Aug. 7, 1962 D. M. JOHNSON 3,048,201

ARTICLE-FORMING DEVICE

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FIG. 1.

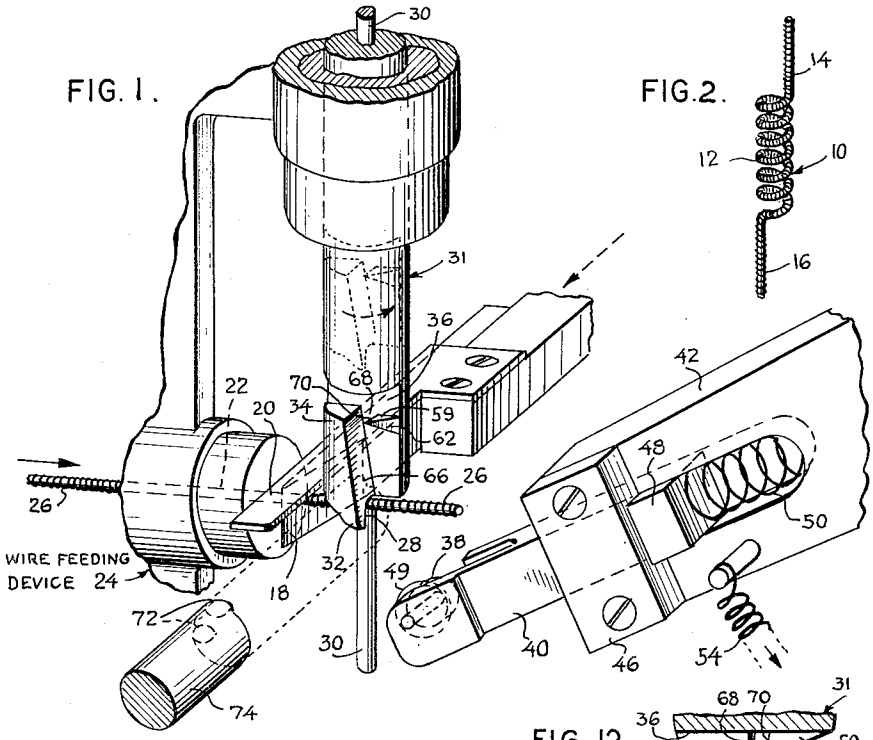


FIG. 2.

FIG. 12.

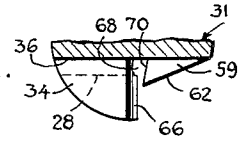
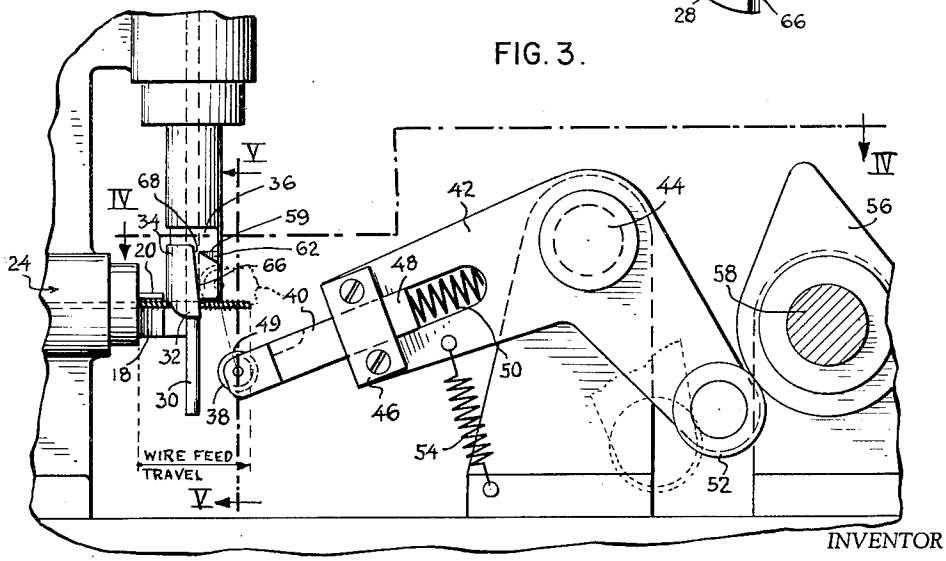


FIG. 3.



INVENTOR

DAVID M. JOHNSON.

BY

ATTORNEY

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FIG. 4.

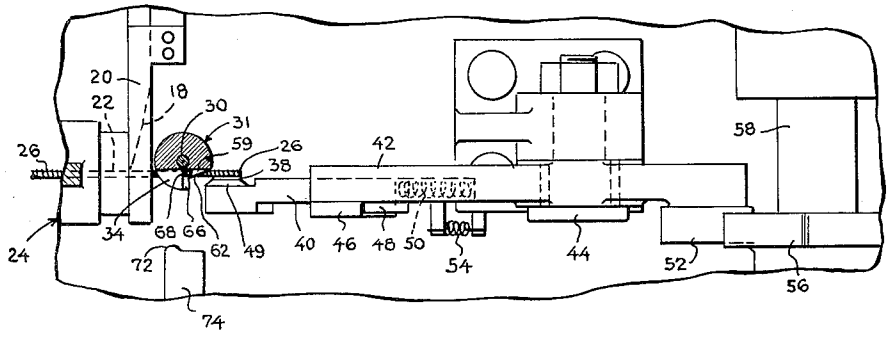


FIG. 5.

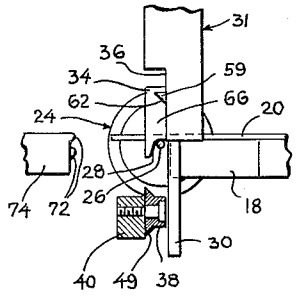


FIG. 6.

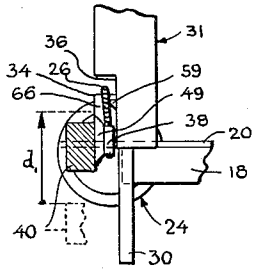


FIG. 7.

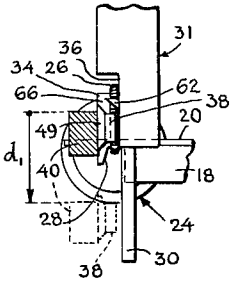


FIG. 8.

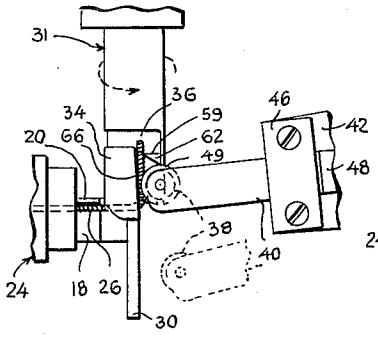


FIG. 9.

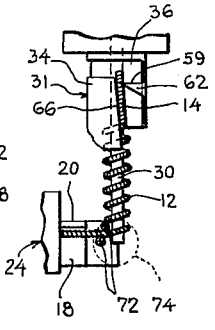
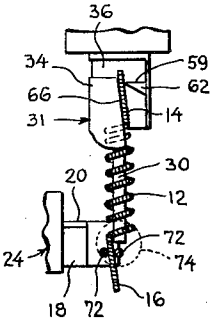


FIG. 10.



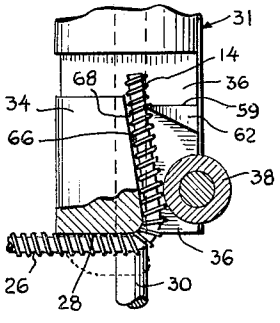


FIG. 11.

INVENTOR

DAVID M. JOHNSON.

BY

ATTORNEY

United States Patent Office 3,048,201 Patented Aug. 7, 1962

3,048,201

ARTICLE-FORMING DEVICE

David M. Johnson, Ocean Grove, N.J., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Filed Dec. 29, 1959, Ser. No. 862,542
5 Claims. (Cl. 140—71.5)

The present invention relates to article-forming devices and, more particularly, to a device for forming a leg of a coiled filament for incandescent lamps and the like.

Heretofore, filaments have been wound from refractory wire on a machine similar to the type shown in U.S. Patent No. 2,120,146, issued June 7, 1938, to E. W. Halvorsen et al. In order to adapt this machine to fabricate a coiled-coil filament having projecting uncoiled legs for high-wattage incandescent lamps, one end of the primary coiling was transversely projected across the longitudinal vertical axis of the coiling die. Such projected or free end was wiped or bent upwardly along the coiling die by an integral and rigid forming device, thus forming a first leg of the coiled filament which was to be wound by the above-mentioned filament-coiling machine.

This above-mentioned conventional integral and rigid leg-forming device was pivotable on the frame portions of the filament-coiling machine in the vertical plane of the longitudinal axis of the coiling die. During the leg-forming operation its operating end slid along the free end of the primary coiling to form such free end against the now stationary coiling die as an anvil. Since the distance from the operating end of the forming device to its pivot was fixed, such operating end often either fractured or deformed the free end of the primary coiling being formed into the first leg or failed to complete the bend, thus resulting, in either event, in a defective coiled filament. In order to separate the shrinkage coiled filaments from the good production a manual inspection operation was required, which inspection was both expensive and time consuming. Although the conventional leg-forming device was adjustably mounted on its pivot repeated adjustment thereof resulted in lost production time and in inefficient operation.

Moreover, no satisfactory means was provided for securing the formed leg in the coiling die during the coil-winding operation, thus causing the first leg to often become misaligned and resulting in closure of the first few turns in the coiled body and in a resultant improper number of turns per inch in the finished coil.

It is therefore the general object of the present invention to avoid and overcome the foregoing and other difficulties of and objections to prior-art practices by the provision of an improved leg-forming device which will not fracture or deform the free end of the wire or primary coiling being formed into a leg of a coiled filament.

A specific object of the present invention is the provision of an improved leg-forming device, the operating end of which is self-positioning with respect to the wire or primary coiling being formed thereby adapting itself for universal use with a wide variety of diameters of the primary coiling or wire being wound, without repeated adjustment of the device thereby reducing lost production time and increasing the efficiency of the coiling operation.

Another object of the present invention is the provision of an improved leg-forming device which cooperates with a biasing means on the coiling die to secure the free end (of the wire or primary coiling being formed into a leg) substantially in the formed position during the coiling operation.

A further object of the present invention is the provision of an improved leg-forming device which moves along the free end of the wire or primary coiling being formed in substantially frictionless engagement therewith, thereby

reducing frictional forces between the leg-forming device and said free end to a reasonable value.

The aforesaid objects of the present invention, and other objects which will become apparent as the description proceeds, are achieved by providing for a coiling machine having a rotatable coiling die and a fixed elongated article extending therefrom, the free end of which elongated article is to be formed into a leg of a coiled member, the combination of an anvil on the coiling die, guide means on the coiling die adjacent the anvil for guiding said free end toward the anvil during the forming thereof into a leg, biasing means on the guide means adjacent the anvil and defining with the anvil and the guide means a leg-receiving means, and a resilient leg-forming device adjacent the free end and operable to move along the latter and to force successive portions of the latter against the anvil thereby forming the leg. The leg-forming device is further operable during the leg-forming operation to retain the already formed portion of the free end along the guide means and to move the remaining portion of the free end into engagement with the biasing means. The biasing means is then adapted upon engagement thereof with the remaining portion to cause movement of the remaining portion away from the guide means so that, as the remaining portion is forced against the anvil by the leg-forming device to complete the leg, the leg is moved out of engagement with the biasing means thereby permitting the leg to snap into the leg-receiving means, the spring-back in the leg being then operable when the leg-forming device releases the leg to seat it in the leg-receiving means.

For a better understanding of the present invention reference should be had to the accompanying drawings, wherein like numerals of reference indicate similar parts throughout the several views and wherein:

FIG. 1 is a perspective view of a portion of the above-mentioned filament-coiling machine and showing the leg-forming device and biasing means of the present invention positioned for the start of the leg-forming operation.

FIG. 2 is a perspective view of a finished coiled-coil filament fabricated on a filament-coiling machine incorporating the leg-forming device and biasing means of the present invention as shown in FIG. 1.

FIG. 3 is a side-elevational view of FIG. 1.

FIG. 4 is a plan view, partially in section, taken along the line IV—IV of FIG. 3 in the direction of the arrows.

FIG. 5 is a fragmentary vertical-sectional view taken along the line V—V of FIG. 3 in the direction of the arrows.

FIG. 6 is a view similar to FIG. 5 and showing an intermediate position of a leg-forming roller and the leg being formed thereby with respect to the biasing means.

FIG. 7 is a view similar to FIGS. 5 and 6 showing the formed leg secured in a leg-receiving means.

FIG. 8 is a side-elevational view taken from the left side of FIG. 7.

FIG. 9 is a view similar to FIGS. 5 through 7 illustrating the position of the coiling die at the end of the coiling operation and further showing the position of a second leg-forming device preparatory for the subsequent cutting of the primary coiling and the forming of the second leg.

FIG. 10 is a view similar to FIGS. 5 through 7 and FIG. 9 showing the position of the second leg-forming device at the end of the second leg-forming operation.

FIG. 11 is an enlarged view of a portion of FIG. 8 showing the contracting relationship of the forming roller and the primary coiling.

FIG. 12 is an enlarged fragmentary plan view of the coiling die, anvil and biasing means.

Although the principles of the present invention are broadly applicable to apparatus for the coiling of an elon-

gated article, such as wire, into springs having extending uncoiled leg portions, the present invention is particularly adapted for use in conjunction with the coiling of a primary coiling into a coiled-coil filament for high-wattage incandescent lamps and hence it has been so illustrated and will be so described.

With specific reference to the form of the present invention illustrated in the drawings, and referring particularly to FIG. 2, a coiled-coil filament (which has been fabricated on a filament-coiling machine incorporating the devices of the present invention) is indicated generally by the reference numeral 10. This finished filament 10 has a coiled body 12 provided with an extending uncoiled first leg 14 and second leg 16.

In order to fabricate the filament 10, first a cutter 18 and a guide 20 carried thereby are moved (by conventional means, not shown) along a path of movement (indicated by the dotted arrow in FIG. 1) from a retracted position (not shown) to the position shown in FIGS. 1 and 4 adjacent a delivery orifice 22 of a wire-feeding device 24. While in this forward position the guide 20 and the cutter 18 are substantially tangent to the delivery orifice 22, thus at their intersection providing a guide for a free end of a primary coiling 26, which free end is to be formed into the first leg 14 of the filament 10. Such primary coiling 26 is then fed from its supply source by the wire-feeding device 24, which also moves the free end of the primary coiling 26 from the position where it is flush with the delivery orifice 22, thence through the above-described guide and through a guide groove 28 to the position shown in FIGS. 1 and 3. Such guide groove 28 is defined between a mandrel 30 depending from a coiling die 31 and a lug 32 projecting from the bottom face of an anvil 34 (as viewed in FIG. 1), which anvil 34 projects laterally from a guide face 36 on the coiling die 31. This guide face 36 guides the free end of the primary coiling 26 toward the anvil 34 during the forming of such free end into the leg 14.

To provide means for moving along the free end of the primary coiling 26 and for forcing successive portions of said free end against the anvil 34 thus forming the first leg 14 of the filament 10, a resilient leg-forming device of the present invention is utilized.

Leg-Forming Device

This leg-forming device (FIGS. 1, 3 and 4) has a flanged roller 38 which is operable to roll along the free end of the primary coiling 26 in substantially frictionless engagement therewith to force successive portions of such free end against the anvil 34 and thus form the first leg 14 of the filament 10. Such flanged roller 38 is mounted on the free end of an operating slide 40 which is reciprocable in a lever 42 pivoted at 44 on the frame portions of the filament-coiling machine. In order to contain the operating slide 40 within the lever 42, a retaining plate 46 is affixed to such lever 42. The operating slide 40 is resiliently maintained in its normally forward position, shown in FIGS. 1, 3 and 4, by a spring 50 which forces a lug 48 on the operating slide 40 into abutting engagement with the retaining plate 46.

A flange 49 on the roller 38 is operable to retain the already formed portion of the free end of the primary coiling 26 (FIG. 6) along the guide face 36 and to move the remaining portion of such free end into engagement with a biasing means, such as a biasing lug 59 (FIGS. 1 and 12), disposed adjacent said anvil 34. This biasing lug 59 (FIG. 12) defines with the anvil 34 and the guide face 36 a leg-receiving means, such as the leg-receiving groove 68. As shown in FIG. 12, this biasing lug is provided with a biasing face 62 and a locking face 70 for use as hereinafter explained.

The drive means utilized to oscillate the flanged roller 38 between the starting position, shown in FIGS. 1 and 3 and the position shown in FIGS. 7, 8 and 11 comprises a roller 52 (FIG. 3) on the lever 42, which roller 52 is

biased by a spring 54 into engagement with a cam 56 affixed to a cam shaft 58 of the filament-coiling machine.

As the flanged roller 38 is moved upwardly from the starting position, shown in FIGS. 1, 3 and 5, a distance d_1 to the position shown in FIG. 7, such roller 38 engages the free end of the primary coiling 26, moves the latter along the guide face 36 and forces successive portions of such free end of the primary coiling 26 against the anvil 34.

It will be appreciated that due to the resilient mounting of the flanged roller 38 it readily adjusts itself to the diameter of the primary coiling 26. In addition, such flanged roller 38 will not fracture or deform the turns in the free end of the primary coiling 26 (FIG. 11) being formed into the first leg 14. Further, such flanged roller 38 rides along such turns in substantially frictionless engagement therewith thereby reducing the heretofore destructive forces between the flanged roller 38 and the free end of the primary coiling 26 and the anvil 34 to a reasonable value.

During this upward movement of the flanged roller 38 from the solid-line position shown in FIG. 5 and the dotted-line positions shown in FIGS. 6–8, to the intermediate solid-line position shown in FIG. 6, the flange 49 on the flanged roller 38 maintains the already formed portions of the free end of the primary coiling 26 against or substantially parallel to the guide face 36 on the coiling die 31.

As the flanged roller 38 approaches the solid-line position shown in FIG. 6, the free end of the primary coiling 26 rides against the outwardly (and upwardly) diverging biasing face 62 (FIGS. 6 and 12) on the biasing lug 59, affixed to the guide face 36. Thus, as the free end of the primary coiling 26 is further forced inwardly against a forming face 66 on the anvil 34 by the flanged roller 38 and as the already formed portion of such free end is restrained by the flange 49 substantially parallel to the guide face 36, such biasing face 62 stresses the relatively resilient free end in a direction away from its normal path of movement parallel to the guide face 36, thus inducing a spring back in such free end.

Near the end of the upward movement of the flanged roller 38 from the solid-line position shown in FIG. 6 to the solid-line position shown in FIG. 7 (thus completing its total upward travel through a distance d_1, FIG. 6), the stressed free end of the primary coiling 26 first slides off the biasing face 62 thus permitting the spring back induced in the free end by the flanged roller 38 to cause such free end to snap into the leg-receiving groove 68. Thereafter the flanged roller 38 completes its forming movement and the free end is moved to the position shown in FIGS. 7 and 8 thus forming the leg 14 and moving such first leg 14 away from the locking face 70 (FIG. 1) on the biasing lug 59.

It will be appreciated that the forming face 66 on the anvil 34 is inclined at an angle to the vertical longitudinal axis of the coiling die 31 to allow for spring back (upon release as hereinafter related) of the now formed first leg 14 for the filament 10 to the position shown in FIG. 2.

Thereafter, the flanged roller 38 is retracted downwardly from the solid-line position shown in FIGS. 7 and 8, the distance d_1 to the starting or dotted-line position shown in such figures preparatory for the winding of the coiled body 12 by the coiling die 31. During this retracting movement of the flanged roller 38 the spring back (induced in the now formed first leg 14 by such flanged roller 38) causes said first leg 14 to seat itself, as shown in FIG. 1, against the inner locking face 70 on the biasing lug 59, which locking face 70 is suitably tapered toward the forming face 66 so as to aid in the locking of the seated first leg 14 in the leg-receiving groove 68.

As shown in FIGS. 8 and 9, the coiling die 31 along with its mandrel 30 is then rotated by conventional means (not shown) in a clockwise direction about its vertical axis (as viewed from the bottom of FIG. 8 and is indi-

cated by the arrow in such figure) and such coiling die is simultaneously moved vertically with the mandrel **30** from the position shown in FIG. 8 to the position shown in FIG. 9, thus forming the coiled body **12** for the filament **10**. Bending lugs **72** on a second leg-forming device **74** are then moved (by conventional means, not shown) from the position shown in FIG. 5 to the position shown in FIG. 9 where such lugs **72** are positioned about the projecting portion of the primary coiling **26** adjacent the last turn in the coiled body **12**. The cutter **18** is then moved forwardly (by conventional means, not shown) from the position shown in FIG. 1 along a continued path of movement, indicated by the dotted-arrow in FIG. 1 to sever the projecting end of the primary coiling **26** substantially flush with the outer face of the wire-feeding device **24**, preparatory for the forming of the second leg **16** by the second leg-forming device **74**. Such second leg-forming device **74** is then rotated in counterclockwise direction from the position shown in FIG. 9 to the position shown in FIG. 10 to form the second leg **16**. It will be noted that such second leg-forming device **74** provides the second leg **16** with a slight overwind to compensate for spring back in said second leg **16** when the latter is released from the filament-coiling machine, as hereinafter explained. The second leg-forming device **74** is then retracted from the position shown in FIG. 10 to the starting position of FIG. 1 and is simultaneously rotated back to the starting position shown in FIG. 9, thereby releasing the compressive force in the first leg **14** against the locking face **70**.

The mandrel **30** is then retracted upwardly within the coiling die **31** to strip the now released finished filament **10** from the leg-receiving groove **68** and to permit such filament **10** to drop downwardly therefrom into a container (not shown).

Whereupon the coiling head **31** is rotated in counterclockwise direction about the vertical longitudinal axis thereof, as viewed from the bottom of FIG. 8, to return such coiling head **31** to its starting coiling position shown in FIG. 8. During this retracting rotary movement of the coiling head **31**, such coiling head **31** and the mandrel **30** are lowered to the starting position shown in FIG. 8. Concurrently with this above-described movement of the coiling die **31** and mandrel **30**, the cutter **18** and the guide **20** are retracted from the cutting position shown in FIG. 10 to the starting position (not shown). Thereafter, the coiling operation or cycle is repeated.

It will be recognized by those skilled in the art that the objects of the present invention have been achieved by the provision of an improved leg-forming device for a coil-winding machine, which improved leg-forming device will not fracture or deform the free end of the wire or primary coiling being formed into the leg of a coiled filament. In addition, the operating end of such improved leg-forming device is self-positioning with respect to such wire or primary coiling thereby adapting itself for universal use with a wide range of diameters of primary coiling or wire; eliminating the need for adjustment of such improved leg-forming; reducing lost production time; and increasing the efficiency of the coiling operation.

This improved leg-forming device cooperates with the biasing means on the coiling die to secure the free end of the wire or primary coiling within the leg-receiving means at the end of the leg-forming operation, thus preventing movement of such formed leg during the coiling operation. Such improved leg-forming device rides along the turns on the free end of the wire or primary coiling being formed in substantially frictionless engagement therewith, thereby reducing the heretofore destructive frictional forces on the primary coiling or wire during the leg-forming operation to a reasonable value.

While in accordance with the patent statutes one preferred embodiment of the present invention has been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto or thereby.

I claim:

1. In combination with a coiling machine having a rotatable coiling die and a feeding device, an elongated coiled article wrapped about a mandrel and fed by and retained by said feeding device, and a free end of said article extending from said feeding device and intended to be formed into a leg of a coiled-coil member, the improvement which comprises, an anvil on said coiling die, guide means on said coiling die adjacent said anvil for guiding said free end toward said anvil during the forming thereof into said leg, biasing means on said guide means adjacent said anvil and defining with said anvil and said guide means a leg-receiving means, a resilient leg-forming device adjacent said free end and operable to move along said free end and to force successive portions of said free end against said anvil thereby forming said leg, said leg-forming device being further operable during the leg-forming operation to retain the already formed portion of said free end along said guide means and to move the remaining portion of said free end into engagement with said biasing means, said biasing means being adapted upon engagement thereof with said remaining portion to cause movement of said remaining portion away from said guide means so that, as said remaining portion is forced against said anvil by said leg-forming device to complete said leg, said remaining portion is moved out of engagement with said biasing means thereby permitting the spring back induced in said remaining portion by said biasing means to cause said remaining portion to snap into said leg-receiving means, the spring back induced in said leg by said leg-forming device then being operable when said leg-forming device releases said leg to seat it in said leg-receiving means.

2. In combination with a coiling machine having a rotatable coiling die and a feeding device, an elongated coiled article wrapped about a mandrel and fed by and retained by said feeding device, and a free end of said article extending from said feeding device and intended to be formed into a leg of a coiled-coil member, the improvement which comprises, an anvil on said coiling die, guide means on said coiling die adjacent said anvil for guiding said free end toward said anvil during the forming thereof into said leg, a lug projecting from said guide means adjacent said anvil, a leg-locking face on said lug defining with said anvil and said guide means a leg-receiving means, a resilient leg-forming device adjacent said free end and operable to move along said free end and to force successive portions of said free end against said anvil thereby forming said leg, a biasing face on said lug disposed along the bending path of movement of said free end, said leg-forming device being further operable during the leg-forming operation to retain the already formed portion of said free end along said guide means and to move the remaining portion of said free end into engagement with said biasing face, said biasing face being adapted upon engagement thereof with said remaining portion to cause movement of said remaining portion away from said guide means so that, as said remaining portion is forced against said anvil by said leg-forming device to complete said leg, said remaining portion is moved out of engagement with said biasing face thereby permitting the spring back induced in said remaining portion by said biasing face to cause said remaining portion to snap into said leg-receiving means, the spring back induced in said leg by said leg-forming device then being operable when said leg-forming device releases said leg to seat it against said leg-locking face.

3. In combination with a coiling machine having a rotatable coiling die and a feeding device, an elongated coiled article wrapped about a mandrel and fed by and retained by said feeding device, and a free end of said article extending from said feeding device and intended to be formed into a leg of a coiled-coil member, the improvement which comprises, an anvil on said coiling die, guide means on said coiling die adjacent said anvil for

guiding said free end toward said anvil during the forming thereof into said leg, biasing means on said guide means adjacent said anvil and defining with said anvil and said guide means a leg-receiving groove, said anvil being provided with a guide groove for positioning said free end adjacent said guide means, a resilient leg-forming device adjacent said free end and operable to move along said free end and to force successive portions of said free end against said anvil thereby forming said leg, said leg-forming device being further operable during the leg-forming operation to retain the already formed portion of said free end along said guide means and to move the remaining portion of said free end into engagement with said biasing means, said biasing means being adapted upon engagement thereof with said remaining portion to cause movement of said remaining portion away from said guide means so that, as said remaining portion is forced against said anvil by said leg-forming device to complete said leg, said remaining portion is moved out of engagement with said biasing means thereby permitting the spring back induced in said remaining portion by said biasing means to cause said remaining portion to snap into said leg-receiving groove, the spring back induced in said leg by said leg-forming device then being operable when said leg-forming device releases said leg to seat it in said leg-receiving groove.

4. In combination with a coiling machine having a rotatable coiling die and a feeding device, an elongated coiled article wrapped about a mandrel and fed by and retained by said feeding device, and a free end of said article extending from said feeding device and intended to be formed into a leg of a coiled-coil member, the improvement which comprises, an anvil on said coiling die, guide means on said coiling die adjacent said anvil for guiding said free end toward said anvil during the forming thereof into said leg, biasing means on said guide means adjacent said anvil and defining with said anvil and said guide means a leg-receiving means, a resilient leg-forming roller adjacent said free end, drive means connected to said roller for moving said roller along said free end and to force successive portions of said free end against said anvil thereby forming said leg, a flange on said roller operable during the leg-forming operation to retain the already formed portion of said free end along said guide means and to move the remaining portion of said free end into engagement with said biasing means, said biasing means being adapted upon engagement thereof with said remaining portion to cause movement of said remaining portion away from said guide means so that, as said remaining portion is forced against said anvil by said roller to complete said leg, said remaining portion is moved out of engagement with said biasing means thereby permitting the spring back induced in said remaining portion by said biasing means to cause said remaining portion to snap into said leg-receiving means, said drive means then being further operable to cause said roller to release said leg thus permitting the spring back induced in said leg by said roller to seat said leg in said leg-receiving means.

5. In combination with a coiling machine having a rotatable coiling die and a feeding device, an elongated coiled article wrapped about a mandrel and fed by and retained by said feeding device, and a free end of said article extending from said feeding device and intended to be formed into a leg of a coiled-coil member, the improvement which comprises, an anvil on said coiling die, a guide face on said coiling die adjacent said anvil for guiding said free end toward said anvil during the forming thereof into said leg, a lug projecting from said guide face adjacent said anvil, a leg-locking face on said lug defining with said anvil and said guide face a leg-receiving groove, a resilient leg-forming roller adjacent said free end, drive means connected to said roller for moving said roller along said free end and to force successive portions of said free end against said anvil thereby forming said leg, a biasing face on said lug disposed along the bending path of movement of said free end, a flange on said roller operable during the leg-forming operation to retain the already formed portion of said free end along said guide face and to move the remaining portion of said free end into engagement with said biasing face, said biasing face being adapted upon engagement thereof with said remaining portion to cause movement of said remaining portion away from said guide face so that, as said remaining portion is forced against said anvil by said leg-forming device to complete said leg, said remaining portion is moved out of engagement with said biasing face thereby permitting the spring back induced in said remaining portion by said biasing means to cause said remaining portion to snap into said leg-receiving groove, said drive means then being further operable to cause said roller to release said leg thus permitting the spring back induced in said leg by said roller to seat said leg against said leg-locking face.

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