Jan. 27, 1953 E. C. HEDLER 2,626,592

MECHANICAL PUSH-TYPE LEAD PENCIL

Filed July 20, 1946 3 Sheets-Sheet 1

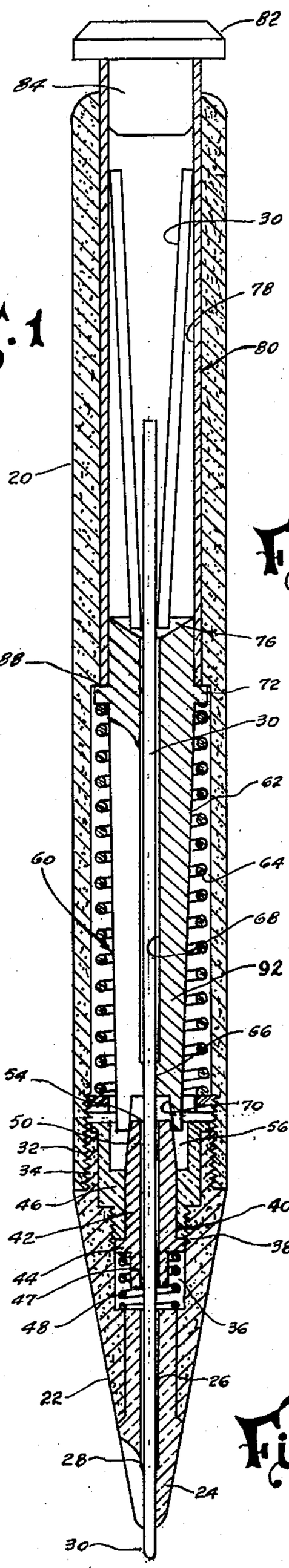

Fig. 1

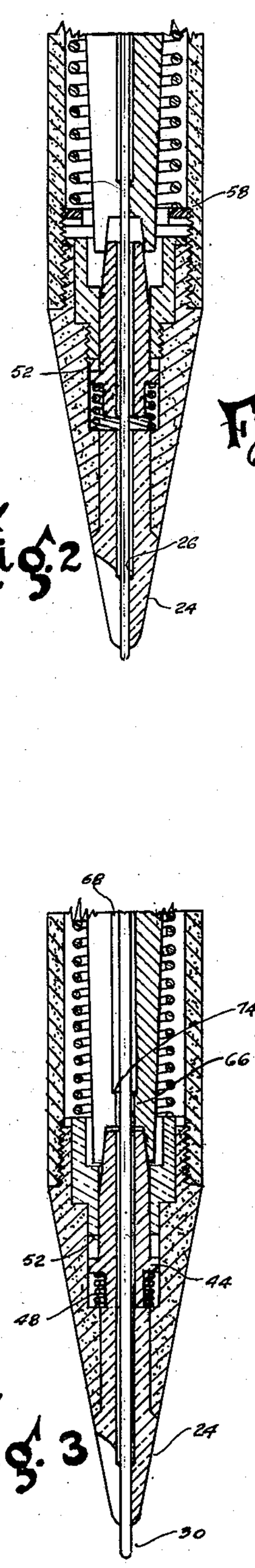

Fig. 2

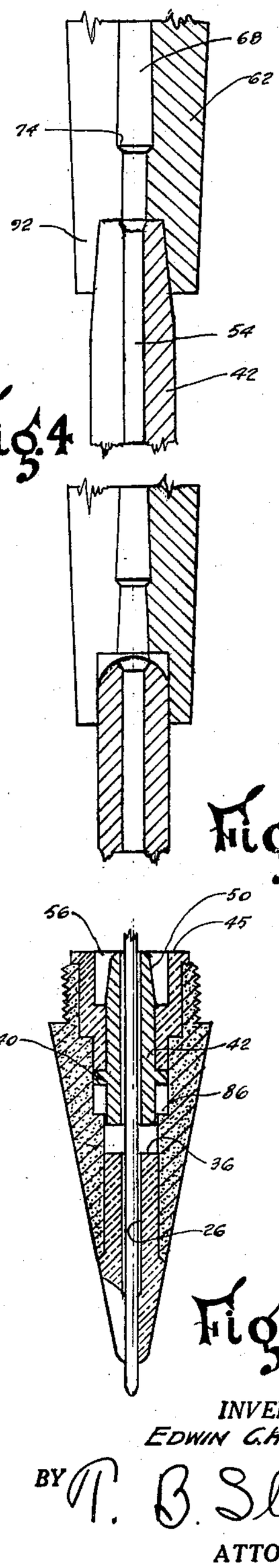

Fig. 4

Fig. 5

Fig. 6

Fig. 3

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MECHANICAL PUSH-TYPE LEAD PENCIL

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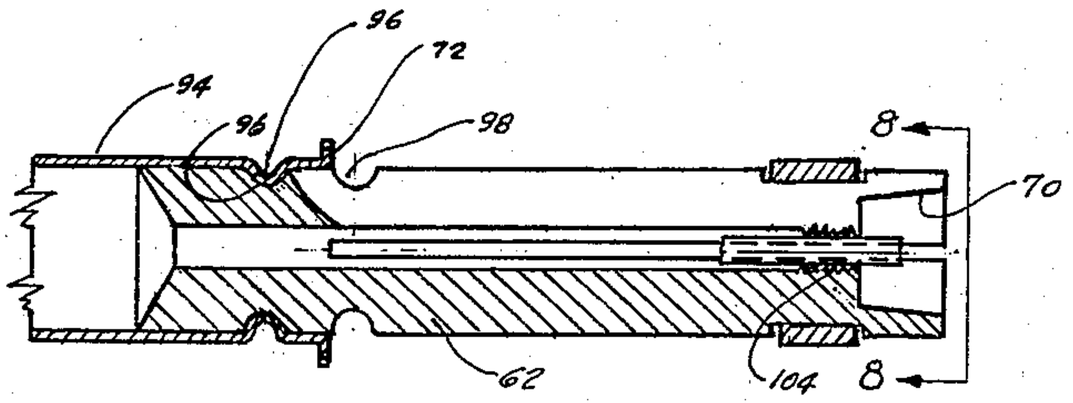

Fig. 7

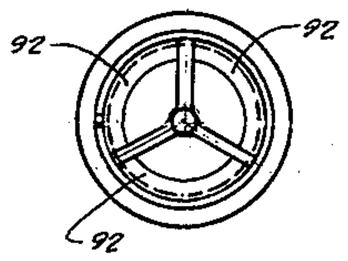

Fig. 8

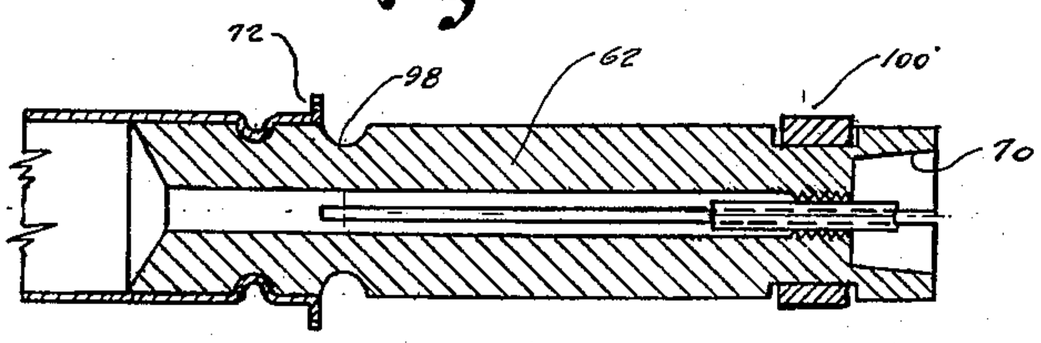

Fig. 9

Fig. 10

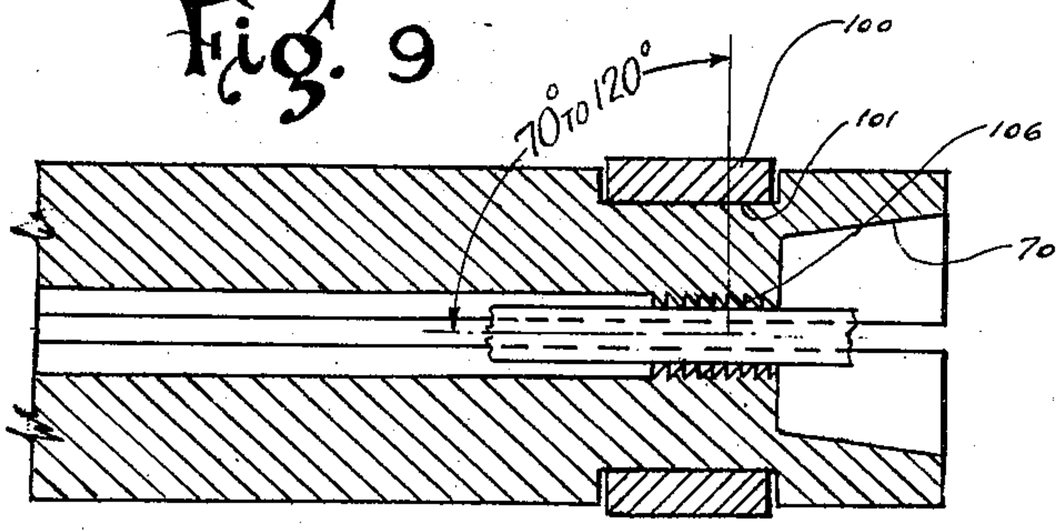

Fig. 11

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MECHANICAL PUSH-TYPE LEAD PENCIL

Filed July 20, 1946 3 Sheets-Sheet 3

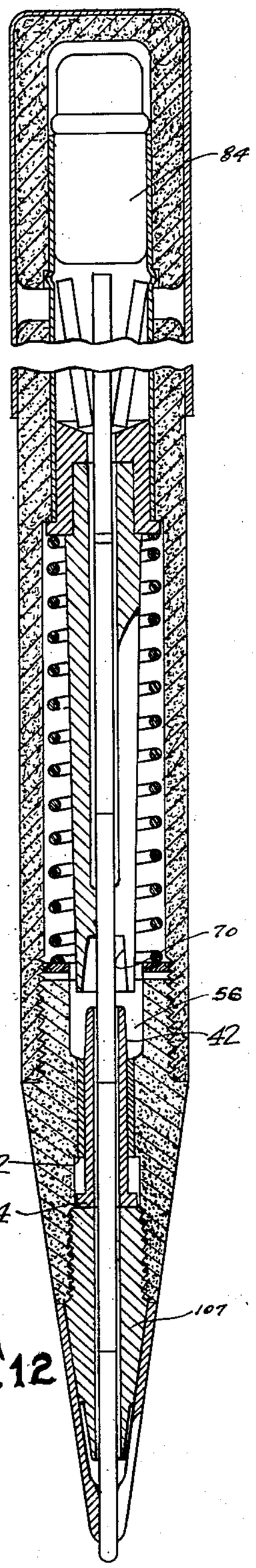

Fig. 12

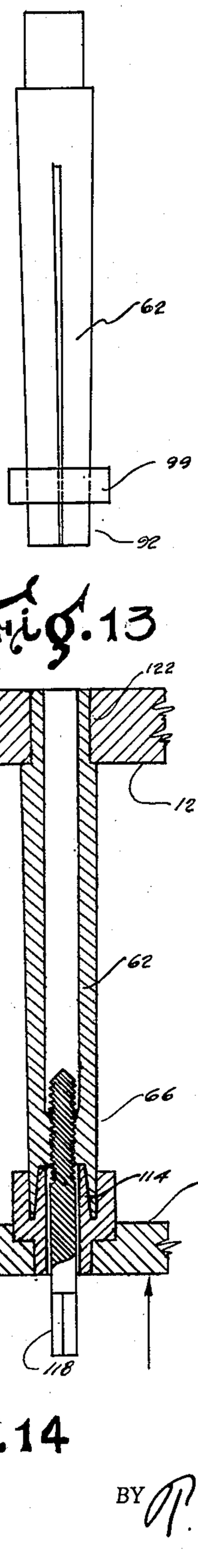

Fig. 13

Fig. 14

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UNITED STATES PATENT OFFICE

2,626,592

MECHANICAL PUSH-TYPE LEAD PENCIL

Edwin C. Hedler, Chicago, Ill.

Application July 20, 1946, Serial No. 685,034

2 Claims. (Cl. 120—17)

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This invention relates to an improved and positive mechanical pencil with push-type feed mechanism.

Therefore, an object of this invention is to produce an efficient push feed type magazine pencil having but a few movable parts, which can be produced at extremely low cost on conventional screw cutting and forming machines and without extensive investment in special equipment.

A still further and additional object of this invention is to provide an efficient and positive feeding means whereby even short sections of lead can be used without jamming or otherwise impairing the effective operation of this improved type of mechanical pencil.

Another object of this invention is to provide a means for definitely aligning the leads regardless of length thereof, within the push feed mechanical mechanism, and forward the same to the writing tip in such aligned position, whereby damaged or broken leads will not be jammed within the mechanism.

Another additional object is to provide a means on the lead gripping clutch members to provide a lead clutching jaw whereby leads are held in a positively fixed position under all normal conditions of use.

Another further object of this invention is to provide a means whereby the entire push feed assembly can be rotated without danger of its becoming inadvertently disassembled and its utility impaired.

These and other objects, adaptations, uses, modifications and variations will be readily apparent to one skilled in this art particularly in view of the lucid, definite and detailed description of the mechanism, the parts thereof and the fundamental elements underlying the principles involved in this invention as given hereinbelow and illustrated in the attached drawings forming a part hereof.

In the drawings, Figure 1, shows an axial sectional elevation of the pencil.

Figure 2 is a somewhat similar but partly broken away elevation showing the lead clutch opening means partly inserted.

Figure 3 shows an elevation somewhat similar to Figure 2 with the clutch opening means fully inserted.

Figure 4 shows an enlarged axial section detail of the lead gripping or clutch means.

Figure 5 shows an enlarged axial section of one of the many possible variations of configuration of either the clutch faces or the clutch opening means.

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Figure 6 is a vertical section thru the tip portion and showing the opening key guide sleeve as being press-fitted into the tip of the pencil. Likewise, it illustrates another variation of maintaining the opening key in juxtaposition with the clutch.

Figure 7 is a vertical section thru part of the lead storage chamber and all of the clutch body showing a means by which the lead storage chamber walls are fixedly engaged to the clutch body.

Figure 8 is an end view of Figure 7 (of the full body) taken along lines 8—8 showing the trisegmented wall of the clutch body.

Figures 9 and 10 are sections somewhat similar to Figure 7, but showing a bisected wall of the clutch body.

Figure 11 is a vertical section showing a special type of lead gripping teeth forming an integral part of the clutch jaws.

Figure 12 shows another modification of my improved step by step push type mechanical pencil and also shows the exit lead gripping means in the tip shell point.

Figure 13 shows one of the means that can be employed to retain the lead gripping clutch members during the heat treating process.

Figure 14 shows a convenient means and method for forming teeth in the lead gripping jaws of the clutch segment.

Essentially, the mechanical pencil of the improved type consists of an outer barrel or pencil case proper, **20**, made of plastic, metal or some other suitable and desirable material. The barrel **20**, has threaded thereto, at one end a tip **22**, thru which the pencil lead **30**, protrudes when in a writing position. The tip **22**, is preferably of metal and contains therein a number of vertical slots to form segments **24**. The ends of said segments have an inwardly directed spring tension to grip the lead **30** and prevent it from rotating about or falling out when the pencil is used. These segments **24**, (all not shown in Figure 1) form an extension of the bore **26**, in the tip **22** about the lead **30**. Within the lower part of the bore **26**, and at the upper part of segments **24**, is an annular internal shoulder **28** which is an integral part of the segments. The floor of this shoulder **28**, slopes conically to provide a centering and aligning slide for the lead **30**, as it moves forward under the urging of the propulsion unit shown in detail in other figures. Furthermore, it provides space for the segments **24** to operate in since the end portions of said segments have induced spring characteristics which grip the lead **30**.

The guiding and gripping portion of the tip 22 comprises a series of inwardly spring tensioned segments 24, soldered or swaged to a core to grip the lead 30. These may be press fitted, molded or screwed into place in the tip 22. The tip 22, by means of a male thread 32, fits into the internal complementary female thread 34 formed on the lower part of the tube body 20, and thus completes the lower outside surface of the pencil.

Located axially in the upper portion of the tip 22, is an annular chamber 36, which houses the entire key or clutch expander mechanism 40. The latter consists of a plunger 42, a combination guide and flange 44, preferably forming an integral part of said plunger 42, and skirt 47. If desired, a spring 48 may be used to maintain the plunger 42, and the bore 54 therein in close coaxial juxtaposition with bore 68 and the clutch mechanism 60. The upper part of the plunger 42 is the clutch opening and expanding means 50. The key 50 and its characteristics and function will be described in detail further hereinbelow. About the plunger body 42 is an annular flange 44. This flange 44, by striking the shoulder 52 which forms an integral part of the plunger guide or sleeve 46, limits the height to which the plunger 42 can travel. Also by compressing the spring 48 or striking the bottom of the tip chamber 36, its further downward movement is limited. The distance of travel controls substantially the amount of lead 30 that will be fed into the bore section 26 of the tip 22. This flange 44 may also serve as a guide within the walls of the chamber 36 to maintain the plunger 42 and the key 50 in coaxial alignment with the clutch mechanism 60. The plunger sleeve or guide 46 is preferably threaded and retained in place my means of threads 38 in the walls of the chamber 36. In this manner, the plunger spring 48 and plunger 42 are locked in place.

In coaxial alignment with the key 50 is the clutch mechanism 60. The clutch mechanism 60 comprises essentially a split tube-like member 62, a coil spring 64, lead gripping jaws 66 and key engaging walls or faces 70. An annular recess 56 is provided in the chamber 36 about the plunger 42 to receive the end or perimeter of the tube-like member 62. On the surface of the upper part of said tube-like split member 62 is an annular flange 72. Within the barrel 20, there is mounted concentrically about the clutch split tube-like member 62, a coil spring 64, whose upper end presses against said annular flange 72 and whose lower end rests preferably upon a threaded washer 58 fitted into the threads 34 within the lower part of the barrel 20. This washer serves as a retainer for the spring 64 and also makes a sub-assembly of the combination of the barrel 20, the actuating tube 80, the clutch tube 62, the spring 64 and the washer itself 58. If the tip portion 22 is unscrewed to remove chips or small broken pieces of lead the sub-assembly just referred to will remain intact with no possibility of losing any of the parts. However, if desired, in place of the threaded washer 58 the bottom of the coil spring 64 may rest directly upon the annular shoulder about the recess 56 forming the top of the plunger guide or sleeve 46. This arrangement would be more desirable where the plunger guide 46 is retained in place by a slip fit in the chamber 36 as shown in Figures 3 and 6.

Within the tube-like split member 62 is a coaxial bore 68. The lower part of this bore 68

terminates as a slightly sloping shoulder 74. This shoulder 74 is adjacent to the lead gripping jaws 66 of the clutch 62. It preferably forms a funnel-like lead guiding entrance to the jaws 66. The upper part of this bore 68 is the terminus of a funnel-like shaped orifice 76, which is the floor of the lead magazine chamber 78. The lead chamber walls 80 rest on the flange 72 of the clutch body or tube 62. The walls 80 of the chamber 78 are telescopically mounted within the barrel or tube 20. If desired, an eraser unit 84 may be inserted within the upper part of the chamber 78. A button 82 is also mounted within the upper part of the chamber 78 to provide a convenient rest for the finger or thumb that may be used to actuate the mechanism that provides the lead at the writing tip.

In order to explain more clearly the function of each of the parts in the combination forming the mechanism of this improved push feed type pencil, the mechanism in actual operation will now be described.

When pressure is applied to the push button 82 it is transmitted to the walls 80 of the lead storage chamber 78 concentrically and slidably mounted within the barrel 20. The applied pressure is directed to the flange 72 of the clutch tube 62. In turn the clutch coil spring 64 is compressed and the entire clutch mechanism 60 is lowered.

With the continued application of pressure the outermost edge of the perimeter about the contact or inner faces 70 of the clutch tube 62 descends into the receiving well or recess 56. As the clutch mechanism 60 moves downwardly under the influence of the continued application of pressure on the thumb rest 82, the walls of the face 70 engage the opening and expanding means 50. At this moment there is no movement resisting counter force. Therefore the entire expander mechanism 40 upon contact by the faces 70 moves together with the clutch mechanism 60, until the flange 44 on the expander body 42 compresses sufficiently the spring 48 to provide sufficient resistance to prevent further free movement. When this occurs or when the bottom of the chamber 36 is touched (or in the case of the modification shown in Figure 6 the restraining shoulder or detent 86 is reached) that the continued application of pressure spreads apart the clutch faces 70 and consequently the jaws 66 attached thereto are opened.

In the meantime a lead 30 under the influence of gravity has fallen into the bore 68 of the clutch tube 62. Its further fall is restrained by the sloping shoulder 74 adjacent the jaws 66. When the jaws 66 are pried open by the expanding means 50, the lead 30 drops past the jaws 66 thru the bore 54 in the key body 42 and into the bore 26 of the tip 22. To facilitate a smooth unobstructed fall and to avoid inadvertent catching, I prefer to flare out the upper receiving part of bore 54, as illustrated in Figures 4 and 5.

It should be noted that the bore 68 of the clutch body tube 62 and the bore 54 of the expander body 42 are in close and almost contacting coaxial relationship so that there is proper alignment of the bores and their contents. The lead 30 is thus permitted to fall freely and unrestrictedly until it contacts the sloping shoulder 28 around the inner walls adjacent the segments 24 of the tip 22. Here it is restrained because the tip segments 24 have an inbuilt spring tension and thus constrict slightly the opening to the tip of the pencil. At this point in the opera-

ting cycle the clutch **62** and the expander body **42** are frictionally engaged.

When the pressure on the finger support **82** is released, the compressed springs **64** of the clutch mechanism **60** and expander body spring **48** force upward both assemblies. However, flange **44** of the expander body **42** is restrained by the shoulder **52** on the plunger guide sleeve **46** and further upward movement of the expander body **42** is prevented. Nevertheless and in spite of the arrested motion of the expander body **42**, the upward motion of the clutch mechanism **60** continues under the influence of its still compressed spring **64**. This upward movement disengages or strips the faces **70** of the tube-like clutch segments **62** from the key or opening and expanding means **50**. The inbuilt spring tension of the tube-like clutch segments **62** now comes into play and closes the lead gripping jaws **66** about the lead **30**. Further upward movement of the clutch assembly mechanism **60** is stopped when the clutch stop flange **72** contacts the internal shoulder **88** which is an integral part of the barrel body **20**.

To push the lead **30** past the constricted shoulder **28** of the tip segment **24**, and expose it in a writing position the operation described above is repeated until the desired length of lead **30** protrudes from the tip **22**.

If it should be desired to retract the projected portion of the lead **30** then the applied pressure of the finger on the finger rest **82** is maintained and the projected lead point **30** is simply pushed inwardly. By maintaining a constant full pressure, the jaws **66** are maintained in an open position and the lead **30** is only held frictionally by the spring tensioned segments **24** of the pencil tip **22**.

The key or opening and expanding means receiving or engaging faces **70** of the clutch tube-like member **62**, may be of several different types and still perform adequately and efficiently their function of engaging frictionally the key **50**. For instance, the contour of the faces **70** and the surface contour of the key **50**, may be complementary so that the maximum amount of surface area of each member is in contact with the adjacent complementary area of the other member to provide the maximum amount of frictional engageability. However, it is obvious that the factor of maximum frictional engageability between the surfaces of the two members depends not only on having the greatest amount of surface contact but also on the characteristics of the surfaces, the angle of repose or contact, the coefficient of friction of the materials used, the effect of adsorbed interfacial films, and other factors and conditions. It, therefore, is apparent that a variation of any of these conditions either singly or in any combination thereof will have an effect on the final result. Some of the variations will be described further hereinbelow.

To obtain good and positive gripping action it is preferred to use a triangular type of clutch and jaw arrangement.

Figures 7 and 8 illustrate another type of a spring means and method of making a clutch mechanism. A tube **94**, an extension of the lead storage chamber walls **80** is so crimped as to fit into the annular recess **95** provided in the clutch tube **62** to form therein a pressed internal ring **96**. A collar or rim **72** is also formed at the lowermost edge of the walls **80**, not only to act as a stop or detent for the clutch spring **64** but also to limit the upward travel of the clutch mechanism when it reaches shoulder **88**. It is

desirable to have collar **72** reach the stop shoulder **88** immediately after jaws **66** have closed firmly on the lead **30**.

It will be noted that an annular recess **98** may be formed near or about the top of the clutch tub-like member **62**. The tube-like member **62** may be a solid piece of material with the necessary slots **90** and bore **68** formed therein by conventional methods. In order to induce or supplement the inbuilt spring characteristics in the segments **92** formed by the slotting of the tube, the ends of the segments **92** which form the exterior walls of the key engaging faces **70** are compressed inwardly and held together in that position by any means such as a spring collar or a sleeve **100**.

In this construction the segments **92** may or may not have inwardly inclined spring characteristics of their own. All or only part of the force for gripping the lead in the writing position of the mechanism may be furnished by the spring collar or ring **100**. Both the segments **92** and the spring collar **100** may be used in such a manner as to supplement each other in performing the closing and gripping function.

From a manufacturing point of view, it is desirable that the tube **62** have a uniform outside diameter. However, one very effective means of controlling the gripping force of the jaws **66** is by changing the taper of the outside wall of the clutch tube **62**, and thereby changing the distribution of tension throughout its length. In a search for simpler and less costly means another method of controlling the spring characteristics has been found. I have found a new and novel means and method by which the spring characteristics inherently induced in the tube **62** during heat treatment can be controlled to any desired degree without need of costly manipulation during the heat treatment process or resorting to costly machining operations. I have found that by forming an annular recess such as **98** about the tube **62** that the spring characteristics induced in the segments **92** can be controlled to any desired degree. If a stiffer spring action is required, for instance, where a writer presses down heavily on the lead during writing, then the recess **98** may be entirely omitted or only partly formed into the body of the tube **62**. If a lighter or more springy action is desired then the recess **98** can be cut deeper. By altering the shape and size of this recess the amount of spring tension existing at the clutch jaws can be controlled.

Whether or not this positive gripping action is more desirable than to permit involuntary retraction of the lead under abnormal writing pressure is a question which only wide usage can answer. In the existing push type pencils which have a positive gripping action on the lead, the most common complaint among the users is undue lead breakage. By positive gripping it is meant that when extreme pressure is applied to the writing point of the lead with the pencil held in a vertical position, the lead will crush either at the jaws or downward therefrom. It appears to be a common occurrence for mechanical pencil users to bear down as heavily on the writing point as they would with a conventional wooden pencil. The latter has a much heavier lead than that used generally in mechanical pencils. This undue initial pressure results in immediate breakage of the lead especially with leads having a .036'' diameter.

One of the features of this invention is a

clutch means which will permit the lead to recede or retract under extreme pressure and before the breaking pressure is reached. The holding or gripping properties of the clutch can be varied from almost zero to the compressible load limit of the lead.

It also is apparent that the contour of the engaging faces 70 of the clutch or of the opening and expanding means 50 may have an infinite number of variations and still be within the scope of the spirit of this invention. For instance, as shown in Figure 5, the clutch faces 70 may be parallel to the longitudinal axis of the pencil or as shown in other figures they may have a slight taper to provide a wedgelike effect. Likewise, the key or opener 50 may be of the same general cross sectional plane and contour as the faces. The important feature is that the key opening and expanding means must be able to enter the space surrounded by the walls of the clutch and that it be held therebetween by friction between the walls and itself. For instance, Figure 5 shows the clutch faces and the opening section of the expander 42 to be substantially parallel to the longitudinal axis of the pencil. The latter, however, is shown to have a dome or spherical shaped head which is capable of entry into the space between the clutch walls, and thus spread apart the lead gripping jaws. The inbuilt spring tension in the segments will frictionally engage and hold the key.

In order to provide for positive gripping action on the lead 30, teeth 104 may be provided on the jaws 66 of the clutch mechanism. It will be noted that due to their angle of bite they are practically self-embedding. They will have a tendency to dig in deeper into the lead 30 with greater application of writing force on the lead tip.

Another feature of this invention is the use of specially-shaped teeth 106 in the clutch jaws 66. These teeth are of the Buttress type. Another feature of this type of tooth is that they will scavenge more readily lead debris than a conventional V-thread type of tooth. The downward slope of the non-gripping portion of the tooth is such that particles, debris, etc. deposited in the teeth by extreme pressure on the point or otherwise will have a better opportunity of falling out by gravity than they would in other types of teeth. There is ample space to take care of any such debris in the cavity 55. This will take care of such accumulations of irregularities, wax, etc. which are on the leads when they are put into the chamber 78, and will have capacity to receive the accumulations of a long period of time without interfering with the normal functioning of the pencil.

Figure 12 shows a modification of the plunger 42 with the expander thereon and having a flat base without any provision for the spring 48. In this modification when the plunger 42 retained between the faces 70 is raised upwardly it is stripped therefrom by the annular base flange 44 upon contact with shoulder 52.

Certain novel methods are employed in the manufacture of the clutch tube 62. Figure 13 shows a method of holding the segments 92 in a converging position as shown for instance in Figure 13 while they go through the heat-treating and tempering processes. In this instance a collar or sleeve 99 is applied to the clutch tube 62 in such a manner that the clutch segments 92 will be held together in correct converging relationship throughout the entire heat treating and tempering process. The bore of the washer or sleeve may be either straight or tapered. It is applied with sufficient force so that it will remain in the proper position until the treatment is completed. It can then be easily "stripped" off in a simple fixture. The segments will have a "set" and thus retain their inwardly acting spring tension.

In putting the teeth into the clutch jaws 66 another novel method is employed. In tapping a .036" hole (the size of the smaller leads) considerable difficulty would be experienced if the tap used were the size of the hole to be tapped. Figure 14 shows a means to accomplish this. A clutch expander 114 is inserted into the clutch jaws 66 which are held apart positively in an abnormally wide open position. The expander 114 preferably is an insert in a plate 116. The clutch expander and tap guide 114 and the clutch tube 62 to be tapped will be held in a coaxial relationship in the machine or fixture while the tapping is being done. By this method a tap considerably larger than the normal diameter of the aperture can be used and the tapping done rapidly and accurately. Plate 116 may move either vertically or horizontally depending upon the type of tapping equipment used. Jaws 120 with a bore 122 are provided so that they can receive the end of the clutch tube 62 to clamp and hold it in the proper position while the jaws 66 are being tapped.

Though obviously it is possible for one skilled in this art to provide many variations and modifications, nevertheless, such variations and modifications are considered to be within the scope and spirit of the fundamental principles underlying this invention as defined by the hereunto appended claims.

I claim:

1. A mechanical pencil of the step-by-step push feed type comprising a barrel, a pointed tip at one end of said barrel, a bore through said tip to receive leads, segments in the pointed end of said tip formed by slotting the end of said tip, the said segments having inwardly induced resiliency to form a bore within said pointed end of smaller diameter than the said lead bore in upper part of said tip, said smaller bore to provide means for retarding exit of the leads, means to attach said tip to said barrel, the said tip having therein a chamber above the said means for retarding exit of the leads for passage of leads to the tip, a clutch opening and lead guiding means coaxially and slidably mounted in said chamber and abutments therein to limit movement of said opening means, the said opening means having therethrough a lead bore, the said opening means comprising a round tubular member with a flange on lower portion to limit travel thereof upon contact with said abutments and an upper portion whose contour is such as to enter into and frictionally engage the lower recessed portion of a lead gripping means, a lead gripping means in coaxial alignment with and above said opening means and having a lower recessed portion, the said gripping means comprising a segmented tube slidably mounted in the bore of said barrel, lead gripping jaws on the lower interior surface of said tube segments, the said tube segments having inwardly inclined spring characteristics of sufficient strength to hold a lead in said jaws against writing pressure, means in said barrel bore to limit the upward movement of said lead

gripping means, a detent on said segmented tube to abut against said means in said barrel bore to limit upward movement in said barrel bore, a coil spring between said opening means and said detent on said segmented clutch tube to disengage said lead gripping means and said opening means, a longitudinal lead chamber tube telescopically mounted within the upper part of said barrel bore and affixed to the upper end of said lead gripping member, said lead gripping means having a concentric recess in the lowermost inner portion thereof, the said recess to permit entry and frictional engagement with the upper portion of said clutch opening means.

2. In the combination of claim 1, the subassembly comprising an externally threaded ring screwed into a threaded lower portion of the interior of said tubular barrel against which the lower end of said coil spring abuts whereby the

said coil spring, said lead gripping member and said tubular barrel act as a unit.

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