Sept. 12, 1944. C. K. LOVEJOY 2,358,091

MECHANICAL PENCIL

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Fig. 1.

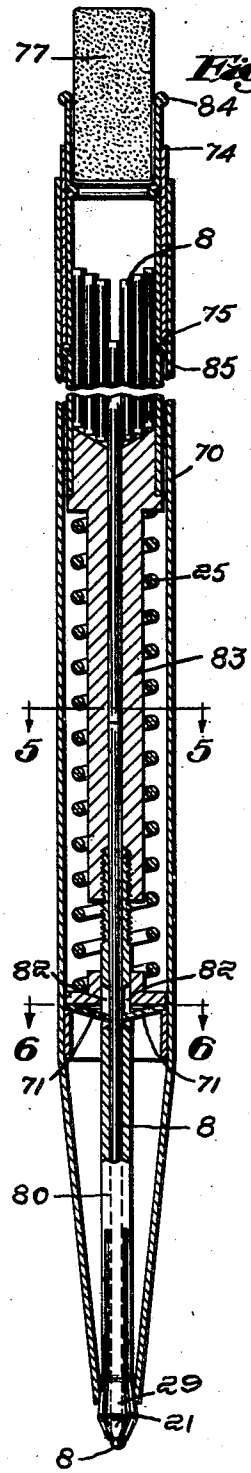

Fig. 2.

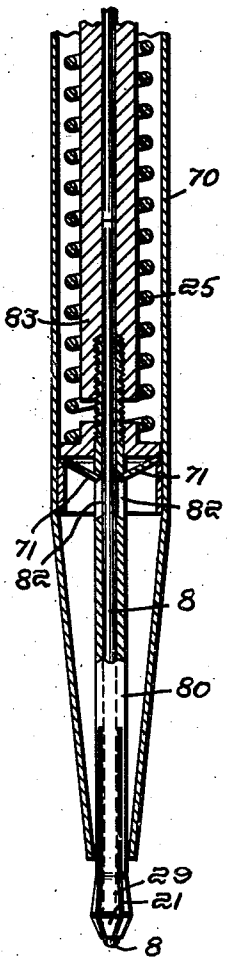

Fig. 3.

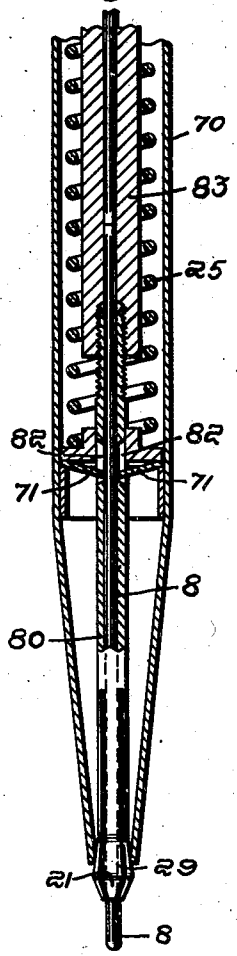

Fig. 4.

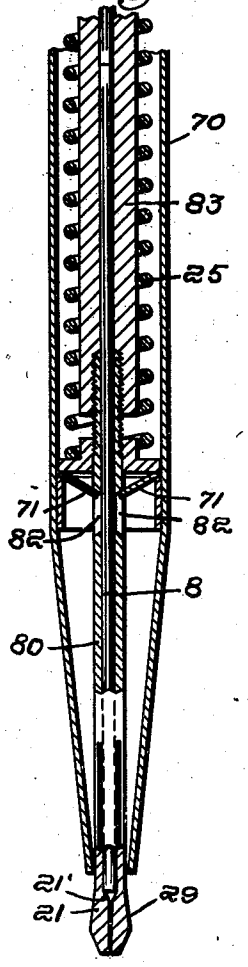

Fig. 5.

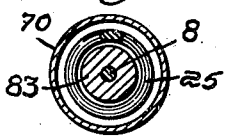

Fig. 6.

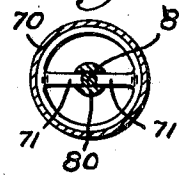

Fig. 7.

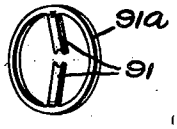

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Fig. 8.

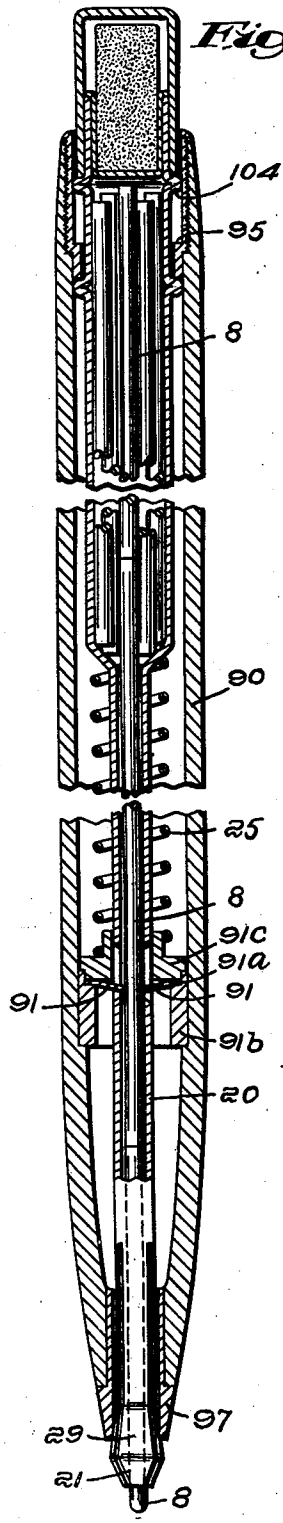


Fig. 10.

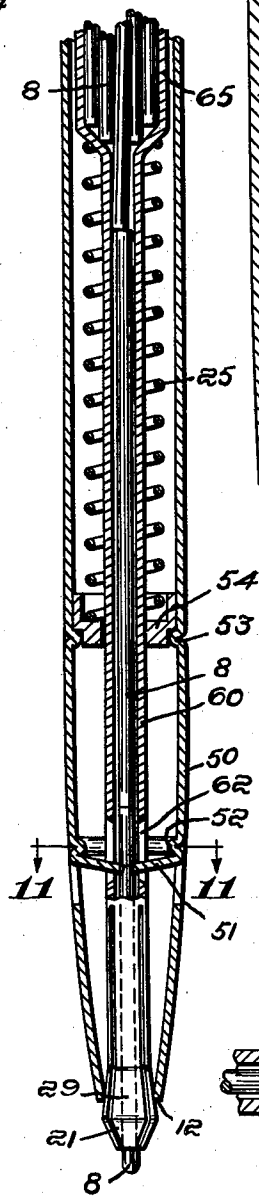


Fig. 9.

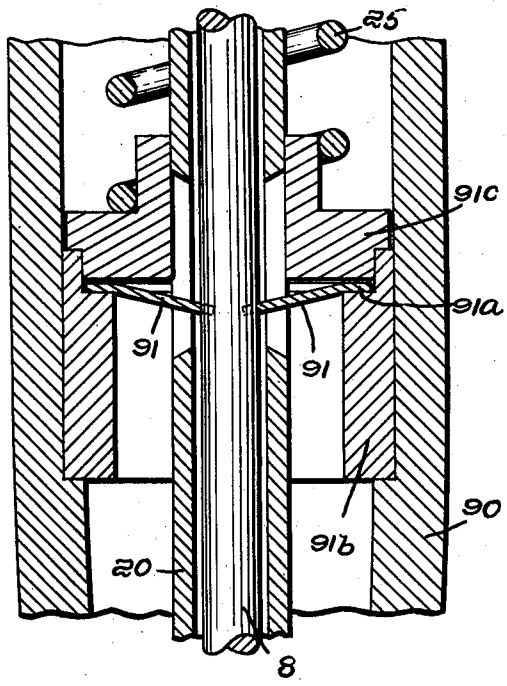


Fig. 11.

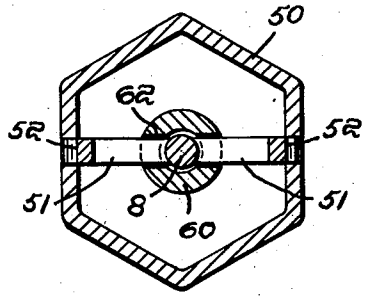
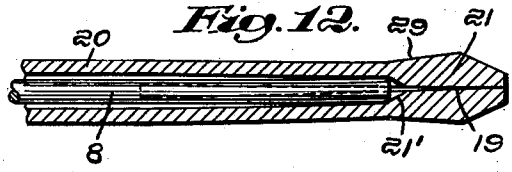


Fig. 12.



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MECHANICAL PENCIL

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Fig. 13.

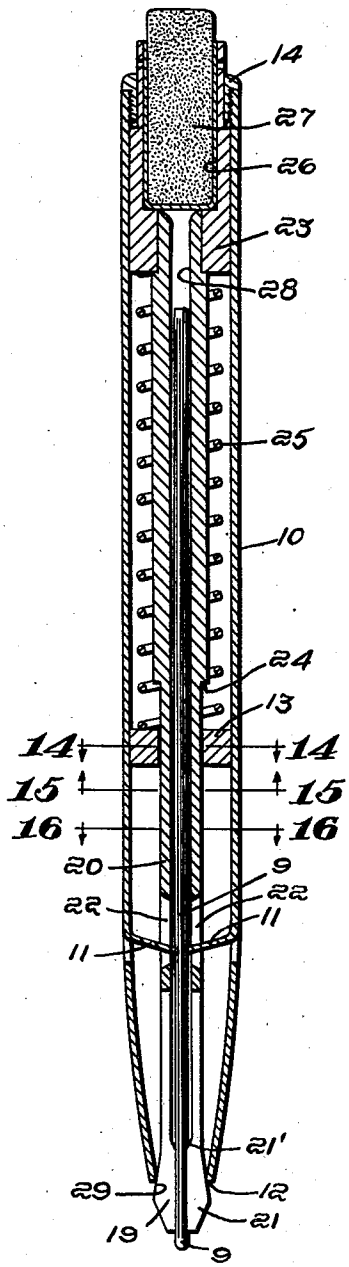


Fig. 14.

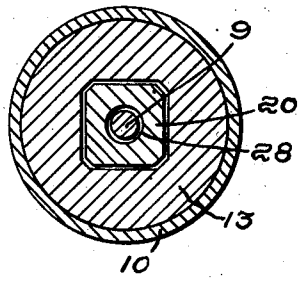


Fig. 15.

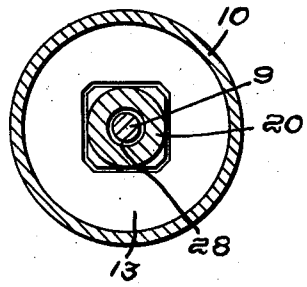
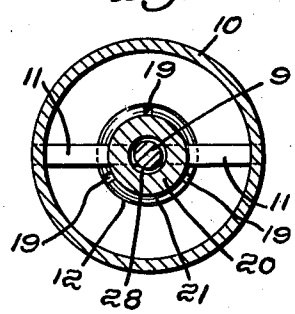


Fig. 16.



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UNITED STATES PATENT OFFICE

2,358,091

MECHANICAL PENCIL

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Application January 22, 1944, Serial No. 519,259

10 Claims. (Cl. 120—17)

This invention relates to mechanical pencils.

More particularly it relates to lead pencils in which a short length of fresh lead is fed for the writing point by a simple pressing and releasing of an exterior part of the pencil.

Heretofore pencils intended for this operative result have had complicated internal structure, comprising various combinations of levers, cams, slides, grippers and other mechanisms of very small dimensions, having the functions successively to grip the lead for holding it stationary, release that lead, feed it out, and then to grip it again. The manufacturing and assembling of such small and numerous parts are expensive. Also the operating results have not always been satisfactory.

Objections are that in some forms the point of the lead is not well supported against writing pressure; or that breakages of the lead occur rather easily, within the barrel or at the point. In some styles the pencil can be used only with leads which conform quite precisely to specified diameter. In some the user has no option as to the length of lead to be fed, at each step; and in some the lead cannot be fed at all if the pencil happens to be pointed upright.

The pencil of the present invention avoids all these objections.

It provides a firm support for the writing point of lead, and yet affords complete selective control of the extent to which this point shall project—either by restricted forward feed or by protective adjustment backward, as may be desired. An outstanding feature is its attaining of these results reliably, by differences of frictional grasp of the lead, and without such complications of internal structure as have characterized previous pressure-feed pencils.

These results are attained by two slip-collets which cooperate to hold, and to feed, the lead within a tube that is reciprocable within the pencil barrel. One of these collets is on the tube; the other is on the barrel. When the tube is still, its collet is firmly seated by a tapered fit in the forward end of the barrel. This collet grasps the lead with resilient prongs that are inclined at a slight angle from parallelism with the axis. The barrel-collet is close behind the barrel's point. It has prongs, inclined at a slight angle from perpendicularity to the axis, which reach the lead through slots in the tube. Each collet opposes regression of the lead relative to itself; but offers mild resistance to advance of the lead relative to itself; and permits advance of the lead relative to itself when that mild resistance is overcome. The tube-collet never lets go of the lead; but its construction is such that when it is projected the lead can be forced back through it. The barrel-collet may be arranged so that it never lets go of the lead; but, for the introduction or moving of short leads, means is provided to spread its jaws momentarily out of the path of the lead.

To advance the lead, one momentarily depresses the tube in the barrel, and so the tube collet at the point draws out a length of lead corresponding to the extent of the depression. During spring return of the tube, the barrel collet prevents regression of the lead, thus leaving the point of lead projected, while the tube collet slips back into its seat where it can support the pressure of writing.

This extraordinarily simple construction is herein illustrated by embodiments in which the tube has a head that protrudes from the top of the barrel, in convenient reach of the user's thumb; and is openable for introduction of leads. The lead may be a single long rod, or a succession of short rods which follow each other automatically from a magazine in the upper part of the tube.

The tube-collet prongs, almost parallel to the lead, are sectors of the tube, separated by narrow slits cut lengthwise in the tube, which, in this region, is composed of resilient metal. The slight spaces made by the slits permit of the sectors being deformed from their natural cylindrical position, so that their forward ends stand closer to the axis than where the surface of the rod of lead will be, which is to be held by them. When the lead is present they are spread correspondingly and grip it by their resilience.

The barrel-collet prongs are made of resilient flexible thin sheet metal and they run almost perpendicular to the lead, from opposite walls of the barrel, inward toward the axis, through slots in opposite sides of the tube, to reach opposite sides of the rod of lead. When at rest and tension free, they stand at an angle tapering preferably about 15° forward from perpendicularity, and they extend far enough into the tube to reach whatever size of rod of lead the pencil is intended to use, or any ordinary variation of that size. As the position of their annular peripheral base is fixed in the barrel, forward drag of lead between them bends these prongs easily, swinging each a little outward from the axis, and lets the lead pass easily; but any incipient backward drag by the lead swings

their ends toward the axis, and jams them stiffly between the lead and their peripheral base; so that they oppose recession of the lead. This opposition sustains the lead while the tube-collet is receding after a forward feeding stroke; and at other times it helps sustain the back thrust of writing pressure. I have found that the providing of a slight degree of looseness in the mounting of the peripheral base of the barrel collet reduces danger of lead breakage.

When an empty pencil is to receive lead, slight pressure on the top of the lead pushes that lead through both collets. For filling an empty pencil with a single lead which is too short to be pushed conveniently, the invention positions and limits the slots so that when the head of the tube is depressed the upper ends of these slots strike their respective barrel-prongs before reaching the limit of their depression stroke. Then the last bit of the tube's depression stroke will bend these prongs forward, and so spread them enough to leave the entire bore of the tube clear for a lead to fall freely by gravity past the location of these prongs. Preferably the stroke is limited so that this spreading is too little to let the ends of the prongs spread past the outer surface of the tube walls, but only into the annular zone between the outer and inner surfaces of the rather thick walls of the tube, so that these prongs never leave their respective slots. This provision is also useful when a leading lead has been worn too short to reach the barrel-collet, in which case an extreme depressing of the tube permits the next following lead to fall past the barrel-collet by gravity, without requiring to be drawn by the tube-collet.

The description which follows, and the accompanying drawings, show embodiments of the invention which are illustrative, but it will be understood that variations may be made.

It is intended that the patent shall cover, by suitable expression in the claims, whatever of patentable invention is found in the constructions disclosed.

In the drawings,

Figure 1 represents in medial longitudinal section a metal barreled pencil of magazine type, embodying the invention, in which the point of lead has been worn short;

Figure 2 is a similar showing of the lower part of the same, with the tube-collet projected, and lead thus drawn out;

Figure 3 is the same as Figure 2 but with the tube-collet retracted, leaving the fresh point of lead ready for writing;

Figure 4 is a similar view of that pencil when being filled from an empty condition, the showing being at the stage in which the leading lead has fallen past the barrel-collet and is temporarily stopped at the entrance to the tube-collet;

Figures 5 and 6 are sections on the lines 5—5, 6—6, of Figure 1;

Figure 7 is a perspective of the barrel-collet of Figures 8 and 9;

Figure 8 is a medial longitudinal section through a pencil embodying the invention in which the barrel is made of plastic;

Figure 9 is a detail of Figure 8 greatly enlarged;

Figure 10 is a medial longitudinal section through the greater part of a very simple construction of pencil embodying the invention, in which the barrel-collet is an integral portion of the barrel;

Figure 11 is a section, enlarged, on the line 11—11 of Figure 10;

Figure 12 is a medial section, greatly enlarged, through the tube-collet showing a lead in the position portrayed in Figure 4;

Figure 13 is a medial longitudinal section through another embodiment of the invention having the characteristic that neither the barrel-collet nor the tube-collet ever releases its hold upon the lead; and

Figures 14, 15 and 16 are cross sections, enlarged, respectively on the lines 14, 15, and 16 of Figure 13.

A simple embodiment of the invention is shown in Figure 13, where a pencil barrel 10 made of resilient metal has a collet 11 whose prongs are tongues cut from opposite sides of the shell of the barrel, drawn thinner and bent inward toward the axis so as to point about 15% forward from a radial plane. These pass through slots 22 in the interior tube 20, so as to engage opposite sides of the rod of lead 9 within the bore 28 of that tube. The barrel's point portion tapers to an open end orifice 12, through which the tube's collet 21 projects. The tube 20, made of metal, plastic or any suitable material, is reciprocable endwise through the barrel 10, by sliding through a bearing-block 13 fixed in the lower part of the barrel; and the tube's sliding top block 23 normally projects from the top of the barrel, and may carry an eraser there. By thumb pressure on this top, the tube can be depressed against helical spring 25 until a shoulder 24 on the tube encounters the fixed block 13 of the barrel. This spring 25 ordinarily holds the tube pressed upward—with the conical back 29 of the tube collet 21 seated in the barrel's point orifice 12, when lead is present in that collet; or, if the pencil is empty of lead, with the tube's top sliding block 23 stopped by a bushing 14 fixed in the top end of the barrel.

Since the prongs 11 of the barrel-collet can function only through the slots 22 of the tube, the tube is made non-rotatable with respect to the barrel by giving it a non-round shape where it passes through the fixed barrel block 13, as seen in Figures 14 and 15; and below that it may preferably be round, as seen in Figures 15 and 16.

Lead can be inserted when the eraser and its shell 26 are removed from the top of the axial bore 28. A lead of standard long length, illustrated in Figure 13, can be pushed down through the barrel-collet 11 until its top end is flush with the top block 23 of the tube. The leading end of this lead will not then have reached the tube collet; but a replacing of the eraser will push it further to the tube collet 21; and the incidental depressing of the tube will project that collet allowing the lead, pressing on the interior slope 21' (Figure 12) of the back of these prongs, to expand the prongs enough to let the lead enter and be gripped. Repeated depressing of the tube will feed the leading end of the lead to writing position, as explained below.

The lower part of the tube is of resilient material and may be integral with the main body of the tube, as in Figures 13, 10 and 8; or may be separable as in Figure 1 if the main body 80 is of other material.

The tube-collet 21, as seen in Figure 12 and elsewhere, is the end portion of the tube 20. The collet head is larger than the nearby body of the tube, has a conical back 29, and has a plurality of slits 19, three being shown, that extend back through a substantial length of the tube to con-

stitute prongs. These prongs are set at an incline at a slight angle from parallelism with the axis. They tend resiliently to close the bore as seen in Figure 12. Hence, when a lead, 8 or 9, is projected through this collet, it spreads these prongs; and they by resilience then grip the lead frictionally so that when the collet moves endwise to the position seen in Figure 2 it draws the lead out with itself.

When thus spread by the presence of a lead the conical back 29 of the tube collet is so large that it cannot fully enter the orifice of the barrel point 12; but it becomes firmly encircled by the end of the barrel; and so the lead point becomes firmly supported to resist writing pressure.

However, the nearly parallel prongs of the tube-collet 21, pressed by spring 25 backward toward the seat 12, have insufficient frictional hold on the lead to resist the spring 25; and so the tube collet 21 slips backward, leaving the lead projected, where it is being held by the barrel-collet, the successive positions being seen in Figures 1, 2 and 3. This operation of step-feeding can be executed without either the barrel-collet or the tube-collet ever releasing its grip on the rod of lead.

When the pencil is empty of lead both collets in Figure 13 mildly oppose the introduction of a lead, but for an initial filling, the lead can easily be pushed through them. Other figures provide means for a lead entering an empty pencil to pass the barrel-collet by gravity.

Figures 10 and 11 illustrate the invention, as thus far described, applied in a pencil whose barrel is a hexagonal metal shell, in which the prongs of the barrel-collet 51 are based in an ogee formation 52, affording them more resilient basal support. This also illustrates how an inward bead 53 in the shell may afford a shoulder for fixing the position of an inserted block 54 as a base for the tube-returning spring 25. In this case the tube 60 is of metal, expanding in its upper part to constitute the magazine 65 for short leads, which is non-rotatable with respect to the barrel, both the barrel 50 and the magazine 65 being hexagonal.

Figures 1–6 show a metallic barreled magazine pencil embodying the invention, in which the barrel-collet 71 is an inserted thimble and washer from which the prongs are bent inward to engage the lead through slots 82 in a tube 80 which holds the succession of standard short leads 8. This tube is composite, its lowest portion having a collet 21 as in the other figures; its middle portion 83 being a separate piece into which the collet portion is screwed; and its top portion being a metallic tube having large diameter, to serve as a magazine and to slide within the barrel 70. The eraser is removable to open the top of the magazine for filling it with leads. When the pencil is empty, the first lead to be inserted will fall freely through the bore of the tube until it reaches the prongs 71 of the barrel-collet. The slots 82, through which those prongs of the barrel-collet reach the lead within the tube, are limited in length, and are positioned so that on its depression stroke the tube does not reach the lower limit of its stroke until the upper ends of these slots 82 have reached and pushed slightly the prongs 71 of the barrel-collet, as seen in Figure 2 and Figure 4, where, it will be noted, these prongs 71 stand at an angle of about 30° from perpendicularity to the axis, instead of at about 15° as in Figures 1 and 3. Slight travel is enough to bend them out of the bore of the tube 80, yet not outside of the walls of that tube. This is limited by positioning the top bead 84 of the tube so that it encounters the top end 74 of an internal ferrule which is fast within the barrel 70. The bottom end of this at 75 constitutes the upward limit by which the bead 85 in the tube is arrested when there is no lead in the collet 21.

The tube 70 being empty, and having been depressed to its limit, as seen in Figure 4, a lead inserted can fall freely through the barrel-collet 71 until its leading end is arrested by the resiliently closed prongs of the tube-collet 21 as in Figure 4 and Figure 12. The bore ends in a conical taper 21' which constitutes a cam for the end of the lead to spread the collet prongs 21, when the user releases the tube from its depression so that the spring 25 drives the tube upward (to the left in Figure 12). The barrel-collet 71 prevents lead from moving upward with the tube; and the prongs 21 are spread by their opposed inclines 21' as the tube's end rises past the stationary leading end of the lead. The travel upward goes far enough for the lead to become grasped between the spread prongs. A repetition of the depressing and releasing of the tube will then feed the lead to a desired step of projection, as illustrated in Figures 1, 2 and 3. The lead point in Figure 1 is presumed to have been worn so that a step feeding is desired. This is attained by simply depressing the tube to the position of Figure 2, thus drawing the lead out a distance equal to the distance through which the user moves his thumb in depressing the tube, either to the full extent permitted by its stop 74 or any less extent. Upon releasing, the tube-collet 21 slides back over the projected lead, to the position of Figure 3, this movement being an advancing of the stationary lead relative to the tube-collet, while regression of the lead is prevented by the barrel-collet 71.

The barrel-collet may take various forms, being an integral part of the barrel in Figures 13 and 10; being an inserted element in Figures 1–4; and being a floating washer in Figures 7, 8 and 9, this last being preferred, and being shown mounted within a magazine pencil having a barrel made of plastic in Figure 8. The whole construction of pencil at present thought most to be preferred is that of Figures 8 and 9, in which a plastic barrel, either circular or polygonal, has taper to a point orifice holding a metallic bushing 97 against which the conical back 29 of the tube-collet 21 becomes seated by the tube spring 25.

The barrel-collet of Figures 8 and 9 is a washer, as seen in Figure 7, stamped from a sheet of resilient metal. Its prongs 91 extend inward from an annular base 91*a* which is mounted loosely in an interior clearance space between a thimble 91*b* and a block 91*c* whose peripheral margins are set solidly together in a fixed position in the barrel. The space which they provide for holding the annular base 91*a* of the barrel-collet loosely between their respective bodies, may allow play of ±.002 inch, both in axial direction and peripherally, and this permits the barrel-collet to "float" enough to adjust itself in relation to variations that may occur in the successive leads.

In the pencil of Figures 8 and 9, the limits of travel of the tube are between the seated position of the tube-collet, illustrated at the bottom of Figure 8, and the projected position in which the bead 104 at the top of the tube engages the shoulder 95 on a thimble that is fast within the top part of the plastic barrel 90.

In operation, one fills an empty pencil of the

type of Figure 13 by removing the eraser and its metallic shell, thumbing down the top end of the tube **20**, and thrusting a long lead or a succession of short leads, or otherwise pressing a single short lead, through to the tube collet, and then releasing the depressed tube. Repeated depressings and releasings of the top will feed the lead step by step. The operation is the same in the other figures, except that for the filling of an empty pencil it is not necessary to push the lead.

For an example, to which however the inventor is not limited, the following dimensions are illustrative of the parts to which they relate. The leads to be used may be any of the standard sizes, viz, diameter of .036' or .046' and length of 4", or 2½" or 1$\frac{3}{16}$"; diameter of pencil barrel $\frac{5}{16}$ inch; diameter of tube **20**, ⅛", thickness of wall of tube, .020"; original width of slits in tube collet, .008; length of those slits, ¾ inch; length of feeding stroke $\frac{5}{32}$ inch.

The barrel collet is not necessarily a single pair of prongs, nor are the friction faces of tube prongs necessarily smooth, but these are here illustrated thus as such have been found sufficient.

I claim as my invention:

1. In a mechanical pencil of the class comprising a barrel, a lead-holding tube mounted coaxially in the barrel for reciprocation endwise, and a spring pressing the tube backward of the barrel, the combination therewith of a resilient collet on the forward end of the tube, outside of the point end of the barrel, having prongs of the wall of the tube at a slight inclination from parallelism, for resiliently squeezing lead that is in the tube and so providing friction that is relatively low but is sufficient to drag the lead forward; and a resilient collet on the barrel having prongs penetrating the tube at a slight inclination pointing forward from perpendicularity to the lead that is within the tube, thus providing friction which with regression of the lead becomes relatively high, sufficient to arrest regression, but with progression of the lead relaxes to less than the frictional drag of the tube collet, sufficiently to permit forward feed of the lead.

2. A mechanical pencil as in claim 1 in which the tube collet has a tapered rear end, which the spring presses against the end of the barrel, thereby increasing the tube collet's squeeze of the lead.

3. A mechanical pencil as in claim 1 in which that portion of the tube which is at the region of the point is of resilient metal, longitudinally slitted with removal of metal to make the said tube prongs; those prongs being set obliquely inward toward the axis, and having their terminal portions constitute an external cam tapered backward, having a diameter which when aggregated with the diameter of the lead exceeds that of the barrel's end-orifice.

4. A mechanical pencil as in claim 1 in which that portion of the tube which is at the region of the point is of resilient metal, longitudinally slitted with removal of metal to make the said tube prongs; those prongs being set obliquely inward toward the axis, and having their terminal portions constitute an internal cam tapered forward and yieldingly obstructing exit of a lead from the tube.

5. A mechanical pencil as in claim 1 in which the barrel is of metal and the barrel collet prongs are integral parts of that metal bent inward.

6. A mechanical pencil as in claim 1 in which the barrel collet prongs have a supporting base at the periphery of the barrel.

7. A mechanical pencil as in claim 1 in which the barrel collet has an annular base close to the periphery of the barrel, from which base its prongs extend to the tube and the lead therein; there being means whose longitudinal position is fixed within the barrel, holding said base.

8. A mechanical pencil as in claim 1 in which the barrel collet has an annular base close to the periphery of the barrel, from which base its prongs extend to the tube and the lead therein; there being means whose longitudinal position is fixed within the barrel, providing play room whose dimensions are microscopic for said base to move about within fixed limits.

9. A mechanical pencil as in claim 1 in which the tube has longitudinal slots through which the barrel prongs penetrate the tube to the lead.

10. A mechanical pencil as in claim 1 in which the tube has longitudinal slots through which the barrel prongs penetrate the tube to the lead and those slots are located so that during the last portion of the feeding stroke of the tube the upper ends of the slots overrun the prongs' ends, thereby to push the barrel prongs out of the interior of the tube.

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