

[54] **PUSH-TYPE MECHANICAL PENCIL
WITH IMPROVED LEAD ADVANCING
MEANS**

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[52] **U.S. Cl.**.....**401/67**

[51] **Int. Cl.**.....**B43k 21/16**

[58] **Field of Search**.....**401/65, 67**

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[57] **ABSTRACT**

A barrel for a push-type mechanical pencil is provided with a large recess and a small recess, with both recesses being defined by a common shoulder. A slidable writing unit within the barrel has an engaging member attached thereto and is contained in the small recess, at its retracted position, by a spring. When a relatively small pushing pressure is applied to the writing unit, the engaging member enters into the large recess and engages to the shoulder, the shoulder being positioned at a writing position. When a relatively large pushing pressure is applied to the writing unit, the engaging member engages with a guide member slidable along the large recess. In such a state, when the pushing pressure is removed, the engaging member retracts into the small recess by leaving the guide member at the shoulder.

4 Claims, 17 Drawing Figures

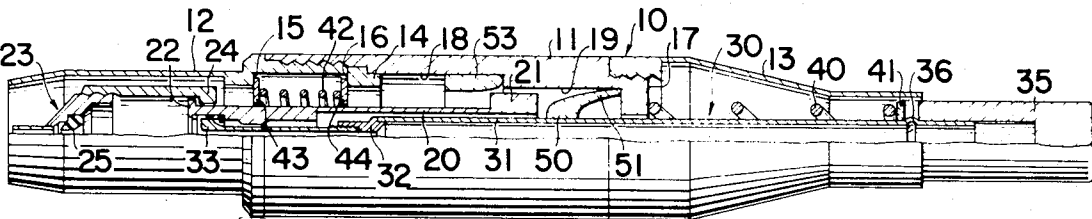
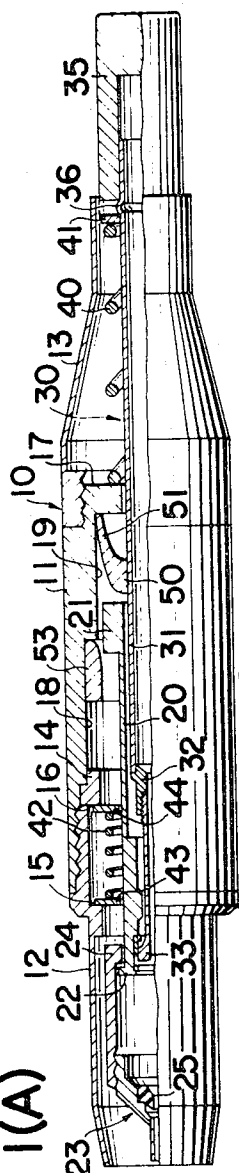


FIG. 1(A)



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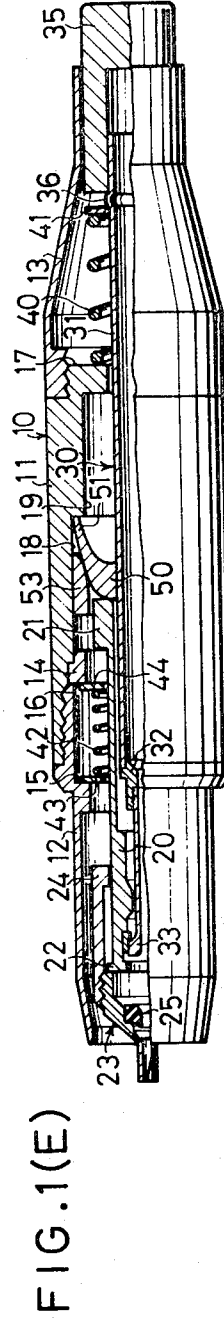
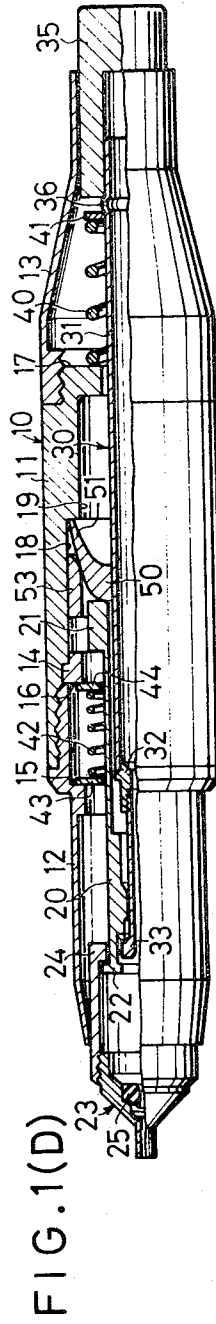
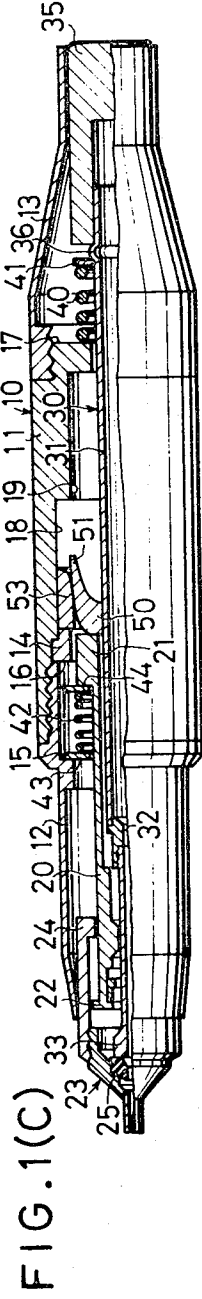
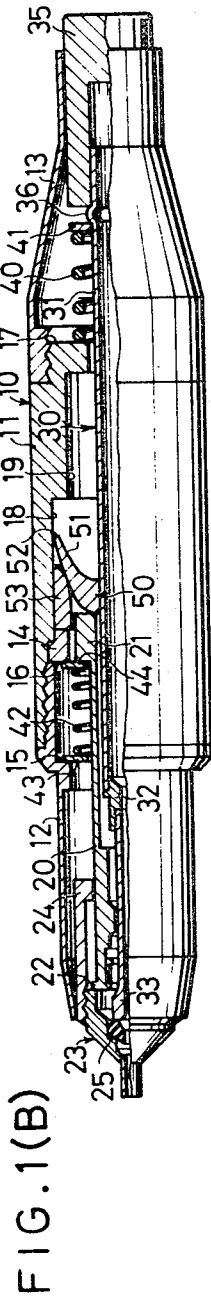


FIG. 2(A)

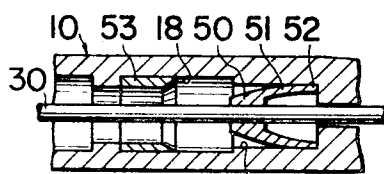


FIG. 2(B)

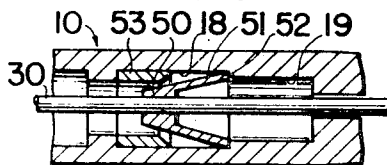


FIG. 2(C)

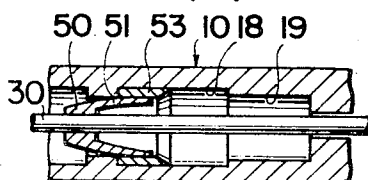


FIG. 2(D)

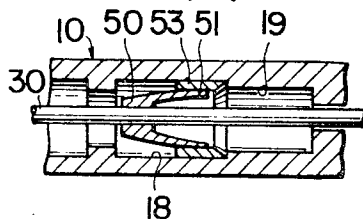


FIG. 3(A)

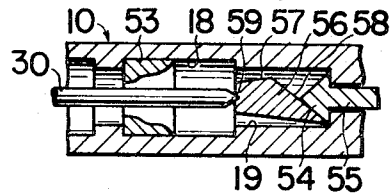


FIG. 3(B)

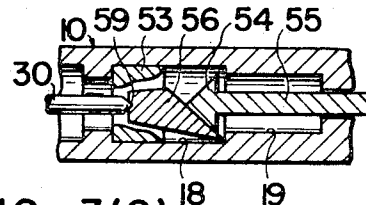


FIG. 3(C)

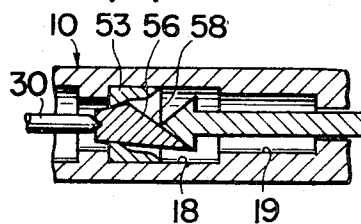
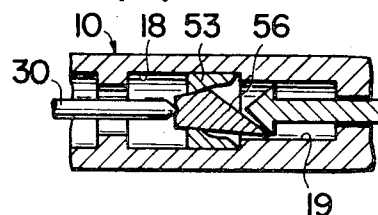
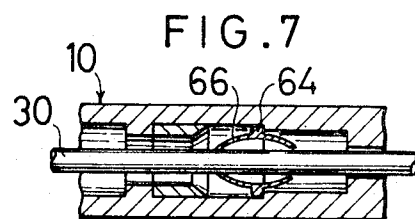
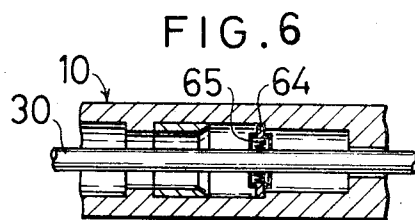
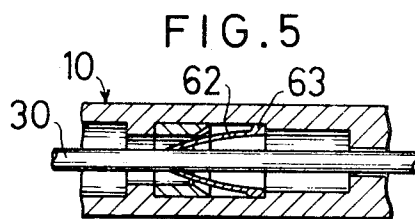
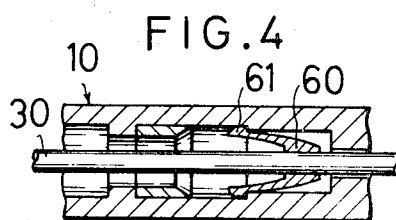


FIG. 3(D)



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PUSH-TYPE MECHANICAL PENCIL WITH IMPROVED LEAD ADVANCING MEANS

This invention relates to mechanical pencils having a chuck to advance a lead, and more particularly to push-type mechanical pencils wherein a writing unit which is slidably provided within a barrel is initially advanced to a writing position by a relatively small pushing pressure and is retracted to its starting position by a relatively large pushing pressure.

In the conventional mechanical pencil, of the kind as mentioned above, the means for advancing and retracting the writing unit from and into the barrel is complicated, as described hereinafter. A cylindrical member having a protrusion is turnably mounted on the writing (pen) unit or a pushing rod projected beyond the rear end of a barrel. The cylindrical member is turned (rotated) for a certain angle as its protrusion is thrust against inclined guide surfaces provided at the inside of the barrel. At every turned position the cylindrical member is straightly retracted and is engaged alternatively with each of short or long grooves also provided at the inside of the barrel, whereby the tip portion of the writing unit is projected and retracted from the barrel. It has been difficult to manufacture such mechanical pencils because the inside surface of the barrel has to be accurately provided with short and long grooves and with inclined guide surfaces to turn the cylindrical member.

In another conventional mechanical pencil of this kind, a slider at the front end thereof supports and protects a lead projected for a relatively long length beyond the tip of the pencil. As the lead is worn out, the slider gradually retracts as it is pressed at the surface of paper. Compared with the mechanical pencil in which only a short length, for example, a few millimeters of lead is projected from the tip of the pencil at every time of use, the mechanical pencil having the slider has the advantage that the lead can be beforehand projected from the tip of the pencil for a relatively long length.

It has been a troublesome operation to project the slider, for a predetermined relatively long length, as a simple pushing operation.

It is an object of the present invention to provide a push-type mechanical pencil with a simple pushing device wherein a writing unit is projected to a writing position and retracted into an outer barrel without providing a rotatable cylindrical member on the pen unit and without forming the complicated inclined guide surfaces and short and long grooves inside of the barrel.

It is another object of the present invention to provide a push-type mechanical pencil, as defined above, wherein the writing unit is initially advanced and set to the writing position by a relatively small pushing pressure and thereafter retracted to its starting position by a relatively large pushing pressure.

It is a further object of the present invention to provide a push-type mechanical pencil, as defined above, wherein, firstly, a slider is largely projected through the front end of the barrel by a pushing pressure slightly larger than that required to advance the writing unit to the writing position but smaller than that required to retract the writing unit to the starting position and, secondly, a lead is projected step by step through the slider by smaller pushing operations.

A push-type mechanical pencil in accordance with the present invention includes a writing unit within a barrel. This writing unit is movable along the axial direction of the barrel and is always urged backwardly by a first spring. When a pushing force is applied to the writing unit against the first spring, it advances (forward) and thereby pushes an annular guide member which is provided around an inner large recess of the barrel to be movable therein. An engaging member is attached to the writing unit. This engaging member has an end portion which is, at the starting position, contained in a small recess in the barrel and tends to extend outwardly. As the writing unit advances, the engaging member also advances and, as soon as the end portion thereof passes the rear shoulder of the large recess, it inclines outwardly due to its own force, or component force of the pushing force, and engages with the shoulder of the large recess. In this position the backward movement of the writing unit is prevented and the writing position is attained.

The writing unit can be advanced further than the writing position. In the most advanced position the engaging member frictionally engages into the annular guide member since the annular member abuts with a front shoulder of the large recess and does not advance any longer. When the pushing force is eliminated in this most advanced position, the engaging member retracts backward, together with the annular guide member, along the same way that it passed before and returns to the starting position by leaving the annular guide member to the rear shoulder of the large recess.

In a preferable push-type mechanical pencil according to the present invention, a cylindrical member is concentrically provided in its barrel and outside of the writing unit. A front marginal portion of the cylindrical member grips a chuck provided at the end of the writing unit relatively firmly and holds a lead securely when the writing unit is urged backward by the compression of the first spring. When the writing unit is advanced, the cylindrical member is also advanced together with it.

A second spring under compression is provided in front of the large recess in the barrel. This second spring does not work at all while the writing unit is advanced to the writing position. The second spring is compressible only after the writing unit further advances from the writing position and an enlarged rear portion of the cylindrical member contacts with the end of the second spring. As the force required to compress the second spring normally exceeds the gripping force between the cylindrical member and the chuck, the cylindrical member is left in position and only the writing unit is advanced forward to push the slider by its front chuck. The second spring is compressed when the engaging member attached to the writing unit comes to push the enlarged end portion of the cylindrical member.

Thus the second spring is compressed. The head portion of the chuck further pushes the slider as much as the spring is compressed.

When the writing unit is retracted to the starting position, the chuck frictionally engages the front end of the cylindrical member which front end is in turn engaged with the rear end of the slider, thereby retracting the slider in the barrel.

The present invention will be better understood with reference to the embodiments illustrated in the accompanying drawings, in which:

FIG. 1A is a side view of a mechanical pencil according to an embodiment of the present invention, the upper half of which is cross sectioned;

FIGS. 1B to 1E are cross-sectional views of the same mechanical pencil as in FIG. 1A, each of which illustrates different positions of movable members;

FIGS. 2A to 2D are cross-sectional views explanatorily showing the pushing device adapted to FIGS. 1A-1C, each of which illustrates different movements of the pushing device;

FIGS. 3A to 3D are cross-sectional views showing another pushing device according to a second embodiment of the present invention, each of which illustrates different movement of the pushing device;

FIGS. 4 to 7 are cross-sectional views showing pushing devices according to other embodiments of the present invention.

In the embodiments shown in FIGS. 1A, 1B and 1C 1D and 1E, an elongated barrel 10 comprises an intermediate cylindrical body 11, a front cylindrical body 12, a back cylindrical extension 13, a part of which is tapered, and an annular ring-like member 14. The front body 12 is threaded to the intermediate cylindrical body 11.

A recess 18 of larger diameter and a recess 19 of smaller diameter are provided in the interior of the intermediate cylindrical body 11, said large and small recess being defined by a shoulder.

A cylindrical member 20 having an annular integral outwardly extending stopper 21, formed of an enlarged rear end, and an outwardly extending flange 22 at its front outward end is contained in the interior of the intermediate cylindrical body 11. Outside of the cylindrical member 20 a slider 23, to support the lead, is slidably mounted to advance from and retract into an orifice of the front cylindrical body 12. The slider 23 is provided with an inwardly directed flange 24 at its rear end to engage with the flange 22 of the cylindrical member 20. The reference numeral 25 designates an annular rubber member which serves to hold the lead while a chuck 33 is open.

The writing or pen unit 30 is an inner casing comprising a tubular lead tank 31 with a connector 32 fixed on its end and a chuck 33 screwed to the connector 32. A cap 35 is removably mounted on the rear open end of the lead tank 31.

A first spring 40 is interposed between the end surface 17 of the intermediate cylindrical body 11 and an annular spring receiving member 41 which engages with a protruding portion 36 formed near the rear open end of the lead tank 31. A second spring 42 is interposed between a shoulder 15 of the front cylindrical body 12 and the front end of the annular ring member 14 by means of annular spring receiving members 43 and 44.

An engaging member 50 is fixed on the writing unit 30. This engaging member 50 has a flexible arm 51 which always tends to extend outwardly and the reference numeral 52 designates its rear end portion. An annular guide member 53 is slidably mounted around the recess 18, i.e., it is able to slide axially. The inner surface of guide member 53 frictionally engages with the engaging member 50, as disclosed hereinafter.

In operation, as shown in the upper half of FIG. 1A, when the writing unit 30 is in its retracted position due to the first spring 40, the rear end portion 52 of the engaging member 50 contacts with the rear end shoulder of the small recess 19 and cannot retract any more (see FIG. 2A). In this position, the chuck 33 at the front end of the writing unit 30 is forced to enter into the front bore of the cylindrical member 20 and the chuck is closed, holding the lead firmly. The chuck 33 and the cylindrical member 20 are relatively firmly engaged with friction therebetween.

Then, when the writing unit 30 is advanced (by pushing the cap 35) the cylindrical member 20 begins to move due to the frictional engagement with the chuck 33 and the first spring 40 is gradually compressed. At this stage the second spring 42 is not yet influenced.

When the end portion 52 of the flexible arm 51 of the engaging member 50 goes beyond the front end of the smaller recess 19, the end portion 52, in spite of the existence of the annular guide 53, pushes it away and extends outwardly by its own flexibility. Then if the pushing force is removed, the end portion 52 is stopped at the rear shoulder of the large recess 18 by the force of the spring 40. This provides a writing position (see FIGS. 1D and 2B).

Pushing the cap 35 furthermore, the stopper 21 of the cylindrical member 20 will contact with an annular spring seat 44 of the second spring 42. When the force required to compress the spring 42 exceeds the frictional engaging force between the cylindrical member 20 and the chuck 33, the cylindrical member 20 is left in place and only the writing unit 30 will advance, and then the grip of the lead by the chuck 33 will be loosened (see FIG. 1B).

As the end portion 52 of the engaging member 50 advances forward, the annular guide member 53 is pushed to move forward. If the writing unit 30 advances still further (even after the further slide of the guide member 53 is prevented by the end surface of the annular member 14 or of the shoulder of the recess 18) the engaging member 50 is forced to enter into the guide member 53 and the end portion 52 of the engaging member 50 is compressed (see FIGS. 1C and 2C).

While the engaging member 50 is in the position as shown in FIG. 2B, the lead is advanced by the well-known chuck device. When it is desired to retract the writing unit 30 to the starting position in the small recess 19, the second spring 42 is compressed enough for the engaging member 50 to firmly engage with the annular guide member 53 and then the pushing force is removed (see FIG. 1C and FIG. 2C). The annular guide member 53 is retracted together with the engaging member 50 by the reaction of the first compressed spring 40, and after the rear end of the guide member 53 stops at the rear shoulder of the recess 18 (see FIG. 2D), the compressed engaging member 50 slides back into the smaller recess 19, also by the reaction of the first spring 40, and returns to the starting position as shown in FIG. 2A.

FIG. 1E illustrates a stage in which the slider 23, which retracts as the lead is worn out by writing, is in the most retracted position, wherein the slider 23 stops at the flange 22.

Though the arm 51 faces rearward in the embodiment above, another arm 60 as shown in FIG. 4 may be employed in place of the former arm 51. The arm 60

faces to the front and is provided with a hook 61 for engagement at its free end.

Furthermore, in place of the arm 51, a structure is considered in which a curved spring board 62 fixed at its one end to the writing unit 30 is provided with a projection 63 at its other free end as shown in FIG. 5, or another alternative is a structure with a protrusion 64 which is always urged outward by a spring 65 or 66 shown in FIG. 6 or FIG. 7.

The engaging member can be replaced by one which is not flexible. One of the embodiments using such a member is as follows. Instead of the flexible engaging member, a connecting member 56 is provided between the writing unit 30, of about half length of the writing unit shown in FIGS. 1A to 1C, and a pushing rod 55 having a head 54 which engages with the rear shoulder of the small recess 19.

This connecting member 56 has an outer surface 57 which operates like a wedge and engages relatively firmly with the inner surface of the annular guide member 53. The member 56 also has a tapered pressure receiving surface 58 which is pressed by the head 54 of the pushing rod 55, and has a seat 59 which is freely inclined at the end of the writing unit 30 as the pushing force is applied to the tapered surface 58 by the pushing rod 55. The seat 59 may be a cone pivot type as shown in the drawing, a knife-edge, a pin-joint type or any other shape that permits the pivotal movement at the end of the pen unit.

As shown in FIG. 3A, as long as the pushing rod 55 is given no pushing force, the rear end of the connecting member 56 stops at the shoulder of the smaller recess 19 and the pen unit 30 is in its retracted starting position. When the pushing rod 55 is pushed forward, the rear end of the connecting member 56 enters into the large recess 18 and then the connecting member 56 inclines outwardly since it is pivotally connected with the end of the writing unit 30 and the tapered surface 58 receives the pushing force. When the pushing force is removed, in this position, the rear end of the connecting member 56 is pushed backward by the spring and stops at the shoulder of the larger recess 18; that is, the writing unit 30 is placed in the writing position (see FIG. 3B).

The pushing rod 55 being pushed forward furthermore, the connecting member 56 is gradually inserted into the annular guide member 53 which is prevented from moving forward by the front shoulder of the recess 18. At the same time the member 56 advances axially, as guided by the inner surface of the guide member 53, and both engages with each other relatively firmly as the insertion goes on. This stage is illustrated in FIG. 3C, where the connecting member 56 cannot be advanced any more even if the pushing force is added.

When the pushing force is eliminated after such firm engagement as shown in FIG. 3C, only the connecting member 56 retracts backward through the position shown in FIG. 3D and returns to the starting position shown in FIG. 3A as in the same way of the first embodiment.

Though the present invention has been described with reference to the preferred embodiments shown in the accompanying drawing, many modifications and alterations may be made within the spirit of the invention.

We claim:

1. A push-type mechanical pencil with lead advancing means comprising:

an elongated barrel having therein a recess of larger diameter and a recess of smaller diameter, said large and small recesses being defined by a shoulder;

a writing unit provided within said barrel and slidable along the axial direction thereof, said writing unit being urged rearward by a spring;

an annular guide member slidably mounted in said large recess; and

an engaging member attached to said writing unit and engageable with the inner surface of said annular guide member;

whereby, when said engaging member is given a pushing force to pass the small recess, it inclines outwardly to be stopped at said shoulder at a writing position, and when said engaging member is engaged with the inner surface of said annular guide member by advancing said writing unit furthermore and then the pushing force is removed, said engaging member smoothly returns to the first starting position without engaging with said shoulder, said retracting path of the engaging member being the same as the advancing path thereof.

2. In a push-type mechanical pencil of claim 1, wherein said engaging member has a tip portion which tends to extend outwardly.

3. In a push-type mechanical pencil of claim 1, wherein said engaging member comprises a pushing rod and a connecting member, said pushing rod having an inclined head portion to contact with said connecting member and a stem extending backward therefrom, said connecting member having an inclined surface to receive a pushing force through said pushing rod and a connecting means able to pivotally incline at the rear end of said writing unit by a component of the pushing force applied to said inclined surface with said pushing rod.

4. A push-type mechanical pencil comprising:

a barrel provided in its inner wall with a recess of larger diameter and a recess of smaller diameter, said large and small recesses being defined by a shoulder;

a writing unit provided within said barrel and adapted to be slidable along its axial direction, said writing unit having a chuck means and being urged rearward by a first spring;

a cylindrical member movably interposed between said barrel and said writing unit;

a lead supporting slider slidably provided between said barrel and said cylindrical member;

means for setting said writing unit to a first position in which said writing unit is concealed within said barrel and to a second position in which the lead is advanced beyond said barrel; and

a second spring compressible by a predetermined pushing force larger than the engaging force between said cylindrical member and said chuck of said pen unit;

whereby said second spring is compressible by an outwardly extending flange of said cylindrical member when the latter is advanced from said second position and said second spring is com-

pressed by the succeeding advancement of said
cylindrical member.

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