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PENCIL SHARPENER

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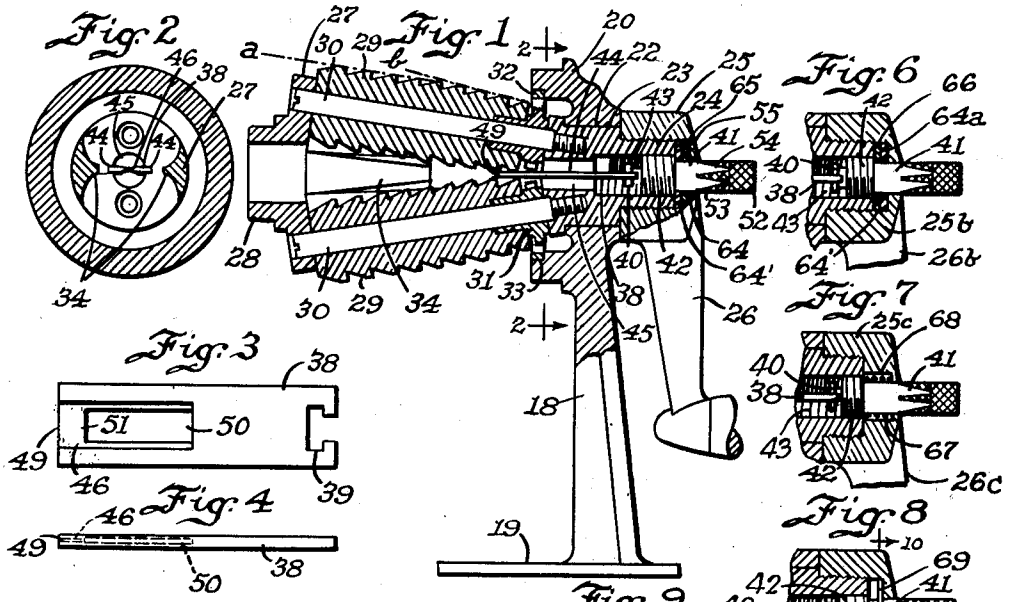

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PENCIL SHARPENER

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This invention relates to pencil sharpeners and more particularly the well known type incorporating two substantially cylindrical cutters in diametrically opposed converging relationship.

A demand has arisen for a pencil sharpener capable of being adjusted readily to produce different degrees of sharpness of pencil points, so that the user is not confined to a standard sharpness of point, which may not be suited to his or her particular needs or for the particular kind of pencil being used. We are aware that efforts have been made by others in this direction, but their designs of pencil sharpeners have been too complicated and expensive to manufacture or were limited to use of a single cutter, being not at all practical if applied to the conventional two-cutter type sharpener mentioned above. For example, in one of the prior designs the spacing of the converging cutters was increased and the cutters were arranged to cut all but the point portion of the lead, while an auxiliary cutter, functioning as a combination pencil stop and point cutter, was adjustable axially between the converging ends of said cutters into the space there-between, the auxiliary cutter having a substantially V-shaped cutting edge to sharpen the end portion of the lead to a sharp, blunt, or medium point according to the length of lead left protruding from the wood as predetermined by the adjustment. The converging cutters, being of hardened tool steel, and the auxiliary cutter being also of hardened tool steel, the need for increased spacing of the converging cutters is self evident; any rubbing of the auxiliary cutter on the other cutters would soon render the same too dull for good operation. On the other hand, the auxiliary cutter's V-shaped cutting edges were adapted only to do a scraping operation on the lead, not a true cutting operation, with the result that gouging would occur, particularly with softer leads and crayons, and breakage was inevitable. It is, therefore, one of the principal objects of our invention to provide a pencil sharpener having the two converging cutters in a normal closely spaced relationship as required to perform the entire cutting operation independently of any auxiliary cutting means, and having a stop plate of unhardened metal axially adjustable between the closely spaced inner ends of the cutters for abutment with the pencil point to limit the insertion of the pencil and, accordingly, predetermine the sharpness or bluntness of the point that will be produced when the pencil is sharpened. The stop plate is hollowed out arcuately on opposite sides lengthwise on a radius bearing a predetermined relationship to the radius of the cutters to provide operating clearance, although an occasional slight amount of rubbing contact with one or the other of the cutters could do no harm, due to the fact that the cutters are hardened, whereas the stop plate is unhardened. In addition, the stop plate is preferably slotted lengthwise of a portion of the hollowed portion, to give additional working clearance for the more closely spaced drive pinions on the inner ends of the cutters throughout the range of axial adjustment of the stop plate, there being left a web at the inner end of the hollowed portion of the stop plate to afford a stop for abutment with the pencil point. With this construction adequate working clearance can be allowed in the diametrically opposed grooves in the cutter frame for slidably receiving the opposed longitudinal edge portions of the stop plate, so that the stop plate may be adjusted easily and there will be no likelihood for the same to stick or bind. Furthermore, this construction enables obtaining close enough setting of the stop plate in every instance to obtain the precise sharpness of point desired, although simple and inexpensive means are employed (using only standard threads and easily produced parts—no keys, pins, spring plungers, special cams, et cetera) to operate the stop plate, it being necessary only to locate the plate longitudinally, not radially and longitudinally.

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Another important feature of our invention is the provision in connection with the axially adjustable stem of friction drag means for holding the stem releasably and yet reasonably securely in adjusted position.

The invention is illustrated in the accompanying drawings, in which—

Fig. 1 is a vertical section lengthwise through a pencil sharpener embodying our invention, the usual chip receptacle being removed;

Fig. 2 is a cross-section on the line 2—2 of Fig. 1, showing the stop plate in end elevation;

Figs. 3 and 4 are a face view and side view, respectively, of the stop plate on an enlarged scale;

Fig. 5 is an end view of the stop plate on the same scale as Figs. 3 and 4, indicating by dot and dash line circles milling cutters, by means of which the opposite sides are hollowed out up to and including the stop end of the plate

Figs. 6, 7, 8, and 9 are fragmentary sectional details corresponding to a portion of Fig. 1, but showing other friction drag means;

Fig. 10 is a cross-section on the line 10—10 of Fig. 8;

Fig. 11 is a side elevation on a larger scale of

a portion of Fig. 1, to better illustrate the pencil point markings on the adjusting stem, this view being related to Fig. 11*a* showing the pointed end of a pencil, the point of which has been sharpened in accordance with the setting of the stop plate indicated on the stem in Fig. 11, and

Figs. 12 and 12*a* are views similar to Figs. 11 and 11*a*, showing a different setting of the stem and the correspondingly blunter point obtainable.

Similar reference numerals are applied to corresponding parts throughout the views.

Referring first to Figs. 1 to 5, the reference numeral 18 designates the standard for the pencil sharpener, which has the usual attaching flange or base portion 19 on one end and a hub portion 20 on the other end adapted to support the usual chip receptacle, it being common practice to provide a bayonet lock connection between the hub 20 and the chip receptacle, so that the latter may easily be removed from time to time to empty the contents and be as easily replaced. A bearing 22 is provided in the hub 20 for the drive shaft 23, which has a reduced externally threaded portion 24, onto which the internally threaded hub portion 25 of a hand crank 26 is mounted to provide a driving connection between the crank and shaft. The shaft 23 has integral therewith a frame or yoke 27, which includes a neck portion 28 on its outer end in concentric relation to the shaft portion 23 through which the end portion of a pencil to be sharpened is entered. Two diametrically opposed, substantially cylindrical, helical milling cutters 29 are mounted in the frame 27 in converging relation on spindles 30, and have drive pinions 31 fixed on the inner ends thereof which mesh with an internal gear ring 32 that is suitably fixed in a recess 33 provided therefor in the hub 20, so that the cutters are caused to turn on their spindles as they are revolved with the frame when the same is turned by means of the crank 26. The diametrically opposed side portions 34 of the frame 27 extend in inwardly converging relation, at a slightly larger angle than the cutters, so as to provide lateral support for the tapered end of the pencil as the pencil is sharpened and fed inwardly by hand, or otherwise. It has heretofore been common practice to provide on the frame 27 within the chip receptacle a stop for abutment with the pencil point, working between the inner ends of the cutters in front of the drive pinions, to limit the inward movement of the pencil and provide a given sharpness of pencil point, the stop being usually in the form of a bell-crank member pivoted on the frame with one arm or finger thereof reaching inwardly between the cutters to act as the stop, this bell-crank member being set at the factory in a fixed position by bending the other arm of the bell-crank member at the time of assembling the sharpener. However, a demand has arisen for a pencil sharpener capable of being adjusted readily externally to produce different degrees of sharpness of pencil points, so that the user will not be confined to a standard sharpness of point, which might not happen to be suited to his or her particular need, or might not be best adapted for a particular kind of pencil being used. For that reason efforts have been made to provide a stop readily adjustable from the outside of the pencil sharpener, but, as has been pointed out before, the designs proposed have been too complicated and expensive to manufacture and were not practical as applied to the conventional two-cutter type sharpeners, such as that herein illustrated and just described. It is important that the close spacing of the converging cutters be left unchanged, so that the entire cutting operation can be performed by the cutters 29, which are best adapted to do this work. For one thing, these cutters are hardened and the cutting edges thereon are accurately ground with a special undercut for durability and knife-like cutting on wood and lead alike. Furthermore, as indicated by the dot and dash lines *a* and *b* in Fig. 1, the inner end portions of the cutters have a slight taper so as to enable making a longer point, as at 35, on the pencil than would be permitted were the point a direct continuation of the taper 36 on the end of the pencil 37, as illustrated in Fig. 11*a*. The sharpness of the pencil point must, therefore, be determined, at least in part, by the closeness of spacing of the inner ends of the cutters 29, and, obviously, that leaves very little room through which to operate any adjustable stop means for abutment with the pencil point to predetermine by the setting thereof the sharpness of the point by predetermining the length of the lead beyond the taper of the wood on the pointed end of the pencil. This limitation upon the design of a pencil sharpener with an outside-operable point sharpener adjustment is what led others heretofore to conclude that the pencil sharpener would have to be substantially completely redesigned to the extent of utilizing the cutters 29 to cut all but the point portion of the lead and providing a separate axially adjustable blade with a V-shaped cutting edge on the inner end thereof to cut the point on the lead to whatever sharpness of point was desired and predetermined by the adjustment of this blade. This blade was necessarily a hardened blade and precautions had to be taken to insure against its coming into contact with the revolving cutters, and that explains the change in the spacing of the revolving cutters to the extent where they were capable of attending to only a part of the cutting operation. However, we have found a much more practical solution to the problem, by providing not a blade but merely a stop plate 38 of unhardened metal axially adjustable between the closely spaced inner ends of the cutters 29, the close spacing of which, for the purposes previously mentioned, is left unchanged. The stop plate 38 is of elongated form, as shown in Figs. 3 and 4, and has a T-slot 39 provided in its outer end for a swivel operating connection with the annularly flanged head 40 provided on the inner end of the adjusting stem 41, which has an enlarged threaded portion 42 intermediate its ends next to the head 40 threaded in the axial bore 43 provided in the shaft 24. The stop plate 38 is slidable freely in grooves 44 provided in diametrically opposite sides of the restricted inner end portion 45 of the bore 43, and has the inner end thereof hollowed out lengthwise on opposite sides arcuately, as indicated at 46, by coining the same and/or feeding the same lengthwise between two closely spaced milling cutters 47, as indicated by the dot and dash line circles in Fig. 5, the milling cutters 47 being slightly larger in diameter than the cutters 29, so as to leave a few thousandths of an inch clearance between the stop plate 38 and the cutters 29, and still leave a flat surface 49 on the end of the stop plate 38 wide enough to serve as a limiting stop for abutment with the end of the pencil point in any position of adjustment of the stop plate within its normal range of adjustment relative to the cutters. An elon-

gated slot 50 is cut lengthwise of the hollowed portion leaving a web 51 at the inner end of the plate on which the stop face 49 just mentioned is afforded. The slot 50 assures ample working clearance for the pinions 31, so that there will be no likelihood whatever of any rubbing contact with the teeth on these pinions, which, of course, would mean noise in the operation of the pencil sharpener in addition to wear on the pinions and unnecessary drag on the operation of the sharpener. On the other hand, since there is only a few thousandths of an inch clearance between cutters 29 and the web 51, and also in view of the fact that the plate 38 is slidable freely in grooves 44, the plate may occasionally touch one or the other of the cutters, but no harm will be done by this because the stop plate 38, as stated before, is of unhardened metal whereas the cutters are hardened.

In operation, when the stop plate 38 is adjusted to the extreme retracted position, shown in Fig. 1, the sharpest and longest point, illustrated in Fig. 11*a* at 35, is producible, and it is obvious that the cutters 29 perform the entire cutting operation on the wood and lead. The sharp tip of the pencil point 35 abuts the flat end surface 49 on the stop plate 38, and in that way the sharpening operation is limited both by engagement of the tapered end portion 36 of the pencil on the converging sides 34 of the frame 27 and by abutment of the tip of the pencil point 35 on the stop surface 49. Now, on the other hand, if the stop plate 38 is adjusted inwardly by means of the stem 41 to any position within the range of axial adjustment of the plate, it should be evident that the pencil point produced will accordingly be shorter and blunter, as illustrated by the point 35*a* in Fig. 12*a*, the entire sharpening operation being taken care of by the cutters 29 in the same way as previously described, and the insertion of the pencil being again limited both by abutment of the pencil point with the stop plate 38 at 49 and by abutment of the tapered end portion 36 of the pencil shaft with the tapered side portions 34 of the frame 27.

Referring now to Figs. 1, 11, and 12, attention is called to the knurling of the outer end portion 52 of the stem 41 to facilitate threading the same in and out in the adjustment of the stop plate 38. Extending inwardly from the knurled tip portion 52 are circumferentially spaced triangular markings 53, which may be knurled, etched, enameled, or otherwise set off in contrast to the smooth and shiny portions 54 therebetween. These markings 53, which form a part of the subject matter of a divisional application filed in the name of Arthur W. Gillespie, Serial No. 162,082, filed May 15, 1950, correspond to the sharpness of the pencil point 35 (Fig. 11*a*), and they are so arranged on the stem 41 with reference to the hole 55 in the hub 25 of the crank 26 that when the stem 41 is adjusted to its fully retracted position, as in Figs. 1 and 11, the whole markings are visible and the operator can see from that that the longest and sharpest pencil point is obtainable with the sharpener when the stem 41 is so adjusted. However, when the stem is threaded inwardly to an intermediate position, as illustrated, for example, in Fig. 12, the triangular markings 53 have their apex portions more or less hidden in the hub 25, depending upon how far inwardly the stem has been threaded, and in that way there is indicated to the operator a blunter pencil point producible with the sharpener when the stem is so adjusted, the shortened markings 53 in Fig. 12 corresponding to the blunter point 35*a* illustrated in Fig. 12*a*.

Referring again to Fig. 1, attention is called to the washer shown at 64, which is of rubber or any other suitable compressible resilient material and arranged to be compressed between the reduced externally threaded end portion 24 of the drive shaft 23 and the end wall 65 on the hub 25 when the crank 26 is tightened. This washer normally has a close fit on the stem 41, but, by reason of its compression in the manner stated, has an even tighter fit on the stem 41, so that it serves to hold the stem against being turned accidentally, or by reason of inertia, in the operation of the crank 26. The compression of the washer 64 also reduces likelihood of the crank 26 loosening once it has been properly tightened. In that way the operator is assured of obtaining the pencil point desired whenever he has properly adjusted the stem 41. The metal washer 64′ protects soft washer 64 from abrasion by the end of the threaded portion 42 of stem 41.

The friction drag obtained by the washer 64 may also be obtained by a washer 64*a* of rubber, or other suitable compressible resilient material, caged in the hub 25*b* of a crank 26*b*, as illustrated in Fig. 6, and arranged so that it has a tendency to hug the periphery of the stem 41 on its internal diameter, and also to engage tightly on its external diameter the smooth portion 66 of the bore in the hub 25*b*. In other words, the washer 64*a* is compressed radially between the stem 41 and hub 25*b*, so that it exerts a compressive force on the stem and an expansive force on the hub. Substantially the same results are obtainable with this construction as with the one described in the previous paragraph. Here again, metal washer 64′ protects soft washer 64*a*.

In Fig. 7 we have shown a coiled compression spring 67 disposed in the counterbore 68 in the hub 25*c* of another crank 26*c* and abutting the enlarged threaded portion 42 of the stem 41. Obviously, when the stem 41 is fully retracted, this spring 67 is compressed to its fullest extent and exerts a frictional drag to resist turning of the stem 41. Substantially the same results are obtainable with this construction as with the two described in the previous two paragraphs.

In Figs. 8 and 10 we have shown a spiral spring 69 which has a central coil 70 hugging the stem 41 to resist by its compressive force turning of the stem, and which has an outer coil 71 engaging the smooth portion 72 of the bore of the hub 25*d* with sufficient expansive force to resist turning of the spring with respect to the hub, so that substantially the same effect is obtained as with the washer 64*a* of Fig. 6.

In Fig. 9 we have shown a volute spring 73, the large end 74 of which has abutment with the hub 25*e*, and the small end 75 of which has abutment with the enlarged threaded portion 42 of the stem 41 to resist turning of the stem in substantially the same manner as the spring 67 in Fig. 7.

It is believed the foregoing description conveys a good understanding of the objects and advantages of our invention. The appended claims have been drawn to cover all legitimate modifications and adaptations.

We claim:

1. A pencil sharpener comprising a support, a head rotatably mounted on said support, a pair of diametrically opposed substantially cylindrical milling cutters carried by said head with their cutting faces in converging relationship to form

a tapered space between said cutters, said cutters being of sufficient length and disposed close enough together to perform the whole sharpening operation on a pencil, and an elongated stop plate of rectangular form guided by its longitudinal edge portions in grooves provided therefor on said head for endwise movement substantially axially thereof in a plane between the converging ends of said cutters, the inner end portion of which plate is arranged to project into the small end of the tapered space between the cutters and has a flat end face for abutment with the tip of a pencil point.

2. A pencil sharpener comprising a support, a head rotatably mounted on said support, a pair of diametrically opposed substantially cylindrical milling cutters carried by said head with their cutting faces in converging relationship to form a tapered space between said cutters, said cutters being of sufficient length and disposed close enough together to perform the whole sharpening operation on a pencil, and an elongated stop plate of rectangular form guided by its longitudinal edge portions in grooves provided therefor on said head for endwise movement substantially axially thereof in a plane between the converging ends of said cutters, the inner end portion of which plate is arranged to project into the small end of the tapered space between the cutters and has a flat end face for abutment with the tip of a pencil point, said stop plate being of unhardened metal and hollowed out on opposite sides to provide operating clearance relative to the cutting faces of said milling cutters, the latter being of hardened metal.

3. A pencil sharpener comprising a support, a head rotatably mounted on said support, a pair of diametrically opposed substantially cylindrical milling cutters carried by said head with their cutting faces in converging relationship to form a tapered space between said cutters, said cutters being of sufficient length and disposed close enough together to perform the whole sharpening operation on a pencil, the inner end portions of said cutters which cut the lead of the pencil being tapered so that the point produced by the cutters is of smaller angle than the tapered end on the wood of the pencil produced by the cylindrical main portion of the converging cutters, and an elongated stop plate of rectangular form guided by its longitudinal edge portions in grooves provided therefore on said head for endwise movement substantially axially thereof in a plane between the converging ends of said cutters, the inner end portion of which plate is arranged to project into the small end of the tapered space between the cutters and has a flat end face for abutment with the tip of a pencil point.

4. A pencil sharpener comprising a support, a head rotatably mounted on said support, a pair of diametrically opposed substantially cylindrical milling cutters carried by said head with their cutting faces in converging relationship to form a tapered space between said cutters, said cutters being of sufficient length and disposed close enough together to perform the whole sharpening operation on a pencil, the inner end portions of said cutters which cut the lead of the pencil being tapered so that the point produced by the cutters is of smaller angle than the tapered end on the wood of the pencil produced by the cylindrical main portion of the converging cutters, and an elongated stop plate of rectangular form guided by its longitudinal edge portions in grooves provided therefor on said head for endwise movement substantially axially thereof in a plane between the converging ends of said cutters, the inner end portion of which plate is arranged to project into the small end of the tapered space between the cutters and has a flat end face for abutment with the tip of a pencil point, said stop plate being of unhardened metal and hollowed out on opposite sides to provide operating clearance relative to the cutting faces of said milling cutters, the latter being of hardened metal.

5. A pencil sharpener comprising a support, a frame including a hollow driven journal end portion rotatably mounted in and projecting through a bearing on said support, milling cutters carried rotatably in said frame in converging relationship forming between them a space, a gear fixed on the support with which pinions fixed on the cutters have meshing engagement, whereby to drive said cutters, an elongated plate of rectangular form slidably mounted by its longitudinal edge portions in grooves provided therefor in said journal for endwise movement axially between said cutters into said space for abutment of its inner end surface with the point end of a pencil, a rotatable handle having a hub portion fixed on the outer end portion of said journal for turning said frame, and an adjusting stem threaded axially in the journal and having a swivel operating connection with the outer end of said plate to move the same selectively in either direction a selected distance, the swivel affording a substantially positive operating connection between the stem and plate without interfering with the freedom of sliding movement of said plate in the aforesaid grooves.

6. A sharpener as set forth in claim 5, including means frictionally resisting turning of said stem relative to said journal in either direction, whereby to prevent an accidental change in setting of said stem.

7. A pencil sharpener comprising a support, a frame including a hollow driven journal end portion rotatably mounted in and projecting through a bearing on said support, milling cutters carried rotatably in said frame in converging relationship forming between them a space, a gear fixed on the support with which pinions fixed on the cutters have meshing engagement whereby to drive said cutters, an elongated plate of rectangular form slidably mounted by its longitudinal edge portions in grooves provided therefor in said journal for endwise movement axially between said cutters into said space for abutment of its inner end surface with the point end of a pencil, a rotatable handle having a hub portion fixed on the outer end portion of said journal for turning said frame, and an adjusting stem threaded axially in the journal and having a swivel operating connection with the outer end of said plate to move the same selectively in either direction a selected distance, the swivel affording a substantially positive operating connection between the stem and plate without interfering with the freedom of sliding movement of said plate in the aforesaid grooves, the outer end portion of said stem being of reduced diameter and projecting axially with working clearance through an opening provided in the hub portion of the handle and providing a knob for direct manual adjustment of said plate from outside said sharpener, there being an annular shoulder defined at the inner end of the reduced end portion of said stem which serves to limit outward adjustment of said stem relative to the hub portion of the handle.

8. A pencil sharpener comprising a support, a frame including a hollow driven journal end portion rotatably mounted in and projecting through a bearing on said support, milling cutters carried rotatably in said frame in converging relationship forming between them a space, a gear fixed on the support with which pinions fixed on the cutters have meshing engagement whereby to drive said cutters, an elongated plate of rectangular form slidably mounted by its longitudinal edge portions in grooves provided therefor in said journal for endwise movement axially between said cutters into said space for abutment of its inner end surface with the point end of a pencil, a rotatable handle having a hub portion fixed on the outer end portion of said journal for turning said frame, an adjusting stem threaded axially in the journal and having a swivel operating connection with the outer end of said plate to move the same selectively in either direction a selected distance, the swivel affording a substantially positive operating connection between the stem and plate without interfering with the freedom of sliding movement of said plate in the aforesaid grooves, the outer end portion of said stem being of reduced diameter and projecting axially with working clearance through a center hole provided in a wall on the hub portion of said handle, there being an annular shoulder defined at the inner end of the reduced end portion of said stem, and friction means housed in the hub portion between said wall and the outer end of said journal arranged to be engaged by said annular shoulder to limit outward adjustment of said stem while resisting turning of said stem in either direction.

9. A pencil sharpener comprising a support, a frame including a hollow driven journal end portion rotatably mounted in and projecting through a bearing on said support, milling cutters carried rotatably in said frame in converging relationship forming between them a space, a gear fixed on the support with which pinions fixed on the cutters have meshing engagement whereby to drive said cutters, an elongated plate of rectangular form slidably mounted by its longitudinal edge portions in grooves provided therefor in said journal for endwise movement axially between said cutters into said space for abutment of its inner end surface with the point end of a pencil, rotatable handle having a hub portion fixed on the outer end portion of said journal for turning said frame, an adjusting stem threaded axially in the journal and having a swivel operating connection with the outer end of said plate to move the same selectively in either direction a selected distance, the outer end portion of said stem projecting axially from the outer end of said journal and through a center hole in a wall on the hub portion of said handle, and friction means housed in the hub portion between said wall and the outer end of said journal resisting turning of said stem in either direction, said friction means comprising a washer of compressible resilient material compressed between the wall of the hub portion and the outer end of the journal and crowded radially inwardly into tight frictional contact peripherally of the stem.

10. A pencil sharpener comprising a support, a frame including a hollow driven journal end portion rotatably mounted in and projecting through a bearing on said support, milling cutters carried rotatably in said frame in converging relationship forming between them a space, a gear fixed on the support with which pinions fixed on the cutters have meshing engagement whereby to drive said cutters, an elongated plate of rectangular form slidably mounted by its longitudinal edge portions in grooves provided therefor in said journal for endwise movement axially between said cutters into said space for abutment of its inner end surface with the point end of a pencil, a rotatable handle having a hub portion fixed on the outer end portion of said journal for turning said frame, an adjusting stem threaded axially in the journal and having a swivel operating connection with the outer end of said plate to move the same selectively in either direction a selected distance, the outer end portion of said stem projecting axially from the outer end of said journal and through a center hole in a wall on the hub portion of said handle, and friction means housed in the hub portion between said wall and the outer end of said journal resisting turning of said stem in either direction, said friction means comprising a washer of compressible resilient material which is distorted radially so that its radially outer portion tends to expand and has tight frictional contact on its outer periphery within said hub and its radially inner portion tends to contract and has tight frictional contact peripherally of said stem.

11. A pencil sharpener comprising a support, a frame including a hollow driven journal end portion rotatably mounted in and projecting through a bearing on said support, milling cutters carried rotatably in said frame in converging relationship forming between them a space, a gear fixed on the support with which pinions fixed on the cutters have meshing engagement whereby to drive said cutters, an elongated plate of rectangular form slidably mounted by its longitudinal edge portions in grooves provided therefor in said journal for endwise movement axially between said cutters into said space for abutment of its inner end surface with the point end of a pencil, a rotatable handle having a hub portion fixed on the outer end portion of said journal for turning said frame, an adjusting stem threaded axially in the journal and having a swivel operating connection with the outer end of said plate to move the same selectively in either direction a selected distance, the outer end portion of said stem projecting axially from the outer end of said journal and through a center hole in a wall on the hub portion of said handle, and friction means housed in the hub portion between said wall and the outer end of said journal resisting turning of said stem in either direction, said friction means comprising a spiral spring which is distorted radially so that its radially outer portion tends to expand and has tight frictional contact on its outer periphery within said hub, and its radially inner portion tends to contract and has tight frictional contact peripherally of said stem.

12. A pencil sharpener comprising a support, a frame including a hollow driven journal end portion rotatably mounted in and projecting through a bearing on said support, milling cutters carried rotatably in said frame in converging relationship forming between them a space, a gear fixed on the support with which pinions fixed on the cutters have meshing engagement whereby to drive said cutters, an elongated plate of rectangular form slidably mounted by its longitudinal edge portions in grooves provided therefor in said journal for endwise movement

axially between said cutters into said space for abutment of its inner end surface with the point end of a pencil, a rotatable handle having a hub portion fixed on the outer end portion of said journal for turning said frame, an adjusting stem threaded axially in the journal and having a swivel operating connection with the outer end of said plate to move the same selectively in either direction a selected distance, the outer end portion of said stem projecting axially from the outer end of said journal and through a center hole in a wall on the hub portion of said handle, and friction means housed in the hub portion between said wall and the outer end of said journal resisting turning of said stem in either direction, said friction means comprising a volute spring which is compressed and surrounds the stem, the spring having its small end frictionally engaging an annular shoulder on the stem and having its large end frictionally engaging the wall of said hub around the center hole.

13. A pencil sharpener comprising a support, a frame including a hollow driven journal end portion rotatably mounted in and projecting through a bearing on said support, milling cutters carried rotatably in said frame in converging relationship forming between them a space, a gear fixed on the support with which pinions fixed on the cutters have meshing engagement whereby to drive said cutters, an elongated plate of rectangular form slidably mounted by its longitudinal edge portions in grooves provided therefor in said journal for endwise movement axially between said cutters into said space for abutment of its inner end surface with the point end of a pencil, a rotatable handle having a hub portion fixed on the outer end portion of said journal for turning said frame, an adjusting stem threaded axially in the journal and having a swivel operating connection with the outer end of said plate to move the same selectively in either direction a selected distance, the outer end portion of said stem projecting axially from the outer end of said journal and through a center hole in a wall on the hub portion of said handle, and friction means housed in the hub portion between said wall and the outer end of said journal resisting turning of said stem in either direction, said friction means comprising a washer of compressible resilient material compressed between the wall of the hub portion and the outer end of the journal and crowded radially inwardly into tight frictional contact peripherally of the stem, the structure including a protecting wear-resisting washer of substantially non-compressible material surrounding the stem on the opposite side of said first washer from the wall of the hub portion.

14. A pencil sharpener comprising a support, a frame including a hollow driven journal end portion rotatably mounted in and projecting through a bearing on said support, milling cutters carried rotatably in said frame in converging relationship forming between them a space, a gear fixed on the support with which pinions fixed on the cutters have meshing engagement whereby to drive said cutters, an elongated plate of rectangular form slidably mounted by its longitudinal edge portions in grooves provided therefor in said journal for endwise movement axially between said cutters into said space for abutment of its inner end surface with the point end of a pencil, a rotatable handle having a hub portion fixed on the outer end portion of said journal for turning said frame, an adjusting stem

threaded axially in the journal and having a swivel operating connection with the outer end of said plate to move the same selectively in either direction a selected distance, the outer end portion of said stem projecting axially from the outer end of said journal and through a center hole in a wall on the hub portion of said handle, and friction means housed in the hub portion between said wall and the outer end of said journal resisting turning of said stem in either direction, said friction means comprising a washer of compressible resilient material which is distorted radially so that its radially outer portion tends to expand and has tight frictional contact on its outer periphery within said hub and its radially inner portion tends to contract and has tight frictional contact peripherally of said stem, the structure including a protecting wear-resisting washer of substantially non-compressible material surrounding the stem on the opposite side of said first washer from the wall of the hub portion.

15. A pencil sharpener comprising a support, a head rotatably mounted on said support, a pair of diametrically opposed substantially cylindrical milling cutters carried by said head with their cutting faces in converging relationship to form a tapered space between said cutters, said cutters being of sufficient length and disposed close enough together to perform the whole sharpening operation on a pencil, and an elongated stop plate of rectangular form guided by its longitudinal edge portions in grooves provided therefor on said head for endwise movement substantially axially thereof in a plane between the converging ends of said cutters, the inner end portion of which plate is arranged to project into the small end of the tapered space between the cutters and has a flat end face for abutment with the tip of a pencil point, said stop plate being of a material appreciably softer than that of the milling cutters and hollowed out on opposite sides to provide operating clearance relative to the cutting faces of said milling cutters.

16. A pencil sharpener comprising a support, a head rotatably mounted on said support, a pair of diametrically opposed substantially cylindrical milling cutters carried by said head with their cutting faces in converging relationship to form a tapered space between said cutters, said cutters being of sufficient length and disposed close enough together to perform the whole sharpening operation on a pencil, the inner end portions of said cutters which cut the lead of the pencil being tapered so that the point produced by the cutters is of smaller angle than the tapered end on the wood of the pencil produced by the cylindrical main portion of the converging cutters, and an elongated stop plate of rectangular form guided by its longitudinal edge portions in grooves provided therefor on said head for endwise movement substantially axially thereof in a plane between the converging ends of said cutters, the inner end portion of which plate is arranged to project into the small end of the tapered space between the cutters and has a flat end face for abutment with the tip of a pencil point, said stop plate being of a material appreciably softer than that of the milling cutters and hollowed out on opposite sides to provide operating clearance relative to the cutting faces of said milling cutters.

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