Dec. 10, 1940. G. W. CRABTREE 2,224,381

CLIP FOLDING MACHINE

Filed Feb. 10, 1939 2 Sheets-Sheet 1

FIG. 1

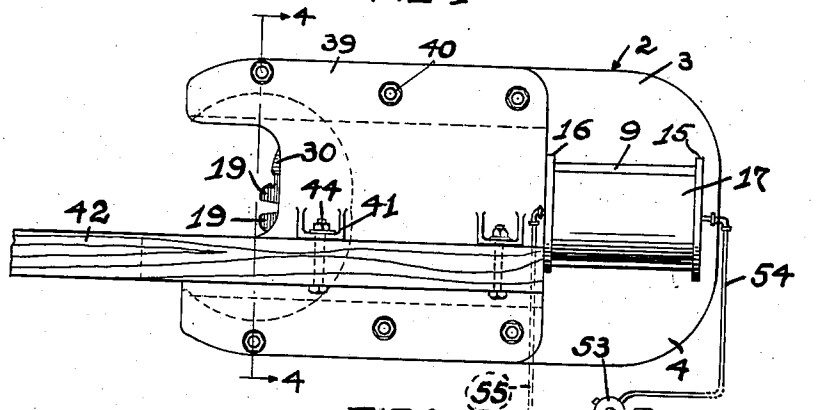


FIG. 2

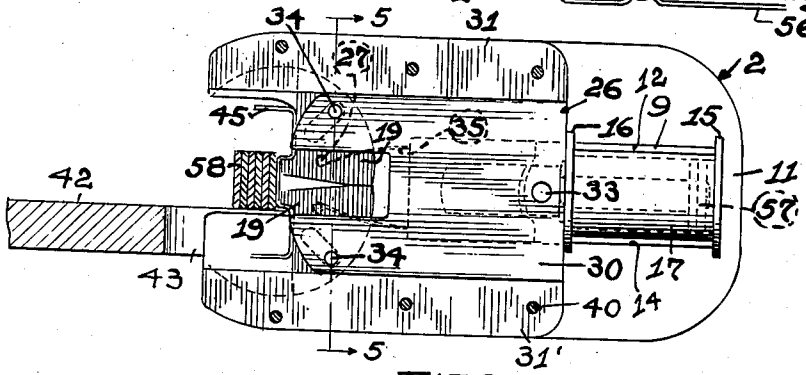
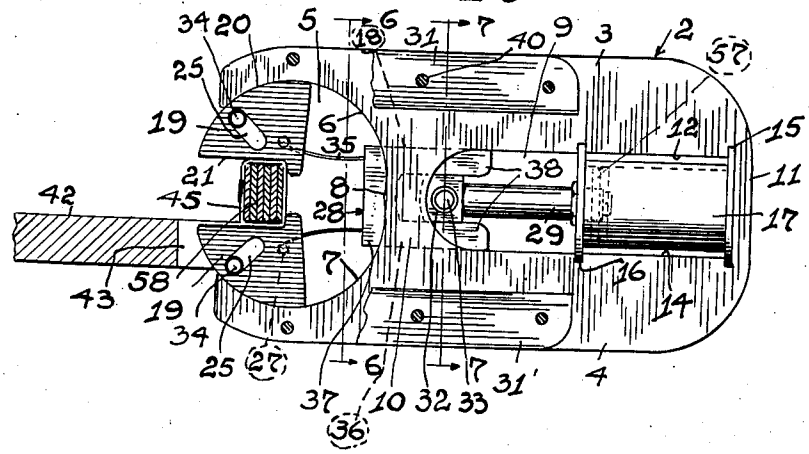


FIG. 3



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FIG. 4

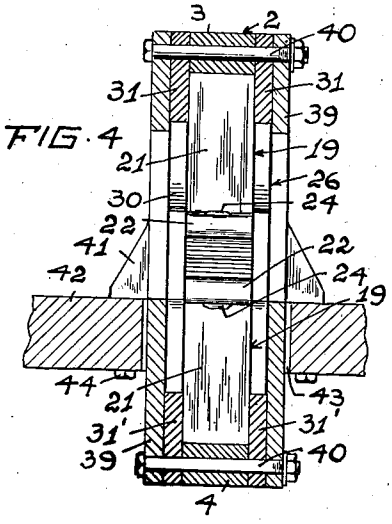


FIG. 6

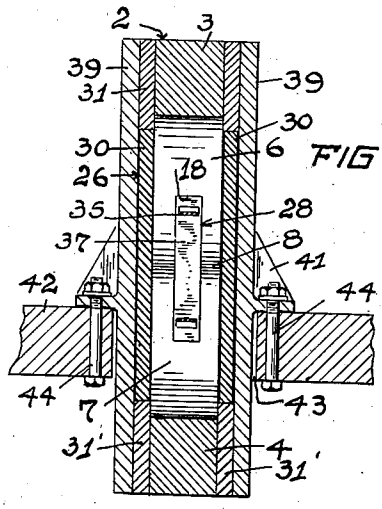


FIG. 5

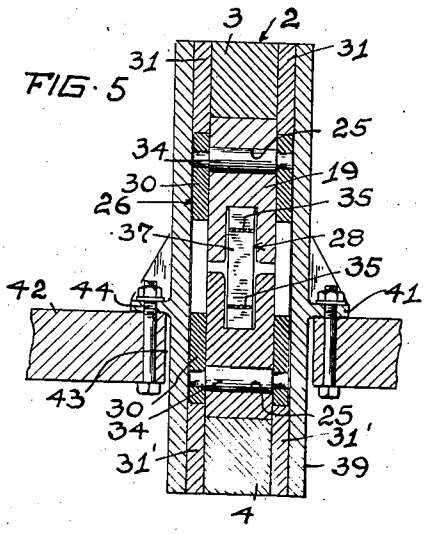


FIG. 7

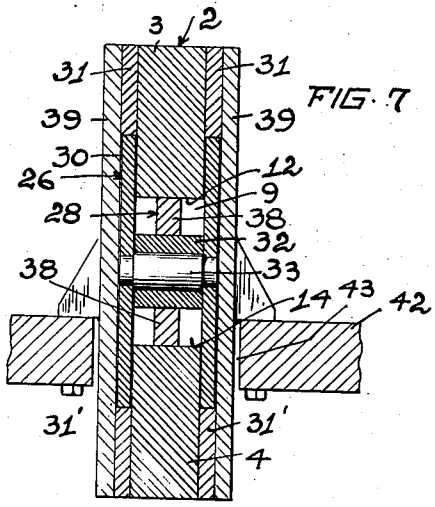


FIG. 8

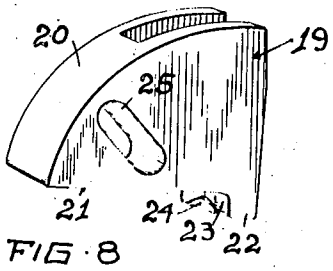
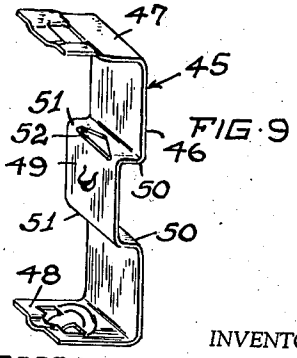


FIG. 9



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UNITED STATES PATENT OFFICE

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CLIP FOLDING MACHINE

George W. Crabtree, Cleveland Heights, Ohio

Application February 10, 1939, Serial No. 255,662

9 Claims. (Cl. 153—1)

My invention relates to improvements in clip folding machines for securing clips detachably to laminated springs, and in general my object is to provide a semi-automatic clip folding machine adapted to readily and easily fold specifically constructed, slightly springing clip blanks around the assembled leaves of a laminated spring and to interengage and interlock the specifically constructed ends of the blanks when completely folded around the spring, the clip blanks being made of springing material, to effect yielding interengagement and proper interlocking of the ends of the clips when folded around a spring.

Another object of my invention is to provide a semi-automatic clip folding machine of the type referred to above embodying a frame structure having arranged therein floating, sector-like blank supporting and folding members adapted to be shifted on a curved guide-way in said frame structure for slidably guiding said members during folding operations and means slidably coupled with said jaw members and slidably mounted on said frame for shifting said members during folding operations.

A further object of my invention is to provide a semi-automatic clip folding machine of the type referred to above embodying a frame structure with a curved guideway, floating, sector-like blank supporting and folding members and slidable means yieldingly forcing said members into contact with their curved guide-way to effect proper relation of said folding members with the curved guide-way during folding operations.

Still another object of my invention is to provide a semi-automatic clip folding machine of the type referred to above embodying a frame structure including a partly heart-shaped guide-way, sector-like floatingly arranged blank supporting and folding members guided by said guide-way, slidable operating means for said members yieldingly forcing same into contact with the guide-way and shiftable means coupled with the supporting and folding members for effecting shifting of said members and therewith folding of specific clip blanks around the assembled leaves of a laminated spring.

With these and incidental objects in view, the invention consists in certain novel features of construction and combination of parts, the essential elements of which are set forth in the appended claims; and a preferred form of embodiment of the invention is hereinafter shown with reference to the drawings accompanying and forming part of this specification.

In the drawings which illustrate a suitable embodiment of the present invention,

Fig. 1 is a side-view of a semi-automatic clip folding machine according to the invention, the machine being mounted upon a work-bench;

Fig. 2 is a side-view of the semi-automatic clip folding machine shown in Fig. 1, with one side plate removed to expose the shiftable slide and its connection with the folding jaws and the piston rod of pneumatic operating means;

Fig. 3 is a side-view of the semi-automatic clip folding machine shown in Figs. 1 and 2 with one side plate and the shiftable slide removed so as to freely expose the frame structure and the folding jaws of the machine;

Fig. 4 is a cross sectional view through the semi-automatic clip folding machine shown in Fig. 1 with the section taken on line 4—4 of said figure;

Fig. 5 is a cross sectional view through the semi-automatic clip folding machine shown in Figs. 1 and 2, the section being taken on line 5—5 of Fig. 2;

Fig. 6 is a cross sectional view through the semi-automatic clip folding machine shown in Figs. 1–3, the section being taken on line 6—6 of Fig. 3;

Fig. 7 is a cross sectional view similar to Fig. 6, the section being taken on line 7—7 of Fig. 3;

Fig. 8 is a perspective view of one of the folding jaws, and

Fig. 9 is a perspective view of one of the specifically constructed clip blanks used with the clip folding machine.

Referring now in detail to the exemplified form of the clip folding machine shown in the drawings, reference numeral 2 indicates an elongated plate-like frame structure having a thickness approximately equal to the width of the clip blanks to be folded thereby. This frame structure embodies symmetrical upper and lower portions 3 and 4 and is provided at its front end with an open, partly heart-shaped cut-out portion 5, the inner edge of which is formed by two segments 6 and 7 arranged symmetrically to each other and to said front end in such a fashion that segments 6 and 7 intersect each other and produce in cut-out portion 5 a cam-like extension 8, thus giving said cut-out portion 5 the partly heart-shaped outline previously referred to. The rear and central portion of frame structure 2 is cut out to form a guiding and operating slot 9, which slot stops short of cut-out portion 5 to provide sufficient material for properly interconnecting upper and lower portions 3 and 4 by a

post-like member 10, and, which slot stops short of the rear end portion of frame structure 2 to provide a post-like rear connection 11 between upper and lower portions 3 and 4. Slot 9 has its parallel edges 12 and 14 grooved as at 15 and 16 to permit of an air cylinder 17 to be rigidly secured to said frame in axial alignment with slot 9, and post-like member 10 is centrally formed with a guiding slot 18 to be used for a purpose later to be described.

The thus constructed frame structure 2 mounts in cut-out portion 5 two symmetrically arranged folding and blank supporting jaw members 19, each of which consists of a solid sector slightly larger than 90°. These jaw members engage with their peripheral surfaces 20 the peripheral guide-way in frame structure 2, which guide-way is formed by segments 6 and 7 in cut-out portion 5. The radii of peripheral surfaces 20 are of course substantially equal to the radii of segments 6 and 7 to effect perfect contact of the guide-way with surfaces 20 during folding operations of the jaw members 19. Each of these jaw members has its folding face 21 parallelly offset to provide an extending blank supporting finger portion 22, the inner wall 23 of which is formed with a centrally arranged protuberance 24 adapted to permit of securely holding a blank in position prior to folding operations. Each jaw member is furthermore provided with an elongated slot 25 arranged at an angle of approximately 45° to the clamping face of the jaw member. This slot which is utilized to effect coupling of the jaw member with a reciprocating slide 26 has preferably its axis intersecting the center of the corresponding segment of the curved guide-way. Finally, the portion of the jaw member opposite to its clamping face is chambered and has extended therethrough a pin 27 to be used for yieldingly coupling the jaw member with a slide member 28, all as will be later described.

The jaw members 19 are actuated by the air cylinder 17, the piston rod 29 of which is coupled with slide 26, consisting of two, parallelly arranged at their front ends, slotted plates 30, which plates are guided between guide rods or plates 31, 31′ on frame structure 2. The rear portion of slide 26 is coupled with a cross head 32 on piston rod 29, a pin 33 being used for this purpose, and the front portion of slide 26 carries two symmetrically arranged rollers 34, which extend through slots 25 in jaw members 19 and thus couple these jaw members through slide 26 with the air cylinder 17. In addition, each of the jaw members 19 is yieldingly forced into contact with its guide-way in frame structure 2 by means of curved, leaf spring 35 coupled with the pin 27 in said member and secured to the U-shaped slide member 28. Slide member 28 which consists of a U-shaped plate 36 fitting the elongated passage or slot 18 in post-like member 10 of frame structure 2 has symmetrically secured to its web portion 37 the leaf springs 35 and the flanges 38 thereof slidably engage the cross head 32 on piston rod 29.

The thus described frame and operating mechanism of the clip folding machine is covered by oppositely arranged side plates 39 which are secured to the frame structure by means of bolts 40. These side plates are preferably provided with ear portions 41 adapted to properly mount the machine on a working bench 42 having a slot 43 arranged therein, which ear portions 41 permit of proper mounting of the machine by bolts 44 extended through these ear portions and the working bench.

The clip folding machine is constructed for a specific type of clip blanks 45, but clip blanks of different sizes, shape and construction may be used by slightly changing the form of the clip folding and supporting jaws. The specific clip blank is shown in Fig. 9 and consists of a substantially U-shaped metal band made preferably of slightly springing material. The web portion 46 of this blank is of substantial greater length than its flanges 47, 48, which latter are formed with means effecting interlocking engagement of the flanges when forcibly engaged with each other during folding operations. In addition, web portion 46 embodies a central area 49, parallelly offset with respect to web 46 by bending the material at right angles at 50 and 51. To weaken the bend 51, triangular cut-outs 52 are provided at this bend, thus facilitating and localizing bending operations at bend 51 during folding of the blank around a spring or similar structure. Cut-outs 52 also serve to effect proper support of blanks 45 on folding jaws 19 prior to folding operations, as will be hereinafter described.

When starting folding operation with the clip folding machine, folding jaw members 19 are in Figs. 1 or 2 position in which the blank supporting portions 23 of the jaw members extend forwardly and their protuberances 24 are directed upwardly and downwardly respectively. In this starting position the jaw members 19 contact their peripheral surfaces opposite extension 8 while leaf springs 35 force the jaw members yieldingly against their guide-way, thus permitting of slight yield of the jaws when a clip blank 45 is forced over extensions 22 and protuberances 24 which then enter into triangular cut-outs 52 for securely holding the blank in working position. After blank 45 is thus placed, a spring 58 is placed in front of and adjacent to the blank and then compressed air is entered into air cylinder 17 by actuating three-way valve 53. This valve is coupled by pipes 54 and 55 with the opposite sides of cylinder 17 and by pipe 56 with a source of compressed air (not shown). Air entering cylinder 17 through pipe 54 shifts piston 57 and therewith slide 26 in a straight forward movement toward spring 58 and this straight movement is transferred to a pivotal movement of jaw members 19, the folding faces 21 of which, while moving through a circle, fully straighten the center portion of clip blank 45 by bending same on its weakened bend, and force the flanges 47 and 48 of said blank toward each other and tightly grip laminated spring 58. Clamping jaw members 19 are returned to starting position when valve 53 is shifted to such position that air enters through pipe 55 into the other end of the air cylinder and effects backward movement of slide 26 and therewith opposite rotation of jaw members 19. The front portions of slide 26 extend slightly beyond the folding faces of the jaw members and thus properly guide the blank during folding operations, and the recess in slide 26 is substantially the same as the width of the spring leaves to effect proper alignment of these leaves during clip folding operations.

Having thus described my invention, what I claim is:

1. In a clip folding machine for folding a preshaped blank to a clip encircling a laminated spring a frame, an open, curved inner guide-way

in said frame, two sector-like jaw members guided with their peripheral surfaces in said guide-way, and slidable means mounted on said frame and coupled with said jaw members, said jaw members each including a slot related at an angle of about 45° to the axis of said slidable means when said jaw members are in open position and said slide member supporting a roller for each of said jaw members extending through the slot of said jaw member for coupling same with said slide.

2. A clip folding machine for folding a preshaped blank to a clip tightly encircling a laminated spring comprising a frame, a curved inner guide-way at one end of said frame embodying symmetrically arranged intersecting segments, a pair of sector-like jaw members, each including a parallelly offset folding face and a blank supporting finger portion forwardly extended from the inner end of said folding face, said jaw members being guided with their peripheral surfaces in the segments of said guide-way, operating means for said jaw members at the other end of said frame arranged in axial alignment with respect thereto, and slidably arranged guiding and coupling means interconnecting said operating means with said jaw members, said guiding and coupling means extending in an open position of said jaw members slightly beyond the folding faces thereof for guiding a blank supported and held by said finger portions during folding operations.

3. A clip folding machine for folding a preshaped blank to a clip tightly encircling a laminated spring, as described in claim 2, wherein said frame includes a straight guide-way, wherein a U-shaped slide is guided in said straight guide-way, and wherein said U-shaped slide supports yielding means coupled with said jaw members and yieldingly forcing said members, into contact with the curved guide-way.

4. A clip folding machine for folding a preshaped blank to a clip tightly encircling a laminated spring, as described in claim 2, wherein said frame includes a straight guide-way, wherein a vertically arranged plate is guided in said straight guide-way, and wherein said plate supports yielding means rigidly connected thereto and pivotally secured to the jaw members for forcing said members into contact with the curved guide-way.

5. In a clip folding machine for folding a preshaped blank to a clip encircling a laminated spring a frame, a curved inner guide-way in said frame, sector-like jaw members floatingly guided with their peripheral surface in said guide-way, and a straight slide means on said frame slidably coupled with said jaw members for supporting and shifting same in said curved guide-way during folding operations.

6. A clip folding machine such as described in claim 5, wherein said straight slide means is coupled with said jaw members by pin and slot connections including slots angularly related to said straight slide means to effect proper floating support of said jaw members during folding operations.

7. In a clip folding machine for folding a preshaped blank to a clip tightly encircling a laminated spring a frame, a curved inner guide-way in said frame embodying symmetrically arranged intersecting curves, a pair of sector-like jaw members floatingly guided with their peripheral surfaces on the surfaces of said guide-way, slidable means mounted on said frame and yieldingly forcing said jaw members into contact with said guide-way, and a second slidable means mounted on said frame and slidably coupled with said jaw members for shifting same in said guide-way during folding operations.

8. In a clip folding machine for folding a preshaped blank to a clip tightly encircling a laminated spring a frame, a curved, inner guide-way of partly heart-shaped form in said frame embodying symmetrically arranged intersecting curves, two sector-like jaw members including folding faces with fingerlike supporting extensions, and a slidable means on said frame, slidably coupled with said jaw members for shifting same in said guide-way during folding operations, said jaw members being floatingly guided with their peripheral surfaces in said guide-way and said fingerlike extensions being extended from the folding faces to grip and support a blank prior to folding operations.

9. A clip folding machine for folding a preshaped blank to a clip tightly encircling a laminated spring, as described in claim 8, embodying a second slidable means supported by said frame and yielding means on said second slidable means coupled with said jaws for yieldably forcing said jaw members into contact with said guide-way.

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