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2,668,615

MEANS FOR SIMULTANEOUSLY FEEDING TWO WIRES

Filed March 23, 1951

FIG. 1

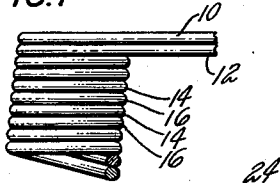


FIG. 2

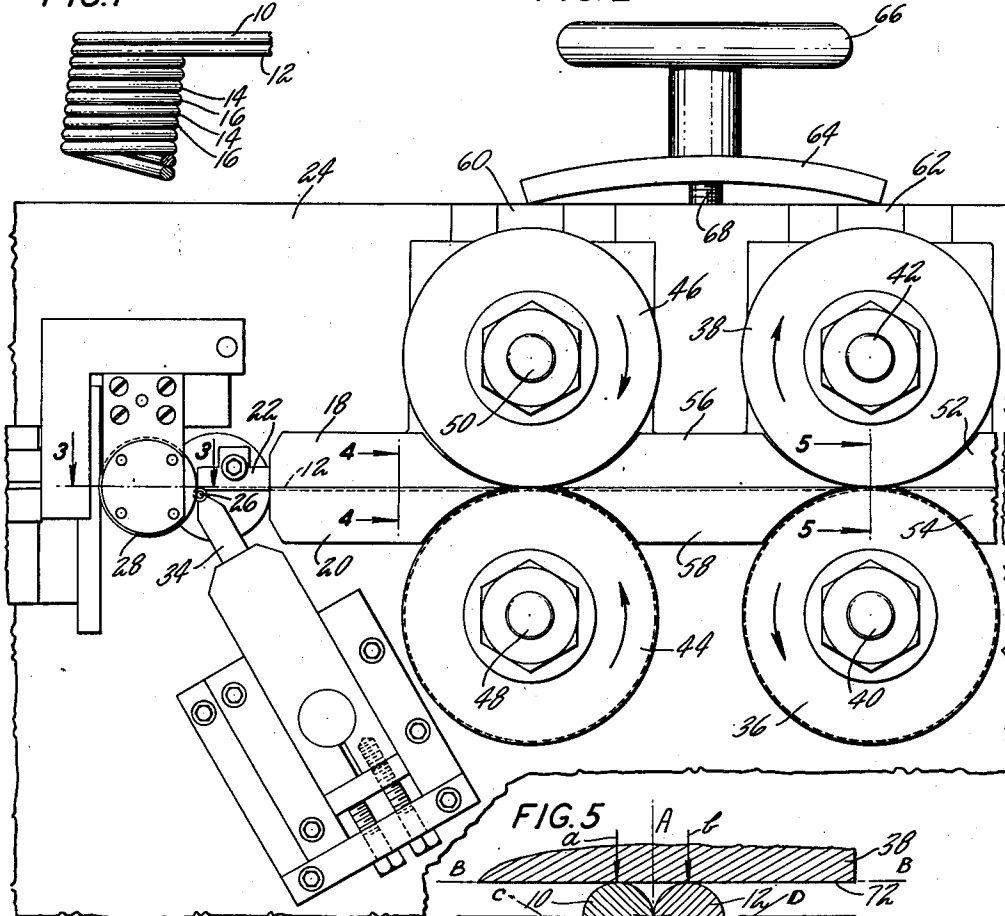


FIG. 3

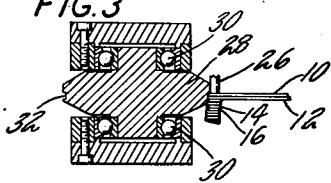


FIG. 4

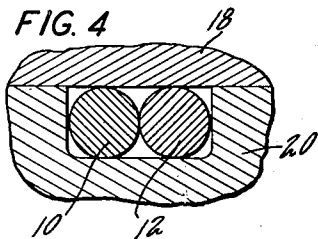


FIG. 5

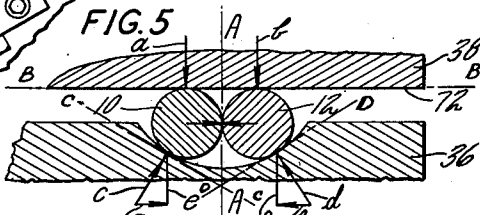


FIG. 6

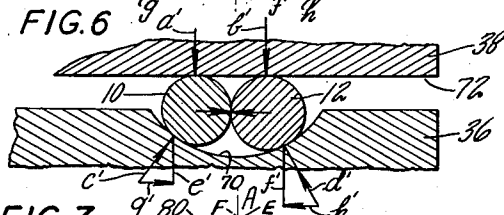
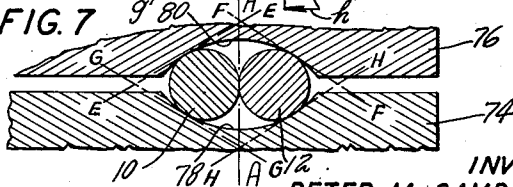


FIG. 7



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2,668,615

MEANS FOR SIMULTANEOUSLY FEEDING
TWO WIRES

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5 Claims. (Cl. 203-230)

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The invention relates to a machine for simultaneously feeding and coiling two contacting wires having closely similar but slightly varying diameters to form a duplex coil having convolutions of uniform diameters. In a duplex coil the convolutions of the two wires are disposed alternately between each other. Duplex wire coils resemble helical springs, but they are ordinarily not used as springs but are particularly adapted for use as flexible casings for Bowden wires or flexible shafts or the like.

Serious difficulties have heretofore been encountered when attempts have been made to feed and coil two similar wires simultaneously to form duplex coils. The two wires normally have the same diameters, but the diameters are nevertheless subject to variations to minute extents from diameter equality. As feeding progresses, one wire may have a diameter larger than that of the other throughout a substantial length and subsequently the other wire may have a diameter larger than that of the first wire throughout a substantial length. The wires are ordinarily fed by one or more pairs of feed rolls and when the two feed rolls of each pair have cylindrical faces or when the said feed rolls have similar separate grooves for the two wires, they fail to apply uniform driving forces to the wires when there is any departure from exact uniformity in wire diameters. The larger wire is gripped and properly fed but the smaller wire is less firmly gripped or not gripped at all. The result is that the smaller wire is moved at a slower speed or not moved at all. However, exact uniformity of wire feeding speeds is necessary in order that the wire convolutions of the duplex coil may have uniform diameters. Said convolutions of the coil are interengaged as they are formed and if one wire is fed at a greater speed than the other then it is formed with larger convolutions.

One object of the invention is to provide a mechanism for simultaneously and uniformly feeding two wires normally having equal diameters but nevertheless subject to slight variations from the diameter equality.

Other objects of the invention will be apparent from the drawing and from the following description and claims.

In the drawing I have shown in detail two alternative embodiments of the invention, but it will be understood that various changes may be made from the constructions shown, and that the drawing is not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawing:

Fig. 1 is an enlarged plan view showing a portion of a duplex wire coil with two wires extending thereto.

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Fig. 2 is a fragmentary front view of a machine embodying the invention.

Fig. 3 is an enlarged fragmentary horizontal sectional view taken along the line 3-3 of Fig. 2.

Fig. 4 is an enlarged fragmentary vertical sectional view taken along the line 4-4 of Fig. 2.

Fig. 5 is an enlarged fragmentary vertical sectional view taken along the line 5-5 of Fig. 2.

Fig. 6 is a view similar to Fig. 5 but showing the conditions which exist when the wires differ in diameter.

Fig. 7 is a view similar to Fig. 5 but showing an alternative construction.

The machine serves to simultaneously feed and coil two wires such as 10 and 12 as shown in Fig. 1. The wires as they are coiled form a closely wound duplex coil wherein the similar convolutions 14 and 16 of the two wires 10 and 12 are disposed alternately between each other.

The details of the machine may be widely varied, more particularly as to the coiling mechanism thereof, but for purposes of illustration I have shown portions of a machine such as disclosed in Patent No. 2,119,002 to Bergevin et al. Reference is made to said patent for various details not herein fully disclosed.

The two wires 10 and 12 are in contact with each other and they are continually fed at uniform speeds from right to left by feed means to be described in detail, being withdrawn from large coils, not shown, supported on suitable reels. As the wires move they are guided and are held straight by the walls of grooves formed in guide members 18, 20 and 22 carried by the main frame 24 of the machine. The guide members 18 and 20 are shown in section in Fig. 4.

A short transverse horizontal coiling arbor 26 is provided, this coiling arbor being carried by the main frame 24. The arbor 26 is adjustable either to an upper position or to a lower position, being shown in its lower position. In the upper position the bottom of the arbor contacts the wires and in its lower position the top of the arbor contacts the wires.

A coiling roll 28 is adjustably carried by the main frame 24, the roll being supported by anti-friction bearings 30, 32 and being freely rotatable about a transverse substantially horizontal axis. The roll 28 is adjacent the coiling arbor 26 and is so positioned that it constitutes an abutment against which the wires 10 and 12 are forced as they are fed toward the left. The roll 28 has a shallow annular groove 32 of the proper width to receive the two wires.

In the operation of the machine as shown, the wires 10 and 12 as they are fed toward the left pass over the coiling arbor 26 and engage the coiling roll or abutment 28 within the groove 32 thereof, said wires being simultaneously coiled downwardly around the arbor 26 to form said

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similar convolutions 14 and 16 constituting the duplex coil. Coiling may be continued to provide a duplex coil of any desired length. The diameter of the convolutions of the coil may be changed by changing the position of the roll 28 with respect to the arbor 26. As shown, the convolutions have a relatively small diameter, but this diameter can be increased by adjusting the roll 28 toward the left. With the arbor 26 below the wires right coils or convolutions are formed as shown. With the arbor 26 above the wires left coils or convolutions are formed.

Preferably a member 34 is provided for engaging and supporting the convolutions 14 and 16 of the coil during and after forming. The member 34 is adjustable for coils of different diameters.

At least one pair of feed rolls 36 and 38 is provided for the wires 10 and 12, said rolls being rotatable about parallel axes and being secured to transverse horizontal shafts 40 and 42. Preferably, a second pair of similar feed rolls 44 and 46 is provided, said rolls being also rotatable about horizontal axes and being secured to transverse horizontal shafts 48 and 50. The rolls of each pair are so positioned that the wires 10 and 12 extend between them and are engaged thereby. Wire guides 52 and 54 are provided at the right of the rolls 36 and 38 and wire guides 56 and 58 are provided between the rolls 36, 38 and the rolls 44, 46. By suitable mechanism, such as gearing, the four shafts 40, 42, 48 and 50 are continually rotated at uniform speeds, the upper shafts 42 and 50 being rotated in the clockwise direction and the lower shafts 40 and 48 being rotated in the counterclockwise direction.

The lower shafts 40 and 48 are rotatable in bearings in fixed positions on the main frame 24. The upper shafts 42 and 50 are rotatable in bearings in bearing blocks 60 and 62 which are vertically movable relatively to the main frame 24. Suitable means, such as a leaf spring 64, is provided for applying downward pressures on the blocks 60 and 62. The tension of the spring 64 can be changed by a hand wheel 66 having threaded engagement with a vertical rod 68. By reason of pressures applied to the blocks 60 and 62 and thence to the rolls 38 and 46 the wires 10 and 12 are gripped between the upper and lower rolls and are fed toward the left.

In accordance with the invention said rolls 36 and 38 of one pair are rotatable about parallel transverse axes located at opposite sides of a longitudinal plane through the transversely spaced centers of the wires or of the paths of wire feeding, being shown as above and below said plane. Each of said rolls has two transversely spaced continuous annular zones shaped for point engagements with the corresponding wires in said paths and each of said rolls is otherwise spaced from the wires so as to permit lateral shifting of the wires as explained below. The annular wire engaging zones on the two rolls are arranged in pairs at opposite sides of a longitudinal central plane between the paths of the two wires, this plane being indicated at A—A in Fig. 5. The two zones of each pair at their points of wire engagement are tangent respectively to two longitudinal planes which diverge transversely toward said central longitudinal plane A—A.

As shown in Fig. 5 the annular wire engaging zones of the upper roll 38 are indicated by the arrows *a* and *b* and the annular wire engaging zones of the lower roll 36 are indicated by the

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arrows *c* and *d*. As shown, the upper roll 38 has a cylindrical surface 72 and the annular wire engaging zones are included in the said surface, being tangent to a longitudinal plane B—B. As shown, the lower roll 36 has an annular relatively shallow wire receiving groove 70 the surface of which is continuously concave, with its greatest depth at said central plane A—A. The annular wire engaging zones indicated by the arrows *c* and *d* are included in the surface of the groove 70 and these zones are tangent respectively to longitudinal planes C—C and D—D. It will be seen that the planes B—B and C—C diverge toward the right and toward the central longitudinal plane A—A. Similarly the planes B—B and D—D diverge toward the left and also toward the central longitudinal plane A—A. As shown in Fig. 5, the planes C—C and D—D are symmetrically disposed and the divergence is the same at the two sides.

When the two rolls have the specific shapes shown, the wire receiving space at the bite between them is deepest at the central plane A—A. The width of the groove 70 is such that both wires can be partly entered therein simultaneously. The depth of the groove is such that the wires can simultaneously engage not only the wall of the groove but also the cylindrical face 72 of the roll 38. When engaged with the wires, the two rolls are spaced apart as shown. Inasmuch as the upper roll 38 is pressed downwardly by the spring 64, the wires are gripped between the two rolls and are fed toward the left as previously stated.

The rolls 44 and 46 are or may be in all respects similar to the rolls 36 and 38 and they engage and feed the wires in the same manner.

With the wire engaging zones at *a*, *b*, *c* and *d* positioned as described, and more particularly as shown in Fig. 5, it will first be assumed that the wires 10 and 12 have exactly equal diameters. Equal downward pressures are applied to the two wires at the wire engaging zones *a* and *b*. By reason of the inclination or divergence of the planes C—C and D—D the pressures against the wires at the zones *c* and *d* are in oppositely inclined directions as indicated, and in the example shown the said pressures are equal. The pressures at *c* and *d* have vertical components *e* and *f* equal to the vertical pressures at *a* and *b* and said pressures at *c* and *d* have equal and opposite transverse components *g* and *h* which tend respectively to move the wire 10 toward the right and to move the wire 12 toward the left. Inasmuch as the two transverse components *g* and *h* are equal, the two wires are symmetrically positioned with respect to the plane A—A and to the zones *c* and *d*.

Still referring to Fig. 5, it will be assumed that the wire 10 is slightly smaller than the wire 12 but that the wires are nevertheless in the positions shown. The pressures at *a* and *c* are greatly reduced or perhaps eliminated. The transverse component *h* of the pressure at *d* becomes greater than the transverse component *g*, if any, of the pressure at *c*. If the wires did not shift transversely, little or no feeding force would be applied to the smaller wire 10. Actually, however, the wires shift toward the left to the positions shown in Fig. 6, this being due to the fact that the transverse pressure component *h* is greater than the transverse pressure component *g*. Inasmuch as each zone has only point contact with the corresponding wire and inasmuch as the rolls are otherwise spaced from the wires, said

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wires are free to shift transversely as stated. It will be understood that the difference in wire diameters is greatly exaggerated in Fig. 6 in order that the action may be more readily apparent.

With the wires in the positions shown in Fig. 6, the directions of the pressures at c' and d' are different from those of the pressures at c and d in Fig. 5, and a condition of equilibrium is established wherein the pressures at c' and d' are such that their opposed transverse components g' and h' are equal. By reason of their differing directions, the total pressure at d' is greater than the total pressure at c' and the vertical component f' is greater than the vertical component e' . The pressures at a' and b' are necessarily equal respectively to the vertical components e' and f' . The total of the pressures at a' and b' is equal to the total of the pressures at a and b , inasmuch as the total of the pressures in each instance is the same as the downward pressure applied by the spring 64.

From the foregoing explanation it will be apparent that pressures are applied to the smaller wire 10 which serve to feed it at the same speed as the larger wire 12. The pressures applied to the smaller wire 10 are somewhat less than those applied to the larger wire 12 but they are nevertheless ample.

It has been assumed that the wire 10 is smaller than the wire 12. When the wire 12 is smaller than the wire 10, the result is the same except that the wires shift toward the right instead of toward the left. During the feeding of long lengths of wires, said wires may alternately shift toward the left or toward the right as the wires relatively vary in diameter. Ordinarily, the differences in diameter are very small and the wires shift to only very small extents.

Fig. 7 shows an alternative construction wherein the rolls 36 and 38 are replaced by rolls 74 and 76 respectively having annular grooves 78 and 80 similar to the groove 70 in the lower wall 36. The grooves 78 and 80 are somewhat shallower than the groove 70. In this alternative construction, the wire engaging zones of the upper roll 76 are tangent respectively to longitudinal planes E—E and F—F and the wire engaging zones of the lower roll 74 are tangent respectively to longitudinal planes G—G and H—H. It will be seen that the planes E—E and G—G diverge toward the right and toward the central longitudinal plane A—A and that the planes F—F and H—H diverge toward the left and toward the said central plane A—A. Considered specifically, this alternative construction is similar to the before-described construction in that the two rolls 74 and 76 are so shaped in transverse section that the wire receiving space at the bite between them is deepest at a central plane such as A—A perpendicular to the axes of roll rotation, said space continuously decreasing in depth in both directions from said central plane. The two wires 10 and 12 are shown as having the same diameters. When the wire 10 is smaller than the wire 12, the two wires shift toward the left, the result being similar to that explained in detail in connection with Figs. 5 and 6. When the wire 12 is smaller than the wire 10, the two wires shift toward the right with a similar result.

The invention claimed is:

1. A mechanism for longitudinally feeding two separate straight contacting wires in two parallel paths which wires normally have equal diameters

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but are subject to slight variations from diameter equality, said mechanism comprising in combination, two companion rolls rotatable about parallel transverse axes located at opposite sides of a longitudinal plane through the centers of the paths of the wires to be fed and having continuous annular surfaces which include two transversely spaced continuous annular zones on each roll shaped for point engagements with the corresponding wires in said paths and said annular surfaces of said rolls being otherwise spaced from the wires, said zones of said annular surfaces on the two rolls being arranged in pairs at opposite sides of a longitudinal central plane which is perpendicular to the first said plane and is between the paths of the two wires and said annular surfaces being so shaped that said two zones of each pair at their points of wire engagement are tangent respectively to two longitudinal planes which diverge transversely toward said central longitudinal plane, means connected with at least one of the rolls for applying power to rotate them in opposite directions, and means for pressing one of the rolls toward the other to cause them to grip two wires in said paths and to press said wires against each other and to shift them transversely to slight extents in accordance with any slight variations from diameter equality so as to thus effect simultaneous and uniform feeding.

2. A mechanism as set forth in claim 1, wherein said annular surfaces of the two rolls are so shaped that said transversely spaced annular wire engaging zones of the two pairs are tangent respectively to two longitudinal planes which diverge to uniform extents.

3. A mechanism as set forth in claim 1, wherein one roll has a cylindrical surface which includes said transversely spaced annular wire engaging zones of said roll, and wherein the other roll has an annular groove which is continuously concave in transverse section with said oppositely inclined transversely spaced annular wire engaging zones of the roll included in surface of the said groove.

4. A mechanism as set forth in claim 1, wherein said annular surfaces of the two rolls are so shaped that said transversely spaced annular wire engaging zones of each roll are tangent to longitudinal planes which oppositely diverge from said longitudinal plane through the centers of the paths of the wires and toward said longitudinal central plane.

5. A mechanism as set forth in claim 3, wherein each roll has an annular groove which is continuously concave in transverse section with said transversely spaced annular wire engaging zones of the roll included in surface of the said groove.

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