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APPARATUS FOR FORMING TERMINAL LOOPS ON COIL SPRINGS

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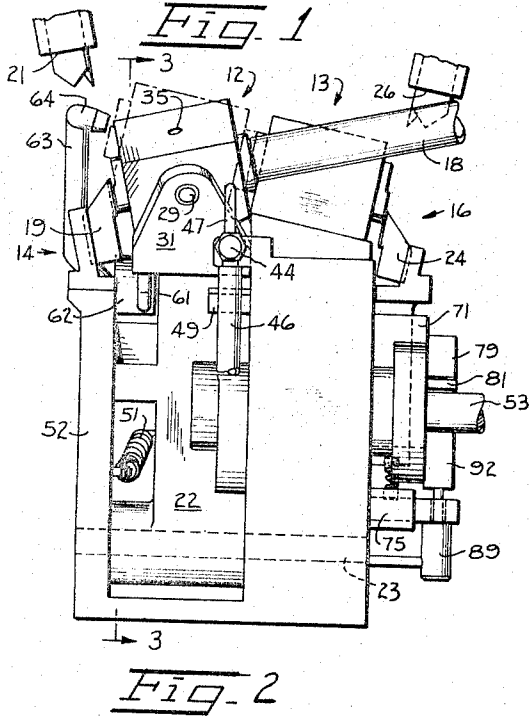
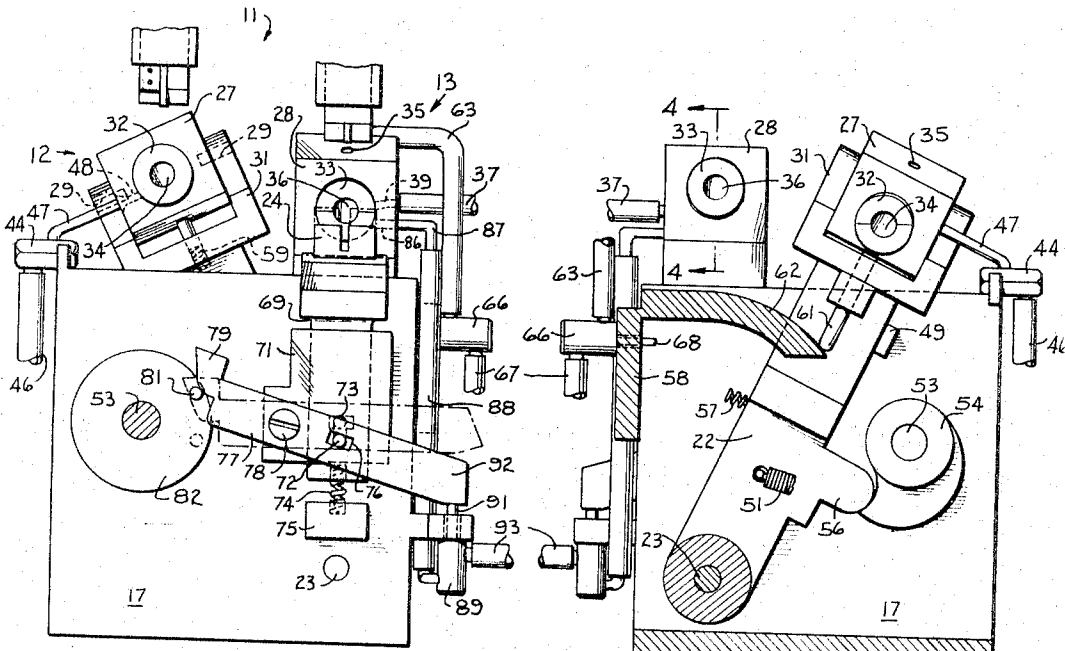


Fig. 3

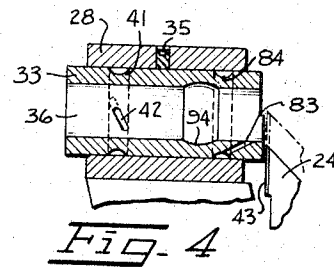


Fig. 4

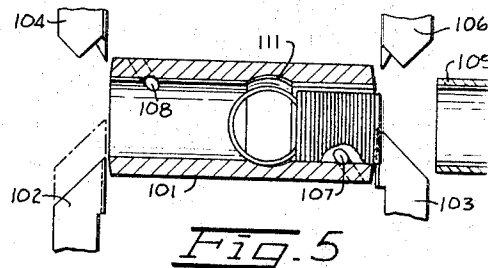


Fig. 5

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APPARATUS FOR FORMING TERMINAL LOOPS ON COIL SPRINGS

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ABSTRACT OF THE DISCLOSURE

This specification describes an improved apparatus for automatically forming loops on the ends of a coil spring. The apparatus includes two work stations, one for each end of a spring and each of which includes a pick and anvil for bending outward a terminal coil of the spring for forming the loop. A cylinder having a spring receiving bore is associated with each work station and a jet of air is injected into the bore for axially advancing and rotating a spring therein into proper position against the anvil for formation of a loop. Mechanism is provided for moving a spring from one to the other for transference of a spring from one to the other for formation of a loop on a spring's second end after a loop has been formed on its first end. The anvil at the station for forming the second loop is retractable from the bore of the cylinder so that a spring can be injected from such bore after the second loop is formed on it.

The invention relates to the production of loops on coil springs and more particularly, to improved apparatus for bending the terminal coils of a coil spring outward from the spring to thereby provide loops at the extremities of the spring.

Coil springs are quite often used for purposes which require the springs to be secured between two members. For this reason it is usual to bend outward the terminal coil on each end of a coil spring to thereby form a loop at each such end. These loops facilitate attachment of the spring to such members.

Automatic apparatus has been provided heretofore for the formation of loops on the ends of a coil spring. In general, such apparatus usually includes a plurality of loop forming work stations each of which is defined by a reciprocating pick element which bends a terminal coil of the spring outward over a forming anvil. A plurality of spring supporting members having spring receiving bores are provided to transport a spring to and between the work stations and position the spring at each of such work stations. Means, such as a jet of air is used to precisely locate the spring within the support member bore in abutment with the forming anvil and in the proper orientation for the loop forming operation. One especially fast type of such apparatus having many advantageous features is disclosed and claimed in applicant's copending application filed on Mar. 8, 1960, Ser. No. 13,511, entitled, "Apparatus for Forming Terminal Loops on Coil Springs," and which issued as Patent No. 3,183,944 on May 18, 1965.

In prior apparatus, it is generally necessary to transport the spring supporting members away from the loop forming work stations in order to receive springs in or discharge springs from the bore. Besides adding to the number of transporting operations which must be performed with respect to each spring, this requires that the spring supporting members be moved relative to the work stations. The positioning of the spring supporting members with respect to the work stations during the formation of the loop is fairly critical. Because of the necessity of moving the supporting members and wear caused there-

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by, misalignment between the spring supporting members and the work stations sometimes occurs.

Accordingly, an object of the present invention is to provide an improved apparatus for bending the terminal coils of a coil spring outward from the spring to form loops on the spring.

Another object of the invention is to provide an apparatus for forming loops on a coil spring in which the number of spring transportation operations performed with respect to each spring during the formation of loops on its ends is minimized.

A further object of the invention is to provide an improved automatic apparatus for forming loops on the ends of a coil spring in which the spring need not be transported from a loop forming work station in order to be discharged from the apparatus.

One other object of the invention is to provide an automatic apparatus for bending outward over an anvil a terminal coil of a coil spring positioned at such anvil by a supporting member in which the anvil is retractable from the spring supporting member.

Still another object of the invention is to provide an improved apparatus for bending outward over an anvil a terminal coil of a coil spring positioned at such anvil by a supporting member in which the supporting member is stationary and the anvil is retractable from the supporting member in order to permit a spring to be discharged from the apparatus.

A still further object of the invention is to provide an improved spring supporting member for a coil spring loop forming apparatus which facilitates proper location of a spring at a work station whereat a loop is to be formed on such spring.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawing accompanying and forming part of the specification. It is to be understood, however, that variations in the showing made by the said drawing and description may be adopted within the scope of the invention as set forth in the claims.

Referring to the drawing:

FIGURE 1 is a front elevation view of a preferred loop forming apparatus of the invention depicting a retractable anvil at one loop forming work station thereof.

FIGURE 2 is a side elevation view of the apparatus of FIGURE 1 depicting the construction thereof.

FIGURE 3 is a sectional view of the apparatus of FIGURE 1 taken on a plane indicated by the line 3—3 in FIGURE 2 and looking in the direction of the arrows.

FIGURE 4 is a view of an anvil and a cross sectional view of a spring support member of the apparatus of FIGURE 1 taken on a plane indicated by line 4—4 of FIGURE 3.

FIGURE 5 is a schematic partial view of another loop forming apparatus of the invention in which only one spring supporting member is needed to provide loops on both ends of a spring.

Generally, the invention is a coil spring loop forming mechanism having a loop forming work station adjacent one end of a spring receiving and locating bore of a support member and in which the anvil of the work station is retractable from the end of the bore to allow a spring to pass through such end of the bore. Because a spring can thus pass through the end of the bore without the spring supporting member having to move from the work station, no movement of the spring support member is necessary. This assures correct alignment between the work station and the spring support member and reduces the time necessary to perform a loop forming operation on a spring.

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A preferred apparatus utilizing the invention is depicted in FIGURES 1-3. Such apparatus is generally indicated by the reference numeral 11 and broadly comprises two spring support members 12 and 13 and two loop forming work stations 14 and 16. Support member 12 and work station 14 are for forming a loop in a first end of a coil spring, and support member 13 and work station 16 are for thereafter forming a loop in the second end of such spring. A spring feed tube 18 is provided to introduce a spring into support member 12 whereat it is positioned and located at a rigidly secured anvil 19 of work station 14 by means to be hereinafter described. Then a pick element 21 of work station 14 moves downward against anvil 19 to bend the terminal coil of a spring outward in a known manner to form a first loop in this spring.

Support member 12 is mounted on a pivot arm 22. This arm 22 is in turn pivotally mounted to support plate 17 by means of a pin 23. After a loop is formed in the first end of a spring at work station 14, arm 22 arcuately moves about pin 23 to move support member 14 to a position whereat the spring can be transferred to support member 13. Such spring transferring position is shown in phantom lines in FIGURE 2. After a spring is transferred to support member 13, it is positioned and oriented against anvil 24 of work station 13 and a pick element 26 reciprocates downward to form a loop in the second end of such spring.

After the second loop is formed in the spring, anvil 24 is retracted as will be discussed below to permit the spring to be discharged from support member 13 without such support member having to move from the work station 16.

From the above it is seen that this loop forming apparatus of the invention is much simpler than prior loop forming apparatus, and can form loops on both ends of a coil spring in a minimum of time with a minimum of movement of such spring.

More particularly as to the construction of the apparatus of this embodiment, each of the spring support members 12 and 13 comprises a block 27 and 28, respectively. Block 28 is rigidly mounted to frame support plate 17, and as best depicted in FIGURE 2, such block slants downward toward anvil 24 in order to utilize gravity to facilitate the positioning and locating of a spring at the anvil. Block 27 is pivotally mounted on pins 29 to a U-member 31. U-member 31 is, in turn, rigidly affixed to the free end of pivot arm 22.

Each of the spring support blocks 27 and 28 has a central passage therethrough in which is located a tubular cylinder 32 and 33, respectively, defining spring receiving bores 34 and 36. The cylinders are tightly held within the respective blocks by set screws 35. On unscrewing of the set screws 35, the cylinders 32 and 33 of the support members can be removed and other cylinders having different diameter bores can be inserted in their place. Thus, the apparatus is adaptable to forming loops on many different diameter springs.

Air jet means for positioning and locating a spring in a loop forming position against each of the anvils is provided in association with each of the supporting members. More particularly, rigidly secured block 28 has a compressed air conduit 37 communicating through a fitting 38 with an air passage 39 through such block. Passage 39 extends through block 28 to the central passage therethrough. As depicted in FIGURE 4, cylinder 33 has a peripheral groove 41 which, with the central passage wall of block 28, defines an annular space around such cylinder. The air passage 39 through block 28 communicates with the central passage adjacent groove 41 so that air introduced into passage 41 will flow into the annular space defined by the groove and thereby flow peripherally about cylinder 21.

Spring receiving and locating cylinder 33 has an air jet inlet passage extending from groove 41 to, and communicating with, bore 36. This air jet passage is obliquely

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inclined with respect to the bore 36 in order that air issuing from such passage will form a helical air current within bore 36 to advance a spring therein to anvil 24 and locate and orient such spring in a loop forming position against such anvil. That is, inlet passage 42 is inclined toward the open end of cylinder 33 adjacent anvil 24 so that air issuing therefrom will have a component of direction toward anvil 24. Inlet passage 42 is also inclined with respect to the radii of bore 36 so that air issuing therefrom will obliquely strike the wall of such bore and thereby be deflected into circular motion adjacent such wall. The thus formed helical air current will advance the spring in bore 36 and locate such spring in abutment against anvil 24 in a manner known to those skilled in the art. That is, the axial component of such air will advance the spring against the anvil while the radial component will rotate the spring to abut the end of the final coil against a vertical shelf 43 on the anvil, and thus orient the spring in position for the formation of a loop.

Because of the provision of groove 41, the angular orientation of cylinder 33 within block 28 is not critical. That is, passage 42 through cylinder 33 need not be aligned with passage 39 through block 28 before air can flow between such passages. This lack of criticality facilitates placement of a cylinder within the block.

In order to introduce a spring advancing and locating air jet into bore 34 of support member 12, a connection 44 is rigidly mounted on the interior face of support plate 17 in communication with an air conduit 46. A nozzle 47 extends angularly upward from connection 44, and its end is adapted to be received within a passage 48 through block 27 when such block is in the loop forming position adjacent anvil 19. Upon arcuate movement of support member 12 from loop forming station 14 to transport a spring to block 28, nozzle 47 disengages from passage 48. However, upon return of block 27 to loop forming station 14 the nozzle again engages the passage for the introduction of air therein.

Passage 48 extends through block 27 to the central passage therethrough in which cylinder 32 is positioned. Such cylinder is similar to the above described cylinder 33 with respect to the means by which a helical air current is introduced therein and, for this reason, is not shown in detail in the drawings. Such cylinder has an annular groove thereabout similar to groove 41 defining an annular space between such cylinder and block 27. Further, an air jet inlet passage extends from such groove to the bore 34 and is inclined with respect to such bore to advance and rotate a spring into a loop forming position against anvil 19.

The mechanism for arcuately reciprocating the support member 12 from the loop forming position adjacent work station 14 to a spring transfer position adjacent support member 13 will now be described. As discussed before, support member 12 is on the free end of an arm 22 which is pivotally mounted to support plate 17 by a pin 23. Such arm is normally urged against a stop 49 on support plate 17 by a tension spring 51 connected between such arm and a frame backing plate 52. When arm 22 is so against stop 49, support member 12 is adjacent loop forming station 12 and in proper alignment with anvil 19 for the formation of a loop on the end of a spring within such support member. Because stop 49 is rigidly mounted on plate 17 and spring 51 urges arm 22 in tight abutment thereagainst, misalignment between support member 12 and anvil 19 does not occur.

A drive shaft 53 extends through support plate 17 and has a cam 54 mounted thereon inwardly of such support plate for rotation therewith. Cam 54 is adapted to engage a semicircular projection 56 on arm 22. The periphery of cam 54 adapted to engage projection 56 has a configuration such that upon clockwise rotation of drive shaft 53 as viewed in FIGURE 3, such cam will pivot arm 22 from the loop forming position to the transfer position. More

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particularly, upon engagement of such cam with projection 56, arm 22 is arcuately moved to a vertical position whereat bore 34 and bore 36 are axially aligned. A spring 57 on arm 22 engages frame side plate 58 as arm 22 approaches such vertical position and compresses to urge the projection 56 of arm 22 against cam 54 to assure that such projection and the cam stay in engagement. This assures proper alignment of cylinders 32 and 33 for the transfer of a spring therebetween.

When support member 12 is adjacent work station 14, such support member slants downward toward anvil 19. However, as depicted in phantom in FIGURE 2 when such support member is in the spring transfer position, bores 34 and 36 are axially aligned with the support member slanted in an opposite direction and toward anvil 24. Means are provided for causing this change of slant of the support member 12 as it arcuately moves from its loop forming position to its transfer position. More particularly, as has been mentioned before, block 27 is pivotally mounted on U-member 31 by pins 29. As shown in FIGURE 1, a compression spring between U-member 31 and the end of block 27 opposite the loop forming station normally urges such block to a position slanting down toward anvil 19. A pin 61 is provided extending through U-member 31 with one end of such pin engaging the end of block 27 adjacent anvil 19. The other end of the pin is adapted to ride on a cam plate 62 which extends inwardly from frame side plate 58 along frame backing plate 52. Cam plate 62 has a surface configuration such that when arm 22 arcuately moves to a vertical position, pin 61 is forced upward against the end of block 27. Such upward movement of the pin pivots block 27 about pins 29 against spring 59 and to a position whereat spring receiving cylinders 32 and 33 are in coaxial alignment.

Air jet means are provided to transfer a spring from support member 12 to support member 13. More particularly, an air conduit 63 having a nozzle 64 in coaxial alignment with bore 36 of support member 13 is provided extending upward from backing plate 52. When bore 34 of support member 12 is coaxially aligned with bore 36 of support member 13, an air jet issuing from nozzle 64 will flow axially through both of such bores and, thereby, carry the spring from the bore of support member 12 to the bore of support member 13.

Arcuate movement of arm 22 to coaxially align such support member bores activate the discharge of air from nozzle 64. That is, conduit 63 communicates through an air valve 66 which, in turn, communicates with another conduit 67 connected to a conventional pressurized air source (not shown). Valve 66 is rigidly secured to backing plate 58 and has a stem 68 extending through such plate. Upon arcuate movement of arm 22 about pin 23 toward a vertical position, such arm engages stem 68 and forces it inward to thereby open valve 66. Thus, when arm 22 coaxially aligns cylinders 32 and 33, such arm also activates the discharge of air from nozzle 64 to transfer a spring from support member 12 to support member 13.

In order that anvil 24 can be retracted from a loop forming position adjacent bore 36 to a position below such bore so that a spring having loops at both ends can be ejected, the anvil is mounted on a vertically reciprocal bar 69. This bar is slidably received in a guide 71 secured to the exterior face of support plate 17. Such arm 69 has a pin 72 extending through a vertical slot 73 in guide 71. Pin 72 and slot 73 are so related that when pin 72 is in engagement with the edge of the upper end of such slot 73, anvil 24 is in the loop forming position in front of bore 36 of support member 13. A strong compression spring 74 is disposed between the bottom of bar 69 and a stop 75 rigidly secured to support plate 17. Such spring acts to normally urge bar 69 upward with pin 72 thereof in engagement with the upper end of slot 73, and, thereby normally maintains anvil 24 in a loop forming position.

Pin 72 extends beyond guide 71 and glides within another slot 76 within a lever arm 77. Lever arm 77 acts to move anvil 24 downward from in front of bore 36 to

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permit a spring to be ejected from such bore. That is, such lever arm is pivotally mounted to guide 71 by means of a bolt 78. The end 79 of arm 77 is adapted to engage a pin 81 projecting outward from a disk 82 which is, in turn, mounted on drive shaft 53 for rotation therewith. Upon counterclockwise rotation as viewed in FIGURE 1 of disk 82 by shaft 53 pin 81 engages lever arm end 79 and pivots such end upward. Since bolt 78 is between lever arm end 79 and slot 76 such upward movement of end 79 is accompanied by a downward movement of slot 76. Slot 76 thereby carries pin 72 and, thus, arm 69 downward against spring 64. In this manner, anvil 24 is retracted from in front of bore 36. As shown in FIGURE 1, the distance such anvil is retracted is sufficient to permit unobstructed egress of a spring from bore 36.

Lever arm 79 also acts to activate means for rejecting a spring from bore 36 upon the retraction of anvil 24. Such a spring is retracted by means of air. More particularly, as depicted in FIGURE 4, cylinder 33 of support member 13 has a passage 83 extending therethrough from a groove 84 peripherally about such cylinder. The annular space defined by groove 84 is in communication with a passage 86 through block 13. This passage 86, in turn, communicates through a fitting 87 with an air conduit 88. An air valve 89 is mounted on support plate 17 and communicates with air conduit 88. Such valve 89 is mounted with a valve stem 91 extending upward to a position below lever arm 77. When such lever arm is pivoted to retract anvil 24, the outward end 92 thereof engages stem 91 and opens valve 89. An air conduit 93 communicates such valve with a pressurized air source, and, upon opening of the valve, air from such source can flow through the valve into conduit 88. The air then flows through air jet 83 and axially ejects a spring from bore 36 when the anvil 24 is retracted.

While not shown, it is to be appreciated that the drive shaft 53 is suitably connected with a prime mover such as a driving motor to continuously provide rotation of such drive shaft. Other cams and drive operating mechanisms (not shown) can also be driven by shaft 53 to provide reciprocal motion of the pick assemblies and operation of the air jet locating means.

In the operation of this embodiment to form a loop on both ends of a spring the spring is first fed into cylinder 32 from feed tube 18. Then a helical air current is introduced within cylinder 32 in the manner hereinabove described to advance and rotate such spring into loop forming abutment with anvil 19. Pick assembly 21 is then moved downward to engage the end coil of the spring and bend it downward over anvil 19 to form a loop in a first end of such spring. After this first loop is formed, cam 54 engages projection 56 on arm 22 and arcuately moves such arm to move support member 12 to a spring transfer position at support member 13. As described earlier, block 27 is pivoted upward by pin 61 during such movement in order to coaxially align cylinder 32 with cylinder 33. Further, such arm engages stem 68 of valve 66 and thereby activates flow of air from nozzle 64 to transfer a spring from support member 12 to support member 13. Then, a helical air current is introduced into cylinder 33 through passage 42 to abut and position the second end of the spring against anvil 24 in loop forming position. In this regard, it is to be appreciated that the loop formed in the first end of the spring generally has a slightly larger transverse diameter than the spring. Thus the loop extends somewhat laterally beyond the spring. While the fact that the loop is slightly larger than the spring has no effect on the axial advance of the spring through cylinder 33, it does prevent a completely uniform rotation of the spring when it is at the anvil. Therefore angular rotation of the spring to properly position the end of the final coil against the shelf 43 of anvil 24 is affected somewhat and, at times, a spring is not properly positioned during loop forming thereon. For this reason, it has been found advantageous to provide an annular relief groove 94 within bore 36 at

a position to be adjacent the spring loop when the spring is at anvil 24. Because of such groove, the spring can rotate at the anvil to the proper orientation without the loop being obstructed. It has been found that the number of rejected springs because of malformed loops has been greatly reduced as compared to prior apparatus because of this feature of the invention.

The edges of such groove are desirably beveled inward so that the groove does not catch the spring as it moves through the cylinder. For illustrative purposes, the depth of groove 94 is magnified. It is to be realized that such groove actually need only be of a slightly larger diameter than the bore in order to be effective.

After the spring is properly positioned against anvil 24, pick assembly 26 is moved downward to catch the final coil on the second end of the spring and bend such coil over anvil 24 to form a second loop on the spring. Immediately thereafter, pin 81 on rotating disk 82 engages end 79 of lever arm 77 and pivots such arm to thereby retract anvil 24 from in front of bore 36. Further, as arm 77 retracts such anvil the end 92 thereof engages valve 91 and air is introduced into bore 36 through air jet passage 83 to eject a spring. Suitable means such as conveyor or chute can be provided below support member 13 in order to catch the springs so ejected.

It should be noted that before a loop is formed on the second end of the spring at anvil 24, support member 12 is returned to the first work station and receives another spring from feed tube 18. Then the pick assemblies 21 and 26 move downward simultaneously to form loops in the respective springs. That is, a first loop is being formed on one end of a spring at the same time the second loop is being formed on a preceding spring. Then, as arm 22 is arcuately moved to transfer the second spring to support member 13, anvil 24 is retracted and the first spring is ejected from such support member.

From the above the ease and rapidity, with which loops are formed on the ends of the spring is readily apparent. Further, there is no transverse movement between block 28 of the second work station and anvil 24. Thus, no transverse misalignment between such members is possible. In addition because arm 22 firmly abuts against stop 49 which is rigidly secured to support plate 17 support member 12 is assured of always being in the same positional relationship with anvil 19 when such support member is in the loop forming position. Therefore, misalignment between support member 12 and anvil 19 is also negated.

The use of retractable anvils permits the use of only one immovable spring locating cylinder to form loops on both ends of a spring. FIGURE 10 schematically illustrates such a cylinder 101 having work stations at each end defined by retractable anvils 102 and 103. Reciprocating pick assemblies 104 and 106 cooperate with anvils 102 and 103, respectively, to form loops on opposite ends of a spring within the cylinder. In order to introduce helical air currents into the bore of cylinder 101 for the purpose of advancing and rotating a spring therein against anvils 102 and 103, air jet passages 107 and 108, respectively, communicate obliquely with such bore. Such passages introduce air into the bore in the manner described with respect to FIGURES 1-4 to properly locate the spring in abutment with the respective anvils.

A spring feed mechanism such as horizontally reciprocating tube 109 is provided at one end of the cylinder. Suitable means such as chute (not shown) can be provided at the opposite end of the cylinder to receive finished springs ejected from such cylinder.

As depicted, the loop on the second end of the spring is formed at anvil 103. Therefore, a relief groove 111 is provided within the cylinder bore to permit proper rotation of such spring and orientation thereof against anvil 103.

In operation, anvil 103 is retracted downward and feed tube 109 reciprocated toward cylinder 101 to permit a

spring to be introduced from such feed tube into the cylinder. A jet of air from passage 107 axially advances the spring through the cylinder and in loop forming abutment against anvil 102. Pick assembly 104 is then moved downward to form a first loop in such spring. While this first loop is being formed, tube 109 is horizontally retracted from cylinder 101 and anvil 103 moved upward to a loop forming position. As soon as the first loop is formed, the air jet from passage 107 is turned off and a helical air current introduced into the cylinder through passage 108 to advance the spring to anvil 103 and properly locate such spring in abutment with such anvil. Then, pick element 106 is moved downward and bends the final turn on the second end of the spring over anvil 103 to form the second loop on such spring. While this second loop is being formed, anvil 102 is being retracted from in front of the cylinder bore. Immediately after the formation of the loop, the air jet through passage 108 is terminated, and air again introduced into passage 107. The air from such passage then acts to eject the spring from the cylinder through the end thereof adjacent anvil 102. Then anvil 102 again moves upward to a loop forming position and another spring is introduced into cylinder 101 to have a loop formed in each of its ends.

What is claimed is:

1. In an apparatus for forming a loop on a coil spring, the combination comprising a support member having a spring receiving and locating bore therein with an open end; a loop forming mechanism adjacent said open end including an anvil against which one end of a spring within said bore is to be abutted and a pick element movable against said anvil for bending the terminal coil of said spring outward to form a loop on said spring; means for positioning said spring in abutment against said anvil in a loop forming position, said means comprising an air passage extending through said support member in oblique communication with said bore for introducing a helical jet of air into said bore; and retracting mechanism connected to said anvil for selectively retracting said anvil from said open end of said bore to permit a spring to pass through said open end.

2. In an apparatus for forming a loop on a coil spring, the combination comprising a support member having a spring receiving and locating bore therein with an open end, a loop forming mechanism adjacent said open end including an abutment to engage the first end of a spring for maintaining said spring within said bore in a predetermined position and orientation at said open end during the formation of said loop, means for rotating and axially advancing said spring within said bore to said predetermined position and orientation, said bore having a loop receiving relief groove therein spaced from said open end a distance substantially equal to the length of the spring for accommodating a loop on the second end of said spring to permit unobstructed rotation of said spring into proper loop forming orientation against said abutment by said means.

3. Apparatus for forming loops on a coil spring comprising a pair of support members each of which has an open ended spring receiving and locating bore therein, a pair of loop forming mechanisms each of which is associated with a respective one of said support members adjacent an open end of the bore thereof and each of which includes an abutment to engage the end of a spring within the bore of its associated support member for maintaining said spring in a predetermined position thereat during the formation of a loop thereon, means associated with each of said supporting members for positioning a spring in loop forming position against the associated abutment, retracting mechanism for selectively retracting the abutment of one of said loop forming mechanism from the open end of the bore of its associated support member to permit a spring to pass through said open end, and mechanism for moving one of said support members with respect to the other to axially align the bores thereof to

permit transfer of a spring from the bore of one to the bore of the other.

4. The apparatus of claim 3 wherein said means associated with each of said supporting members for positioning a spring in loop forming position includes an air passage extending through the associated support member in oblique communication with the bore thereof for introducing a helical jet of air into said bore.

5. Apparatus for forming loops on a coil spring comprising a pair of support members each of which has an open ended spring receiving and locating bore there-through; a pair of loop forming mechanisms each of which is associated with a respective one of said supporting members adjacent an open end of the bore thereof and each of which includes a forming anvil to engage the end of a spring within the bore of its associated support member and a pick element movable against said anvil for bending the terminal coil of a spring outward to form a loop on the spring; means associated with each of said supporting members for rotating and axially advancing a spring within the bore thereof to a predetermined position and orientation against the associated anvil; a first one of said support members being adapted to support a spring during the formation of a first loop thereon at a first end thereof by its associated loop forming mechanism and being mounted on a pivot arm and the second one of said support members being adapted to support a spring during the formation of a second loop thereon at a second end thereof by its associated loop forming mechanism and being rigidly mounted on a frame member, said pivot arm

being pivotal to move said first support member between a loop forming position adjacent its associated loop forming mechanism and a spring transfer position in which the bore thereof is axially aligned and adjacent the bore of said second support member; means for effecting transfer of a spring from said first support member to said second support member when said first member is in said spring transfer position, the anvil of the loop forming mechanism associated with said rigidly mounted second support member being retractable from the bore thereof to permit discharge of a spring therefrom; and means for effecting such discharge of a spring from the bore of said second support member.

6. The apparatus of claim 5 wherein a loop receiving annular relief groove is provided within the bore of said second support member spaced from said open end a distance substantially equal to the length of said spring for accommodating a loop on the first end thereof to permit unobstructed rotation of said spring into proper loop forming orientation against the anvil of the loop forming mechanism associated with said second support member.

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30 WILLIAM J. STEPHENSON, *Primary Examiner.*

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,336,953

August 22, 1967

George A. Reddington

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 22, after "mov-" insert -- ing one of the cylinders to align its bore with that of the --.

Signed and sealed this 5th day of August 1969.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.

Commissioner of Patents