This invention relates to mechanical pencils of the type in which the rotation of one part of the pencil body relative to another part about their common axis operates to drive a plunger axially within the pencil body for propelling the lead therein and projecting a portion of it from the pencil tip. One object of this invention is to provide a mechanical pencil adapted to utilize an unusually long section of lead without reloading. Another object is to provide a pencil in which the lead may be inserted through the upper end of the pencil that is, the end remote from the writing tip. Another object is to provide a mechanical pencil which shall be simple and economical to manufacture. Other objects will appear as the description proceeds. The invention consists of certain features and elements of construction in combination, as herein shown and described and as indicated by the claims.

In the drawings:

Figure 1 is an axial sectional view of a pencil embodying this invention, the middle portion of the pencil body being broken out to condense the view.

Figure 2 is an axial sectional view of the tip and the adjacent part of the barrel on a larger scale than Figure 1, and showing further details of the structure.

Figure 3 is an enlarged section on the same scale as Figure 2, showing the upper end portion of the pencil with the cap and eraser in place on the barrel.

Figure 4 is a transverse section taken as indicated at line 4—4 on Figure 2.

Figure 5 is a transverse section taken as indicated at line 5—5 on Figure 3.

Figure 6 is an enlarged view of the plunger taken in a plane at right angles to the views of this part in Figures 1 and 3.

Figure 7 is a detail section taken axially of the pencil showing some of the same parts as Figure 2.

Figure 8 is an enlarged detail section similar to Figure 3, showing modified construction.

Figure 9 is a transverse section taken as indicated at line 9—9 on Figure 8.

Figure 10 is a transverse section taken similarly to Figure 4 but showing a modified construction and omitting the supply of spare leads.

Figure 11 is a detail section taken as indicated at line 11—11 on Figure 10.

Figure 12 is a transverse section taken similarly to Figure 4 but illustrating another modification of the structure.

Figure 13 is an axial sectional view similar to Figure 1 but showing a “bullet” type of pencil equipped with the mechanism embodying this invention.

Figure 14 is a side elevation of the pencil shown in Figure 13 but with the tip extended in position for use.

Figure 15 is a transverse section taken as indicated at line 15—15 on Figure 13.

Figure 16 is an enlarged sectional view of the tip end of a pencil of modified construction, in which the tip does not rotate with respect to the barrel.

Figure 17 is an enlarged sectional view of the upper end of the pencil showing the arrangement for rotating the head portion for feeding the lead. The barrel may be fitted with the usual spring clip for holding it in the pocket when not in use. The liner 2 of the barrel is fitted with a frictional grip to retain the cap 9.

Most mechanical pencils are made approximately six inches in length in order to be convenient to handle in writing, but in most of them only a small portion of this length is utilized for the section of lead in use. This requires frequent renewal of the lead, with waste of time and effort. Our invention permits the greater portion of the pencil barrel to be filled with the section of lead in actual use, with the result that this lead may be substantially four inches in length, and will require renewal much less frequently than the one and three-eights inch leads in common use. The barrel may also be designed as a magazine to accommodate a large number of spare leads of the four-inch length.

A further improvement embodied in the present structure is the arrangement of the parts to permit removal of the lead-propelling plunger from the upper end of the pencil barrel so that the new lead may be inserted from this end instead of being introduced through the tip. This muzzle or tip-loading is a delicate task, often resulting in broken leads.

Referring first to Figure 1, it will be seen that the body of the pencil includes a barrel comprising a shell 1 which is shown as of substantial thickness, and which may be composed of Bakelite, Pyrolin or any other suitable material, and which is formed snugly over a tubular metallic liner 2 which thus becomes a part of the barrel. The body also includes a tapered tip portion 3 having a metallic terminal 4 through which the lead 5 is fed as it wears away, and through which it projects sufficiently for use in writing. The barrel may be fitted with the usual spring clip for holding it in the pocket when not in use. The liner 2 of the barrel projects beyond the upper end of the outer shell 1 to receive internally the metallic cup 7 which holds the rubber eraser 8 and to support externally the ornamental cap 9 which encloses the eraser. One or more bosses 10 may be pressed in the surface of the upper end portion of the liner 2 to afford a frictional grip to retain the cap 9.

Disposed axially within the barrel, and extending into the tip of the pencil, is a guide tube 11.
for the lead 5 having a helical slot 12 which extends from a point near the end of the tube within the tip 3 and throughout the remainder of its length, said slot being open at the upper end of the tube 11 adjacent the upper end of the barrel. Immediately outside the guide tube 14 there is shown a guide member in the form of a co-axial tube 13 which may be made from a flat sheet bent into curved form with its edges 14 brought into abutting relation, as seen in Figure 4. At the opposite side of the tube a portion of the wall is offset to form a guideway 18 which extends longitudinally adjacent the helically slotted tube 11.

A lead-propelling plunger 16 is slidably carried in the guide tube 11 and is provided with laterally projecting lugs 17 spaced apart in accordance with the pitch of the helical slot 12 so as to extend through said slot and into engagement with the guideaway 15 of the tube 13. At its upper end the tube 13 is anchored in the barrel by means of a metallic insert 18 having a smaller cylindrical portion snugly fitting the tube 13 and either shown or formed with an offset of a portion of the tube 18 as shown in Figures 2 and 7. The other end of the member 21 is flanged inwardly and formed to fit snugly over the tube 13 engaging its offset portion and thus holding it against rotation in the barrel.

The barrel 4 is helically fixed secured in the tip. Its extreme lower end is thrust tightly into the tapered terminal 4 and it is also held fast by means of a tight bushing 23 which centers the tube 11 in the metallic core 24 of the body portion 3 of the tip. The upper end of the metallic terminal 4 fitting tightly into the extreme end of the liner 2 at 22 and swedged over, as seen in Figures 2 and 7. The other end of the member 21 is flanged inwardly and formed to fit snugly over the tube 13 engaging its offset portion and thus holding it against rotation in the barrel.

The barrel 4 is helically fixed secured in the tip. Its extreme lower end is thrust tightly into the tapered terminal 4 and it is also held fast by means of a tight bushing 23 which centers the tube 11 in the metallic core 24 of the body portion 3 of the tip. The upper end of the metallic terminal 4 fitting tightly into the extreme end of the liner 2 at 22 and swedged over, as seen in Figures 2 and 7. The other end of the member 21 is flanged inwardly and formed to fit snugly over the tube 13 engaging its offset portion and thus holding it against rotation in the barrel.

To facilitate the replacement of the plunger 16 I provide means by which the user may know the position of the guideaway 15 in the barrel, and may be able to position the lugs 17 properly with respect to it without attempting to peer into the tip 11. A lug 17 is located outside the barrel 4 at the same side of the axis as the guideaway 15 and in substantially radial alignment therewith, and the end portion 16a of the plunger is formed with an additional lug 17a aligned with the lug 17a. So that the user may know that when the lug 17a is arranged to project radially toward the side of the barrel which carries the clip 6 the lugs 17a will be aligned with the guideway 15 and will enter the latter readily as the plunger is pushed into place. Preferably the tube 14 with its helical slot 15 terminates in a short distance inwardly of the end of the tube 13 so that one of the lugs 17a may be first entered in the guideaway 15 and then pushed into engagement with the end of the slot 12 as the tip 3 is slowly rotated. As soon as the first lug 17a has been picked up by the helical slot, the plunger will be drawn into the tube 14 and into abutting relation with the upper end of the lead previously placed therein. It will be understood that the lug 17a is positioned at such a distance from the lugs 17 that it will register in the helical slot as the plunger advances. Then upon replacement of the eraser 8 and cap 9 the pencil will be again ready for use.

The parts are so dimensioned that there is an annular space between the inner surface of the liner tube 2 and the tube 13 to accommodate a supply of extra leads 50 as shown in Figure 2. In order to render this supply available the insert 18 is cut away at 30 leaving openings through which the leads may be inserted for filling the magazine and removed, as required.

Figures 1 and 3 show a special construction of the cap 9 which permits it to be readily inserted into the conical feature of the pencil. It is provided with a liner tube 31 of thin metal, to which is applied a fine metal cap 32 formed, for example, of an alloy of gold or silver. Or, if desired, the liner 75
and cap 32 may be integral. In either case, the main covering 33 will be of Pyrolin or similar material. The spiral 34 is spirally wound to the body 31 of the barrel. This composition covering may be formed from a short section of tubing, which, when heated and forced into a mold over the liner 31 will assume the proper shape to fit snugly around the liner and against the shoulder formed by the rim 32 leaving only the cap portion of the metal exposed.

It may be noted that in providing the frictional resistance to rotation of the tip on the barrel, the material of the part 25 including its spring ears 29 should be of a slightly different hardness from the material of the bushing 28 upon which it bears; preferably, the bushing may be of a somewhat harder grade of metal, for example, nickel alloy than the tube 25 with ears 29. This will insure a smooth action.

Figures 8 and 9 show a modified construction for connecting the tip rotatably to the barrel. In this form the tubular core 35 is molded in the composition tip 3 in the same manner as the part 25 of Figure 2, but beyond the shoulder 36 of the tip the core 35 is split longitudinally by a series of slits 37 and 38. These extensions of the slits are sprung so as to bear outwardly against the inner surface of a sleeve 39 which is fixed in the barrel 1 by being forced into the tapering end portion of the liner 2. At the inner end the sleeve 36 is formed with an outwardly pressed bead 31 providing an annular channel into which the outwardly flared terminal flange 38 of the part 35 engages permanently but rotatably when said part is pushed into the sleeve 36 in the assembling. Thus the tip 3 is held securely onto the end of the barrel 1 with capacity for relative rotation thereon. The end portion of the helically slotted tube 11 is held frictionally in the tip 3 by means of an interposed tight bushing 39 inserted between the tube 11 and the reduced neck of the core 35. Thus the tube 11 may be rotated by turning the tip 3 on the barrel to place the flange 16 to be led toward the tip for feeding the lead therethrough or toward the opposite end of the pencil for removal to permit reloading with lead.

Figures 10 and 11 show the modified construction for anchoring the guide portions to the barrel and to the guide tube 82. The part that is indicated at 83 formed with an offset portion 54 providing a guideway for the lugs 17 of the plunger 16. The tube may be made of a piece of sheet metal, bent into shape, and including radially extending portions 55 which project from the guide-forming portions 54 and terminate in flaring margins 56. These parts, in turn, are anchored to lugs 24 struck inwardly from the cylindrical wall of the liner 2. If the pencil barrel is made of a molded tube 60 of synthetic material, but without a liner tube, it may be formed, as indicated in Figure 12, so as to fit snugly around the offset portion 61 of the guide tube 62 and this portion may have flaring side walls 63 by which it is interlocked with the material of the tube 60 and serves to suspend the cylindrical portion of the tube 62 in axial position therein. Adjacent this cylindrical portion may be chambered at 64 to provide a partially annular space, serving as a magazine for spare leads 58.

Figures 13, 14 and 15 present the application of our novel mechanism to a pencil of the "bullet" type, which is made comparatively short, and with a blunt, rounded nose, so that it may be carried conveniently and safely in the vest pocket. As shown, this pencil includes a metallic barrel 70 open at the upper end to provide a socket 71 for the eraser 72 and its metallic cover 73. At the lower end the barrel is swedged to a smaller diameter, as seen at 74, where it fits snugly around a telescoping section 75 most of which is contained within the barrel 70 when the pencil is in collapsed position and carrying it. This section 75 may be drawn out to extend the pencil to a convenient writing length, and a portion of the surface may be knurled at 76. The telescoping section may be held at any one of three positions determined by the small bosses 78 adapted to engage the outer edge of the rod in part of the barrel 70 to prevent it slipping back into the barrel while in use. The bluntly rounded bullet nose 77 of the tube 75 may have secured in it a conical support 78 for the lower end of the helically slotted tube 79. The latter is further anchored by the insertion of a washer 80 soldered between the conical part 78 and the tube 79. The conical member includes a guiding bore and friction tip for the lead 51 and this member 79 is fitted centrally and flush into the end of the rounded nose 77.

The tube 79 is rotatably carried in a slotted guide tube 82 which, in this instance, is formed simply as a split tube with an open slot 83 into which the lugs 84 of the plunger 85 project. At the upper end, guide tube 82 is provided with a flange 86 which may be a separate member permanently secured thereon, and whose outer periphery is non-circular. The barrel 70 is also made non-circular in cross-section, as shown, it is octagonal, so that the non-circular flange 86 will be held therein against rotation, and will thus serve to hold the plunger 85 in fixed position when the bullet-nose of the tube 75 is rotated for turning the helically slotted tube 79. By such relative rotation it will be understood that the plunger 85 is caused to travel endwise for feeding the lead 81 and projecting it from the bullet-nose 77 as needed. Or, by reverse rotation, the plunger may be projected from the upper end of the barrel and removed to permit the insertion of a fresh lead or leads in the guide tube 79. The upper end of the tube 75 is slightly flared, and is interlocked with the peripheral portion of the plunger 85 but with sufficient looseness to permit rotation of the tube 75 while the flange 86 is held against rotation. Near its bluntly rounded end 77 the tube 75 may have a bead 87 which will permit it to be grasped for drawing out the tube 75 into extended position, as shown in Figure 14. When this extended it will carry with it the octagonal flange 86 within the barrel 70 to a limit determined by inwardly projecting bosses 88 formed in the wall of the barrel 70 and adapted to engage the flange 86. The mechanism will be operable for feeding the lead, whether the plunger is extended to its full length or left in telescoped position, as shown in Figure 13.

It will be evident that the rotation of the helically slotted tube 11 for feeding the plunger 16 need not be effected by turning the tip of the barrel, but that a portion of the barrel, such as a head portion, may be provided at the upper end and may be mounted rotatably with respect to the remainder of the barrel and attached to the tube 11 for turning it. Or, if desired, the longitudinally slotted guide member, such as the tube 13 of Figure 2, or the tube 35 shown in Figure 5 may be rotated either by the tip or the head portion of the barrel while the helically slotted 75.
tube is secured fixedly in the barrel. One such re-arrangement of the elements is illustrated in Figures 16, 17 and 18, in which the barrel 90 is tapered down to meet the metallic terminal 91 through which the lead is fed and is engaged non-rotatively therewith. The inner end of the terminal 91 is threaded to the guide tube 93 for connection with the end of the guide tube 93 which is shouldered at 84 and fitted with a washer 95 bearing against the shoulder so that the terminal 91 may act as a nut to draw the tube 93 firmly into the tapered end of the metallic lining of the barrel 90. The washer 95 will engage the liner frictionally and with sufficient wedging action to insure that it will not turn in the barrel, but the cross section of the guide tube 93 and the opening in the washer 95 may be non-circular to insure that the tube shall be locked against rotation in the washer. The helically slotted tube, however, is rotatively mounted in the tube 93 which serves as a bearing therefor. As seen in Figure 19, the upper end of the guide tube 93 is formed with a groove 96 and a hollow head member 97 having a re-entrant neck 98 at the outer end of said neck to engage in the groove 96 and thus retain the head longitudinally in its proper relation to the barrel while permitting it to rotate about the axis of the barrel. Beyond the end of the guide tube 93 whose slot 100 opens toward the upper end of the pencil, the helically slotted tube 11 extends for a short distance, and has secured to it a collar 101 having a helical slot 102 coinciding with the slot 12 of the tube 11. The collar may be secured to the end of the tube 11 in any effective manner so as to rotate therewith while the neck portion of the head 97 is, in turn, fixed to the collar 101 as by indentations 103 engaging corresponding depressions in the surface of the collar 101. It may be understood that the cap 104 will be fitted to the head 97 so as to be removable longitudinally, but having turning on the head 97; thus the cap may be grasped for rotating the head to turn the helically slotted tube 11 and operate the plunger therein. The annular space around the guide tube 93 may serve as a magazine for leads which are inserted through an opening 105 in the transverse wall of the head 97. Preferably, the metallic eraser holder 106 is formed with a boss 107 adapted to fill the opening 105 when the eraser is in place, and thus prevent the leads from working into the opening and being broken off at their upper ends by the rotation of the head 97 when it is turned for adjusting the plunger within it. This latter feature is in accordance with United States Patent No. 1,801,671, granted to Charles R. Keenan, and dated April 21, 1931.

We claim:

1. In a mechanical pencil, a body including a barrel part and a part co-axial with the barrel and rotatably connected therewith, a helically slotted tubular member and a longitudinally extending guide member, one of said members being rotatable by the other body part, together with a plunger having a laterally extending lug engageable with the helical slot and with the longitudinal guide so that rotation of one of said body parts with respect to the other will feed the plunger in the barrel, both said helical slot and said longitudinal guide terminating at a substantial distance within the upper end portion of the pencil body, and being unobstructed to permit removal of the plunger therefrom and insertion of lead therein at said upper end, and said plunger including a portion dimensioned to project beyond the upper end of the pencil body while said lug is still engaged in the helical slot, and means externally disposed on the body indicating the location circumferentially of the longitudinal guide therein, said projecting portion of the plunger being provided with means to indicate the position of the said lug thereon to facilitate entering the lug into engagement with the guide when the plunger is inserted in the upper end of the pencil body.

2. In a mechanical pencil, a body including a barrel part and a part co-axial with the barrel and rotatably connected therewith, a helically slotted tubular member and a longitudinally extending guide member, one of said members being rotatable by one of said body parts and the other member being rotatable by the other body part, together with a plunger having a laterally extending lug engageable with the helical slot and with the longitudinal guide so that rotation of one of said body parts with respect to the other will feed the plunger in the barrel, both said helical slot and said longitudinal guide terminating within the upper end portion of the pencil body, and being unobstructed to permit removal of the plunger therefrom and insertion of lead therein at said upper end, and said plunger including a portion dimensioned to project beyond the upper end of the pencil body while said lug is still engaged in the helical slot, and means externally disposed on the body indicating the location circumferentially of the longitudinal guide therein, said projecting portion of the plunger having an additional lug positioned to register in the helical slot and extending laterally in the same direction as the first mentioned lug to indicate the position of the latter when it is inserted in the said body, and means to facilitate engaging said lug with the guideway.

3. In a mechanical pencil, a barrel, a tip rotatable therein, a lead guide tube operably connected to the tip and formed with a helical slot opening at the upper end of the barrel, said barrel having a longitudinal guide extending adjacent said helical slot and opening at the upper end of the barrel, a plunger having a lug extending laterally through the helical slot and into engagement with the guideway, whereby said plunger is movable by relative rotation of the tip and barrel and is removable at the upper end of the barrel to permit insertion of the lead therein, said plunger including a portion dimensioned to project beyond the upper end of the pencil body while said lug is still engaged in the helical slot, and a clip externally secured to the body and disposed to indicate the location of the longitudinal guide therein, said projecting portion of the plunger being provided with laterally extending means to indicate the position of the lug of the plunger so that alignment of said indicating means with the clip will facilitate entering the lug into engagement with the guideway when the plunger is inserted in the upper end of the pencil body.

4. In a mechanical pencil, a barrel, a tip rotatable therein and inseparably connected therewith, a lead guide tube operably connected to the tip and formed with a helical slot opening at the upper end of the barrel, said barrel having a longitudinal guide extending adjacent said helical slot and opening at the upper end of the barrel, and a plunger having a lug extending laterally through the helical slot and into engagement with the guideway, whereby said plunger is movable by relative rotation of the tip and barrel and is removable at the upper end of the barrel to permit insertion of the lead therein, said plunger including a portion dimensioned to project beyond the upper end of the pencil body.
erally through the helical slot and into engagement with the guideway, whereby said plunger is movable by relative rotation of the tip and barrel and is removably placed at the upper end of the barrel to permit the insertion of lead therein, said plunger having a portion dimensioned to project a substantial distance beyond the upper end of the barrel while the said lug is still engaged in the helical slot to facilitate removal of the plunger and replacement thereof, together with means externally disposed on the body indicating the location of the longitudinal guideway therein, and means on the projecting portion of the plunger adapted to indicate the position of the said lug thereon to facilitate entering the lug into engagement with the guideway when the plunger is inserted in the upper end of the pencil body.

5. In a mechanical pencil, a barrel comprising a main section and a tip section telescopically engaged with each other and adapted for relative rotation about their common axis, a lead guide tube having one end secured in the tip section and having a helical slot at its upper end for receiving the end of a lead pencil lead, said guide tube being formed with a helical slot and a longitudinal guideway extending adjacent said helical slot, said guide tube extending adjacent said helical slot and also opening at the upper end of the barrel to permit the insertion of said lead upon removal of the plunger at said upper end of the pencil.

6. In a mechanical pencil, a barrel comprising a main section and a tip section telescopically engaged with each other and adapted for relative rotation about their common axis, a lead guide tube having one end secured in the tip section and having a helical slot at its upper end for receiving the end of a lead pencil lead, said guide tube being formed with a helical slot and a longitudinal guideway extending adjacent said helical slot and also opening at the upper end of the barrel to permit the insertion of said lead upon removal of the plunger at said upper end of the pencil.

7. In the structure defined in claim 5, said main barrel portion being of non-circular cross-section internally, and the longitudinal guide tube having a non-circular cross-section internally, and a helical slot at its upper end engaged against rotation in said barrel section, together with a flange on the upper end of the tip section rotatively interlocked with said flange of the guide tube to insure movement of said tube with the top section throughout the range of telescopic movement of the latter in the main barrel while permitting said tip section to rotate about its axis in the barrel.

8. In a mechanical pencil, a two-part barrel comprising a main section and a tip section of smaller diameter than the main section, said main section terminating in a portion of reduced diameter to fit snugly around the tip section as a bearing therefor to permit rotation of the tip in the barrel and telescopic movement of the tip through said bearing, together with a lead guide tube axially secured in the tip, a lead-feeding plunger adapted to travel in said tube, a mechanism for moving said plunger carried by said tip section throughout its range of telescopic movement and operable by the rotation of the tip section in the main barrel.

9. In the structure defined in claim 8, said barrel section being of non-circular cross-section internally, and said mechanism including a non-circular anchoring element engageable in said barrel to hold a member of the mechanism against rotation while permitting it to travel longitudinally in the barrel through the range of telescopic movement of the tip section.

10. In a writing implement, a cap comprising a metallic base structure of tubular form having an outwardly offset portion, and a covering of molded plastic material fixed to said base terminating at said offset to leave a part of the metallic structure exposed.

11. In a writing implement, a cap comprising a metallic base structure of tubular form with a metallic terminal forming an end wall for the cap and including an annular flange fitted over the tubular base portion, the main section having a top section shoulder, and a covering of molded plastic material fixedly encasing the tubular base structure and terminating at said shoulder, leaving the terminal itself exposed.

12. In a mechanical pencil, a barrel, a head portion co-axial therewith and rotatable with respect thereto, a lead guide tube located axially in the barrel and secured to said head for rotation thereby, said tube being formed with a helical slot opening at the upper end through said head, said barrel having a longitudinal guideway extending adjacent said helical slot and also opening at the upper end of the barrel, and a plunger having a lug extending laterally through the helical slot and into engagement with the guideway, whereby said plunger is movable by relative rotation of the head and barrel and is removably placed at the upper end of the barrel and through the head to permit insertion of lead in the guide tube.

13. In the combination defined in claim 12, said longitudinal guideway of the barrel being formed in a tube anchored in the barrel adjacent the tip, said tube being inter-engaged with the head to prevent longitudinal separation of the head and the helically slotted tube from the barrel.

14. In the structure defined in claim 12, said head comprising an upwardly open cup adapted to receive an eraser, and a neck portion of reduced diameter extending into the barrel, said helically slotted tube having means at its upper end fixed thereto and interlocked with said neck of the head for transmitting rotation from the head to the helically slotted tube.

FRANKLIN H. KEERAN.
CHARLES R. KEERAN.