Jan. 6, 1953 J. L. SMITH 2,624,377

HOOK FORMING TOOL FOR HELICAL SPRINGS

Filed Nov. 6, 1947 2 SHEETS—SHEET 1

Fig. 1.

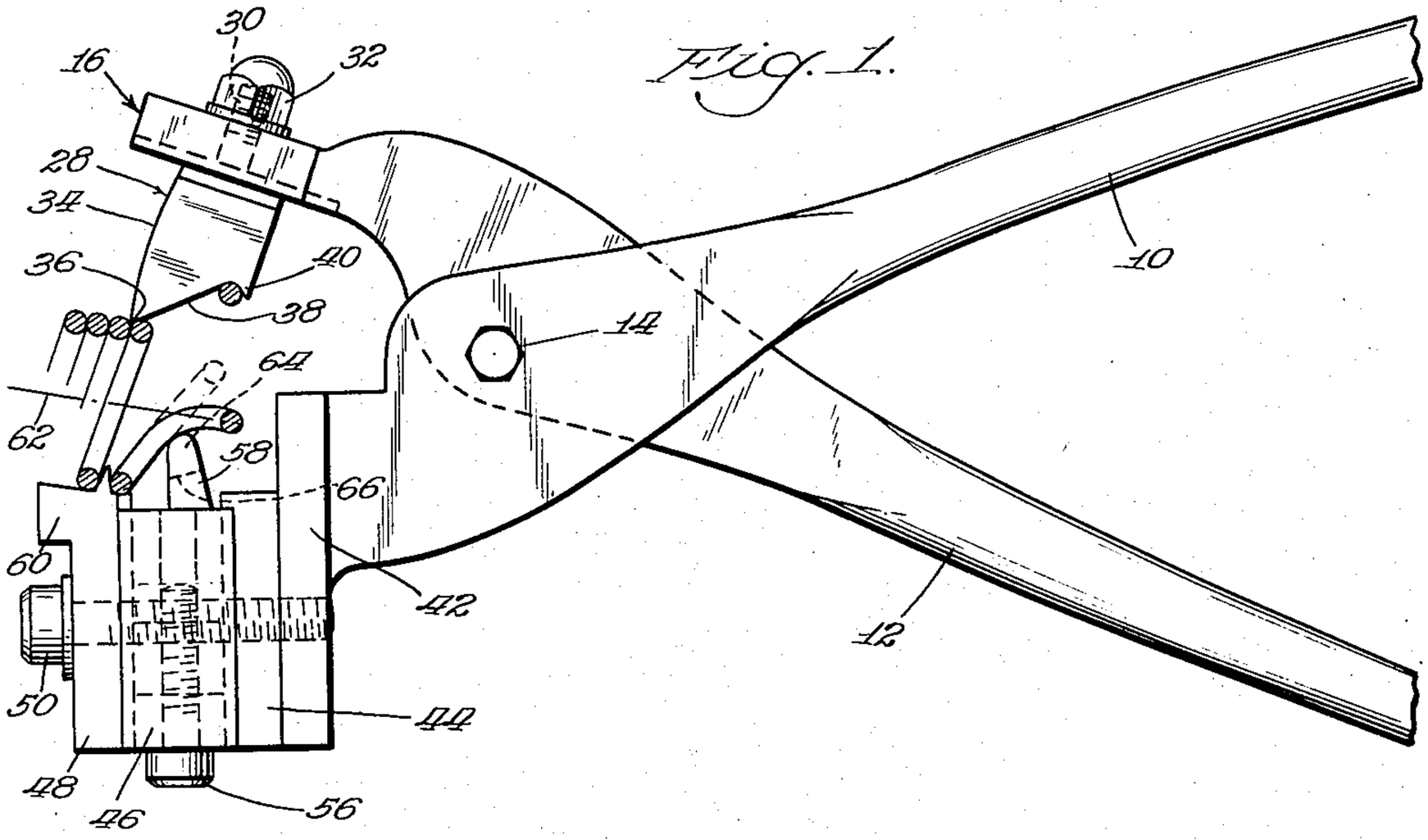
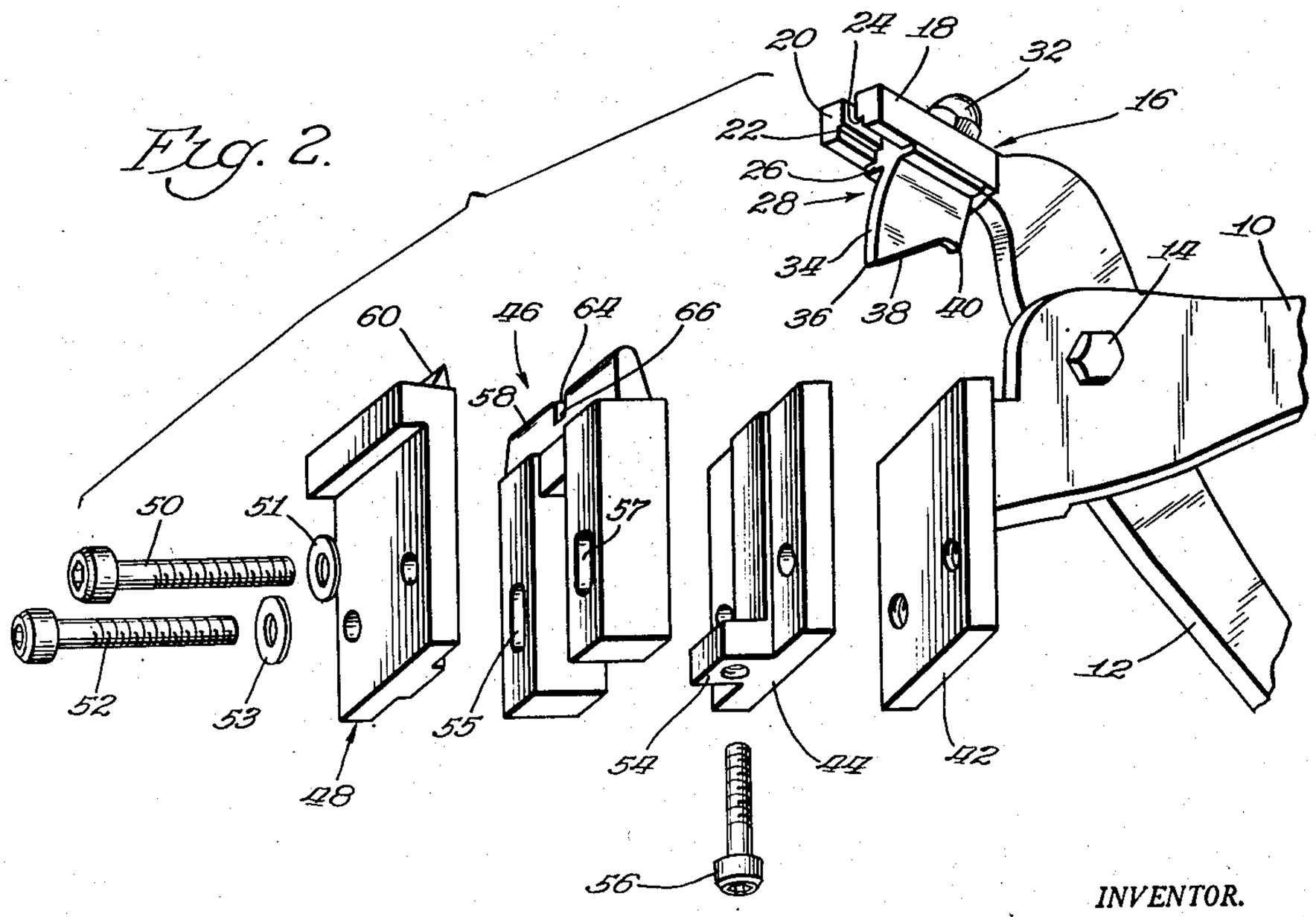


Fig. 2.



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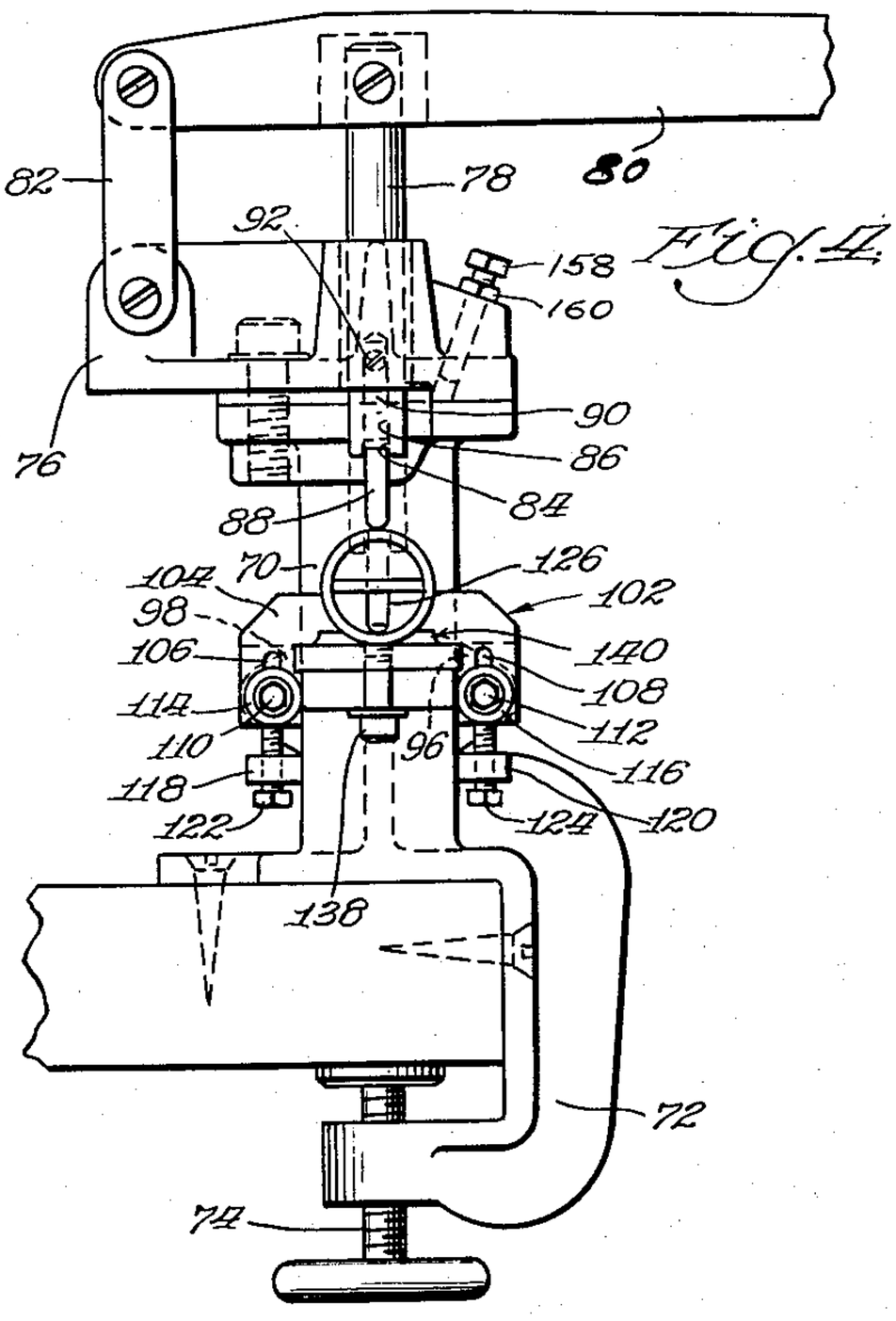

Fig. 4.

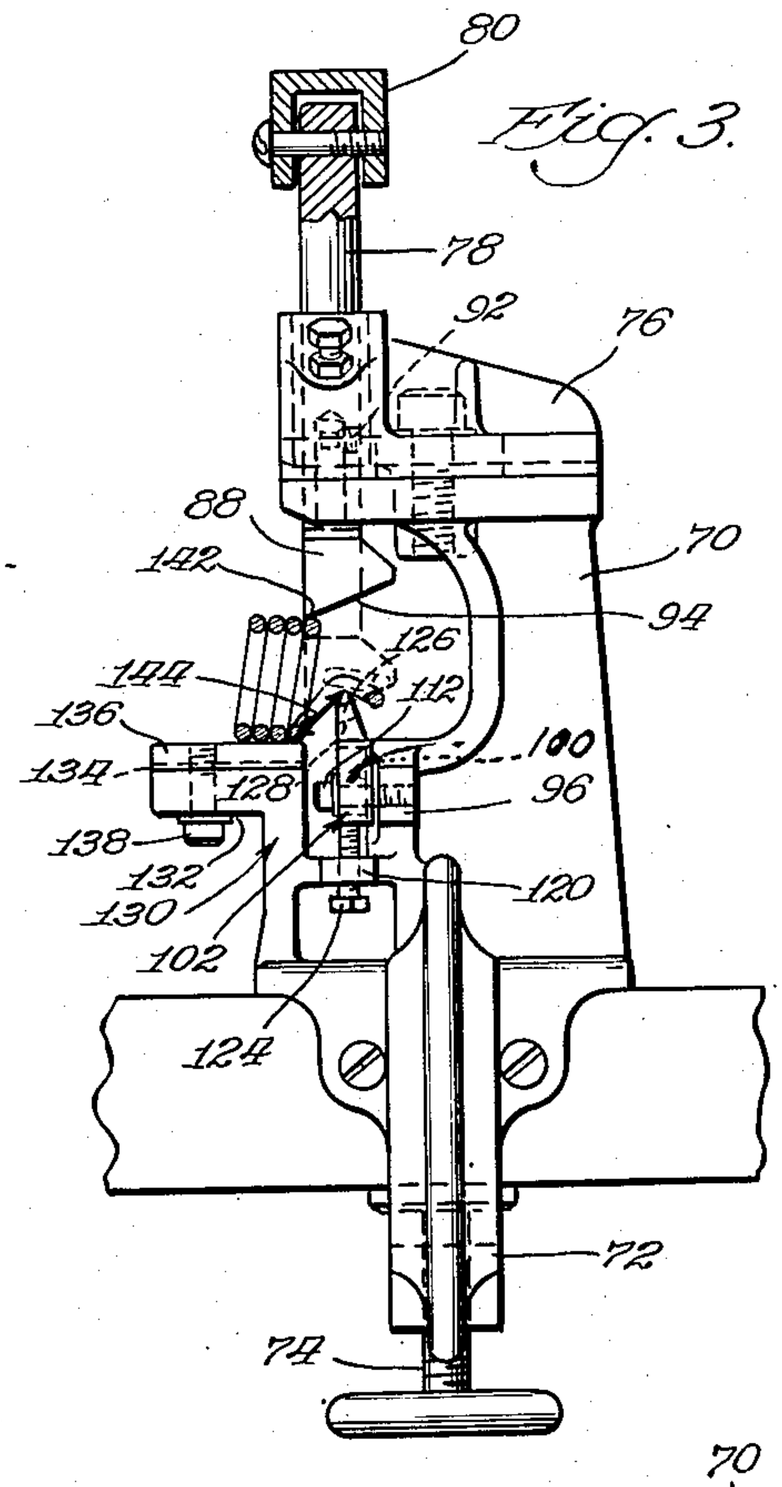

Fig. 3.

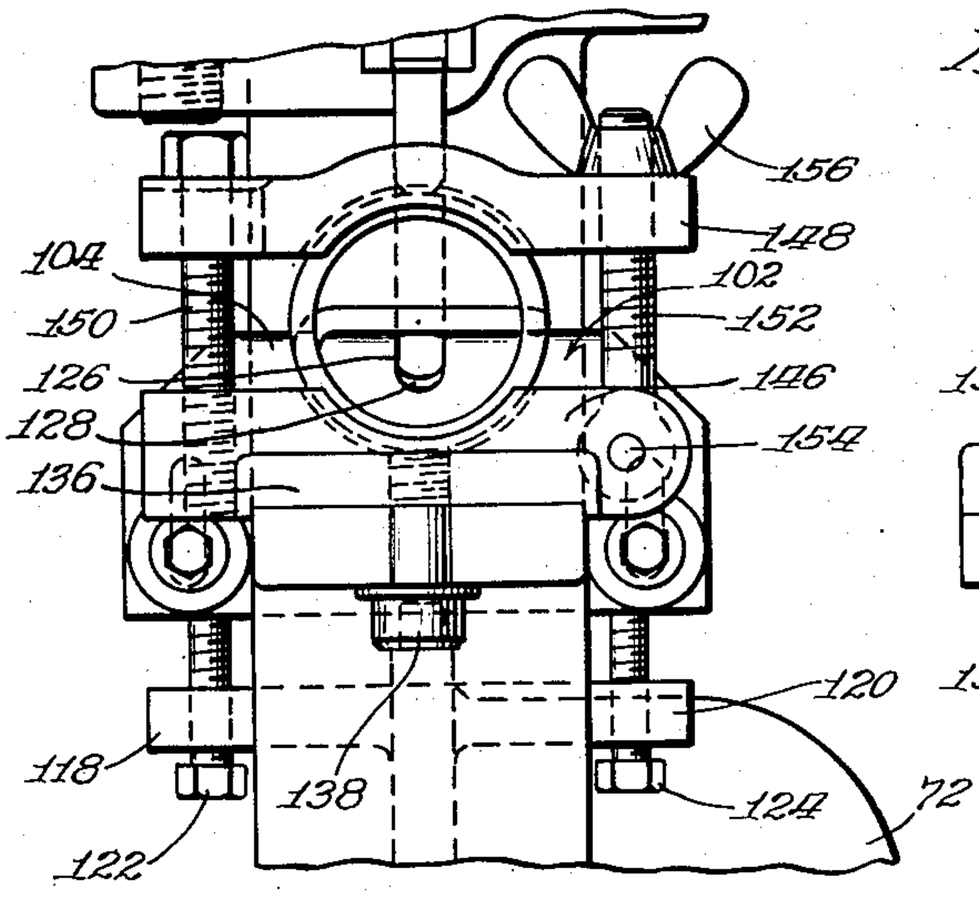

Fig. 6.

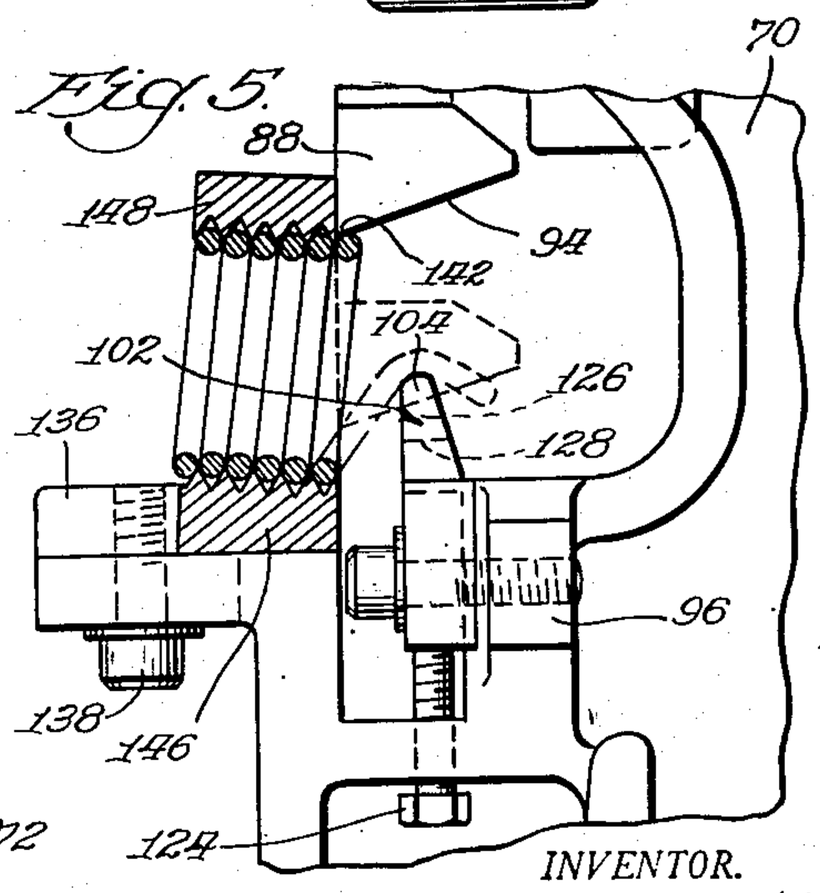

Fig. 5.

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HOOK FORMING TOOL FOR HELICAL SPRINGS

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Application November 6, 1947, Serial No. 784,436

1 Claim. (Cl. 140—103)

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This invention relates to both a bench tool and a hand tool for forming single bend hooks on helical springs. Applicant has pending United States patent application Serial No. 721,339, filed January 10, 1947, and has issued United States Letters Patent No. 2,500,327, which throw additional light on this development.

The principal object of this invention is to provide improved shaping tools which will require less effort to form a hook on the end of a helical spring. This object is not important in a tool designed to handle springs made of comparatively lightweight, spring wire. Where, however, the spring is made of one-eighth inch spring wire, much strength is required to bend the wire, and while the bending operation is being performed, the helix must be tightly held. Also, in the case of the hand tool, even if the wire weight is not so great, if the diameter of the helix is large, it is difficult for a hand distended by the widely spread handles to exert the necessary initial pressure.

This general object is attained by providing shaping tools for forming a single bend hook on the end of a spring. A single bend hook is one in which a portion of the end loop of a helix is bent outwardly at right angles to the remaining portion of the loop at a point about 180 to 220 degrees from the end of the loop. This is to be contrasted with a tool for forming the double bend loop (a single right angle bend and 90-degree twist) such as the tools disclosed in the copending applications. The tools for performing this operation comprise a support for the spring, a ledge over which a portion of the end loop is to be bent, and a punch or plate having a cleaving edge and camming surface for separating a portion of the end loop from the spring and for bending it over the ledge.

The second object of this invention is to provide adjustability for either the spring support or the punch and for the ledge in order to change their relationship to each other so as to accommodate springs having different diameters. This adjustability is critical in the case of a hand tool because these are used by small quantity spring users, such as operators of hardware stores, who must be able to adjust the tool quickly for different diameter springs. Adjustability is important for the bench tool intended for light production work because it dispenses with a multitude of sets of dies and shaping tools ordinarily used for springs of various diameters and eliminates mounting thereof in a press. In carrying out these general objects, applicant

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shows a hand tool and a bench tool, but underlying principles of operation as well as their physical parts are much the same.

A specific object of this invention is to provide a broad ledge over which the end loop of springs of various diameters may be bent.

Another specific object of this invention is to provide a cleaving plate having a loop cleaving edge and a camming surface of a length capable of bending the end loop of springs of various diameters, in conjunction with a transverse slot in the ledge into which the plate may seat.

Another object of this invention is to make either the spring support or the punch adjustable forwardly and rearwardly with respect to the ledge, as well as to make the ledge vertically adjustable, both for the purpose of centering the hook on the various diameter springs.

Another object of the invention is to provide means for holding the helical spring during the loop forming operation. Applicant provides two embodiments that attain this object. In one embodiment, a wedge inserted between adjacent loops of a spring performs the function of a back stop during the forming operation so that the helix will not back away from the hook forming zone. In the second embodiment, a clamp for holding the helix is mounted on the spring support. This clamp is disclosed in the drawings mounted on the bench tool, but could be adapted to the hand tool.

Another object of the invention is to provide a stop on the punch element on the hand tool which reduces the strength required to give the final set to the hook.

These and such other objects as may hereinafter appear are attained in the embodiments of the invention shown in the accompanying drawings wherein:

Fig. 1 is a side view of a hand hook forming tool;

Fig. 2 is a partially exploded perspective view of the hand tool of Fig. 1;

Fig. 3 is a side elevation of a bench hook forming tool;

Fig. 4 is a front view of a bench tool shown in Fig. 3;

Fig. 5 is a side elevation of the forming zone of the tool of Fig. 3 with applicant's spring locking clamp in position; and,

Fig. 6 is a front view of the equipment shown in Fig. 5.

The hand tool

Continuing to refer to the drawings and particularly to Fig. 1, the hand tool consists of a pair

of handles 10 and 12, joined together at the pivot 14. The work end of the handle 12 constitutes a punch holder 16 which consists of forwardly extending, spaced arms 18 and 20. The arms are slotted on their inner lower side to form ways 22 and 24 in which rides a slide 26 carrying a punch or plate or shaping tool 28. Upwardly directed from the slide 26 is a bolt stem 30 whose upper end is threaded to receive nut 32 which is designed to hold the punch or blade 28 rigidly in a selected position in the ways 22 and 24 of the punch holder 16. The punch 28 comprises a flat plate having a forward circular edge 34 which follows an arc having 14 as its center. A loop cleaving edge is identified by the numeral 36. A straight camming surface 38 has at its rearward end a stop lug 40.

Mounted on the work end of the handle 10 and integral therewith is an anvil plate 42 on the face of which are mounted an anvil holder 44, an anvil 46, and an avil stop 48, by means of a pair of screws 50 and 52 and washers 51 and 53.

Referring to Fig. 2, the anvil 46 is movable vertically with respect to either the anvil holder 44 or the anvil stop 48 when the screws 50 and 52 are loosened. This is accomplished by complementary ways and slides disposed between the respective members and slots 55 and 57. The anvil is an inverted U-shaped member and is positioned over a shoulder 54 formed integrally with the anvil holder 44. A screw 56 is invertedly and threadedly mounted in the shoulder 54 and the upper end of the screw 56 engages the underside of the cross member of the anvil 46. Inasmuch as this is in vertical alignment with the load point between the work ends of the handles, the load will be taken by the screw 56 and not by the screws 50 and 52.

The anvil 46 carries transversely on its upper side a ledge 58. Transversely through this ledge is a slot 64 having a width adapted to pass the blade 28 and having a sloping bottom 66 that registers with the camming surface 38 and limits the closing of the tool very exactly so as to produce uniform loops. The anvil stop carries transversely on its upper edge a loop severing blade 60.

In order to use this tool, a user positions the spring as illustrated in Fig. 1, and then loosens the screws 50, 52, and 56 so that he can lower the top of the ledge 58 to a point slightly below the axis 62 of the spring. The position of the ledge will vary with the diameter of the spring. He then loosens the nut 32 and positions the plate 28 so that the circular edge 34 and cleaver edge will engage the valley between the two end loops of the spring when the said loops are seated over the wedge 60. As the handles are pressed together the blade 26 peels off the end loop and the surface 38 cams it over against the ledge 58. The edge 38 passes into the slot 64 while the outer end of the loop continues to bend the two sides of the loop over the ledge 58. That portion of the end loop indicated by the numeral 66 ultimately engages the stop lug 40 on the plate 28 and this enables the user to give a set to the bend during which time he can remove his left hand from the helix and grasp both handles with both hands should he desired to do so. By this action, he might overbend the loop. This is prevented by the camming edge 38 engaging the bottom 66 of the slot 64.

The bench tool

Two embodiments of the bench tool are shown

in Figures 3 to 6. The bench tool is very similar to that shown in United States Letters Patent No. 2,500,327. Numeral 70 identifies a casting having a clamp 72 with screw 74 at its lower end and a casting 76 for holding a ram 78 mounted on its upper end. The ram is operated by an arm 80 pivotally connected to the ram and to a link 82 pivotally connected to the rear top of the casting 76. The lower end of the ram is slotted at 84 and axially tapped at 86 to receive the shaping blade 88 which has fastened into its upper end a stem 90 which is removably held in the ram by a set screw 92. The blade 88 has a camming surface 94 which does not terminate on its inner end in a stop lug such as 40 illustrated in Figure 1, because this lug is primarily useful in a hand tool where it is necessary to assist in shaping the end hook because the tool is not held rigidly as it is on a bench.

The lower fixed jaw of the casting carries a pair of bosses 96 and 98 and a forwardly extending vertical shoulder 100 whose vertical side edges act as ways for complementary channels in slide 102. Referring to Figure 4, the slide 102 is an inverted U-shaped member carrying along its upper side a ledge 104 and through its depending side arms the slots 106 and 108. Set screws 110 and 112 with washers 114 and 116 are threadedly seated in horizontal holes in the bosses 96 and 98. The casting 70 also carries bosses 118 and 120 vertical alignment with the bottom of the slide 102 and these are vertically tapped and threaded to receive set screws 122 and 124. The ledge carries a transverse slot 126 which has an upwardly, rearwardly sloping bottom 128 parallel to the camming surface 94 of the shaping plate 88.

Casting 70 has an upwardly directed bracket 130 carrying a slot 132 and having its edges grooved to form a way 134. Resting on the horizontal portion of this bracket is a spring support 136 in which is mounted a set screw 138. Transversely of the spring support 136, and integral therewith is a wedge 140. Threadedly seated in the head 70 is a set screw 158 and locking nut 160 which serves as a limit or stop for the handle 80. This enables the operator to control the depth of the ram stroke and thereby handle springs of different diameters.

The tool is used as follows. Assuming that the spring illustrated in Figures 3 and 4 is a one-inch diameter spring, the user will rest the end loop 142 over the wedge 140 and will loosen the set screw 138. The spring support, referring to Figure 3, will then be moved to the right or the left until the distance 144 is approximately one-half the diameter of the spring or slightly more than one-half the diameter of the spring. He then tightens the screw 138. Then he sets the handle stop 158 so that the shaping plate 88 may be forced downward to the position illustrated in dotted line in Figure 3. He next positions the spring on the spring support 136 so that the wedge 140 separates the two end loops and turns the spring until the end is at approximately the level of the top of the ledge 104, or lower. He then depresses the handle making certain that the cleaving edge of the plate 88 will engage the valley between the tops of the two end loops. By following through with the stroke as illustrated in Figure 3, he will place an end hook on the spring.

The embodiment illustrated in Figures 5 and 6 is identical to the embodiment heretofore described excepting for the spring holder. The

spring holder consists of a pair of shoes 146 and 148 which are held in spaced relationship by threaded bolts 150 and 152. The bolt 152 is pivotally fastened at 154 to the lower shoe 146 and the upper shoe 148 is slotted so that the bolt may be slipped in over the end and the shoes drawn together by a wing nut 156. The lower shoe may be formed integrally with the spring support 136 as shown. Referring to Figure 6, the two shoes are complementarily, arcuately slotted and threaded, the pitch of the threads being an average pitch for the size spring that is intended to be used in the tool. It is not necessary that the loops of the spring fit snugly into the threads.

Returning now to the invention as a whole, attention is invited to the fact that in the hand tool shown in Figures 1 and 2, the plate is adjustable while in the two bench tools the plate is not adjustable. On the other hand, in the two bench tools, the spring support is adjustable whereas in the hand tool the spring support is not. The adjustability in either case assists in relating the initial position of the spring to the ledge.

It should be mentioned here that it is possible to form a hook loop on the end of the spring so that in substance it is the equivalent of a closed loop. By setting, referring to Figure 3, the spring support quite close to the ledge 102, the end of the spring may be kept close to the adjacent loop. The result is an 180 degree semicircular loop on the end of the spring in which one end of the loop is fastened to the body of the spring and the other end of the loop, which is the end of the spring, is abutting the end loop at approximately 360 degrees of arc away from its own end. To this extent, a tool for forming a hook on the end of the spring can make a closed loop on the end of the spring.

Attention is invited to the arcuate edge on the forward side of the plate 88. This curve is drawn with the pivot as a center and is of great value in steadying the spring during the hook forming operation. If the edge were straight or followed some configuration other than that of a curve having the pivot as a center, the upper part of the spring would tend to move forward or backward from the position shown in the drawings during the hook forming operation.

Having thus described my invention, what I claim is:

A bench tool for forming a hook on a helical spring comprising a frame having an upper jaw and a lower jaw spaced from each other, a clamp on the frame for fastening the frame to a fixed support, a helical spring support mounted on the lower jaw and movable in a plane normal to the movement of the jaws, means for fixing the spring support in a selected position, a wedge on the spring support for engaging the outside valley between two loops of a spring, a slide mounted on the lower jaw adjacent one end of the spring support and movable toward the upper jaw, means for fixing said slide in selected position, a ledge on the top of said slide transverse to the line of movement of the spring support, an upwardly directed slot through said ledge, a ram mounted on the upper jaw and movable toward the lower jaw, a plate suspended from the ram edgewise and parallel to and in alignment with the slot in the ledge, a loop cleaving edge mounted on the lower end of the plate above the spring support, and a camming surface extending along the lower edge of the plate over the ledge, said plate and camming surface having a thickness less than the width of the slot.

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