ABSTRACT
A socket for holding the writing ball of a ball-point pen comprises a tubular member having a tip portion formed to hold a writing ball, a rod inserted into the tubular member to receive the ball in a seat provided at the forward end thereof, ink passages formed between the tubular member and the rod, and grooved ink outlets circumferentially provided in the inner walls of the tip portion of the tubular member to communicate with the ink passages and the outside of the socket, whereby aqueous ink filled in the ink passages is supplied through the ink outlets to the portion of the ball which is exposed to the outside of the socket.

6 Claims, 7 Drawing Figures
SOCKET FOR HOLDING THE WRITING BALL OF
A BALL-POINT PEN

BACKGROUND OF THE INVENTION

i. Field of the Invention

This invention relates to a socket for holding the writing ball of a ball-point pen and more particularly to a socket adapted for application of aqueous ink.

ii. Description of the Prior Art

The socket of the prior art ball-point pen comprises a tubular member and a rod received therein. A writing ball is rotatably held in the tip portion of the tubular member.

With the known ball-point pen, the ball is held by the whole inner wall of the tip portion of the tubular member. Writing ink is caused to pour out of the socket only through an annular gap or clearance allowed between the outer peripheral surface of the ball and the inner wall of the tip portion of the tubular member. Accordingly, no other special means than the clearance is provided to guide the ink out of the socket.

Since, with such a ball-point pen, very viscous ink is exclusively used as a rule, the clearance is made relatively large to facilitate the delivery of the ink. Therefore, the prior art ball-point pen is accompanied with the various drawbacks that the writing ball is likely to be displaced from its normal position in the tip portion, causing ink to be poured out unevenly; unpleasant noises arise during writing by the rubbing of the rotating ball against the inner wall of the tip portion of the tubular member and the forward end portion of the rod, possibly with the resultant wear of the ball; and the large clearance gives rise to the fall of the ball off the interior of tip portion of the tubular member. A further disadvantage of the prior art ball-point pen is that where the very viscous ink is replaced by an aqueous type of lower viscosity, the wide clearance leads to an unduly large discharge of the aqueous ink, making the ball-point pen unavailable for practical use. Though an attempt may be made to narrow the clearance in order to avoid such drawback, the undue restriction of the clearance will considerably decrease the delivery on ink. Moreover, in formation of the tip portion of the tubular member, it is very difficult to effect a fine adjustment of the clearance.

It is accordingly the object of this invention to provide a socket for holding the writing ball of a ball-point pen which enables aqueous ink to be properly supplied to the writing ball without any irregular rate, prevents the ball from falling out, and suppresses the occurrence of any unpleasant noise during writing due to the displacement of the ball from its normal position in the socket.

SUMMARY OF THE INVENTION

According to this invention, there is provided a socket for holding the writing ball of a ball-point pen, which comprises a tubular member having an opening of generally rectangular cross section formed therein so as to extend along the tubular member and surround the writing ball at the forward end portion thereof, a generally conical tip portion formed at the forward end of the tubular member so as to retain the writing ball in the reduced portion of the generally conical tip portion, generally triangular ink outlets formed in the inner walls of the tip portion and extending along the tip portion so as to communicate with the outside of the socket at the forward end thereof and with the corresponding corners of the rectangular hole at the rear end thereof, and a rod inserted into the tubular member to receive the writing ball at the forward end thereof; and at least one ink passage extending lengthwise of the tubular member and formed between the inner walls of the tubular member and the outer wall of the rod so as to communicate with the ink outlets.

All the inner peripheral wall of at least the forward end of the tip portion of the tubular member, except for those portions of the peripheral wall in which the ink outlets are formed, contacts the writing ball to support it.

According to this invention, ink is delivered on the surface of, for example, a sheet of paper from the ink duct means under a very stable condition mainly through the ink outlets, instead of through a clearance between the inner wall of the tubular member and ball as is the case with the prior art ball-point pen.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal sectional view of a socket according to an embodiment of this invention for holding the writing ball of a ball-point pen;

FIG. 2 is a front view of FIG. 1;

FIG. 3 is a sectional view on line 3—3 of FIG. 1;

FIG. 4 is a longitudinal sectional view of a socket according to another embodiment of the invention for holding the writing ball of a ball-point pen;

FIG. 5 is a front view of FIG. 4;

FIG. 6 is a sectional view on line 6—6 of FIG. 4; and

FIG. 7 is a sectional view on line 7—7 of FIG. 4.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIGS. 1 to 3, a socket 10 comprises a tubular member 11 and a round rod 12 received therein. As best indicated in FIG. 3, the tubular member 11 is provided inside with a hole 13 having a generally square or rectangular cross section and lengthwise penetrating the tubular member 11. The round rod 12 is forcefully inserted into the hole 13. A steel writing ball 14 is inserted into the tubular member 11 at the front end thereof so as to have part of the ball 14 exposed to the outside from the opening of the socket 10. Formed at the forward end of the round rod 12 is a conical ball seat 16 having shape complementary to the peripheral outline of the ball 14 so as to support the ball 14.

The tip portion 15 of the tubular member 11 is deformed as illustrated in FIGS. 1 and 2. The front inner edge 17 of the tip portion 15 has its cross section changed by deforming same (i.e., by application of pressure) from the previous square form into a circular one for contact with the ball 14. In this case, those portions of the internally square tubular member 11 which constituted, before forming the tip portion, the four corners 13a of the hole 13 lengthwise penetrating the tubular member 11 are left intact to form four ink outlets 20 having a generally triangular cross section. Namely, the generally triangular ink outlets 20 are provided between the inner walls 15a of the tip portion 15 and the outer peripheral surface of the ball 14 so as to be distributed equidistantly in the circumferential direction of said ball 14. As is apparent from the foregoing description, the ball 14 is rotatably held between
the formed conical tip portion 15 of the tubular member 11 and the concave ball seat 16 of the rod 12.

Spaces allowed between the inner wall of the tubular member 11 (namely, the inner wall 13b of the penetrating hole 13) and the outer periphery 12a of the round rod 12 constitute ink duct means or ink passages 18 being filled with aqueous ink 19. These four ink passages 18 communicate with an ink cartridge (not shown) connected to the opposite end of the tubular member 11 to the tip portion 15 so as to receive ink delivered from the cartridge.

The flat end face 21 of the rod 12 and the peripheral surface of the ball 14 define ink reservoirs 22. The reservoirs 22 enable the peripheral surface of the ball 14 to be always wetted with the ink 19.

There will now be described the operation of a socket according to this invention for the writing ball of a ballpoint pen. When the writing ball 14 rolls on, for example, a sheet of paper, those portions of the peripheral surface of the ball 14 wetted with ink 19 in the ink reservoirs 22 are exposed to the outside of the socket 10 in turn. However, the exposed portion of the peripheral surface of the ball 14 is chiefly supplied with aqueous ink from the ink passages 18 through the ink outlets 20. Accordingly, the ink 19 held in the ink passages 18 is unceasingly supplied through the outlets 20 in a proper amount to the point at which the ball 14 contacts the paper.

Delivery of ink 19 from the ink cartridge (not shown) to the ink passages 18, and thence to the ink reservoirs 22 and ink outlets 20 is effected by capillary action. When the ink outlets 20 have a proper size, then ink 19 can be supplied in an adequate amount to a point of contact between the ball 14 and the paper surface.

Referring to the embodiment of FIGS. 4 to 7, a socket 110 comprises a tubular member 111 bored with a lengthwise extending hole having a circular cross section and a rod 112 having a circular cross section and having its outer periphery closely contacting the inner wall 111a of the tubular member 111. A square hole 113 is formed, as shown in FIGS. 4 and 7, in the forward portion 123 of the tubular member 111. The tip portion 115 of the tubular member 111 is formed like the tip portion 15 of FIGS. 1 to 3. A steel writing ball 114 is supported by the inner wall 115a of the tip portion 115 and a concave ball seat 116 formed in the forward end of the rod 112. The front inner edge 117 of the tip portion 115 contacts the peripheral surface of the ball 114 like the edge 17 of the preceding embodiment. Those portions of the square hole 113 which are defined by the inner wall 123a of the forward end portion 123 and the peripheral surface of the ball 114 play the part of ink outlets 120. Those portions of the ink outlets 120 which are disposed in the tip portion 115 have the same shape and function as the ink outlets 20 of the preceding embodiment.

The flat forward end face 121 of the rod 112 and the outer peripheral surface of the ball 114 jointly define ink reservoirs 122 for wetting the peripheral surface of the ball 114 with aqueous ink.

The rod 112 is provided with a groove 124 extending lengthwise throughout the rod 112. This long groove 124 and the inner wall 111a of the tubular member 111 jointly define an ink duct means or passage 118 being filled with aqueous ink 119. The ink passage 118 is open at one end to the ink outlets 120 and ink reservoirs 122 and at the opposite end open to the interior of an ink cartridge (not shown). The ink passage 118 has exactly the same function as the ink passages 18 of the preceding embodiment. The socket 110 according to the embodiment of FIGS. 4 to 7 is operated in substantially the same manner as the socket 10 according to the embodiment of FIGS. 1 to 3, description thereof being omitted by way of avoiding duplication.

Provision of the ink outlets 20, 120 in the foregoing two embodiments respectively enables a clearance between the writing balls 14, 114 and the tip portions 15, 115 of the tubular members 11, 111 to be reduced to such an extent that the rolling of the balls 14, 114 is not obstructed. Accordingly, the balls 14, 114 are prevented from being displaced in the sockets 10, 110, giving rise to no noises when the balls 14, 114 roll on a sheet of paper during writing nor their falling off the sockets 11, 111.

What is claimed is:

1. A socket for holding the writing ball (14) of a ballpoint pen, comprising:
   a tubular member (11) having a longitudinally directed hole (13) formed therein and extending along the tubular member (11), said hole (13) having at least a longitudinal portion of generally rectangular cross-section at the forward end portion thereof for surrounding the writing ball (14) at said forward end portion thereof;
   a generally conical tip portion (15) formed at said forward end portion of the tubular member (11) for retaining the writing ball (14) in the reduced portion of the cone of the generally conical tip portion (15);
   a plurality of generally triangular ink outlets (20) formed in the inner walls (15a) of the tip portion (15) and extending along the tip portion (15) so as to communicate with the outside of the socket at the forward end thereof and with corresponding corners of the generally rectangular portion of the hole (13) at the rear end thereof;
   a rod (12) inserted into the hole (13) of the tubular member (11) to receive the writing ball (14) at the forward end of the rod, and
   an ink duct means (18) extending lengthwise of the tubular member (11) and formed between the inner walls (13a) of the tubular member (11) and the outer wall (12a) of the rod (12), the ink duct means (18) communicating with the ink outlets (20).

2. A socket according to claim 1 wherein the ink outlets (20) are arranged with a substantially equal peripheral spacing therebetween in the tip portion (15) of the tubular member (11).

3. A socket according to claim 1 wherein a ball seat (16) is provided at the forward end of the rod (12) which contacts the writing ball (14).

4. A socket according to claim 1 wherein an ink reservoir (22) is provided between the forward end of the rod (12) and the writing ball (14) to wet the writing ball (14) with ink.

5. A socket according to claim 1, wherein said hole (13) in said tubular member (11) has a generally rectangular cross section throughout the tubular member and said rod (12) has a generally circular cross section with the outer generally circular peripheral wall of the rod pressed against portions of the inner walls of the generally rectangular hole (13), the ink duct means (18) comprising ink passages of generally triangular
cross section formed between non-contacting portions of the outer peripheral wall (12a) of the rod (12) and the inner wall (13a) of the hole (13).

6. A socket according to claim 1, wherein the inner walls of the forward end portion of said tubular member define the generally rectangular hole portion (113-FIG. 4) and the inner walls of the remaining portion of said tubular member define a generally circular inner wall (111a) of the hole therein; said rod (112) has a generally circular cross section with the outer periphery thereof substantially in contact with the circular inner wall (111a) of the tubular member; and said ink duct means (118) comprises a groove (124) formed in the rod along the full length thereof.

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