Feb. 16, 1954 H. OTTE 2,669,009

OIL CUP ASSEMBLY MACHINE

Filed Jan. 25, 1950 3 Sheets-Sheet 1

FIG. 1

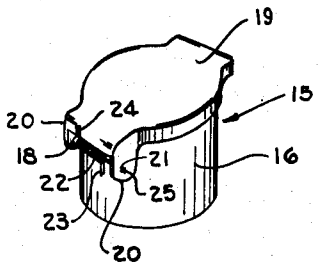


FIG. 3

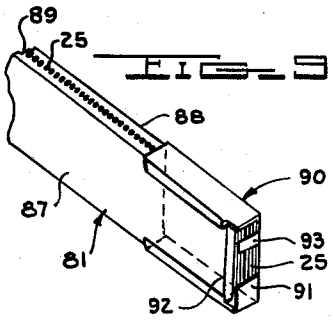


FIG. 2

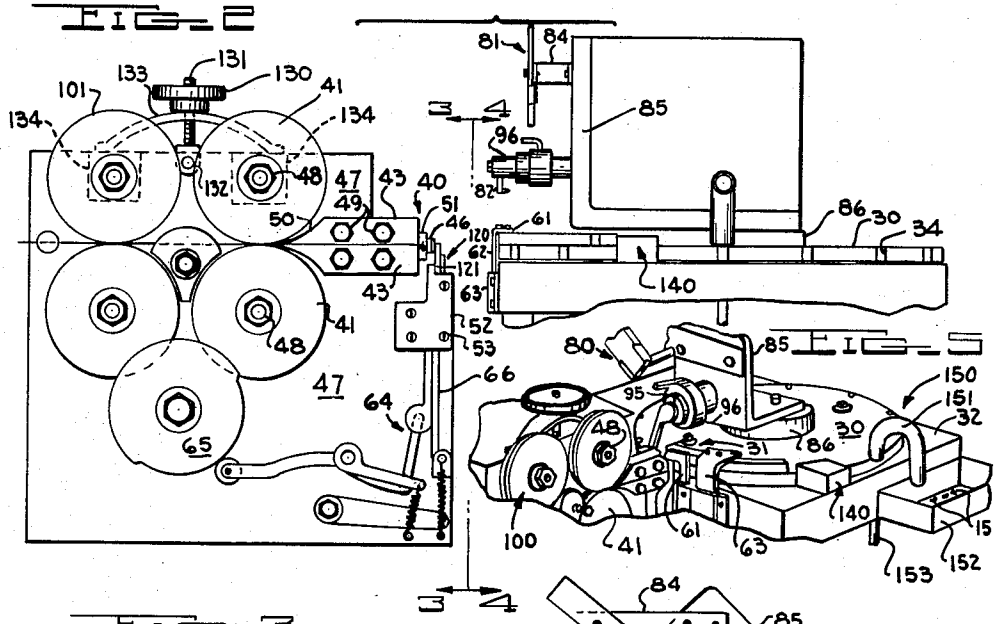


FIG. 5

FIG. 3

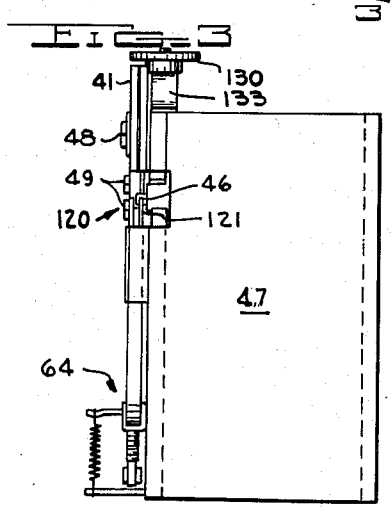
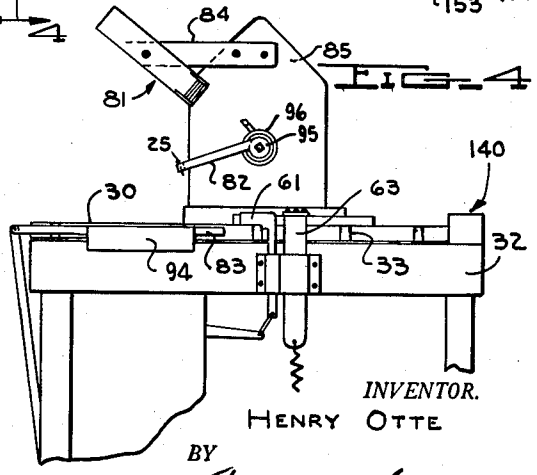


FIG. 4



INVENTOR.
HENRY OTTE
BY
Arthur M. Smith
ATTORNEY

Feb. 16, 1954 H. OTTE 2,669,009

OIL CUP ASSEMBLY MACHINE

Filed Jan. 25, 1950 3 Sheets-Sheet 2

FIG. 6

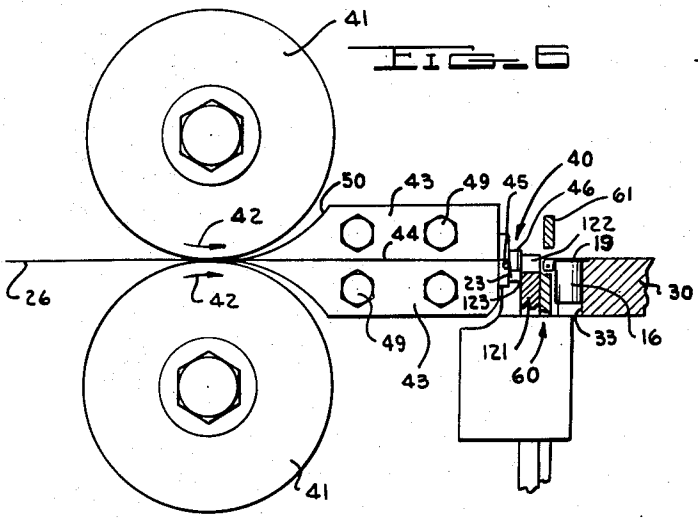


FIG. 7

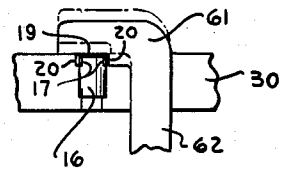


FIG. 8

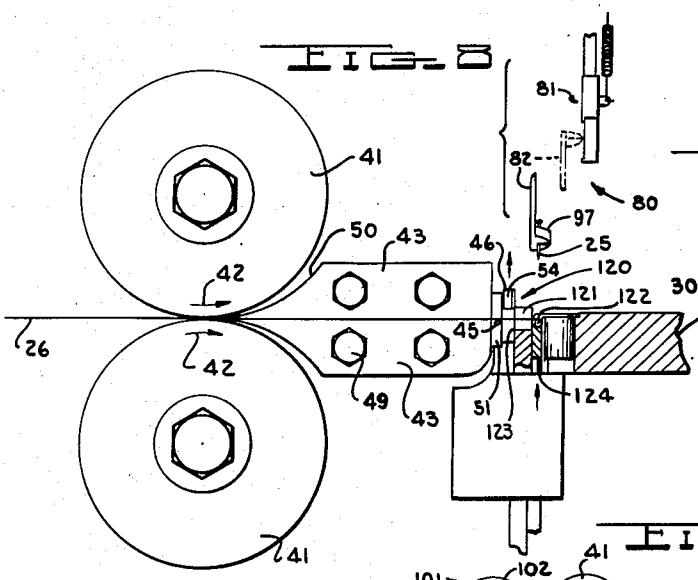


FIG. 10

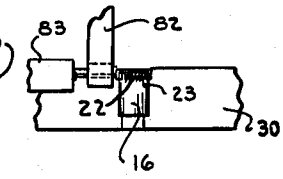


FIG. 11

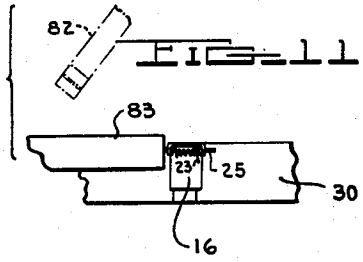
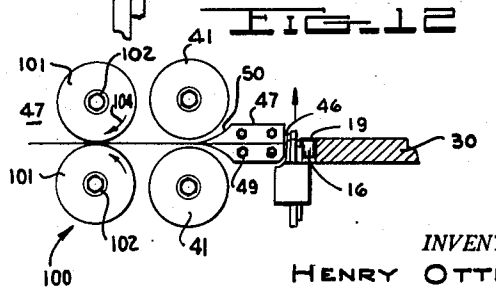


FIG. 12



INVENTOR.
HENRY OTTE
BY Arthur M. Smith
ATTORNEY

Feb. 16, 1954 H. OTTE 2,669,009

OIL CUP ASSEMBLY MACHINE

Filed Jan. 25, 1950 3 Sheets-Sheet 3

FIG. 13

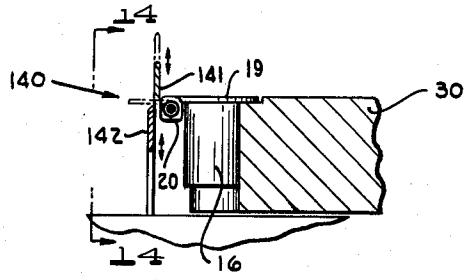


FIG. 14

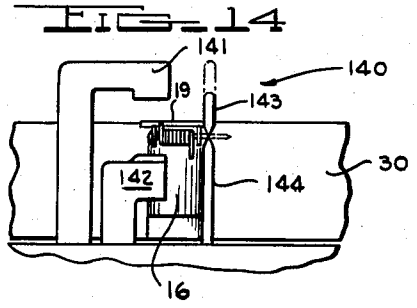
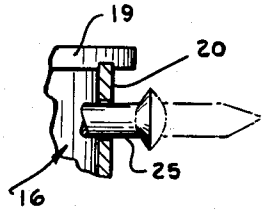


FIG. 15



INVENTOR.
HENRY OTTE
BY Arthur M. Smith
ATTORNEY

Patented Feb. 16, 1954

2,669,009

UNITED STATES PATENT OFFICE

2,669,009

OIL CUP ASSEMBLY MACHINE

Henry Otte, Detroit, Mich., assignor to Bowen Products Corporation, Ecorse, Mich., a corporation of Michigan

Application January 25, 1950, Serial No. 140,487

2 Claims. (Cl. 29—148.2)

1

This invention relates generally to an assembly process and machine for a spring loaded cap assembly and more particularly, but not exclusively, to a machine and process for assembling an oil cup and cap with a closure spring and for automatically tensioning the spring to hold the cap securely, yet yieldably, in its closed position.

Oil cups of the general type to which the present invention is concerned are extensively used in very large quantities in multifarious machines, such as electric motors. Prior to the present invention, it has not been possible to produce these oil cup units on a mass production basis, but instead they were assembled manually after separate manufacture of each of the component parts. Due to the relatively small dimensions of the various parts of the assembly, the necessity for tensioning of the spring during assembly and the number of operations required to assemble a single unit, the manual assembly operation is difficult, slow and relatively expensive. For example, one oil cup assembly unit which is frequently used includes a spring having a diameter approximately $\frac{1}{16}$ of an inch and an overall length of approximately $\frac{3}{32}$ of an inch. Previously, it was necessary to form the spring in a special operation. The cup, cap and preformed spring were then held manually in an assembled position and assembled with a retaining pin or nail while maintaining the spring under tension. The many economic and operational disadvantages of such procedure should be apparent.

In the present invention, the spring is formed and assembled under tension with a cup and cap entirely and automatically by a machine. While the novel process disclosed herein may be carried out by various machines, it is preferred that the machine operate in a timed cycle wherein the various component parts are coordinated to provide several operations simultaneously and to complete the entire assembly cycle in a minimum time period.

In the embodiment of the machine shown in the drawings, an indexing table is provided having a plurality of cup receiving recesses adapted to receive a cup and a cap in assembled relation thereon prior to indexing of the table to the spring assembly station. In the beginning of the operation of the machine the end of the spring wire is provided with an engaging tip and the wire is then formed to provide a spring coil adjacent the tip. At this point, the coil is still attached to the unfinished supply of wire. The spring is then moved by means of the unfinished wire into assembled relation with the cup and

2

cap, between the spaced depending tabs thereof, and secured in assembled relation with the cup and cap by an automatically inserted nail.

The tensioning of the spring is effected by drawing on the unformed end of the spring wire while simultaneously holding the free end of the coil against rotation relative to the cap and cup.

A cutting tool in the machine then automatically severs the spring wire at a point spaced somewhat from the spring coil so as to provide a second engaging tip on the coil. At this point, the engaging tips engage the cap and cup respectively, so as to maintain the spring under the desired tension and normally hold the cap in its closed position.

The table then indexes to bring the assembled cup and cap unit to the spring wire trim and nail cut-off station. At this station the last formed engaging tip on the spring coil is trimmed to make the end thereof substantially coincide with the top of the cap. Also, the end of the nail is pinched off and flared to secure the component parts in assembled relation.

The table then indexes a second time and the finished cup and cap assembly is removed from the table, such as by an air blast.

The latter operations have been described in timed relation to the same oil cup and cap unit. However, it should be understood that the operations at the various work stations of the machine are preferably performed simultaneously on different assembly units.

Feeding of the spring wire, both to effect the formation of the spring coil, and to position the spring coil within assembled relation with the cap and cup is effected by a pair of feed rollers. A second pair of rollers is provided to retract the spring wire and thus effect tensioning of the spring coil. These rollers engage opposite sides of the spring wire and are coordinated in operation with the operation of the other component parts of the machine.

It is, therefore, a primary object of this invention to provide a method and machine for automatically and mechanically assembling complete oil cup assembly units and for automatically forming the cap closure spring and for tensioning the same while in assembled relation with the cap and cup.

Another object is to provide a method and machine of the above type in which the spring coil is formed and assembled with the cap and cup prior to severing the coil from the unformed spring wire so as to use the latter in positioning the coil in assembled relation with the cap

and cup and also for tensioning the coil thereafter.

Another object of the present invention is to provide a machine of the above type in which an unformed spring wire is provided with an engaging tip and coiled adjacent the engaging tip to produce a coil spring and in which, after positioning and assembling the coil with the cup and cap and tensioning the spring, the spring wire is then severed at a point spaced from the coil to provide a second engaging tip to maintain tension on the assembled spring.

Another object is to provide a machine having a plurality of feed rollers for the spring wire which operates in timed relation with the other component parts of the machine, which rollers automatically operate to feed the spring wire against a forming tool to produce a spring coil, to feed the formed spring coil into assembled position with the cap and cup, to draw on the spring wire after it is secured to the cap and cup to effect the tensioning of the coil spring and to return the spring wire to its initial position after it has been severed from the spring coil.

Still another object of the invention is to provide a machine having provisions for trimming the engaging tip on the coil spring so that the latter does not extend above the top of the cap when in operative engagement with the latter.

Another object is to provide a means for flaring the end of the nail so as to secure the unit in assembled relation and also a means for automatically removing the finished oil cup unit from the indexing table.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Fig. 1 is a perspective view of an oil cup unit assembled in the machine and in accordance with the process of the present invention.

Fig. 2 is an end elevation at the machine embodying the features of the present invention and showing the two main parts of the machine somewhat separated for clarity.

Fig. 3 is a side elevation of the wire forming and feeding mechanism, looking in the direction of the arrows 3—3 of Fig. 2.

Fig. 4 is a side elevational view of the indexing table and nail feeding mechanism, looking in the direction of the arrows 4—4 of Fig. 2.

Fig. 5 is a fragmentary perspective view of the assembly machine of the present invention.

Fig. 6 is an elevational view, partly in section, showing the spring wire feeding mechanism and coil spring forming mechanism and also showing a cap and cup positioned to receive the coil spring being formed.

Fig. 7 is a sectional view showing the guide fork for holding the cap and cup in assembled relation.

Fig. 8 is an elevational view, partly in section, showing the coil spring in assembled relation with the cap and cup and also showing the nail pick-up arm just prior to insertion of the nail into the aligned openings of the cap, cup and spring.

Fig. 9 is a fragmentary perspective view showing the nail hopper.

Fig. 10 is a fragmentary elevational view showing the ram as it initially engages the nail to move the same into assembled relation.

Fig. 11 is a similar view showing the ram in its fully extended position and showing the retaining nail in its final position.

Fig. 12 is an elevational view, partly in section, showing the feed rollers in their disengaged position and the draw rollers in an engaged position with the spring wire just following the spring coil cut-off operation.

Fig. 13 is a sectional view illustrating the coil spring trimming mechanism and showing the severed portion of the spring wire tab in phantom.

Fig. 14 is an elevational view taken substantially on the line 14—14 of Fig. 13.

Fig. 15 is a fragmentary sectional view illustrating the nail cut-off operation and showing the severed portion of the nail in phantom.

Before explaining the present invention in detail it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

The oil cup unit 15 with which the present invention is concerned is shown particularly in Fig. 1 and comprises a cup 16 having a pair of spaced tabs 17 provided with aligned openings 18; a cap 19 having a similar pair of spaced downwardly depending tabs 20 overlying the tabs 17 and provided with openings 21 in axial alignment with the openings 18; a coil spring 22 having engaging tips 23 and 24 adapted to engage a portion of the cap and cup respectively to maintain the spring under tension and resiliently hold the cap 19 in closed position; and a nail 25 extending through the openings 18 and 21 and the coil spring 22.

In the embodiment of the present invention shown in the drawings, the assembly machine comprises generally an indexing table 30 (see particularly Fig. 5) adapted to index a cup 16 and cap 17 at the spring assembly station 31 at the beginning of each cycle of the machine; a coil spring forming mechanism 40 (Fig. 6) adapted to form a coil spring 18 on the end of the spring wire 26; a coil spring positioning mechanism 60 (Fig. 6) adapted to move the coil spring into assembled relation with the cap and cup and to align the axis of the coil with the openings therein; a nail feeding mechanism 80 (Fig. 8) adapted to pivotally secure the cap and cup and to assemble the same with the coil spring 18; a spring tensioning mechanism 100 (Fig. 12) adapted to tension the coil spring 18 after the same is secured with the cup and cap; a coil spring cut-off mechanism 120 (Fig 2) adapted to sever the coil spring 18 from the spring wire 19 after the tensioning operation of the tensioning mechanism 100, a coil spring trim and nail flaring mechanism 140 (Figs. 13 and 14); and an assembly objector 150 (Fig. 5) for automatically removing the finished units from the table.

As shown particularly in Figs. 2 and 5, the table 30 is annular and is rotatably supported on a supporting structure 32. The table is driven from below by suitable mechanism (not shown) which is housed within the supporting structure and which is adapted to revolve the table in increments in timed relation to the operation of the other component parts of the machine.

The table 30 is provided with a plurality of recesses 33 (Fig. 6) each adapted to receive a

cup 16 and a cap 17 and is also provided with a peripheral groove 34 (Fig. 2) into which the tabs of the cup and cap extend.

In the modification shown herein, the caps and cups are positioned manually in the recesses 33 prior to indexing of the same to the spring assembly station. However, it should be understood that hoppers or the like may be provided for both the caps and cups to permit completely automatic assembly of the oil cup unit 15.

The coil spring forming mechanism 40 is shown particularly in Fig. 6 and includes the feed rollers 41 which are movable into and out of engagement with the spring wire 26 and, in the engaged position, are adapted to rotate in the direction indicated by the arrows 42 to feed the spring wire 26 toward the indexing table 30; the guide bars 43 providing a longitudinal guide slot 44 for the wire; a pin 45 movable in a horizontal plane and in a direction perpendicular to the direction of movement of the wire 26 and adapted to move under and engage the wire in the operative position thereof; and a curling tool 46 movable in a vertical plane, which plane is positioned to the right of the pin as viewed in Fig. 6 and is adapted to engage the projecting end of the spring wire to form, in cooperation with the pin 45, the engaging tip 23 on the coil spring 22.

The curling tool 46 in its down position is in the path of movement of the spring wire and forms a coil on the end of the wire in response to movement of the wire thereagainst. The curling tool is also adapted to move out of the path of the wire after formation of the coil thereon to permit positioning of the coil spring in assembled relation with the cap and cup. Movement of the curling tool 46, as well as movement of the pin 45, and feed rollers 41, is controlled in timed relation with the other component parts of the machine to give a continuous cyclic operation for the coil spring forming mechanism 40.

The feed rollers 41 are journaled in a supporting housing 47 and are operatively connected to a driving shaft (not shown) by the nuts 48. The feed rollers 41 are controlled by a clutch mechanism (not shown) which is adapted to move the rollers into engagement with the spring wire during the coil forming operation (Figs. 2 and 6) and also during feeding of the formed coil spring 22 into assembled relation with the cap and cup (Fig. 8).

The guide bars 43 are secured to the support housing 47 by the bolts 49 and each bar is provided with a corresponding arcuate portion 50 (Figs. 2, 6, 8 and 12) to permit extension of the guide slots between the forward portions of the feed rollers 41.

The pin 45 is axially slidable in the plate 51 secured to the supporting housing 47 and its movement is also controlled, timed and actuated by mechanism (not shown) within the supporting housing. The pin 45 is adapted to extend beneath the spring wire prior to downward movement of the curling tool 46 at the beginning of the spring forming cycle and remains in the extended position until the formation of the coil spring is completed. It then automatically retracts, after the curling tool has raised, to permit forward feeding of the coil spring by the feed rollers 41.

The curling tool 46 is vertically slidable in the supporting housing 47 and is guided by the rear surface of the cutoff fork 121. The bracket 52 is secured to the supporting housing 47 by the screws 53. One side of the curling tool 46 is

formed with an arcuate face 54 (Fig. 8) to permit free rotation of the engaging tip 23 of the coil spring 22 during formation of the coil. While the curling tool 46 may be of any suitable type, it is preferably provided with a vertical groove (not shown) into which the end of the wire being formed is adapted to extend. The groove preferably extends at a slight angle to the vertical to guide the spiral formation of the coil approximately 1 degree to the vertical, depending upon the gage of the wire.

The coil spring positioning mechanism 60 (Fig. 6) includes, in addition to the feed rollers 41, the guide fork 61 having the downward extension 62 (Fig. 2) slidably mounted for vertical movement in the bracket 63 for engaging opposite sides of the cap and cup carried by the indexing table 30; the wire cut-off fork 121 which provides the coil guide slot 122; and the coil spring supporting bar 124 adapted to engage under and support the spring in assembled relation prior to insertion of the nail by the nail feeding mechanism 70. The guide fork 61 is controlled in timed relation to the operation of the machine by suitable mechanism (not shown). The coil spring supporting bar is controlled by suitable mechanism (not shown) through the linkage 64 and cam wheel 65.

The nail feeding mechanism 80 (Fig. 8) comprises the nail hopper 81 (see also Fig. 9); a nail pickup arm 82 adapted to extract a nail 25 from the hopper 81 during each cycle of the machine and position the same in axial alignment with the openings in the tabs 17 and 20 of the cap and cup and the coil spring 22; and a nail ram 83 (Fig. 10) adapted to move the nail 25 into its assembled position.

The nail hopper 81 (Fig. 2) is mounted on a bracket 84 secured to the angle support 85, which support is carried by the vertical shaft 86 on the supporting structure 32. The nail hopper 81 (Fig. 9) comprises a pair of spaced plates 87 and 88 forming a channel 89 therein adapted to receive a row of nails 25 and a retainer 90 secured to the plates 87 and 88. The channel 89 slidably receives the shank of the nails 25 and engages the heads thereof to maintain the nails in alignment. One of the plates 87 has the lower end cut away to provide an opening 92 into which the nail pickup arm 82 is adapted to move.

The retainer 90 has an upper tab 93 which extends over the end of the channel and cooperates with the lower tab 91 to retain the nails in the hopper. The nails are held by gravity against the tabs but are free to move upward in the channel when the nail pickup arm moves into operative position to extract the lowermost nail.

The nail pickup arm 82 (Figs. 2 and 8) is also carried by the angle support 85 and is both pivotal and axially movable relative thereto. The movement of the arm 82 is controlled by a suitable cam mechanism the details of which form no part of the present invention and are, accordingly, not shown in the drawings. As shown particularly in Figs. 2 and 5, the shaft 95 of the nail pickup arm is slidable axially within the housing 96 to permit movement of the spring detent 97 into the hopper (dotted line position, Fig. 8) and out of the hopper after extraction of the nail 25 therefrom. The shaft 95 of the arm is rotatably journaled to pivot the arm downwardly to position the nail in axial alignment with the openings in the tabs of the cap and cup and in the coil spring (Fig. 10). After the ram moves the nail partially into the opening, the shaft 95 moves

axially outwardly relative to the housing 96 to release the nail from the spring detent 97, and then rotates upwardly to begin another cycle. All of the operations of the arm 82 are synchronized with the operations of the other component parts of the machine. Since the details of this mechanism form no part of the present invention, it is not shown or described herein.

The nail ram 83, shown particularly in Figs. 4, 10 and 11 is horizontally slidable in the cylinder 94 on the supporting housing 32 in axial alignment with the openings 18 and 21 of the oil cup unit and is actuated and controlled by any suitable mechanism (not shown) which is timed to the other operations of the machine. The ram 83 is operative upon rotation of the nail pickup arm 82 to its lowered position and automatically retracts after the spring detent 97 releases the nail and after the latter has been fully moved into its assembled position with the cap, cup and coil spring.

The coil spring tensioning mechanism 100 (Fig. 12) includes the draw rollers 101 which are similar to the feed rollers 41, being relatively movable into and out of operative engagement with the spring wire. The draw rollers 101 are each journaled in the supporting housing 47 and are connected to a driving shaft by the nuts 102. The draw rollers are adapted to rotate in the direction of the arrows 104 (see Fig. 12) after the nail 25 has been inserted by the nail feeding mechanism 80 to tension the spring 22.

The coil spring severing mechanism 120 (Fig. 2) comprises the cut-off fork 121 having the guide arms 122 and a cutting edge 123 between the arms on the rearward edge thereof. In operation, the cut-off fork is adapted to move upwardly, shown particularly in Fig. 12 to cooperate with the lower forward cutting surface 124 of the curling tool 46.

The coil spring trim and nail flaring mechanism 140 (Fig. 14) is positioned on the supporting structure 32 at a subsequent station of the indexing table, relative to the assembly station, as shown particularly in Fig. 5. The details of this mechanism are illustrated in Figs. 13–15 inclusive.

With particular reference to Figs. 13 and 14, the coil spring trimming operation is effected by a pair of vertically movable blades 141 and 142. These blades are each slidably mounted on the supporting structure and are operatively coupled by suitable linkage to a prime mover (not shown) in the machine and their operation is suitably coordinated with the other operations of the machine.

The nail severing mechanism is shown particularly in Fig. 14. This mechanism includes a pair of vertically movable cutting members 143 and 144 slidably mounted on the supporting structure and adapted to also operate in synchronism with the other parts of the machine to sever and flare the end of the nail 25. The flared end of the nail, shown particularly in Fig. 15, retains the nail in assembled relation with the cap, cup and coil spring. The severed portion of the nail 25 is shown in phantom in Fig. 15.

The oil cup unit ejector 150 (Figs. 2 and 5) includes the U-shaped hose 151 having an open end positioned above the oil cup assembly and having the other end extending into a receptacle 152. The ejector also includes the air line 153 which is connected to a suitable source of fluid such as air under pressure (not shown). The air under pressure is preferably controlled by a suitable valve operated in synchronism with the other operations of the machine.

The tension of the feed rollers 41 and the draw rollers 101 on the spring wire 26 may be adjusted by the adjusting screw 130. As shown in Fig. 2, a stud 131 is pivotally secured at 132 to the supporting housing 47, and extends through an arcuate spring bar 133. The ends of the spring bar engage bearing blocks 134 which journal the upper rollers 101 and 41 and which are vertically slidable in the support housing 47. Axial movement of the screw 130 on the threaded stud 131 varies the tension on the blocks 134 and accordingly varies the tension between the pairs of rollers 41 and 101.

The coil spring is not severed from the unfinished spring wire until after the coil spring is tensioned. Thus, the unfinished spring may be used to guide and position the coil spring in its assembled position with the cup and cap and may also be used to tension the coil spring after assembly. In this way, the spring coil may easily and readily be handled in spite of the relatively small dimensions of the coil spring and a substantial savings in material is effected since the retracted spring wire may be utilized in the next successive spring coil.

A savings of material is also effected in that a smaller nail may be used with the automatic nail severing and flaring mechanism than was possible when the assembly was performed manually. While, per unit, this savings may appear relatively small, when manufacturing oil cup units in very large quantities, savings of a fractional cent per unit is very advantageous and important.

The engaging tips on the spring coil are automatically provided on the spring coil, which tips maintain the desired tension on the spring after complete assembly. The first tip is formed by a cooperation between the draw rollers 101, the curling tool 46 and the pin 45. After completion of one cycle of the machine, the draw rollers return the spring wire to a position wherein the tip thereof extends beneath the curling tool. The latter then moves downwardly, engaging the tip and bending the same around the pin 45. The second tip is produced by severing the spring wire at a point spaced from the coil. The length of the tip is determined by the width of the cutting tool.

It should be noted that in the particular embodiment of the invention disclosed herein, several elements or parts are employed to accomplish a plurality of operations so as to provide both efficiency and economy in manufacture and operation. The feed rollers 41 are used to feed the spring wire against the curling tool to form the spring coil and these rollers are also used to feed the spring coil into its assembled position with the cup and cap. The same rollers could also be employed to tension the spring, if desired, in which case mechanism would be required to reverse the rotation thereof.

The curling tool 46 is used to form the initial engaging tip in cooperation with the pin 45, to form the coil spring, and to sever the coil from the spring wire in cooperation with the cut-off fork.

The cut-off fork 121 not only affects the final cut off of the coil spring, but also provides a guide slot to direct the coil spring into assembled relation with the cup and cap.

It should be apparent from the foregoing that the present machine and process makes it possible for a single operation to produce several

times the production which was possible using former manual methods. The present machine and process produces an article which is far superior to articles produced by prior methods, due to uniformity of product and also due to the sensitive control which may be exercised over the various operations in the assembly.

Having thus described my invention, I claim:

1. In a process for assembling oil cups having a cap hinged to a cup and resiliently held in closed position thereon, the novel steps of forming a spring coil on the spring wire spaced from the free end thereof to provide an engaging tip on the free end, positioning the spring coil in axial alignment with the axis about which the cap is hinged, inserting a pin through said spring coil to secure said spring to said cap and cup, drawing on said unformed spring wire while said engaging tip is in engagement with said assembly to tension said spring and severing said spring wire at a point spaced from said coil to provide an engaging tip engaging said cap to hold said coil spring under tension and to yieldably hold said cap in closed position on said cup.

2. In a process for assembling oil cups having a cap hinged to a cup and resiliently held in closed position thereon, the novel steps of forming a coil on the spring wire spaced from the free

end thereof to provide an engaging tip on the free end, positioning the spring coil in axial alignment with the axis about which the cap is hinged, inserting a nail through said spring coil to secure said spring to said cap and cup, drawing on said unformed spring wire while said engaging tip is in engagement with said assembly to tension said spring, severing said spring wire at a point spaced from said coil to provide an engaging tip engaging said cap to hold said coil spring under tension and to yieldably hold said cap in closed position on said cup, and thereafter flaring the end of said nail to secure the component parts in assembled relation.

HENRY OTTE.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,050,363	Harter	Jan. 14, 1913
1,531,243	Nolan	Mar. 24, 1925
1,644,137	Linebarger	Oct. 4, 1927
1,540,435	Tebo	June 2, 1935
2,052,356	Long	Aug. 25, 1936
2,084,411	Robarge	June 22, 1937
2,270,300	Hothersall	Jan. 20, 1942
2,276,579	Halversen et al.	Mar. 17, 1942