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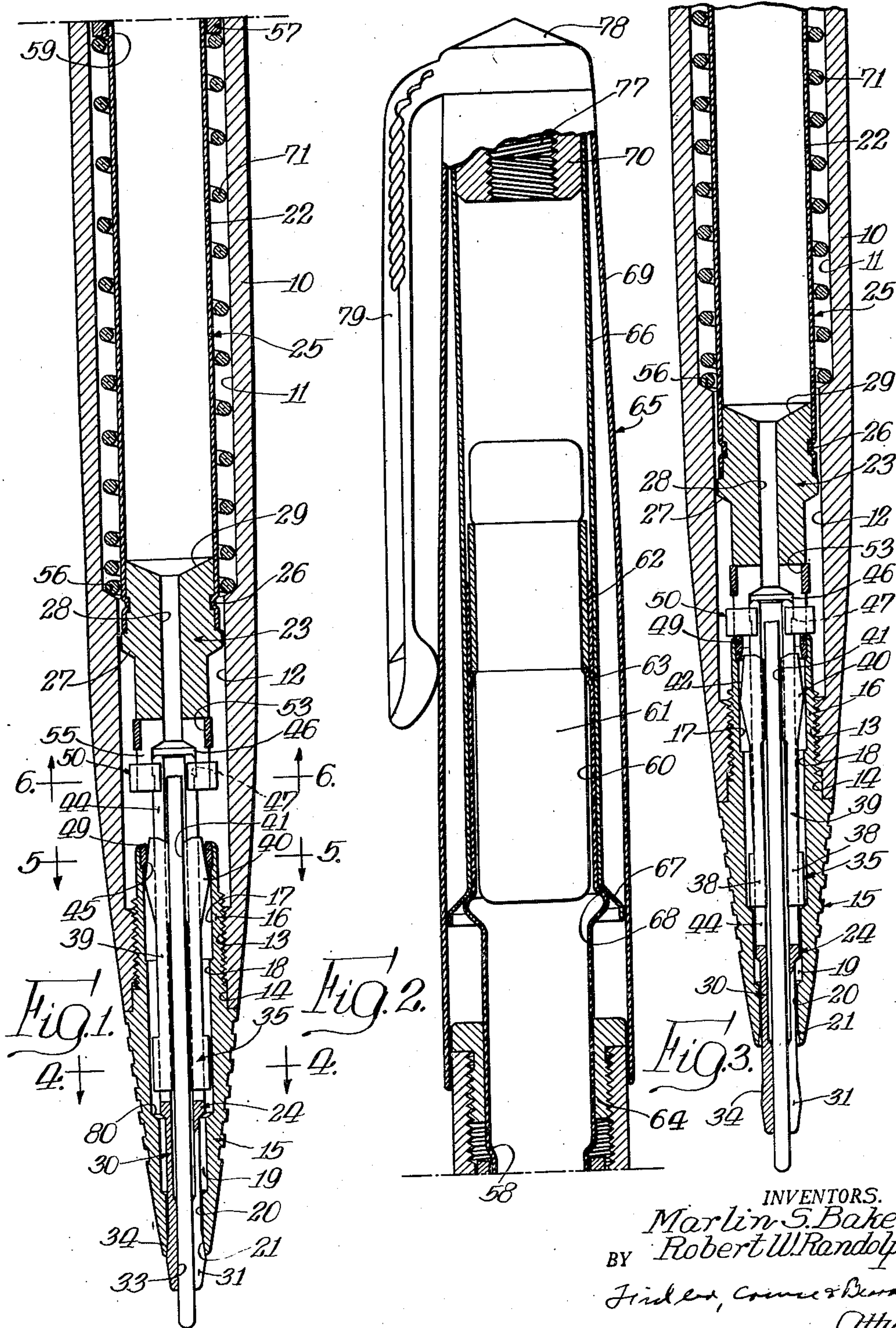
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CLUTCH MECHANISM FOR MECHANICAL PENCILS

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2 Sheets-Sheet 1



INVENTORS.
Marlin S. Baker,
BY Robert W. Randolph,
Fischer, Cooney & Bendley
Attys.

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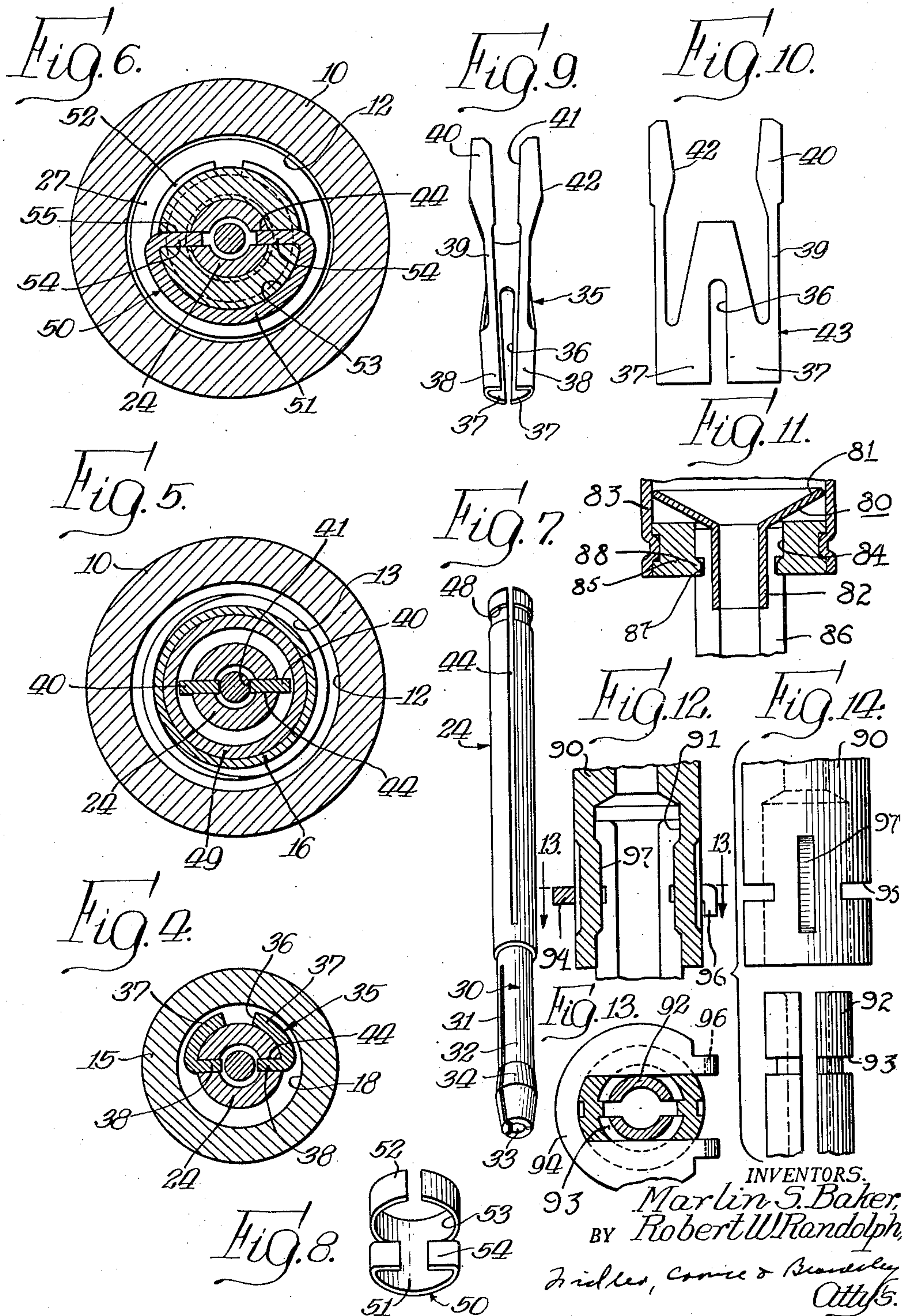
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CLUTCH MECHANISM FOR MECHANICAL PENCILS

Marlin S. Baker, Janesville, and Robert W. Randolph, Milton, Wis., assignors to The Parker Pen Company, Janesville, Wis., a corporation of Wisconsin

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This invention relates to mechanical pencils and has to do particularly with a mechanical pencil of the step-by-step type wherein the lead is fed progressively in steps by repeated actuation of the lead feed mechanism.

It is an object of the invention to provide a lead actuating clutch for a mechanical pencil of the step-by-step type which may be made simply and inexpensively from sheet material merely by punching and bending and without any machining operations.

Another object is to provide a mechanical pencil of the step-by-step type having an actuating clutch carried on and frictionally engaging a lead guide tube for movement therewith and adapted, when restrained against movement, to permit the latter to slide therethrough, in which pencil the lead actuating clutch embodies improved means for maintaining the frictional engagement with the lead guide tube.

Another object is to provide a lead guide tube for a mechanical pencil of the step-by-step type which may be detachably connected to the lead magazine element for convenience in assembling a lead actuating clutch therewith.

Another object is to provide a mechanical pencil of the step-by-step type wherein the lead guide tube is readily detachable from the lead magazine and may be removed and replaced, if desired, without replacement of the lead magazine.

Other objects and advantages of the invention will appear from the following description taken in connection with the appended drawings, in which:

Figure 1 is an enlarged fragmentary longitudinal sectional view through the forward portion of a mechanical pencil embodying my invention;

Fig. 2 is an enlarged fragmentary longitudinal sectional view through the rearward portion of the mechanical pencil;

Fig. 3 is a view similar to Fig. 1 only showing the lead-feeding mechanism in another operative position than shown in Fig. 1;

Fig. 4 is an enlarged transverse sectional view taken along line 4—4 of Fig. 1;

Fig. 5 is an enlarged transverse sectional view taken along line 5—5 of Fig. 1;

Fig. 6 is an enlarged transverse sectional view taken along line 6—6 of Fig. 1;

Fig. 7 is a perspective view of the combined lead guide tube and point clutch forming a portion of the pencil of Fig. 1;

Fig. 8 is a perspective view of the lock for con-

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necting the lead guide tube to the lead magazine;

Fig. 9 is a perspective view of the lead actuating clutch;

Fig. 10 is a plan view of the blank from which the lead actuating clutch is formed;

Fig. 11 is a fragmentary longitudinal sectional view illustrating a modified form of locking means for connecting the lead guide tube to the magazine;

Fig. 12 is a fragmentary longitudinal sectional view showing still another form of locking arrangement;

Fig. 13 is a transverse sectional view taken along line 13—13 of Fig. 12; and

Fig. 14 is a fragmentary exploded view of the cooperating end portions of the lead guide tube and magazine shown in Fig. 12.

The pencil, in accordance with the present invention, includes a barrel which may be formed of any suitable material, as for example a metal or a plastic, and preferably is formed of a plastic such as synthetic resin. The barrel 10 is of generally tubular form and has a bore therethrough providing bore portions 11, 12 and 13 of progressively smaller diameters and an end portion 14. A tapered tip 15, which preferably is formed of metal, is secured to the forward end of the barrel 10 as by a nipple portion 16 screwed into threads formed in the bore portion 13, the tip being firmly held in abutment against the end of the barrel as shown, with the nipple portion 16 extending rearwardly into the bore portion 12. The tip 15, as will be understood, forms with the barrel a housing or casing for the lead holding and feeding mechanism hereinafter described and has a bore extending throughout its length, in alignment with the bore of the barrel, and comprising bore portions 17, 18, 19, 20 and 21, respectively, the purpose of which is described hereinafter.

The lead holding and feeding mechanism comprises a lead magazine 25 which may be suitably formed by an elongate, generally tubular member 22 open at its rear end and substantially closed at its forward end, as by an end member 23 which preferably serves also as a connector for connecting to the magazine a lead guide tube 24 hereinafter more fully described. The connector 23 may be secured to the tubular magazine member 22 in any suitable manner and, in the present illustrative embodiment, is secured by spinning a bead 26 into a circumferential groove formed in the connector 23. A peripheral flange 27 is provided on the connector 23 against which

the forward end of the tubular member 22 abuts, which flange may also serve to guide the forward end of the magazine 25 in the bore portion 12.

The magazine 25 is adapted to contain a supply of leads of appropriate lengths, which leads are discharged successively from the magazine through a discharge opening 28 formed in the connector 23, the inner end wall 29 of the latter being tapered or convergent toward the opening 28 in order to guide the forward end of a lead into the discharge opening.

The lead guide tube 24 is formed as an elongate tubular member and is adapted to receive leads successively from the discharge opening 28 and to guide them therefrom into a position in which a suitable portion of the forwardmost lead projects from the forward end of the pencil and is held in a suitable position for writing. To this end, the lead guide tube is connected at its rearward end to the connector 23 in alignment with the discharge opening 28. The lead guide tube 24 extends through the bore of the tip 15 and projects slightly therefrom at its forward end. The lead guide tube 24 carries at its forward end a point clutch which preferably is formed as an integral part of the tube. The forward end portion 30 of the tube 24 is of reduced diameter and is provided with a plurality of (preferably three) slits 31 extending inwardly from the forward end of the tube to provide clutch fingers 32, the forward end portions of which are formed internally with inwardly projecting portions 33 which provide clutch jaws adapted to grip a lead therebetween. The clutch fingers 32 are formed exteriorly with outwardly divergent surfaces 34 adapted to be contracted by the walls of the bore portion 21, which are also outwardly divergent, when the point clutch is in its retracted position in the tip 15 as illustrated in Fig. 1. The fingers 32 are resilient and are normally positioned so that the jaws 33 define a bore of slightly less diameter than the diameter of the lead used in the pencil. Thus, these fingers provide a collet type clutch adapted to lightly grip a lead which is inserted therein. When the point clutch is in retracted position, the jaw portions of the fingers are wedged in the end of the tip and thus the lead guide tube is held against further rearward movement. In addition, the clutch serves to resist rearward movement of the lead therein when writing pressure is applied to the lead.

The lead guide tube 24, including the point clutch, is adapted to be reciprocated by corresponding movement of the magazine in the barrel and when moved from its retracted position (Fig. 1) to its projected position (Fig. 3) carries the lead forwardly to advance the lead relatively to the pencil casing. For the purpose of preventing the return of the lead with the point clutch when the latter is retracted, a lead actuating clutch 35 is provided which is adapted to grip the lead after it has been advanced by the point clutch and to hold it substantially in its projected or advanced position, permitting the point clutch to be retracted without carrying the lead rearwardly. The lead actuating clutch 35 (Fig. 9) includes an arcuate body portion which at one end is formed with a substantially semi-circular cross-sectional shape and is slitted, as at 36, inwardly from that end throughout a substantial portion to define spaced friction arms 37 the remaining portion of the body being unslitted. Extending radially inwardly from the side edges of the arcuate body portion at the slitted end

thereof are retaining flanges 38 which are disposed in the diametrical chordal plane of the arc of the friction arms. Extending from the inner end edges of the retaining flanges 38 are lead gripping fingers 39 which carry at their free ends lead gripping jaws 40 which fingers and jaws lie in the plane of the retaining flanges 38. The jaws 40 are formed at their inner edges with lead gripping edge portions 41 and at their outer edges with inclined portions 42 adapted to cooperate with a clutch actuating sleeve hereinafter described.

The actuating clutch 35 lends itself to formation from sheet metal by punching and bending and without any machining operation. The clutch preferably is formed by punching from a sheet of suitable metal, as for example, beryllium, copper or brass, a blank such as the blank 43, having the general shape illustrated in Fig. 10. The flat blank is then suitably bent to form the arcuate body portion and the appropriate portions of the blank bent inwardly therefrom so that the portions which are to form the retaining flanges 38, the fingers 39 and the jaw portions 40 lie in a single plane as above described.

The actuating clutch 35 is assembled on the lead guide tube prior to attachment of the latter with the magazine, the lead guide tube being provided with diametrically disposed slots 44 which extend inwardly from the rearward end of the tube throughout a substantial portion of the length thereof. The slots 44 are adapted to receive the retaining flanges 38, the fingers 39 and the jaws 40. Thus, the clutch 35 is retained on the lead guide tube with the jaws 40 entering the slots 44 and positioned to grip a lead disposed in the lead guide tube.

The fingers 39 of the actuating clutch are resilient and normally maintain the jaws 40 out of engagement with a lead disposed in the lead guide tube. However, actuating means are provided for contracting the jaws against a lead in the tube slightly before the lead guide tube moves into the retracted or rearward position. To this end, the nipple portion 16 of the tip is formed with the bore portion 17 in which the jaws 40 reciprocate and which serves as a clutch actuating sleeve. The inner end of the bore portion 17 is formed with a reduced diameter so that when the jaws are in that portion of the sleeve, they are contracted, but when the jaws are advanced out of rearward position, they are permitted to expand away from the lead. Preferably, there is provided at the inner end of the nipple 16 a clutch seat 49 which takes the form of a ring crimped in the inner end of the nipple and having a converging surface portion 45 adapted to receive the edge portions 42 of the jaws and contract the jaws against the lead.

The lead guide tube is detachably connected to the connector 23 in order to permit the clutch 35 to be assembled with the tube. Preferably the rearward end of the lead guide tube is telescoped in a socket 46 formed in the forward end of the connector 23 which socket is so formed as to provide a rearwardly facing flange or shoulder 47 and the rearward end of the lead guide tube 24 is provided with a forwardly facing shoulder 48 adapted to engage behind the shoulder 47 to retain the lead guide tube in the socket 46. For the purpose of firmly clamping the end of the lead guide tube in the socket 46, a lock 50 (see Fig. 8) is provided, which is carried in the connector and is adapted to expand the end of the lead guide tube in the socket 46 to maintain the

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shoulders 47 and 48 in engagement. The lock 50 has an arcuate body portion 51 adapted to seat against the connector 23 with arcuate fingers 52 extending therefrom and adapted to fit in a peripheral groove 53 therein to retain the lock on the connector and against a longitudinal displacement. Forwardly of the fingers 52 is a second pair of fingers 54 which are turned inwardly at their end portions and extend through slots 55 of the connector 23 and enter the slots 44 in the lead guide tube 24 to expand the latter sufficiently to maintain the shoulder 48 in engagement behind the shoulder 47 and thus lock the lead guide tube in the connector.

The above described members are assembled by inserting the retaining flanges 38 of the clutch 35 in the ends of the slots 44 of the lead guide tube 24 and sliding the clutch 35 onto the lead guide tube 24. The lock 50 is disposed on the connector 23, with the fingers 52 spread apart and the lock slid rearwardly on the connector to a position wherein the fingers 54 are at the rear or bottom end of the slots 55. Thereafter, the rear end of the lead guide tube 24 is inserted in the socket 46 with the tube slots 44 aligned with the slots 55 of the connector 23. The lock 50 is then slid forwardly, with the fingers 54 entering the slots 44 to prevent the rear end of the lead guide tube 24 from being accidentally pulled out of the socket 46. The fingers 52 are then bent inwardly to seat in the groove 53 and prevent longitudinal displacement of the lock 50 on the connector 23.

The movable assembly, which includes the magazine 25, lead guide tube 24 and actuating clutch 35, is normally urged rearwardly in the barrel 10 by a retracting spring 71 which preferably takes the form of a coil spring seated at its forward end against a shoulder 56 formed at the juncture of the bore portions 11 and 12 and bearing at its rearward end against a thrust ring 57 firmly secured to the tubular member 22, in any suitable manner. For example, the thrust ring 57 may be seated against a shoulder 58 and held by a tang 59 struck up from the tubular member 22. The tubular member 22 is slidable in and is retained in the barrel 10 by a barrel bushing 64 threaded in the rearward end of the barrel 10.

The tubular member 22 projects from the rearward end of the barrel 10 and preferably is formed with a socket portion 60 for receiving an eraser 61 which may be carried in an eraser cup 62 seated against an internal bead 63. While the pencil may be actuated by depressing the projecting end of the tubular member 22, or the eraser where one is provided, preferably a cap 65 is provided which incloses the projecting end of the tubular member 22 and which cap is depressed to operate the pencil. The cap 65 may be formed in any suitable manner but preferably includes a liner 66 which telescopes over the end of the tubular member 22 and has a flange 67 adapted to abut an external bead 68 on the tubular member 22 for limiting the telescoping movement of the cap on the tubular member 22 and for transmitting thrust to the latter. A cap shell 69 incloses the cap liner 66 and is secured thereto in a known manner, as by a liner bushing 70 which receives a clip screw bushing 77 into which is screwed a clip screw 78 adapted to secure a clip 79 on the end of the cap 65.

The pencil is charged with leads by removing cap 65 and the eraser 61 and by inserting one or more leads in the magazine 25 whereafter the

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eraser and cap are replaced. The lead in the magazine 25, or one of the leads where a plurality are disposed in the magazine, enters the discharge opening 28 when the pencil is placed in point down position and passes into the rearward end of the lead guide tube. Upon depression of the cap 65 and consequent forward movement of the movable assembly (including the magazine 25 and the lead guide tube 24) the clutch 35 is advanced and the jaws 40 are permitted to open and allow the lead to pass through and the leading end of the lead contacts the inner ends of the point clutch jaws 33.

When the pressure on the cap is released, the retracting spring 71 returns the movable assembly to its rearward position. However, prior to the completion of the return movement of the assembly, the clutch jaws 40 enter the ring 45 and are contracted against the lead to securely hold the lead against rearward movement. The remainder of the movable assembly continues to move rearwardly, the lead guide tube 24 being moved rearwardly with respect to the lead so that the lead enters between the jaws 33 and the jaws are drawn back over the lead to expose the forward end thereof.

Upon a second depression of the cap, the lead is carried forwardly with the point clutch inasmuch as the jaws engage the lead with sufficient grip to move it therewith. The lead actuating clutch 35 is also carried forwardly into a position where the jaws are free of the ring and may expand by reason of their resiliency and release their grip upon the lead. Prior to the completion of the forward movement of the movable assembly the forward end of the lead actuating clutch 35 strikes the shoulder 80 defined between the bore portions 18 and 19 (see Fig. 3), thus halting further movement of the clutch 35. However, the lead guide tube 24 continues to move forwardly and carries the lead through the actuating clutch 35 a substantial distance. Forward movement of the assembly is halted when the forward end of the connector 23 strikes the rear end of the nipple 16, on the ring 49 where the latter projects from the nipple. When the pressure on the cap is released the movable assembly, including the lead actuating clutch 35, moves rearwardly. After a short rearward movement of the clutch, the jaws 40 engage the ring 49 and are contracted thereby to grip the lead and hold it against rearward movement. The magazine and lead guide tube, however, continue rearwardly until the point clutch wedges in the bore portion 21 of the tip to halt further rearward movement of the assembly. During this latter portion of the rearward movement of the lead guide tube it is moved relatively to the lead with the result that a correspondingly greater amount of lead projects from the forward end of the point clutch than before the just-described cycle of operation took place.

The means for detachably locking the lead guide tube to the magazine may take various forms and two such additional forms are disclosed herein by way of illustration.

Referring now to Fig. 11, the locking means comprises a lock 80 formed with a funnel-shaped portion 81 which may serve as the end wall or floor of the magazine and a tubular portion 82 extending therefrom. The funnel-shaped portion is frictionally positioned in the magazine by engagement with the side wall member 83 with the tubular portion 82 extending through an opening 84 in the connector 85. The lead guide tube 86

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has a slitted end formed with a circumferential groove 87 which engages a lip 88 on the connector 85 and is locked in such position by the tubular portion 82. The lead guide tube is assembled with the magazine by inserting it in the opening 84 and then inserting the tubular portion 82 in the end of the lead guide tube. These members may be disassembled by inserting an expansible tool in the tubular portion and withdrawing the tubular portion from the lead guide tube whereafter the latter may be withdrawn from the connector.

Still another form of connector is shown in Figs. 12 to 14 to which reference now is made. In this form the connector is formed with a reduced extension 90 having a socket 91 in which the slitted end of the lead guide tube 92 is inserted. The latter is formed with a circumferential groove 93 and a lock 94 of generally horseshoe form is provided the legs of which extend through slots 95 in the connector 90 and enter the groove 93. The ends of the lock 94 may be bent over as indicated at 96 to prevent displacement of the lock. In order to prevent the end of the lead guide tube from being accidentally pulled out of the socket, the connector is provided with ribs 97 which enter the slits in the tube and prevent contraction of the end of the tube.

From the foregoing it will be seen that the present invention provides a mechanical pencil of the step-by-step type which is positive and certain in operation. At the same time, however, the construction is relatively simple and lends itself to economical manufacture and assembly.

The lead actuating clutch is of simple construction and may be formed by merely punching a blank from sheet material and forming the blank into final shape to constitute the clutch by simple bending operations. The clutch may be readily adjusted in the course of the assembly of the pencil to provide the desired frictional engagement with the lead guide tube to insure the best operation of the pencil. Moreover, should the lead actuating clutch become broken or require adjustment or replacement it may be removed readily by merely disconnecting the lead guide tube from the magazine and removing the clutch from the lead guide tube.

The lead guide tube, which includes the point clutch, may be formed very easily and may be attached readily to the magazine in the assembly operation. Moreover, it may be readily removed and replaced without replacement of the lead magazine should replacement of the guide tube become necessary, as for example when it is damaged in use.

The present invention also provides a pencil which may be made small and compact, if desired, without detriment to the necessary strength and efficiency of the lead propelling mechanism. Among the features which contribute to this result is the arrangement of the lead clutch with its jaws extending rearwardly and the positioning of the driving or retracting spring around the magazine.

We claim:

1. A mechanical pencil of the step-by-step type comprising a casing, a lead magazine element slidable in said casing and having a lead discharge opening in its forward end, spring means urging said magazine element rearwardly in said casing, a lead guide tube in said casing having a lead clutch at its forward end and formed with op-

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posed slots extending inwardly from its rearward end, a second lead clutch slidably carried on said lead guide tube including a slotted arcuate body portion having opposed, fixed, retaining flanges at one end thereof, said body portion at least partially enclosing said tube with said flanges entering into said slots, and resilient lead engaging jaws projecting from the other end of said body portion and extending into said opposed slots, a clutch-actuating element carried by said casing in position to engage and urge said jaws inwardly when said magazine element is urged rearwardly in said casing, and means for detachably connecting said lead guide tube to said magazine element for movement therewith and with said lead guide tube in position to receive a lead from said lead discharge opening.

2. A mechanical pencil of the step-by-step type comprising a casing, a lead magazine element slidable in said casing and having a lead discharge opening in its forward end, spring means urging said magazine element rearwardly in said casing, a lead guide tube in said casing having a lead clutch at its forward end and formed with opposed slots extending inwardly from its rearward end, a second lead clutch slidably carried on said lead guide tube and having an arcuate body portion with opposed retaining flanges extending inwardly from the edges thereof at one end of said portion, said body portion at least partially enclosing said tube with said flanges extending into said opposed slots to retain said second clutch on said lead guide tube, said second clutch having jaws in the plane of and extending rearwardly from said flanges and being disposed wholly rearwardly of said body portion and adapted to project through said opposed slots for engaging a lead in said lead guide tube, a clutch-actuating element carried by said casing in position to engage and urge said jaws inwardly when said magazine element is urged rearwardly in said casing, and means for detachably connecting said lead guide tube to said lead magazine element for movement therewith and with said lead guide tube in position to receive a lead from said lead discharge opening.

3. In a mechanical pencil of the step-by-step type, in combination, a lead magazine element having a socket formed at its forward end, and a point clutch and lead guide comprising an elongated tubular member slotted inwardly from one end to define a collet clutch and slotted inwardly from the other end to define a pair of parallel resilient magazine-engaging fingers, an internal shoulder formed in said socket and a cooperating external shoulder on the end of each of said fingers adapted to seat in said socket behind said internal shoulder to provide a detachable snap-in connection between said lead guide and magazine, and locking means for maintaining said fingers in engagement with socket shoulder.

4. A point clutch and lead guide for a mechanical pencil of the step-by-step type having a movable magazine element provided with an inwardly extending shoulder at its forward end and comprising a tubular member slotted inwardly from its forward end to define a collet clutch and formed with two diametrically aligned slots extending inwardly from the rearward end and terminating short of said first-named slots to provide a pair of rearwardly extending resilient magazine-engaging fingers, and an arcuate shoulder formed on each of said fingers at the rearward end thereof for cooperation with the shoulder on

said magazine for detachably connecting said member to said magazine element.

5. An actuating lead clutch for mechanical pencils of the step-by-step type having a diametrically slotted lead guide tube comprising an arcuate body portion slotted longitudinally throughout a portion of its length to define spaced arcuate friction arms extending therefrom designed to at least partially encompass the lead guide tube to maintain the lead clutch slidably disposed on the tube, retaining flanges extending inwardly from the forward edges of said friction arms and disposed substantially in a single plane and designed for entry into said slots, and spaced lead gripping jaws extending from corre-

sponding rear ends of said flanges and disposed substantially in the plane thereof likewise designed for entry into said slots.

MARLIN S. BAKER.

ROBERT W. RANDOLPH.

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