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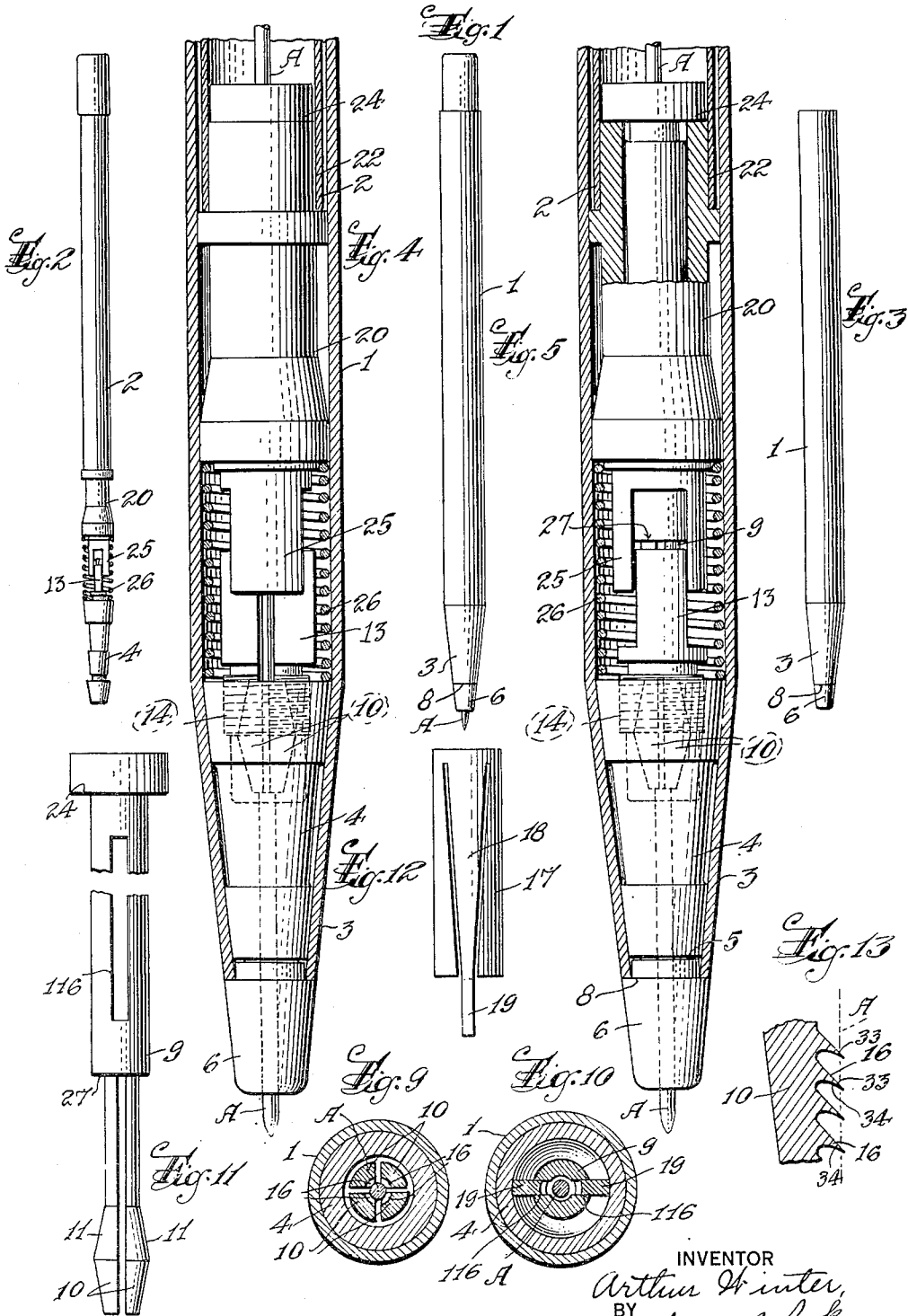
A. WINTER

2,028,855

MECHANICAL PENCIL

Filed Sept. 12, 1934

2 Sheets-Sheet 1



INVENTOR
Arthur Winter,
BY
Harry S. Cook,
ATTORNEY

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A. WINTER

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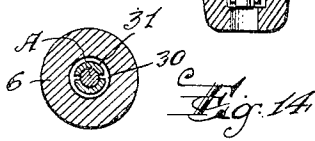
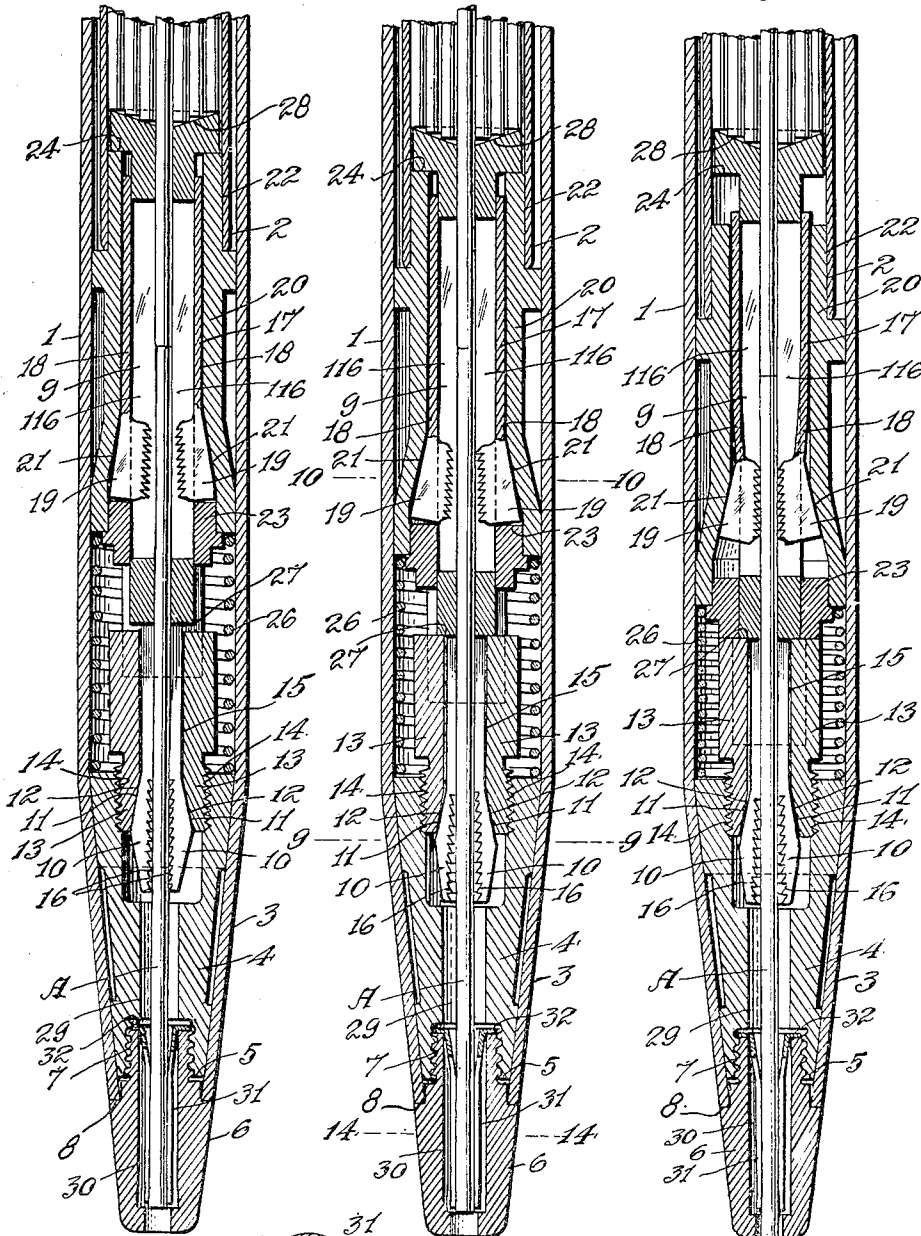
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2 Sheets-Sheet 2

Fig. 6

Fig. 7

Fig. 8



INVENTOR
Arthur Winter,
BY
Harry N. Hook,
ATTORNEY

UNITED STATES PATENT OFFICE

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MECHANICAL PENCIL

Arthur Winter, Weehawken, N. J.

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17 Claims. (Cl. 120—17)

This invention relates to mechanical pencils of the step-by-step type, wherein leads are fed from a magazine into a lead holding and advancing mechanism for projecting the leads step-by-step longitudinally from one end of the pencil casing.

Known pencils of this general character have not been entirely satisfactory because either the leads are broken by the clutch mechanisms during passage of the leads from the magazine to writing position, or the leads are insecurely held in writing position so they are pressed backwardly into the casing during writing operations, or the leads are so positively held in projected position that they cannot be pushed backwardly into the casing to adjust the length of the projected portion. Moreover, known pencils are complex and many of them easily become inoperative through mal-adjustment or failure of cooperation of the parts.

A prime object of my invention is to provide a novel and improved pencil of this general character which shall overcome the above-mentioned difficulties and which shall be relatively simple, inexpensive, reliable and durable in operation and construction.

Another object is to provide such a mechanical pencil embodying novel and improved mechanism for advancing the leads step-by-step from the magazine to writing position, whereby the leads shall be positively gripped without danger of slipping of the gripping mechanism during advancement of the leads and the gripping mechanism shall be quickly and completely disengaged from the leads upon retraction of the advancing mechanism at the will of the operator from any point in the lead advancing movement.

Another object is to provide a novel and improved construction and combination of a lead advancing mechanism and a mechanism for positively holding the lead in writing position so that the lead holding mechanism shall be released approximately simultaneously with or slightly before the gripping of the lead by the advancing mechanism and the lead shall be gripped by the holding mechanism at approximately the same time or slightly before the disengaging of the advancing mechanism from the lead.

Another object is to provide a novel and improved construction and combination of parts whereby the lead can be completely released from both the advancing mechanism and the holding mechanism so that the lead can be easily slid back manually into the casing to adjust the length of the writing portion.

A further object is to provide a novel and im-

proved yielding lead guiding mechanism for the tip of the casing which shall be automatically yieldable to maintain the lead in direct alinement with the advancing and holding mechanism and thereby avoid undue lateral strains on the lead which might fracture or break the lead at the tip of the pencil, and to prevent rotation of the writing portion of the lead.

Other objects, advantages and results of the invention will appear from the following description when read in connection with the accompanying drawings.

Referring to the accompanying drawings in which corresponding and like parts are designated throughout the several views by the same reference characters,

Figure 1 is a side elevation of the complete pencil embodying the invention.

Figure 2 is a side elevation of the inner section and the lead advancing and holding mechanism.

Figure 3 is a side elevation of the outer section.

Figure 4 is an enlarged fragmentary vertical sectional view through the writing end of the outer section of the casing, showing the lead advancing and holding mechanism in side elevation.

Figure 5 is a similar view taken on a plane at right angles to that shown in Figure 4.

Figure 6 is a fragmentary vertical longitudinal sectional view through the outer section of the casing and the lead holding and advancing mechanism showing the parts in their normal lead holding position.

Figure 7 is a similar view showing the parts in the position assumed during release of the lead by the lead holding mechanism just prior to gripping of the lead by the advancing mechanism.

Figure 8 is a similar view showing the completion of the lead advancing movement of the advancing mechanism.

Figures 9 and 10 are horizontal sectional views on the lines 9—9 and 10—10 of Figure 7.

Figure 11 is a detached side elevation of the lead holding tube.

Figure 12 is a similar view of the lead advancing clutch sleeve and jaws.

Figure 13 is an enlarged fragmentary longitudinal sectional view through the teeth of one of the lead holding jaws, and

Figure 14 is a horizontal sectional view on the line 14—14 of Figure 7.

Specifically describing the illustrated embodiment of the invention the pencil comprises a casing which includes telescopically associated outer and inner tubular sections 1 and 2 respectively.

One end of the outer section is tapered at 3, while the inner section 2 is slid into the other end of the outer section.

5 Within the outer section is mounted a lead advancing and a holding mechanism which is shown as comprising a body sleeve 4 tapered to approximately conform to the inner wall of the tapered portion 3 of the outer section and with one end terminating short of the end of the outer section as at 5. This body sleeve 4 is secured in the outer section by a tip 6 which is screw-threaded at 7 into the body sleeve and has a shoulder 8 to abut the end of the outer section 1.

15 A lead holding tube 9 is mounted at one end in the body sleeve 4 and has said end longitudinally slit to provide a plurality of lead gripping jaws 10. The outer surfaces of these jaws are tapered at 11 to cooperate with corresponding flared surfaces 12 in a clamping sleeve which is formed of two identical sections 13. These two sections 13 of the clamping sleeve are applied to the tube from opposite sides thereof and have screw-threaded portions 14 threaded into the body sleeve 4, the two sections providing between them an opening 15 through which the lead holding tube 9 is longitudinally slidable. The inner sides of the jaws 10 are provided with teeth 16 for gripping a lead A when the tube 9 is pulled into the clamping sleeve to cause engagement of the tapered surfaces 11 and 12.

30 The other end of the lead holding tube has a pair of diametrically opposite slots 16 and has slidable thereover a lead advancing clutch sleeve 17. This sleeve is longitudinally slitted to form a pair of diametrically opposite resilient arms 18 at the free ends of which are lead gripping jaws 19 which project through the respective slots 16.

40 The sleeve 17 is longitudinally slidable on the tube 9 and is operatively connected to the inner section 2 of the case so that upon sliding of said inner section into the casing the jaws 19 are pressed into engagement with the lead, and the sleeve is slid along the tube to advance the lead, while when the inner section is retracted the jaws are disengaged from the lead. As shown, an actuating collar 20 is telescopically fitted over the sleeve 17 and has a cam surface 21 to cooperate with the jaws 19; and this collar 20 is connected at 22 with the inner section 2 of the casing. Assuming the parts to be in the normal position shown in Figure 6 with the inner section retracted, the collar 20 is in position to permit the jaws 19 to be sprung outwardly from the lead by the arms 18. When the inner section is pressed inwardly of the outer section the cam surfaces 21 slide upon the tapered jaws 19 so as to force the jaws inwardly against the lead and continued movement of the inner section and collar 20 in the same direction then slides the sleeve 17 on the tube 9 to advance the lead as shown in Figure 8. As the inner section 2 and collar 20 are retracted, the cam surface 21 moves away from the jaws to permit them to spring outwardly away from the lead. The sleeve 17 has a frictional engagement with the tube 9 so as to initially hold the sleeve against movement upon movement of the collar in either direction to permit the surface 21 to engage and disengage the jaws to force the jaws against the lead and to permit the jaws to withdraw from the lead respectively; and the collar has an interior shoulder 23 to abut the ends of the jaws 19 as the collar approaches the limit of its retracting movement for positively moving the sleeve 17 to its initial position shown in Figure 6. Outward movement or retraction of the inner section and

collar 20 is limited by abutment of the collar 20 with a shoulder 24 on the end of the lead holding tube 9, while inward movement of the collar 20 and inner section is limited by engagement of the end of the collar with the sections 13 of the clamping sleeve.

Means is provided for retracting the collar 20 and inner section, this means being shown as a spring 26 interposed between the end of the collar and the end of the body section 4.

10 As shown, preferably the collar has a bifurcated extension 25 embracing the sections 13 of the clamping sleeve to prevent rotation of the collar and sleeve 17 and thereby avoid chipping or grooving of the lead held by the jaws.

15 The lead holding tube 9 has a limited longitudinal movement in opposite directions, the movement outwardly of the outer casing or in the direction of retraction of the inner section being limited by engagement of the tapered surfaces 11 of the jaws 10 with the tapered surfaces 12 of the clamping sleeve. Movement in the other direction is limited by engagement of a stop shoulder 27 on the tube with the ends of the clamping sleeve sections 13. This limited movement is just sufficient to permit clamping and release of the lead by the jaws 10. The jaws are moved into clamping engagement with the lead by retraction of the collar 20 and inner section, and the spring 26 yieldingly holds the jaws in this lead holding position. Upon the beginning of the inward movement of the collar 20 and inner section 2, the compression of the spring 26 is relieved from the shoulder 24 on the tube 9 so that said tube may longitudinally move to disengage the jaws 10 from the lead. Should the tube not move upon simple release of the compression of the spring, the frictional engagement of the collar 20 with the sleeve 17 and the sleeve 17 with the tube will positively move the tube. This motion will continue until the shoulder 27 abuts the clamping sleeve sections 13, and this motion preferably takes place slightly before the gripping of the lead by the advancing jaws 19. Then continuing movement of the collar 20 inwardly of the outer section will cause the jaws 19 to grip the lead and slide the sleeve 17 along the tube 9 to advance the lead therethrough. Upon release of the inner section under the influence of the spring 26, the retraction of the collar 20 and inner section 2 moves the tube 9 to cause the jaws 10 to clamp the lead in the first instance by frictional engagement between the collar 20, sleeve 18 and the tube, whereupon the lead is held against retraction. This action preferably takes place at about the same time or slightly before the release of the jaws 19 from the lead. Continued retraction of the collar 20 will then carry the sleeve 17 to its initial position and cause abutment of the collar with the shoulder 24 so as to exert a positive pull on the tube 9 to hold the jaws 10 in engagement with the lead.

55 With this construction it will be noted that the lead may be projected from the tip step-by-step upon relative reciprocation of the inner and outer sections 1 and 2, the clutch 10, 12 releasing the lead to permit advance thereof, and holding the lead in projected position against retraction by the advancing mechanism as the latter retracts. Also, on each step the lead may be ejected any desired amount up to the limit of the advancing movement of the sleeve 17. It is important to note that by slightly moving the inner section into the outer section the lead can be released from both the clutch 10, 12 and the

advancing jaws 19, so that the lead freely can be pushed into the casing to adjust the length of the projecting portion should the lead be projected too far.

5 It will be obvious from the foregoing, that the leads may be deposited in the tube 9 in any suitable manner, but as shown the outer end of the inner section 2 serves as a magazine, the bottom of which is conically concave at 28 concentric
10 with the opening through the tube 9 so that the leads will fall by gravity into said opening.

As the leads leave the holding clutch 10, 13, they are projected through openings 29 and 30 in the body section 4 and tip 6, respectively.
15 The openings 29 and 30 are preferably in alignment with each other and in alignment with the opening through the tube 9, but it is difficult to maintain exact alignment due to the separability of the tip 6. When the openings are out of
20 alignment the leads are liable to be cracked by unbalanced lateral strains. To avoid this, I make the openings 29 and 30 larger in diameter than the lead and utilize a thin walled longitudinally slitted tube 31 which frictionally
25 receives the lead and is mounted in the openings 30 in the tip 6 in spaced relation to the walls of said opening. A flange 32 may be formed on the tube 31 for securing it to the tip. With this construction, the flexible tube 31 may yield laterally
30 to accommodate slight misalignment of the lead and the opening 30. Also, this tube 31 will hold the writing portion of the lead against rotation during writing operations and in some degree will hold the lead against dropping out of the
35 casing when such writing portion has become disengaged from the holding clutch 12, 13.

For quickly and positively but lightly gripping the lead, the jaws 10 of the holding clutch preferably have their teeth formed as shown in Figure
40 13, each tooth having its biting edge formed by the convergence of a surface 33, which is at approximately forty-five degrees to the axis of the lead and inclined in the direction of the movement of the lead outwardly of the casing, and a concave surface 34 so as to form an acutely
45 angled sharp edge to grip the lead. The lead may slip by the jaws over the forty-five degree surface 33, but will be positively gripped and held against retraction by the sharp edges of the teeth and without injury to the lead.

50 While I have shown the pencil as embodying certain details of construction it should be understood that this is primarily for the purpose of illustrating the invention and that many modifications and changes may be made in the structure of the pencil without departing from the spirit or scope of the invention.

Having thus described my invention, what I claim is:

60 1. A mechanical pencil comprising telescopically associated inner and outer tubular sections, a slotted lead holding tube mounted for longitudinal movement in opposite directions in said
65 outer tube, a clutch on and slidable longitudinally of said tube and having jaws passing through the slots therein to engage a lead in the tube, an operative connection between said inner section and said clutch to cause engagement and disengagement of said jaws with a lead in said tube
70 upon movement of said inner section into said outer section and retraction of said inner section respectively, whereby said lead is slid through said tube by said clutch toward projected position from said outer section and released by said
75 clutch upon movements of the clutch in opposite

directions respectively, said tube and said outer section, having cooperating parts one of which is operatively connected to said inner section to grip and hold said lead in projected position upon retraction of said inner section and to release
5 said lead upon movement of the inner section into the outer section.

2. A mechanical pencil comprising telescopically associated inner and outer tubular sections, a lead holding tube mounted for longitudinal
10 movement in opposite directions in said outer section, one end of said tube having longitudinal slots, a sleeve frictionally slidable on said end of said tube and having jaws passing through said
15 slots to engage a lead in said tube, an operative connection between said inner tubular section and said sleeve for forcing said jaws into engagement with a lead upon movement of the inner section into the outer section and permitting said
20 jaws to withdraw from said lead as said inner section is retracted, means for automatically retracting said inner section, an operative connection between said inner section and said tube to move the latter in one direction longitudinally
25 as said inner section is retracted, the other end of said tube and said outer section carrying cooperating parts of a clutch for gripping and holding a lead projected as said tube is moved in said
30 direction by retraction of said inner section, said tube having limited longitudinal movement in the other direction as the inner section is moved into the outer section to release said clutch.

3. A mechanical pencil comprising telescopically associated inner and outer tubular sections, a lead holding tube mounted in said outer section, one end of said tube having longitudinal
35 slots, a sleeve on and slidable longitudinally of said tube and having integral resilient arms carrying jaws projecting through said slots to engage a lead in said tube, and actuating means
40 connected to and actuated in both of opposite directions by said inner section and having a cam surface to engage said resilient arms and force said jaws into engagement with said lead and slide said sleeve on said tube to advance said
45 lead in said tube upon movement of said inner section into said outer section and to release said jaws from engagement with said lead and retract said sleeve upon retraction of said inner section.

50 4. A mechanical pencil comprising telescopically associated inner and outer tubular sections, a lead holding tube mounted in said outer section, one end of said tube having longitudinal slots, a sleeve on and slidable longitudinally of
55 said tube and having resilient arms carrying jaws projecting through said slots to engage a lead in said tube, and an actuating collar slidable on said sleeve and connected to said inner section, said collar having an interior cam surface to engage said resilient arms and force said
60 jaws into engagement with said lead and slide said sleeve on said tube to advance said lead in said tube upon movement of said inner section into said outer section and to release said
65 jaws from engagement with said lead and retract said sleeve upon retraction of said inner section.

5. The mechanical pencil set forth in claim 3 wherein said lead holding tube is longitudinally
70 movable in said outer section, and with the addition of cooperating clutch parts on said tube and said outer section to hold and release an advanced lead upon movement of said tube in opposite directions respectively, and means operative upon movement of said inner section into
75

said outer section and into retracted position to move said tube in the direction to release said lead and in the direction to hold said lead respectively.

6. The mechanical pencil set forth in claim 4 wherein said lead holding tube is longitudinally movable in said outer section, and with the addition of cooperating clutch parts on said tube and said outer section to hold and release an advanced lead upon movement of said tube in opposite directions respectively, said tube having a stop shoulder engaged by said collar upon retraction of said inner section to move said tube in the direction to hold the lead, said collar being disengaged from said shoulder upon movement of the inner section into said outer section to permit the tube to move in the direction to release said lead.

7. The mechanical pencil set forth in claim 4 wherein said lead holding tube is longitudinally movable in said outer section, and with the addition of cooperating clutch parts on said tube and said outer section to hold and release an advanced lead upon movement of said tube in opposite directions respectively, said tube having a stop shoulder engaged by said collar upon retraction of said inner section to move said tube in the direction to hold the lead, said collar being disengaged from said shoulder upon movement of the inner section into said outer section to permit the tube to move in the direction to release said lead, said cooperating clutch parts limiting movement of the tube in the direction to hold the lead and said tube and outer section having cooperating stops to limit movement of the tube in the other direction.

8. The mechanical pencil set forth in claim 4 wherein said lead holding tube is longitudinally movable in said outer section, and with the addition of cooperating clutch parts on said tube and said outer section to hold and release an advanced lead upon movement of said tube in opposite directions respectively, said tube having a stop shoulder engaged by said collar upon retraction of said inner section to move said tube in the direction to hold the lead, said collar being disengaged from said shoulder upon movement of the inner section into said outer section to permit the tube to move in the direction to release said lead, and means for automatically retracting said inner section and yieldingly holding it in retracted position.

9. The mechanical pencil set forth in claim 4 wherein said lead holding tube is longitudinally movable in said outer section, and with the addition of cooperating clutch parts on said tube and said outer section to hold and release an advanced lead upon movement of said tube in opposite directions respectively, said tube having a stop shoulder engaged by said collar upon retraction of said inner section to move said tube in the direction to hold the lead, said collar being disengaged from said shoulder upon movement of the inner section into said outer section to permit the tube to move in the direction to release said lead, said cooperating clutch parts limiting movement of the tube in the direction to hold the lead and said tube and outer section having cooperating stops to limit movement of the tube in the other direction, and means for automatically retracting said inner section and yieldingly holding it in retracted position.

10. The mechanical pencil set forth in claim 4 wherein said lead holding tube is longitudinally movable in said outer section, and with the addi-

tion of cooperating clutch parts on said tube and said outer section to hold and release an advanced lead upon movement of said tube in opposite directions respectively, said tube having a stop shoulder engaged by said collar upon retraction of said inner section to move said tube in the direction to hold the lead, said collar being disengaged from said shoulder upon movement of the inner section into said outer section to permit the tube to move in the direction to release said lead, said sleeve frictionally engaging said tube to move the tube in both directions.

11. The mechanical pencil set forth in claim 4 wherein said lead holding tube is longitudinally movable in said outer section, and with the addition of cooperating clutch parts on said tube and said outer section to hold and release an advanced lead upon movement of said tube in opposite directions respectively, said tube having a stop shoulder engaged by said collar upon retraction of said inner section to move said tube in the direction to hold the lead, said collar being disengaged from said shoulder upon movement of the inner section into said outer section to permit the tube to move in the direction to release said lead, said cooperating clutch parts limiting movement of the tube in the direction to hold the lead and said tube and outer section having cooperating stops to limit movement of the tube in the other direction, said sleeve frictionally engaging said tube to move the tube in both directions.

12. The mechanical pencil set forth in claim 4 wherein said lead holding tube is longitudinally movable in said outer section, and with the addition of cooperating clutch parts on said tube and said outer section to hold and release an advanced lead upon movement of said tube in opposite directions respectively, said tube having a stop shoulder engaged by said collar upon retraction of said inner section to move said tube in the direction to hold the lead, said collar being disengaged from said shoulder upon movement of the inner section into said outer section to permit the tube to move in the direction to release said lead, said sleeve frictionally engaging said tube to move the tube in both directions, and yielding means for automatically retracting said inner section and holding it in retracted position.

13. A mechanical pencil comprising telescopically associated inner and outer tubular sections, a lead holding tube mounted in said outer section, one end of said tube having longitudinal slots, a sleeve on and slidable longitudinally of said tube and having resilient arms carrying jaws projecting through said slots to engage a lead in said tube, and actuating means connected to said inner section and having a cam surface to engage said resilient arms and force said jaws into engagement with said lead and slide said sleeve on said tube to advance said lead in said tube upon movement of said inner section into said outer section and to release said jaws from engagement with said lead and retract said sleeve upon retraction of said inner section, said lead holding tube having limited longitudinal movement in opposite directions and said sleeve having frictional engagement with said tube to move it in both directions, and cooperating clutch parts on said tube and said outer section to hold and release an advanced lead upon movement of said tube in opposite directions respectively.

14. A mechanical pencil comprising telescopically associated inner and outer tubular sections,

a lead holding tube mounted in said outer section, one end of said tube having longitudinal slots, a sleeve on and slidable longitudinally of said tube and having resilient arms carrying jaws projecting through said slots to engage a lead in said tube, and actuating means connected to said inner section and having a cam surface to engage said resilient arms and force said jaws into engagement with said lead and slide said sleeve on said tube to advance said lead in said tube upon movement of said inner section into said outer section and to release said jaws from engagement with said lead and retract said sleeve upon retraction of said inner section, said lead holding tube having limited longitudinal movement in opposite directions and said sleeve having frictional engagement with said tube to move it in both directions, and cooperating clutch parts on said tube and said outer section to hold and release an advanced lead upon movement of said tube in opposite directions respectively, and yielding means for automatically retracting said actuating means and holding it in retracted position, said actuating means when in retracted position operatively engaging said tube to maintain clutch parts in lead holding position.

15. A lead gripping and holding device for mechanical pencils including a plurality of jaws each having a tooth formed by the intersection of a plane surface at an angle of approximately forty-five degrees to the axis of said device and a concave curved surface.

16. A mechanical pencil comprising telescopically associated inner and outer tubular sections, a slotted lead holding tube mounted in said outer section, a clutch on and slidable longitudinally of said tube and having jaws through the slots therein to engage a lead in the tube, an operative connection between said inner section and said clutch to cause engagement and disengagement of said jaws with a lead in said tube to advance and release the lead upon movement of said inner

section into said outer section and retraction of said inner section respectively, and a second clutch positively operated upon disengagement of the first clutch from the lead to grip and hold the projected lead and positively operated upon engagement of the first clutch with the lead to release the projected lead, whereby the projected lead is held by the second clutch against retraction as the lead is released by the first clutch upon retraction thereof, and the lead is slid through the second clutch when the lead is gripped and advanced by the first clutch.

17. A mechanical pencil comprising telescopically associated inner and outer tubular sections, a slotted lead holding tube mounted for longitudinal movement in opposite directions in said outer tube, a clutch on and slidable longitudinally of said tube and having jaws passing through the slots therein to engage a lead in the tube, an operative connection between said inner section and said clutch to cause engagement and disengagement of said jaws with a lead in said tube upon movement of said inner section into said outer section and retraction of said inner section respectively, whereby said lead is slid through said tube by said clutch toward projected position from said outer section and released by said clutch upon movements of the clutch in opposite directions respectively, said tube carrying gripping jaws through which the lead is longitudinally movable and said outer section having a cam surface to cooperate with said jaws, said tube being movable longitudinally to a limited extent in opposite directions as said clutch is moved, said jaws being movable with said tube relatively to said cam surface in opposite directions upon movement of said inner section into said outer section and retraction of said inner section to cause said gripping jaws to release and to grip and hold said lead in advanced position respectively.

ARTHUR WINTER.