May 4, 1943. A. N. BLUM 2,318,456

CUTTING CHAIN SHARPENER

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Fig. 3.

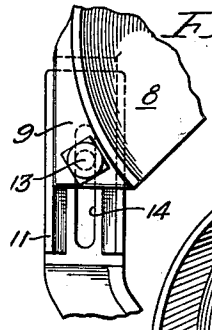

Fig. 1.

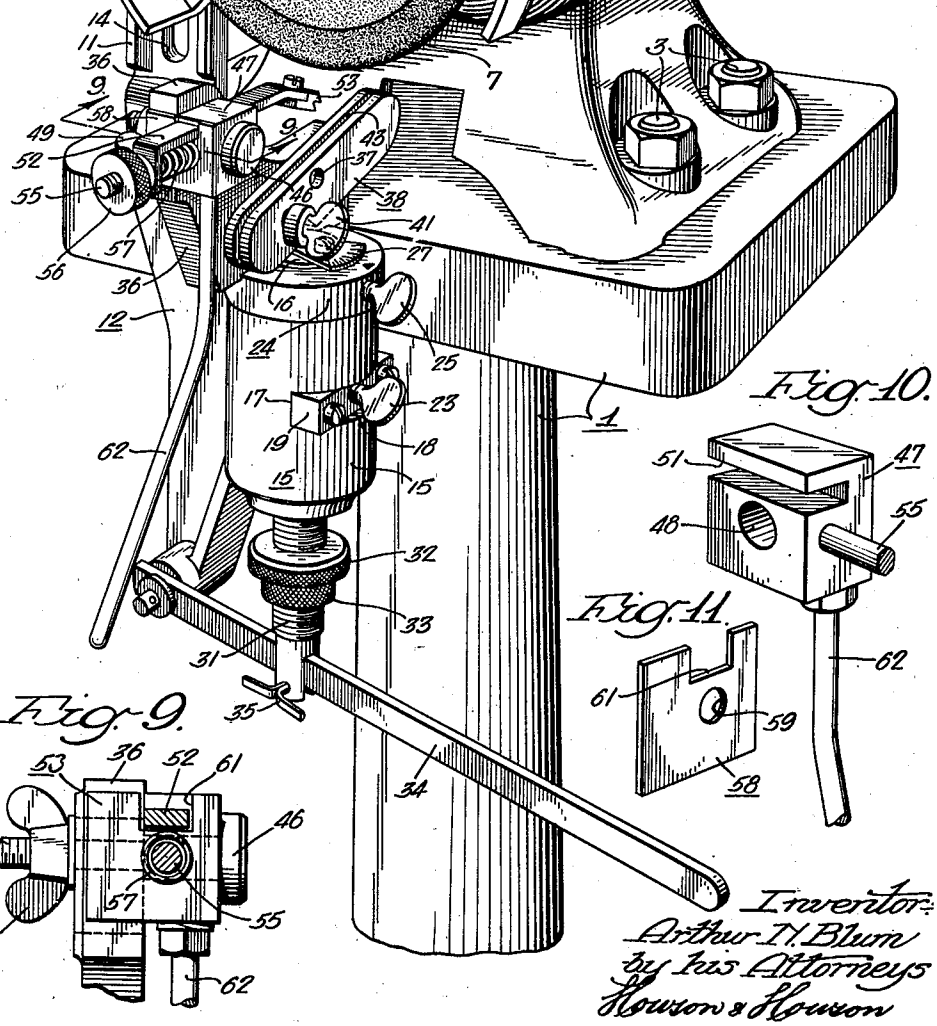

Fig. 10.

Fig. 11.

Fig. 9.

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Fig. 4.

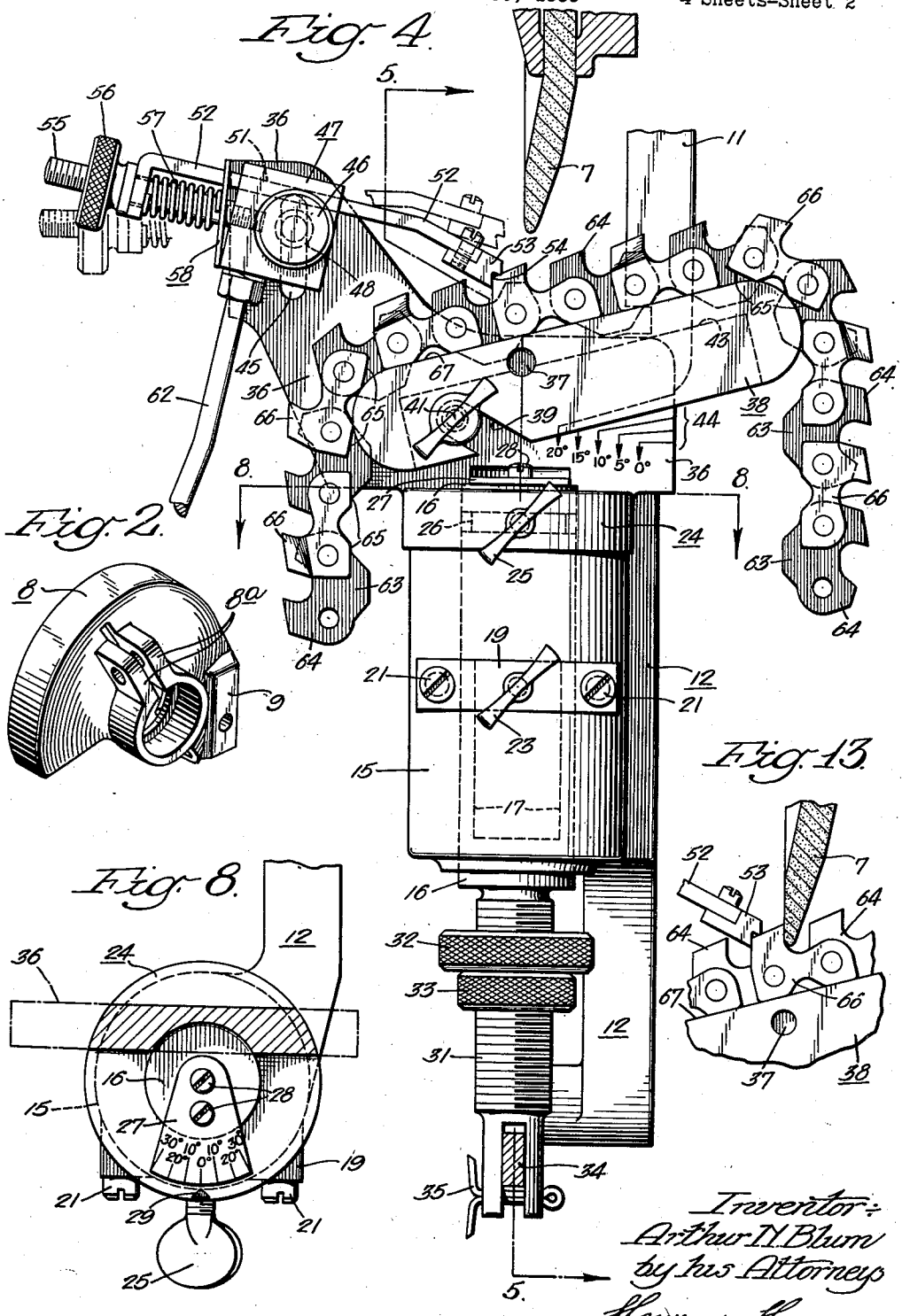

Fig. 2.

Fig. 13.

Fig. 8.

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CUTTING CHAIN SHARPENER

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Fig. 5.

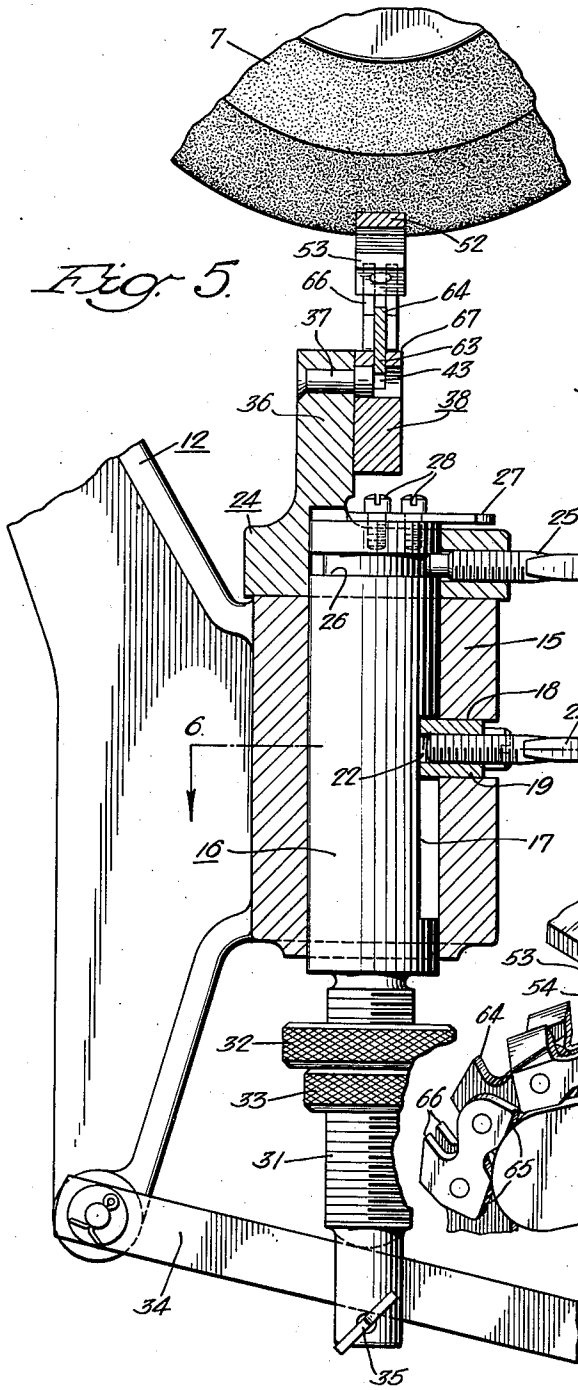

Fig. 7.

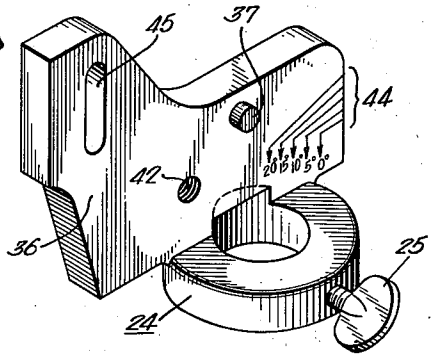

Fig. 6.

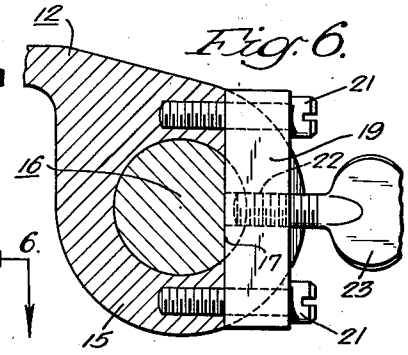

Fig. 12.

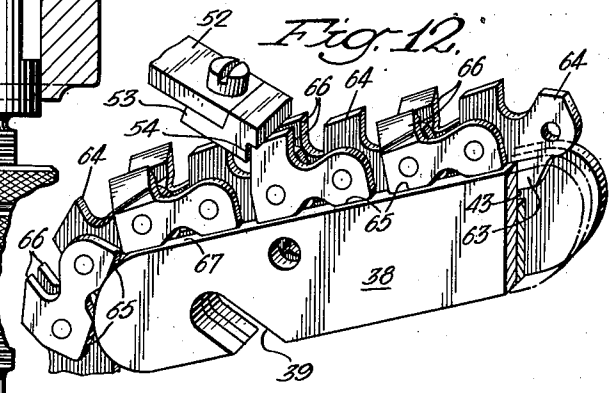

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Fig. 14.

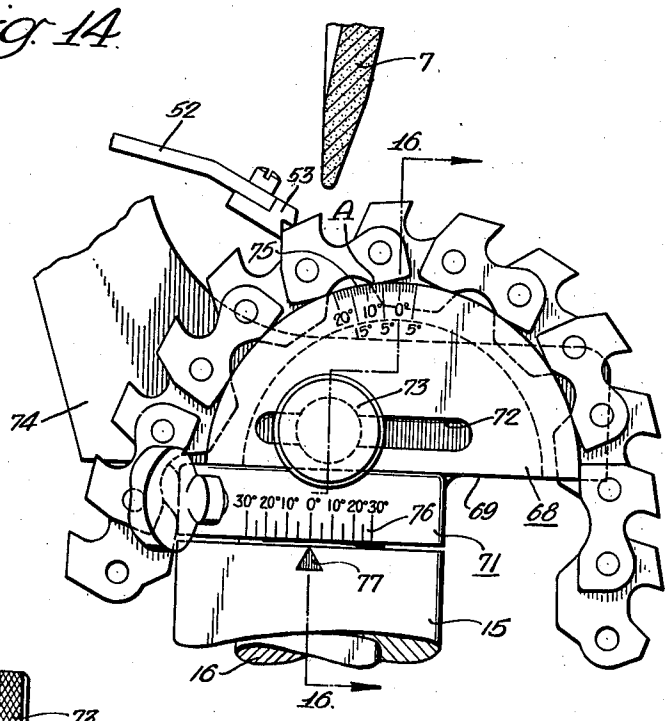


Fig. 16.

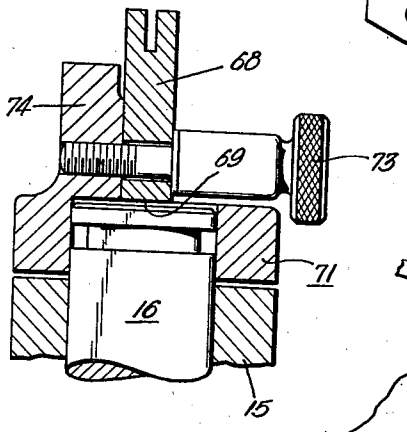


Fig. 15.

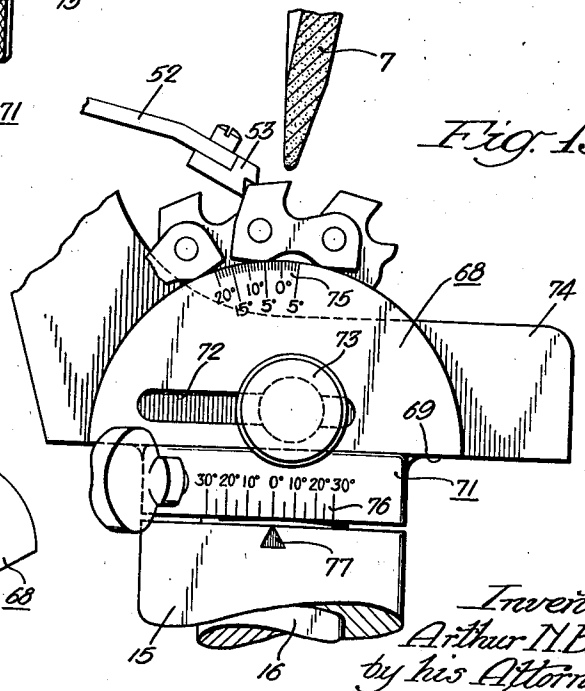
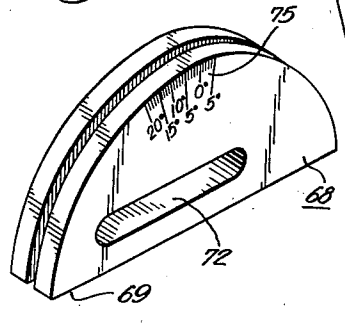


Fig. 17.



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Patented May 4, 1943 2,318,456

UNITED STATES PATENT OFFICE

2,318,456

CUTTING CHAIN SHARPENER

Arthur N. Blum, Philadelphia, Pa.

Application December 30, 1939, Serial No. 311,878

25 Claims. (Cl. 51—98)

This invention relates to devices for sharpening cutter teeth, and while the principles of the invention, as hereinafter defined, may be used to advantage in devices for sharpening the cutting teeth of a variety of tools, the immediate object is to provide an improved device for sharpening the teeth of chain saws.

More specifically, an object of the invention is to provide a device of the stated character having the extreme flexibility of adjustment to permit presentation of the work to the sharpening tool in any relative position that may be required to effect the proper sharpening of the individual teeth, and wherein provision is made for the precise positioning of each tooth with respect to the sharpening tool that is essential for obtaining exact uniformity in the corresponding teeth of the entire series.

Another object of the invention is to provide a sharpening device of the stated character in the nature of an attachment that shall be capable of application to commercial grinders of conventional form.

The invention further resides in various structural and mechanical details hereinafter described and illustrated in the attached drawings, in which:

Figure 1 is a view in perspective of a device made in accordance with my invention;

Fig. 2 is a rear view in perspective of one of the elements of the device shown in Fig. 1;

Fig. 3 is a fragmentary front elevational view illustrating a detail of construction;

Fig. 4 is an enlarged side elevational view of the device;

Fig. 5 is a sectional view taken on the line 5—5, Fig. 4;

Fig. 6 is a sectional view taken on the line 6—6, Fig. 5;

Fig. 7 is a view in perspective of one of the elements of the device shown in Fig. 5;

Fig. 8 is a sectional view taken on the line 8—8, Fig. 4;

Fig. 9 is a sectional view taken on the line 9—9, Fig. 1;

Figs. 10 and 11 are detached views in perspective of elements of that portion of the mechanism shown in Fig. 9;

Fig. 12 is a fragmentary view in perspective illustrating the mode of operation of one of the elements of the device;

Fig. 13 is a fragmentary sectional view illustrating the relative positions of the work and the sharpening tool during the sharpening operation;

Fig. 14 is a fragmentary side elevational view illustrating a modification within the scope of the invention;

Fig. 15 is a corresponding view showing the illustrated elements in a different position of relative adjustment;

Fig. 16 is a section on the line 16—16, Fig. 14, and

Fig. 17 is a view in perspective of one of the elements of the device illustrated in the immediately preceding figures.

With reference to the drawings, the reference numeral 1 designates a pedestal support for a commercial grinder 2, the said grinder being fixed to said support by bolts 3. The grinder 2 comprises the usual housing 4 for an electric motor, the shaft 5 of this motor projecting through opposite sides of the housing and having attached to the respective projecting ends abrasive wheels 6 and 7. The abrasive wheel 7 in the present instance is of a special form designed for grinding the teeth of a chain saw of the character to which the present invention relates.

Attached to the fixed structure of the grinder 2 is a guard 8, and this guard is mounted, after the conventional manner, for angular adjustment about the axis of the shaft 5. In the present instance the guard is adjustably fitted to the cylindrical extension 10 of the housing 4 in which the shaft 5 of the motor is journaled, and is anchored in adjusted position on said extension by means of the split-collar clamp shown at 8a in Fig. 2. The guard 8 is provided with an apertured boss 9, see Fig. 3, which is shaped for interlocking sliding engagement with a slotted arm 11 of a bracket 12. The arm 11 is channeled longitudinally for reception of the boss 9, and the latter acts as a guide for adjustment of the arm on the guard in the longitudinal direction. A bolt 13 passes through the aperture of the boss 9 and through the slot 14 of the bracket arm 11, and secures the bracket in adjusted position to the guard 8 from which the bracket depends, as illustrated in Fig. 1.

As shown in Fig. 5, the bracket 12 comprises a hollow cylindrical guide portion 15 in which a cylindrical member 16 is slidably mounted. This member 16 has a flat-bottomed recess 17 in one side thereof, and the wall of the cylinder 15 is slotted at 18 for reception of a bar 19, which extends into the recess 17 of the member 16 and forms a stop limiting the longitudinal sliding movement of the member 16 in the cylinder 15. The bar 19, see Fig. 6, is secured to the body of the cylinder 15 by means of screws 21, and the

inner face of the bar coacts with the flat bottom of the recess 17 to prevent the member 16 from turning about its axis in the cylinder 15. This bar also has a tapped hole 22 for reception of a thumb screw 23 which, when turned inwardly, bears against the flat bottom of the recess 17 and thereby acts to fix the member 16 in adjusted position within the cylinder 15.

Attached to the top of the member 16 is a collar 24, this collar carrying a thumb screw 25, the inner end of which engages in a circumferential slot 26 in the upper end of the member 16. This mode of attachment of the collar 24 to the member 16 provides for adjustment of the collar around the circumference of the member 16, and provides further for fixing the collar in any required adjusted position upon the said member. As shown in Figs. 5 and 8, a segmental plate 27 is attached by screws 28 to the upper end of the member 16, and this plate projects outwardly from said member in proximity to the upper surface of the collar 24, and bears a scale which cooperates with a suitable marking 29 on the collar to indicate the angular adjustment of the collar with respect to the member 16.

The member 16 has a depending stem 31 which is threaded for reception of a knurled stop nut 32 and cooperating lock nut 33, and these nuts may be adjusted on the threaded stem to limit the extent of the upward movement of the member 16 in the cylindrical guide 15 by engagement with the lower end of the cylinder 15. Pivotally attached at the lower end of the bracket 12 is a lever 34 which extends through the bifurcated lower end of the stem 31 and is secured between said bifurcations by a split pin 35. By manipulation of the outer end of the lever 34, the member 16 may be elevated against gravity and lowered with gravity in the guide cylinder 15.

The collar 24 has an upstanding bracket arm 36, see Fig. 7, and pivotally suspended against one face of this bracket arm 36 upon a projecting pin 37 is a slotted member 38 which constitutes a carrier for the toothed saw chain during the sharpening operation, as hereinafter described. The support member 38 is provided with a slot 39 extending inwardly from the under side thereof for reception of a set screw 41 which is threaded into a tapped hole 42 in the side of the bracket arm 36, this slot 39 being arranged so as to permit adjustment of the member 38 about the supporting pin 37 and to clamp the member 38 solidly against the bracket arm 36 in the selected position of adjustment. As shown in Fig. 1, the member 38 is provided at the top with a longitudinal slot 43, and this slot extends also to the curved ends of the said member. It will be noted by reference to Fig. 7 that the bracket arm 36 has marked thereon a scale 44 which functions to indicate the angularity of the member 38 with respect to the horizontal in various adjusted positions.

With reference again to Fig. 7, it will be noted that the bracket arm is provided with a slot 45, and secured to the face of the bracket arm by means of a bolt 46 which extends through the slot 45 is a block 47. The bolt 46 passes through an aperture 48 in the block and is shaped to form a pivotal support for the latter. A wing nut 49 on the threaded end of the bolt 46 provides for ready release of the bolt for adjustment in the slot 45. As shown in Fig. 10, the block 47 is provided with a slot 51, the open side of this slot in assembly being closed by the face of the bracket arm 36. Slidably supported in the slot 51 is a bar 52, one end of which projects into proximity to and directly above the member 38. To this end of the bar is attached a tip 53 having a transverse notch 54 in its end, the function of which will be hereinafter described. The other end of the bar 52 is offset downwardly and is provided with an aperture through which extends a rod 55 secured in and projecting from the end of the block 47. The rod 55 is threaded at its outer end for reception of an adjusting nut 56, and this nut bears against the outer end of the bar 52, as best shown in Fig. 4. Carried by the rod 55 is a coiled spring 57, and this spring is confined between the down-turned end of the bar 52 and a spring plate 58 also supported on the rod 55 and bearing against the adjoining end surface of the bracket arm 36.

The spring plate 58 is shown in Fig. 11, and it will be noted that the plate is provided with an aperture 59 through which the rod 55 extends, and also with a recess 61 at its upper edge which provides for passage of the bar 52, all as shown in Fig. 9. This plate 58 not only finds a bearing against the end face of the bracket arm 36, but also against the corresponding face of the block 47. The spring plate 58 under pressure of the spring 57 exerts resilient pressure against the block 47, tending to retain this block in a position in which its outer face is flush or in parallel alignment with the adjoining end face of the bracket arm 36 against which the spring 58 bears, as previously set forth. This normal position of the block 47 is shown in Fig. 1. The spring 57 also resiliently presses the extremity of the bar 52 against the inner face of the adjusting nut 56. It will be apparent that by manipulation of the nut 56 and the action of the spring 57, the bar 52 may be adjusted longitudinally in the slot 51 of the block 47.

As previously described, the spring 57 and spring plate 58 tend to retain the block 47 in a normal position, as shown in Fig. 1, wherein the bar 52 and the rod 55 will occupy the respective positions shown in broken lines in Fig. 4. The arrangement, however, permits movement of the block 47 and of the associated parts around the pivot provided by the bolt 46, and this movement of the block 47 may be effected through the medium of a handle 62 which extends downwardly from the under side of the said block. When this handle is turned to the left, as viewed in Fig. 4, the inner end of the bar 52, which carries the tip 53 as previously described, is depressed against the tension of the spring plate 58 toward the upper surface of the member 38.

The manner in which the member 38 functions to support the saw chain is illustrated in Figs. 4 and 12. As therein illustrated, the base projections 63 of the central links 64 of the chain fit snugly and slidably within the slot 43 of the support, while the flat under surfaces 65 of the side links 66 of the chain bear upon the upper surface 67 of the member 38 at opposite sides of the slot 43. The chain is thus solidly supported and guided on the member 38, with the cutter teeth projecting upwardly toward the grinding wheel 7. By elevating the member 16 through the medium of the lever 34 as previously described, the forward or cutting faces of the teeth may be brought into engagement with the abrasive wheel.

The bar 52 with its tip 53 functions to establish

the position of or to index the toothed links of the chain on the support 38 with respect to the grinding wheel 7. This is illustrated in Figs. 4 and 12, wherein it will be noted that the tip 53, when the rod 52 is adjusted downwardly through the medium of the handle 62 as previously described, engages the rear upper corner or corners of the saw teeth, said rear corners of the teeth being confined in the notch 54 of the tip 53. The rod 52 is adjusted longitudinally in the block 47 in the manner previously described so that the tooth or teeth of the chain which are engaged in the notch 54 of the tip 53 will occupy a position on the member 38 such that when the support 38 is moved upwardly, the forward face and gullet of the tooth will be brought into proper engagement with the grinding wheel 7 for the sharpening operation. Thus the operation upon each individual tooth is identical with the operation upon each of the other like teeth of the chain, and the required uniformity of result is obtained.

In the aforedescribed device, and as previously pointed out, the respective supports for the sharpening tool and the work are connected so as to establish a fixed relation between the work support as a whole and the rotary axis of the said tool. In the illustrated embodiment of the invention, this is accomplished by attaching the work support structure to the wheel guard 8, which is adjustable about the axis of the wheel. It is apparent that irrespective of the position in which the guard may be clamped by the collar 8a, the relation of the work support and the grinding wheel will be correct. It will be noted further that the cylindrical guide 15 is arranged in the work support so that its longitudinal axis intersects the axis of the grinder 7 which constitutes the sharpening tool. Similarly, the work carrier 38 is arranged so that the slot 39 thereof is intersected by the longitudinal axis of the guide 15, and the pivotal axis of the carrier 38 in the pin 37, which extends at right angles to the plane of the slot 39, is also intersected by the axis of said guide. By reference to Fig. 4, it will be noted also that the parts are relatively arranged so that the longitudinal axis of the guide 15 lies in a common plane with the forward or working face of the grinding wheel 7. Since the bracket arm 11 and its guide channel extend in parallel relation to the said axis of the guide 15, any adjustment of the bracket 12 with respect to the guard 8, for the purpose, for example, of compensating for wear of the grinding wheel, will not affect the fixed relation of the parts. With this arrangement of parts, the relative adjustments and movements between the work carrier and the sharpening tool that are required for presenting the work to the tool in the sharpening operations are referred to a simple series of relatively fixed and interrelated planes and axes.

In a toothed chain of the type illustrated, the sharpening of the teeth is effected by grinding the forward faces of the teeth, as shown in Fig. 13. It is apparent that the hook of the tooth will be determined by the angular position of the chain carrier 38 on the pivot 37, as indicated on the scale 44, see Fig. 4. The working face of the tooth may in some instances lie in a plane normal to the adjoining side faces, or in other words square to the direction of movement of the tooth, and in other instances may be beveled so as to extend in a plane forming an angle other than 90° with the direction of tooth movement, and this angularity of the working face of the tooth in the transverse direction is determined by the angular position of the collar 24 with respect to the slide member 16, as indicated on the scale 27, see Fig. 8. The depth of the cut made by the tool in the face of the tooth is determined by the position of the chain and of the individual teeth upon the carrier 38 as determined by the adjustment of the member 52, this adjustment being effected through the hand nut 56 on the micrometer screw 55. It is apparent that the effective height of any of the teeth will be determined by the amount of metal removed from the working face, and any desired differential in the effective heights of certain of the teeth of the series may be regulated accordingly. Similarly the extent to which the cut extends into the gullet of the tooth is controlled by the stop nut 32 and lock nut 33, which limits the extent to which the slide member 16 may be elevated through the medium of the lever 34 toward the grinding wheel.

In the operation of the device, the chain is established in the carrier member 38 in the manner illustrated. The member 38 may then be adjusted angularly about the pivot 37 to produce the required amount of hook, as indicated on the scale 44. The collar 24, which supports the carrier 38, as previously described, may then be adjusted on the member 16 so as to determine the transverse angularity of the face of the tooth, as indicated on the scale 27. The member 16 may now be elevated in the guide 15 by means of the lever 34 to an extent bringing the tooth into position with respect to the grinding wheel 7, the forward face of the tooth contacting the opposed face of the grinding wheel and the latter extending to the desired extent into the gullet of the tooth. In this elevated position, the member 16 may be temporarily retained by tightening the set screw 23. With the parts in this elevated position, the stop nut 32 is now turned up so as to engage the under side of the guide 15, the nut 32 being locked in this position through the medium of the lock nut 33. The bar 52 may now be depressed through the lever 62 to bring the tip 53 into proximity to the rear upper edge of the tooth and the bar then adjusted longitudinally through the medium of the hand nut 56 so as to engage the said rear edge of the tooth in the notch 54. Any subsequent further advance of the adjusting nut 56 will determine the exact depth to which the metal will be removed from the face of the tooth by the grinding wheel 7.

The set screw 23 is now released to permit the slide member 16 to return to its normal depressed position in the guide 15. The nut 56 is then turned on the micrometer screw 55 to advance the bar 52 longitudinally to an extent corresponding to the desired depth of cut on the face of the tooth. The lever 62 is then retracted to bring the tip 53 of the bar 52 into engagement with the rear edge of the tooth so that the upper rear corner of the tooth is engaged solidly in the notch 54, as previously described. It will be noted that the lever 62 is so located with respect to the rear end of the carrier 38 that that portion of the chain which depends from the rear end of the carrier lies in proximity to the said lever, so that both the lever and the chain may be held in the same hand, and sufficient tension may be imposed manually upon the chain to retain the tooth solidly engaged by the notch 54 of the tip 53. When manual force is applied jointly

to the chain and to the lever 62 so as to hold the rear edge of a tooth under tension against the notched tip 53 of the index bar 52 to cause the tip 53 to bear down solidly upon the said rear edge of the tooth, the work is clamped securely to the carrier 38 in accurately indexed relation to the grinding wheel; and all of these several functions, as stated above, are under the simultaneous actuating control of one hand of the operator. With his other hand the operator now actuates the lever 34 to elevate the chain into engagement with the grinding wheel 7 whereby a predetermined amount of metal is removed by the grinding wheel from the face of the tooth and the adjoining portion of the gullet. Each corresponding tooth of the complete series is then similarly brought and held in proper position upon the carrier 38, and is presented to the grinding wheel by elevation of the member 16 through the medium of the lever 34. Differing teeth of the series may be similarly sharpened after adjustment of the various parts of the device in the manner described above to effect the proper presentation of the teeth to the sharpening tool.

It will be noted in the device described above that the upper portion of the work carrier 38, upon which the chain is supported for presentation to the grinding wheel 7, is flat, and that adjustment of the carrier in one plane is obtained by pivotal movement thereof about the pin 37. This arrangement is desirable, in that it simplifies adjustment of the carrier in said plane to the exact angular position with respect to the plane of the grinding wheel that will afford the required degree of hook in the chain teeth. The hook angle is clearly apparent to the eye and is indicated directly on the scale 44. Furthermore, since the sections of the chain immediately adjoining the tooth presented to the grinding tool are held straight and flat upon the carrier, there is no possibility that the tool may foul the proximate ends of the adjoining teeth, the clearance for the tool being constant in each setting of the carrier.

It is not essential, however, that the adjustment of the carrier to regulate the hook angle shall be pivotal in character, since by employing a carrier of somewhat different form, the hook angle may be regulated as desired by a purely translational adjustment of the carrier in the given plane. A carrier of this character and its mode of adjustment is illustrated in Figs. 14 to 17, inclusive, wherein it will be noted that the work carrier 68 is curved at the top, the curve in the present instance describing the arc of a circle, and the flat base 69 of the carrier seats slidably upon the upper surface of the collar 71 which corresponds to the collar 24 of the previously described embodiment. The carrier 68 has a slot 72 which extends parallel to the flat base 69 of the carrier, and a clamping screw 73 extends through this slot and is threaded into the bracket arm 74, this arm being integral with or fixed to the collar 71 and corresponding to the arm 36 of the embodiment previously described. The screw 73 when tightened clamps the carrier 68 solidly against the proximate face of the arm 74, and when loosened permits adjustment of the carrier on its seat in the longitudinal direction to an extent limited by the length of the slot 72. The carrier 68 supports the toothed chain in the same general manner as the carrier 38 of the previously described embodiment, but in this instance the portion of the chain presented toward the tool is flexed to the curve of the upper surface of the carrier 68 upon which the chain seats.

It will be apparent that with this arrangement any adjustment of the carrier on its seat as described above will change the angle at which the supported chain is presented to the grinding tool. This is illustrated, for example, in Fig. 15, which shows the carrier in a different position of adjustment than that shown in Fig. 14. It will be noted that the front or cutting face of the tooth which occupies a position on the carrier immediately below the grinding wheel 7 in Fig. 15 bears a different angular relation to the plane of the face of the wheel than the face of the chain tooth occupying a corresponding relative position in Fig. 14. By adjustment of the carrier 68, therefore, the hooks of the teeth may be ground to any required angle. The adjustment of the carrier 68 occurs in the same relative plane as that of the carrier 38 of the previously described embodiment, but is translational in character rather than pivotal.

An indexing scale indicated by the reference numeral 75 is provided on the carrier 68 to facilitate adjustment of the carrier and of the chain on the carrier into position to afford the correct hook angle. The datum point for the empirical scale 75 may be selected on any point on the base of the tooth, for example the point marked A on Fig. 14. For adjustment of the collar 71 about the axis of the cylindrical member 16, an index scale is provided on the side of the said collar, as indicated at 76, this scale being related to the relatively fixed datum point 77 on the side of the guide cylinder 15. In all other respects and with the exception of the form and mode of adjustment of the carrier 68, the device may correspond to that illustrated in Figs. 1 to 13, inclusive.

It will be apparent that the curved work seat of the carrier 68 need not necessarily take the form of a circular arc, and that the work carrier, in fact, may take various forms other than that shown in the two aforedescribed embodiments of the invention. It will be apparent also that the adjustment of the carrier in the one plane may without departure from the invention be effected by a combination of translational and pivotal movements.

While, for purpose of specific illustration, the device has been described in conjunction with an electric grinder of conventional commercial type, it is apparent that the device is not restricted to use with any particular form of grinding mechanism or character of sharpening tool, and that there may be considerable modification in the form of the device and the relative arrangement of the component parts without departure from the invention as hereinafter defined.

I claim:

1. The combination with a support structure, of a tool mounted in said support for rotation in a predetermined plane, a member guided in said support for longitudinal reciprocation along a path intersecting at right angles the axis of rotation of said tool, a work carrier mounted on said member, means for adjusting said carrier relative to the member and said member relative to the support, each angularly with respect to the plane of said tool, means for clamping the work on the carrier by manual pressure, said means comprising an abutment for indexing the work with respect to the tool, and an actuator for said indexing and clamping means arranged so that one hand of the operator may simultane-

ously retain the work in pressure engagement with said abutment and actuate said means to exert clamping pressure on the work.

2. The combination with a support structure, of a tool mounted in said support for rotation in a predetermined plane, a member guided in said support for longitudinal reciprocation along a path intersecting at right angles the axis of rotation of said tool, a work carrier mounted on said member, means for adjusting said carrier on said member with respect to the plane of the tool, means for traversing said member in the guide, adjustable means for limiting said traverse movement in the direction of the tool, means for clamping the work on the carrier by manual pressure, said means comprising an abutment for indexing the work with respect to the tool, and an actuator for said indexing and clamping means arranged so that one hand of the operator may simultaneously retain the work in pressure engagement with said abutment and actuate said means to exert clamping pressure on the work.

3. The combination with a support structure, of a tool mounted in said support for rotation in a predetermined plane, a member guided in said support for longitudinal reciprocation along a path intersecting at right angles the axis of rotation of said tool, a work carrier mounted on said member, means for adjusting said carrier on said member with respect to the plane of the tool, means for traversing said member in the guide, means for limiting the traverse movement, releasable means for immobilizing said member in the guide in any desired position in the path of said traverse, means for clamping the work on the carrier by manual pressure, said means comprising an abutment for indexing the work with respect to the tool, and an actuator for said indexing and clamping means arranged so that one hand of the operator may simultaneously retain the work in pressure engagement with said abutment and actuate said means to exert clamping pressure on the work.

4. The combination with a support structure, of a tool mounted in said structure, a member mounted in said structure for movement to and from the tool, a work carrier on said member, and means on said member for positioning the work on its carrier with respect to the tool, said positioning means comprising an element pivoted to said member and having a threaded extension, a work-engaging element longitudinally adjustable in said pivoted element, a nut on said threaded extension constituting a stop to limit the longitudinal movement of said work-engaging element in one direction, a leaf spring supported on said extension and seating against both said member and said pivoted element, and a coiled spring on said extension confined between the leaf spring and said work-engaging element and exerting pressure to hold the said element against the stop nut and the leaf spring to its seat, said leaf spring being thereby operative to retain said pivoted element resiliently in a predetermined angular position on its pivot while permitting oscillation of said pivoted element to traverse the work-engaging element with respect to the carrier.

5. The combination with a support structure, of a tool mounted in said support for movement in a predetermined plane, a work carrier guided in said support for movement with respect to said tool, said carrier having a straight seat adapted to support a toothed chain in a rectilinear line intersecting the plane of said tool for presentation to the latter, and means for pivotally adjusting said carrier in the support in a plurality of planes intersecting the plane of said tool, one of said planes of adjustment including said rectilinear line.

6. The combination with a support structure, of a tool mounted in said support for movement in a predetermined plane, a work carrier guided in said support for movement with respect to said tool, said carrier having a straight seat adapted to support a toothed chain in a rectilinear line intersecting the plane of said tool for presentation to the latter, and means for pivotally adjusting said carrier in the support in each of two planes intersecting the plane of said tool and at right angles to each other, one at least of said two planes of adjustment being at right angles to the plane of the tool.

7. The combination with a support structure, of a tool mounted in said support for rotation in a predetermined plane, a work carrier guided in said support for reciprocation along a path intersecting at right angles the axis of rotation of said tool, means for angularly adjusting said carrier in the support in a plurality of planes intersecting the plane of said tool to thereby vary the angular position of the work with respect to the last-named plane, means for clamping the work on the carrier by manual pressure, said means comprising an abutment for indexing the work with respect to the tool, and an actuator for said indexing and clamping means arranged so that one hand of the operator may simultaneously adjust the work and actuate said means to index and clamp the work on the carrier.

8. The combination with a support structure, of a tool mounted in said support for rotation in a predetermined plane, a work carrier guided in said support for reciprocation along a path intersecting at right angles the axis of rotation of said tool, means for angularly adjusting said carrier in the support in each of two planes intersecting the plane of said tool and at right angles to each other to thereby vary the angular position of the work with respect to the last-named plane, means for clamping the work on the carrier by manual pressure, said means comprising an abutment for indexing the work with respect to the tool, and an actuator for said indexing and clamping means arranged so that one hand of the operator may simultaneously adjust the work and actuate said means to index and clamp the work on the carrier.

9. The combination with a support structure, of a tool mounted in said support for rotation in a predetermined plane, a work carrier guided in said support for reciprocation along a path intersecting at right angles the axis of rotation of said tool, means for angularly adjusting said carrier in the support in each of two planes intersecting the plane of said tool and at right angles to each other, one at least of said two planes of adjustment being at right angles to the plane of the tool, means for clamping the work on the carrier by manual pressure, said means comprising an abutment for indexing the work with respect to the tool, and an actuator for said indexing and clamping means arranged so that one hand of the operator may simultaneously adjust the work and actuate said means to index and clamp the work on the carrier.

10. The combination with a support structure, of a shaft journaled in said structure, a grinding wheel on the shaft, a work support mounted on

said structure for angular adjustment as a whole about the axis of said shaft as a center, a member guided in said work support for longitudinal reciprocation along a path intersecting at right angles the said shaft axis, and a work carrier mounted on said member for angular adjustment in a plurality of different planes with respect to the plane of rotation of said wheel.

11. The combination with a support structure, of a tool mounted in said support for movement in a predetermined plane, a work carrier guided in said support for movement with respect to said tool, said carrier having a straight seat adapted to support a toothed chain in a rectilinear line intersecting the plane of said tool for presentation to the latter, and means for pivotally adjusting said carrier in the support in each of two planes intersecting the plane of said tool and at right angles to each other.

12. A cutting chain sharpener having in combination a sharpening wheel, a reciprocating member arranged so that it can be reciprocated by one hand of the operator, a second member rotatably adjustable on the said reciprocating member, a chain carrier adjustably attached to said second member and having a runway for support of said chain, an element having an oscillating indexing and clamping abutment for said chain and arranged so that the other hand of the operator may progressively index the chain along said runway and then simultaneously actuate said element to engage the chain, hold the chain in pressure engagement with the element, and clamp the chain to said runway.

13. A cutting chain sharpener as defined in claim 12, wherein the work carrier has a straight runway adapted to support the toothed chain in a rectilineal line.

14. A cutting chain sharpener as defined in claim 12, wherein the said element which is adapted to engage and disengage the toothed chain has micrometrically adjustable means for precise indexing of the chain with respect to the sharpening wheel.

15. A cutting chain sharpener as defined in claim 12, wherein a guard embraces said sharpening wheel and is angularly adjustable about its axis, and that the said reciprocating member is guided in a support structure adjustably attached to said guard.

16. A cutting chain sharpener as defined in claim 12, wherein the center line of said reciprocating member, the axis of rotation of said second member, the path of oscillation of the indexing abutment of said element, are all parallelly adjacent to, or substantially coincide with the path traced by the work at the points of contact with the sharpening wheel.

17. The combination with a support structure, of a tool mounted in said structure for rotation in a predetermined plane, a work carrier guided in said support for radial reciprocation with respect to the tool, means for traversing the carrier in the guide, a combined stop and clamping element for indexing the work with respect to the tool and for clamping the work in indexed position upon the carrier, and an actuator for said element arranged so that one hand of an operator may simultaneously manipulate the element and the work so as to move the work on the carrier into pressure engagement with the stop and, while retaining said engagement, actuate the stop to clamp the work on the carrier.

18. The combination with a support structure, of a tool mounted in said structure for rotation in a predetermined plane, a work carrier mounted in said structure and having means for guiding the work for adjustment with respect to the tool, means for adjusting the carrier in a plurality of planes to vary the angular position of the work with respect to the plane of the tool means for relatively reciprocating said tool and carrier with respect to each other in a direction radially of the tool, a combined stop and clamping element for indexing the work with respect to the tool and for clamping the work in the carrier guide in the indexed position, and an actuator for said indexing and clamping element arranged so that one hand of an operator may simultaneously manipulate the element and the work so as to move the work on the carrier into pressure engagement with the stop and, while retaining said engagement, actuate the stop to clamp the work on the carrier.

19. The combination with a support structure, of a tool mounted in said structure for rotation in a predetermined plane, a work carrier mounted in said structure, means for adjusting the carrier in a plurality of planes to vary the angular position of the carrier with respect to the plane of the tool, means for relatively reciprocating said tool and carrier with respect to each other in a direction radially of the tool, a combined stop and clamping element movable to and from the carrier in one of said planes of adjustment for indexing the work with respect to the tool and for clamping the work in the indexed position on the carrier, and an actuator for said indexing and clamping element arranged so that one hand of an operator may simultaneously manipulate the element and the work so as to move the work on the carrier into pressure engagement with the stop and, while retaining said engagement, actuate the stop to clamp the work on the carrier.

20. The combination with a support structure, of a grinding wheel mounted in said structure for rotation in a predetermined plane, a work carrier mounted in said structure for manual reciprocation on a line substantially radial to the wheel, means for positioning the work on the carrier and for clamping the work in position during the grinding operation, said means comprising a combined stop and clamping element and a support for the element relatively fixed with respect to the carrier, said element being guided by said support for manual actuation to engage the work on the carrier, means operative independently of the movements of the work carrier for normally retaining the element in a retracted position with respect to the work, and means arranged so that one hand of an operator may advance the stop, may move the work on the carrier into pressure engagement with the stop, and while retaining said pressure engagement may actuate the said stop to clamp the work on the carrier.

21. The combination with a support structure, of a grinding wheel mounted in said structure for rotation in a predetermined plane, a work carrier mounted in said structure for manual reciprocation on a line substantially radial to the wheel, means for positioning the work on the carrier and for clamping the work in position during the grinding operation, said means comprising a combined stop and clamping element mounted for oscillation on a pivot relatively fixed with respect to the carrier and adapted in operative positions to predeterminedly locate the work on the carrier with respect to

the tool and to clamp the work in said predetermined position, means operative independently of the movements of the work carrier for normally retaining said element in retracted position with respect to the work, and an actuator for said element arranged so that one hand of the operator may simultaneously manipulate the element and the work so as to move the work on the carrier into pressure engagement with the stop and, while retaining said engagement, actuate the stop to clamp the work on the carrier.

22. The combination with a support structure, of a grinding wheel mounted in said structure for rotation in a predetermined plane, a work carrier mounted in said structure for manual reciprocation on a line substantially radial to the wheel, said carrier having a work receiving slot in which the work is freely guided for adjustment on the carrier in a path transverse to the plane of the tool, means for locating the work in a predetermined position of adjustment longitudinally of the slot and for clamping the work in the adjusted position in the carrier, said means comprising a combined stop and clamping element mounted on a pivot relatively fixed with respect to the carrier for oscillation in the plane of said slot, means for traversing the carrier radially with respect to the wheel, and an actuating lever for said locating and clamping element extending in proximity to said carrier so that one hand of an operator may simultaneously manipulate the element and the work so as to move the work on the carrier into pressure engagement with the stop and, while retaining said engagement, actuate the stop to clamp the work on the carrier.

23. The combination with a support structure, of a grinding wheel mounted in said structure for rotation in a predetermined plane, a work carrier mounted in said structure for reciprocation on a line substantially radial to the wheel, said carrier having a work receiving slot in which the said work is freely guided for adjustment in a path transverse to the plane of the tool, means for locating the work in predetermined position longitudinally of said slot and for clamping the work to the carrier in said position, said means comprising a combined stop and clamping element mounted on a pivot relatively fixed with respect to the carrier for oscillation in the plane of said slot, an operating lever for said element extending past and in proximity to one end of said carrier substantially in alignment with the slot whereby one hand of an operator may simultaneously manipulate the element and the work so as to move the work on the carrier into pressure engagement with the stop and, while retaining said engagement, actuate the stop to clamp the work on the carrier.

24. The combination with a support structure, of a grinding wheel mounted in said structure for rotation in a predetermined plane, a work carrier mounted in said structure for reciprocation on a line substantially radial to the wheel, said carrier having a work receiving slot in which the said work is freely guided for adjustment in a path transverse with the plane of the tool, means for locating the work in predetermined position longitudinally of said slot and for clamping the work in said position, said means comprising a combined stop and clamping element mounted on a pivot relatively fixed with respect to the carrier for oscillation in the plane of said slot, means for adjusting said element longitudinally of the slot, an actuator for said element extending in proximity to the carrier whereby one hand of an operator may simultaneously manipulate the element and the work so as to move the work on the carrier into pressure engagement with the stop and, while retaining said engagement, actuate the stop to clamp the work on the carrier.

25. The combination with a support structure, of a grinding wheel mounted in said structure for rotation in a predetermined plane, a work carrier mounted in said structure for manual reciprocation on a line substantially radial to the wheel, stop-and-clamping means for holding the work in position during the grinding operation, means operatively independent of the movements of the work carrier for retracting the said stop-and-clamping means from the work after the grinding operation so as to free the work for manual adjustment to a new position on the carrier, and means arranged so that one hand of an operator may simultaneously manipulate the stop means and the work so as to move the work on the carrier into pressure engagement with the stop and, while retaining said engagement, actuate the stop to clamp the work on the carrier.

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