Dec. 13, 1955 O. H. MILLER 2,726,637

PENCIL

Filed Oct. 10, 1952

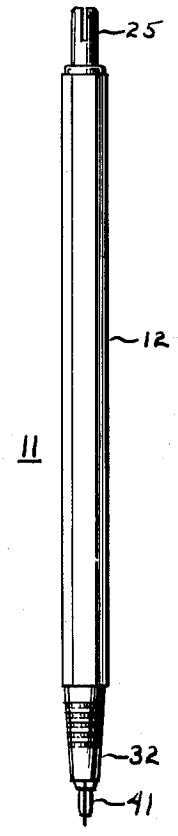

Fig. 1

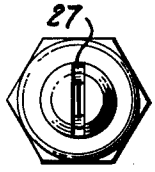

Fig. 4

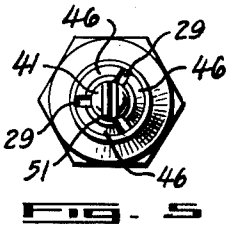

Fig. 5

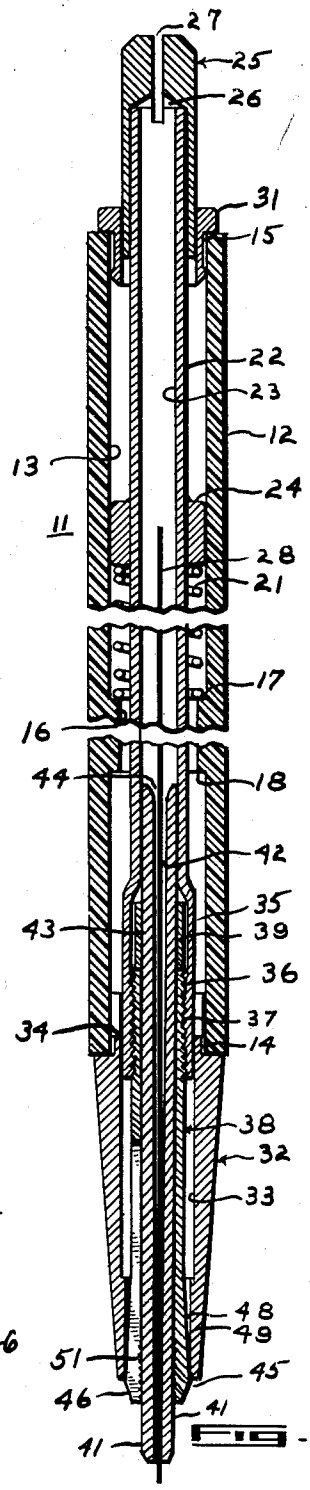

Fig. 2

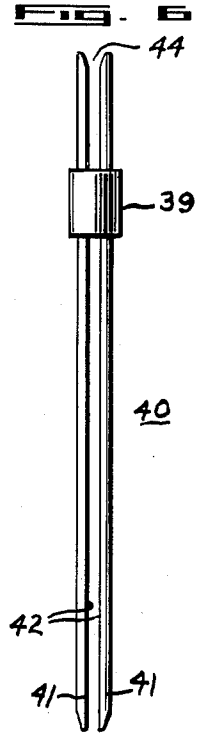

Fig. 6

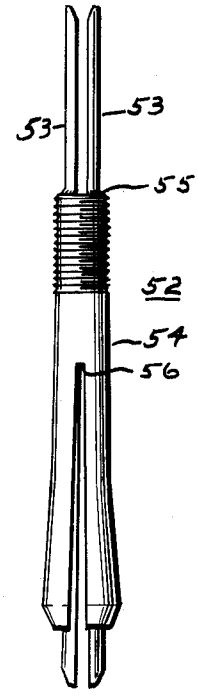

Fig. 7

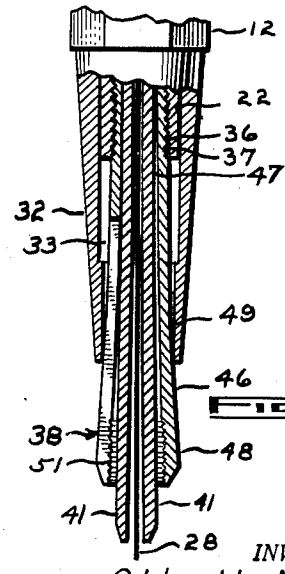

Fig. 3

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2 Claims. (Cl. 120—22)

This invention relates to mechanical lead pencils and more particularly to an improved holding device for receiving and firmly holding a replaceable endwise movable lead or marking element designed to mark lines of uniform width regardless of wear.

In the commercial production of complicated structures such as bridges, ships, aircraft, automotive vehicles, etc., it is trade practice to fabricate components of the structure in their required dimensional form by utilizing full-scale patterns or templates as guides. To construct the patterns or templates it is necessary to prepare full-scale drawings of the component parts of the structure. A full-scale drawing may be drawn on drawing paper of cloth and then reproduced on a metal sheet in a well-known manner by a photographic process. Alternatively, a full-scale drawing may be made directly upon a sheet of metal which has been sprayed with a white lacquer. The sheet of metal carrying the reproduced drawing is then cut along the lines appearing thereon to effect the template.

As the accuracy of the template dimensions depend on the uniformity of the width of the drawn lines, the draftsman shapes his drawing pencil lead in the form of a chisel edge. Since template drawings are of such size as to require large footages of drawn lines, the draftsman is required to shape his pencil lead constantly to maintain uniform line widths. Accordingly, the ratio of the draftman's shaping time to drawing time is both vexatious and costly.

Attainment of lines of uniform width is made still more difficult if the drawing surface is non-uniform or of a roughened character since abrasion of the pencil point occurs more rapidly and a widened and/or irregular line results when extant drawing pencils are used. Particular difficulty is encountered when working on a drawing cloth made of glass fibers because the surface texture is highly abrasive and uniform lines are impracticable, yet glass drawing cloth is desirable because it is durable and dimensionally stable.

Therefore, the principal object of the invention is to provide a novel and improved lead holding device with which lines of uniform width are drawn and which does not require the drawing lead to be sharpened during use.

Another object of the invention is to provide an improved holding means for supporting a marking element which is of the same width as the width of the line to be drawn.

Another object of the invention lies in the provision of an improved support for a marking element of rectangular shape.

A further object of the invention is the provision of a marking device embodying improved means for gripping and supporting lead so that it is less likely to fracture during use.

Another object of the invention is the provision of a lead holder so constructed as to allow replacement of the lead with ease and facility.

Another object of the invention is the provision of a

mechanical lead holder so constructed as to allow a simple and practical means to feed the lead as it wears.

Still another object of the invention is the provision of a lead holding device so constructed as to allow gravity feed of the lead.

A further object of the invention is to provide a lead holding device so designed as to allow simple ejection of broken pieces of a fractured lead without the necessity of disassembling.

Still another object of the invention is to provide a marking device which is simple in construction, economical to manufacture and efficient in operation.

Other objects and features of the present invention will be readily apparent to those skilled in the art from the following specification and appended drawings wherein is illustrated a preferred form of the invention, and in which:

Fig. 1 is an elevational view of a pencil embodying the present invention.

Fig. 2 is an enlarged longitudinal sectional view through the pencil.

Fig. 3 is a detail sectional view showing the collet end of the barrel of the pencil with the collet in open position.

Fig. 4 is a detail showing the top end of the pencil.

Fig. 5 is a detail showing the drawing end of the pencil.

Fig. 6 is an elevational view illustrating a preferred lead gripping means.

Fig. 7 is an elevational view illustrating an alternative lead gripping means.

Referring now with particularity to the drawings, there is shown a pencil designed within the conception of this invention and referenced by the numeral **11**. Pencil **11** is comprised of a barrel or casing **12** of hexagonal cross-section having an axial cylindrical bore **13** extending longitudinally between opening **14** in the bottom end and opening **15** in the top end of casing **12**. Substantially at the longitudinal center of casing **12** bore **13** is narrowed by an annular wall projection **16** having an upper annular shoulder **17** and a lower annular shoulder **18**. Annular shoulder **17** forms an abutment against which the lower end of a compression spring **21** rests. The barrel **12**, which may be formed from wood, plastic, metal, or any suitable material, is slidably fitted with a cylindrical shaft **22** of smaller diameter than bore **13** and projecting slightly below opening **14** at the lower end of barrel **12** and projecting to a greater extent from opening **15** at the upper end of barrel **12** as shown in Fig. 2. Shaft **22** is afforded a through bore **23** and is exteriorly fitted as by welding or brazing with an annular bushing **24** whose outer diameter approximates the inner diameter of bore **13** of barrel **12**, the cylindrical surfaces formed on these diameters being in coaxial slidable relationship to each other. The bushing **24** is positioned on shaft **22** above the projecting wall formation **16** with its lower annular face serving as a stop against which the upper end of compression spring **21** rests such that a downward movement of shaft **22** compresses spring **21**.

That portion of shaft **22** which extends beyond opening **15** on the upper end of casing **12** is fitted with a cylindrical thumb cap **25** having a cylindrical bore **26** which extends longitudinally upward for about two-thirds of the length of cap **25** and receives the upper end of shaft **22**. Cap **25** is permanently mounted upon shaft **25** by being machine pressed thereunto. A diametrical slot **27** is milled through the top of cap **25** and communicates with bore **23** of shaft **22** to allow the insertion of a length of lead **28** into bore **23** through slot **27** for operative positioning in pencil **11** as will be described in detail hereinafter. A cylindrical shoul-

der bushing 31 snugly but slidably encircles thumb cap 25 at the point where the latter emerges from opening 15 at the upper end of barrel 12. Shoulder bushing 31 is comprised of two diameters, one larger than bore 13 of barrel 12 and the other approximately equal to bore 13 such that bushing 31 is machine pressed into opening 15 of barrel 12 providing lateral support for thump cap 25 and shaft 22. It is understood that bushing 31 may be positioned alternatively by threading, welding or by the use of any other suitable mounting device. A frustro-conical sleeve or nose-piece 32 having an inner bore 33, and an upper portion of reduced diameter 34 which approximates the diameter of bore 13, is machine pressed into bore 13 through opening 14 at the lower end of barrel 12.

The lower end of shaft 22 is flared to provide an enlarged portion 35 whose outer diameter is slightly less than the diameter of bore 33 of nose-piece 32 to permit insertion of flared portion 35 within bore 33. Flared portion 35 of shaft 22 is tapped at its lower end to afford an internal thread 36 which cooperates with an external thread 37 formed on the upper end of a collet 38 to secure the latter to shaft 22. Threaded collet portion 37 terminates adjacent an annular ring 39 rotatably positioned within the enlarged portion 35 of shaft 22 and restricted longitudinally by the reduced diameter of bore 23 on its upper side and threaded portion 37 of collet 38 on its lower side.

Fig. 6 illustrates an embodiment of a lead gripping means, designated generally by the numeral 40. This lead gripping means 40 embodies a pair of elongated leg members 41, each substantially half round in transverse section, and having extended flat surfaces 42 which pass through annular ring 39 such that a major part of members 41 emerge from the lower part of annular ring 39. Annular ring 39, as shown, is a short cylindrical member whose outer diameter is slightly less than the inner diameter of the enlarged portion of shaft 22. It is provided with a bore 43 whose inner diameter approximates the width of lead 28 and within which members 41 are inserted as described above and rigidly fastened to the walls thereof as by welding such that their flat surfaces 42 face each other in parallel across a space or slot opening 44 of slightly greater dimension than the thickness of the lead 28. It is understood that the flat surfaces 42 of members 41 may be roughened as by serration or cross-filing to effect a firmer lead gripping action. The members 41 are formed from a resilient material so that any deviation from their normally parallel relationship sets up a spring bias which tends to restore such relationship. The upper ends of members 41 are beveled to facilitate entry of lead 28 into the slot opening 44. The lower tips of members 41 are provided with cosmetic beveled edges.

The collet 38 is a cylindrical member of non-uniform diameter tapering from a larger diameter near its fingered lower end 45 to a smaller diameter at upper threaded portion 37. The lower portion 45 of collet 38 is provided with a plurality of longitudinally extending slots 29 which split the collet 38 into three prongs or annularly arranged spread-apart fingers 46 which cooperate to effect a three-jawed collet chuck. Collet 38 is made of steel whereby fingers 46 will have resiliency so that they can be flexed or moved toward one another on the application of a compression force to their exterior arcuate wall surfaces 48 by mating arcuate inner wall surface 49 of nose-piece 32 as detailed in Fig. 2. It is apparent that the whole of collet 38 cannot be inserted within bore 33 of nose-piece 32, the exterior dimensions of the lower ends of clamping fingers 46 being greater than the opening into bore 33. Interior arcuate surfaces 51 at the lower ends of fingers 46 are serrated to provide for a rigid non-slidable grasp on lead gripping members 41 when collet 38 is in the closed position illustrated in Fig. 2. It is understood that the material used in making collet 38 and members 41 is not limited to steel, though steel is preferred, and it is contemplated that any metal or other material having resilient characteristics may be employed.

In an alternative lead holding arrangement shown in Fig. 7, identified generally by the numeral 52, lead gripping members 53 are provided which are rigidly fastened to a collet 54 at the upper inside edge 53 and pass downwardly through bore 56 thereof. These gripping members 53 and collet 54 are of the same dimensions, material, and positioning with respect to one another as lead gripping members 41 and collet 38 described in the first embodiment above. However, in this second embodiment, there is no annular ring 39 employed.

A description of the pencil operational assembly is made easier by review of those portions which comprise manufactured sub-assemblies. The barrel 12 and the nose-piece 32 constitute one sub-assembly which may be designated as the barrel sub-assembly; thumb cap 25, shaft 22 and annular bushing 24 are grouped into a second sub-assembly termed the shaft sub-assembly; a third sub-assembly is constituted of gripping members 41 and annular ring 39 in the first described embodiment or gripping members 53 and collet 54 in the alternate embodiment shown in Fig. 7. Shoulder bushing 31, compression spring 21, and collet 38 comprise individual parts in the pencil assembly.

Thus, in assembly of the sub-assemblies of pencil 11 the compression spring 21 is inserted into bore 13 through the top of the barrel 12 and the spring gravitates until its lower end is adjacent to the shoulder 17 of wall formation 16 within bore 13. Shaft 22 is likewise inserted into bore 13 through the top of the barrel 12 and allowed to gravitate until the lower end of annular bushing 24 fastened on the shaft 22 lies adjacent the top of compression spring 21. Shoulder bushing 31 is then slipped over thumb cap 25 and machine pressed into bore 13 at opening 15 in the top of barrel 12 thereby providing lateral slidable support for shaft 22 and effectively preventing removal of the shaft sub-assembly. The lead gripping sub-assembly 40 shown in Fig. 6 is inserted long extensions first into the bore 47 of collet 38 through the upper end thereof and allowed to gravitate until the lower edge of annular ring 39 seats on the upper annular edge of collet 38, and the whole being inserted into bore 33 of nose-piece 32 through the lower end of nose-piece 32 and then rotated to effect interengagement of external threaded portion 37 on the upper end of collet 38 and internal thread 36 in the enlarged diameter 35 of shaft 22. After the threaded attachment of collet 38 to shaft 22 the restoring force of compression spring 21 exerts an upward pull on collet 38 to bring exterior arcuate wall surfaces 48 of clamping fingers 46 into mating engagement with interior arcuate wall surfaces 49 at the lower end of nose-piece 32. In this static position, the clamping fingers 46 are in a closed position on gripping leg members 41, the lower end of which are caused to move toward each other against a restoring resilient force and if no lead is in the pencil the flat surfaces 42 of the lower end of the gripping members 41 will meet.

Lead 28 used in this pencil is required to be rectangular in cross-section and is inserted into pencil 11 by passing through slot 27 in thumb cap 25 thereby entering bore 23 of shaft 22 gravitating into the space 44 between the flat faces 42 of elongated gripping members 41 downward until the lead is constrained where the faces 41 come together as they do near the opening of nose-piece 32.

To position the lead for drawing, the thumb cap 25 is depressed as with the thumb until spring 21 is fully compressed thereby setting the limit of downward motion and the action of pencil 11 is as follows: As thumb cap 25 is depressed, shaft 22 moves downward forcing annular bushing 24 to compress spring 21 thereby setting up a restoring force. Collet 38 and the gripping as-

sembly within collet 38 being affixed to shaft 22 also move downward. As clamping fingers 46 of collet 38 emerge from the lower opening of bore 33 in nose-piece 32, they are released from constraint by the arcuate wall 49 of nose-piece 32 and being inherently spring biased, they open radially outward. The opening of the three-jawed collet thereby removes the holding force on gripping members 41 causing the latter to spring return to a normal parallel relationship as hereinbefore described. Thus, when thumb cap 25 is depressed, the collet 38 is in its open position as illustrated in Fig. 3 and Fig. 5, and lead 28 is free to move downward of its own weight beyond the lower ends of elongated gripping members 41 where it is positioned as to desired exposed length by the forefinger.

When the draftsman is satisfied with the lead position he slowly removes his thumb from the thumb cap 25 causing a series of actions opposite to that described above and detailed as follows: spring 21 under extreme compression forces annular bushing 24, hence shaft 22 and thumb cap 25 upward. Collet 38 being threaded to shaft 22 also moves upward carrying with it the sub-assembly comprised of gripping members 41 and annular ring 39. As the flared clamping fingers 46 are pulled into the bore 33 of nose-piece 32 the arcuate walls 49 of the latter are slidably engaged by the arcuate walls 48 of the fingers 46 to cause fingers 46 to move radially inward and the inner serrated arcuate walls 51 of these fingers 46 clamp on gripping members 41 causing the latter to move toward each other against their inherent resilient bias and thusly clamping and supporting the lead 28 in position.

In the alternative embodiment, wherein the gripping members 53 are fastened as by welding directly to the collet 54 as hereinbefore described, the action is similar to that of the first embodiment.

When the lead gripping assembly of the embodiment shown in Fig. 6 is used care must be exercised to rotate the lead and gripping members 41 such that none of the slots 29 align with space 44 between gripping members 41 but rather that the inner arcuate walls 51 of clamping fingers 46 lie across and close the space 44 between gripping members 41, as illustrated in Fig. 5, so that the lateral edges of the lead 28 are constrained from lateral movement and hence from longitudinal misalignment.

When the lead gripping assembly of the embodiment shown in Fig. 7 is utilized care is taken that the gripping members 53 are fastened to collet 54 in such angular position that the inner wall surfaces of the clamping fingers of collet 54 lie across and close the space between members 53 so that the lateral edges of the lead are constrained from lateral movement and hence from longitudinal misalignment of the lead. Thus the relative position of these parts are similar to the relative positions of their counterparts of the first embodiment as illustrated in Fig. 5. In this second embodiment, the proper angular position of the elongated members 53 with respect to the clamping fingers of collet 54 is manufactured into the device and no particular attention, while loading the pencil, to proper positioning in this regard is required.

In both embodiments, moreover, the lead receives additional lateral support for maintaining alignment from bore 23, coaxially aligned bore 43 in annular ring 39, and the bores 47 and 56 of both collets 38 and 54 in a closed position because all mentioned bores are made of approximately equal diameter and equal to the width of the lead. Further, the elongated gripping members 41 with the lead clamped between them present a transverse cross-section closely approximating a circle with the lead diametrically positioned thereby allowing the three clamping fingers to clamp and simultaneously correct the lead laterally for true alignment.

It is understood that the clamping fingers in the collets of either embodiment are not necessarily limited to three though that number has been used in describing this invention.

When lead 28 has been worn down and additional writing surface is required the thumb cap 25 is depressed and lead 28 will gravity feed from the nose-piece 32 opening with the draftsman limiting the amount of emergence with the forefinger. Should the lead 28 within pencil 11 accidentally fracture it is a simple matter to clear the pencil of broken pieces if desired by depressing thumb cap 25 while shaking the pencil until all pieces drop out. A new lead is then inserted as hereinbefore described.

The construction of the pencil 11 herein described is particularly adapted for use with flat leads which are of a thickness equal to the desired width of the line to be drawn. The particular thickness of lead used varies with the type of work and it may be used by a draftsman on a lofting operation or by a carpenter on a wood structure. In lofting practice, thin lines having a thickness of between .015 and .020 inch are particularly desirable. The pencil of this invention is capable of supporting leads of thicknesses mentioned without their breaking.

As the thickness of the lead utilized in the pencil is equal to the required width of the line to be drawn it is obvious that the operation of sharpening the lead is obviated. As the line is drawn the lead abrades without any gaining in thicknesses, since there can be no gaining. With the thickness of the lead remaining constant as the lead wears away, the width of the line drawn by the lead will be uniform.

The width of the lead used need be no more than that necessary to slide over declivities and indentations on the drawing paper. In lofting practice a lead width of .10 inch has been found satisfactory for leads of the thinness above stated. The length of lead that may be accommodated is dependent on the length of the pencil.

The hardness of the lead used is also dependent on the work being done and the roughness of the drawing surface. A fairly hard lead such as 6H is preferred for lofting work on fiber glass drawing cloth since it provides without exertion of undue pressure, a sharp black line which reproduces well when photographed. However, the selection of the proper grade lead is a matter of experience.

While certain preferred embodiments of the invention have been specifically disclosed it is understood that the invention is not limited thereto, as many variations will be readily apparent to those skilled in the art and the invention is to be given its broadest possible interpretation within the terms of the following claims.

What I claim is:

1. A pencil comprising a barrel with a nose-piece, an axial passage extending through said barrel and nose-piece and opening to the exterior at each end, lead grasping means for holding lead of rectangular section and of a thickness no greater than the width of a line to be drawn, comprising a pair of elongated resilient lead gripping members of segmental section having the flat surfaces thereof in opposition and normally spaced apart, a clamping member having a plurality of clamping fingers annularly disposed about said elongated members with interior wall surfaces of certain of said clamping fingers arranged for engagement with the longitudinal edges of said elongated members, said clamping fingers being operative on said elongated members for moving them toward one another to apply a holding pressure upon a lead disposed between the flat surfaces thereof, means for supporting said clamping member and said elongated members for rectilinear movement within said axial passage, said supporting means comprising a tubular member disposed for a portion of its length within said passage, extending its upper end to the exterior of the barrel and having its lower end affixed to the clamping member, said elongated members extending at one of their ends within said tubular member and restrained against independent longitudinal movement therein, the opposite other ends of said elon-

gated members projecting through said nose-piece to the exterior thereof, said tubular member having an opening in its upper end for insertion of lead into the tubular member and therealong into position between the flat surfaces of said elongated members, and spring means within said barrel exerting its bias on said tubular member for holding said clamping fingers normally in clamping engagement with said elongated members.

2. A pencil comprising a barrel with a nose-piece, an axial passage extending through said barrel and nose-piece and opening to the exterior at each end, lead grasping means for holding lead of rectangular section and of a thickness no greater than the width of a line to be drawn, comprising a pair of elongated resilient lead gripping members of segmental section having the flat surfaces thereof in opposition and normally spaced apart, a clamping member having a threaded portion and a plurality of clamping fingers annularly disposed about said elongated members with interior wall surfaces of certain of said clamping fingers arranged for engagement with the longitudinal edges of said elongated members, said clamping fingers being operative on said elongated members for moving them toward one another to apply a holding pressure upon a lead disposed between the flat surfaces thereof, camming surfaces on said clamping fingers engageable with interior wall surfaces of said nose-piece for moving said clamping fingers into clamping position on said elongated members, means for supporting said clamping member and said elongated members for rectilinear movement within said axial passage, said supporting means comprising a tubular member disposed for a portion of its length within said passage, extending its upper end to the exterior of the barrel and having its lower end threaded to the clamping member, said elongated members extending at one of their ends within said tubular member and restrained against independent longitudinal movement therein, the opposite ends of said elongated members projecting through said nose-piece to the exterior thereof, said tubular member having an opening in its upper end for insertion of lead into the tubular member and therealong into position between the flat surfaces of said elongated members, and spring means within said barrel confined between stops afforded by said tubular member and by said barrel exerting its bias on said tubular member for holding said clamping fingers normally in clamping engagement with said elongated members.

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