Feb. 16, 1954 G. D. FENTON ET AL 2,669,275

APPARATUS FOR INSTALLING CLIPS IN COIL SPRINGS

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FIG. 1.

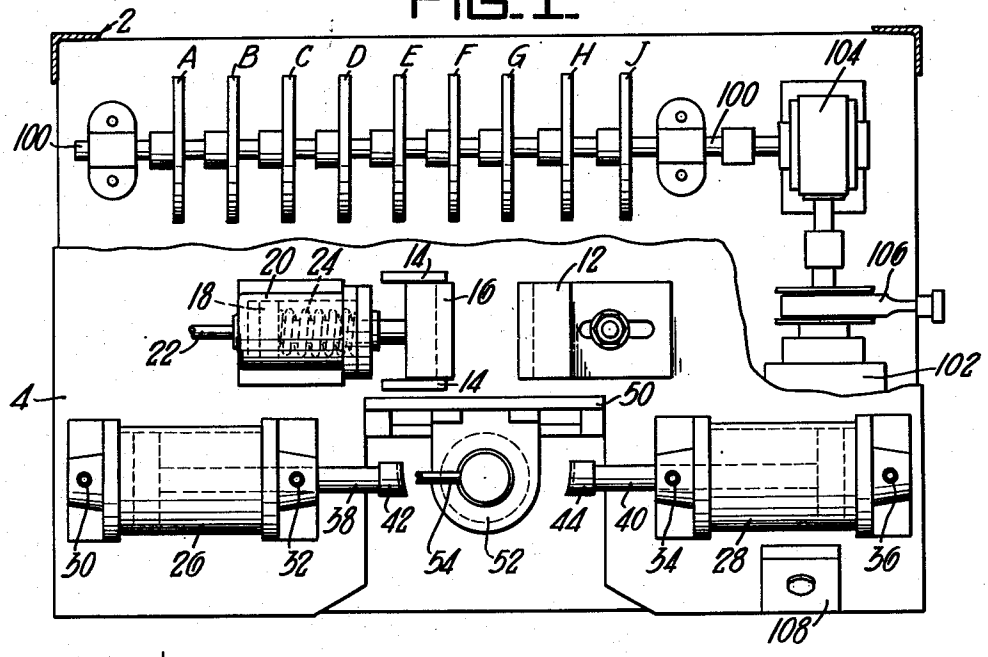
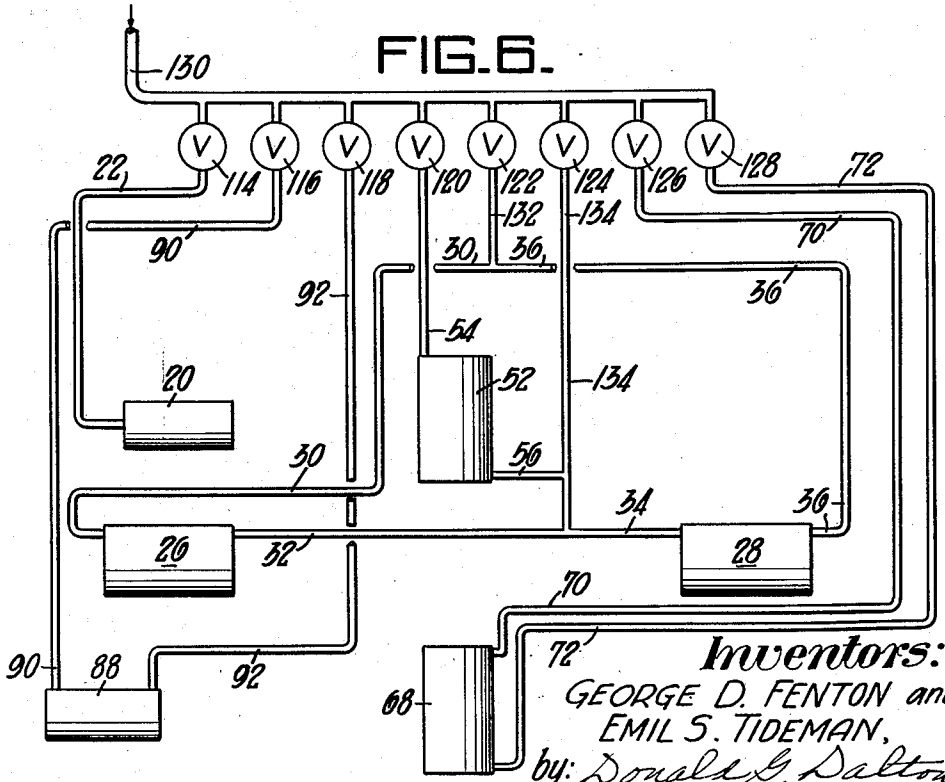


FIG. 6.



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FIG. 2.

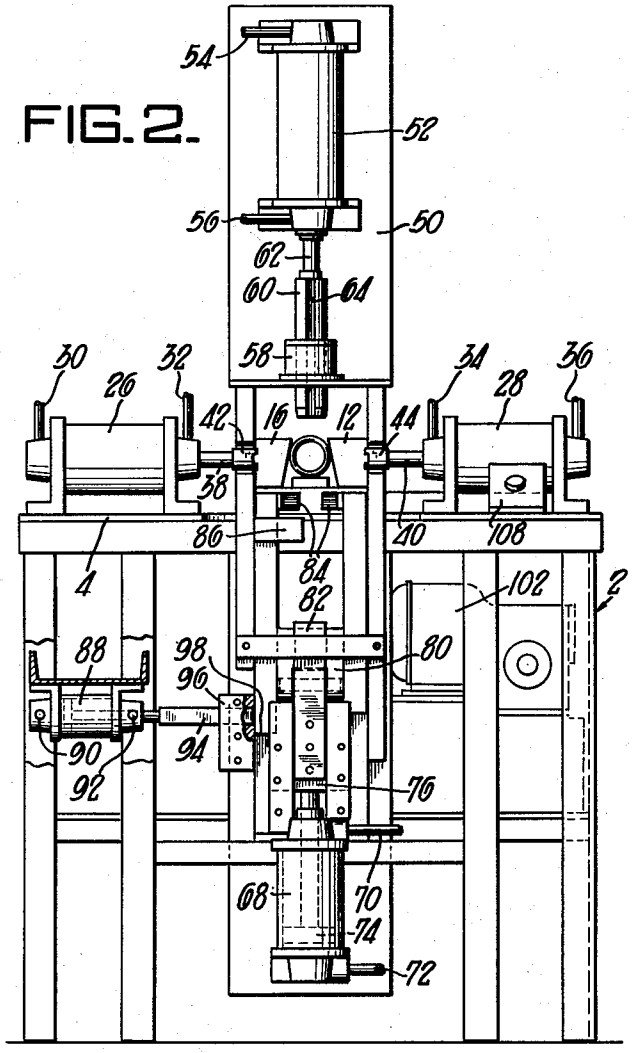


FIG. 4.

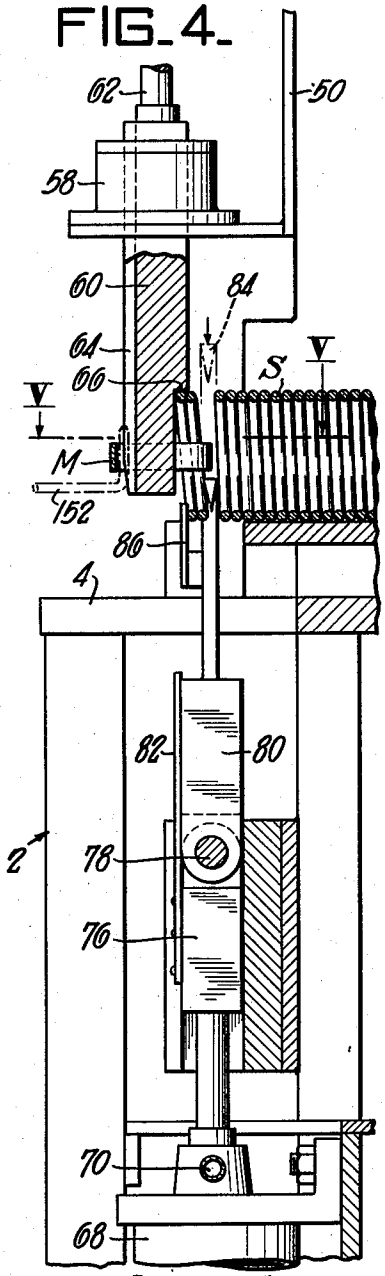
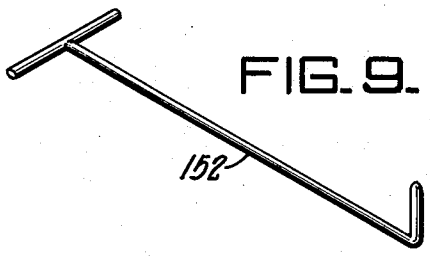


FIG. 9.



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APPARATUS FOR INSTALLING CLIPS IN COIL SPRINGS

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FIG. 3.

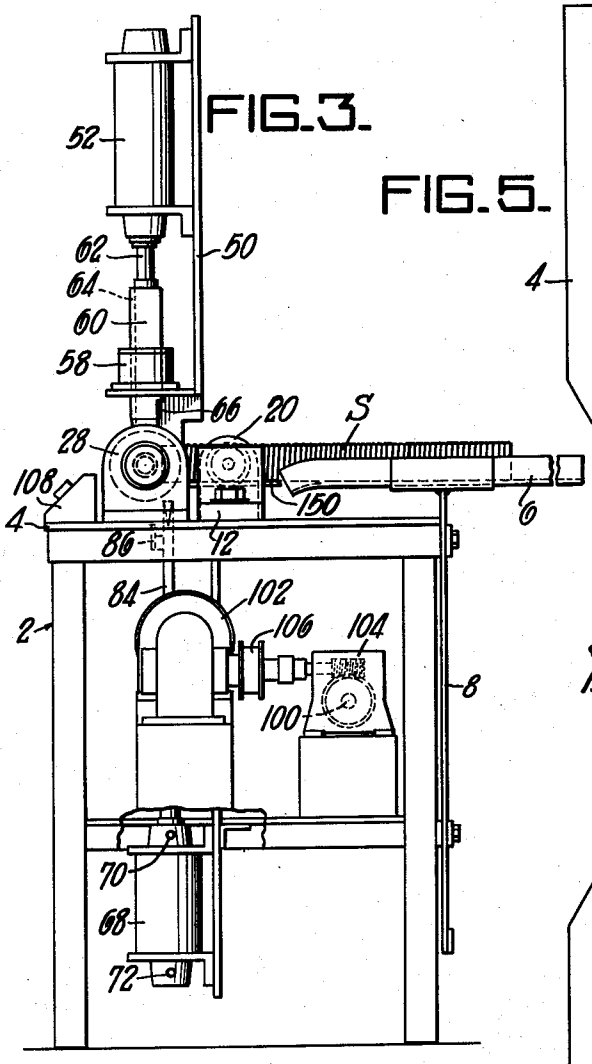


FIG. 5.

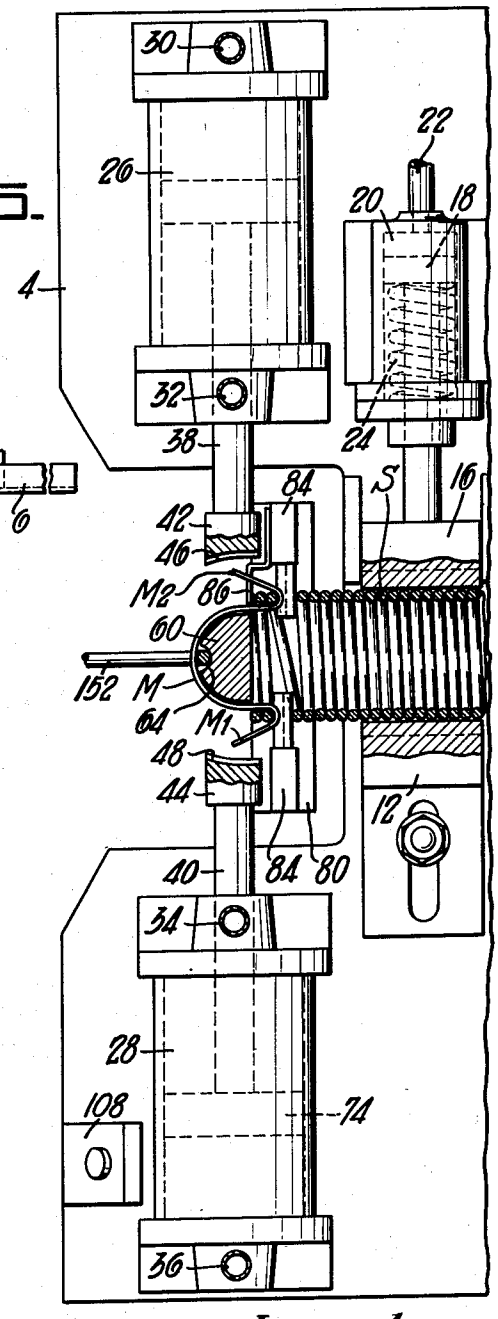
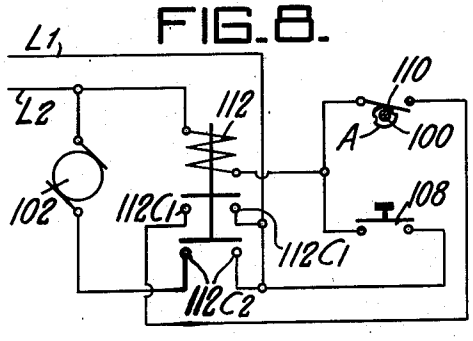


FIG. 8.



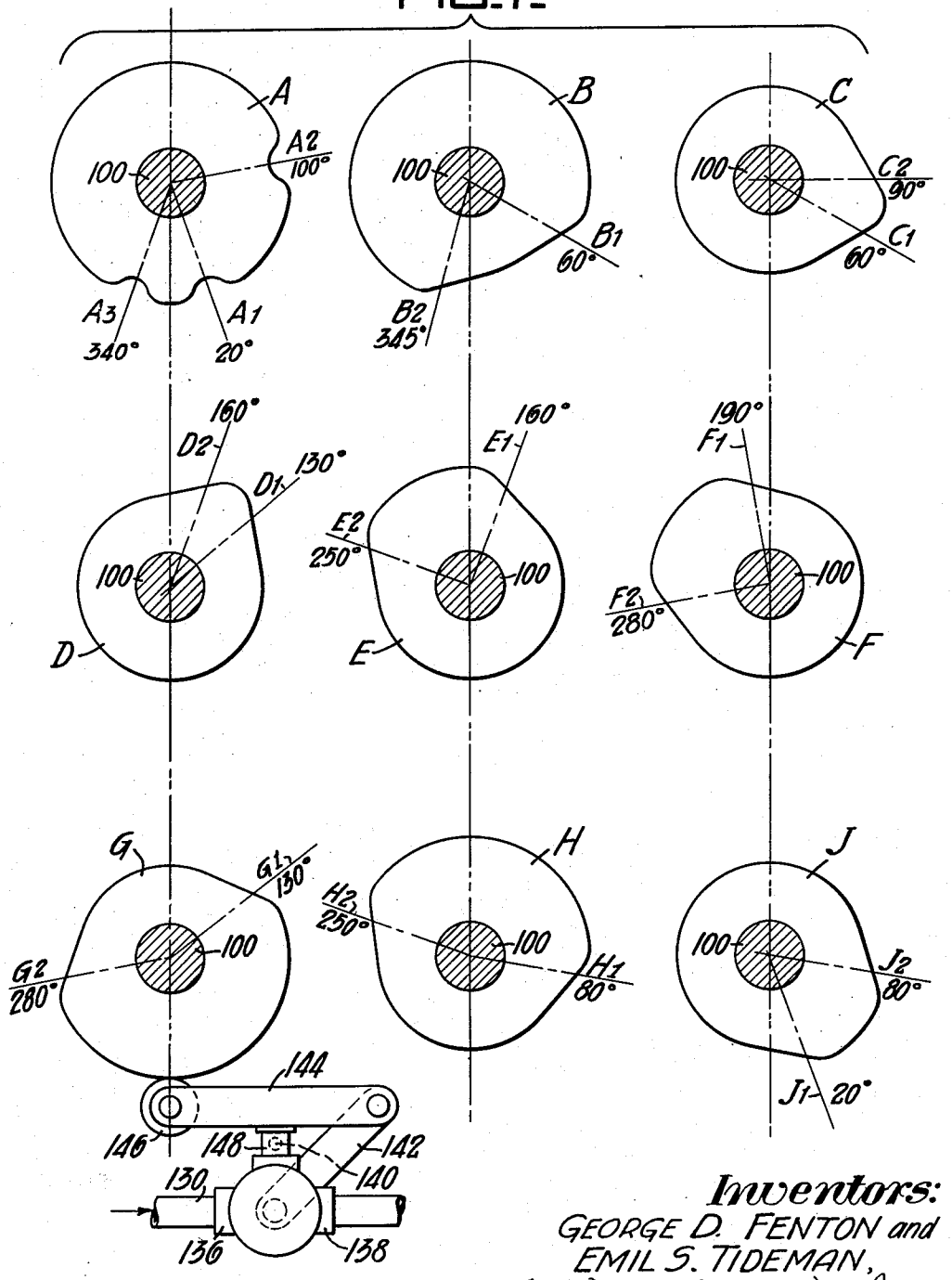
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APPARATUS FOR INSTALLING CLIPS IN COIL SPRINGS

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FIG. 7.



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UNITED STATES PATENT OFFICE

2,669,275

APPARATUS FOR INSTALLING CLIPS IN COIL SPRINGS

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Application February 5, 1951, Serial No. 209,505

8 Claims. (Cl. 153—1)

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This invention relates to apparatus for installing flat wire clips in the end coils of closely wound coil springs and more particularly to springs which are used in conjunction with overhead garage doors. In these springs it is necessary to install M-shaped clips between convolutions near the end of the spring such as the second and third convolutions. Prior to our invention this was done by forcing an opening in the coil with a hand tool and then twisting a clip into the opening to the proper depth. When the clip was properly positioned, it was necessary to hammer the end tabs of the clip shut. This method was slow and the labor cost was extremely high. There was also definite accident hazard in assembling the clip.

It is an object of our invention to provide semi-automatic apparatus for attaching M-shaped clips into the end coils of a closely wound coil spring.

This and other objects will be more apparent after referring to the following specification and attached drawings, in which:

Figure 1 is a top plan view of our machine with parts cut away;

Figure 2 is a front elevation of the machine of Figure 1;

Figure 3 is a side elevation of the machine of Figure 1;

Figure 4 is a vertical sectional view taken substantially through the center line of a spring located in position for a clip to be inserted therein;

Figure 5 is an enlarged sectional view taken on the line V—V of Figure 4;

Figure 6 is a schematic diagram of the air cylinders and the air system therefor;

Figure 7 is a view showing the various cams for controlling the operation of the machine;

Figure 8 is a schematic wiring diagram; and

Figure 9 is a perspective view of a hook used in connection with our invention.

Referring more particularly to the drawings the reference numeral 2 indicates a machine frame having a horizontal top 4. A spring trough or feed table 6 is supported above the top 4 by means of an adjustable bar 8 fastened to the rear end of the frame 2. If desired, an outboard support (not shown) may also be provided. Mounted on the table top 4 at one side of the spring trough 6 is a stationary vise jaw 12. Mounted on the table top 4 in alignment with the jaw 12, but on the opposite side of spring trough 6, are guides 14 which receive a movable vise jaw 16. Jaw 16 is attached to the

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piston rod of a piston 18 which is received in an air cylinder 20 having an air inlet 22 at its rear end. A spring 24 is provided for retracting the jaw 16 when air pressure is removed from the piston. The inner ends of the jaws 12 and 16 are beveled downwardly and outwardly so as to better hold the coil spring S.

Air cylinders 26 and 28 are mounted on table top 4 in substantial alignment with each other and in substantial parallelism with air cylinder 20. Cylinder 26 s provided with air conduits 30 and 32 at its ends and air cylinder 28 is provided with conduits 34 and 36 at its ends. Mounted on piston rods 38 and 40 of the cylinders 26 and 28 are hammers 42 and 44 respectively. The inner faces of the hammers 42 and 44 are provided with horizontal grooves 46 and 48.

A bracket 50 extends upwardly from the table top 4 and supports a vertical air cylinder 52, the axis of which is located between the hammers 42 and 44. Air conduits 54 and 56 are provided, one at each end of the air cylinder 52. A bearing 58 is mounted on the support 50 and slidably receives an arbor 60 which is attached to the piston rod 62 of the piston of the air cylinder 52. The lower part of the arbor 60 is provided with a vertical groove 64 on its forward face. The rear face of the bottom part of the arbor 60 is cut away at 66.

Mounted on the machine frame 2 below table top 4 is an air cylinder 68 having air conduits 70 and 72, one at each end. The air cylinder 68 is in substantial alignment with the air cylinder 52 except that it is slightly to the rear thereof. A piston 74 is slidably mounted in the air cylinder 68 and has connected thereto a member 76 which extends upwardly toward the table 4. Connected to the top of the member 76 by means of a hinge 78 is a tool carrying member 80. A spring 82 fastened to the face of the member 76 extends over the front of tool carrying member 80. A pair of spaced apart wedge shaped tools 84 extends upwardly from and are fastened to the member 80. A stop member 86 is fastened to and extends upwardly from the member 80 to a distance less than the height of the tools 84. A horizontal air cylinder 88 is mounted on the machine frame 2 above and to one side of the air cylinder 68. Air conduits 90 and 92 are connected to the ends of the cylinder 88. Fastened to the piston of the air cylinder 88 is a stop member 94 which is horizontally slidable in a guide 96 from a position at one side of the member 76 to a position in the

path of travel of the member 76. In this second position stop member 94 contacts a shoulder 98 on the member 76 to limit downward movement thereof.

A cam shaft 100 is mounted on the machine frame 2 in any desirable location preferably below the table top 4. The cam shaft 100 is rotated by the motor 102 through a gear reducer 104. A brake 106 is provided between the motor 102 and the gear reducer 104. The cam shaft 100 has nine cams A, B, C, D, E, F, G, H and J mounted thereon. A normally open push button starting switch 108 is provided on the front of the machine in a position easily accessible to the operator. A cam switch 110 is mounted adjacent cam A which is provided with three depressed positions in which the normally closed contacts of the switch are open. When the switches 108 and 110 are in their normal position the motor 106 is started in operation by momentarily depressing the push button switch 108. When this occurs power from the lines L1 and L2 flows through the relay coil 112 thus energizing the coil and causing its contacts 112C1 and 112C2 to close. This causes current to flow through the motor 102 from the line L2 to the contacts 112C2 back to the line L1. When pressure is removed from the push button switch 108 the coil 112 remains energized since current flows from the line L2 to the cam switch 110, contacts 112C1 and back to the line L1. Rotation of the motor 106 causes rotation of the shaft 100 and this rotation will continue until cam A reaches a position in which a depressed portion of cam A causes the contacts of the switch 110 to open. As soon as this occurs the coil 112 becomes deenergized thus deenergizing the motor. However, the cam A continues to rotate a slight amount beyond the depressed portion of the cam before the cam shaft 100 is stopped by means of brake 106. Thus the contacts of switch 110 again become closed.

Located adjacent the cams B, C, D, E, F, G, H and J are three-way air valves 114, 116, 118, 120, 122, 124, 126 and 128, respectively. Air for operating the hydraulic motors is supplied through an air conduit 130 having a branch line leading to each of the valves 114 to 128, inclusive. Valve 114 is connected to conduit 22, valve 116 is connected to conduit 90, valve 118 is connected to conduit 92 valve 120 is connected to conduit 54, and valve 122 is connected to a conduit 132 which in turn is connected to the conduits 30 and 36. Valve 124 is connected to a conduit 134 which in turn is connected to the conduits 32, 34 and 56; valve 126 is connected to conduit 70; and valve 128 is connected to conduit 72. The third port of each of the valves 114 to 128 is open to the atmosphere and the valve will be in position to exhaust to the atmosphere when the connection to the air pressure line 130 is closed. The contours of the cams A to J, inclusive, are shown in Figure 7 in their positions at the start of operation of the machine. The operation of the valves 114 to 128 is the same in each instance and is best shown in Figure 7. Each of the valves has an outlet 136 to the supply line 130, an outlet 138 to the operating cylinder and an exhaust port 140 to the atmosphere. A bracket 142 is fastened to the valve body and pivotally supports a cam lever 144 having a cam follower 146 at its free end which bears against the respective cams. In the position shown in the drawing plunger 148 of the valve is depressed by lever 144 and there is flow of air from the air supply to the operating cylinder. When the cam moves to a position in which the cam follower 146 contacts a depressed portion of the cam, the plunger 148 moves upwardly connecting the port 138 to exhaust port 140 and closing off port 136.

The operation of the device is as follows: With the cams in the position shown all of the pistons will be in their retracted position and the machine is ready for operation. The operator then feeds a spring S into the trough 6 with its front end positioned to the rear of the cylinder 68. The vertical position of the spring S may be varied by providing a removable plate 150 of the desired thickness beneath the spring. The push button switch 108 is momentarily depressed, thus causing rotation of the motor 102 which in turn causes rotation of all of the cams in the direction shown. Rotation of the motor continues until the cam A reaches the depressed portion A1 where opening of the switch 110 causes deenergization of the motor 106. However, the motor continues to turn until the cam follower rises out of the depression A1. The brake 106 then stops all rotation of the motor. In the meantime cam J reaches point J1 which opens valve 128 to supply air through conduit 72 to the cylinder 68. This causes upward movement of the tools 84 to a position above the top level of spring S. In this position the stop 86 will be in line with the spring S. The spring S is then moved against the stop 86 which positions it for insertion of the clip M. The push button switch 108 is then depressed momentarily to energize the motor 102 causing rotation of the cams until the depressed portion A2 of cam A reaches its lowest point of travel. Rotation of the motor 102 then stops in the same manner as described above. In the meantime cam B has rotated so that cam follower 146 contacts point B1, thus supplying air through conduit 22 to cylinder 20 which causes the jaw 16 to move inwardly toward jaw 12 thus clamping the spring S in centered position. Cam C has also rotated to a position where cam follower 146 bears against point C1, this opening valve 116 to admit air to the rear of cylinder 88, thus moving stop 94 to its inner position. Shortly after valve 116 opens cam H reaches point H1 thus opening valve 126 to admit air to conduit 70 and cam J reaches point J2 closing valve 128, thus permitting exhaust of air through conduit 72. This pulls the tools 84 downwardly to the position shown in Figure 4, thus forming an opening between the second and third convolutions in the spring S as shown. It will be noted that shoulder 98 bears against stop 94 limiting the downward movement of the piston 74. The operator then pushes the clip M down through the opening in the convolutions and pulls it to the position shown in Figure 4. The operator holds the end of the clip C in the position shown in Figure 5 by means of a hook 152, the end of which is received in the groove 64. The operator then momentarily depresses the push button switch 108 which causes the motor 106 to rotate until point A3 reaches its lowest point of travel. The motor then stops rotating in the manner described above. In this position the cam shaft 100 has returned to its original position. Various operations take place during this movement of the cam. First point D1 of cam D reaches its lowest position, causing valve 118 to open admitting air through conduit 92 to the front end of cylinder 88, thus retracting the stop 94. This permits piston 74 to complete its stroke to move tools 84 completely through the spring, thus permitting the convolutions to close on the clip M. Pre-

vious to this time the valve 116 had been opened to atmosphere. When point E1 of cam E reaches its lowest position valve 120 will open thus admitting air to conduit 54 and the upper end of cylinder 52. Point G1 of cam G also reaches its lowest position, thus opening valve 124 to atmosphere. This admittance of air to conduit 54 forces the arbor downwardly to the position shown in Figure 4, in which position the arbor acts as an anvil. Point F1 of cam F then reaches its lowest position, thus admitting air through valve 122 to conduits 30 and 36 causing the hammers 42 and 44 to move inwardly and bend the outer legs M1 and M2 against the inner legs of the clip M, thus fastening the clip securely to the spring S. Point E2 of cam E then reaches its lowest point, thus opening valve 120 at atmosphere and point G2 of cam G reaches its lowest point opening valve 124 to retract the anvil 60 and the hammers 42 and 44. Point F2 of cam F reaches its lowest point at the same time thus opening valve 122 to atmosphere and permitting this reverse movement of the hammers. Point B2 of cam B then reaches its lowest point, thus opening valve 114 to atmosphere permitting the spring 24 to open the vise to release the spring S. This completes the operation, the spring is removed and the machine is ready to receive another spring for insertion of a clip.

While one embodiment of our invention has been shown and described it will be apparent that other adaptations and modifications may be made without departing from the scope of the following claims.

We claim:

1. Apparatus for installing an M-shaped clip on a coil spring comprising a substantially horizontal feed table for the spring, means for clamping a coil spring in position on said feed table, four fluid cylinders arranged radially around one end of the clamped coil spring at approximately 90° intervals, a piston in each of said cylinders, a pair of spaced apart wedge shaped tools attached to and movable with one of said pistons, an arbor attached to and movable with the piston opposite the tool carrying piston, a hammer attached to each of the other two pistons, means for causing said tool carrying piston to move radially to force said tools part way through the coil spring to separate a pair of adjacent coils thereof, means for causing said tool carrying piston to move radially to move said tools out of engagement with said spring after an M-shaped clip has been inserted in position through said spring, means for causing said arbor carrying piston to move radially inwardly to insert said arbor into a position between the inner legs of said clip, means for causing said hammer carrying pistons to move radially inwardly to force said hammers against the outer legs of said clip and bend them against the inner legs, means for causing said arbor and hammer carrying pistons to move radially outwardly to retract the arbor and hammers from said spring.

2. Apparatus for installing an M-shaped clip on a coil spring comprising a substantially horizontal feed table for the spring, means for clamping a coil spring in position on said feed table, four fluid cylinders arranged radially around one end of the clamped coil spring at approximately 90° intervals, a piston in each of said cylinders, a pair of spaced apart wedge shaped tools attached to and movable with one of said pistons, an arbor attached to and movable with the piston opposite the tool carrying piston, a hammer attached to each of the other two pistons, means for causing said tool carrying piston to move radially to force said tools part way through the coil spring to separate a pair of adjacent coils thereof, means for stopping movement of said tool carrying piston after the tools have separated said adjacent coils of the spring, means for completing movement of said tools through said spring after a clip has been inserted in position through said spring, means for causing said arbor carrying piston to move radially inwardly to insert said arbor into a position between the inner legs of said clip, means for causing said hammer carrying pistons to move radially inwardly to force said hammers against the outer legs of said clip and bend them against the inner legs, means for causing said arbor and hammer carrying pistons to move radially outwardly to retract the arbor and hammers from said spring.

3. Apparatus for installing an M-shaped clip on a coil spring comprising a substantially horizontal feed table for the spring, means for clamping a coil spring in position on said feed table, four fluid cylinders arranged radially around one end of the clamped coil spring at approximately 90° intervals, a piston in each of said cylinders, a pair of spaced apart wedge shaped tools attached to and movable with one of said pistons, an end stop for said spring carried by said tool carrying piston below said tools, an abutment connected to said tool carrying piston, a fifth fluid cylinder between said table and the cylinder of the tool carrying piston arranged at approximately right angles thereto, a piston in said fifth cylinder, a horizontally movable stop member attached to said last named piston, an arbor attached to and movable with the piston opposite the tool carrying piston, a hammer attached to each of the other two pistons, means for causing said tool carrying piston to move radially to force said tools part way through the coil spring to separate a pair of adjacent coils thereof, means for causing said fifth piston to move inwardly until its stop member moves into position to engage the abutment and prevent further outward movement of said tools, means for causing said fifth piston to move outwardly to remove its stop member from engagement with said abutment and permit said tools to complete their movement through said spring after a clip has been inserted in position through said spring, means for causing said arbor carrying piston to move radially inwardly to insert said arbor into a position between the inner legs of said clip, means for causing said hammer carrying pistons to move radially inwardly to force said hammers against the outer legs of said clip and bend them against the inner legs, means for causing said arbor and hammer carrying pistons to move radially outwardly to retract the arbor and hammers from said spring.

4. Apparatus for installing an M-shaped clip on a coil spring comprising a substantially horizontal feed table for the spring, means for clamping a coil spring in position on said feed table, four fluid cylinders arranged radially around one end of the clamped coil spring at approximately 90° intervals, a piston in each of said cylinders, a tool carrying member pivotally connected to one of said pistons, a pair of spaced apart wedge shaped tools mounted on said tool carrying member, an end stop for said spring mounted on said tool carrying member inwardly of said tools, an abutment connected to said last named piston, a fifth fluid cylinder between said table and the

cylinder of the tool carrying piston arranged at approximately right angles thereto, a piston in said fifth cylinder, a horizontally movable stop member attached to said last named piston, an arbor attached to and movable with the piston opposite the tool carrying piston, a hammer attached to each of the other two pistons, means for causing said tool carrying piston to move radially to force said tools part way through the coil spring to separate a pair of adjacent coils thereof, means for causing said fifth piston to move inwardly until its stop member moves into position to engage the abutment and prevent further outward movement of said tools, means for causing said fifth piston to move outwardly to remove its stop member from engagement with said abutment and permit said tools to complete their movement through said spring after a clip has been inserted in position through said spring, means for causing said arbor carrying piston to move radially inwardly to insert said arbor into a position between the inner legs of said clip, means for causing said hammer carrying pistons to move radially inwardly to force said hammers against the outer legs of said clip and bend them against the inner legs, means for causing said arbor and hammer carrying pistons to move radially outwardly to retract the arbor and hammers from said spring.

5. Apparatus for installing an M-shaped clip on a coil spring comprising a substantially horizontal feed table for the spring, a stationary vise jaw at one side of the feed table, a movable vise jaw at the other side of the feed table, a fluid cylinder, a piston in said cylinder, means connecting said piston to said movable vise jaw to clamp a coil spring in position on said feed table, four fluid cylinders arranged radially around the clamped end of the clamped coil spring at approximately 90° intervals, a piston in each of said cylinders, a pair of spaced apart wedge shaped tools attached to and movable with one of said pistons, an arbor attached to and movable with the piston opposite the tool carrying piston, a hammer attached to each of the other two pistons, means for causing said tool carrying piston to move radially to force said tools part way through the coil spring to separate a pair of adjacent coils thereof, means for stopping movement of said tool carrying piston after the tools have separated said adjacent coils of the spring, means for completing movement of said tools through said spring after a clip has been inserted in position through said spring, means for causing said arbor carrying piston to move radially inwardly to insert said arbor into a position between the inner legs of said clip, means for causing said hammer carrying pistons to move radially inwardly to force said hammers against the outer legs of said clip and bend them against the inner legs, means for causing said arbor and hammer carrying pistons to move radially outwardly to retract the arbor and hammers from said spring.

6. Apparatus for installing an M-shaped clip on a coil spring comprising a substantially horizontal feed table for the spring, a vise jaw at one side of the feed table, a movable vise jaw at the other side of the feed table, a fluid cylinder, a piston in said cylinder, means connecting said piston to said movable vise jaw, a second fluid cylinder below said feed table, a piston in said second fluid cylinder, a wedge shaped tool attached to said last named piston, a third fluid cylinder above said feed table in substantial alignment with said second cylinder, a piston in said third cylinder, a downwardly extending arbor attached to said last named piston, fourth and fifth fluid cylinders mounted one on each side of said feed table at approximately the same elevation as said feed table and in substantially the same vertical plane as said third cylinder, a piston in each of said last named cylinders, a hammer connected to each of said last named pistons, means for supplying fluid to the rear of said first cylinder to clamp a coil spring in said vise, means for supplying fluid to the second cylinder to force the tools part way through the coil spring to separate a pair of adjacent coils thereof, means for causing said tool carrying piston to move said tools through said spring after an M-shaped clip has been inserted in position through said separated coils, means for supplying fluid to the top of said third cylinder to move said arbor into a position between the inner legs of said clip, means for supplying fluid to the outer ends of said fourth and fifth cylinders to force said hammers against the outer legs of said clip and bend them against the inner legs, means for supplying fluid to the inner ends of said third, fourth and fifth cylinders to retract the hammers and arbor from said spring, and means for retracting the movable vise jaw to release said spring.

7. Apparatus for installing an M-shaped clip on a coil spring comprising a substantially horizontal feed table for the spring, a vise jaw at one side of the feed table, a movable vise jaw at the other side of the feed table, a fluid cylinder, a piston in said cylinder, means connecting said piston to said movable vise jaw, a second fluid cylinder below said feed table, a piston in said second fluid cylinder, a vertically movable tool carrying member connected to said last named piston, a pair of spaced apart wedge shaped tools mounted on said tool carrying member, an end stop for said spring mounted on said tool carrying member below said tools, an abutment connected to said last named piston, a third fluid cylinder above said feed table in substantial alignment with said second cylinder, a piston in said third cylinder, a downwardly extending arbor attached to said last named piston, fourth and fifth fluid cylinders mounted one on each side of said feed table at approximately the same elevation as said feed table and in substantially the same vertical plane as said third cylinder, a piston in each of said last named cylinders, a hammer connected to each of said last named pistons, means for supplying fluid to the bottom of said second cylinder to raise the stop thereof to a position in alignment with a spring on said feed table, means for supplying fluid to the rear of said first cylinder to clamp a coil spring in said vise, means for supplying fluid to the top of said second cylinder to force the tools downwardly part way through the coil spring to separate a pair of adjacent coils thereof, means for stopping movement of said tool carrying piston after the tools have separated adjacent coils of the spring, means for making said last named means inoperative to permit movement of said tools through said spring after an M-shaped clip has been inserted in position through said separated coils and arranged in a horizontal position, means for supplying fluid to the top of said third cylinder to move said arbor into a position between the inner legs of said clip, means for supplying fluid to the outer ends of said fourth and fifth cylinders to force said hammers against the outer legs of said clip and bend them against the inner

legs, means for supplying fluid to the inner ends of said third, fourth and fifth cylinders to retract the hammers and arbor from said spring, and means for retracting the movable vise jaw to release said spring.

8. Apparatus for installing an M-shaped clip on a coil spring comprising a substantially horizontal feed table for the spring, a vise jaw at one side of the feed table, a movable vise jaw at the other side of the feed table, a fluid cylinder, a piston in said cylinder, means connecting said piston to said movable vise jaw, a second fluid cylinder below said feed table, a piston in said second fluid cylinder, a vertically movable tool carrying member pivotally connected to said last named piston, a pair of spaced apart wedge shaped tools mounted on said tool carrying member, an end stop for said spring mounted on said tool carrying member below said tools, an abutment connected to said last named piston, a third fluid cylinder between said second fluid cylinder and the feed table, a piston in said third fluid cylinder, a horizontally movable stop member attached to said last named piston, a fourth fluid cylinder above said feed table in substantial alignment with said second cylinder, a piston in said fourth cylinder, a downwardly extending arbor attached to said last named piston, fifth and sixth fluid cylinders mounted one on each side of said feed table in approximately the same vertical plane as said fourth cylinder, a piston in each of said last named cylinders, a hammer connected to each of said last named pistons, means for supplying fluid to the bottom of said second cylinder to raise its stop to a position in alignment with a spring on said feed table, means for supplying fluid to the rear of said first cylinder to clamp a coil spring in said vise, means for supplying fluid to the rear of said third cylinder

to move its stop member to a position below the said abutment, means for supplying fluid to the top of the second cylinder to force the tools downwardly part way through the coil spring to separate a pair of adjacent coils thereof, said stop member bearing against said abutment to stop downward movement of said tool carrying member, means for supplying fluid to the forward end of said third cylinder to retract it stop member from beneath said abutment to permit movement of said tools through said spring after an M-shaped clip has been inserted through said separated coils and arranged in a horizontal position, means for supplying fluid to the top of said fourth cylinder to move said arbor into a position between the inner legs of said clip, means for supplying fluid to the outer ends of said fifth and sixth cylinders to force said hammers against the inner legs, means for supplying fluid to the inner ends of said fourth, fifth and sixth cylinders to retract the hammers and arbor from said spring, and means for retracting the movable vise jaw to release said spring.

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EMIL S. TIDEMAN.

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