July 11, 1944. F. P. MOORE 2,353,177

MECHANICAL PENCIL

Filed Sept. 17, 1942

Fig. 1

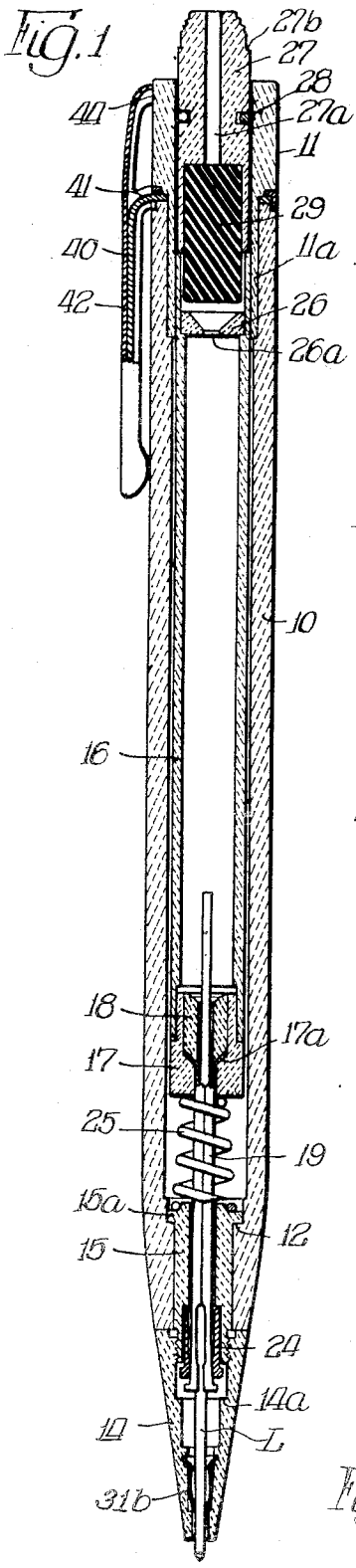


Fig. 2

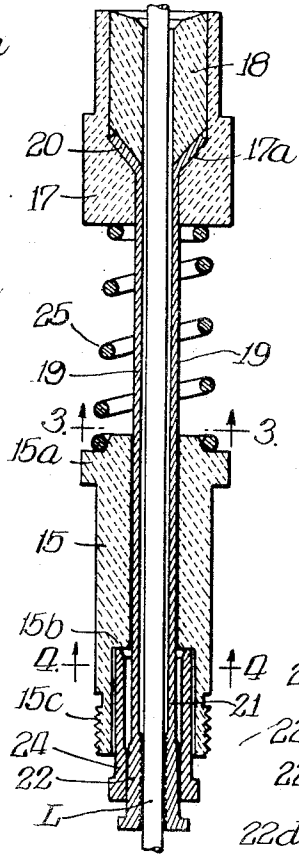


Fig. 3

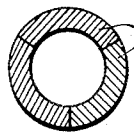


Fig. 4

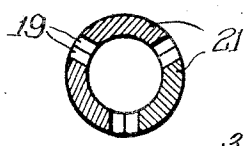


Fig. 5

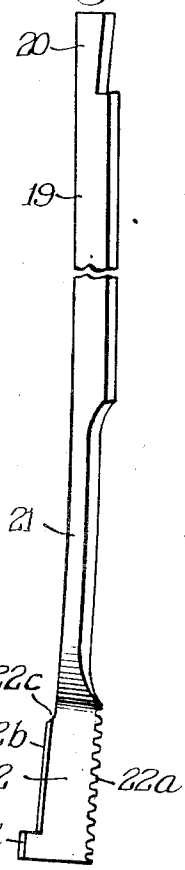


Fig. 6

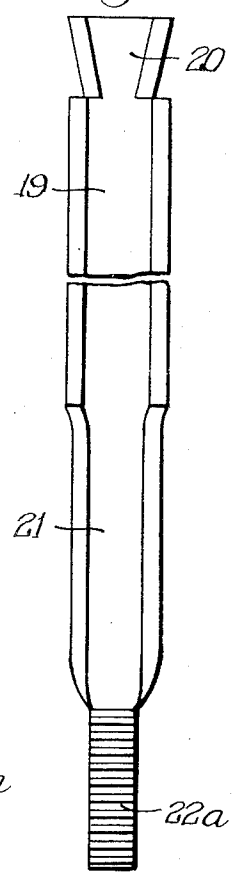


Fig. 7

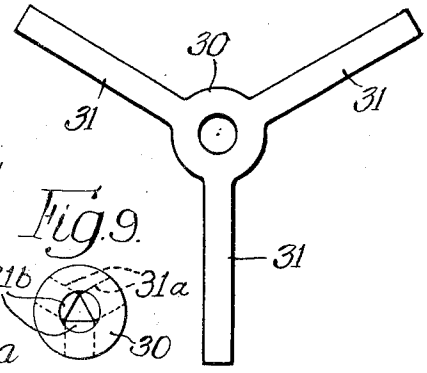
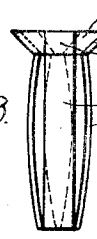


Fig. 9.

Fig. 8.



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UNITED STATES PATENT OFFICE

2,353,177

MECHANICAL PENCIL

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Application September 17, 1942, Serial No. 458,613

15 Claims. (Cl. 120—17)

This invention relates to mechanical lead pencils of the type adapted to retain a plurality of lead sticks in a magazine and to feed them successively, step by step, to the writing point by manual operation of a feeding mechanism.

A general object of the present invention is the provision of improved construction for such lead pencils, by virtue of which the amount of metal employed therein may be reduced to a minimum, the pencil may be produced in quantities economically and at low cost per unit and of a character which is sturdy in structure, accurate and reliable in operation and durable in use.

Other objects reside in the provision of certain improved parts in mechanical pencils.

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

In the present specification are illustrated and described certain forms in which the invention may be embodied, but it is to be understood that these are presented merely for purposes of illustration and are not to be construed to limit the appended claims short of the true and most comprehensive scope of the invention defined in them.

In the drawing:

Fig. 1 is a longitudinal section through a mechanical pencil embodying the present invention, the section being taken on a diameter;

Fig. 2 is a sectional view of a portion of the feeding mechanism, same being on a scale considerably larger than that of Fig. 1;

Fig. 3 is a cross section of the assembled lead guide tube on approximately line 3—3 of Fig. 2 but on a considerably larger scale;

Fig. 4 is a cross section through the clutch arms, on approximately line 4—4 of Fig. 2 but on a considerably larger scale;

Fig. 5 is a side elevational view of one of the guide tube and clutch arm segments, the same being shortened to approximately one-half its length by the breaking out of a portion of it and being shown on a scale approximately the same as that of Figs. 3 and 4;

Fig. 6 is an inside elevational view of the element shown in Fig. 5, as looking at the right-hand side of Fig. 5;

Fig. 7 is a plan view of a blank punched from sheet stock for the production of a lead retaining element;

Fig. 8 is an elevational view of the lead retaining element formed up from the flat blank shown in Fig. 7; and

Fig. 9 is a top view of same.

In addition to the conservation of metal for other uses, the present invention obtains certain direct and positive advantages and improvements in the manufacture and performance of mechanical lead pencils, and, furthermore, greatly simplifies the construction and assembly of such metal parts as are used. The invention resides primarily in the new and improved construction by virtue of which non-metallic materials, such as suitable plastics, may be utilized for the construction of almost the entire device. The nature of the improvements will be most quickly ascertained from a consideration of the illustrative embodiment shown in the drawing. In this the reference numeral 10 designates the barrel of the pencil, which is a tubular member of suitable stiffness such as may be formed from a plastic material, such as thoroughly cured pyroxylin. For a short distance from its upper end the bore of the barrel is somewhat enlarged in diameter to receive the sleeve 11*a* of the guide bushing 11, which may be made of the same material as the barrel or of a non-metallic material having greater resistance to abrasion than that of the barrel. The upper portion of the top bushing 11 juts over the upper end of the barrel while the thickness of the sleeve 11*a* is such that its inner wall extends inwardly somewhat beyond the normal bore wall of the barrel. The lower end portion of the barrel is tapered externally and its bore is reduced in diameter so as to provide an internal shoulder 12. For association with the barrel 10 there is provided a tapering tip 14, which likewise may be made of suitable rigid plastic material and which is mounted upon the barrel as hereinafter described, so that the barrel and the tip conjointly form the casing for the operating parts of the pencil.

The operating parts form a portion of a unit assembly which includes an anchor bushing 15, made of suitable durable plastic material and shaped to fit in the reduced lower end bore of the barrel and having a peripheral flange 15*a* adapted to rest upon the internal shoulder 12. This bushing 15 has an axial bore which is enlarged in its lower portion to provide an internal shoulder 15*b* and the bushing is of such length that its lower end portion projects beyond the lower end of the barrel when the flange 15*a* is seated as above described, said lower end portion being externally screw-threaded as at 15*c*. The tip 14 is internally threaded so as to screw onto the portion 15*c* of the bushing, whereby the upper end of the tip may be drawn up tightly against the lower end of the barrel and the barrel and tip rigidly con-

nected in coaxial relationship. The magazine tube 16 is a reciprocable member made of a suitable rigid non-metallic material and is of diameter to be received freely within the bore of the barrel 10, so that it may be reciprocated longitudinally therein with its upper portion guided in the sleeve 11a of the top bushing. Fitted within and upon the lower end portion of the magazine tube 16 is a socket member 17 of non-metallic material and formed with an axial bore, the upper portion of which is of larger diameter than the lower portion, and affording a conic or dished surface 17a, and a plug member 18, of non-metallic material, is provided, of proper size to fit within the enlarged portion of the bore of the socket member 17. The plug member 18 has an axial bore of somewhat smaller diameter than that of the lower portion of the socket member 17, and at its upper end is counter-bored to provide a funnel-like entry into its axial bore.

The lead guide tube and lead feeding clutch jaws are formed as a plurality of identical metallic strips which may be stamped out of flat sheet stock and shaped up into transversely arched or complementary segmental form. In the embodiment illustrated the tube is formed of three such segmental or complementary strips which are of the form illustrated in Figs. 5 and 6. For most of their length they are of simple transversely arched form, to provide the lead guide tube portions 19 which are adapted to fit together in complementary relationship to form a cylindrical tube, as illustrated in Fig. 3, and at their upper ends they are relieved laterally to provide the clenching tips 20. For a short distance above their lower ends the strips are of reduced width so as to provide flexible arm portions 21 and these, at their lower end portions, are swaged so as to still further reduce their width and increase their thickness to form clutch jaws 22 having serrated lead engaging surfaces 22a extending inwardly from the normal inner surface of the arm portions 21, and outer wedging surfaces 22b flaring angularly from the outer surfaces of the arms 21 and merging into them by way of inclined shoulder portions 22c. At their lower ends the jaws are formed with outwardly projecting stop lugs 22d having abrupt shoulders presented upwardly. The arm portions 21 are set in slightly outwardly curved or sprung form and the metal of which these strips are made has sufficient resiliency or spring quality to cause the arm members 21 to return to their bowed form shown in Fig. 5 after they have been flexed a slight distance inwardly, that is, in the direction of their concave sides.

When placed together in complementary relationship, the portions 19 of these strips form a substantially cylindrical tube, as illustrated in Fig. 3, of size such as to engage in the upper bore of the bushing 15 with a close but freely slidable fit, while the portions 21 form outwardly sprung, inwardly flexible resilient arms carrying lead gripping jaws 22 at their lower ends. For cooperation with these jaws, and as a means for flexing them inwardly, there is provided a rigid constricting member or clutch collar 24. The upper portion of this collar is of an external diameter permitting it to occupy the lower bore portion of bushing 15 with a liberal circumferential clearance, and collar 24 itself has a bore of size to permit it to slide freely on the associated arm portions 21 but which is sufficiently restricted at its lower end to prevent entry of the shoulder portions 22c within it when the arms 21 are in their normal outwardly sprung or relaxed condition and relationship. Consequently, upon forcible retraction of the shoulder portions 22c into the constricting collar 24, the jaws 22 will be swung slightly inward or toward the common axis, and the arm members 21 will be slightly deflected inwardly and placed under resilient tension. Upon further retraction of the jaws into the constricting collar so that the lower end of the bore of the latter engages the wedging surfaces 22b, the jaws will be pressed still further inwardly and a binding engagement between the bore of the collar and the wedge surfaces 22b will be produced by virtue of the outward resilient pressure of the arms 21. A helical spring 25 is provided for assembly with the other operating parts.

The parts constituting the operating unit are assembled exteriorly of the barrel. Three of the segmental strips are placed together in complementary arrangement, the constricting collar 24 is then slid onto them from their upper ends, followed by the bushing 15, which retains them in their complementary relationship. Then the spring 25 is threaded onto the upper portion of the associated strips, and then the socket member 17, the lower bore portion of which fits the periphery of the assembled strips 19 quite closely. By means of a suitable conforming die and spreading punch, the end portions 20 of the strips are then bent outwardly into conformity with the dished inner surface portions 17a, and then the plug member 18 is inserted into the bore of the socket member 17 and secured permanently in place by means of cement or the like with its tapered lower end engaging the flaring inner surfaces of the portions 20 and its axial bore aligning with the bore of the lead guide tube formed by the complementary members 19. Then the magazine tube 16 is fitted onto the socket member 17 and secured thereto by cement or in other suitable fashion. A lead gauge member 26 is inserted in the upper end of the magazine tube and secured therein, said lead gauge member having an aperture 26a of width to admit lead sticks of the maximum diameter for which the pencil is designed and to prevent admission of larger ones.

The unit assembly thus completed is mounted in the barrel by inserting it through the upper end thereof, seating the anchor bushing 15 upon the shoulder 12 and screwing on the tip 14 until its upper end is set up tightly against the lower end of the barrel. The actuating member or means for applying manual operating pressure to the operating parts comprises an eraser holder 27 which is adapted to fit slidably in the tube bushing 11 and carries resilient friction means such as a light spring ring 28 which bears resiliently upon the bore wall of said bushing to prevent the eraser holder from falling out. One end of the eraser holder is formed with a socket to receive and hold a rubber eraser 29 and the other end is finished as a push button or head with a longitudinal bore 27a therethrough, through which a slender element, such as a wire, may be inserted to push the worn-down portion of the eraser out of the socket. The eraser holder is adapted to be retained in the bushing 11 with either end upward, and when it is in the position with the eraser housed, as shown in Fig. 1, the end of the holder abuts the upper end of the magazine tube 16, while when in the inverted position, with the eraser projecting out of the upper end of the bushing 11, the peripheral

shoulder 27b of the holder rests on the upper end of the magazine tube 16. Accordingly, with the eraser holder in either position, downward pressure may be exerted upon its projecting end portion to move the magazine tube 16 and the conjoined socket member 17 and complementary strip members all downwardly together against the pressure of the spring 25, and upon release of pressure from the eraser holder, said parts are returned upwardly by reaction of said spring. The shoulder 15b forms a rearward limit stop for the constricting collar 24 and a shoulder 14a in the tip forms a forward limit stop for said collar. The magazine tube 16 and feeding clutch parts, however, have a greater extent of forward and rearward movement than is thus permitted the constricting collar, and the size of the bore of the tip below the shoulder 14a is such as to permit such additional forward movement of the clutch jaws. In the lower portion of the tip is mounted a lead gripping member for holding the lead stick when it is out of the control of the feeding clutch, and in Figs. 7 and 8 I illustrate a new and improved constriction for such lead gripping member which permits its being made from flat sheet metal. In Fig. 7 is shown a blank which is punched out of sheet metal of proper kind, same being formed with a hub portion 30 of generally annular form, from which extend radially finger portions 31 arranged at equidistant angular spacing. In Fig. 8 is shown the completely formed lead gripping member made from this blank by simple procedure wherein the hub portion 30 is first dished to a frusto-conic form with its central aperture at its lower end, and the finger members 31 are then bent downwardly along and in conformity with the outer surface of the dished hub portion 30, as at 31a, and thence are bent outwardly and given a bowed set in the form shown at 31b in Fig. 8. This provides cooperating resilient fingers whose lower ends are closer to one another than are their upper ends, so that a lead stick which will pass freely through the central orifice in the hub member will have to spring the finger members outwardly in order to pass between their lower ends. Accordingly, a lead stick so positioned between the lower ends of the fingers will be gripped by them and retained against falling through under the influence of gravity. This lead gripping member is mounted in a cavity in the tip 14 which is of such cross sectional size that it makes contact with the outermost surfaces of the bowed finger portions 31b, and may place them under a very slight tension. Consequently, when the lead stick is forced between the lower ends of the fingers, the flexure takes place entirely in the bowed portions below the parts 31a, thus giving a long spring action without flexing either of the sharp bends at the ends of the portions 31a. Thus, the device, which is necessarily quite small and delicate, is particularly well qualified for prolonged service without losing its resiliency or developing fatigue. This lead gripping device is retained in the tip in coaxial relationship with the lead feeding parts, as by seating the sloping surfaces of the portions 31a against a correspondingly shaped shoulder in the tip and then forcing down a feather or burr from the wall of the tip against the upper margin of the hub portion 30.

If desired, the pencil may be fitted with a clasp such as of the construction illustrated in the patent to Alexander, No. 2,274,393, wherein a shank portion 40 of resilient metal is carried on a ring portion 41 which embraces the sleeve 11a and lies between the upper end of the barrel 10 and the jutting portion of the bushing 11, said shank being supplemented by an outer leaf portion or shell 42 of resilient plastic material which enshrouds the shank portion 42 and is properly secured thereto, but extends beyond its upper end and is suitably secured at 44 to the upper portion of the bushing 11.

For the operation of the device, the magazine tube 16 may be appropriately charged with lead sticks of suitable diameter inserted through the aperture 26a of the lead gauge member. When the pencil is held with its point downward, one of these sticks finds its way through the bore of the plug member 18 into the lead guide tube formed by the portions 19 and passes by gravity downwardly until it is stopped against the upper end of the lead gripping portion 22a of the jaws which at such time are held in inwardly displaced position by virtue of the fact that the jaws are held retracted within the constricting collar 24. Pressure then being applied to the eraser holder 27 to move the operating parts downwardly within the barrel, the jaws 22 will thereby be moved downwardly and will carry the constricting collar 24 with them until such collar is stopped by abutment against the shoulder 14a. After the constricting collar has thus been stopped, downward movement of the jaws continues until their shoulders 22c pass beyond the lower end of the constricting collar 24, whereupon the inwardly stressed arms 21 spring outwardly to their cast-off position, thus permitting the lead stick to drop between them. Upon release of the eraser holder 27, the parts are returned rearwardly by spring 25, and in the course of said rearward movement the rearward end of said constricting collar 24 comes up against the shoulder 15b and is stopped, but the other parts, including the jaws 22, continue their rearward movement, the jaws 22 being cammed by passage of the shoulder portions 22c and parts of the wedging surfaces 22b into the bore of the constricting sleeve until the lead gripping surfaces 22a are moved into gripping engagement with the lead stick L. This arrests rearward movement of the parts before the stop lugs 22d reach the lower end of the constricting collar 24. When the eraser holder is next pressed downwardly, the lead stick remains gripped between the jaws and is carried forward and forced between the resilient gripping fingers 31b, and after the forward movement of the collar 24 has been stopped by shoulder 14a and the jaws have been moved forward to free the lead stick, as above described, the parts are again returned rearwardly when pressure is removed from the eraser holder, the lead stick being left in the grip of the fingers 31b until it is regripped at the higher point when the jaws 22 are again retracted into the collar 24. In the upward movement of the jaws, the collar 24 is carried upwardly by virtue of engagement of the shoulder portions 22c against its lower end, and it is thereby prevented from exerting a premature constricting action upon the jaws before it reaches the rear limit stop 15b. By successive operations of the pencil in this fashion, all of the lead sticks may be fed from the magazine, step by step. In the absence of a lead stick from the clutch, the stop lugs 22d come up against the lower end of the collar 24 and retain the operating parts against withdrawal from the barrel.

By virtue of the various features of the construction above described, it is possible to reduce

the amount of metal in the pencil to a very small proportion, namely, that necessary to provide the lead gripping member in the tip, the constricting collar 24, the complementary strips 21, the spring 25 and the detent spring 28. The clasp, of course, is not essential to the operation of the device and may be omitted entirely, but even in it the amount of metal may be reduced as above described.

What I claim is:

1. In a lead feeding mechanism for mechanical pencils, in combination, a tubular magazine member, a socket member at the lower end thereof and having a stepped bore, a plurality of resilient strips arranged in complementary relationship to form a tube with its upper portion fitting in the smaller lower portion of said bore, said strips having upper end portions bent outwardly over a stepped surface in said bore, and a plug member secured in the larger portion of said bore with its lower end in engagement with said outwardly bent portions of said strips, said plug member having a bore forming a passage from the tubular magazine member into said tube.

2. In a lead feeding mechanism, a structure as described in claim 1 and including also a bushing in which lower portions of said strips are guided for longitudinal sliding movement in complementary relationship.

3. In a lead feeding mechanism for mechanical pencils, in combination, a non-metallic reciprocable tubular member, a plurality of resilient metallic strips mounted thereon in complementary relationship to one another and extending therefrom in the form of a tube, a non-metallic bushing in which said strips are guided in their complementary relationship for longitudinal reciprocating movement, and a metallic collar cooperating with the lower portions of said strips to constrain them toward each other, said strips being shiftable longitudinally relative to said collar to free them from its constraint.

4. In a lead feeding mechanism for mechanical pencils, in combination, a reciprocable tubular member, a plurality of resilient metallic strips of complementary form mounted on said tubular member and extending forwardly therefrom in the form of a tube, a bushing in which said strips are guided in their complementary relationship for longitudinal reciprocation, a longitudinally shiftable collar cooperating with portions of said strips to constrain them toward each other, said bushing affording an abutment limiting rearward movement of said collar relative thereto, said strips being movable forwardly with said tubular member to free them from constraint of said collar, and stop means carried by one or more of said strips for engagement with said collar to limit rearward movement of said strips and said tubular member relative to said bushing.

5. In a mechanical pencil, in combination, an elongate tubular member, a tubular barrel in which said tubular member is mounted for longitudinal reciprocation, the bore of said barrel being of size and form such as to allow liberal clearance around the tubular member, a bushing mounted in the end of said bore and extending inwardly therefrom into guiding cooperation with the tubular member to guide it co-axially in the barrel, means in the lower portion of the barrel for guiding the lower end of said tubular member coaxially therein, and an actuating member frictionally retained in said bushing and slidable longitudinally therein to impart longitudinal movement to the tubular member.

6. In a mechanical pencil having a tubular barrel, the combination of a reciprocable member operating therein with a clearance from the barrel bore wall, a guide bushing mounted at the end of the barrel and forming a centering guide projecting inwardly from the barrel bore wall for the upper end of the reciprocable member, an actuating member slidably mounted in said bushing and abutting an upper end portion of the reciprocable member, and resilient friction means restraining said actuating member against movement in the bushing.

7. In a lead feeding mechanism for a mechanical pencil, in combination, a substantially rigid tubular magazine and a plurality of strips mounted on said magazine about a common axis to form a lead guide tube extending from one end thereof, which lead guide tube formed by said strips is of smaller bore than the magazine and has communication with said magazine to permit passage of lead sticks singly from one to the other, portions of said strips being resiliently flexible inwardly relative to the magazine to tension them and being adapted to spring outwardly by their inherent resiliency when so tensioned.

8. In mechanism of the sort described, a structure as specified in claim 7 and wherein portions of the strips which are remote from the magazine are formed as jaws for gripping a lead stick in the tube.

9. In mechanism of the sort described, a structure as specified in claim 7 and wherein portions of the strips which are at the magazine are fixed in complementary relationship and portions of said strips which are remote from the magazine are formed as resilient arms flexible toward and from the axis of the tube and carrying jaws for gripping a lead stick in the tube at a distance from the magazine.

10. A lead holding member for mechanical pencils comprising a dished annular hub having finger members formed integrally with it and extending from its peripheral edge along its converging outer surface and thence extending in the general direction of its extended axis but bowed outwardly to form spring-like grippers disposed around the axis and with their free ends associated to grip a lead stick disposed in the axial position.

11. The combination with a lead holding member as specified in claim 10 of a sheath member having a cavity in which the lead holding member is housed, said sheath member having an axial passage permitting passage of a lead stick axially through said holding member and having walls of the cavity constraining the bowed grippers.

12. In a mechanical pencil having a tubular barrel, a lead feeding mechanism comprising a tubular magazine reciprocable longitudinally in said barrel, a plurality of resiliently flexible strips mounted on said magazine about a common longitudinal axis, said strips having their ends which are remote from the magazine formed as lead gripping jaws, a constraining collar encompassing said jaws for cooperation therewith to wedge them inwardly for gripping engagement with a lead stick, stops mounted in the barrel for cooperation with said collar to limit its forward and rearward movements, and stop lugs formed on said jaws beyond the forward end of said collar and adapted for co-

operation therewith to prevent retraction of said jaws out of said collar.

13. A lead holding member for mechanical pencils comprising a dished annular hub having finger members formed integrally with it at its peripheral edge and extending therefrom in the general direction of the extended axis of the hub but bowed to form spring-like grippers disposed around said axis and having portions associated to grip a lead stick disposed in the axial position.

14. A lead holding member for mechanical pencils as specified in claim 13 and wherein said fingers are approximately straight in cross section.

15. In a mechanical lead pencil, the combination with mechanism specified in claim 7, of means encompassing said lead guide tube and forming a guide therefor and limiting the outward flexion of said strips.

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