

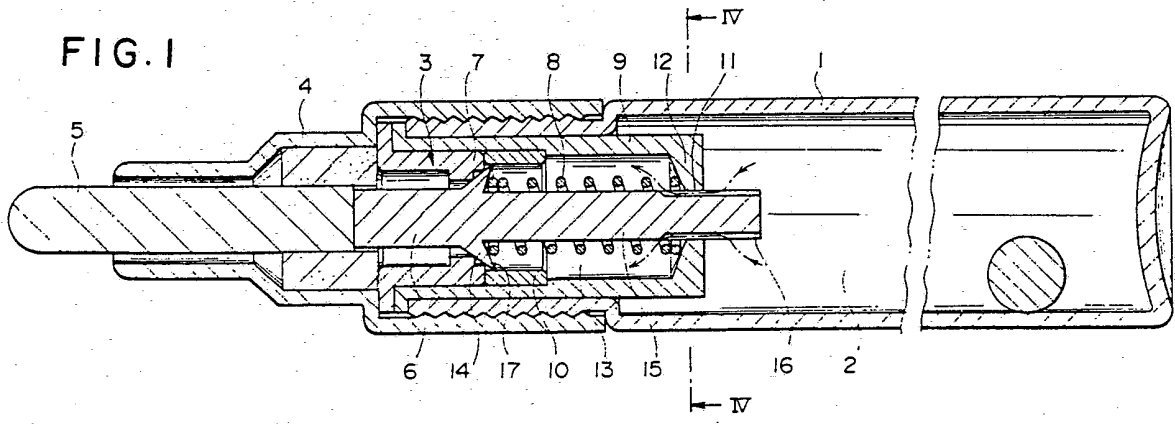
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(54) Liquid applicator

(57) A liquid applicator, e.g. a pen or a manicure liquid coating instrument, comprises a liquid storage part (2) provided in a shaft cylinder (1), a coating member (5) provided at the top of the shaft cylinder, and valve means (3) and an intermediate chamber (13) provided between said liquid storage part and said coating member. These applicator components are so constructed that the intermediate chamber cannot communicate with the liquid storage part and the coating member simultaneously, thereby providing improved control of flow of liquid from the storage part to the coating member.



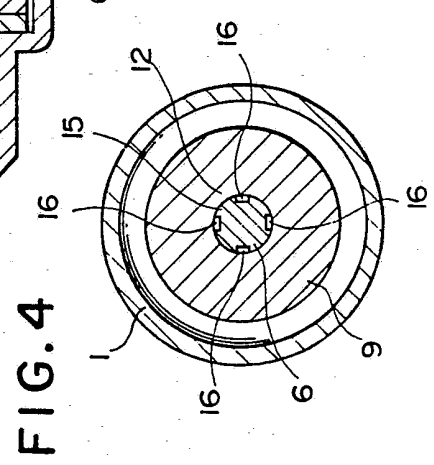
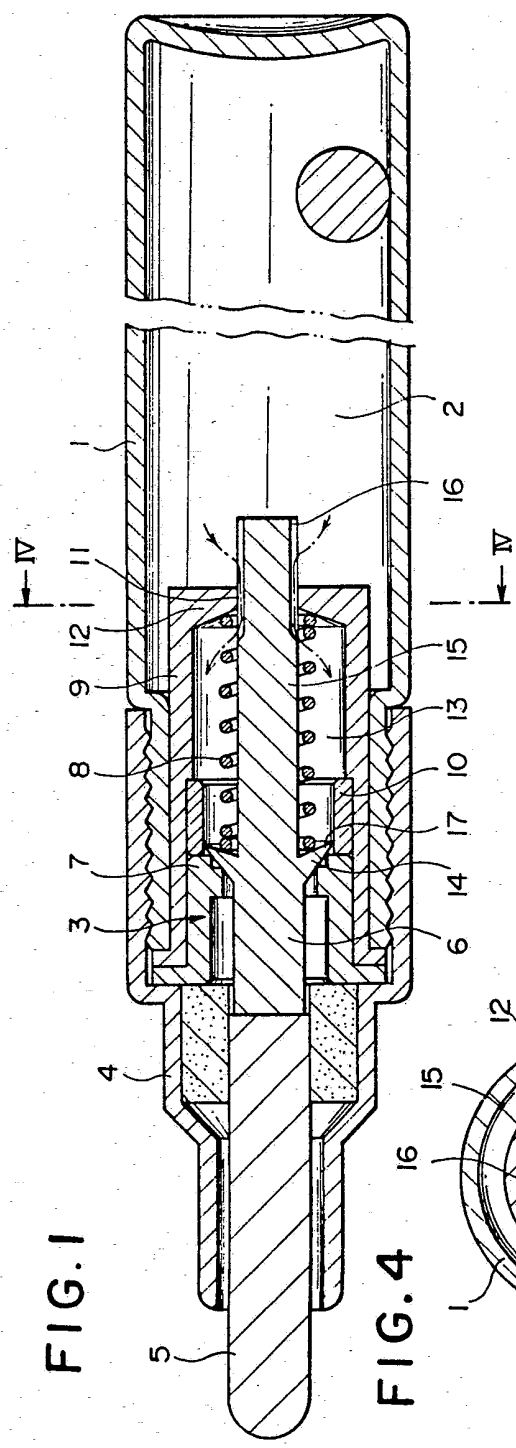


FIG. 2

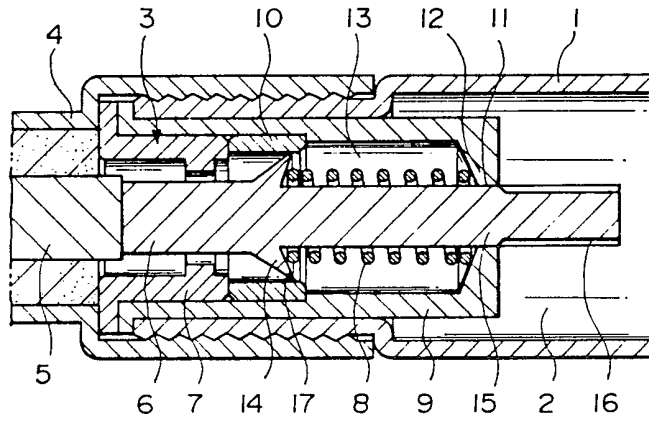
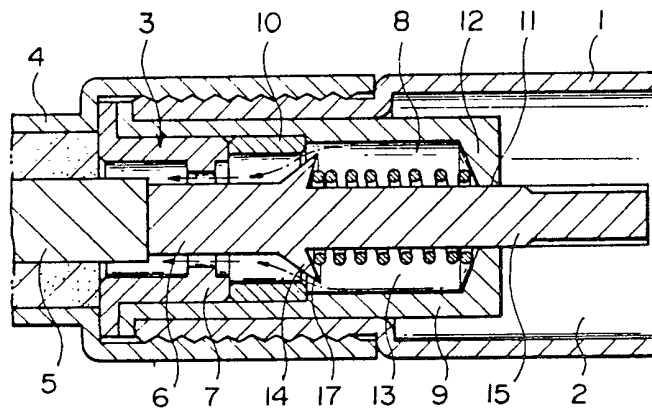


FIG. 3



"Liquid Applicator"

The present invention relates to a liquid applicator, e.g. a writing or cosmetic instrument such as a marking pen or manicure liquid coating instrument, and in particular to a liquid applicator  
5 having a valve means for controlling the supply of liquid, located between a liquid storage part and a liquid coating or applying member, together with a liquid supply control mechanism.

In a type of liquid applicator known in the  
10 prior art, a liquid storage part is directly communicated with a coating member to which liquid is supplied when a valve means is opened. With such an applicator, when the valve opening time becomes too long, the rate of supplying liquid to the coating member  
15 becomes excessive. Furthermore when air stored in the liquid storage part expands, due to an ambient temperature rise, etc., the liquid is violently expelled when the valve is opened causing splashing of the liquid from the coating member. These defects  
20 are associated with conventional liquid applicators known in the prior art.

Viewed from one broad aspect the present invention provides a liquid applicator comprising a liquid storage part, a liquid applying member,  
25 an intermediate chamber disposed between said liquid storage part and said liquid applying member, first valve means communicating said intermediate chamber with said liquid applying member, and second valve means communicating said intermediate chamber with  
30 said liquid storage part, the valves being arranged such that said first valve means is closed when said second valve means is opened for communicating the liquid storage part with the intermediate chamber, and said second valve means is closed when the

first valve means is opened to communicate the intermediate chamber with the liquid applying member.

Thus, there is no continuous communication between the main storage part, and liquid is supplied to the applying member via the intermediate chamber whereby the maximum volume of liquid supplied to the member at any one time is limited by the volume of the intermediate chamber.

Preferably said intermediate chamber comprises a cylinder provided at a front end adjacent a valve seat, and a hole provided at a rear end, and a valve rod extends between said cylinder and said hole, one end of said rod bearing a valve member cooperating with a valve seat to form said first valve means and the other end of said rod having a longitudinal groove cooperating with said hole to define said second valve means.

In a particularly preferred embodiment a piston member is provided on said valve rod in said chamber and the length and position of said groove are formed in such a manner that, when the piston of the valve rod is located in the cylinder, the groove is partially engaged with said hole to communicate the liquid storage part with the intermediate chamber through the groove and, from immediately before the piston of the valve rod moves to outside the cylinder and as long as the piston is located outside the cylinder, said groove is disengaged from said hole and said hole is hermetically sealed with the valve rod and the chamber does not communicate with the liquid storage part.

If desired said liquid storage part, said valve means, and said chamber are provided as a cartridge, the cartridge being made freely detachable.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings, in which:-

Fig. 1 is a sectional view at the center of a marking pen according to one embodiment of the present invention;

Figs. 2 and 3 show sectional views of a center part in the marking pen of Fig. 1, and

Fig. 4 is a sectional view of line IV-IV in Fig. 1.

A marking pen comprises a shaft cylinder 1, a large part of the interior of which forms a liquid storage part in the form of ink tank 2. The front end of said shaft cylinder 1 is open and, at its open part, a valve means 3 and a chamber 13 are provided.

To the front end of the shaft cylinder 1 is screwed a top cylinder 4, said top cylinder 4 being provided with a coating member in the form of a tip 5. The tip 5 is movable back and forth axially within top cylinder 4. The rear end of said tip 5 engages with the top end of a valve rod 6 of a valve means. Valve rod 6 moves in conjunction with the movement of the tip while opening or closing the valve means.

Valve means 3 basically comprises valve rod 6, valve seat member 7 and a valve spring, namely coil spring 8. Valve rod 6 is normally biased towards tip 5 by means of coil spring 8 located between the rear part of valve body 14 and the inner surface of the rear wall in the chamber 13, so that the valve body 14 is seated in normal conditions.

The top of an extended part of the valve rod 6, in the front side of the valve body 14, engages with the rear end of tip 5. Thus, the valve rod 6 is driven back to open the valve by moving the tip 5 backwardly overcoming the force of coil spring 8.

The valve body 14 also acts as a piston that can move liquid-tightly in the cylinder 10, as the outer periphery is expanded. According

to this embodiment, the valve body 14 and the piston 17 are formed integrally but may otherwise be constructed separately in back and forth positions in the axial direction.

5           The valve rod 6 passes through a hole 11 drilled at the rear end of the chamber 13. At the rear end of the valve rod 6, four grooves 16 of a constant length are provided at equal angular intervals.

10           The length of the cylinder 10 determines the length of the grooves 16 in the valve rod 6, and therefore determines the axial stroke of the valve rod 6 which moves backwardly to shutoff the communication between the ink tank 2 and the chamber  
15 13. However, the cylinder length does not relate to the ink supply rate. Consequently, the length of the cylinder 10 will not give advantageous or disadvantageous effect to the scope of the present invention, although an excessively long or short  
20 cylinder 10 is not preferable. The supply rate of ink per unit time is determined by the volume of the chamber 13.

          The length of the grooves 16 is set in such a manner that, when the piston 17 is located in  
25 the cylinder 10, the grooves partially enter the hole 11 for communicating the interior of the chamber 13 with the ink tank 2 through the groove 16 and, from immediately before the piston 17 moves outside the cylinder 10 and as long as the piston 17 is  
30 not engaged with the cylinder 10, the grooves 16 are disengaged from said hole 11 while said hole 11 is hermetically sealed with a part of the valve rod 6, where the groove 16 is not provided, thus shutting off the interior of the chamber 13 from  
35 the ink tank 2. Therefore, the chamber 13 never communicates simultaneously with the tip 5 and the ink tank 2. Instead, the chamber 13 can communicate only with either the tip 5 or the ink tank 2 at

any one time. However, immediately before the piston 17 is disengaged with the cylinder 10, the chamber 13 does not communicate with either tip 5 or ink tank 2.

5           According to this embodiment, the ink tank 2 is formed by the shaft cylinder 1 itself, integrally constructed with the entire liquid coating instrument. Another construction is also possible, where the ink tank 2 comprises a cartridge, and another member  
10 with the valve means 3 and the chamber 13 structured in a similar manner is provided, thus the cartridge can be made detachable.

The operation of the marking pen with this embodiment is described below.

15           First referring to Fig. 1, the tip 5 is in a non-knocked state, where the valve body 14 of the valve rod 6 is seated on a valve seat member 7 by the force of the coil spring 8. Thus, the piston 17 is located at the extreme front end of  
20 the cylinder 10 while the grooves 16 at the rear end partially engage with the hole 11 of the chamber 13 to communicate the chamber 13 with the ink tank 2. In this position ink stored in the ink tank 2 can enter the chamber 13, but since the tip 5  
25 and the chamber 13 are not communicated, the valve being closed, ink cannot pass from the chamber 13 to the tip 5.

When the tip 5 is moved axially backwardly from the position shown in Fig.1 overcoming the  
30 force of the coil spring, as shown in Fig. 2, then immediately before the piston 17 leaves the cylinder 10, the grooves 16 at the rear end of the valve rod 6 are also disengaged from the hole 11 towards the interior of the ink tank 2, whereby the communication  
35 between the interior of the chamber 13 and the ink tank 2 is shut off.

When the tip 5 is driven further backwardly, as shown in Fig. 3, the piston 17 leaves the cylinder



10 while communicating the interior of the chamber  
13 with the tip 5, although the hole 11 is maintained  
still liquidtight. Thus, a volume of ink, temporarily  
stored in the chamber 13, is supplied to the tip

5 5.

When the tip 5 is released from a pushing  
force after the above, the valve rod 6 is driven  
forwardly by the force of the coil spring 8, resuming  
the state shown in Fig. 1.

10 Thus, a volume of ink that is supplied to  
the tip 5 by a single supply operation, e.g. a  
knocking operation, is only that contained in the  
chamber 13 at a time when the ink tank 2 is completely  
closed from chamber 13. No more ink is supplied  
15 unless the knocking operation of the tip 5 is repeated.

It is to be clearly understood that there  
are no particular features of the foregoing specification,  
or of any claims appended hereto, which are at  
present regarded as being essential to the performance  
20 of the present invention, and that any one or more  
of such features or combinations thereof may therefore  
be included in, added to, omitted from or deleted  
from any of such claims if and when amended during  
the prosecution of this application or in the filing  
25 or prosecution of any divisional application based  
thereon.

CLAIMS:

1. A liquid applicator comprising a liquid storage part, a liquid applying member, an intermediate chamber disposed between said liquid storage part and said liquid applying member, first valve means  
5 communicating said intermediate chamber with said liquid applying member, and second valve means communicating said intermediate chamber with said liquid storage part, the valves being arranged  
10 such that said first valve means is closed when said second valve means is opened for communicating the liquid storage part with the intermediate chamber, and said second valve means is closed when the first valve means is opened to communicate the intermediate chamber with the liquid applying member.

15

2. An applicator according to claim 1 wherein said intermediate chamber comprises a cylinder provided at a front end adjacent a valve seat, and a hole provided at a rear end, and wherein  
20 a valve rod extends between said cylinder and said hole, one end of said rod bearing a valve member cooperating with a valve seat to form said first valve means and the other end of said rod having a longitudinal groove cooperating with said hole  
25 to define said second valve means.

3. An applicator according to claim 2 wherein a piston member is provided on said valve rod in said chamber and the length and position of said  
30 groove are formed in such a manner that, when the piston of the valve rod is located in the cylinder, the groove is partially engaged with said hole to communicate the liquid storage part with the intermediate chamber through the groove and, from  
35 immediately before the piston of the valve rod

moves to outside the cylinder and as long as the piston is located outside the cylinder, said groove is disengaged from said hole and said hole is hermetically sealed with the valve rod and the chamber does  
5 not communicate with the liquid storage part.

4. An applicator according to claim 3 wherein said valve member and said piston member are formed integrally with each other.  
10

5. An applicator according to any preceding claim wherein said liquid storage part is provided in a shaft and said applying member is provided at the top of the shaft.  
15

6. An applicator according to any of claims 1 to 4, wherein said liquid storage part, said valve means, and said chamber are provided as a cartridge, the cartridge being made freely detachable.  
20

7. A liquid applicator substantially as hereinbefore described with reference to the accompanying drawings.