioned between said piston and said cartridge for conducting air into and out of the cartridge,
 a second annular sealing ring in sliding contact with said cartridge,
 10 a stationary enclosure for said second sealing ring forming the bottom of said chamber, said enclosure being open in cross section on a side facing said cartridge,
 an enclosed airtight chamber formed between said sealing ring when the latter is in a downward position, cation with the interior of said cartridge through said air passage means,
 an air vent in said barrel adjacent and above said first sealing ring when the latter is in a downward position, said air vent having an interior rounded edge in sliding contact with the first sealing ring,
 said air vent providing communication between the atmosphere and said chamber when said piston is positioned above said air vent,
 25 whereby when said piston is moved downwardly said air vent is closed to pressurize said chamber and said ink cartridge and at the same time said ball point is moved into writing position.

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LAWRENCE CHARLES, *Primary Examiner.*