July 4, 1933. R. BACK 1,916,199

WRITING IMPLEMENT

Filed Aug. 24, 1932 2 Sheets-Sheet 1

Fig. 1

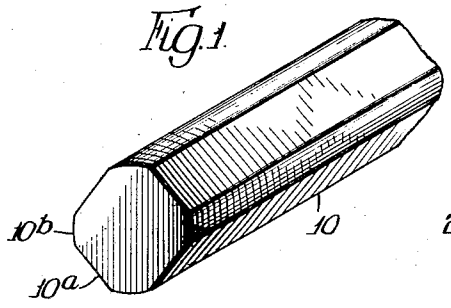


Fig. 2

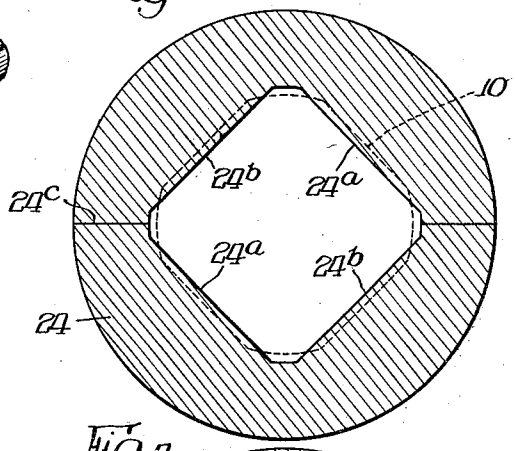


Fig. 3

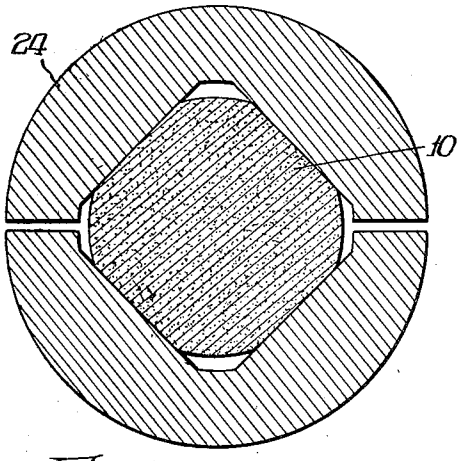


Fig. 4

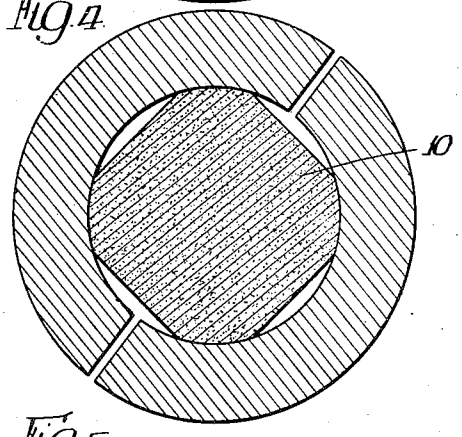


Fig. 6

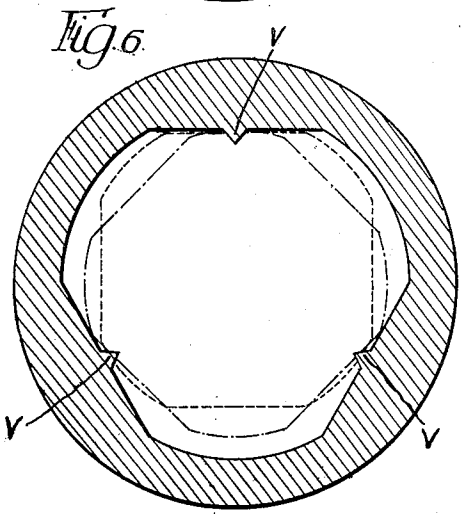
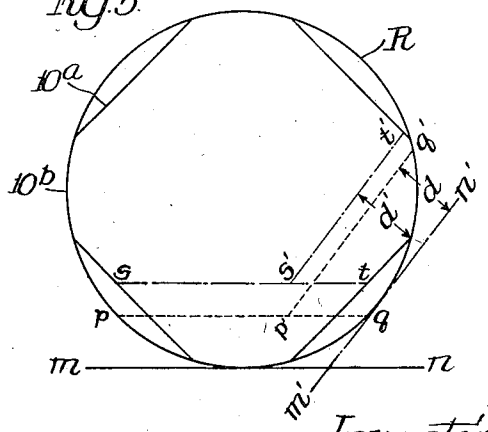


Fig. 5



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July 4, 1933. R. BACK 1,916,199

WRITING IMPLEMENT

Filed Aug. 24, 1932 2 Sheets-Sheet 2

Fig. 7.

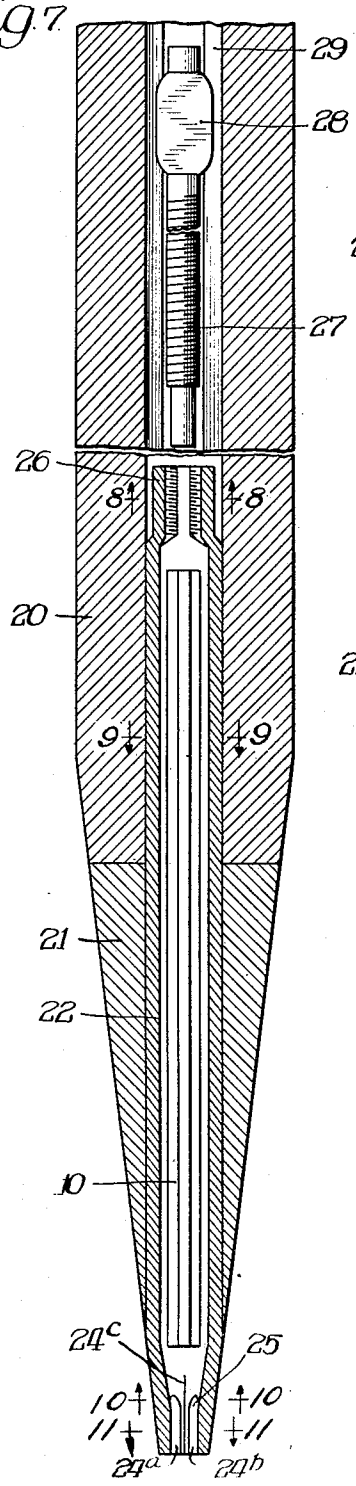


Fig. 8.

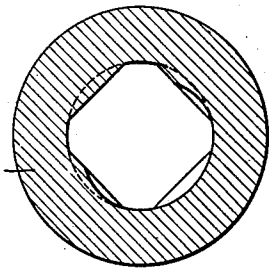


Fig. 9.

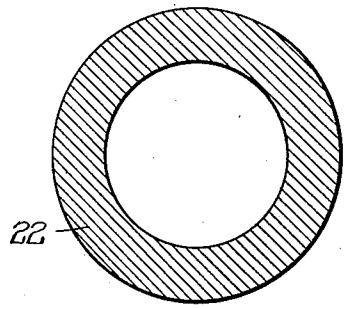


Fig. 10.

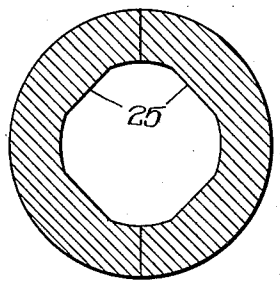


Fig. 11.

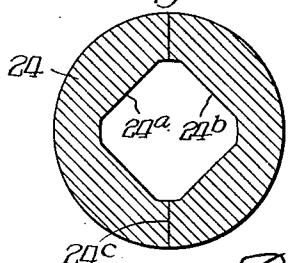


Fig. 12.

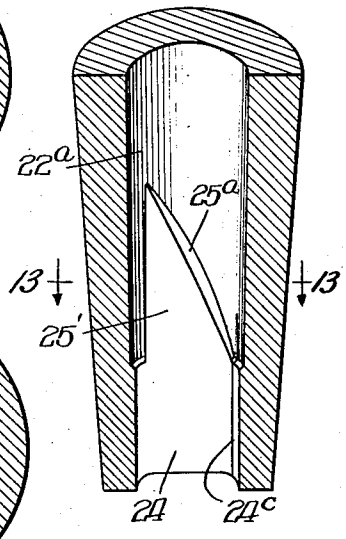


Fig. 13.

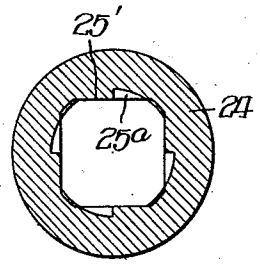
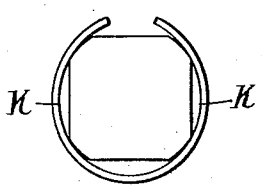


Fig. 14.



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Patented July 4, 1933 1,916,199

UNITED STATES PATENT OFFICE

ROBERT BACK, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WAHL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE

WRITING IMPLEMENT

Application filed August 24, 1932. Serial No. 630,261.

This invention relates to writing implements, and resides particularly in improvements in pencil leads and in mechanical pencils.

So-called "thin" leads are now employed quite extensively in mechanical pencils of various types and constructions, the pencils being supplied with new leads when required. "Thin" leads are so designated in the trade because of their small cross section, same being quite substantially less than that of the leads generally incorporated in the conventional wood mantled lead pencils.

Mechanical pencils designed for the use of thin leads have been for some time rather uniformly standardized as to the size of lead which they employ, and they are adapted, almost universally, for the use of leads of circular or round peripheral contour.

The manufacture of pencil leads involves a procedure of considerable intricacy, including the proper proportioning and combining of a number of different constituents, the extrusion of the plastic mixture through dies to produce a filament of the desired cross-sectional form, the severing of the extruded filament into sticks of the desired length, the straightening of the sticks, and the curing, drying, and in the case of graphite leads, the baking of the sticks. Because of the large number of variable factors present in such procedure, including shrinkage of the material in drying, progressive wear and enlargement of the extrusion dies, and other circumstances, it is a matter of considerable difficulty to hold the product closely to uniform cross-sectional size. Since all of the various types of mechanical pencils extensively in use include various features for gripping the lead, and/or for affording it guidance and lateral support at the writing tip of the pencil, variations in cross-sectional size of lead, beyond rather definite tolerances, may preclude its use in a mechanical pencil, or may seriously impair the utility and operability of the pencil.

One of the results aimed at in the development of the thin-lead mechanical pencil has been the provision of a writing point which will remain desirably slender without necessitating sharpening of the lead. Of course, other things being equal, the smaller the cross-sectional size of the lead, the thinner will be the writing point. The leads, however, are comparatively fragile, and their low tensile strength imposes limitations which it is not feasible to pass in reduction of their cross-sectional size. It has been a problem, consequently, to provide a thin lead, suitable for use in mechanical pencils, which will have the requisite strength and at the same time the desired writing qualities.

One of the objects of the present invention is the provision of a thin lead which may be used in various types of mechanical pencils now extensively in use, and which possesses desirable and improved writing qualities and at the same time the requisite strength against breaking, particularly in the degrees of hardness which have been found to be most generally desired.

Another object is the provision of such a pencil lead of a form such as to admit of its being successfully used in mechanical pencils even though it may be over-size to a considerable degree.

Yet another object is the provision of such a pencil lead of a form qualifying it for use in a number of types of mechanical pencils now quite extensively used, and adapted particularly to prevent its rotating, while employed in writing, in such various types of pencils.

Yet another object is the provision of a pencil lead of a form such as to materially reduce the likelihood of clogging or distortion of the pencil parts through which the lead is fed and in which it is clasped.

An additional object of the invention is the provison of an improved mechanical pencil characterized by features adapted to accomplish certain novel and advantageous results when used in combination with a lead of the character contemplated by the present invention.

Another object is the provision of an improved writing implement involving the

combination of a lead of novel character with a holder of novel character.

Another object is the provision of a mechanical pencil tip which is especially adapted to accommodate over-size leads without clogging.

Another object is the provision of a mechanical pencil adapted to effect proper rotative positioning of the lead relative to the tip incident to the propulsion of the lead to the writing point.

Another object is the provision of a combination of lead and mechanical pencil tip whereby the lead is held securely against rotation in the pencil during writing.

Other and further objects of the invention will be pointed out or indicated hereinafter, or will be apparent to one skilled in the art upon an understanding of the invention or its employment in use.

For the purpose of aiding in an explanation of the invention, I show in the accompanying drawings forming a part of this specification, certain structural forms in which the invention may be embodied and utilized, but it is to be understood that these are presented by way of example and are not to be construed in any fashion calculated to limit the appended claims short of the true and most comprehensive scope of the invention in the art.

In said drawings,

Fig. 1 is a perspective view of a portion of a stick of pencil lead embodying my invention, the figure being on a greatly enlarged scale;

Fig. 2 is a cross section through the tip portion of a mechanical pencil embodying features of my invention;

Fig. 3 is a similar cross section of the same device showing the relationship of parts when a stick of lead is gripped therein;

Fig. 4 is a similar cross section of a familiar type of pencil tip, with my improved stick of lead gripped therein, same serving to illustrate the fashion in which my improved lead cooperates with such a pencil tip;

Fig. 5 is a diagram serving to show a comparison of wear effects on a lead of circular contour and a lead having characteristic features of my invention;

Fig. 6 is a cross section through a mechanical pencil tip of another type heretofore used, serving to illustrate cooperative relationship of same with a lead having characteristic features of my invention;

Fig. 7 is a fragmentary longitudinal section of a mechanical pencil embodying features of my invention;

Fig. 8 is a cross section, approximately at 8—8, through the lead guide tube illustrated in Fig. 7;

Fig. 9 is a similar cross section, approximately at 9—9, through the lead guide tube;

Fig. 10 is a cross section, approximately at 10—10, through the tip;

Fig. 11 is a cross section, approximately at 11—11, through the tip;

Fig. 12 is a perspective sectional view of another form of mechanical pencil tip embodying features of my invention;

Fig. 13 is a cross-sectional view of such tip, taken approximately on line 13—13 of Fig. 12; and

Fig. 14 is an end view of a lead clamp or socket of a type quite generally employed in mechanical pencils, particularly pencils of the propel-repel type, illustrating a manner in which my improved lead stick may cooperate with same.

An understanding of the nature and characteristics of the present invention may be had from a consideration of the embodiments illustrated in the drawings, and from the following description of the examples there illustrated.

Fig. 1 serves to illustrate the form of a pencil lead embodying the present invention. Such a lead may be made of any suitable marking material possessing the proper abradible quality and requisite strength against breaking. The lead is in the form of a stick 10 of suitable length, and is characterized by its cross-sectional form, which is shown on still larger scale in Fig. 5. It will be observed that the cross-sectional contour is that of a polyhedron having four straight sides, designated by the reference character 10^a, and four interposed sides, designated by the reference character 10^b, arranged in alternate sequence with the straight sides. The straight sides 10^a of the cross section are of substantially equal length and somewhat longer than the interposed sides 10^b, and opposite straight sides are parallel. Consequently, the stick is of somewhat greater thickness between opposite interposed sides 10^b than between opposite straight sides 10^a. The lead stick is desirably of uniform cross section throughout its length, and preferably the interposed sides 10^b are curved on a uniform radius from the axial center of the stick.

A polyhedral lead stick of this novel form, particularly in the "thin lead" sizes approximating 0.047 inch maximum thickness, possesses numerous advantages, certain of which will now be pointed out in detail.

As compared with lead sticks of the conventional circular cross-sectional contour, of corresponding maximum thickness, it possesses superior writing characteristics, in that it presents a plurality of peripheral bearing areas which do not broaden so rapidly with the wearing away of the material incident to writing. A comparison is illustrated in Fig. 5. Assuming that the line *m—n* represents the surface of a sheet of paper, and the writing is commenced with a portion of one of

the sides 10[b] bearing on the sheet, it will be observed that by the time the lead is worn away to line *p*—*q*, the bearing surface will have broadened appreciably less than would the bearing surface on a round lead of corresponding maximum diameter, illustrated by the circle R in this figure. The wearing away of the polyhedral lead would have to reach the line *s*—*t* before the bearing surface would attain the width of the bearing surface of the round lead worn to the line *p*—*q*. When materially worn off at one side, to the line *s*—*t* for example, the adjacent side portions of the polyhedral lead present relatively narrow bearing surfaces which, if the pencil is shifted so as to cause one of them to bear on the paper, will travel smoothly on the paper and produce a thin line. Normally, in writing with a pencil, an individual rotates the pencil on its axis from time to time as the line broadens with wear of the lead, in order to apply to the paper a portion which will make a narrower line. Assuming that a pencil using a round lead is so shifted that the lead, after having been worn down to the line *p*—*q* as above described, is moved to the relationship to the paper represented in Fig. 5 by the relationship of the segment *p*—*q*—*q'*—*p* to the line *m'*—*n'*, and the writing continued, it will be apparent that when the lead is worn off to the distance *d*, the writing surface will have assumed a width *p'*—*q'*. In the case of the worn polyhedral lead similarly shifted, however, when the wear will have proceeded to the same extent (*d'*), the bearing surface will have attained the width *s'*—*t'*, which is perceptibly less than the distance *p'*—*q'*. Because of these characteristics the polyhedral lead, when employed normally in writing, operates with a more consistently "sharp" effect than does the round lead.

Another practical advantage accrues from the circumstance that the bearing surface of my polyhedral lead does not broaden so rapidly with wear. Under equal pressure, a narrow bearing surface will make a darker or stronger line than a broad bearing surface, due to the fact that it affords better opportunity for close contact throughout its width with the rough surface of the paper. As the bearing surface broadens, there is a tendency for the writer to apply more pressure in order to keep the line dark, and this results in still more rapid wear on the bearing surface. In view of the fact that in the use of my polyhedral lead the bearing surface does not broaden so rapidly, the incentive for increasing the pressure is less, with the results that the rate of wear is less and there is less likelihood of applying pressure sufficient to break the lead. Consequently, for the reasons above pointed out, it usually does not become so frequently desirable to shift the pencil when employing lead of my improved form as it does when writing with a pencil with round lead.

As compared with leads of polygonal cross sections such as triangular, square or hexagonal leads of corresponding maximum thickness, my improved form of lead possesses definitely higher strength against breaking, other factors, such as constitution and density of the lead, being equal, and it does not afford the likelihood of sharp corners catching on the paper as do leads of such other forms.

Over-size leads of my improved form may be successfully used in mechanical pencils in instances where correspondingly over-size round leads would clog or injure the pencil. There are large numbers of mechanical pencils now in use which have tips with round bores for supporting or gripping the lead. In Fig. 4 is illustrated the fashion in which a lead of my improved form fits in such a tip. It will be observed that the extent of surface bearing of the lead stick on the bore of the tip is very materially less than the circumference of the bore, and that the portions of the lead in surface contact with the bore wall are separated from one another by void spaces between the lead stick and the bore wall. A round lead may be of such over-size as to preclude its being forced through such a tip without permanent distortion of the resilient gripping portions, and effort to so insert an over-size round lead is likely to result in its being crushed and clogging the pencil, or permanently springing the gripping portions more or less out of shape, so that thereafter they will not grip a normal sized lead stick effectively, with the result that the lead will be loose in the pencil. A correspondingly over-size lead of my improved form may be employed in such a pencil without harm, due to the fact that the relatively narrow rounded portions will shave off readily and permit the lead to pass through the bore of the tip under the proper clamping pressure. There are now in use also a great many mechanical pencils having rigid or non-expansible tips. A type of such a tip is illustrated in Fig. 6, wherein the tip is shown provided with inwardly projecting longitudinal ridges V designed to bite into the lead stick as it is propelled longitudinally through thet bore, and thus hold it against rotation and against falling out. Various posiions which may be assumed by leads of my improved form in such tips are illustrated in dotted lines in that figure, from which it will be seen that they are adapted for equally effective cooperation with the ribs V, and that they can be used if somewhat over-size, due to the readiness with which the round corners may be shaved off in the operation of propelling the lead stick into the tip.

It is quite important that the lead stick in a mechanical pencil be effectively retained

against rotation when in writing position, in order to prevent its turning back to a broad bearing position on the paper when the pencil has been turned to bring a narrow bearing area into play. There are numbers of mechanical pencils in use, particularly of the "propel-repel" type, in which the upper end of the lead stick is held in a resilient clamp or socket which forms a part of the lead-propelling mechanism and which is movable forwardly to feed the lead and backwardly to retract it. These sockets are rarely truly circular, and as a result, when a round lead stick is inserted into them, bearing contact is effected only between the innermost portions of the resilient clamping sleeve and the periphery of the lead stick, and the lead stick may be rotated rather freely in the resilient sleeve because the bearing points of the latter ride quite freely on the round stick surface. The lead stick of my improved form is adapted for very effective cooperation with such an out-of-round clamping sleeve in a fashion to hold the lead stick more securely against rotation. This is due to the fact that because of the cross-sectional form of my lead stick, the innermost portions of the encompassing sleeve may find positions at the flat sides of the stick, where they offer obstruction to passage of the thicker portions of the stick when torque is exerted on the latter. Fig. 14 serves to illustrate this feature, portions of the sleeve which are in-set from a true circular contour being indicated at K.

In Figs. 7 to 11 inclusive are illustrated features of one form of my improved mechanical pencil. The reference numeral 20 designates the barrel or shaft of the pencil, upon which is mounted the removable tip assembly. The tip assembly includes the tip body 21 adapted to abut the end of the barrel, and the lead guide tube 22 fixed axially in the tip body and extending beyond the upper end thereof and adapted to be received in the axial bore of the barrel, where it is retained by friction such as to hold the tip assembly in place on the barrel, yet permit its rotation thereon upon application of requisite force. At the lower end of the lead guide tube is a lead-holding tip 24, which may be formed, as in the embodiment here illustrated, by swaging down the end portion of the tube to reduce the diameter and change the contour of its bore in the swaged portion. As illustrated in Fig. 11, a portion of the tip bore is of generally quadrilateral cross-sectional form, and the perpendicular distance between the opposite flat sides is slightly less than the thickness of the contemplated lead stick between opposite flat sides. The cross-sectional contour of the squared tip bore corresponds in general to the cross section of the contemplated lead stick, but its rounded corner portions are somewhat narrower. In Fig. 2 is shown a cross section of the squared tip portion, the opposite flat sides being designated by the reference characters 24^a and 24^b, and the cross section of the contemplated lead stick is indicated in dotted lines. The squared tip portion is split across at opposite corners of the squared bore, as shown at 24^c. This renders the squared tip portion resiliently expansible to accommodate intrusion of the lead stick and to permit the squared tip portion to exert a resilient clamping or clutching grip upon the lead stick to hold the latter against falling out. In Fig. 3 is shown a cross section wherein the lead stick is thus gripped in the expansible tip portion. Due to the correspondingly squared contour of the lead stick and tip bore, the former is securely held against rotation in the latter, but may be propelled therethrough to project the lead stick beyond the lower end of the tip as required.

It will be observed that due to the form of the squared tip bore and the lead stick, empty spaces are left between them at the rounded corner portions of the bore. Due to this feature, the tip may accommodate a lead stick which is considerably over-size, without clogging or jamming, as it affords room in the directions in which the tip is non-expansible. Moreover, the clearance spaces between the lead stick and the clefts 24^c afford discharge passages for dust shaved from the lead stick, thus tending to avoid its being crowded into the clefts where it might hold the tip segments apart and impair their clamping action.

As seen in Fig. 10, the flatted portions of the tip bore are continued upwardly for a distance from the narrowest portion thereof and diverge gradually toward the circular portion of the tube bore, said extended flatted portions 25 gradually thinning until they coalesce with the wall of the latter. These extended flatted portions form guides for the positioning of the lead stick relative to the squared tip bore, functioning in that respect as hereinafter described.

At its upper end the lead guide tube has an inwardly swaged portion 26, and between that swaged portion and the reduced tip portion the cross section of the tube bore is larger than that of the squared tip portion and of the swaged portion 26 by an amount such as to permit a rotary adjustment therein of the contemplated lead stick. The length of this portion of the tube bore also exceeds the length of the contemplated lead stick. The portion 26 is swaged in such fashion as to square its bore to a size and shape which will just accommodate introduction of the contemplated polyhedral lead stick, as illustrated in Fig. 8, thus functioning as a form and size gauge for the lead sticks. The bore walls of the swaged portion 26 are screw threaded for cooperation with the threaded lead-propelling plunger 27, which plunger,

on account of such screw-threaded engagement, is adapted to feed longitudinally into the lead guide tube when rotated in one direction relative thereto, and to feed out of same when rotated in opposite direction. At its upper end the plunger 27 carries a spline 28 which rides in a spline groove 29 in the barrel, whereby to hold the plunger against rotation relative to the barrel, yet permit it to travel longitudinally in the same. The plunger can thus be fed in either direction relative to the lead guide tube by rotation of the barrel relative to the tip assembly, and the plunger may be completely withdrawn from the barrel by withdrawal of the tip assembly therefrom.

The tip assembly being so withdrawn from the barrel, the plunger may be unscrewed from the lead guide tube, and a lead stick of cross-sectional size and form appropriate for passing through the gauge bore of the reduced portion 26 may be inserted therethrough into the lead guide tube. The end of the plunger may then be screwed into the reduced portion 26 to bring its terminus into contact with the upper end of the lead stick. Further screwing in of the plunger will propel the lower end of the lead stick toward the squared tip portion 24, in which movement the end of the lead stick encounters the guide flats 25. Being free to rotate in the bore of the lead guide tube, the lead stick will accommodate its position to the position of the guides and the squared portion of the tip bore so that its flat sides will register with the flat guide surfaces and thus, when propelled into the squared tip bore, it will occupy the proper fitting position therein. The tip assembly with the plunger therein may then be placed in position on the barrel, whereupon the pencil is ready for use, the lead being extended at the writing tip from time to time by relative rotation of the tip assembly and the barrel.

In Figs. 12 and 13 is illustrated a different form of tip embodying features of the invention, in which the normally cylindrical bore 22^a of the tip is reduced at the lower end of the tip to give it the squared form as above described, and the guides 25′ which continue upwardly from the flat sides of the squared bore, are formed with spiralled or inclined upper margins 25^a for cooperation with the end of the lead stick to aid in its rotation to a position in which its rounded portions will nest in the corner portions of the squared tip bore and its flat sides will match with the flat sides of the bore.

What I claim is:

1. An article of manufacture consisting of a stiff lead stick suitable for use in mechanical pencils, said lead stick being of approximately uniform cross section throughout substantially its entire length, said cross section being bounded by four straight sides disposed in parallelogram relationship and joined by four convexly arcuate sides of approximately identical contour.

2. An article of manufacture consisting of a pencil lead stick which is of approximately uniform cross section throughout substantially its entire length, said cross section being bounded by four straight sides of substantially equal length and four interposed sides of approximately equal length disposed alternately with said straight sides and extending obliquely thereto, said interposed sides being shorter than said straight sides.

3. A pencil lead stick as specified in claim 1 and in which the arcuate sides are on approximately a uniform radius from the axial center of the stick.

4. In a mechanical pencil, in combination, a lead guide tube having at its upper end a polyhedral gauge opening for admission of a lead stick and at the lower end of the guide tube a lead-holding tip having a polyhedral bore, the tube between said opening and bore being of size permitting rotary adjustment therein of a lead stick of a shape adapted to prevent its rotation while passing through said opening.

5. In a mechanical pencil, in combination, a lead-holding tip having a polyhedral bore, a gauge member above the tip, a lead guide tube between the tip and gauge member for guiding a lead stick to the tip, said gauge member having a polyhedral gauge opening for admission of a lead stick, said guide tube having a bore of a size permitting rotary adjustment therein of a lead stick of size and shape such that it is non-rotatable in the tip bore or gauge opening, and means for propelling a lead stick longitudinally through the tip bore while it is held by the tip against rotation relative to the tip.

6. In a mechanical pencil, in combination, a lead-holding tip, a guide tube for guiding a lead stick to said tip, said guide tube being provided at its upper end with a threaded polyhedral bore of a size and shape adapted to permit passage therethrough of a lead stick appropriate for passage through the tip, and a lead-propelling plunger adapted for cooperation with said bore.

7. In a mechanical pencil, the combination specified in claim 6 and wherein the lead-holding tip has a polyhedral bore.

8. In a mechanical pencil, in combination, a lead-holding tip having a bore of generally quadrilateral form in cross section and having its lower end split transversely at opposite corner portions of its bore.

9. In a mechanical pencil, in combination, a lead-holding tip having a polyhedral bore, a lead guide tube having its bore arranged to guide a lead stick to the tip bore, the minimum diameter of the tube bore being not less than the maximum width of the tip bore, a guide member adjacent the tip bore and

adapted for cooperation with a lead stick in the tube to adjust it relative to the tip bore, and means for propelling a lead stick into the tip bore from the tube.

10. In a mechanical pencil, in combination, a tip having a bore of non-circular cross-sectional contour, means for propelling a lead stick into said non-circular bore, and a guide member adjacent the path of the lead stick above said bore adapted for cooperation with the lead stick to adjust it rotatively relative to said bore incident to entry of the lead stick thereinto.

11. In a mechanical pencil, in combination, a lead guide tube having in its upper part a polyhedral gauge opening for admission of a lead stick, a lead-holding tip at the lower end of the tube, said tip having a polyhedral bore of smaller cross-sectional dimensions than said gauge opening, said tip being resiliently expansible to permit passage therethrough of a lead stick admissible by the gauge opening, and means operable to propel a lead stick from the guide tube through the tip bore.

12. In a mechanical pencil, in combination, a polyhedral lead stick having oppositely disposed parallel flat sides and intervening sides extending obliquely to the flat sides, a pencil tip for holding said lead stick for writing, said tip having a polyhedral bore with oppositely disposed flat sides arranged for surface contact with flat sides of the lead stick, the flat sides of the tip bore being wider than the flat sides of the lead stick so as to afford clearances between the bore walls and the oblique sides of the lead stick, and means for propelling the lead stick longitudinally through the tip bore while it is held thereby against rotation therein.

13. In a mechanical pencil, in combination, a tip at the lower end of the pencil, said tip having a bore for accommodating passage of a lead stick, a tubular member above said tip for containing a lead stick, and a gauge member adjacent the upper end of said tubular member, said gauge member having a polyhedral gauge opening through which a lead stick must pass in order to enter the tubular member, said tubular member being of such size as to permit rotative adjustment therein of a lead stick which would be non-rotatable in the gauge opening.

14. In a mechanical pencil, in combination, a tip having a lead-receiving bore with flat sides, means for directing a lead stick to said tip, and guide members having flat surfaces diverging toward said means from the flat sides of the tip bore.

15. In a mechanical pencil, the combination with a lead-holding tip having a bore which is substantially circular in cross section, of a lead stick having four straight sides arranged in approximately parallelogram relationship and four curved sides interposed alternately with the straight sides, the cross sectional dimensions of the stick being such that the curved sides will have bearing engagement on the wall of the bore to hold the straight sides spaced therefrom, and means for propelling the lead stick longitudinally through the tip bore.

16. In a mechanical pencil, the combination as specified in claim 15 and wherein the tip is cleft to render it resiliently expansible.

In testimony whereof I have hereunto subscribed my name, at Chicago, Illinois, this 23rd day of August, 1932.

ROBERT BACK.